Appendix A

Hydraulic Calculations

A.1 Main Storm Drain WSPGW Models

A.2 Street Flow Calculations

A.3 Drop Inlet Calculations

A.4 Lateral Pipe Calculations

A.1 MAIN STORM DRAIN WSPG MODELS

Ultimate Condition

Interim Condition

Ultimate Condition

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T1   OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE                0
T2   ULTIMATE CONDITIONS
T3   FILE NAME: OAKEYULT.WSW,  MODEL BY: HDR, DATE: 1/16/2008

SO  -7165.6402045.750  1
R   -7000.0002046.840  1       .013                                    .000    .000 0
JX  -6975.0002046.980  1  2    .013   18.000          2050.680        -90.0          .000
R   -6850.0002047.710  1       .013                                    .000    .000 0
JX  -6821.1502047.880  1  3    .013    8.000          2052.250         90.0          .000
R   -5820.0002053.890  1       .013                                    .000    .000 0
JX  -5800.0002054.010  1  4    .013   78.000          2054.530        -30.0          .000
TS  -5790.0002054.070  8       .013                                    .000
R   -5740.0002054.370  8       .013                                    .000    .000 0
JX  -5725.0002054.460  8  5    .013   17.000          2055.680        -90.0          .000
R   -5690.0002054.550  8       .013                                    .000    .000 0
JX  -5670.0002054.670  8  6  7.013    6.000    5.0002056.5902057.080-90.0 90.0    .000
R   -5600.0002055.210  8       .013                                    .000    .000 0
R   -5590.0002055.310  8       .013                                    .000
R   -5180.0002059.410  8       .013                                    .000    .000 0
JX  -5160.0002059.610  8 11    .013  269.000          2061.520        -30.0          .000
R   -4830.0002062.910  8       .013                                    .000    .000 0
JX  -4820.0002063.010 13 12    .013   63.000          2063.450        -45.0          .000
TS  -4810.0002063.110 14       .013
R   -4750.0002063.710 14       .013
R   -4740.0002063.860 14       .013                                    .000 -25.000 0
R   -3850.0002077.210 14       .013                                    .000  25.000 0
SH  -3830.0002077.510 14                              2082.290

CD   1  3   0    .000   8.000   10.000  .000  .000   .00
CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  4   1    .000   3.500     .000  .000  .000   .00
CD   4  4   1    .000   3.500     .000  .000  .000   .00
CD   5  4   1    .000   2.000     .000  .000  .000   .00
CD   6  4   1    .000   2.000     .000  .000  .000   .00
CD   7  4   1    .000   2.000     .000  .000  .000   .00
CD   8  3   0    .000   8.000    8.000  .000  .000   .00
CD   9  4   1    .000   2.000     .000  .000  .000   .00
CD  10  4   1    .000   2.000     .000  .000  .000   .00
CD  11  3   0    .000   5.000    5.000  .000  .000   .00
CD  12  4   1    .000   3.000     .000  .000  .000   .00
CD  13  3   0    .000   8.000    5.000  .000  .000   .00
CD  14  3   0    .000   5.000    5.000  .000  .000   .00
Q           465.000   .0
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OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE 0

ULTIMATE CONDITIONS

FILE NAME: OAKEYULT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-7165.640	2045.750	5.571	2051.321	929.00	16.68	4.32	2055.64	.00	6.45	10.00	8.000	10.000	.00	0 .0
11.718	.0066					.0058	.07	5.57	1.24	5.33	.013	.00	.00	BOX
-7153.922	2045.827	5.587	2051.415	929.00	16.63	4.29	2055.71	.00	6.45	10.00	8.000	10.000	.00	0 .0
105.099	.0066					.0055	.57	5.59	1.24	5.33	.013	.00	.00	BOX
-7048.824	2046.519	5.860	2052.379	929.00	15.85	3.90	2056.28	.00	6.45	10.00	8.000	10.000	.00	0 .0
39.106	.0066					.0048	.19	5.86	1.15	5.33	.013	.00	.00	BOX
-7009.718	2046.776	6.146	2052.922	929.00	15.12	3.55	2056.47	.00	6.45	10.00	8.000	10.000	.00	0 .0
9.718	.0066					.0043	.04	6.15	1.07	5.33	.013	.00	.00	BOX
-7000.000	2046.840	6.447	2053.287	929.00	14.41	3.22	2056.51	.00	6.45	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0056					.0028	.07	6.45	1.00		.013	.00	.00	BOX
-6975.000	2046.980	7.310	2054.290	911.00	12.46	2.41	2056.70	.00	6.36	10.00	8.000	10.000	.00	0 .0
11.192	.0058					.0028	.03	7.31	.81	5.49	.013	.00	.00	BOX

---------- WARNING - Flow depth near top of box conduit ----------

-6963.808	2047.045	7.211	2054.257	911.00	12.63	2.48	2056.73	.00	6.36	10.00	8.000	10.000	.00	0 .0
HYDRAULIC JUMP														

---------- WARNING - Flow depth near top of box conduit ----------

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE

0

ULTIMATE CONDITIONS
FILE NAME: OAKEYULT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-6963.808	2047.045	5.584	2052.630	911.00	16.31	4.13	2056.76	.00	6.36	10.00	8.000	10.000	.00	0 .0
113.808	.0058					.0055	.62	5.58	1.22	5.49	.013	.00	.00	BOX
-6850.000	2047.710	5.677	2053.386	911.00	16.05	4.00	2057.39	.00	6.36	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0059					.0057	.16	5.68	1.19		.013	.00	.00	BOX
-6821.150	2047.880	5.398	2053.278	903.00	16.73	4.34	2057.62	.00	6.33	10.00	8.000	10.000	.00	0 .0
367.041	.0060					.0060	2.20	5.40	1.27	5.40	.013	.00	.00	BOX
-6454.110	2050.083	5.398	2055.481	903.00	16.73	4.34	2059.83	.00	6.33	10.00	8.000	10.000	.00	0 .0
405.185	.0060					.0059	2.40	5.40	1.27	5.40	.013	.00	.00	BOX
-6048.925	2052.516	5.461	2057.976	903.00	16.54	4.25	2062.22	.00	6.33	10.00	8.000	10.000	.00	0 .0
228.925	.0060					.0055	1.25	5.46	1.25	5.40	.013	.00	.00	BOX
-5820.000	2053.890	5.727	2059.617	903.00	15.77	3.86	2063.48	.00	6.33	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0060					.0074	.15	5.73	1.16		.013	.00	.00	BOX
-5800.000	2054.010	4.212	2058.221	825.00	19.59	5.96	2064.18	.00	5.96	10.00	8.000	10.000	.00	0 .0
TRANS STR	.0060					.0077	.08	4.21	1.68		.013	.00	.00	BOX
-5790.000	2054.070	6.546	2060.616	825.00	15.75	3.85	2064.47	.00	6.91	8.00	8.000	8.000	.00	0 .0
18.452	.0060					.0056	.10	6.55	1.09	6.39	.013	.00	.00	BOX
-5771.548	2054.181	6.591	2060.772	825.00	15.65	3.80	2064.57	.00	6.91	8.00	8.000	8.000	.00	0 .0
31.548	.0060					.0052	.17	6.59	1.07	6.39	.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm-Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5740.000	2054.370	6.913	2061.283	825.00	14.92	3.46	2064.74	.00	6.91	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0060					.0033	.05	6.91	1.00		.013	.00	.00	BOX
-5725.000	2054.460	7.954	2062.414	808.00	12.70	2.50	2064.92	.00	6.82	8.00	8.000	8.000	.00	0 .0
22.945	.0026					.0033	.08	7.95	.79	8.00	.013	.00	.00	BOX
---------- WARNING - Flow depth near top of box conduit ----------														
-5702.055	2054.519	8.000	2062.519	808.00	12.63	2.48	2064.99	.00	6.82	8.00	8.000	8.000	.00	0 .0
2.571	.0026					.0048	.01	8.00	.79	8.00	.013	.00	.00	BOX
-5699.484	2054.526	8.006	2062.531	808.00	12.63	2.48	2065.01	.00	6.82	8.00	8.000	8.000	.00	0 .0
HYDRAULIC JUMP														
-5699.484	2054.526	5.745	2060.271	808.00	17.58	4.80	2065.07	.00	6.82	8.00	8.000	8.000	.00	0 .0
9.484	.0026					.0076	.07	5.74	1.29	8.00	.013	.00	.00	BOX
-5690.000	2054.550	5.679	2060.229	808.00	17.78	4.91	2065.14	.00	6.82	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0060					.0084	.17	5.68	1.32		.013	.00	.00	BOX
-5670.000	2054.670	5.306	2059.976	797.00	18.78	5.47	2065.45	.00	6.76	8.00	8.000	8.000	.00	0 .0
70.000	.0077					.0092	.64	5.31	1.44	5.63	.013	.00	.00	BOX
-5600.000	2055.210	5.213	2060.423	797.00	19.11	5.67	2066.09	.00	6.76	8.00	8.000	8.000	.00	0 .0
10.000	.0100					.0094	.09	5.21	1.47	5.09	.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5590.000	2055.310	5.218	2060.528	797.00	19.09	5.66	2066.19	.00	6.76	8.00	8.000	8.000	.00	0 .0
135.710	.0100					.0091	1.24	5.22	1.47	5.09	.013	.00	.00	BOX
-5454.290	2056.667	5.323	2061.990	797.00	18.72	5.44	2067.43	.00	6.76	8.00	8.000	8.000	.00	0 .0
146.953	.0100					.0084	1.23	5.32	1.43	5.09	.013	.00	.00	BOX
-5307.336	2058.136	5.582	2063.719	797.00	17.85	4.95	2068.66	.00	6.76	8.00	8.000	8.000	.00	0 .0
69.145	.0100					.0074	.51	5.58	1.33	5.09	.013	.00	.00	BOX
-5238.192	2058.828	5.855	2064.683	797.00	17.02	4.50	2069.18	.00	6.76	8.00	8.000	8.000	.00	0 .0
36.052	.0100					.0066	.24	5.85	1.24	5.09	.013	.00	.00	BOX
-5202.140	2059.188	6.141	2065.329	797.00	16.22	4.09	2069.42	.00	6.76	8.00	8.000	8.000	.00	0 .0
17.277	.0100					.0058	.10	6.14	1.15	5.09	.013	.00	.00	BOX
-5184.863	2059.361	6.440	2065.802	797.00	15.47	3.72	2069.52	.00	6.76	8.00	8.000	8.000	.00	0 .0
4.863	.0100					.0052	.03	6.44	1.07	5.09	.013	.00	.00	BOX
-5180.000	2059.410	6.756	2066.166	797.00	14.75	3.38	2069.54	.00	6.76	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0021	.04	6.76	1.00		.013	.00	.00	BOX
-5160.000	2059.610	9.198	2068.808	528.00	8.25	1.06	2069.87	.00	5.13	8.00	8.000	8.000	.00	0 .0
151.048	.0100					.0021	.31	9.20	.51	3.73	.013	.00	.00	BOX
-5008.952	2061.121	8.000	2069.121	528.00	8.25	1.06	2070.18	.00	5.13	8.00	8.000	8.000	.00	0 .0
31.346	.0100					.0014	.04	8.00	.51	3.73	.013	.00	.00	BOX

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-4977.606	2061.434	7.627	2069.061	528.00	8.65	1.16	2070.22	.00	5.13	8.00	8.000	8.000	.00	0 .0
28.694	.0100					.0016	.05	7.63	.55	3.73	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4948.912	2061.721	7.272	2068.993	528.00	9.08	1.28	2070.27	.00	5.13	8.00	8.000	8.000	.00	0 .0
1.839	.0100					.0018	.00	7.27	.59	3.73	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4947.073	2061.739	7.248	2068.988	528.00	9.11	1.29	2070.28	.00	5.13	8.00	8.000	8.000	.00	0 .0
HYDRAULIC JUMP														
		---------- WARNING - Flow depth near top of box conduit ----------												
-4947.073	2061.739	3.478	2065.218	528.00	18.98	5.59	2070.81	.00	5.13	8.00	8.000	8.000	.00	0 .0
117.073	.0100					.0126	1.48	3.48	1.79	3.73	.013	.00	.00	BOX
-4830.000	2062.910	3.358	2066.268	528.00	19.65	6.00	2072.27	.00	5.13	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0133	.13	3.36	1.89		.013	.00	.00	BOX
-4820.000	2063.010	5.018	2068.028	465.00	18.53	5.33	2073.36	.00	6.45	5.00	8.000	5.000	.00	0 .0
TRANS STR	.0100					.0134	.13	5.02	1.46		.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-4810.000	2063.110	4.970	2068.080	465.00	18.71	5.44	2073.52	.00	5.00	5.00	5.000	5.000	.00	0 .0
60.000	.0100					.0143	.86	4.97	1.48	5.00	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4750.000	2063.710	4.775	2068.485	465.00	19.48	5.89	2074.38	.00	5.00	5.00	5.000	5.000	.00	0 .0
10.000	.0150					.0150	.15	4.78	1.57	4.77	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4740.000	2063.860	4.775	2068.635	465.00	19.48	5.89	2074.53	.00	5.00	5.00	5.000	5.000	.00	0 .0
509.824	.0150					.0150	7.65	4.78	1.57	4.78	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4230.176	2071.507	4.775	2076.282	465.00	19.48	5.89	2082.17	.00	5.00	5.00	5.000	5.000	.00	0 .0
380.176	.0150					.0150	5.70	4.78	1.57	4.78	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3850.000	2077.210	4.780	2081.990	465.00	19.46	5.88	2087.87	.00	5.00	5.00	5.000	5.000	.00	0 .0
-3830.000	2077.510	4.780	2082.290	465.00	19.46	5.88	2088.17	.00	5.00	5.00	5.000	5.000	.00	0 .0

```
T1   OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE                0
T2   INTERIM CONDITIONS
T3   FILE NAME: OAKEYINT.WSW,  MODEL BY: HDR, DATE: 1/16/2008

SO  -7165.6402045.750  1
R   -7000.0002046.840  1      .013                                    .000    .000 0
JX  -6975.0002046.980  1  2   .013   18.000         2050.680         -90.0          .000
R   -6850.0002047.710  1      .013                                    .000    .000 0
JX  -6821.1502047.880  1  3   .013    8.000         2052.250          90.0          .000
R   -5820.0002053.890  1      .013                                    .000    .000 0
JX  -5800.0002054.010  1  4   .013   78.000         2054.530         -30.0          .000
TS  -5790.0002054.070  8      .013                                    .000
R   -5745.0002054.370  8      .013                                    .000    .000 0
JX  -5725.0002054.460  8  5   .013   18.000         2054.920         -90.0          .000
R   -5690.0002054.550  8      .013                                    .000    .000 0
JX  -5670.0002054.670  8  6  7.013   23.000      9.02056.5902057.080-90.0 90.0    .000
R   -5600.0002055.210  8      .013                                    .000    .000 0
R   -5590.0002055.310  8      .013                                    .000
R   -5260.0002058.610  8      .013                                    .000    .000 0
JX  -5240.0002058.810  8  9   .013   14.000         2062.07          -90.0          .000
R   -5220.0002059.010  8      .013                                    .000    .000 0
JX  -5200.0002059.210  8 10   .013   43.000         2062.38          -90.0          .000
R   -5180.0002059.410  8      .013                                    .000    .000 0
JX  -5160.0002059.610  8 11   .013  203.000         2061.520         -30.0          .000
R   -4920.0002062.010  8      .013                                    .000    .000 0
JX  -4900.0002062.210  8 12   .013   39.000   31.0002063.5502063.690-90.0 90.0    .000
R   -4830.0002062.910  8      .013                                    .000    .000 0
JX  -4820.0002063.010 13 14   .013   56.000         2063.450         -45.0          .000
TS  -4810.0002063.110 15      .013
R   -4750.0002063.710 15      .013
R   -4740.0002063.860 15      .013                                    .000
R   -3950.0002075.710 15      .013                                    .000    .000 0
JX  -3930.0002076.010 15 16 17.013   75.500   75.5002076.5202076.870-90.0 90.0    .000
R   -3900.0002076.460 15      .013                                    .000    .000 0
JX  -3880.0002076.760 15 18   .013  103.000         2077.670         -90.0          .000
JX  -3860.0002077.060 15 19   .013  134.900         2077.500          90.0          .000
R   -3830.0002077.510 15      .013                                    .000    .000 0
SH  -3830.0002077.510 15                              .000

CD   1  3   0    .000   8.000   10.000  .000  .000   .00
CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  4   1    .000   3.500     .000  .000  .000   .00
CD   4  4   1    .000   3.500     .000  .000  .000   .00
CD   5  4   1    .000   2.000     .000  .000  .000   .00
CD   6  4   1    .000   2.000     .000  .000  .000   .00
CD   7  4   1    .000   2.000     .000  .000  .000   .00
CD   8  3   0    .000   8.000    8.000  .000  .000   .00
CD   9  4   1    .000   3.000     .000  .000  .000   .00
CD  10  4   1    .000   2.000     .000  .000  .000   .00
CD  11  3   0    .000   5.000    5.000  .000  .000   .00
CD  12  4   1    .000   3.000     .000  .000  .000   .00
CD  13  3   0    .000   6.000    5.000  .000  .000   .00
CD  14  4   1    .000   3.000     .000  .000  .000   .00
CD  15  3   0    .000   5.000    5.000  .000  .000   .00
CD  16  4   1    .000   3.000     .000  .000  .000   .00
CD  17  4   1    .000   2.500     .000  .000  .000   .00
CD  18  4   1    .000   3.000     .000  .000  .000   .00
CD  19  4   1    .000   3.000     .000  .000  .000   .00
Q              0.100    .0
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OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE 0

INTERIM CONDITIONS

FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-7165.640	2045.750	5.571	2051.321	929.00	16.68	4.32	2055.64	.00	6.45	10.00	8.000	10.000	.00	0 .0
11.718	.0066					.0058	.07	5.57	1.24	5.33	.013	.00	.00	BOX
-7153.922	2045.827	5.587	2051.415	929.00	16.63	4.29	2055.71	.00	6.45	10.00	8.000	10.000	.00	0 .0
105.099	.0066					.0055	.57	5.59	1.24	5.33	.013	.00	.00	BOX
-7048.824	2046.519	5.860	2052.379	929.00	15.85	3.90	2056.28	.00	6.45	10.00	8.000	10.000	.00	0 .0
39.106	.0066					.0048	.19	5.86	1.15	5.33	.013	.00	.00	BOX
-7009.718	2046.776	6.146	2052.922	929.00	15.12	3.55	2056.47	.00	6.45	10.00	8.000	10.000	.00	0 .0
9.718	.0066					.0043	.04	6.15	1.07	5.33	.013	.00	.00	BOX
-7000.000	2046.840	6.447	2053.287	929.00	14.41	3.22	2056.51	.00	6.45	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0056					.0028	.07	6.45	1.00		.013	.00	.00	BOX
-6975.000	2046.980	7.310	2054.290	911.00	12.46	2.41	2056.70	.00	6.36	10.00	8.000	10.000	.00	0 .0
11.192	.0058					.0028	.03	7.31	.81	5.49	.013	.00	.00	BOX

---------- WARNING - Flow depth near top of box conduit ----------

-6963.808	2047.045	7.211	2054.257	911.00	12.63	2.48	2056.73	.00	6.36	10.00	8.000	10.000	.00	0 .0
HYDRAULIC JUMP														

---------- WARNING - Flow depth near top of box conduit ----------

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE 0

INTERIM CONDITIONS

FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-6963.808	2047.045	5.584	2052.630	911.00	16.31	4.13	2056.76	.00	6.36	10.00	8.000	10.000	.00	0 .0
113.808	.0058					.0055	.62	5.58	1.22	5.49	.013	.00	.00	BOX
-6850.000	2047.710	5.677	2053.386	911.00	16.05	4.00	2057.39	.00	6.36	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0059					.0057	.16	5.68	1.19		.013	.00	.00	BOX
-6821.150	2047.880	5.398	2053.278	903.00	16.73	4.34	2057.62	.00	6.33	10.00	8.000	10.000	.00	0 .0
268.378	.0060					.0060	1.61	5.40	1.27	5.40	.013	.00	.00	BOX
-6552.772	2049.491	5.398	2054.889	903.00	16.73	4.34	2059.23	.00	6.33	10.00	8.000	10.000	.00	0 .0
412.553	.0060					.0060	2.47	5.40	1.27	5.40	.013	.00	.00	BOX
-6140.219	2051.968	5.415	2057.383	903.00	16.68	4.32	2061.70	.00	6.33	10.00	8.000	10.000	.00	0 .0
320.219	.0060					.0056	1.79	5.42	1.26	5.40	.013	.00	.00	BOX
-5820.000	2053.890	5.680	2059.569	903.00	15.90	3.93	2063.49	.00	6.33	10.00	8.000	10.000	.00	0 .0
JUNCT STR	.0060					.0075	.15	5.68	1.18		.013	.00	.00	BOX
-5800.000	2054.010	4.198	2058.208	825.00	19.65	6.00	2064.21	.00	5.96	10.00	8.000	10.000	.00	0 .0
TRANS STR	.0060					.0079	.08	4.20	1.69		.013	.00	.00	BOX
-5790.000	2054.070	6.450	2060.520	825.00	15.99	3.97	2064.49	.00	6.91	8.00	8.000	8.000	.00	0 .0
28.213	.0067					.0057	.16	6.45	1.11	6.13	.013	.00	.00	BOX
-5761.787	2054.258	6.591	2060.849	825.00	15.65	3.80	2064.65	.00	6.91	8.00	8.000	8.000	.00	0 .0
16.787	.0067					.0052	.09	6.59	1.07	6.13	.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5745.000	2054.370	6.913	2061.283	825.00	14.92	3.46	2064.74	.00	6.91	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0045					.0048	.10	6.91	1.00		.013	.00	.00	BOX
-5725.000	2054.460	8.030	2062.490	807.00	12.61	2.47	2064.96	.00	6.81	8.00	8.000	8.000	.00	0 .0
35.000	.0026					.0048	.17	8.03	.79	8.00	.013	.00	.00	BOX
-5690.000	2054.550	8.109	2062.659	807.00	12.61	2.47	2065.13	.00	6.81	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0060					.0045	.09	8.11	.79		.013	.00	.00	BOX
-5670.000	2054.670	8.466	2063.136	775.00	12.11	2.28	2065.41	.00	6.63	8.00	8.000	8.000	.00	0 .0
70.000	.0077					.0045	.31	8.47	.75	5.51	.013	.00	.00	BOX
-5600.000	2055.210	8.238	2063.448	775.00	12.11	2.28	2065.72	.00	6.63	8.00	8.000	8.000	.00	0 .0
10.000	.0100					.0045	.04	8.24	.75	4.98	.013	.00	.00	BOX
-5590.000	2055.310	8.182	2063.492	775.00	12.11	2.28	2065.77	.00	6.63	8.00	8.000	8.000	.00	0 .0
2.361	.0100					.0045	.01	8.18	.75	4.98	.013	.00	.00	BOX
-5587.639	2055.334	8.168	2063.501	775.00	12.11	2.28	2065.78	.00	6.63	8.00	8.000	8.000	.00	0 .0
HYDRAULIC JUMP														
-5587.639	2055.334	5.160	2060.494	775.00	18.77	5.47	2065.97	.00	6.63	8.00	8.000	8.000	.00	0 .0
66.153	.0100					.0090	.59	5.16	1.46	4.98	.013	.00	.00	BOX
-5521.486	2055.995	5.224	2061.219	775.00	18.55	5.34	2066.56	.00	6.63	8.00	8.000	8.000	.00	0 .0
138.696	.0100					.0083	1.16	5.22	1.43	4.98	.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5382.790	2057.382	5.479	2062.861	775.00	17.68	4.86	2067.72	.00	6.63	8.00	8.000	8.000	.00	0 .0
66.379	.0100					.0074	.49	5.48	1.33	4.98	.013	.00	.00	BOX
-5316.411	2058.046	5.746	2063.792	775.00	16.86	4.41	2068.21	.00	6.63	8.00	8.000	8.000	.00	0 .0
34.868	.0100					.0065	.23	5.75	1.24	4.98	.013	.00	.00	BOX
-5281.543	2058.395	6.026	2064.421	775.00	16.08	4.01	2068.43	.00	6.63	8.00	8.000	8.000	.00	0 .0
16.788	.0100					.0058	.10	6.03	1.15	4.98	.013	.00	.00	BOX
-5264.755	2058.563	6.321	2064.883	775.00	15.33	3.65	2068.53	.00	6.63	8.00	8.000	8.000	.00	0 .0
4.755	.0100					.0051	.02	6.32	1.07	4.98	.013	.00	.00	BOX
-5260.000	2058.610	6.630	2065.240	775.00	14.61	3.32	2068.56	.00	6.63	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0037	.07	6.63	1.00		.013	.00	.00	BOX
-5240.000	2058.810	7.298	2066.108	761.00	13.03	2.64	2068.75	.00	6.55	8.00	8.000	8.000	.00	0 .0
12.434	.0100					.0037	.05	7.30	.85	4.91	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-5227.566	2058.934	6.959	2065.893	761.00	13.67	2.90	2068.79	.00	6.55	8.00	8.000	8.000	.00	0 .0
1.676	.0100					.0041	.01	6.96	.91	4.91	.013	.00	.00	BOX
-5225.890	2058.951	6.897	2065.849	761.00	13.79	2.95	2068.80	.00	6.55	8.00	8.000	8.000	.00	0 .0
HYDRAULIC JUMP														

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE

0

INTERIM CONDITIONS

FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-5225.890	2058.951	6.212	2065.163	761.00	15.31	3.64	2068.80	.00	6.55	8.00	8.000	8.000	.00	0 .0
1.256	.0100					.0054	.01	6.21	1.08	4.91	.013	.00	.00	BOX
-5224.634	2058.964	6.245	2065.209	761.00	15.23	3.60	2068.81	.00	6.55	8.00	8.000	8.000	.00	0 .0
4.634	.0100					.0051	.02	6.25	1.07	4.91	.013	.00	.00	BOX
-5220.000	2059.010	6.551	2065.561	761.00	14.52	3.27	2068.83	.00	6.55	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0038	.08	6.55	1.00		.013	.00	.00	BOX
-5200.000	2059.210	8.035	2067.245	718.00	11.22	1.95	2069.20	.00	6.30	8.00	8.000	8.000	.00	0 .0
5.731	.0100					.0038	.02	8.04	.70	4.70	.013	.00	.00	BOX
-5194.269	2059.267	8.000	2067.267	718.00	11.22	1.95	2069.22	.00	6.30	8.00	8.000	8.000	.00	0 .0
14.269	.0100					.0026	.04	8.00	.70	4.70	.013	.00	.00	BOX
-5180.000	2059.410	7.787	2067.197	718.00	11.53	2.06	2069.26	.00	6.30	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0020	.04	7.79	.73		.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-5160.000	2059.610	8.964	2068.574	515.00	8.05	1.01	2069.58	.00	5.05	8.00	8.000	8.000	.00	0 .0
119.996	.0100					.0020	.24	8.96	.50	3.66	.013	.00	.00	BOX
-5040.004	2060.810	8.000	2068.810	515.00	8.05	1.01	2069.82	.00	5.05	8.00	8.000	8.000	.00	0 .0
31.679	.0100					.0013	.04	8.00	.50	3.66	.013	.00	.00	BOX

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-5008.325	2061.127	7.627	2068.754	515.00	8.44	1.11	2069.86	.00	5.05	8.00	8.000	8.000	.00	0 .0
29.087	.0100					.0015	.04	7.63	.54	3.66	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4979.238	2061.418	7.272	2068.689	515.00	8.85	1.22	2069.91	.00	5.05	8.00	8.000	8.000	.00	0 .0
26.433	.0100					.0017	.04	7.27	.58	3.66	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-4952.805	2061.682	6.933	2068.615	515.00	9.28	1.34	2069.95	.00	5.05	8.00	8.000	8.000	.00	0 .0
23.683	.0100					.0019	.05	6.93	.62	3.66	.013	.00	.00	BOX
-4929.122	2061.919	6.611	2068.530	515.00	9.74	1.47	2070.00	.00	5.05	8.00	8.000	8.000	.00	0 .0
9.122	.0100					.0021	.02	6.61	.67	3.66	.013	.00	.00	BOX
-4920.000	2062.010	6.479	2068.490	515.00	9.94	1.53	2070.02	.00	5.05	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0013	.03	6.48	.69		.013	.00	.00	BOX
-4900.000	2062.210	7.284	2069.494	445.00	7.64	.91	2070.40	.00	4.58	8.00	8.000	8.000	.00	0 .0
28.684	.0100					.0013	.04	7.28	.50	3.28	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE 0
INTERIM CONDITIONS
FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-4871.316	2062.497	6.945	2069.442	445.00	8.01	1.00	2070.44	.00	4.58	8.00	8.000	8.000	.00	0 .0
26.330	.0100					.0014	.04	6.94	.54	3.28	.013	.00	.00	BOX
-4844.986	2062.760	6.622	2069.382	445.00	8.40	1.10	2070.48	.00	4.58	8.00	8.000	8.000	.00	0 .0
.517	.0100					.0016	.00	6.62	.58	3.28	.013	.00	.00	BOX
-4844.469	2062.765	6.614	2069.379	445.00	8.41	1.10	2070.48	.00	4.58	8.00	8.000	8.000	.00	0 .0
HYDRAULIC JUMP														
-4844.469	2062.765	3.017	2065.782	445.00	18.44	5.28	2071.06	.00	4.58	8.00	8.000	8.000	.00	0 .0
14.469	.0100					.0127	.18	3.02	1.87	3.28	.013	.00	.00	BOX
-4830.000	2062.910	3.002	2065.912	445.00	18.53	5.33	2071.24	.00	4.58	8.00	8.000	8.000	.00	0 .0
JUNCT STR	.0100					.0130	.13	3.00	1.88		.013	.00	.00	BOX
-4820.000	2063.010	4.347	2067.357	389.00	17.90	4.97	2072.33	.00	5.73	5.00	6.000	5.000	.00	0 .0
TRANS STR	.0100					.0134	.13	4.35	1.51		.013	.00	.00	BOX
-4810.000	2063.110	4.306	2067.417	389.00	18.07	5.07	2072.48	.00	5.00	5.00	5.000	5.000	.00	0 .0
60.000	.0100					.0143	.86	4.31	1.53	4.87	.013	.00	.00	BOX
-4750.000	2063.710	4.135	2067.845	389.00	18.81	5.50	2073.34	.00	5.00	5.00	5.000	5.000	.00	0 .0
10.000	.0150					.0150	.15	4.14	1.63	4.13	.013	.00	.00	BOX
-4740.000	2063.860	4.135	2067.995	389.00	18.81	5.50	2073.49	.00	5.00	5.00	5.000	5.000	.00	0 .0
254.773	.0150					.0150	3.82	4.14	1.63	4.14	.013	.00	.00	BOX

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE

0

INTERIM CONDITIONS

FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-4485.227	2067.682	4.135	2071.817	389.00	18.81	5.50	2077.31	.00	5.00	5.00	5.000	5.000	.00	0 .0
354.573	.0150					.0142	5.03	4.14	1.63	4.14	.013	.00	.00	BOX
-4130.654	2073.000	4.333	2077.333	389.00	17.96	5.01	2082.34	.00	5.00	5.00	5.000	5.000	.00	0 .0
101.645	.0150					.0126	1.28	4.33	1.52	4.14	.013	.00	.00	BOX
-4029.010	2074.525	4.545	2079.069	389.00	17.12	4.55	2083.62	.00	5.00	5.00	5.000	5.000	.00	0 .0
50.527	.0150					.0112	.57	4.54	1.42	4.14	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3978.483	2075.283	4.766	2080.049	389.00	16.32	4.14	2084.19	.00	5.00	5.00	5.000	5.000	.00	0 .0
28.483	.0150					.0100	.28	4.77	1.32	4.14	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3950.000	2075.710	5.000	2080.710	389.00	15.56	3.76	2084.47	.00	5.00	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0150					.0052	.10	5.00	1.23		.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
-3930.000	2076.010	9.550	2085.560	238.00	9.52	1.41	2086.97	.00	4.13	5.00	5.000	5.000	.00	0 .0
30.000	.0150					.0052	.15	9.55	.75	2.82	.013	.00	.00	BOX

OAKEY DRAIN FACILITY - BIRCH STREET TO CAHLAN DRIVE 0
INTERIM CONDITIONS
FILE NAME: OAKEYINT.WSW, MODEL BY: HDR, DATE: 1/16/2008

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-3900.000	2076.460	9.254	2085.714	238.00	9.52	1.41	2087.12	.00	4.13	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0150					.0017	.03	9.25	.75		.013	.00	.00	BOX
-3880.000	2076.760	10.931	2087.691	135.00	5.40	.45	2088.14	.00	2.83	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0150					.0000	.00	10.93	.43		.013	.00	.00	BOX
-3860.000	2077.060	11.553	2088.613	.10	.00	.00	2088.61	.00	.02	5.00	5.000	5.000	.00	0 .0
30.000	.0150					.0000	.00	11.55	.00	.02	.013	.00	.00	BOX
-3830.000	2077.510	11.103	2088.613	.10	.00	.00	2088.61	.00	.02	5.00	5.000	5.000	.00	0 .0

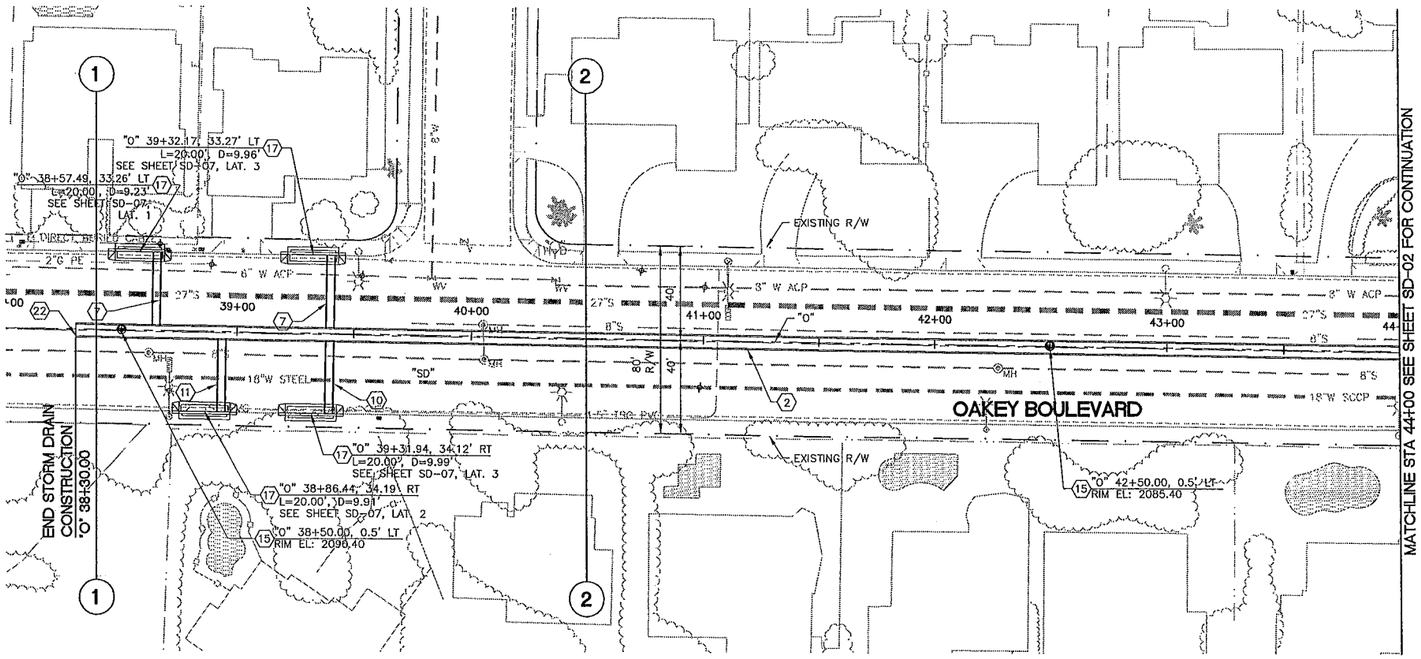
A.2 STREET FLOW CALCULATIONS

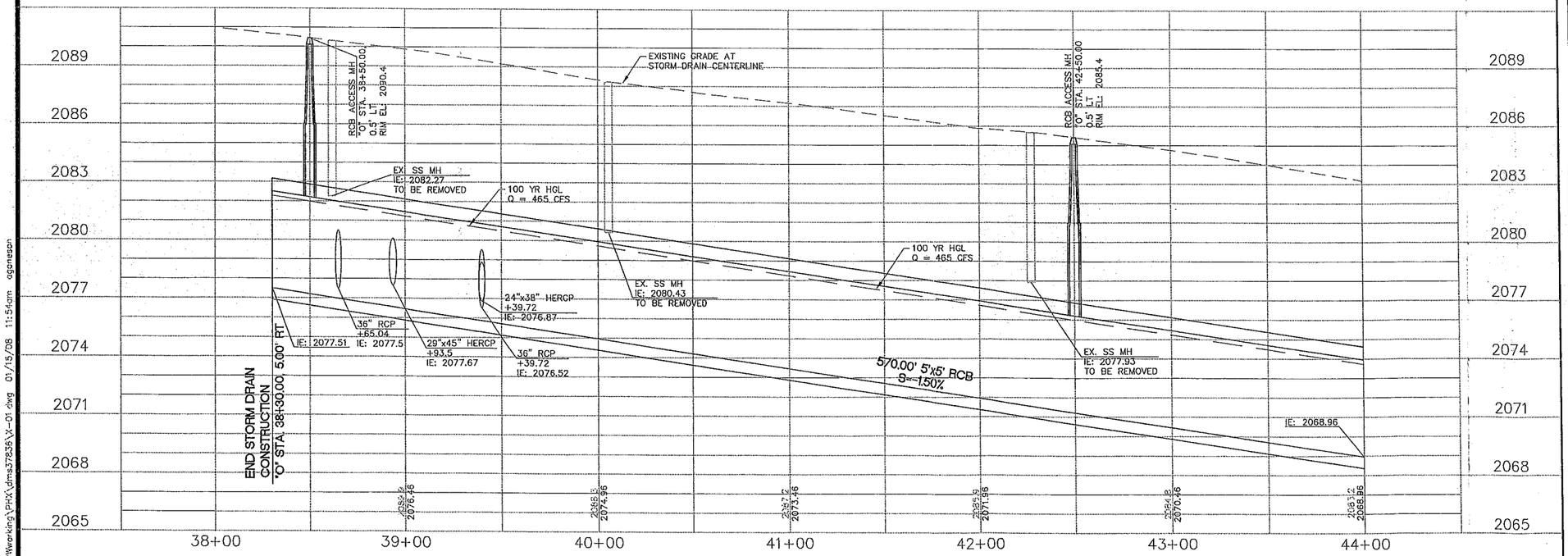
Cross-section Locations

Ultimate Condition

Interim Condition

Cross-section Locations





30 0 30 60

DRAINAGE NOTES

1. PROTECT-IN-PLACE
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LAS VEGAS VALLEY WATER DISTRICT DATE

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100% SUBMITTAL
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JAN 11, 2008

Call before you Underground 1-702-455-7511 (also locates traffic signal interconnect) 1-702-432-5300 (also locates FIRE & Sprinkler)

Call before you Dig 811 1-800-227-2600 (also locates traffic signal interconnect) 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS			
NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

HDR

DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

HDR Engineering, Inc.

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

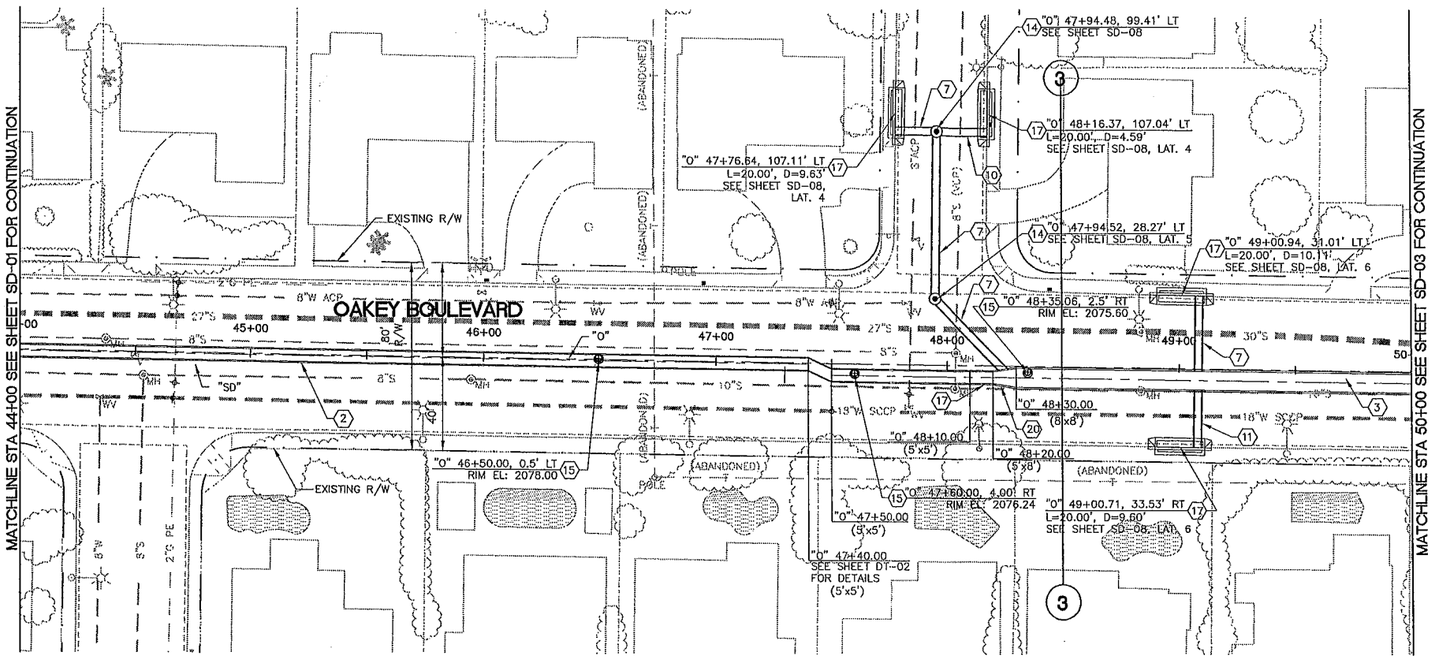
SHEET: CROSS SECTION EXHIBIT
STA 38+00.00 TO STA 44+00.00

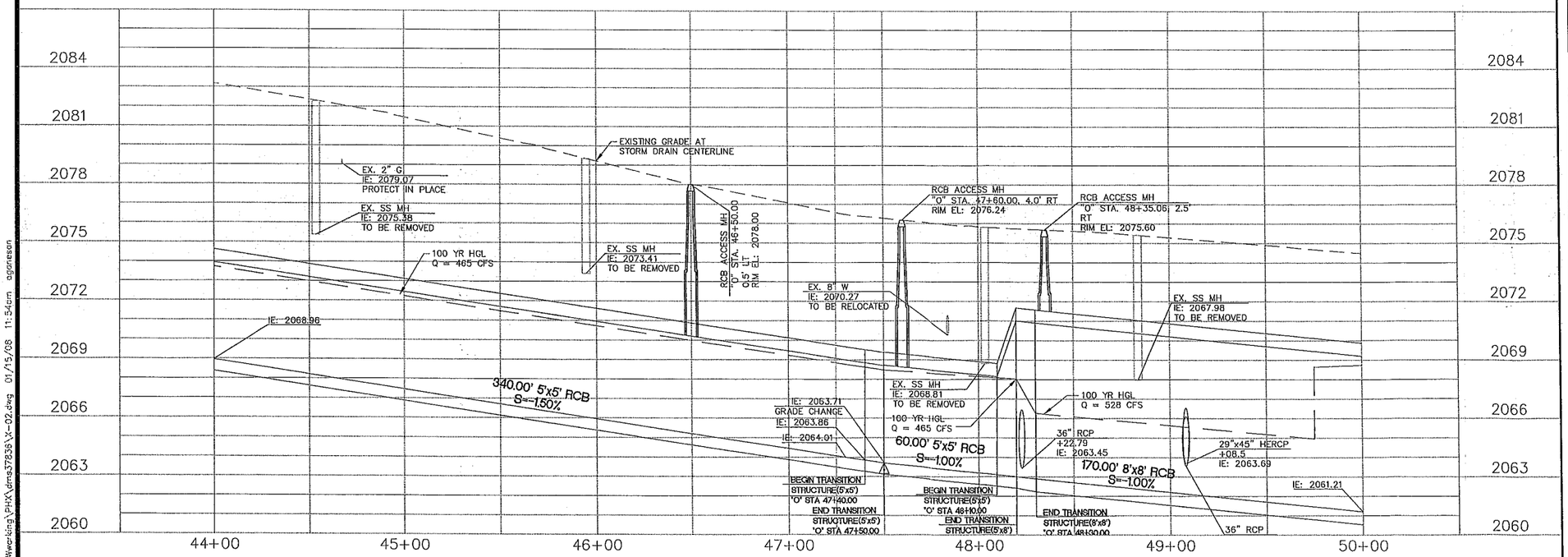
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671
PROFESSIONAL ENGINEER, STATE OF NEVADA

Sheet X-01 of

DRAWING NO. XXXXXX

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DRAINAGE NOTES

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LAS VEGAS VALLEY WATER DISTRICT DATE

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JAN 11, 2008

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Call before you OVERHEAD
1-702-593-6111

Call before you UnderGround
1-702-455-7511
1-702-432-5300

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

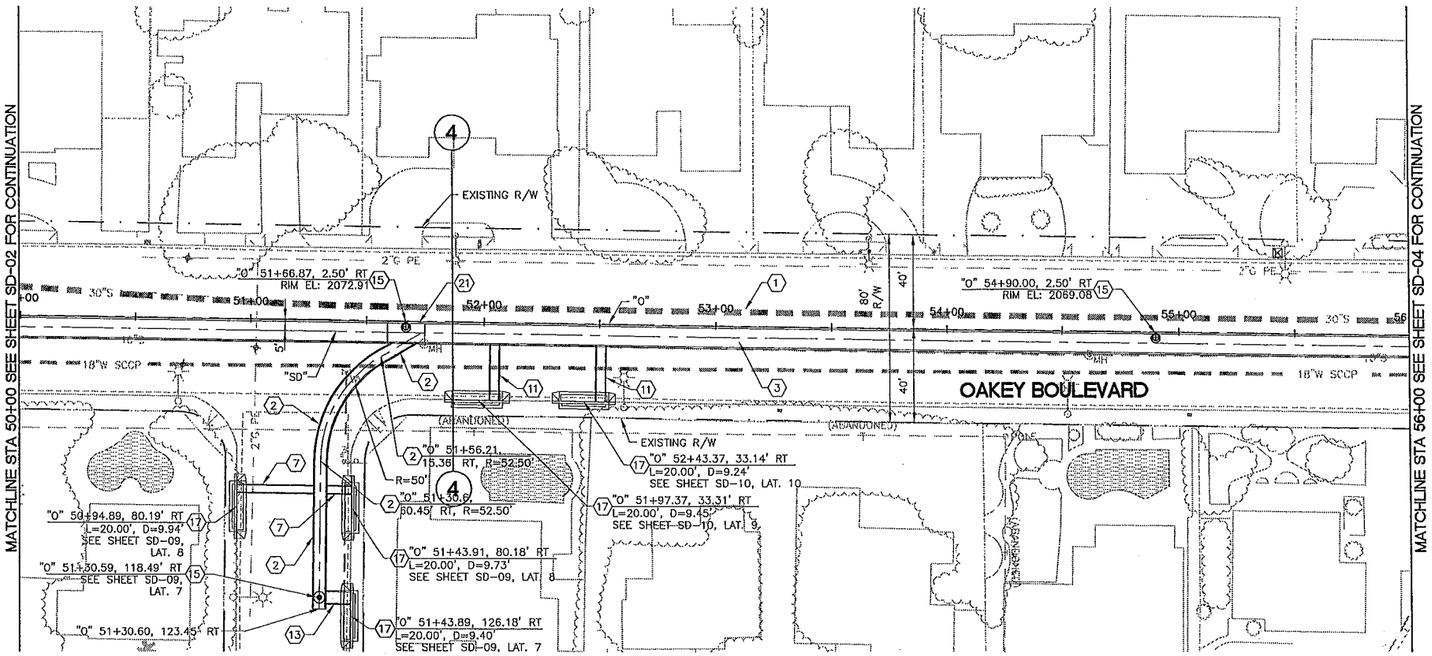
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

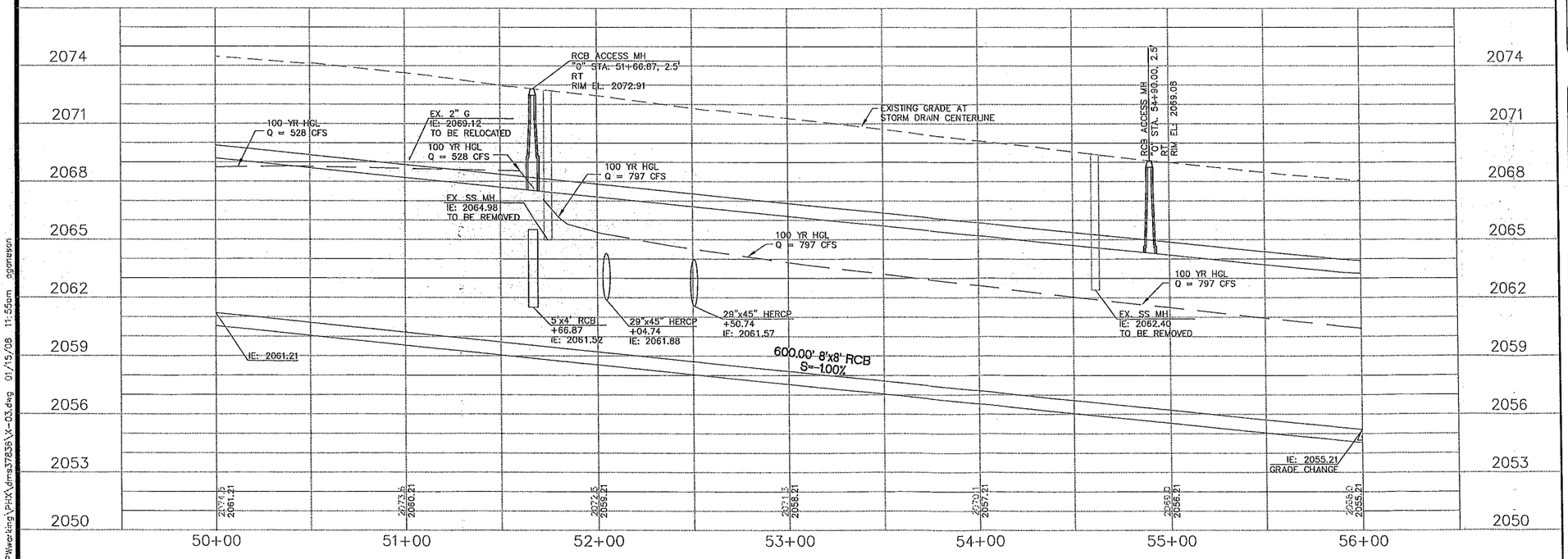
SHEET: CROSS SECTION EXHIBIT
STA 46+00.00 TO STA 50+00.00

RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
017617
STATE OF NEVADA
PROFESSIONAL ENGINEER

Sheet X-02 of
DRAWING NO. XXXXXX

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DRAINAGE NOTES

1. PROTECT-IN-PLACE
2. CONSTRUCT 5'x5' PRECAST RCB
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LAS VEGAS VALLEY WATER DISTRICT DATE

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JAN 11, 2008

Call before you Dig Underground 1-702-455-7511 (Las Vegas Valley Area) 1-702-732-5300 (Rural Areas, Cities & Mobile Homes)

Call 811 before you Dig 1-800-227-2600 (Outside Clark County) 1-702-455-7511

Call before you OVERHEAD 1-702-593-8111

Avoid accidental power line contact. It's easy.

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

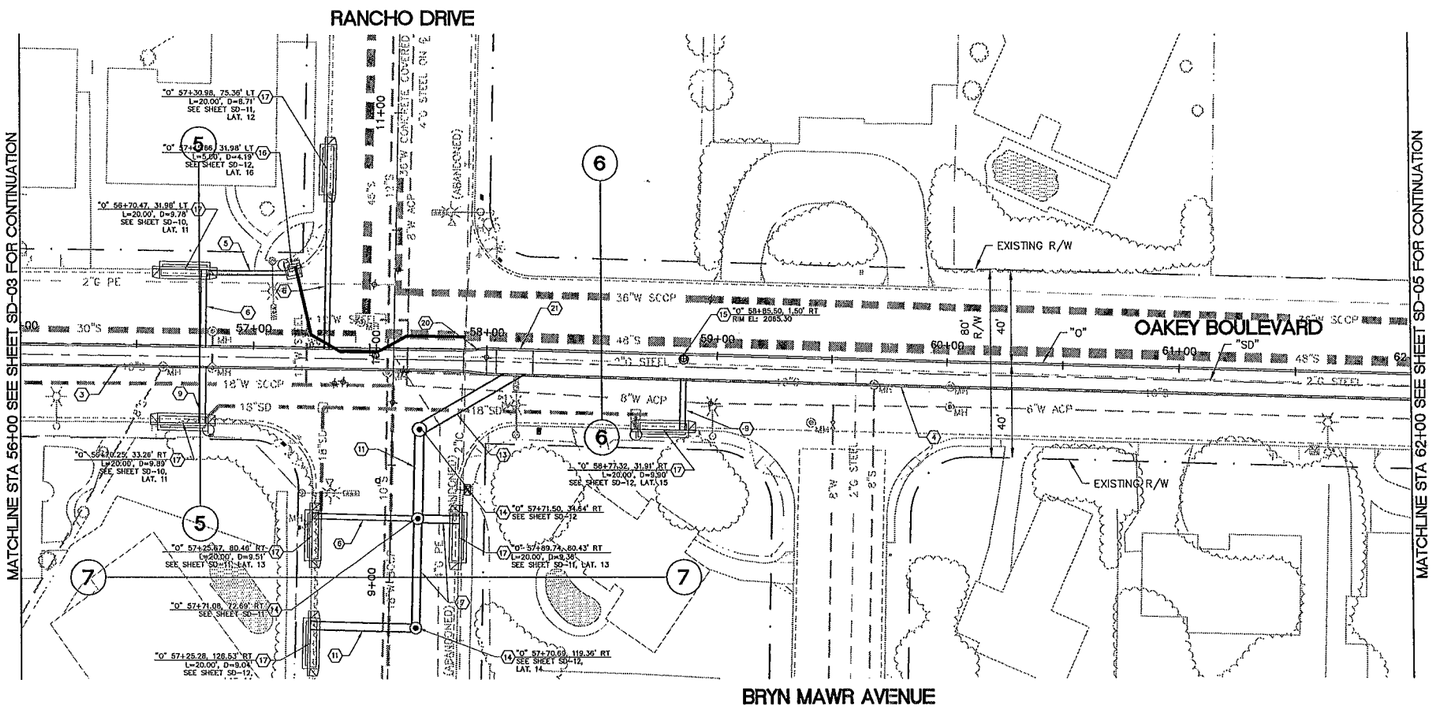
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
CROSS SECTION EXHIBIT
STA 50+00.00 TO STA 56+00.00

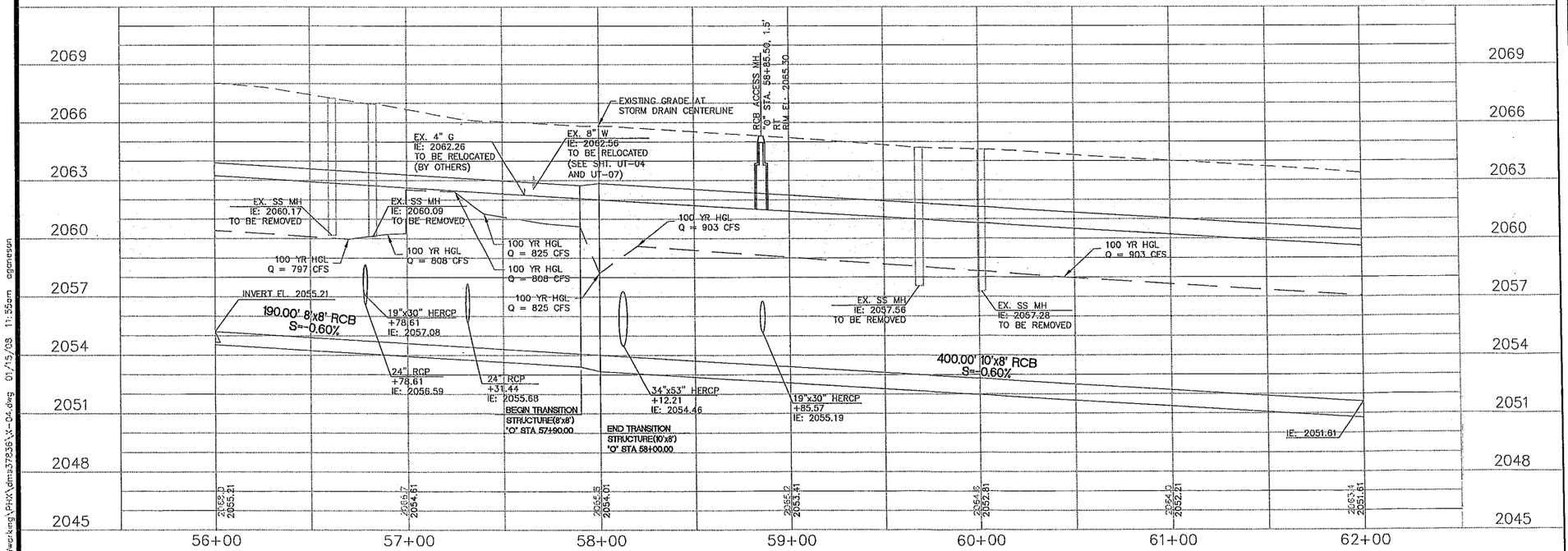
SHEET:

RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671
PROFESSIONAL ENGINEER - STATE OF NEVADA

Sheet X-03 of
DRAWING NO. XXXXXX

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LAS VEGAS VALLEY WATER DISTRICT DATE

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Call before you UnderGround 1-702-455-7511 (Las Vegas Metro Area) 1-702-472-5300 (Rest of Nevada, State of Washington)

Call 811 1-800-227-2600 (Las Vegas Metro Area) 1-702-455-7944

Call before you OVERHEAD 1-702-593-6111

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY OF LAS VEGAS NEVADA

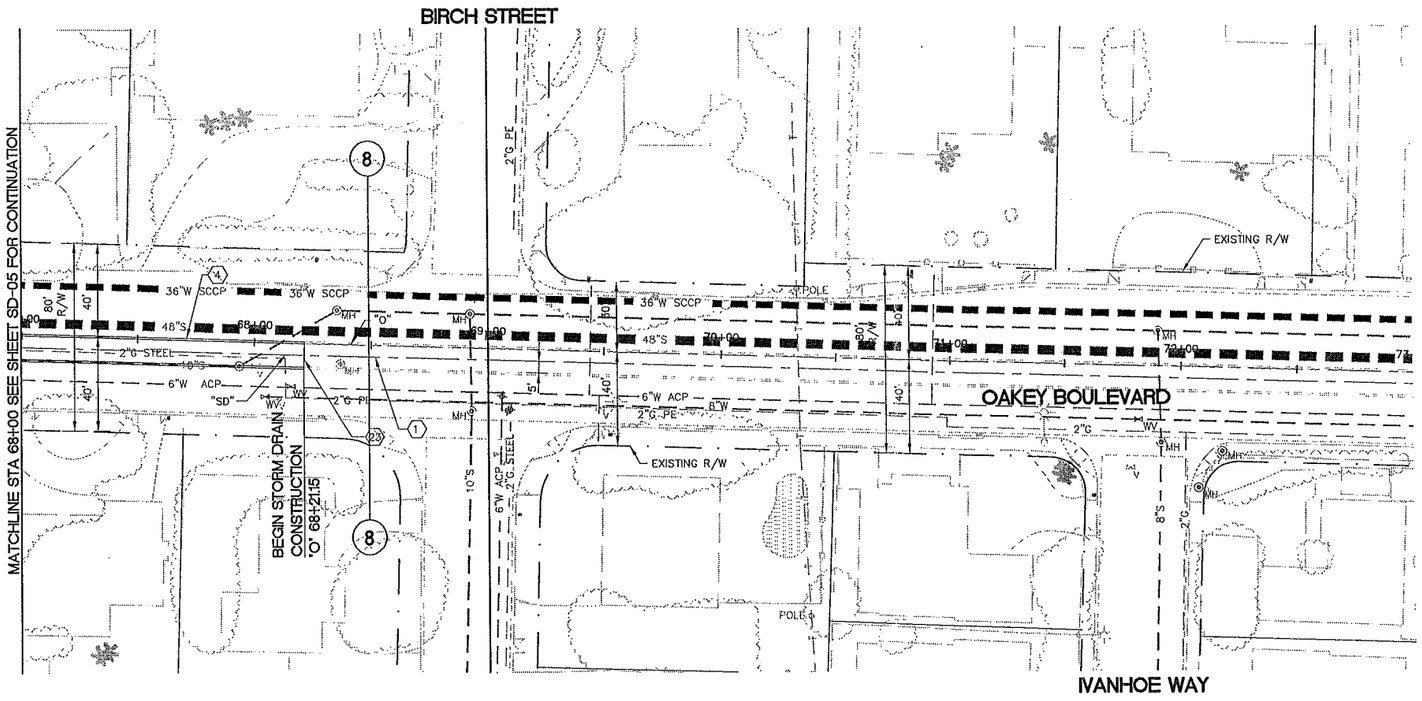
CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
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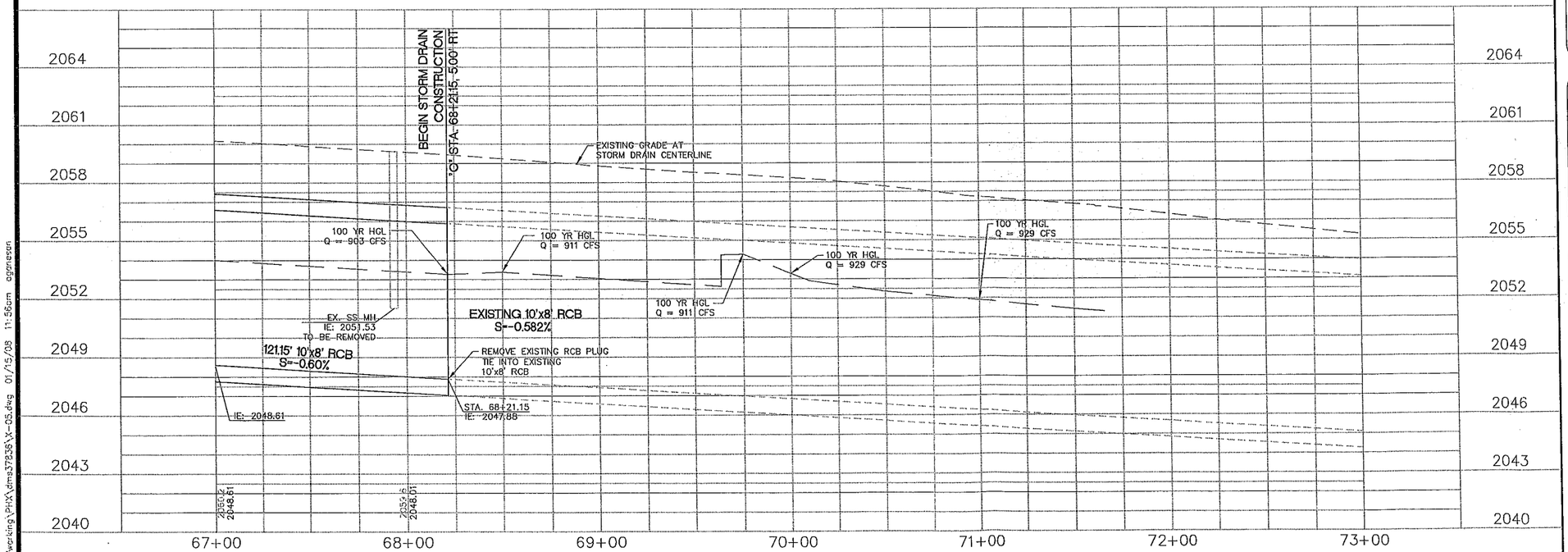
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: CROSS SECTION EXHIBIT
STA 56+00.00 TO STA 62+00.00

RAJANISH HANUMANTHAIAH Exp. 06-30-09 CIVIL No. 017671 STATE OF NEVADA PROFESSIONAL ENGINEER

Sheet X-04 of
DRAWING NO. XXXXX

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DRAINAGE NOTES

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Call before you OVERHEAD 1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET: CROSS SECTION EXHIBIT
STA 68+00.00 TO STA 74+00.00

RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671 STATE OF NEVADA
PROFESSIONAL ENGINEER

Sheet X-05 of

DRAWING NO. XXXXXX

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Ultimate Condition

Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	10.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+08, 0.13)	0.013
(0+08, 0.13)	(0+40, 0.77)	0.016

Results

Normal Depth	0.44	ft
Elevation Range	0.00 to 0.77	
Flow Area	2.94	ft²
Wetted Perimeter	17.36	ft
Top Width	16.91	ft
Normal Depth	0.44	ft
Critical Depth	0.49	ft
Critical Slope	0.00549	ft/ft
Velocity	3.41	ft/s
Velocity Head	0.18	ft
Specific Energy	0.62	ft

Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-N

Results

Froude Number	1.44	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.44	ft
Critical Depth	0.49	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00549	ft/ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-N

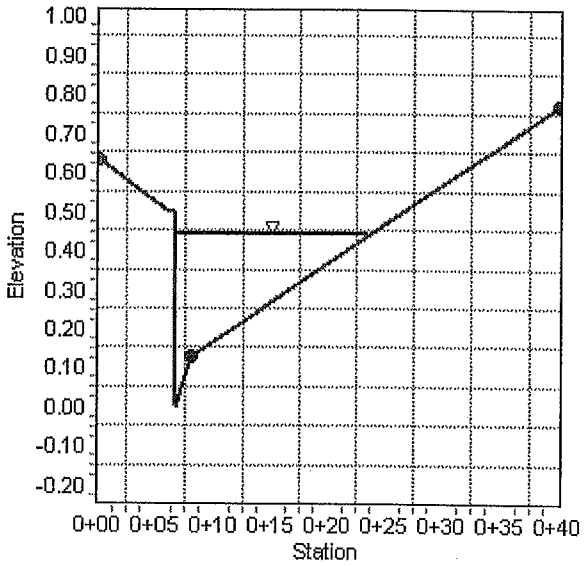
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.44	ft
Discharge	10.0	ft^3/s

Cross Section Image



Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	33.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.016
(0+72, 0.13)	(0+80, 0.63)	0.013

Results

Normal Depth		0.65	ft
Elevation Range	0.00 to 0.77		
Flow Area		8.11	ft²
Wetted Perimeter		34.34	ft
Top Width		33.81	ft
Normal Depth		0.65	ft
Critical Depth		0.72	ft
Critical Slope		0.00526	ft/ft
Velocity		4.07	ft/s
Velocity Head		0.26	ft
Specific Energy		0.90	ft

Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-S

Results

Froude Number	1.47	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.65	ft
Critical Depth	0.72	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00526	ft/ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow-S

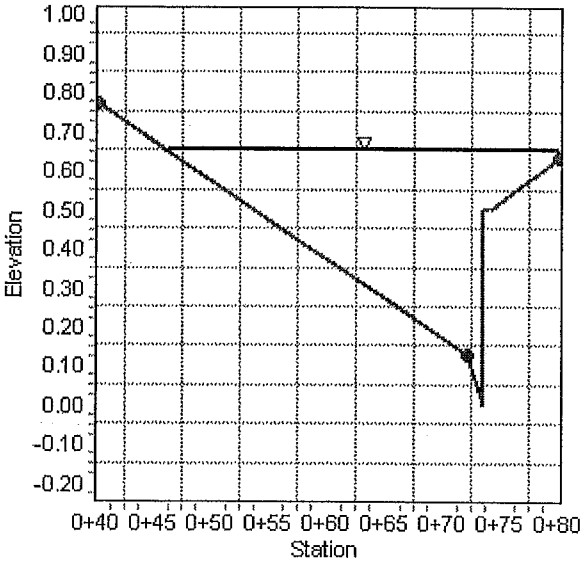
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.65	ft
Discharge	33.0	ft^3/s

Cross Section Image



Worksheet for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow- S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	0.7	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.013
(0+72, 0.13)	(0+80, 0.63)	0.016

Results

Normal Depth	0.21	ft
Elevation Range	0.00 to 0.77	
Flow Area	0.37	ft²
Wetted Perimeter	5.64	ft
Top Width	5.43	ft
Normal Depth	0.21	ft
Critical Depth	0.22	ft
Critical Slope	0.00709	ft/ft
Velocity	1.89	ft/s
Velocity Head	0.06	ft
Specific Energy	0.26	ft

Worksheet for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow- S

Results

Froude Number		1.28	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.21	ft
Critical Depth	0.22	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00709	ft/ft

Cross Section for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow- S

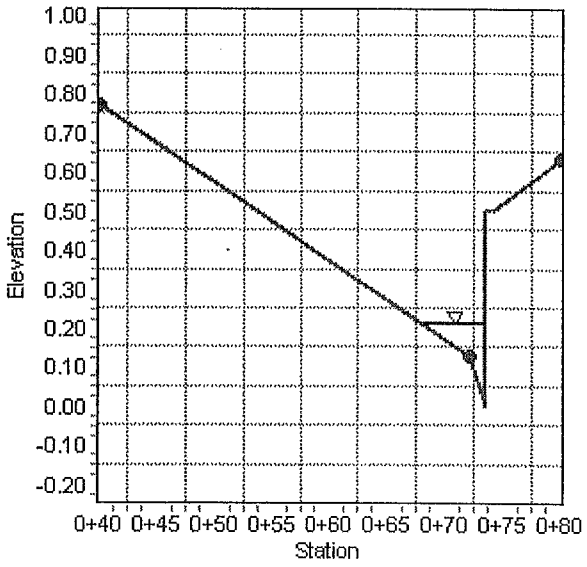
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.21	ft
Discharge	0.7	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	11.4	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.49	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		3.82	ft²
Wetted Perimeter		19.84	ft
Top Width		19.35	ft
Normal Depth		0.49	ft
Critical Depth		0.52	ft
Critical Slope		0.00563	ft/ft
Velocity		2.99	ft/s
Velocity Head		0.14	ft
Specific Energy		0.63	ft
Froude Number		1.18	

Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.52	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00563	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

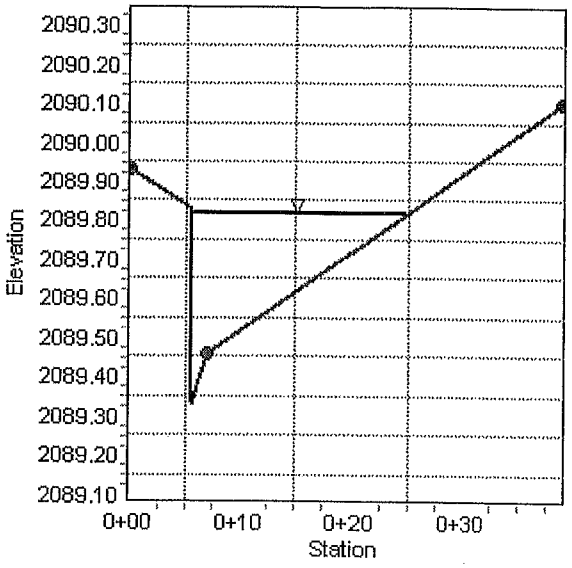
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.49	ft
Discharge	11.4	ft^3/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	0.7	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.22	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.46	ft²
Wetted Perimeter		6.47	ft
Top Width		6.24	ft
Normal Depth		0.22	ft
Critical Depth		0.22	ft
Critical Slope		0.00846	ft/ft
Velocity		1.51	ft/s
Velocity Head		0.04	ft
Specific Energy		0.26	ft
Froude Number		0.97	

Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.22	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00846	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

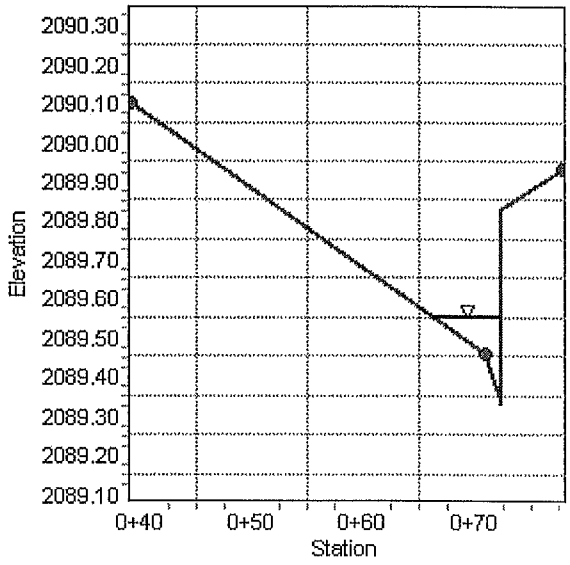
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.22	ft
Discharge	0.7	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-N

Results

Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.58	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00552	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 100-yr

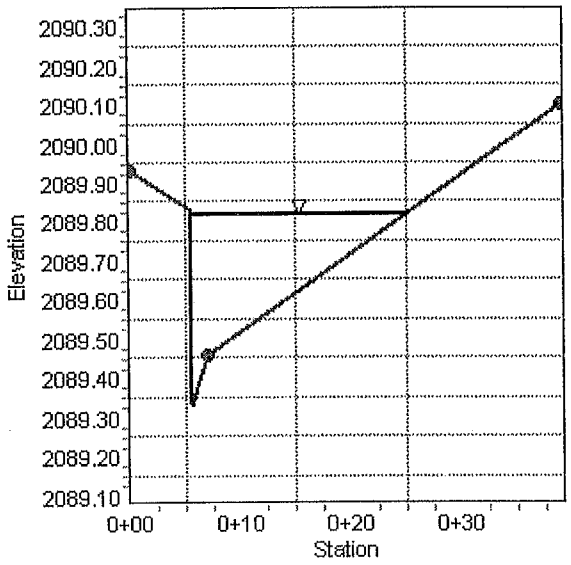
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.49	ft
Discharge	15.9	ft^3/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	10.7	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.43	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	2.83	ft²
Wetted Perimeter	17.05	ft
Top Width	16.61	ft
Normal Depth	0.43	ft
Critical Depth	0.51	ft
Critical Slope	0.00544	ft/ft
Velocity	3.78	ft/s
Velocity Head	0.22	ft
Specific Energy	0.65	ft
Froude Number	1.61	

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.51	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00544	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 100-yr

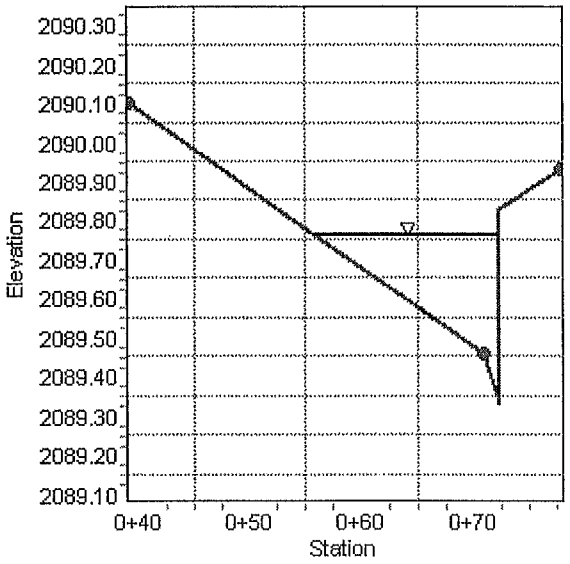
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.43	ft
Discharge	10.7	ft³/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	7.9	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.45	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		3.21	ft²
Wetted Perimeter		18.16	ft
Top Width		17.69	ft
Normal Depth		0.45	ft
Critical Depth		0.46	ft
Critical Slope		0.00573	ft/ft
Velocity		2.46	ft/s
Velocity Head		0.09	ft
Specific Energy		0.55	ft
Froude Number		1.02	

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.46	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00573	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow

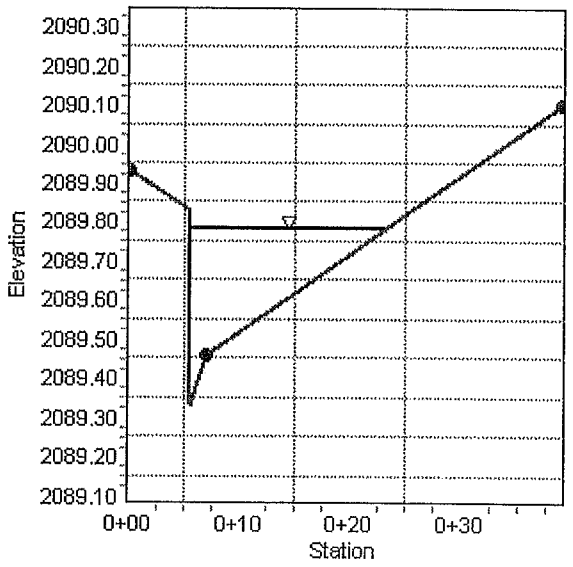
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.45	ft
Discharge	7.9	ft³/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	18.2	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.60	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		6.72	ft^2
Wetted Perimeter		31.21	ft
Top Width		30.69	ft
Normal Depth		0.60	ft
Critical Depth		0.61	ft
Critical Slope		0.00575	ft/ft
Velocity		2.71	ft/s
Velocity Head		0.11	ft
Specific Energy		0.72	ft
Froude Number		1.02	

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.60	ft
Critical Depth	0.61	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00575	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow

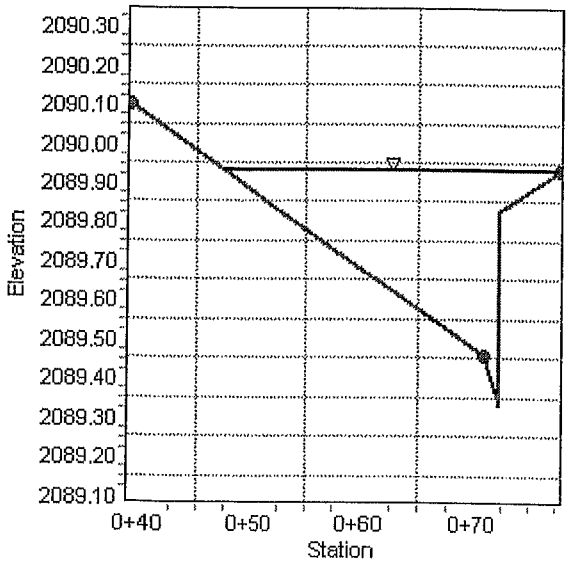
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.60	ft
Discharge	18.2	ft^3/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.90	%
Discharge	74.6	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+78, 2089.93)	0.016

Results

Normal Depth		0.70	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		19.97	ft²
Wetted Perimeter		72.48	ft
Top Width		71.25	ft
Normal Depth		0.70	ft
Critical Depth		0.75	ft
Critical Slope		0.00564	ft/ft
Velocity		3.73	ft/s

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

Results

Velocity Head	0.22	ft
Specific Energy	0.92	ft
Froude Number	1.24	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.75	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00564	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

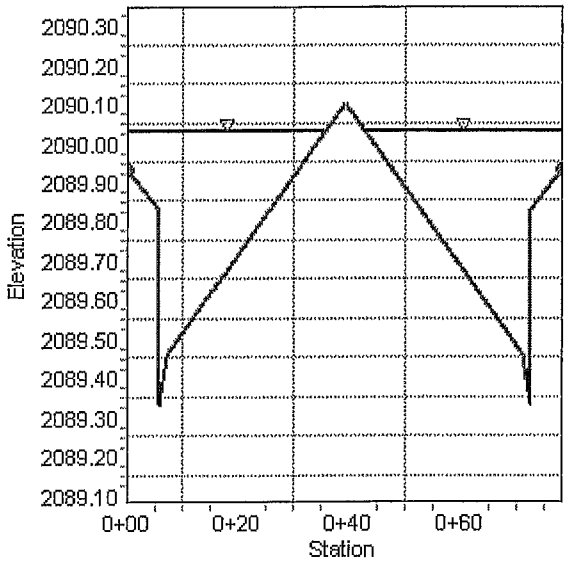
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.90	%
Normal Depth	0.70	ft
Discharge	74.6	ft³/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.60	%
Discharge	12.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.53	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		4.72	ft²
Wetted Perimeter		23.63	ft
Top Width		23.12	ft
Normal Depth		0.53	ft
Critical Depth		0.53	ft
Critical Slope		0.00609	ft/ft
Velocity		2.54	ft/s
Velocity Head		0.10	ft
Specific Energy		0.63	ft
Froude Number		0.99	

Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-N

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.53	ft
Critical Depth	0.53	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00609	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-

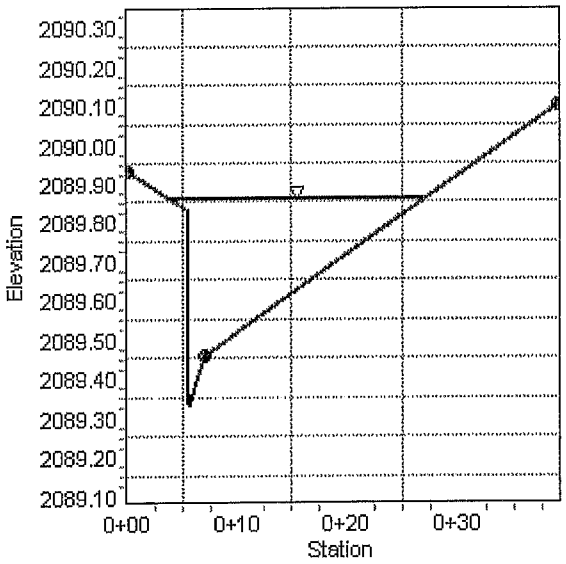
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.60	%
Normal Depth	0.53	ft
Discharge	12.0	ft^3/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	3.2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.34	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		1.55	ft²
Wetted Perimeter		12.50	ft
Top Width		12.15	ft
Normal Depth		0.34	ft
Critical Depth		0.34	ft
Critical Slope		0.00577	ft/ft
Velocity		2.06	ft/s
Velocity Head		0.07	ft
Specific Energy		0.41	ft
Froude Number		1.02	

Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.34	ft
Critical Depth	0.34	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00577	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-

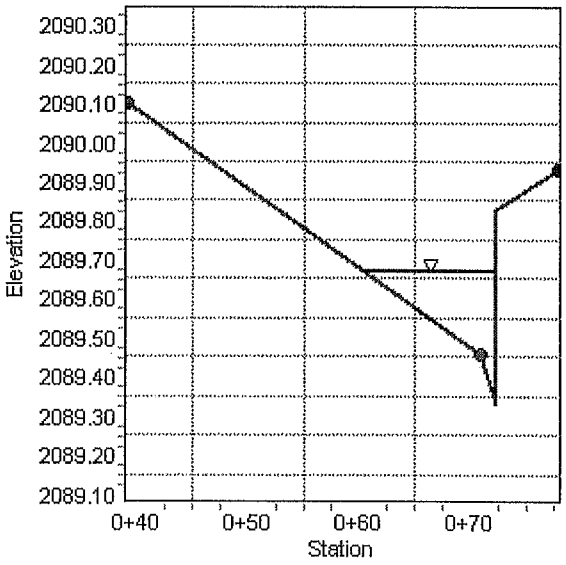
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.34	ft
Discharge	3.2	ft³/s

Cross Section Image



Worksheet for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	4.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+08, 0.13)	0.013
(0+08, 0.13)	(0+40, 0.77)	0.016

Results

Normal Depth		0.33	ft
Elevation Range	0.00 to 0.77		
Flow Area		1.40	ft²
Wetted Perimeter		11.85	ft
Top Width		11.51	ft
Normal Depth		0.33	ft
Critical Depth		0.37	ft
Critical Slope		0.00549	ft/ft
Velocity		2.86	ft/s
Velocity Head		0.13	ft
Specific Energy		0.46	ft

Worksheet for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow-N

Results

Froude Number	1.44	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.37	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00549	ft/ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow-N

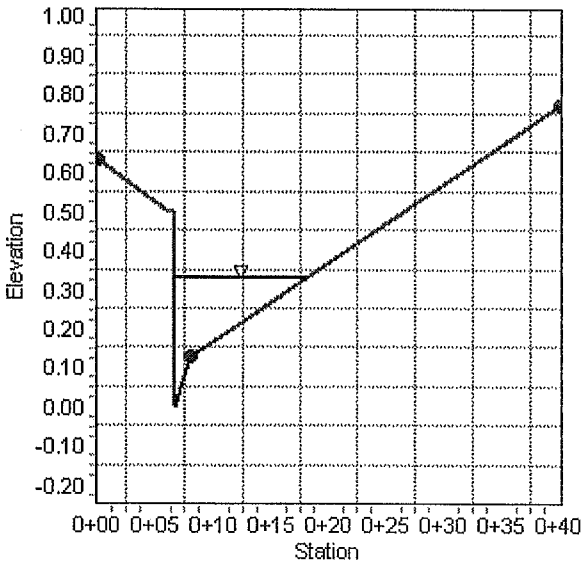
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.33	ft
Discharge	4.0	ft³/s

Cross Section Image



Worksheet for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	15.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.016
(0+72, 0.13)	(0+80, 0.63)	0.013

Results

Normal Depth		0.51	ft
Elevation Range	0.00 to 0.77		
Flow Area		4.20	ft²
Wetted Perimeter		21.59	ft
Top Width		21.09	ft
Normal Depth		0.51	ft
Critical Depth		0.57	ft
Critical Slope		0.00588	ft/ft
Velocity		3.57	ft/s
Velocity Head		0.20	ft
Specific Energy		0.70	ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow-S

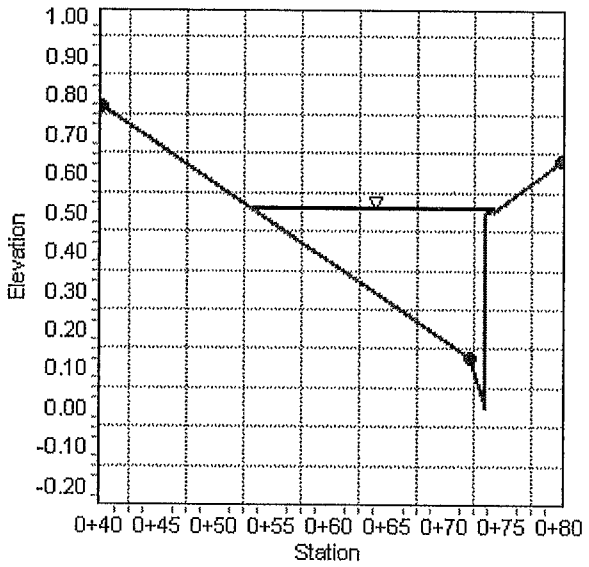
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.51	ft
Discharge	15.0	ft³/s

Cross Section Image



Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr Flow- S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	0.1	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.013
(0+72, 0.13)	(0+80, 0.63)	0.016

Results

Normal Depth		0.11	ft
Elevation Range	0.00 to 0.77		
Flow Area		0.07	ft²
Wetted Perimeter		1.40	ft
Top Width		1.28	ft
Normal Depth		0.11	ft
Critical Depth		0.11	ft
Critical Slope		0.01089	ft/ft
Velocity		1.40	ft/s
Velocity Head		0.03	ft
Specific Energy		0.14	ft

Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr Flow- S

Results

Froude Number	1.05	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.11	ft
Critical Depth	0.11	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.01089	ft/ft

Cross Section for XS 2-2 (Oakey just east of Cahlan) 10-yr Flow- S

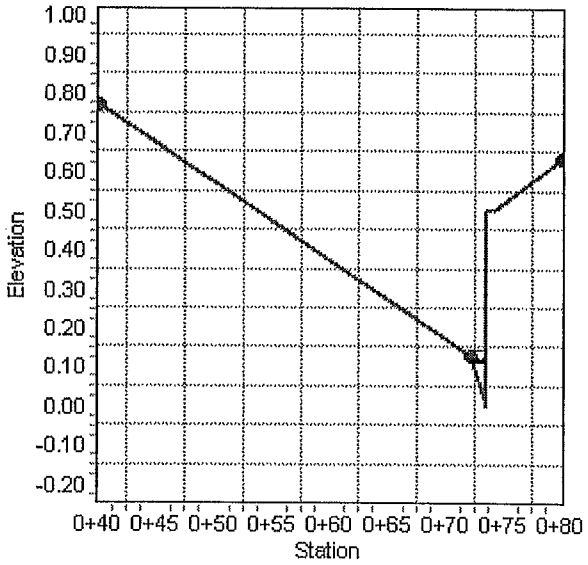
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.11	ft
Discharge	0.1	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	3.4	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.33	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		1.45	ft²
Wetted Perimeter		12.06	ft
Top Width		11.72	ft
Normal Depth		0.33	ft
Critical Depth		0.35	ft
Critical Slope		0.00565	ft/ft
Velocity		2.35	ft/s
Velocity Head		0.09	ft
Specific Energy		0.42	ft
Froude Number		1.18	

Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

Results

Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.35	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00565	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

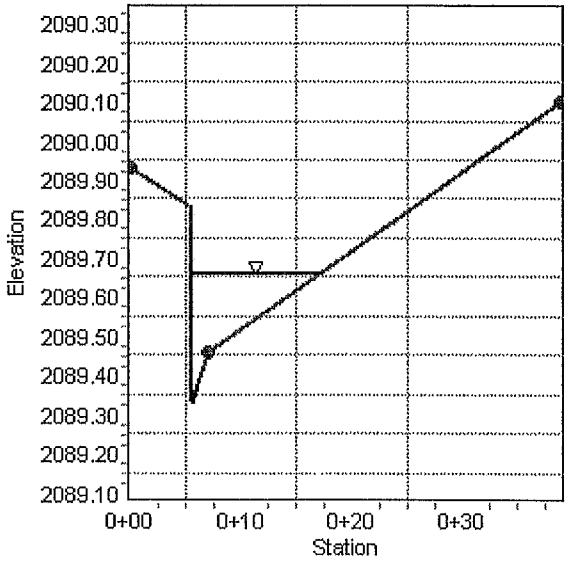
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.33	ft
Discharge	3.4	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	0.1	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.11	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.07	ft²
Wetted Perimeter		1.40	ft
Top Width		1.28	ft
Normal Depth		0.11	ft
Critical Depth		0.11	ft
Critical Slope		0.00720	ft/ft
Velocity		1.41	ft/s
Velocity Head		0.03	ft
Specific Energy		0.14	ft
Froude Number		1.05	

Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.11	ft
Critical Depth	0.11	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00720	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

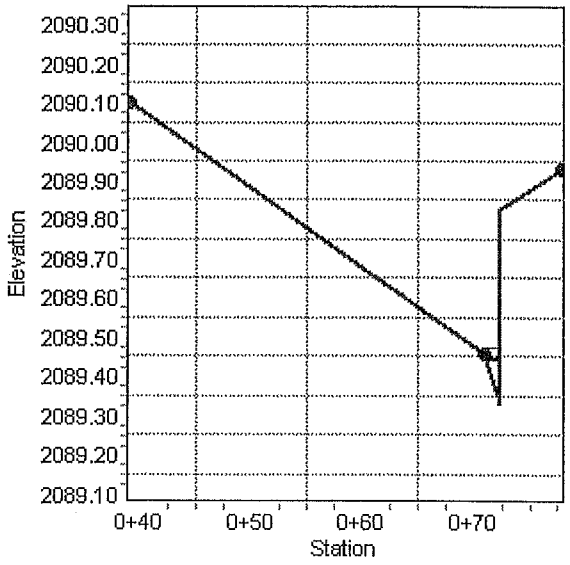
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.11	ft
Discharge	0.1	ft^3/s

Cross Section Image



Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr -N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	0.2	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.14	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.11	ft^2
Wetted Perimeter		2.11	ft
Top Width		1.96	ft
Normal Depth		0.14	ft
Critical Depth		0.16	ft
Critical Slope		0.00775	ft/ft
Velocity		1.76	ft/s
Velocity Head		0.05	ft
Specific Energy		0.19	ft
Froude Number		1.29	

Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr -N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.14	ft
Critical Depth	0.16	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00775	ft/ft

Cross Section for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr

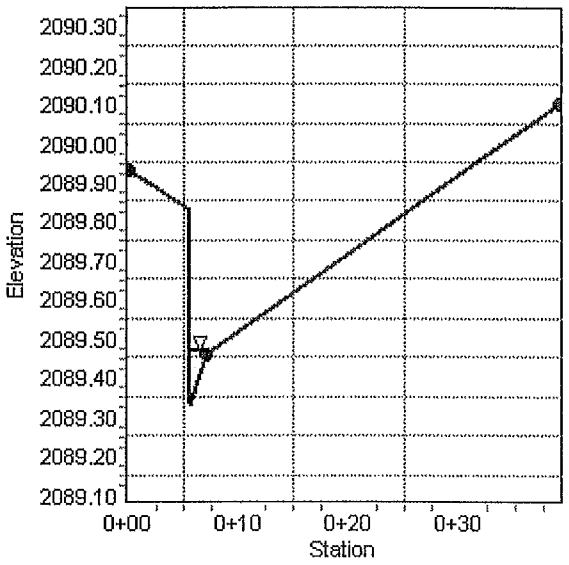
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.14	ft
Discharge	0.2	ft^3/s

Cross Section Image



Worksheet for XS4-4 (Oakey just east of Villa De Conde Way) 10-yr-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	11.5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.45	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	3.18	ft²
Wetted Perimeter	18.08	ft
Top Width	17.61	ft
Normal Depth	0.45	ft
Critical Depth	0.52	ft
Critical Slope	0.00550	ft/ft
Velocity	3.62	ft/s
Velocity Head	0.20	ft
Specific Energy	0.66	ft
Froude Number	1.50	

Worksheet for XS4-4 (Oakey just east of Villa De Conde Way) 10-yr-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.52	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00550	ft/ft

Cross Section for XS4-4 (Oakey just east of Villa De Conde Way) 10-yr-

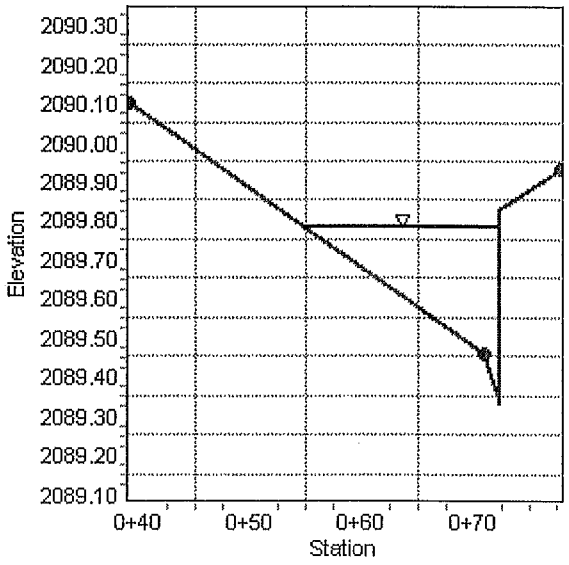
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.45	ft
Discharge	11.5	ft^3/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	2.2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.28	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.87	ft²
Wetted Perimeter		9.18	ft
Top Width		8.89	ft
Normal Depth		0.28	ft
Critical Depth		0.31	ft
Critical Slope		0.00751	ft/ft
Velocity		2.54	ft/s
Velocity Head		0.10	ft
Specific Energy		0.38	ft
Froude Number		1.44	

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.31	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00751	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-

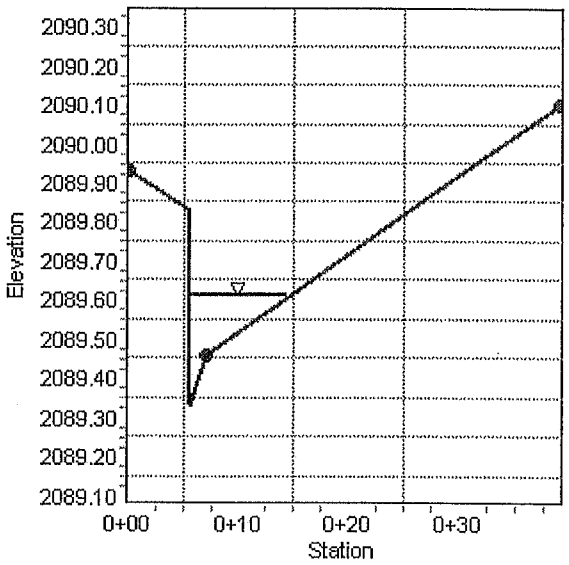
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.28	ft
Discharge	2.2	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	3.1	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.30	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		1.03	ft²
Wetted Perimeter		10.09	ft
Top Width		9.79	ft
Normal Depth		0.30	ft
Critical Depth		0.34	ft
Critical Slope		0.00531	ft/ft
Velocity		3.00	ft/s
Velocity Head		0.14	ft
Specific Energy		0.44	ft
Froude Number		1.63	

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.30	ft
Critical Depth	0.34	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00531	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-

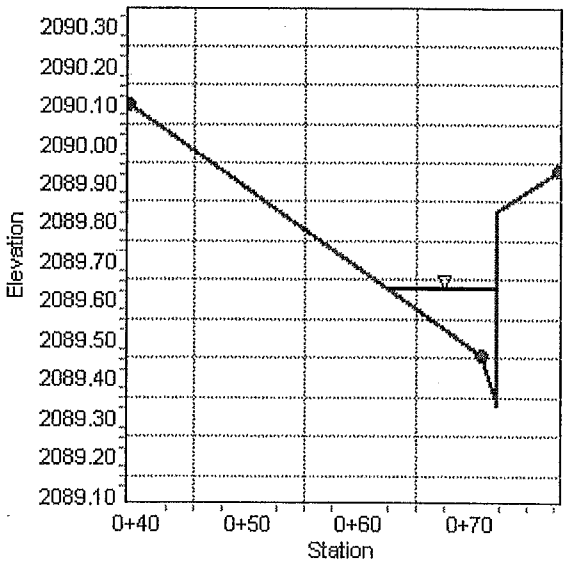
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.30	ft
Discharge	3.1	ft³/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	1.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.28	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	0.85	ft²
Wetted Perimeter	9.06	ft
Top Width	8.78	ft
Normal Depth	0.28	ft
Critical Depth	0.27	ft
Critical Slope	0.00804	ft/ft
Velocity	1.54	ft/s
Velocity Head	0.04	ft
Specific Energy	0.31	ft
Froude Number	0.87	

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-N

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.27	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00804	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-

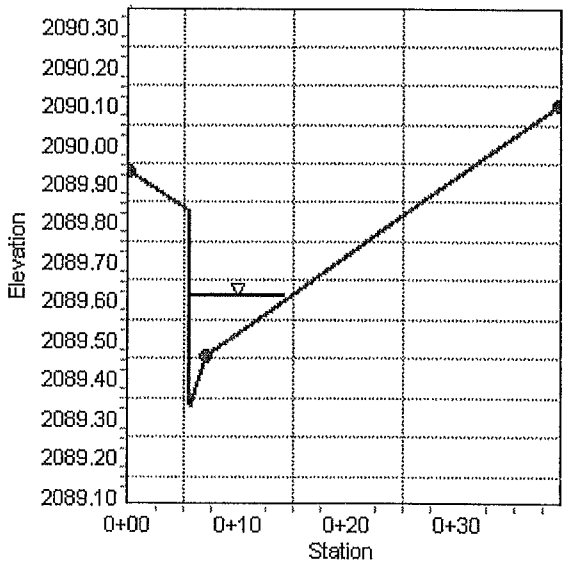
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.28	ft
Discharge	1.3	ft^3/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	4.9	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.39	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	2.19	ft²
Wetted Perimeter	14.94	ft
Top Width	14.54	ft
Normal Depth	0.39	ft
Critical Depth	0.39	ft
Critical Slope	0.00580	ft/ft
Velocity	2.24	ft/s
Velocity Head	0.08	ft
Specific Energy	0.47	ft
Froude Number	1.02	

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.39	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00580	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-

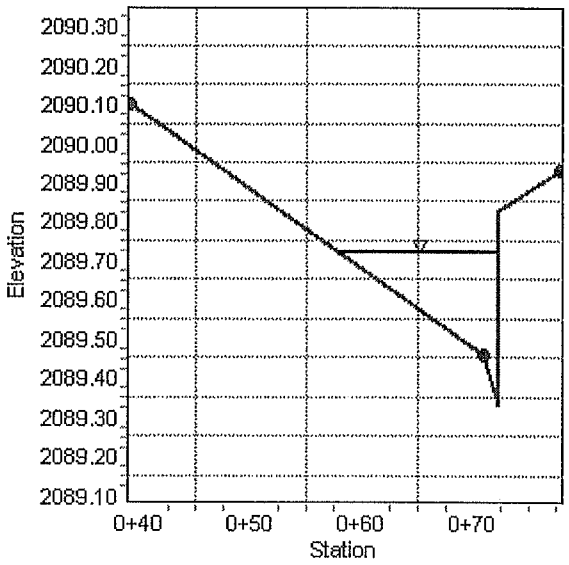
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.39	ft
Discharge	4.9	ft³/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Discharge	23.5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.61	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		6.98	ft²
Wetted Perimeter		31.64	ft
Top Width		31.12	ft
Normal Depth		0.61	ft
Critical Depth		0.65	ft
Critical Slope		0.00553	ft/ft
Velocity		3.37	ft/s
Velocity Head		0.18	ft
Specific Energy		0.79	ft
Froude Number		1.25	

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.65	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00553	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

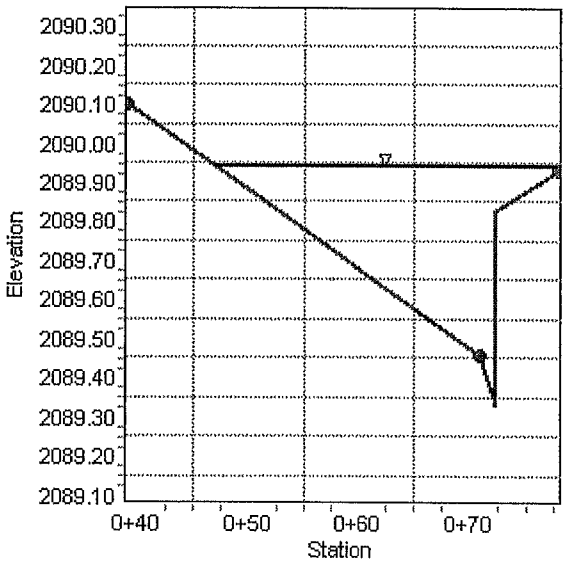
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Normal Depth	0.61	ft
Discharge	23.5	ft³/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Discharge	8.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.43	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		2.76	ft²
Wetted Perimeter		16.81	ft
Top Width		16.37	ft
Normal Depth		0.43	ft
Critical Depth		0.46	ft
Critical Slope		0.00561	ft/ft
Velocity		2.90	ft/s
Velocity Head		0.13	ft
Specific Energy		0.56	ft
Froude Number		1.25	

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.46	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00561	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

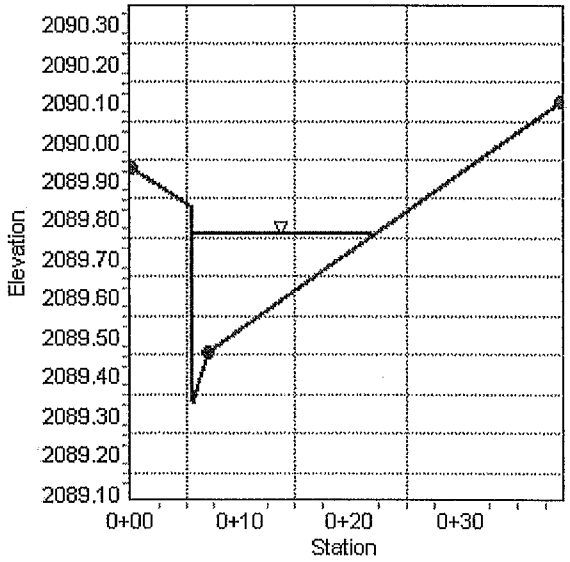
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Normal Depth	0.43	ft
Discharge	8.0	ft³/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	1.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.28	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.85	ft²
Wetted Perimeter		9.06	ft
Top Width		8.78	ft
Normal Depth		0.28	ft
Critical Depth		0.27	ft
Critical Slope		0.00804	ft/ft
Velocity		1.54	ft/s
Velocity Head		0.04	ft
Specific Energy		0.31	ft
Froude Number		0.87	

Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-N

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.27	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00804	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-N

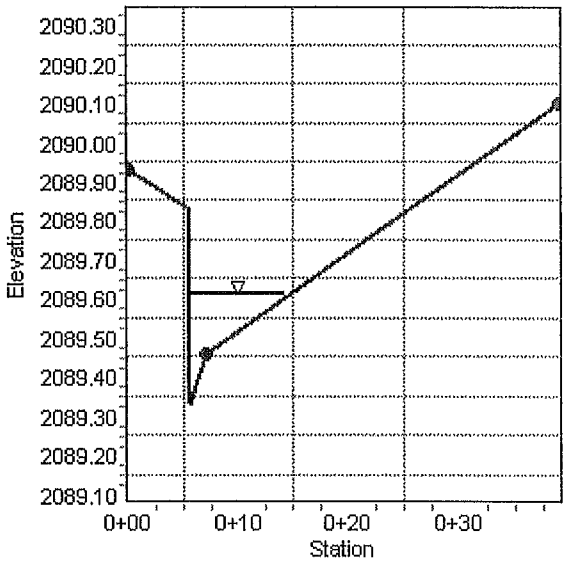
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.28	ft
Discharge	1.3	ft³/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	0.3	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.19	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.26	ft^2
Wetted Perimeter		4.49	ft
Top Width		4.30	ft
Normal Depth		0.19	ft
Critical Depth		0.18	ft
Critical Slope		0.00891	ft/ft
Velocity		1.16	ft/s
Velocity Head		0.02	ft
Specific Energy		0.21	ft
Froude Number		0.83	

Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.19	ft
Critical Depth	0.18	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00891	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

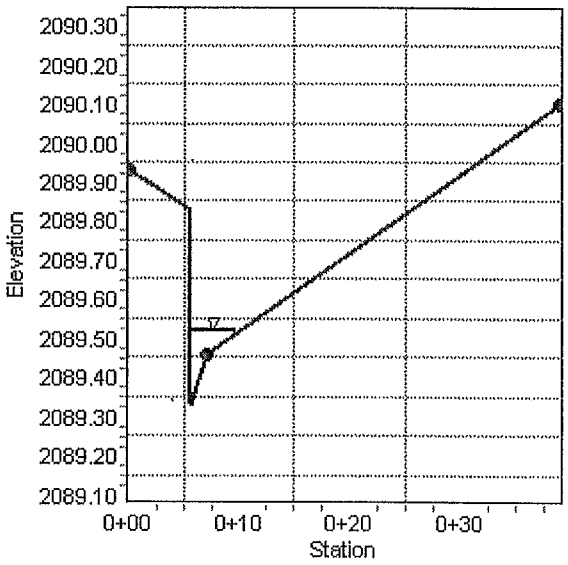
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.19	ft
Discharge	0.3	ft³/s

Cross Section Image



Interim Condition

Worksheet for XS4-4(Oakey just east of Villa De Conde Way)100-yr-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	9.9	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.43	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		2.82	ft²
Wetted Perimeter		17.01	ft
Top Width		16.57	ft
Normal Depth		0.43	ft
Critical Depth		0.49	ft
Critical Slope		0.00547	ft/ft
Velocity		3.51	ft/s
Velocity Head		0.19	ft
Specific Energy		0.62	ft
Froude Number		1.50	

Worksheet for XS4-4(Oakey just east of Villa De Conde Way)100-yr-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.49	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00547	ft/ft

Cross Section for XS4-4(Oakey just east of Villa De Conde Way)100-yr-

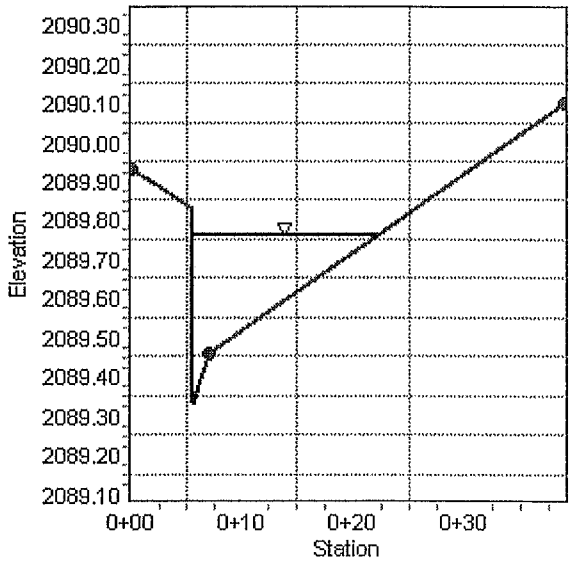
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.43	ft
Discharge	9.9	ft³/s

Cross Section Image



Worksheet for XS4-4(Oakey just east of Villa De Conde Way)100-yr-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	59.3	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.013
(0+71, 2089.46)	(0+78, 2089.93)	0.016

Results

Normal Depth		0.72	ft
Elevation Range	2089.33 to 2090.10 ft		
Flow Area		10.74	ft^2
Wetted Perimeter		37.31	ft
Top Width		36.67	ft
Normal Depth		0.72	ft
Critical Depth		0.87	ft
Critical Slope		0.00361	ft/ft
Velocity		5.52	ft/s
Velocity Head		0.47	ft
Specific Energy		1.20	ft
Froude Number		1.80	

Worksheet for XS4-4(Oakey just east of Villa De Conde Way)100-yr-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.72	ft
Critical Depth	0.87	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00361	ft/ft

Cross Section for XS4-4(Oakey just east of Villa De Conde Way)100-yr-

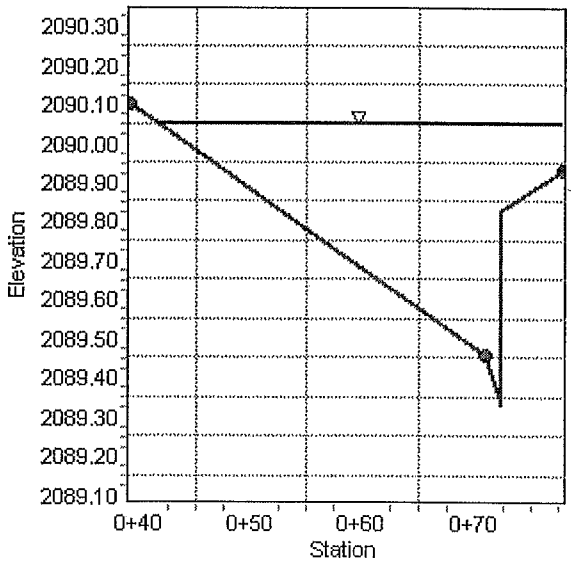
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.72	ft
Discharge	59.3	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	15.9	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.49	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		3.87	ft^2
Wetted Perimeter		19.99	ft
Top Width		19.49	ft
Normal Depth		0.49	ft
Critical Depth		0.58	ft
Critical Slope		0.00552	ft/ft
Velocity		4.10	ft/s
Velocity Head		0.26	ft
Specific Energy		0.75	ft
Froude Number		1.62	

Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	465.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+80, 0.63)	0.016

Results

Normal Depth		1.18	ft
Elevation Range	0.00 to 0.77		
Flow Area		57.79	ft²
Wetted Perimeter		82.13	ft
Top Width		80.00	ft
Normal Depth		1.18	ft
Critical Depth		1.47	ft

Worksheet for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow

Results

Critical Slope		0.00388	ft/ft
Velocity		8.05	ft/s
Velocity Head		1.01	ft
Specific Energy		2.18	ft
Froude Number		1.67	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.18	ft
Critical Depth	1.47	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00388	ft/ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 100-yr Flow

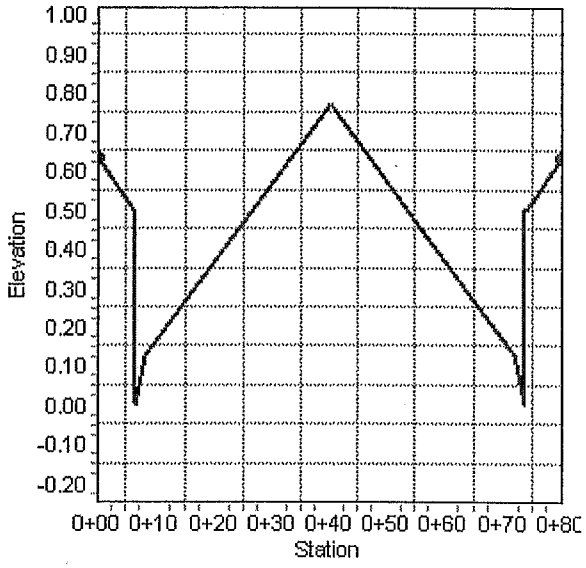
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	1.18	ft
Discharge	465.00	ft³/s

Cross Section Image



Worksheet for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	38.30	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+07, 0.00)	0.013
(0+07, 0.00)	(0+08, 0.13)	0.013
(0+08, 0.13)	(0+40, 0.77)	0.016

Results

Normal Depth	0.66	ft
Elevation Range	0.00 to 0.77 ft	
Flow Area	8.45	ft²
Wetted Perimeter	34.86	ft
Top Width	34.31	ft
Normal Depth	0.66	ft
Critical Depth	0.76	ft
Critical Slope	0.00429	ft/ft
Velocity	4.53	ft/s
Velocity Head	0.32	ft

Worksheet for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow-N

Results

Specific Energy		0.98	ft
Froude Number		1.61	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.76	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00429	ft/ft

Cross Section for XS 2-2 (Oakey just east of Cahlan) 100-yr Flow-N

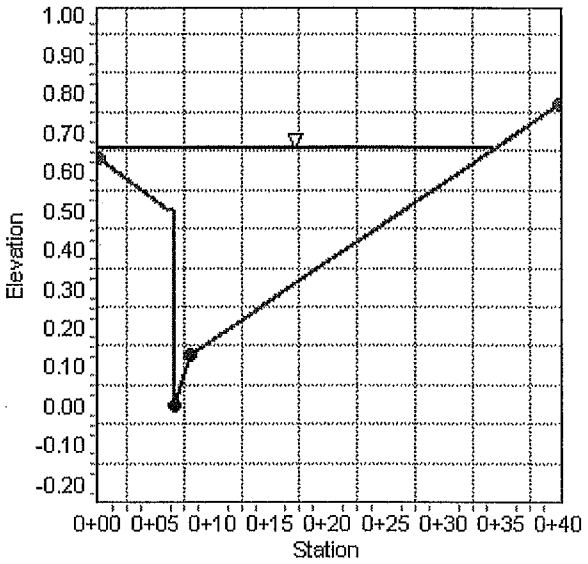
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.66	ft
Discharge	38.30	ft³/s

Cross Section Image



Worksheet for Copy of XS 2-2 (Oakey just east of Cahlan) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	38.30	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.016
(0+72, 0.13)	(0+74, 0.00)	0.013
(0+74, 0.00)	(0+74, 0.50)	0.013
(0+74, 0.50)	(0+74, 0.50)	0.013
(0+74, 0.50)	(0+80, 0.63)	0.013

Results

Normal Depth	0.66	ft
Elevation Range	0.00 to 0.77 ft	
Flow Area	8.66	ft^2
Wetted Perimeter	35.16	ft
Top Width	34.61	ft
Normal Depth	0.66	ft
Critical Depth	0.76	ft
Critical Slope	0.00461	ft/ft

Worksheet for Copy of XS 2-2 (Oakey just east of Cahlan) 100-yr Flow-S

Results

Velocity		4.42	ft/s
Velocity Head		0.30	ft
Specific Energy		0.97	ft
Froude Number		1.56	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.66	ft
Critical Depth	0.76	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00461	ft/ft

Cross Section for Copy of XS 2-2 (Oakey just east of Cahlan) 100-yr

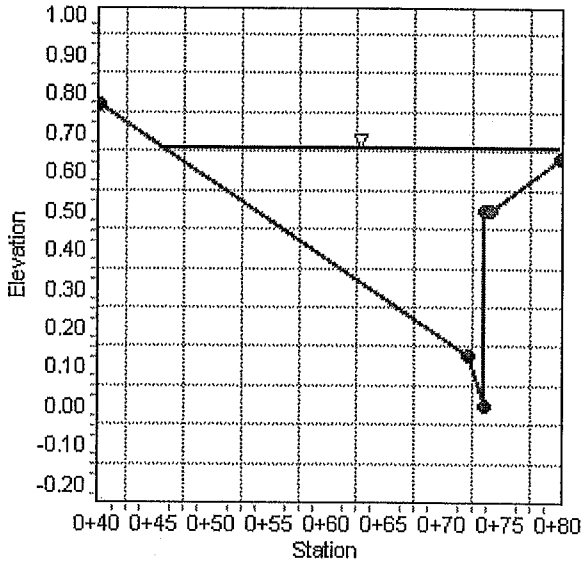
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.66	ft
Discharge	38.30	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	49.70	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+06, 2089.83)	0.013
(0+06, 2089.83)	(0+06, 2089.33)	0.013
(0+06, 2089.33)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.76	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	12.22	ft²
Wetted Perimeter	39.31	ft
Top Width	38.63	ft
Normal Depth	0.76	ft
Critical Depth	0.82	ft
Critical Slope	0.00469	ft/ft
Velocity	4.07	ft/s
Velocity Head	0.26	ft

Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

Results

Specific Energy		1.02	ft
Froude Number		1.27	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.76	ft
Critical Depth	0.82	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00469	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 100-yr Flow-N

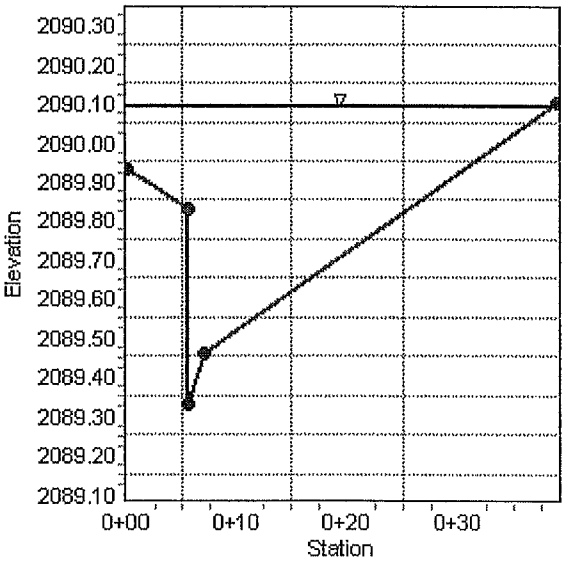
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.76	ft
Discharge	49.70	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	38.30	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+73, 2089.33)	0.013
(0+73, 2089.33)	(0+73, 2089.83)	0.013
(0+73, 2089.83)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.70	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	10.06	ft²
Wetted Perimeter	36.34	ft
Top Width	35.72	ft
Normal Depth	0.70	ft
Critical Depth	0.76	ft
Critical Slope	0.00482	ft/ft
Velocity	3.81	ft/s
Velocity Head	0.23	ft

Worksheet for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

Results

Specific Energy		0.93	ft
Froude Number		1.27	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.76	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00482	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 100-yr Flow-S

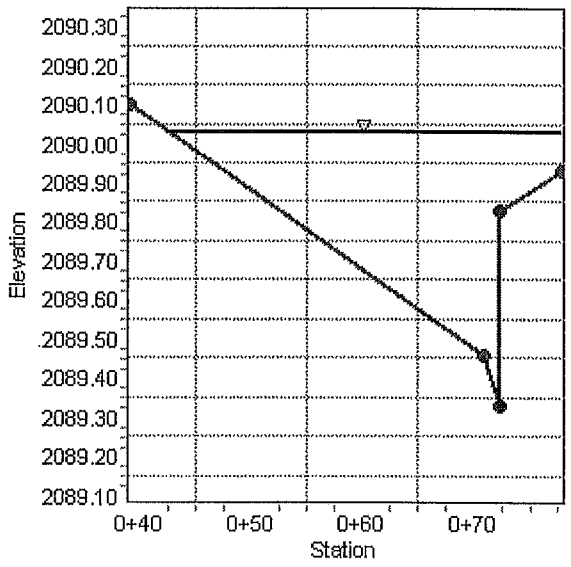
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.70	ft
Discharge	38.30	ft^3/s

Cross Section Image



Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 100-yr-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	26.30	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+06, 2089.83)	0.013
(0+06, 2089.83)	(0+06, 2089.33)	0.013
(0+06, 2089.33)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.59	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	6.18	ft²
Wetted Perimeter	29.54	ft
Top Width	29.03	ft
Normal Depth	0.59	ft
Critical Depth	0.68	ft
Critical Slope	0.00458	ft/ft
Velocity	4.25	ft/s
Velocity Head	0.28	ft

Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 100-yr-N

Results

Specific Energy		0.87	ft
Froude Number		1.62	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.59	ft
Critical Depth	0.68	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00458	ft/ft

Cross Section for XS 4-4 (Oakey just east of Villa De Conde Way) 100-

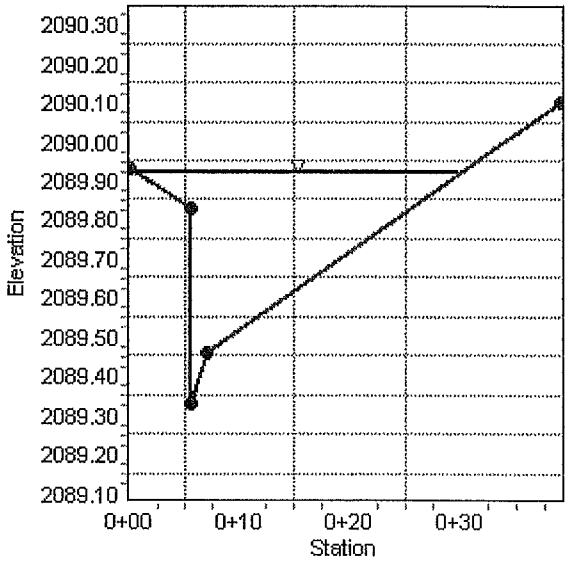
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.59	ft
Discharge	26.30	ft³/s

Cross Section Image



Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 100-yr-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	59.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+78, 2089.93)	0.016

Results

Normal Depth	0.63	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	14.91	ft²
Wetted Perimeter	64.82	ft
Top Width	63.74	ft
Normal Depth	0.63	ft
Critical Depth	0.70	ft
Critical Slope	0.00584	ft/ft
Velocity	3.98	ft/s

Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 100-yr-S

Results

Velocity Head		0.25	ft
Specific Energy		0.87	ft
Froude Number		1.45	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.63	ft
Critical Depth	0.70	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00584	ft/ft

Cross Section for XS 4-4 (Oakey just east of Villa De Conde Way) 100-

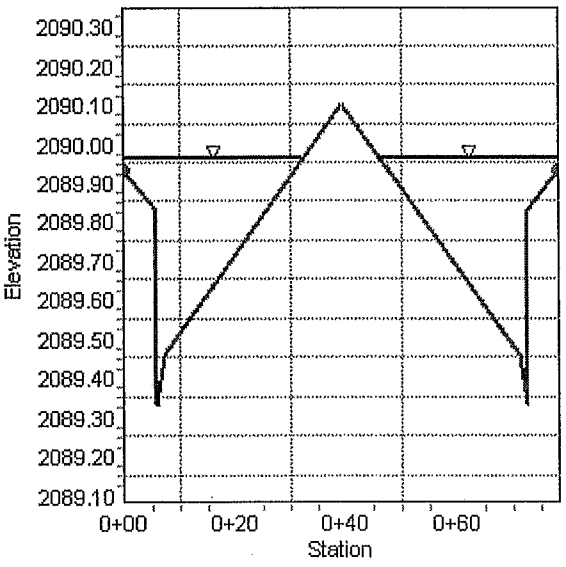
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.63	ft
Discharge	59.3	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	32.3	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+06, 2089.83)	0.013
(0+06, 2089.83)	(0+06, 2089.33)	0.013
(0+06, 2089.33)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.61	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	6.91	ft^2
Wetted Perimeter	31.52	ft
Top Width	31.00	ft
Normal Depth	0.61	ft
Critical Depth	0.72	ft
Critical Slope	0.00451	ft/ft
Velocity	4.68	ft/s
Velocity Head	0.34	ft

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-N

Results

Specific Energy		0.95	ft
Froude Number		1.75	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.72	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00451	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 100-yr

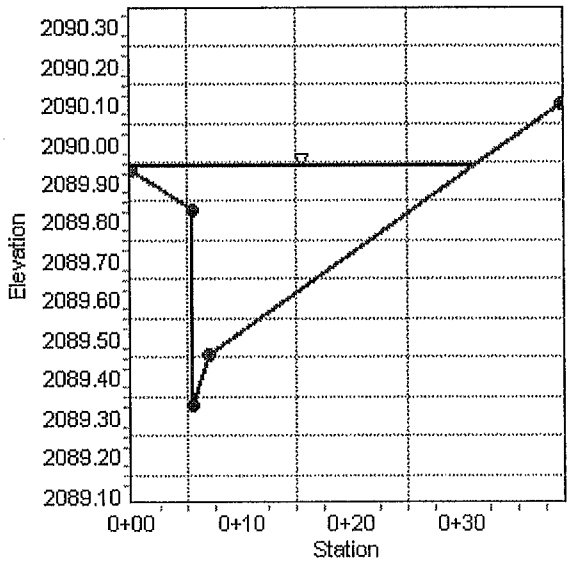
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.61	ft
Discharge	32.3	ft^3/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	10.7	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+73, 2089.33)	0.013
(0+73, 2089.33)	(0+73, 2089.83)	0.013
(0+73, 2089.83)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.43	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	2.83	ft²
Wetted Perimeter	17.05	ft
Top Width	16.61	ft
Normal Depth	0.43	ft
Critical Depth	0.51	ft
Critical Slope	0.00544	ft/ft
Velocity	3.78	ft/s
Velocity Head	0.22	ft

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 100-yr Flow-S

Results

Specific Energy		0.65	ft
Froude Number		1.61	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.43	ft
Critical Depth	0.51	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00544	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 100-yr

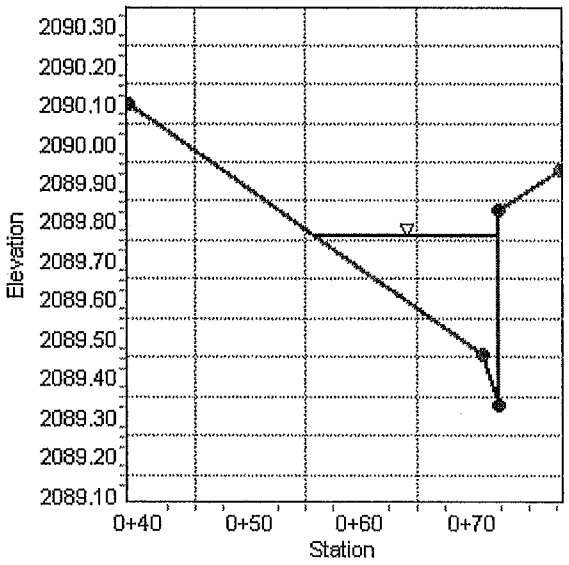
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.43	ft
Discharge	10.7	ft³/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	14.4	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+06, 2089.83)	0.013
(0+06, 2089.83)	(0+06, 2089.33)	0.013
(0+06, 2089.33)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.55	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	5.17	ft^2
Wetted Perimeter	25.61	ft
Top Width	25.10	ft
Normal Depth	0.55	ft
Critical Depth	0.56	ft
Critical Slope	0.00509	ft/ft
Velocity	2.79	ft/s
Velocity Head	0.12	ft

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-N

Results

Specific Energy		0.67	ft
Froude Number		1.08	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.55	ft
Critical Depth	0.56	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00509	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow

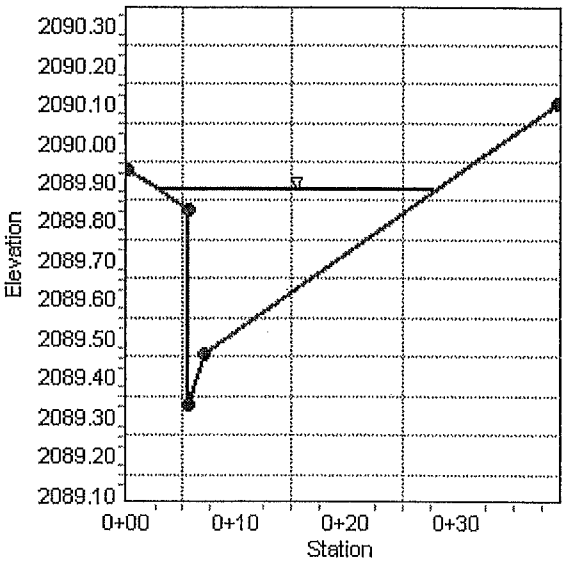
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.55	ft
Discharge	14.4	ft^3/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	18.2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+73, 2089.33)	0.016
(0+73, 2089.33)	(0+73, 2089.83)	0.013
(0+73, 2089.83)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.59	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	6.44	ft²
Wetted Perimeter	30.46	ft
Top Width	29.95	ft
Normal Depth	0.59	ft
Critical Depth	0.61	ft
Critical Slope	0.00515	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Results

Specific Energy		0.72	ft
Froude Number		1.07	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.59	ft
Critical Depth	0.61	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00515	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow

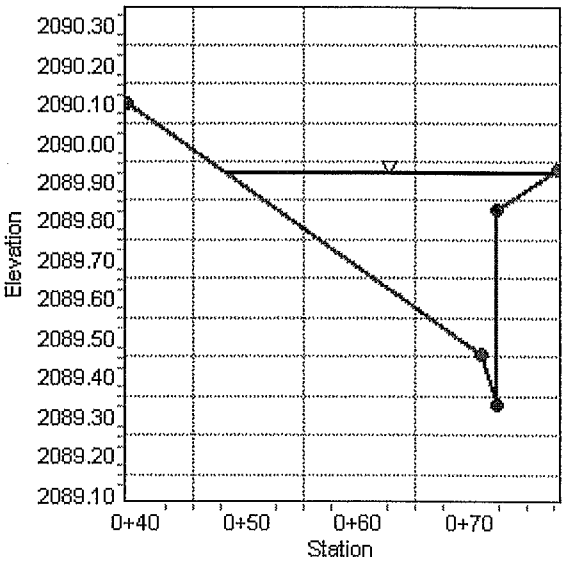
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.59	ft
Discharge	18.2	ft^3/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	18.2	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+73, 2089.33)	0.016
(0+73, 2089.33)	(0+73, 2089.83)	0.013
(0+73, 2089.83)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.59	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	6.44	ft^2
Wetted Perimeter	30.46	ft
Top Width	29.95	ft
Normal Depth	0.59	ft
Critical Depth	0.61	ft
Critical Slope	0.00515	ft/ft
Velocity	2.83	ft/s
Velocity Head	0.12	ft

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow-S

Results

Specific Energy		0.72	ft
Froude Number		1.07	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.59	ft
Critical Depth	0.61	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00515	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 100-yr Flow

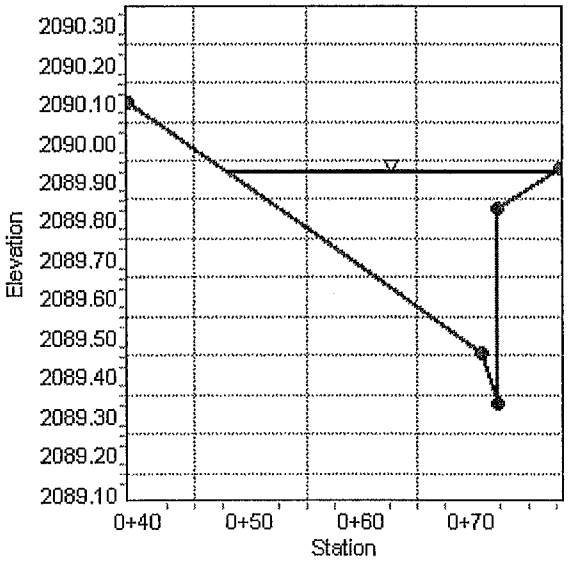
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.59	ft
Discharge	18.2	ft³/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Discharge	74.6	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+78, 2089.93)	0.016

Results

Normal Depth		0.70	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		19.97	ft²
Wetted Perimeter		72.48	ft
Top Width		71.25	ft
Normal Depth		0.70	ft
Critical Depth		0.75	ft
Critical Slope		0.00564	ft/ft
Velocity		3.73	ft/s

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

Results

Velocity Head		0.22	ft
Specific Energy		0.92	ft
Froude Number		1.24	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.70	ft
Critical Depth	0.75	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00564	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 100-yr

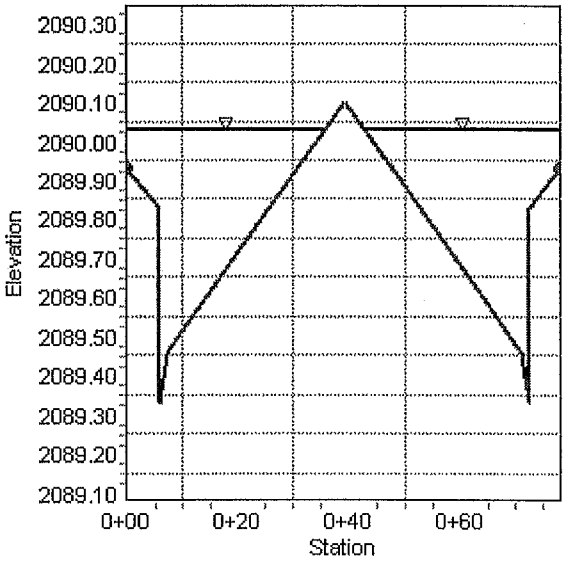
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Normal Depth	0.70	ft
Discharge	74.6	ft³/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	3.2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+73, 2089.33)	0.016
(0+73, 2089.33)	(0+73, 2089.83)	0.013
(0+73, 2089.83)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.35	ft
Elevation Range	2089.33 to 2090.10 ft	
Flow Area	1.64	ft²
Wetted Perimeter	12.88	ft
Top Width	12.52	ft
Normal Depth	0.35	ft
Critical Depth	0.34	ft
Critical Slope	0.00669	ft/ft
Velocity	1.95	ft/s
Velocity Head	0.06	ft

Worksheet for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-S

Results

Specific Energy		0.41	ft
Froude Number		0.95	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.35	ft
Critical Depth	0.34	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00669	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 100-yr Flow-

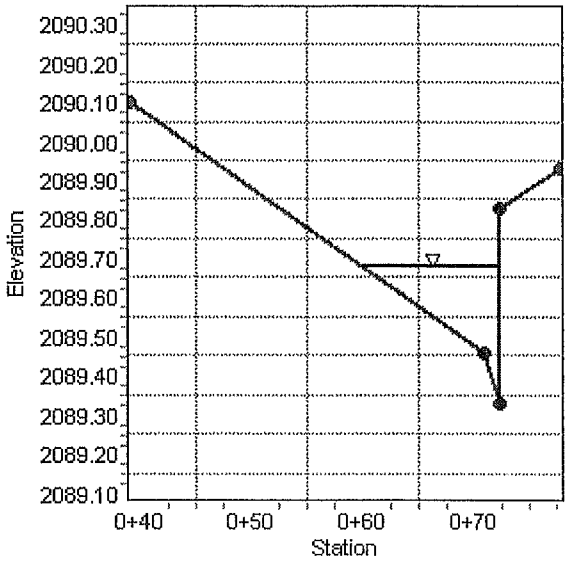
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.35	ft
Discharge	3.2	ft³/s

Cross Section Image



Worksheet for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	173.0	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+80, 0.63)	0.016

Results

Normal Depth		0.85	ft
Elevation Range	0.00 to 0.77 ft		
Flow Area		31.82	ft²
Wetted Perimeter		81.48	ft
Top Width		80.00	ft
Normal Depth		0.85	ft
Critical Depth		0.98	ft

Worksheet for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow

Results

Critical Slope		0.00476	ft/ft
Velocity		5.44	ft/s
Velocity Head		0.46	ft
Specific Energy		1.31	ft
Froude Number		1.52	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.85	ft
Critical Depth	0.98	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00476	ft/ft

Cross Section for XS 1-1 (Oakey just west of Cahlan) 10-yr Flow

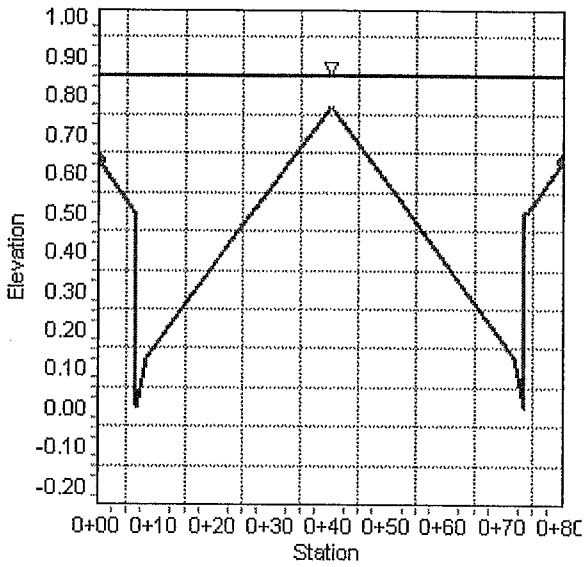
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.85	ft
Discharge	173.0	ft³/s

Cross Section Image



Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	14.9	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.63
0+06	0.50
0+07	0.50
0+07	0.00
0+08	0.13
0+40	0.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.63)	(0+08, 0.13)	0.013
(0+08, 0.13)	(0+40, 0.77)	0.016

Results

Normal Depth		0.50	ft
Elevation Range	0.00 to 0.77		
Flow Area		4.17	ft²
Wetted Perimeter		21.45	ft
Top Width		20.94	ft
Normal Depth		0.50	ft
Critical Depth		0.57	ft
Critical Slope		0.00586	ft/ft
Velocity		3.58	ft/s
Velocity Head		0.20	ft
Specific Energy		0.70	ft

Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr N

Results

Froude Number	1.41	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.50	ft
Critical Depth	0.57	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00586	ft/ft

Cross Section for XS 2-2 (Oakey just east of Cahlan) 10-yr N

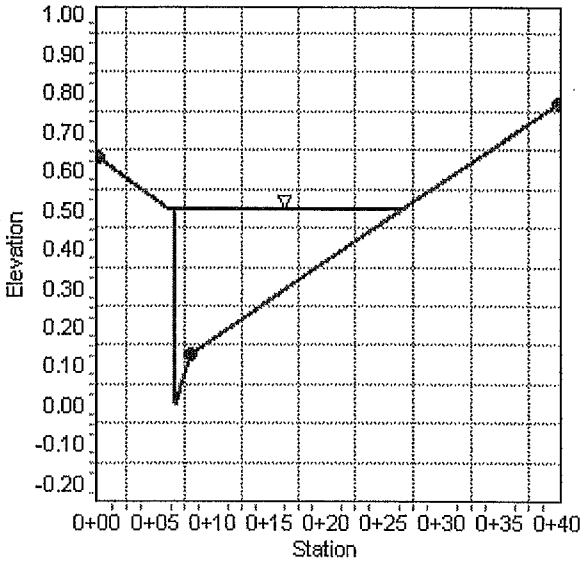
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.50	ft
Discharge	14.9	ft³/s

Cross Section Image



Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	2.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+40	0.77
0+72	0.13
0+74	0.00
0+74	0.50
0+74	0.50
0+80	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+40, 0.77)	(0+72, 0.13)	0.013
(0+72, 0.13)	(0+80, 0.63)	0.016

Results

Normal Depth		0.28	ft
Elevation Range	0.00 to 0.77		
Flow Area		0.89	ft²
Wetted Perimeter		9.29	ft
Top Width		9.00	ft
Normal Depth		0.28	ft
Critical Depth		0.31	ft
Critical Slope		0.00535	ft/ft
Velocity		2.60	ft/s
Velocity Head		0.10	ft
Specific Energy		0.38	ft

Worksheet for XS 2-2 (Oakey just east of Cahlan) 10-yr-S

Results

Froude Number	1.46	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.31	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00535	ft/ft

Cross Section for XS 2-2 (Oakey just east of Cahlan) 10-yr-S

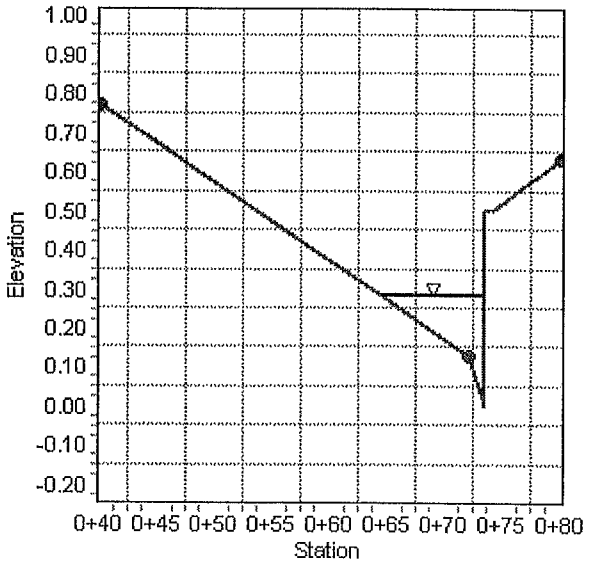
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.28	ft
Discharge	2.3	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	18.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.58	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		6.02	ft²
Wetted Perimeter		28.94	ft
Top Width		28.43	ft
Normal Depth		0.58	ft
Critical Depth		0.61	ft
Critical Slope		0.00580	ft/ft
Velocity		3.04	ft/s
Velocity Head		0.14	ft
Specific Energy		0.72	ft
Froude Number		1.16	

Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.58	ft
Critical Depth	0.61	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00580	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 10-yr Flow-N

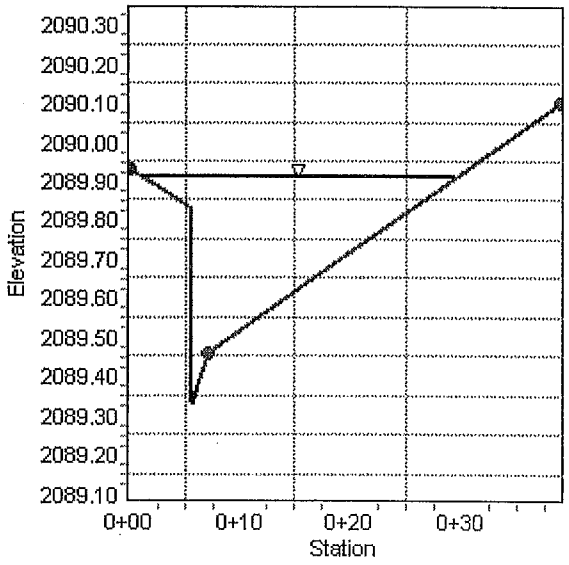
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.58	ft
Discharge	18.3	ft³/s

Cross Section Image



Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Discharge	2.3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth	0.30	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	1.05	ft²
Wetted Perimeter	10.16	ft
Top Width	9.86	ft
Normal Depth	0.30	ft
Critical Depth	0.31	ft
Critical Slope	0.00554	ft/ft
Velocity	2.20	ft/s
Velocity Head	0.08	ft
Specific Energy	0.37	ft
Froude Number	1.19	

Worksheet for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.30	ft
Critical Depth	0.31	ft
Channel Slope	0.00800	ft/ft
Critical Slope	0.00554	ft/ft

Cross Section for XS 3-3 (Oakey just east of Strong) 10-yr Flow-S

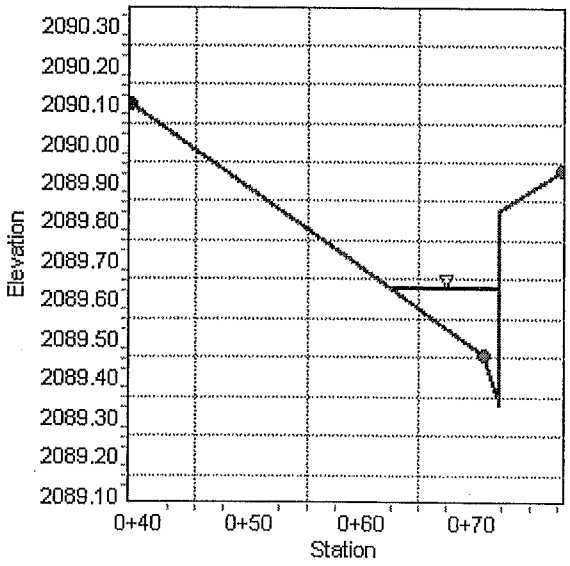
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00800	ft/ft
Normal Depth	0.30	ft
Discharge	2.3	ft³/s

Cross Section Image



Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	2.5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.28	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.91	ft²
Wetted Perimeter		9.45	ft
Top Width		9.16	ft
Normal Depth		0.28	ft
Critical Depth		0.32	ft
Critical Slope		0.00530	ft/ft
Velocity		2.73	ft/s
Velocity Head		0.12	ft
Specific Energy		0.40	ft
Froude Number		1.53	

Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.28	ft
Critical Depth	0.32	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00530	ft/ft

Cross Section for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-

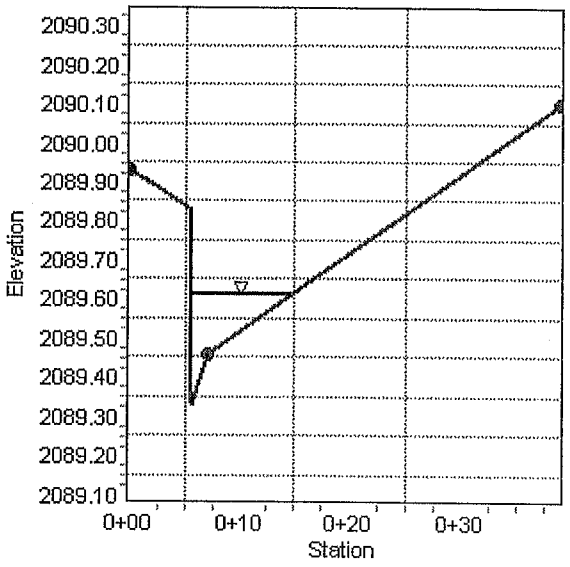
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.28	ft
Discharge	2.5	ft³/s

Cross Section Image



Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Discharge	11.6	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.45	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		3.20	ft²
Wetted Perimeter		18.14	ft
Top Width		17.68	ft
Normal Depth		0.45	ft
Critical Depth		0.52	ft
Critical Slope		0.00551	ft/ft
Velocity		3.63	ft/s
Velocity Head		0.20	ft
Specific Energy		0.66	ft
Froude Number		1.50	

Worksheet for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.45	ft
Critical Depth	0.52	ft
Channel Slope	0.01300	ft/ft
Critical Slope	0.00551	ft/ft

Cross Section for XS 4-4 (Oakey just east of Villa De Conde Way) 10-yr-

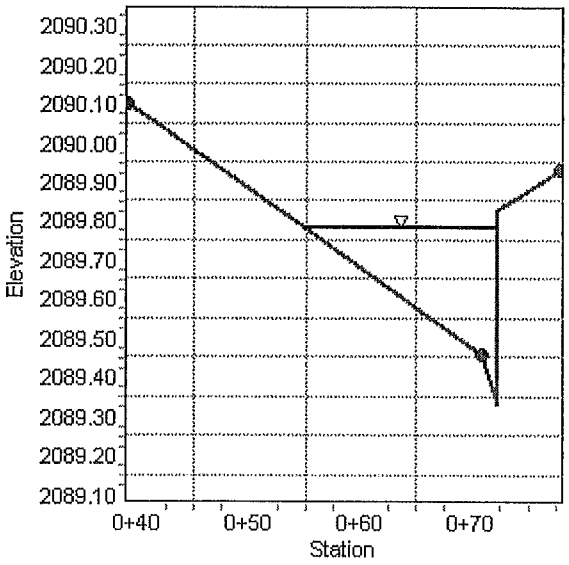
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01300	ft/ft
Normal Depth	0.45	ft
Discharge	11.6	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-N

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	4.5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth	0.33	ft
Elevation Range	2,089.33 to 2,090.10	
Flow Area	1.41	ft²
Wetted Perimeter	11.89	ft
Top Width	11.55	ft
Normal Depth	0.33	ft
Critical Depth	0.38	ft
Critical Slope	0.00541	ft/ft
Velocity	3.19	ft/s
Velocity Head	0.16	ft
Specific Energy	0.49	ft
Froude Number	1.61	

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-N

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.33	ft
Critical Depth	0.38	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00541	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-

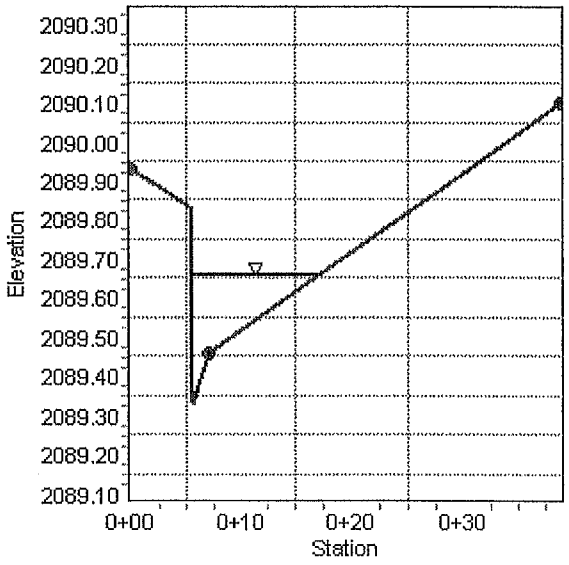
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.33	ft
Discharge	4.5	ft³/s

Cross Section Image



Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Discharge	3.1	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.30	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		1.03	ft²
Wetted Perimeter		10.09	ft
Top Width		9.79	ft
Normal Depth		0.30	ft
Critical Depth		0.34	ft
Critical Slope		0.00531	ft/ft
Velocity		3.00	ft/s
Velocity Head		0.14	ft
Specific Energy		0.44	ft
Froude Number		1.63	

Worksheet for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.30	ft
Critical Depth	0.34	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00531	ft/ft

Cross Section for XS 5-5 (Oakey just west of Rancho Drive) 10-yr Flow-

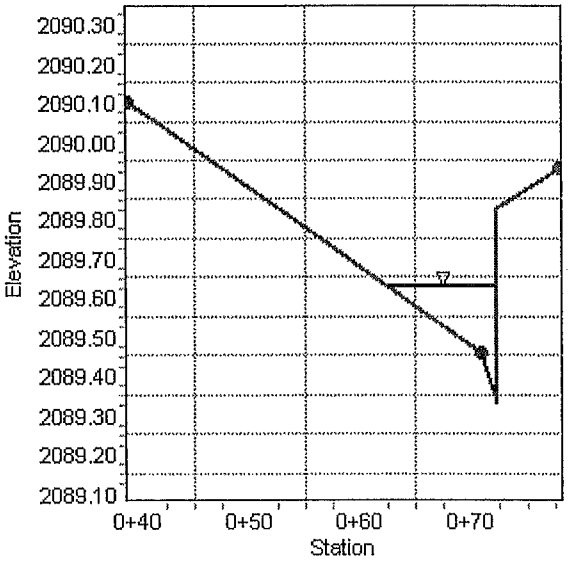
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.30	ft
Discharge	3.1	ft³/s

Cross Section Image



Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	4.9	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.39	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		2.19	ft²
Wetted Perimeter		14.94	ft
Top Width		14.54	ft
Normal Depth		0.39	ft
Critical Depth		0.39	ft
Critical Slope		0.00580	ft/ft
Velocity		2.24	ft/s
Velocity Head		0.08	ft
Specific Energy		0.47	ft
Froude Number		1.02	

Worksheet for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-S

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.39	ft
Critical Depth	0.39	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00580	ft/ft

Cross Section for XS 6-6 (Oakey just east of Rancho Drive) 10-yr Flow-

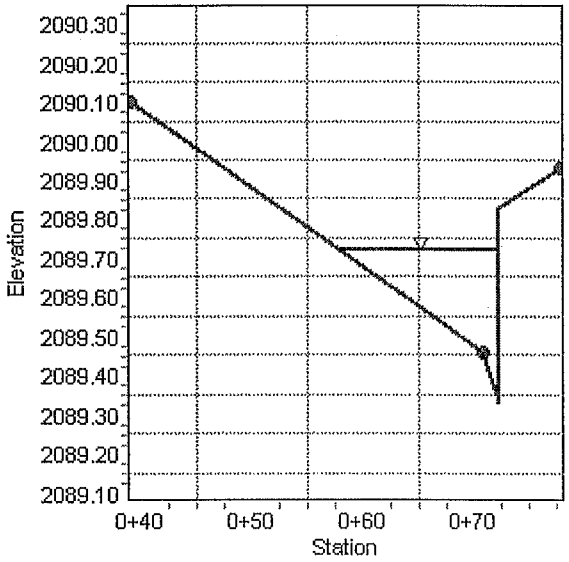
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.39	ft
Discharge	4.9	ft³/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Discharge	23.5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+39	2090.10
0+71	2089.46
0+73	2089.33
0+73	2089.83
0+78	2089.93

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+39, 2090.10)	(0+71, 2089.46)	0.016
(0+71, 2089.46)	(0+78, 2089.93)	0.013

Results

Normal Depth		0.61	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		6.98	ft²
Wetted Perimeter		31.64	ft
Top Width		31.12	ft
Normal Depth		0.61	ft
Critical Depth		0.65	ft
Critical Slope		0.00553	ft/ft
Velocity		3.37	ft/s
Velocity Head		0.18	ft
Specific Energy		0.79	ft
Froude Number		1.25	

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

Results

Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.65	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00553	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-East

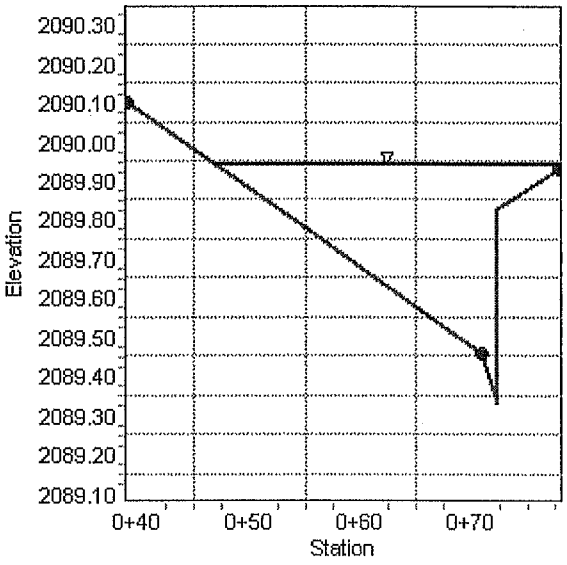
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Normal Depth	0.61	ft
Discharge	23.5	ft^3/s

Cross Section Image



Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Discharge	23.5	ft^3/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.61	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		6.98	ft^2
Wetted Perimeter		31.64	ft
Top Width		31.12	ft
Normal Depth		0.61	ft
Critical Depth		0.65	ft
Critical Slope		0.00553	ft/ft
Velocity		3.37	ft/s
Velocity Head		0.18	ft
Specific Energy		0.79	ft
Froude Number		1.25	

Worksheet for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

Results

Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.61	ft
Critical Depth	0.65	ft
Channel Slope	0.00900	ft/ft
Critical Slope	0.00553	ft/ft

Cross Section for XS 7-7 (Rancho Drive just south of Oakey) 10-yr-West

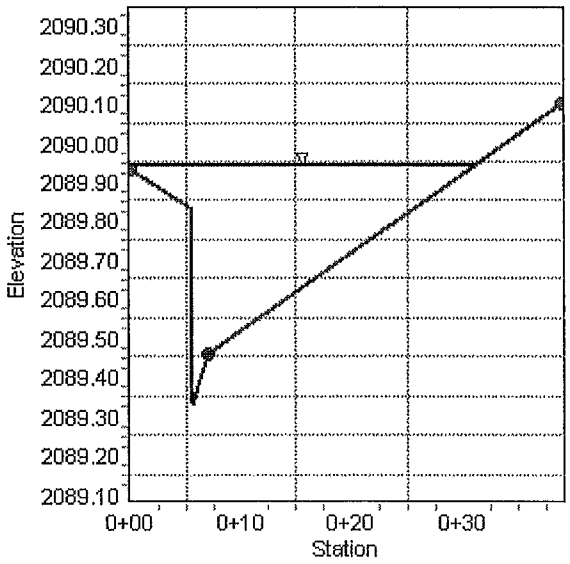
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00900	ft/ft
Normal Depth	0.61	ft
Discharge	23.5	ft³/s

Cross Section Image



Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	0.4	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2089.93
0+06	2089.83
0+06	2089.33
0+07	2089.46
0+39	2090.10

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2089.93)	(0+07, 2089.46)	0.013
(0+07, 2089.46)	(0+39, 2090.10)	0.016

Results

Normal Depth		0.20	ft
Elevation Range	2,089.33 to 2,090.10		
Flow Area		0.33	ft²
Wetted Perimeter		5.26	ft
Top Width		5.05	ft
Normal Depth		0.20	ft
Critical Depth		0.19	ft
Critical Slope		0.00883	ft/ft
Velocity		1.21	ft/s
Velocity Head		0.02	ft
Specific Energy		0.22	ft
Froude Number		0.84	

Worksheet for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

Results

Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.19	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00883	ft/ft

Cross Section for XS 8-8 (Oakey just west of Birch Street) 10-yr Flow-S

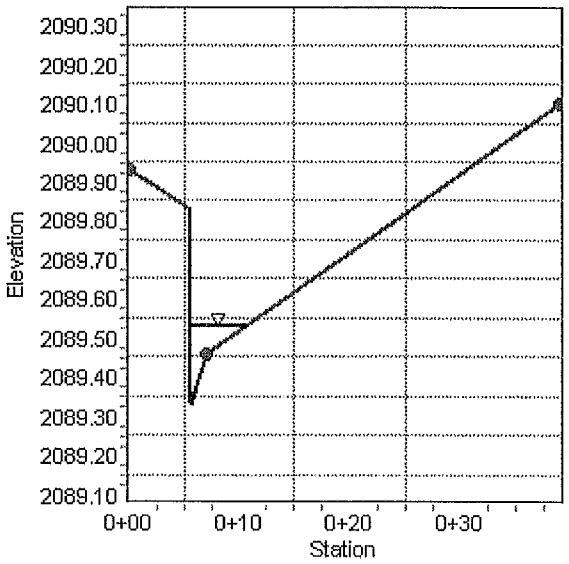
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.20	ft
Discharge	0.4	ft³/s

Cross Section Image



A.3 DROP INLET CALCULATIONS

Ultimate Condition

Interim Condition

Ultimate Condition

Worksheet for DI @ STA 38+57.49, 33.26' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		10.0	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	87.57	%
Intercepted Flow	8.8	ft³/s
Bypass Flow	1.2	ft³/s
Spread	16.17	ft
Depth	0.42	ft
Flow Area	2.68	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.73	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.83	
Grate Flow Ratio	0.27	
Equivalent Cross Slope	0.06789	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	25.14	ft

Cross Section for DI @ STA 38+57.49, 33.26' LT- 100 year

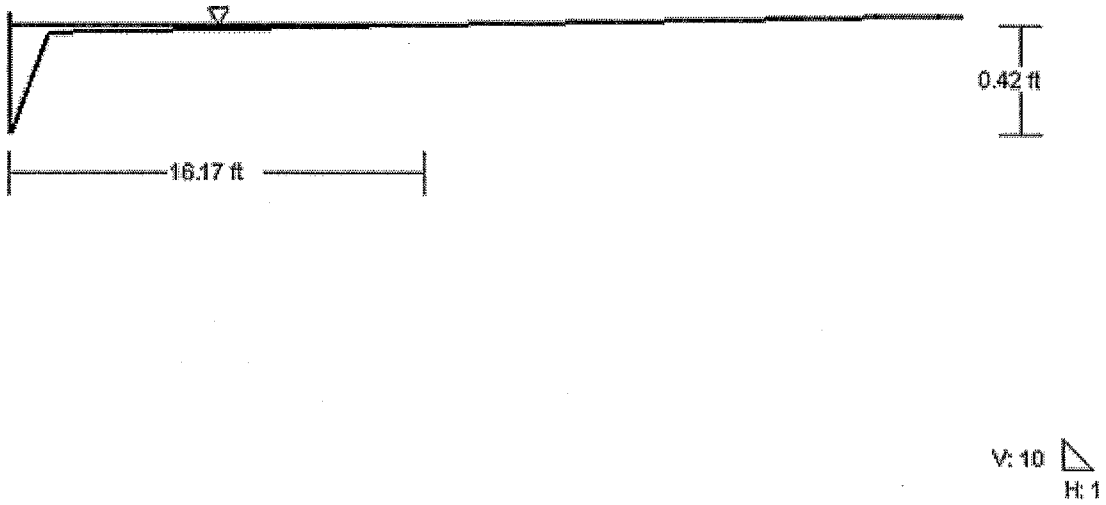
Project Description

Solve For	Efficiency

Input Data

Discharge		10.0	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		87.57	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 38+86.44, 34.19' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		33.0	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	78.57	%
Intercepted Flow	25.9	ft³/s
Bypass Flow	7.1	ft³/s
Spread	25.63	ft
Depth	0.61	ft
Flow Area	6.64	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.97	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.74	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.04949	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	50.17	ft

Cross Section for DI @ STA 38+86.44, 34.19' RT- 100 year

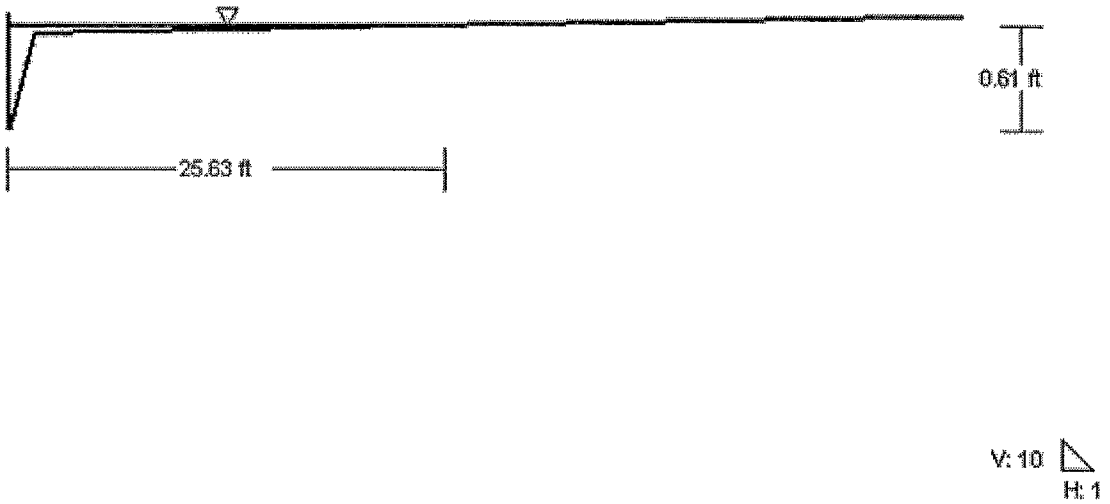
Project Description

Solve For	Efficiency

Input Data

Discharge		33.0	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		78.57	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+32.17, 33.27' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		1.2	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	96.99	%
Intercepted Flow	1.2	ft³/s
Bypass Flow	0.0	ft³/s
Spread	6.58	ft
Depth	0.23	ft
Flow Area	0.50	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.38	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.64	
Equivalent Cross Slope	0.13201	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	6.92	ft

Cross Section for DI @ STA 39+32.17, 33.27' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		1.2	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		96.99	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+31.94, 34.12' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		7.1	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.61	%
Intercepted Flow	6.4	ft³/s
Bypass Flow	0.7	ft³/s
Spread	14.12	ft
Depth	0.38	ft
Flow Area	2.06	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.44	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.85	
Grate Flow Ratio	0.32	
Equivalent Cross Slope	0.07508	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	20.49	ft

Cross Section for DI @ STA 39+31.94, 34.12' RT- 100 year

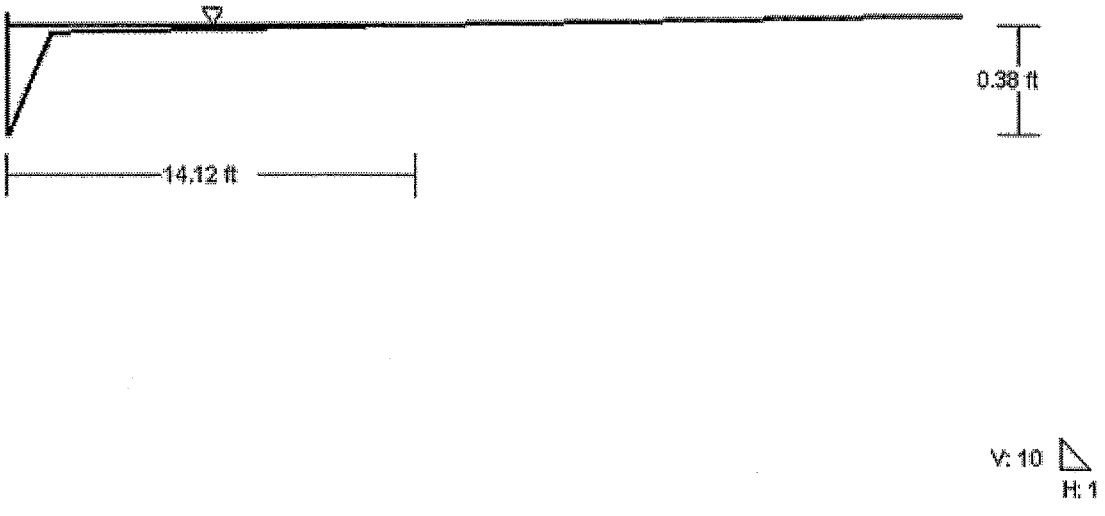
Project Description

Solve For	Efficiency

Input Data

Discharge		7.1	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.61	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 47+76.64, 107.11' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.016	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.66	%
Intercepted Flow	27.8	ft³/s
Bypass Flow	3.2	ft³/s
Spread	38.77	ft
Depth	0.72	ft
Flow Area	12.10	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.56	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03610	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	36.89	ft

Cross Section for DI @ STA 47+76.64, 107.11' LT- 100 year

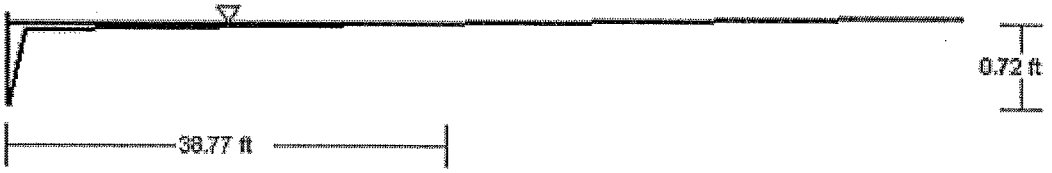
Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.016	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.66	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 48+16.37, 107.04' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.016	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.66	%
Intercepted Flow	27.8	ft³/s
Bypass Flow	3.2	ft³/s
Spread	38.77	ft
Depth	0.72	ft
Flow Area	12.10	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.56	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03610	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	36.89	ft

Cross Section for DI @ STA 48+16.37, 107.04' LT- 100 year

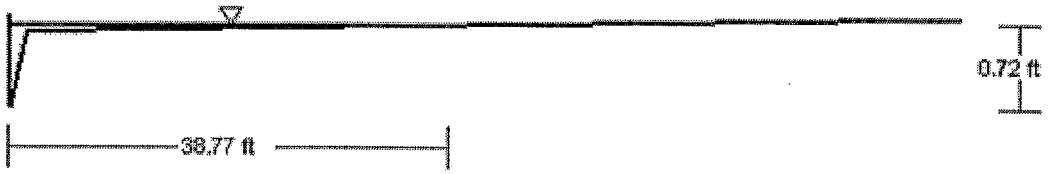
Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.016	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.66	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 49+00.94, 31.01' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.4	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.20	%
Intercepted Flow	10.2	ft³/s
Bypass Flow	1.2	ft³/s
Spread	18.41	ft
Depth	0.46	ft
Flow Area	3.46	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.29	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.86	
Grate Flow Ratio	0.24	
Equivalent Cross Slope	0.06179	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	24.89	ft

Cross Section for DI @ STA 49+00.94, 31.01' LT- 100 year

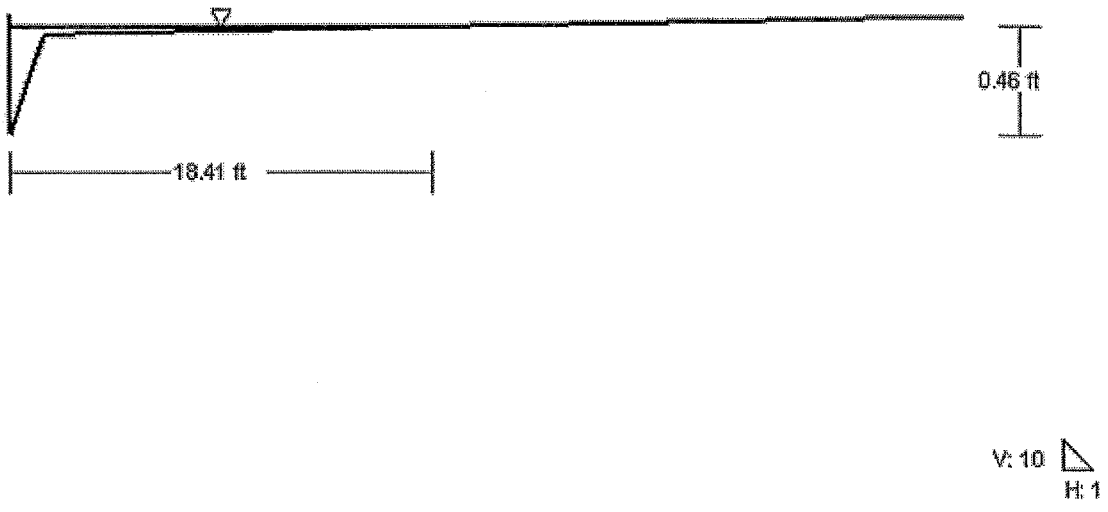
Project Description

Solve For	Efficiency

Input Data

Discharge		11.4	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.20	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 49+00.71, 33.53' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		0.7	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	98.50	%
Intercepted Flow	0.7	ft³/s
Bypass Flow	0.0	ft³/s
Spread	5.56	ft
Depth	0.21	ft
Flow Area	0.38	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	1.84	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.94	
Grate Flow Ratio	0.73	
Equivalent Cross Slope	0.14651	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	4.59	ft

Cross Section for DI @ STA 49+00.71, 33.53' RT- 100 year

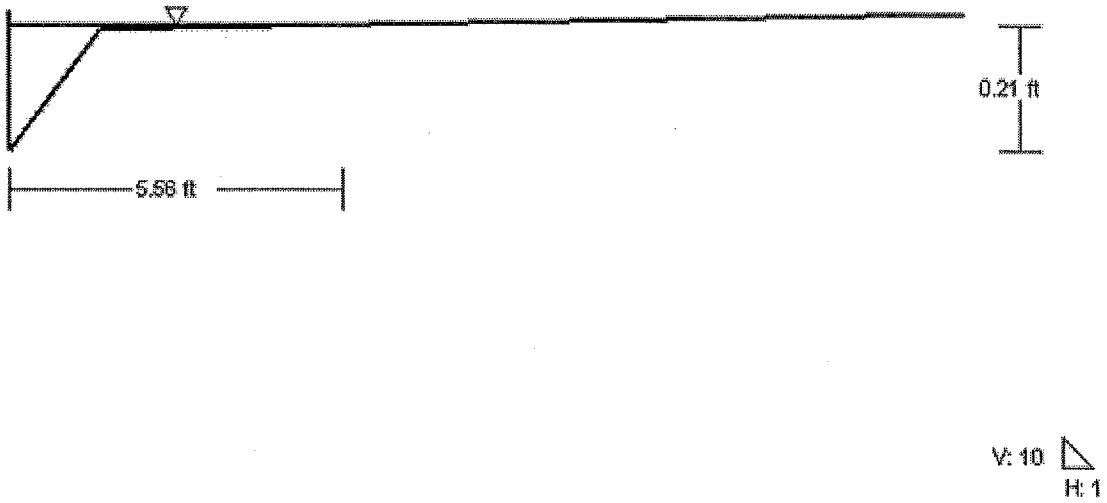
Project Description

Solve For	Efficiency

Input Data

Discharge		0.7	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		98.50	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 51+43.89, 126.18' RT-100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		271.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.012	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	51.08	%
Intercepted Flow	138.4	ft³/s
Bypass Flow	132.6	ft³/s
Spread	83.11	ft
Depth	1.06	ft
Flow Area	39.80	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	6.81	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.48	
Grate Flow Ratio	0.05	
Equivalent Cross Slope	0.02097	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	192.55	ft

Cross Section for DI @ STA 51+43.89, 126.18' RT-100 year

Project Description

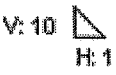
Solve For	Efficiency

Input Data

Discharge		271.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.012	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		51.08	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 51+43.91, 80.18' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		147.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.012	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	58.22	%
Intercepted Flow	85.6	ft³/s
Bypass Flow	61.4	ft³/s
Spread	66.03	ft
Depth	0.87	ft
Flow Area	25.15	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	5.84	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.55	
Grate Flow Ratio	0.07	
Equivalent Cross Slope	0.02363	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	138.65	ft

Cross Section for DI @ STA 51+43.91, 80.18' RT- 100 year

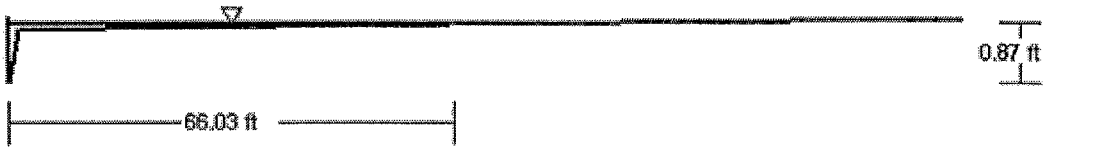
Project Description

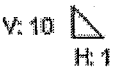
Solve For	Efficiency

Input Data

Discharge		147.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.012	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		58.22	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 51+97.37, 33.31' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		59.3	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	72.14	%
Intercepted Flow	42.8	ft³/s
Bypass Flow	16.5	ft³/s
Spread	31.55	ft
Depth	0.73	ft
Flow Area	10.02	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	5.92	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.68	
Grate Flow Ratio	0.14	
Equivalent Cross Slope	0.04370	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	70.84	ft

Cross Section for DI @ STA 51+97.37, 33.31' RT- 100 year

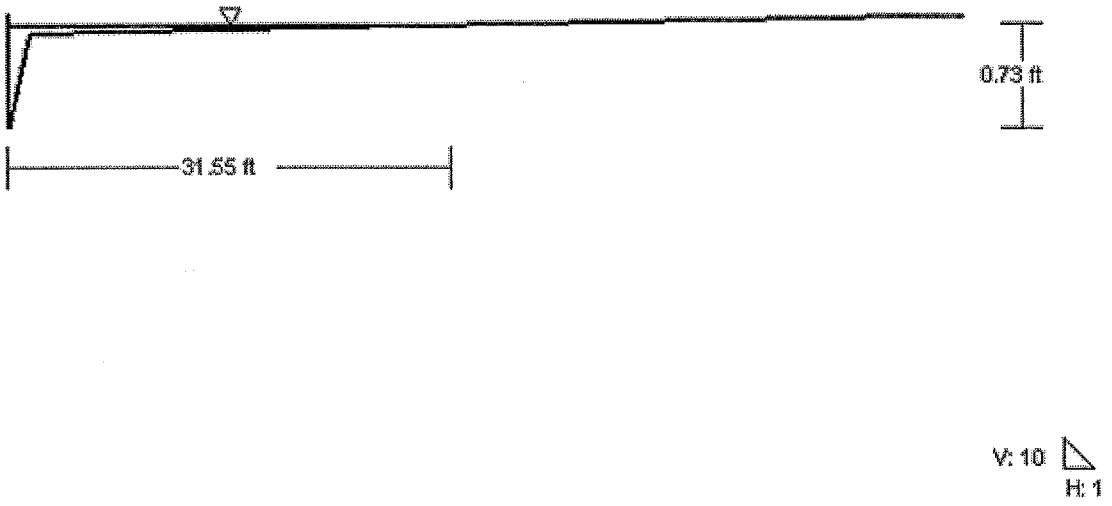
Project Description

Solve For	Efficiency

Input Data

Discharge		59.3	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		72.14	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 52+43.37, 33.14' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		16.5	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	83.53	%
Intercepted Flow	13.8	ft³/s
Bypass Flow	2.7	ft³/s
Spread	19.35	ft
Depth	0.48	ft
Flow Area	3.82	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.33	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.79	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.05966	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	34.36	ft

Cross Section for DI @ STA 52+43.37, 33.14' RT- 100 year

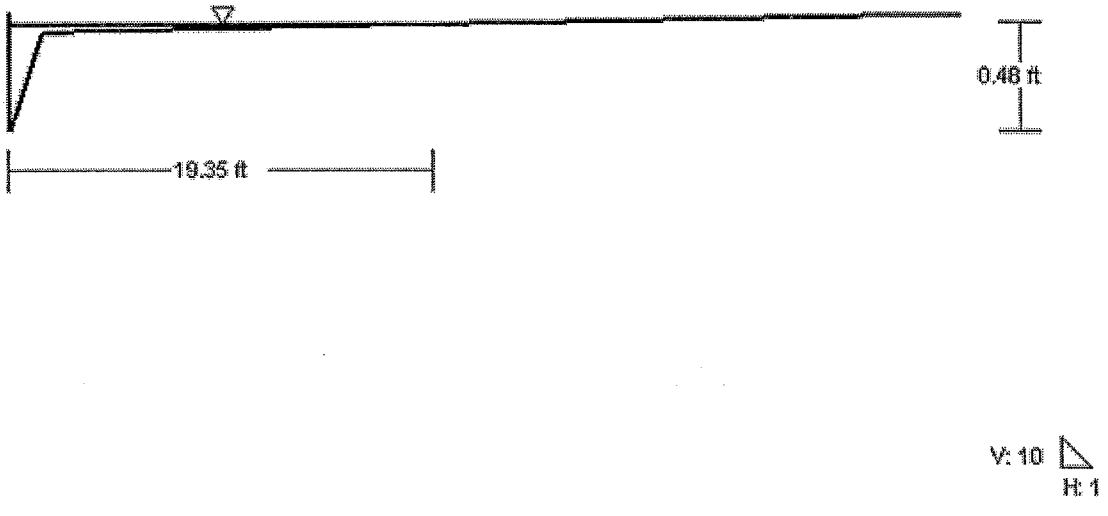
Project Description

Solve For	Efficiency

Input Data

Discharge		16.5	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		83.53	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.47, 31.98' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		15.9	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	82.68	%
Intercepted Flow	13.1	ft³/s
Bypass Flow	2.8	ft³/s
Spread	18.55	ft
Depth	0.47	ft
Flow Area	3.51	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.53	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.77	
Grate Flow Ratio	0.24	
Equivalent Cross Slope	0.06148	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	34.66	ft

Cross Section for DI @ STA 56+70.47, 31.98' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		15.9	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		82.68	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.25, 33.26' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		10.7	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	85.68	%
Intercepted Flow	9.2	ft³/s
Bypass Flow	1.5	ft³/s
Spread	15.89	ft
Depth	0.41	ft
Flow Area	2.60	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.12	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.80	
Grate Flow Ratio	0.28	
Equivalent Cross Slope	0.06875	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.45	ft

Cross Section for DI @ STA 56+70.25, 33.26' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		10.7	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		85.68	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 57+15.86, 31.98' LT-100 year

Project Description

Solve For	Spread

Input Data

Discharge		7.9	ft³/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		3.33	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		0.00	%
Curb Opening Length		3.34	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option	Use Both

Results

Spread	21.05	ft
Depth	0.52	ft
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Open Grate Area	4.50	ft²
Active Grate Weir Length	6.33	ft

Cross Section for DI @ STA 57+15.86, 31.98' LT-100 year

Project Description

Solve For	Spread

Input Data

Discharge		7.9	ft³/s
Spread		21.05	ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		3.33	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		0.00	%
Curb Opening Length		3.34	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Cross Section Image



V: 1
H: 1

Worksheet for DI @ STA 57+25.28, 126.53' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.006	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	56.50	%
Intercepted Flow	29.4	ft³/s
Bypass Flow	22.6	ft³/s
Spread	65.04	ft
Depth	0.49	ft
Flow Area	12.35	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	4.21	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.53	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.02010	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	107.06	ft

Cross Section for DI @ STA 57+25.28, 126.53' RT- 100 year

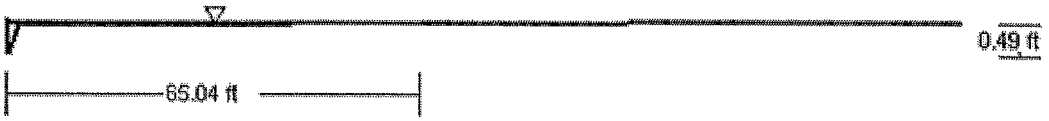
Project Description

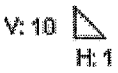
Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.006	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		56.50	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+25.67, 80.46' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		22.6	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.006	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	66.10	%
Intercepted Flow	15.0	ft³/s
Bypass Flow	7.7	ft³/s
Spread	47.36	ft
Depth	0.39	ft
Flow Area	6.59	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	3.43	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.62	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.02673	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	63.64	ft

Cross Section for DI @ STA 57+25.67, 80.46' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		22.6	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.006	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		66.10	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+30.98, 75.36' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.005	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	77.92	%
Intercepted Flow	17.9	ft³/s
Bypass Flow	5.1	ft³/s
Spread	64.69	ft
Depth	0.44	ft
Flow Area	10.55	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	2.18	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.76	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.01999	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	54.60	ft

Cross Section for DI @ STA 57+30.98, 75.36' LT- 100 year

Project Description

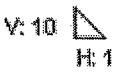
Solve For	Efficiency

Input Data

Discharge		23.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.005	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		77.92	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+89.74, 80.43' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.032	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	82.60	%
Intercepted Flow	43.0	ft³/s
Bypass Flow	9.0	ft³/s
Spread	24.45	ft
Depth	0.85	ft
Flow Area	9.47	ft²
Gutter Depression	0.08	ft
Total Depression	0.24	ft
Velocity	5.49	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.79	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.05870	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	49.61	ft

Cross Section for DI @ STA 57+89.74, 80.43' RT- 100 year

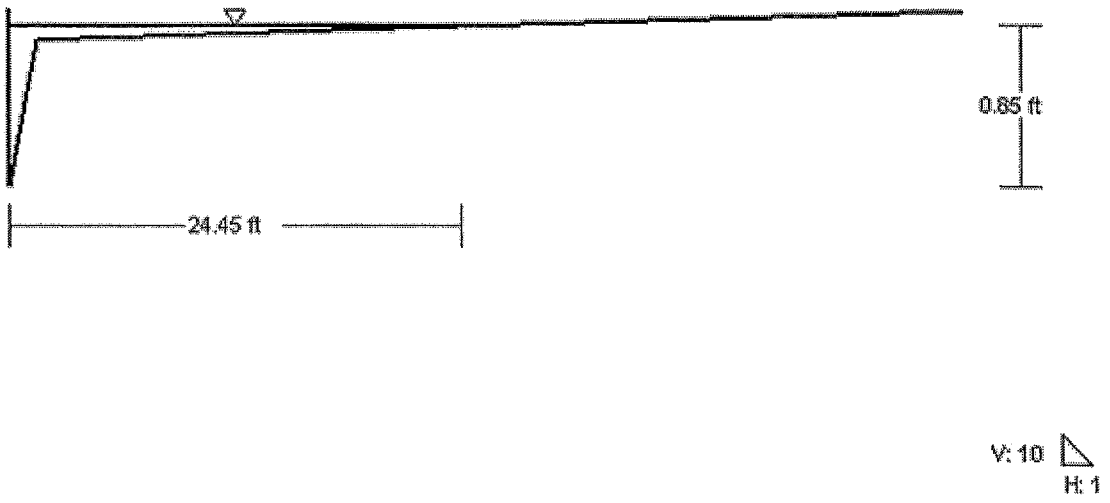
Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.032	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		82.60	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 58+77.32, 31.91' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		18.2	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	88.37	%
Intercepted Flow	16.1	ft³/s
Bypass Flow	2.1	ft³/s
Spread	23.31	ft
Depth	0.56	ft
Flow Area	5.50	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.31	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.86	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.05260	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	30.60	ft

Cross Section for DI @ STA 58+77.32, 31.91' RT- 100 year

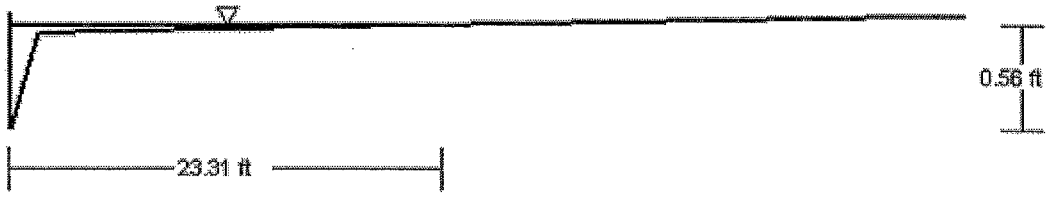
Project Description

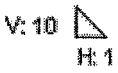
Solve For	Efficiency

Input Data

Discharge		18.2	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.020	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		88.37	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 38+57.49, 33.26' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge	4.0	ft³/s
Slope	0.01200	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	13.33	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	92.55	%
Intercepted Flow	3.7	ft³/s
Bypass Flow	0.3	ft³/s
Spread	11.19	ft
Depth	0.32	ft
Flow Area	1.32	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.02	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.40	
Equivalent Cross Slope	0.08963	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	14.48	ft

Cross Section for DI @ STA 38+57.49, 33.26' LT- 10 year

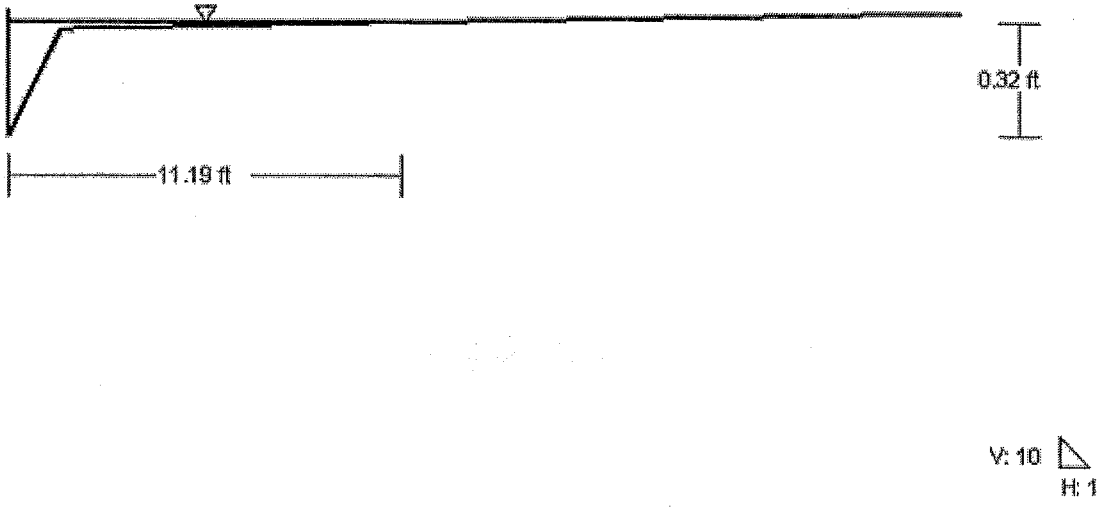
Project Description

Solve For	Efficiency

Input Data

Discharge		4.0	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		92.55	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 38+86.44, 34.19' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge	15.0	ft³/s
Slope	0.01200	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	13.33	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	84.85	%
Intercepted Flow	12.7	ft³/s
Bypass Flow	2.3	ft³/s
Spread	18.93	ft
Depth	0.47	ft
Flow Area	3.66	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.10	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.80	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.06059	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	31.91	ft

Cross Section for DI @ STA 38+86.44, 34.19' RT- 10 year

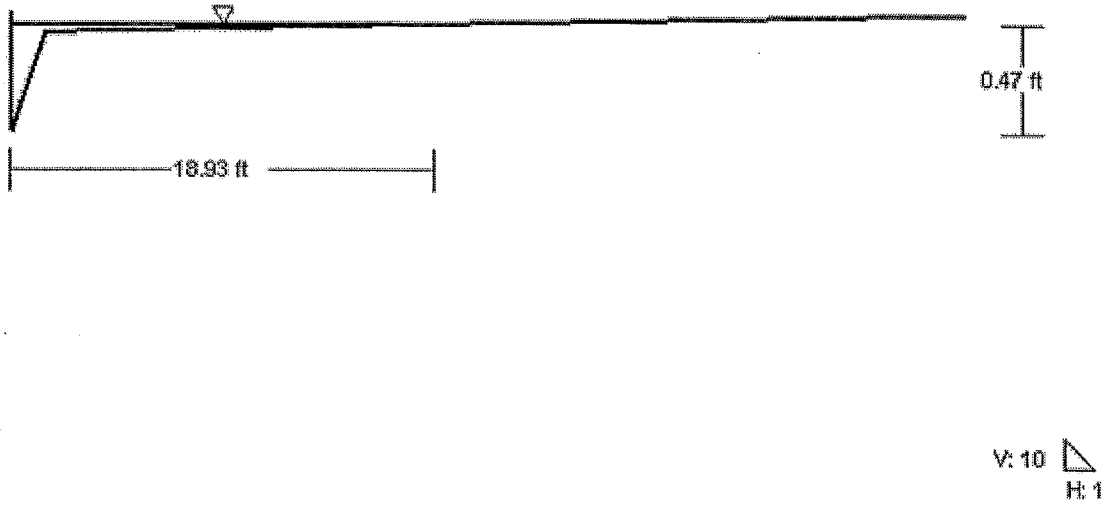
Project Description

Solve For	Efficiency

Input Data

Discharge		15.0	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		84.85	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+32.17, 33.27' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		0.3	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	99.78	%
Intercepted Flow	0.3	ft³/s
Bypass Flow	0.0	ft³/s
Spread	2.77	ft
Depth	0.15	ft
Flow Area	0.15	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.03	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.94	
Grate Flow Ratio	0.96	
Equivalent Cross Slope	0.18828	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	3.13	ft

Cross Section for DI @ STA 39+32.17, 33.27' LT- 10 year

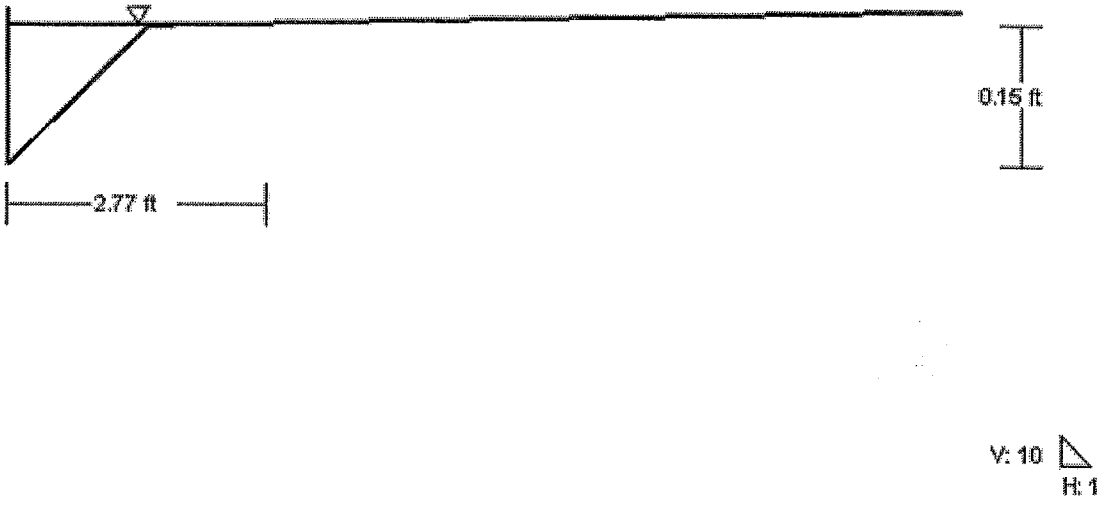
Project Description

Solve For	Efficiency

Input Data

Discharge		0.3	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		99.78	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+31.94, 34.12' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		2.3	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	94.85	%
Intercepted Flow	2.2	ft³/s
Bypass Flow	0.1	ft³/s
Spread	8.86	ft
Depth	0.27	ft
Flow Area	0.86	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.90	
Grate Flow Ratio	0.50	
Equivalent Cross Slope	0.10704	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	10.32	ft

Cross Section for DI @ STA 39+31.94, 34.12' RT- 10 year

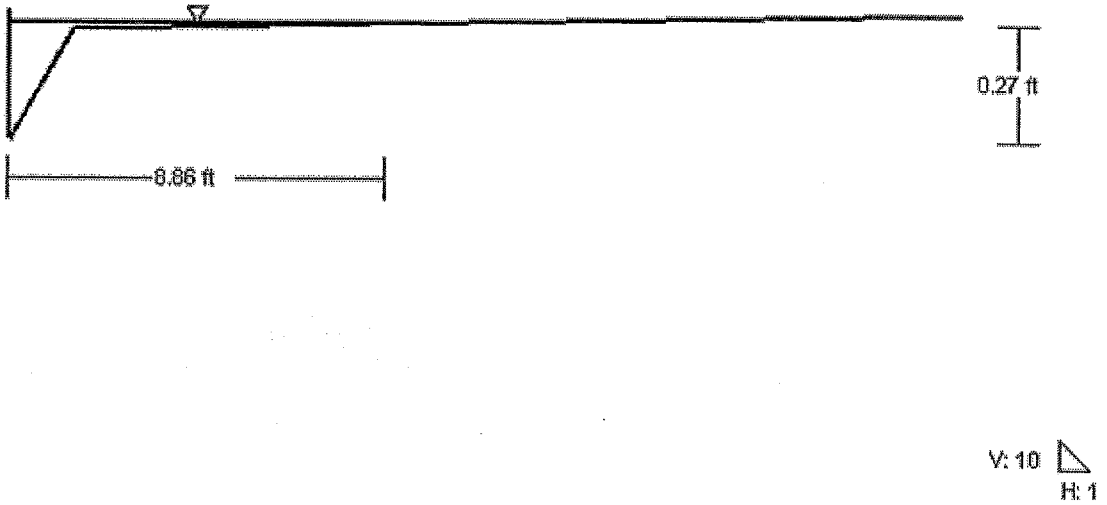
Project Description

Solve For	Efficiency

Input Data

Discharge		2.3	ft³/s
Slope		0.01200	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		94.85	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 47+76.64, 107.11' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge	11.5	ft³/s
Slope	0.00250	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.083	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.016	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Grate Width	1.50	ft
Grate Length	13.33	ft
Grate Type	Curved Vaned	
Clogging	0.00	%
Curb Opening Length	13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	93.49	%
Intercepted Flow	10.8	ft³/s
Bypass Flow	0.7	ft³/s
Spread	26.58	ft
Depth	0.53	ft
Flow Area	5.73	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.01	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.04619	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	20.98	ft

Cross Section for DI @ STA 47+76.64, 107.11' LT- 10 year

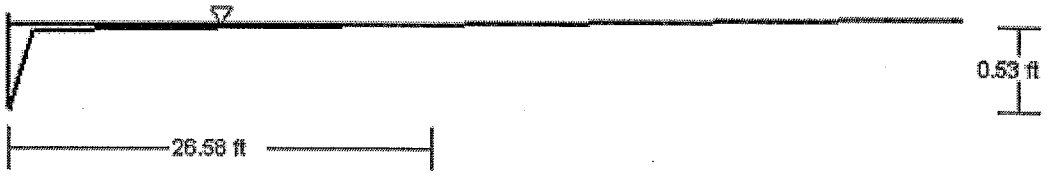
Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.00250	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		93.49	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 48+16.37, 107.04' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.00250	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	93.49	%
Intercepted Flow	10.8	ft³/s
Bypass Flow	0.7	ft³/s
Spread	26.58	ft
Depth	0.53	ft
Flow Area	5.73	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.01	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.04619	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	20.98	ft

Cross Section for DI @ STA 48+16.37, 107.04' LT- 10 year

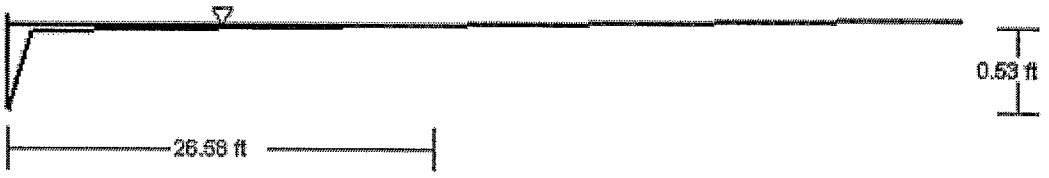
Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.00250	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		93.49	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 49+00.94, 31.01' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		3.4	ft³/s
Slope		0.00800	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	94.49	%
Intercepted Flow	3.2	ft³/s
Bypass Flow	0.2	ft³/s
Spread	11.38	ft
Depth	0.32	ft
Flow Area	1.37	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.49	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.91	
Grate Flow Ratio	0.39	
Equivalent Cross Slope	0.08850	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	12.07	ft

Cross Section for DI @ STA 49+00.94, 31.01' LT- 10 year

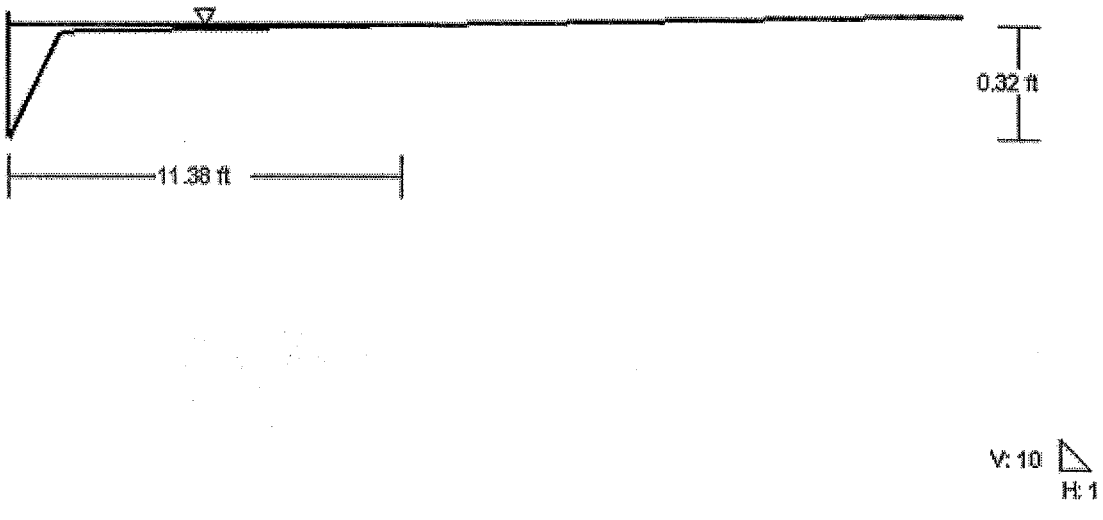
Project Description

Solve For	Efficiency

Input Data

Discharge		3.4	ft³/s
Slope		0.00800	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		94.49	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 49+00.71, 33.53' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		0.1	ft³/s
Slope		0.00800	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	100.00	%
Intercepted Flow	0.1	ft³/s
Bypass Flow	0.0	ft³/s
Spread	1.30	ft
Depth	0.11	ft
Flow Area	0.07	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	1.41	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.97	
Grate Flow Ratio	1.00	
Equivalent Cross Slope	0.19441	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.01	
Total Interception Length	1.71	ft

Cross Section for DI @ STA 49+00.71, 33.53' RT- 10 year

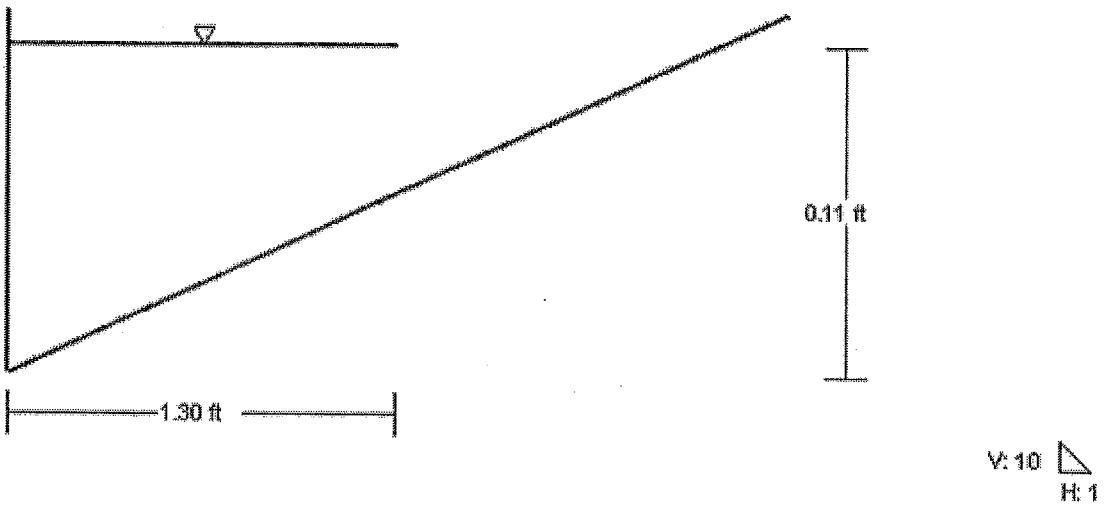
Project Description

Solve For	Efficiency

Input Data

Discharge		0.1	ft³/s
Slope		0.00800	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		100.00	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 51+43.89, 126.18' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		108.0	ft³/s
Slope		0.01000	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	61.75	%
Intercepted Flow	66.7	ft³/s
Bypass Flow	41.3	ft³/s
Spread	58.79	ft
Depth	0.78	ft
Flow Area	19.95	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	5.41	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.59	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.02526	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	117.03	ft

Cross Section for DI @ STA 51+43.89, 126.18' RT- 10 year

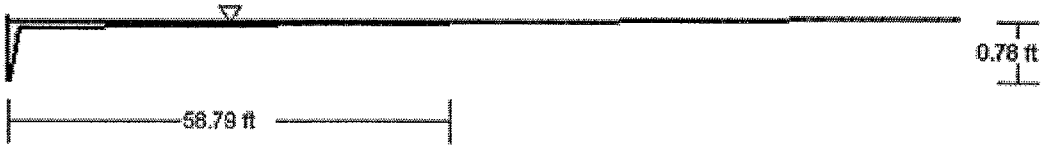
Project Description

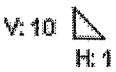
Solve For	Efficiency

Input Data

Discharge		108.0	ft³/s
Slope		0.01000	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		61.75	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 51+43.91, 80.18' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		41.3	ft³/s
Slope		0.01000	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	72.05	%
Intercepted Flow	29.8	ft³/s
Bypass Flow	11.5	ft³/s
Spread	40.86	ft
Depth	0.58	ft
Flow Area	9.68	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	4.27	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.69	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03203	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	67.77	ft

Cross Section for DI @ STA 51+43.91, 80.18' RT- 10 year

Project Description

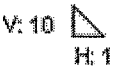
Solve For	Efficiency

Input Data

Discharge		41.3	ft³/s
Slope		0.01000	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		72.05	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 51+97.37, 33.31' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.01300	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	86.14	%
Intercepted Flow	9.9	ft³/s
Bypass Flow	1.6	ft³/s
Spread	16.81	ft
Depth	0.43	ft
Flow Area	2.90	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.97	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.81	
Grate Flow Ratio	0.26	
Equivalent Cross Slope	0.06597	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.78	ft

Cross Section for DI @ STA 51+97.37, 33.31' RT- 10 year

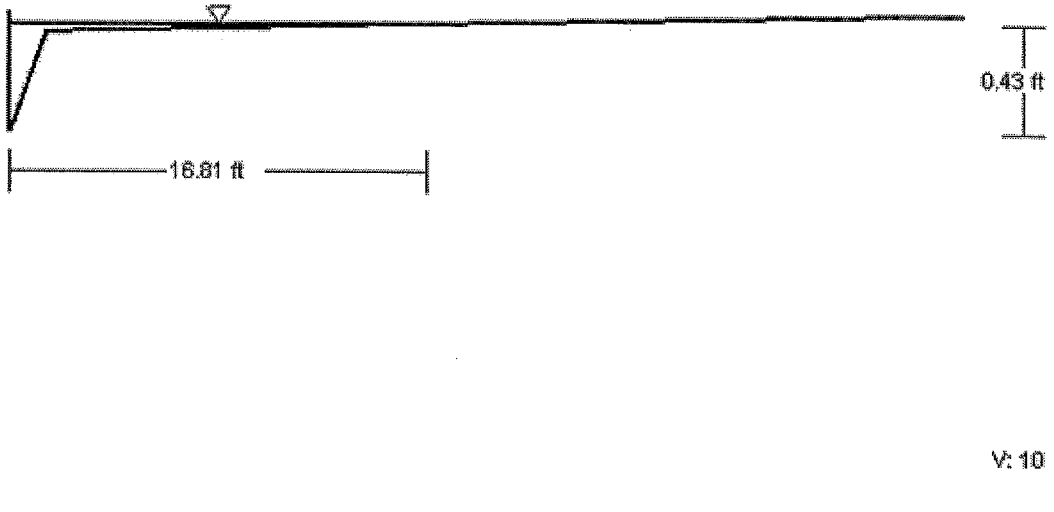
Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.01300	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		86.14	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 52+43.37, 33.14' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		1.6	ft³/s
Slope		0.01300	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	95.99	%
Intercepted Flow	1.5	ft³/s
Bypass Flow	0.1	ft³/s
Spread	7.40	ft
Depth	0.24	ft
Flow Area	0.62	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.59	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.90	
Grate Flow Ratio	0.58	
Equivalent Cross Slope	0.12196	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	8.39	ft

Cross Section for DI @ STA 52+43.37, 33.14' RT- 10 year

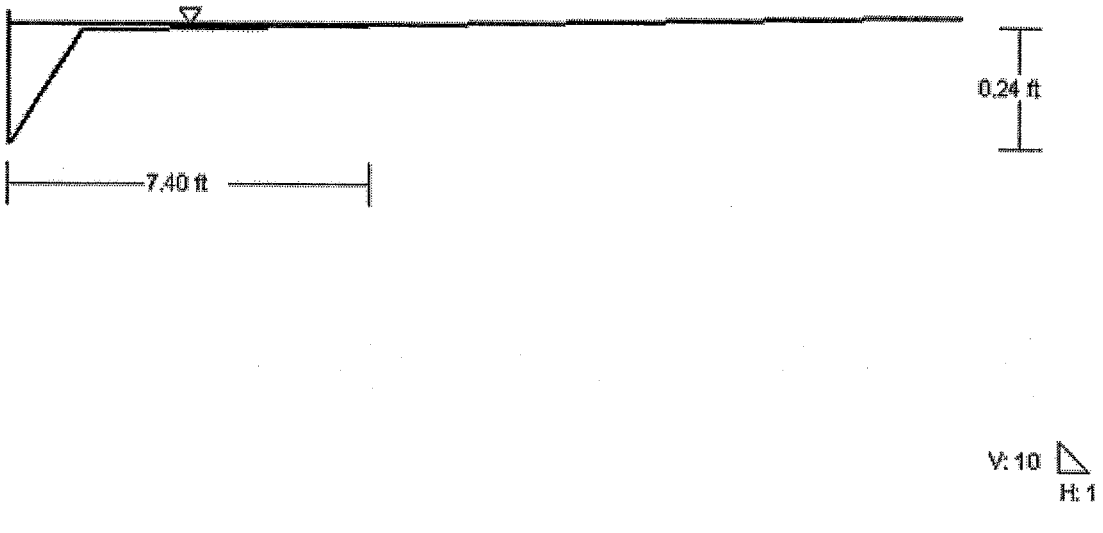
Project Description

Solve For	Efficiency

Input Data

Discharge		1.6	ft³/s
Slope		0.01300	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		95.99	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.47, 31.98' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		2.2	ft³/s
Slope		0.01500	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	94.52	%
Intercepted Flow	2.1	ft³/s
Bypass Flow	0.1	ft³/s
Spread	8.27	ft
Depth	0.26	ft
Flow Area	0.76	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.91	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.53	
Equivalent Cross Slope	0.11259	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	10.51	ft

Worksheet for DI @ STA 56+70.25, 33.26' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		3.1	ft³/s
Slope		0.01500	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	92.99	%
Intercepted Flow	2.9	ft³/s
Bypass Flow	0.2	ft³/s
Spread	9.60	ft
Depth	0.29	ft
Flow Area	0.99	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.12	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.87	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.10076	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	12.97	ft

Cross Section for DI @ STA 56+70.25, 33.26' RT- 10 year

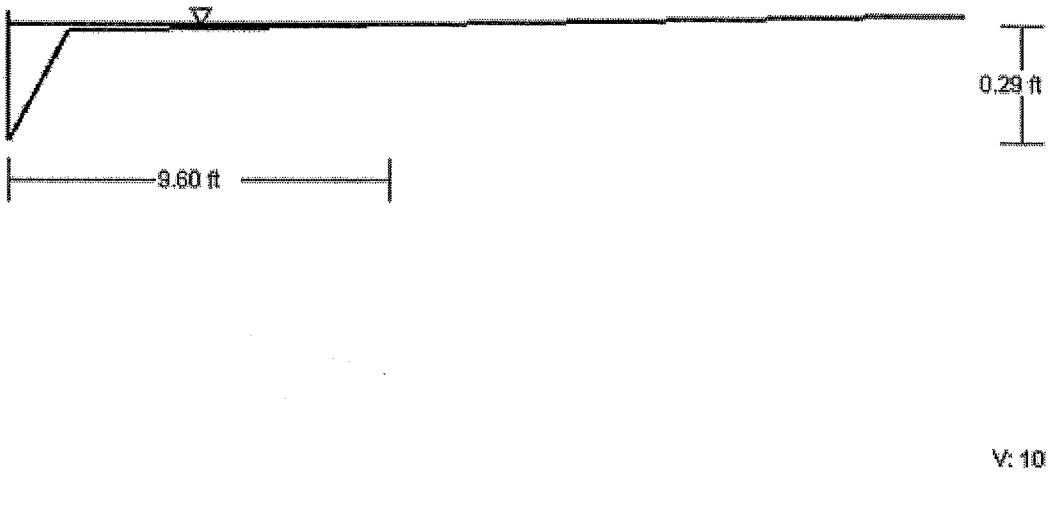
Project Description

Solve For	Efficiency

Input Data

Discharge		3.1	ft³/s
Slope		0.01500	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		92.99	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 57+25.28, 126.53' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.01310	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	65.68	%
Intercepted Flow	15.4	ft³/s
Bypass Flow	8.1	ft³/s
Spread	48.04	ft
Depth	0.39	ft
Flow Area	6.78	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	3.47	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.61	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.02637	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	65.18	ft

Cross Section for DI @ STA 57+25.28, 126.53' RT- 10 year

Project Description

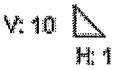
Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.01310	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		65.68	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+25.67, 80.46' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		8.1	ft³/s
Slope		0.01310	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.75	%
Intercepted Flow	6.2	ft³/s
Bypass Flow	1.9	ft³/s
Spread	31.75	ft
Depth	0.30	ft
Flow Area	3.01	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	2.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.72	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.04013	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	32.38	ft

Cross Section for DI @ STA 57+25.67, 80.46' RT- 10 year

Project Description

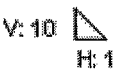
Solve For	Efficiency

Input Data

Discharge		8.1	ft³/s
Slope		0.01310	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		76.75	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+30.98, 75.36' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		8.0	ft^3/s
Slope		0.00430	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	85.58	%
Intercepted Flow	6.8	ft^3/s
Bypass Flow	1.2	ft^3/s
Spread	43.14	ft
Depth	0.33	ft
Flow Area	4.74	ft^2
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	1.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.83	
Grate Flow Ratio	0.13	
Equivalent Cross Slope	0.02974	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.61	ft

Cross Section for DI @ STA 57+30.98, 75.36' LT- 10 year

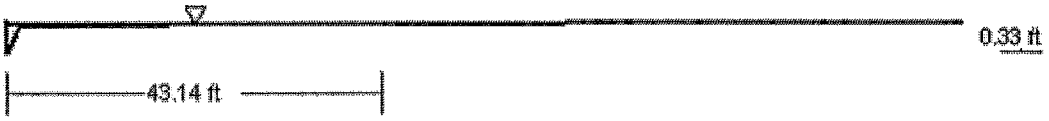
Project Description

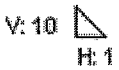
Solve For	Efficiency

Input Data

Discharge		8.0	ft³/s
Slope		0.00430	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		85.58	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+89.74, 80.43' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.00860	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.03	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	87.88	%
Intercepted Flow	20.7	ft³/s
Bypass Flow	2.8	ft³/s
Spread	18.08	ft
Depth	0.65	ft
Flow Area	5.21	ft²
Gutter Depression	0.08	ft
Total Depression	0.24	ft
Velocity	4.51	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.84	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.06831	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	32.45	ft

Cross Section for DI @ STA 57+89.74, 80.43' RT- 10 year

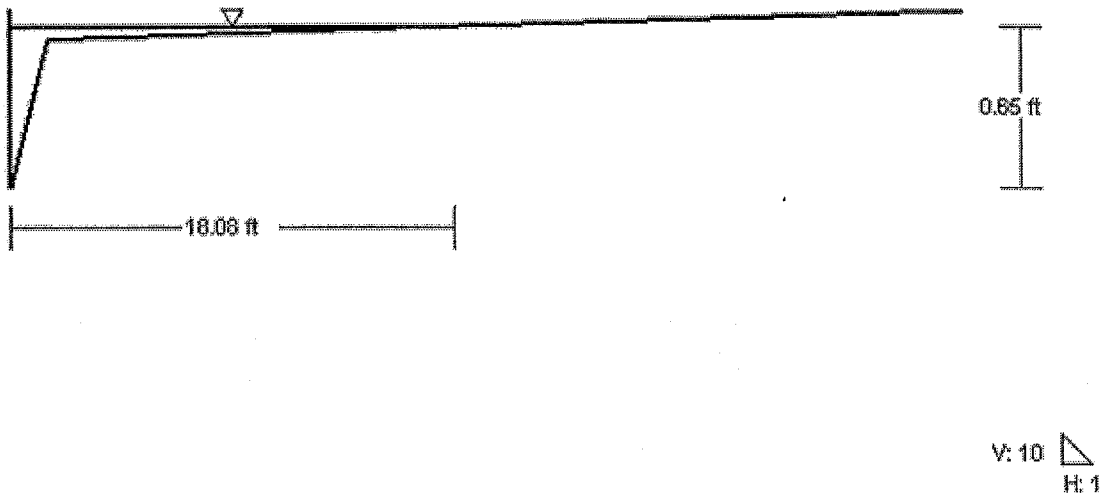
Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.00860	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.03	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		87.88	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 58+77.32, 31.91' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		4.9	ft³/s
Slope		0.00600	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	94.10	%
Intercepted Flow	4.6	ft³/s
Bypass Flow	0.3	ft³/s
Spread	13.98	ft
Depth	0.37	ft
Flow Area	2.03	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.42	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.91	
Grate Flow Ratio	0.32	
Equivalent Cross Slope	0.07563	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	14.18	ft

Cross Section for DI @ STA 58+77.32, 31.91' RT- 10 year

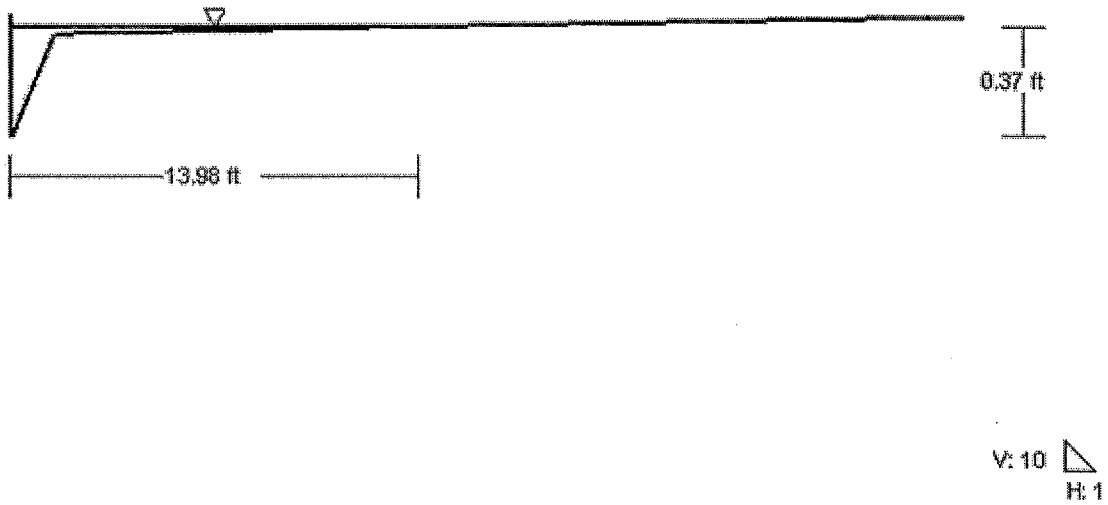
Project Description

Solve For	Efficiency

Input Data

Discharge		4.9	ft³/s
Slope		0.00600	ft/ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		94.10	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Interim Condition

Worksheet for DI @ STA 38+57.49, 33.26' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		232.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	58.16	%
Intercepted Flow	135.2	ft³/s
Bypass Flow	97.3	ft³/s
Spread	53.63	ft
Depth	1.17	ft
Flow Area	28.84	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	8.06	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.55	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.03360	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	143.72	ft

Cross Section for DI @ STA 38+57.49, 33.26' LT- 100 year

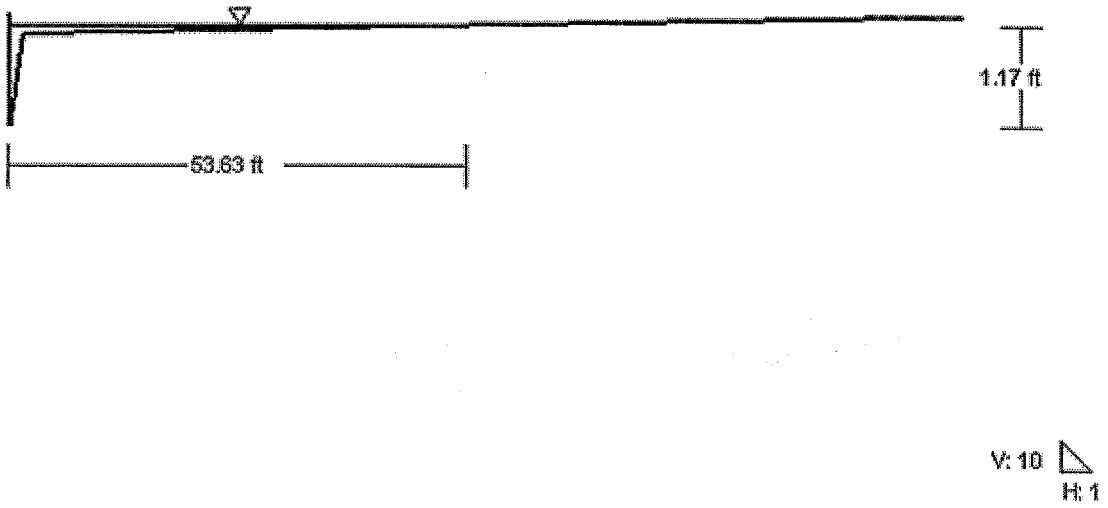
Project Description

Solve For	Efficiency

Input Data

Discharge		232.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		58.16	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 38+86.44, 34.19' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		164.9	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	62.12	%
Intercepted Flow	102.4	ft³/s
Bypass Flow	62.5	ft³/s
Spread	47.13	ft
Depth	1.04	ft
Flow Area	22.28	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	7.40	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.58	
Grate Flow Ratio	0.09	
Equivalent Cross Slope	0.03556	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	120.25	ft

Cross Section for DI @ STA 38+86.44, 34.19' RT- 100 year

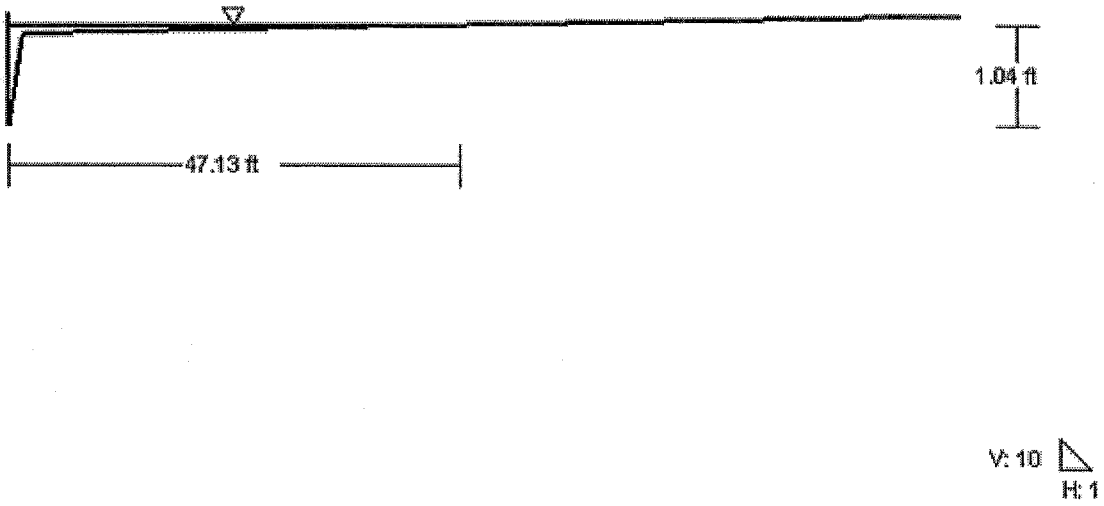
Project Description

Solve For	Efficiency

Input Data

Discharge		164.9	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		62.12	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+32.17, 33.27' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		113.7	ft^3/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	66.28	%
Intercepted Flow	75.4	ft^3/s
Bypass Flow	38.3	ft^3/s
Spread	40.97	ft
Depth	0.91	ft
Flow Area	16.85	ft^2
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	6.75	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.62	
Grate Flow Ratio	0.10	
Equivalent Cross Slope	0.03801	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	98.83	ft

Cross Section for DI @ STA 39+32.17, 33.27' LT- 100 year

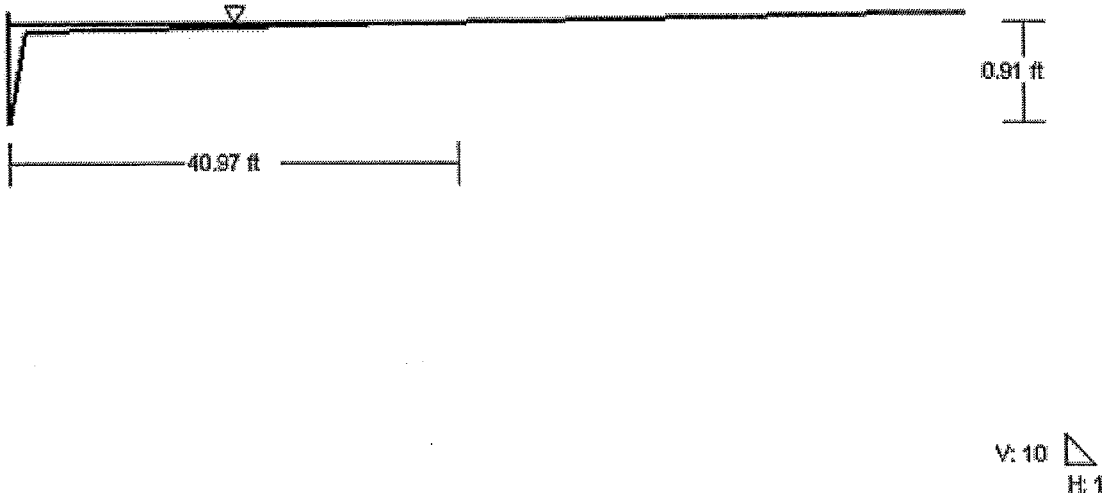
Project Description

Solve For	Efficiency

Input Data

Discharge		113.7	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		66.28	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+31.94, 34.12' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		113.7	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	66.28	%
Intercepted Flow	75.4	ft³/s
Bypass Flow	38.3	ft³/s
Spread	40.97	ft
Depth	0.91	ft
Flow Area	16.85	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	6.75	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.62	
Grate Flow Ratio	0.10	
Equivalent Cross Slope	0.03801	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	98.83	ft

Cross Section for DI @ STA 39+31.94, 34.12' RT- 100 year

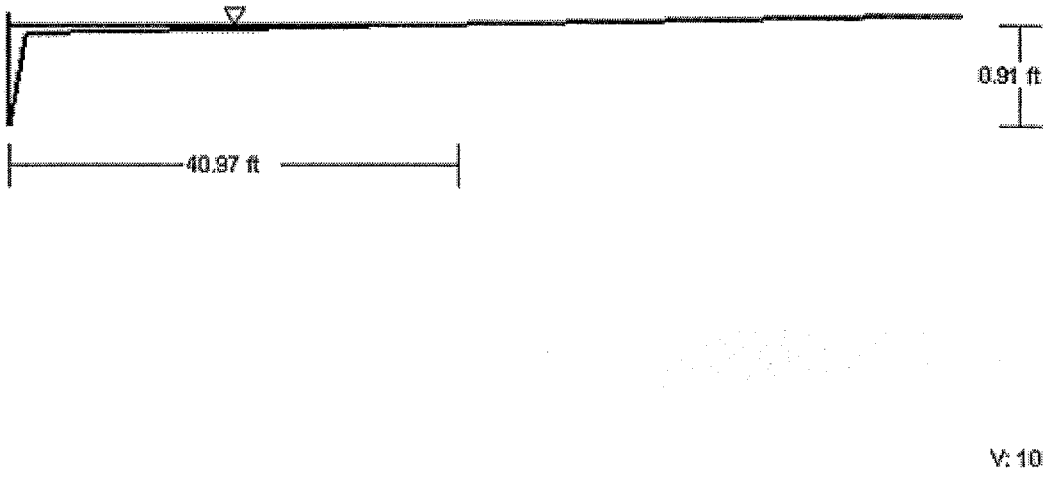
Project Description

Solve For	Efficiency

Input Data

Discharge		113.7	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		66.28	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 47+76.64, 107.11' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.66	%
Intercepted Flow	27.8	ft³/s
Bypass Flow	3.2	ft³/s
Spread	38.77	ft
Depth	0.72	ft
Flow Area	12.10	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.56	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03610	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	36.89	ft

Cross Section for DI @ STA 47+76.64, 107.11' LT- 100 year

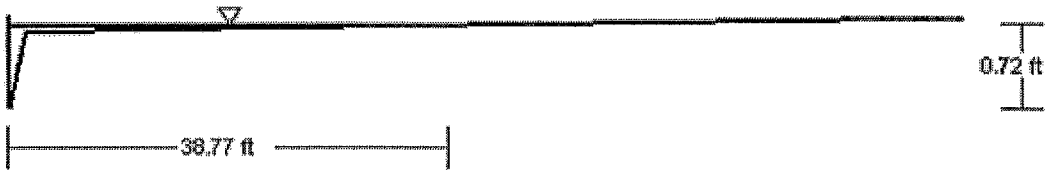
Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.66	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 48+16.37, 107.04' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	89.66	%
Intercepted Flow	27.8	ft³/s
Bypass Flow	3.2	ft³/s
Spread	38.77	ft
Depth	0.72	ft
Flow Area	12.10	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.56	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.88	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03610	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	36.89	ft

Cross Section for DI @ STA 48+16.37, 107.04' LT- 100 year

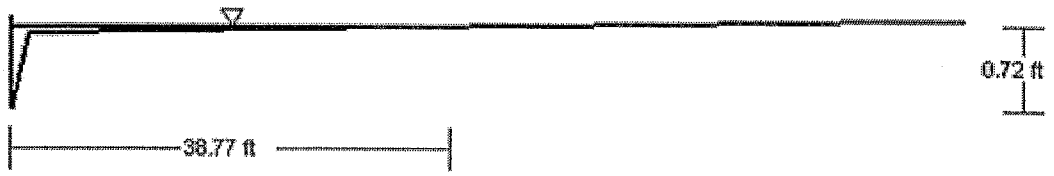
Project Description

Solve For	Efficiency

Input Data

Discharge		31.0	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		89.66	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 49+00.94, 31.01' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		49.7	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	79.14	%
Intercepted Flow	39.3	ft³/s
Bypass Flow	10.4	ft³/s
Spread	32.35	ft
Depth	0.74	ft
Flow Area	10.54	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.72	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.76	
Grate Flow Ratio	0.13	
Equivalent Cross Slope	0.04308	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	57.35	ft

Cross Section for DI @ STA 49+00.94, 31.01' LT- 100 year

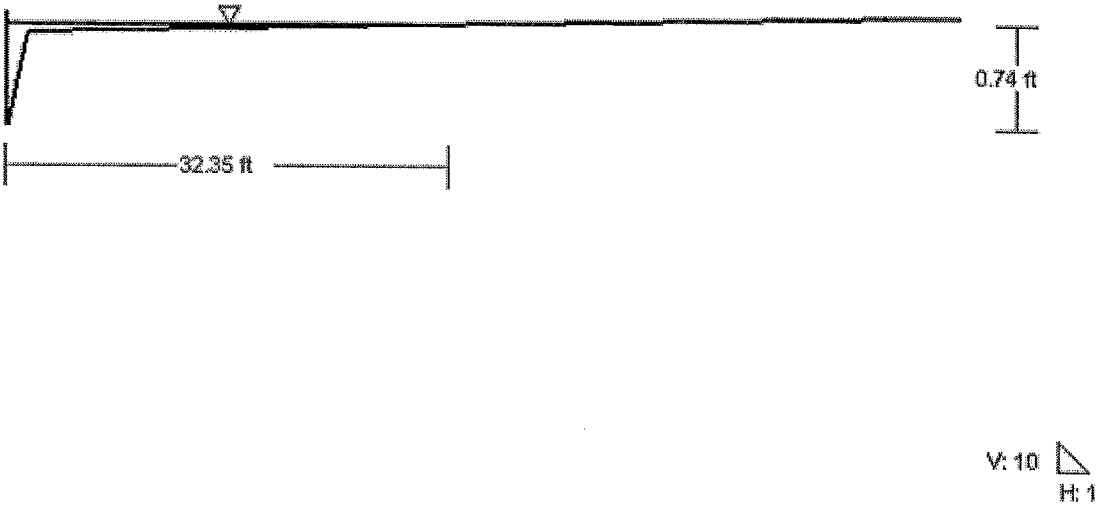
Project Description

Solve For	Efficiency

Input Data

Discharge		49.7	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		79.14	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 49+00.71, 33.53' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		38.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	81.24	%
Intercepted Flow	31.1	ft³/s
Bypass Flow	7.2	ft³/s
Spread	29.30	ft
Depth	0.68	ft
Flow Area	8.66	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.42	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.78	
Grate Flow Ratio	0.15	
Equivalent Cross Slope	0.04561	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	49.67	ft

Cross Section for DI @ STA 49+00.71, 33.53' RT- 100 year

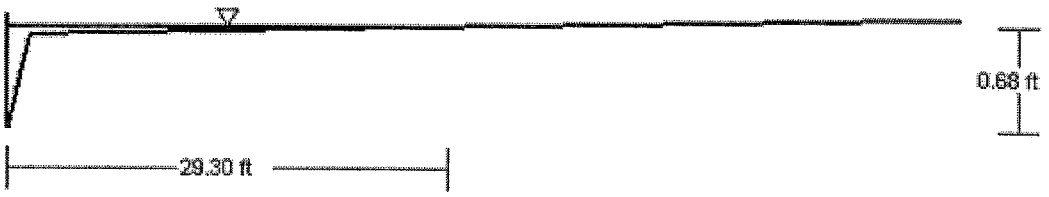
Project Description

Solve For	Efficiency

Input Data

Discharge		38.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		81.24	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 51+43.89, 126.18' RT-100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		271.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	51.08	%
Intercepted Flow	138.4	ft³/s
Bypass Flow	132.6	ft³/s
Spread	83.11	ft
Depth	1.06	ft
Flow Area	39.80	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	6.81	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.48	
Grate Flow Ratio	0.05	
Equivalent Cross Slope	0.02097	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	192.55	ft

Cross Section for DI @ STA 51+43.89, 126.18' RT-100 year

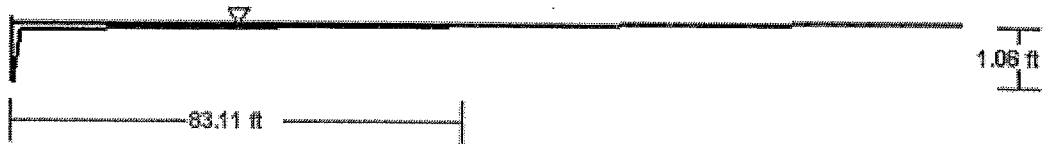
Project Description

Solve For	Efficiency

Input Data

Discharge		271.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		51.08	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 51+43.91, 80.18' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		147.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	58.22	%
Intercepted Flow	85.6	ft³/s
Bypass Flow	61.4	ft³/s
Spread	66.03	ft
Depth	0.87	ft
Flow Area	25.15	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	5.84	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.55	
Grate Flow Ratio	0.07	
Equivalent Cross Slope	0.02363	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	138.65	ft

Cross Section for DI @ STA 51+43.91, 80.18' RT- 100 year

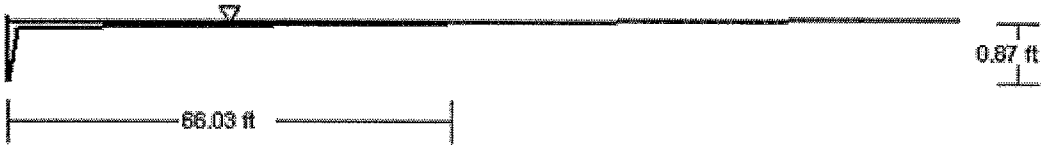
Project Description

Solve For	Efficiency

Input Data

Discharge		147.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		58.22	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 51+97.37, 33.31' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		59.3	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	72.14	%
Intercepted Flow	42.8	ft³/s
Bypass Flow	16.5	ft³/s
Spread	31.55	ft
Depth	0.73	ft
Flow Area	10.02	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	5.92	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.68	
Grate Flow Ratio	0.14	
Equivalent Cross Slope	0.04370	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	70.84	ft

Cross Section for DI @ STA 51+97.37, 33.31' RT- 100 year

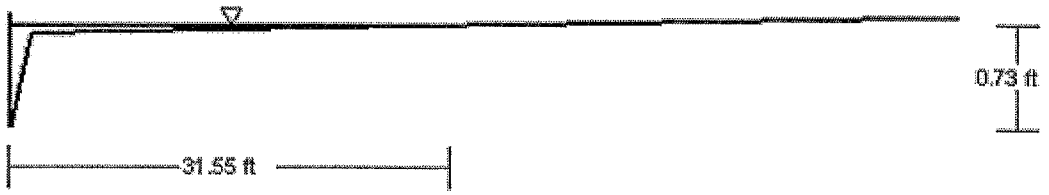
Project Description

Solve For	Efficiency

Input Data

Discharge		59.3	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		72.14	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 52+43.37, 33.14' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		16.5	ft^3/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	83.54	%
Intercepted Flow	13.8	ft^3/s
Bypass Flow	2.7	ft^3/s
Spread	19.34	ft
Depth	0.48	ft
Flow Area	3.81	ft^2
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.33	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.79	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.05968	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	34.33	ft

Cross Section for DI @ STA 52+43.37, 33.14' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		16.5	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		83.54	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 56+70.47, 31.98' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		32.3	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.50	%
Intercepted Flow	24.7	ft³/s
Bypass Flow	7.6	ft³/s
Spread	24.36	ft
Depth	0.58	ft
Flow Area	6.01	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	5.38	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.71	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.05112	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	52.15	ft

Cross Section for DI @ STA 56+70.47, 31.98' LT- 100 year

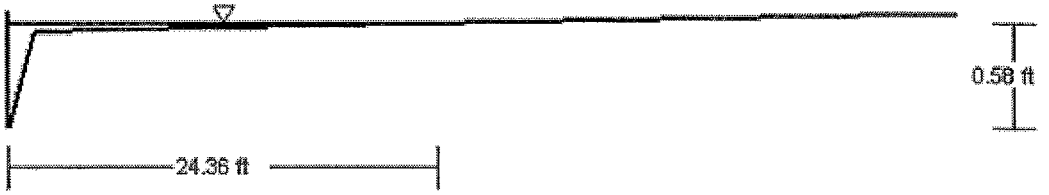
Project Description

Solve For	Efficiency

Input Data

Discharge		32.3	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		76.50	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.25, 33.26' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		10.7	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	85.68	%
Intercepted Flow	9.2	ft³/s
Bypass Flow	1.5	ft³/s
Spread	15.89	ft
Depth	0.41	ft
Flow Area	2.60	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.12	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.80	
Grate Flow Ratio	0.28	
Equivalent Cross Slope	0.06875	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.45	ft

Cross Section for DI @ STA 56+70.25, 33.26' RT- 100 year

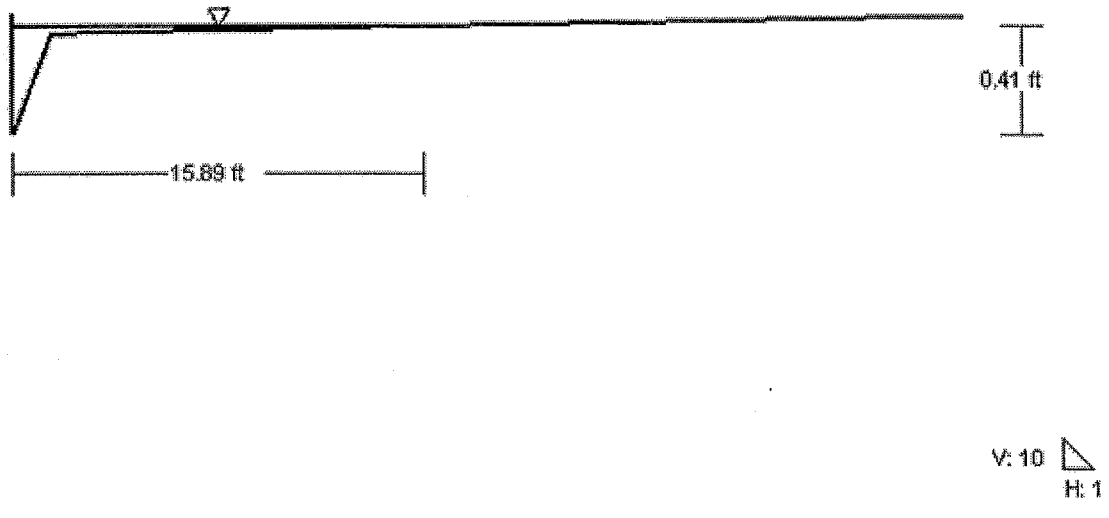
Project Description

Solve For	Efficiency

Input Data

Discharge		10.7	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		85.68	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 57+15.86, 31.98' LT-100 year

Project Description

Solve For	Spread

Input Data

Discharge		14.4	ft^3/s
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		3.33	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		0.00	%
Curb Opening Length		3.34	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Options

Calculation Option	Use Both

Results

Spread	32.07	ft
Depth	0.74	ft
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Open Grate Area	4.50	ft^2
Active Grate Weir Length	6.33	ft

Cross Section for DI @ STA 57+15.86, 31.98' LT-100 year

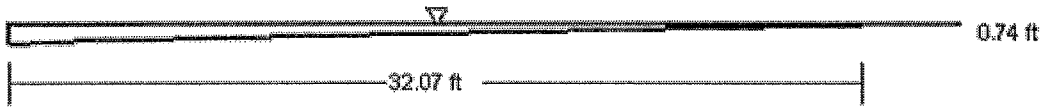
Project Description

Solve For	Spread

Input Data

Discharge		14.4	ft³/s
Spread		32.07	ft
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		3.33	ft
Grate Type	P-50 mm (P-1-7/8")		
Clogging		0.00	%
Curb Opening Length		3.34	ft
Opening Height		0.50	ft
Curb Throat Type	Horizontal		
Throat Incline Angle		90.00	degrees

Cross Section Image



V: 1
H: 1

Worksheet for DI @ STA 57+25.28, 126.53' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	56.50	%
Intercepted Flow	29.4	ft³/s
Bypass Flow	22.6	ft³/s
Spread	65.04	ft
Depth	0.49	ft
Flow Area	12.35	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	4.21	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.53	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.02010	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	107.06	ft

Cross Section for DI @ STA 57+25.28, 126.53' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		56.50	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+25.67, 80.46' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		22.6	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	66.10	%
Intercepted Flow	15.0	ft³/s
Bypass Flow	7.7	ft³/s
Spread	47.36	ft
Depth	0.39	ft
Flow Area	6.59	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	3.43	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.62	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.02673	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	63.64	ft

Cross Section for DI @ STA 57+25.67, 80.46' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		22.6	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		66.10	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+30.98, 75.36' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	77.92	%
Intercepted Flow	17.9	ft³/s
Bypass Flow	5.1	ft³/s
Spread	64.69	ft
Depth	0.44	ft
Flow Area	10.55	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	2.18	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.76	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.01999	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	54.60	ft

Cross Section for DI @ STA 57+30.98, 75.36' LT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.01	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		77.92	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+89.74, 80.43' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.03	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	82.60	%
Intercepted Flow	43.0	ft³/s
Bypass Flow	9.0	ft³/s
Spread	24.45	ft
Depth	0.85	ft
Flow Area	9.47	ft²
Gutter Depression	0.08	ft
Total Depression	0.24	ft
Velocity	5.49	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.79	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.05870	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	49.61	ft

Cross Section for DI @ STA 57+89.74, 80.43' RT- 100 year

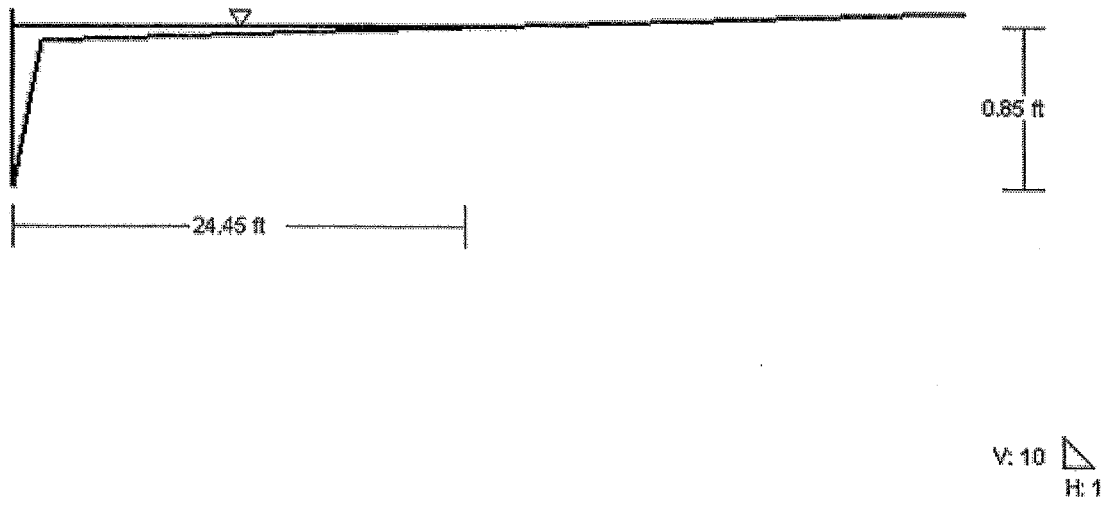
Project Description

Solve For	Efficiency

Input Data

Discharge		52.0	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.03	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		82.60	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 58+77.32, 31.91' RT- 100 year

Project Description

Solve For	Efficiency

Input Data

Discharge		18.2	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	88.37	%
Intercepted Flow	16.1	ft³/s
Bypass Flow	2.1	ft³/s
Spread	23.31	ft
Depth	0.56	ft
Flow Area	5.50	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.31	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.86	
Grate Flow Ratio	0.19	
Equivalent Cross Slope	0.05260	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	30.60	ft

Cross Section for DI @ STA 58+77.32, 31.91' RT- 100 year

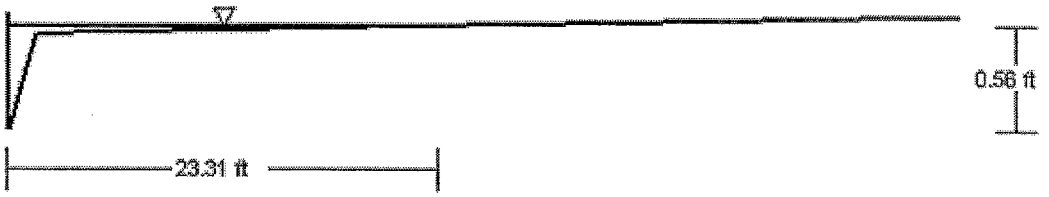
Project Description

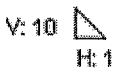
Solve For	Efficiency

Input Data

Discharge		18.2	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		0.083	ft/ft
Road Cross Slope		0.02	ft/ft
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		88.37	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 38+57.49, 33.26' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		86.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	69.22	%
Intercepted Flow	59.9	ft³/s
Bypass Flow	26.6	ft³/s
Spread	36.95	ft
Depth	0.83	ft
Flow Area	13.72	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	6.30	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.65	
Grate Flow Ratio	0.12	
Equivalent Cross Slope	0.04007	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	85.36	ft

Cross Section for DI @ STA 38+57.49, 33.26' LT- 10 year

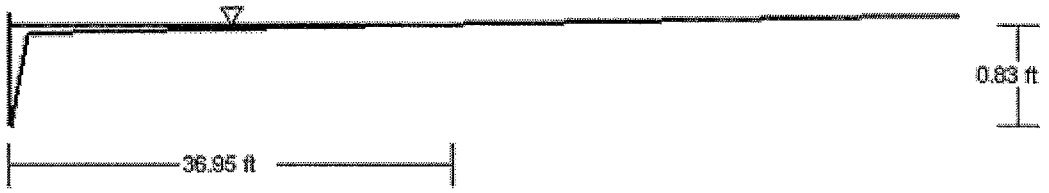
Project Description

Solve For	Efficiency

Input Data

Discharge		86.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		69.22	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 38+86.44, 34.19' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		56.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	73.57	%
Intercepted Flow	41.6	ft³/s
Bypass Flow	14.9	ft³/s
Spread	31.45	ft
Depth	0.72	ft
Flow Area	9.96	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	5.67	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.69	
Grate Flow Ratio	0.14	
Equivalent Cross Slope	0.04378	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	67.69	ft

Cross Section for DI @ STA 38+86.44, 34.19' RT- 10 year

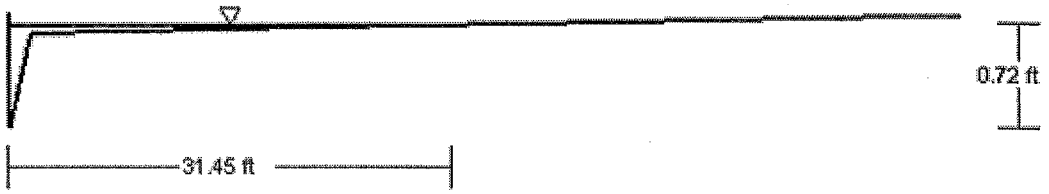
Project Description

Solve For	Efficiency

Input Data

Discharge		56.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		73.57	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 39+32.17, 33.27' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		56.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	73.57	%
Intercepted Flow	41.6	ft³/s
Bypass Flow	14.9	ft³/s
Spread	31.45	ft
Depth	0.72	ft
Flow Area	9.96	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	5.67	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.69	
Grate Flow Ratio	0.14	
Equivalent Cross Slope	0.04378	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	67.69	ft

Cross Section for DI @ STA 39+32.17, 33.27' LT- 10 year

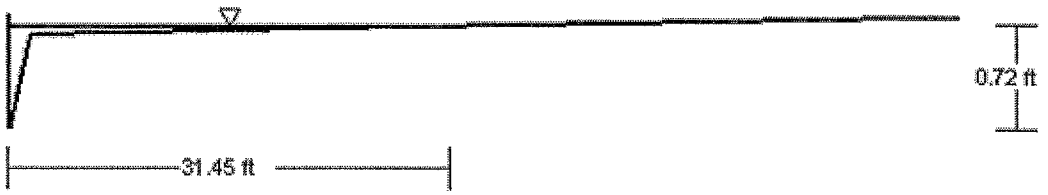
Project Description

Solve For	Efficiency

Input Data

Discharge		56.5	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		73.57	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 39+31.94, 34.12' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		14.8	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	84.94	%
Intercepted Flow	12.6	ft³/s
Bypass Flow	2.2	ft³/s
Spread	18.84	ft
Depth	0.47	ft
Flow Area	3.62	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	4.09	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.80	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.06081	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	31.66	ft

Cross Section for DI @ STA 39+31.94, 34.12' RT- 10 year

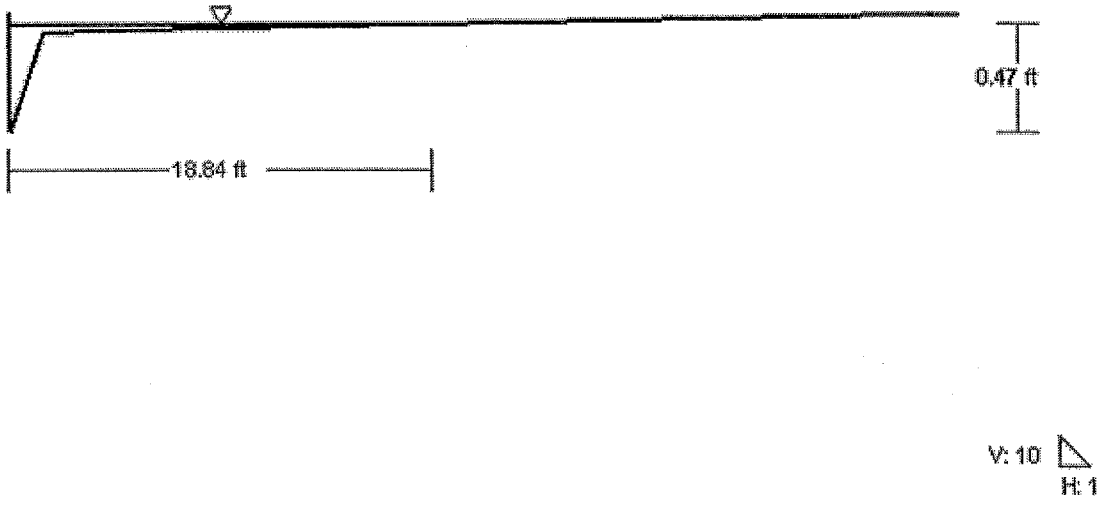
Project Description

Solve For	Efficiency

Input Data

Discharge		14.8	ft³/s
Slope		1.20	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		84.94	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 47+76.64, 107.11' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.60	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	93.49	%
Intercepted Flow	10.8	ft³/s
Bypass Flow	0.7	ft³/s
Spread	26.58	ft
Depth	0.53	ft
Flow Area	5.73	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.01	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.04619	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	20.98	ft

Cross Section for DI @ STA 47+76.64, 107.11' LT- 10 year

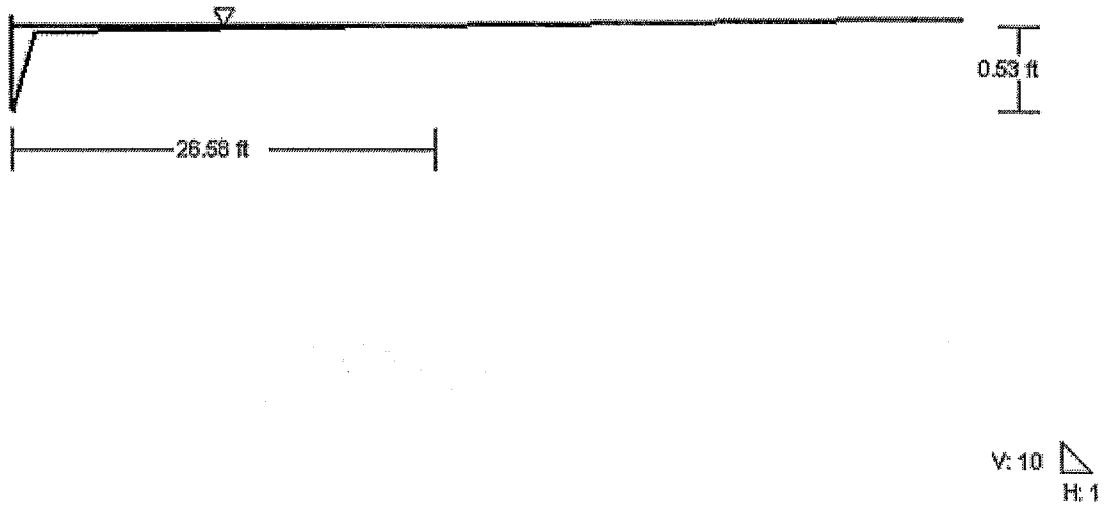
Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.60	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		93.49	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 48+16.37, 107.04' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.60	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	93.49	%
Intercepted Flow	10.8	ft³/s
Bypass Flow	0.7	ft³/s
Spread	26.58	ft
Depth	0.53	ft
Flow Area	5.73	ft²
Gutter Depression	0.10	ft
Total Depression	0.27	ft
Velocity	2.01	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.17	
Equivalent Cross Slope	0.04619	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	20.98	ft

Cross Section for DI @ STA 48+16.37, 107.04' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.5	ft³/s
Slope		0.25	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.60	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		93.49	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 49+00.94, 31.01' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		18.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	86.44	%
Intercepted Flow	15.8	ft³/s
Bypass Flow	2.5	ft³/s
Spread	22.11	ft
Depth	0.54	ft
Flow Area	4.96	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.83	
Grate Flow Ratio	0.20	
Equivalent Cross Slope	0.05448	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	32.74	ft

Cross Section for DI @ STA 49+00.94, 31.01' LT- 10 year

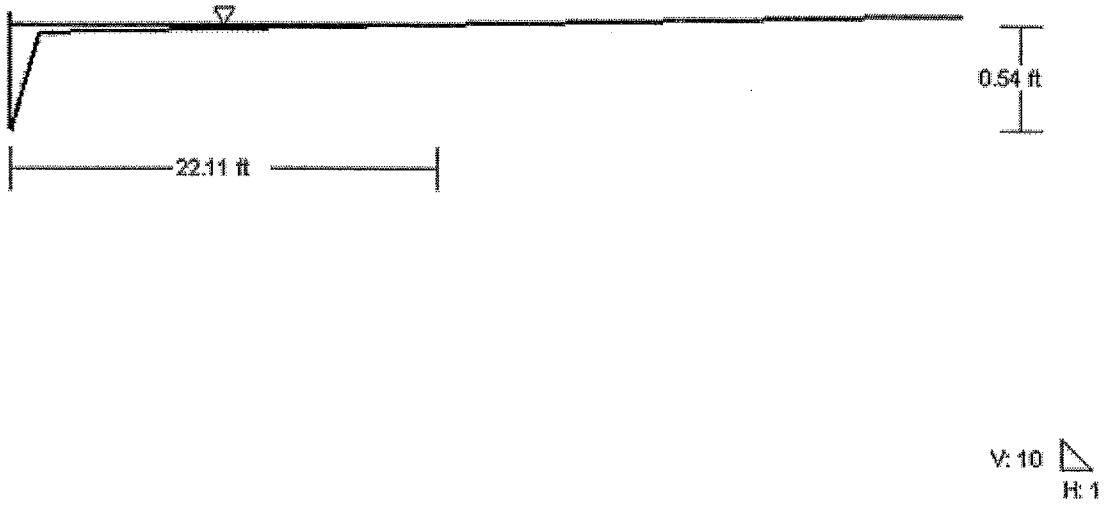
Project Description

Solve For	Efficiency

Input Data

Discharge		18.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		86.44	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 49+00.71, 33.53' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		2.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	95.74	%
Intercepted Flow	2.2	ft³/s
Bypass Flow	0.1	ft³/s
Spread	9.67	ft
Depth	0.29	ft
Flow Area	1.01	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.29	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.92	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.10025	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	9.50	ft

Cross Section for DI @ STA 49+00.71, 33.53' RT- 10 year

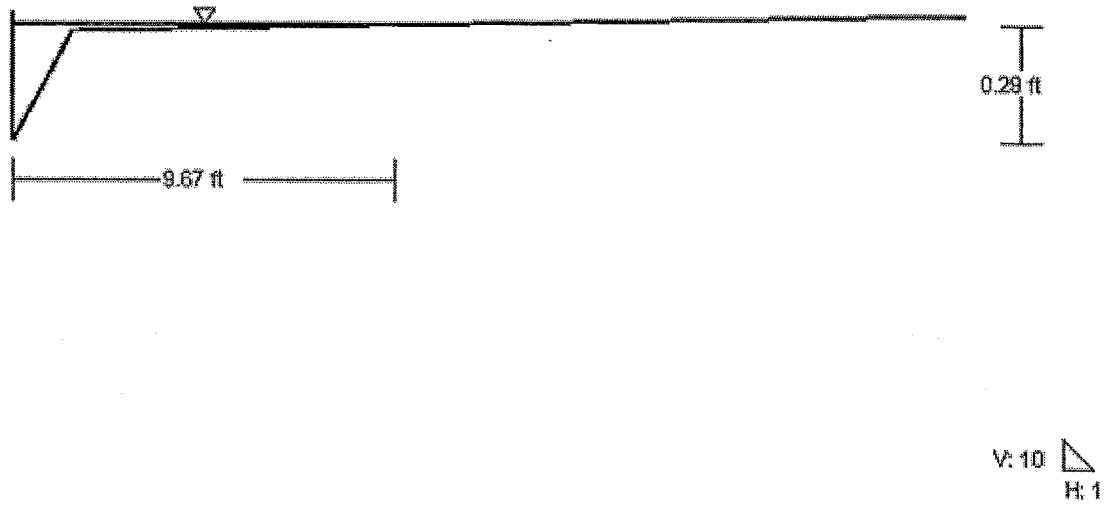
Project Description

Solve For	Efficiency

Input Data

Discharge		2.3	ft³/s
Slope		0.80	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		95.74	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 51+43.89, 126.18' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		108.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	61.75	%
Intercepted Flow	66.7	ft³/s
Bypass Flow	41.3	ft³/s
Spread	58.79	ft
Depth	0.78	ft
Flow Area	19.95	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	5.41	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.59	
Grate Flow Ratio	0.08	
Equivalent Cross Slope	0.02526	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	117.03	ft

Cross Section for DI @ STA 51+43.89, 126.18' RT- 10 year

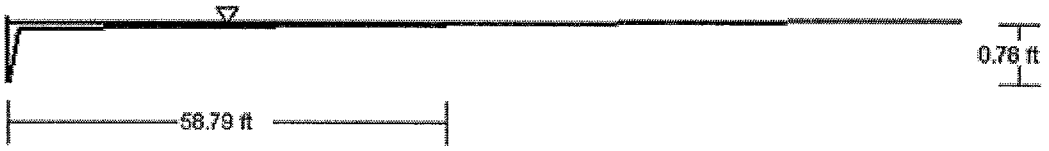
Project Description

Solve For	Efficiency

Input Data

Discharge		108.0	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		61.75	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 51+43.91, 80.18' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		41.3	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	72.05	%
Intercepted Flow	29.8	ft³/s
Bypass Flow	11.5	ft³/s
Spread	40.86	ft
Depth	0.58	ft
Flow Area	9.68	ft²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	4.27	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.69	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.03203	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	67.77	ft

Cross Section for DI @ STA 51+43.91, 80.18' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		41.3	ft³/s
Slope		1.00	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		1.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		72.05	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 51+97.37, 33.31' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		11.6	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	86.08	%
Intercepted Flow	10.0	ft³/s
Bypass Flow	1.6	ft³/s
Spread	16.87	ft
Depth	0.43	ft
Flow Area	2.92	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.98	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.81	
Grate Flow Ratio	0.26	
Equivalent Cross Slope	0.06581	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.92	ft

Cross Section for DI @ STA 51+97.37, 33.31' RT- 10 year

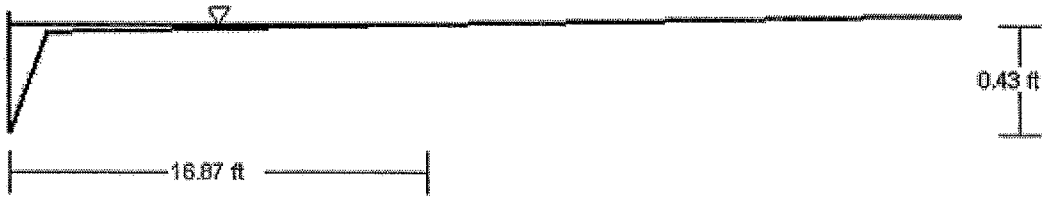
Project Description

Solve For	Efficiency

Input Data

Discharge		11.6	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		86.08	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 52+43.37, 33.14' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		1.6	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	95.99	%
Intercepted Flow	1.5	ft³/s
Bypass Flow	0.1	ft³/s
Spread	7.40	ft
Depth	0.24	ft
Flow Area	0.62	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.59	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.90	
Grate Flow Ratio	0.58	
Equivalent Cross Slope	0.12196	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	8.39	ft

Cross Section for DI @ STA 52+43.37, 33.14' RT- 10 year

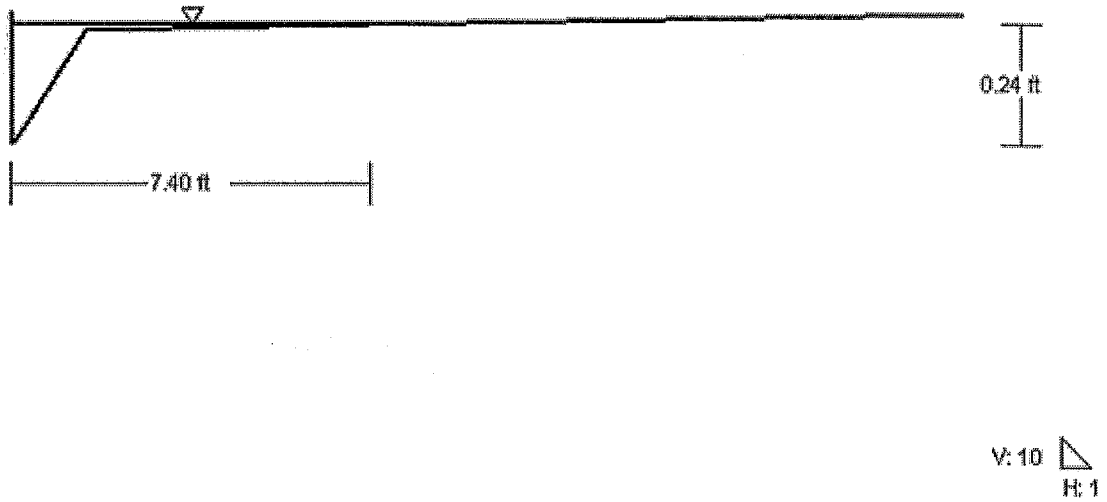
Project Description

Solve For	Efficiency

Input Data

Discharge		1.6	ft³/s
Slope		1.30	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		95.99	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.47, 31.98' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		4.5	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	91.10	%
Intercepted Flow	4.1	ft³/s
Bypass Flow	0.4	ft³/s
Spread	11.22	ft
Depth	0.32	ft
Flow Area	1.33	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.38	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.85	
Grate Flow Ratio	0.40	
Equivalent Cross Slope	0.08945	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	16.29	ft

Cross Section for DI @ STA 56+70.47, 31.98' LT- 10 year

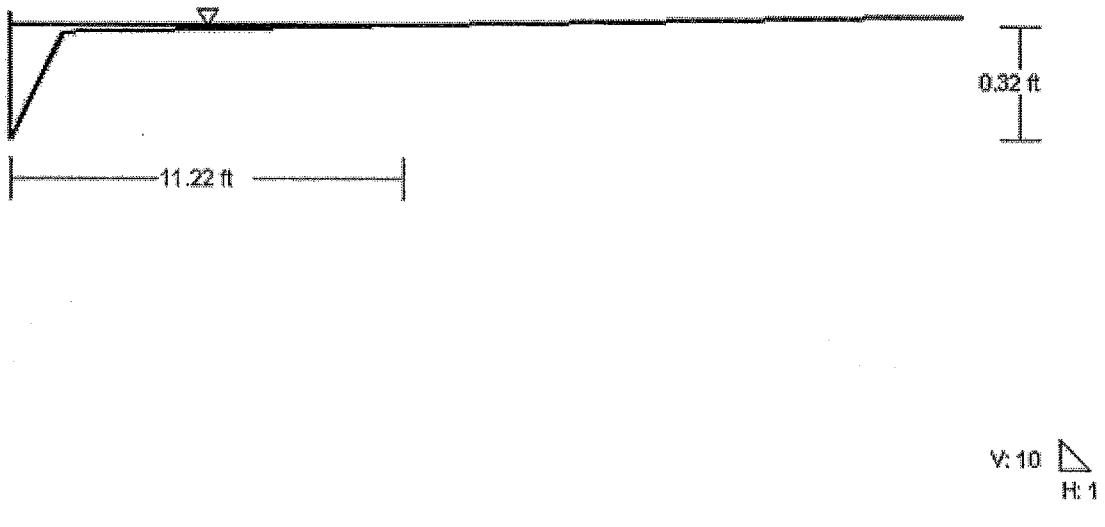
Project Description

Solve For	Efficiency

Input Data

Discharge		4.5	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		91.10	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 56+70.25, 33.26' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		3.1	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	92.99	%
Intercepted Flow	2.9	ft³/s
Bypass Flow	0.2	ft³/s
Spread	9.60	ft
Depth	0.29	ft
Flow Area	0.99	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	3.12	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.87	
Grate Flow Ratio	0.46	
Equivalent Cross Slope	0.10076	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	12.97	ft

Cross Section for DI @ STA 56+70.25, 33.26' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		3.1	ft³/s
Slope		1.50	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		92.99	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 57+25.28, 126.53' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.58	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	65.68	%
Intercepted Flow	15.4	ft³/s
Bypass Flow	8.1	ft³/s
Spread	48.04	ft
Depth	0.39	ft
Flow Area	6.78	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	3.47	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.61	
Grate Flow Ratio	0.11	
Equivalent Cross Slope	0.02637	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	65.18	ft

Cross Section for DI @ STA 57+25.28, 126.53' RT- 10 year

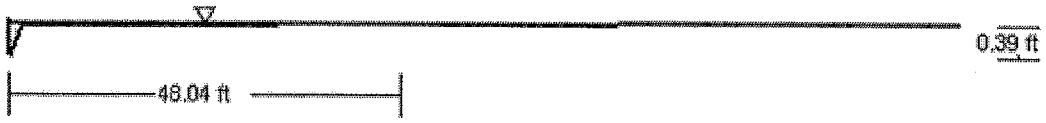
Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.58	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		65.68	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+25.67, 80.46' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		8.1	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.58	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	76.75	%
Intercepted Flow	6.2	ft³/s
Bypass Flow	1.9	ft³/s
Spread	31.75	ft
Depth	0.30	ft
Flow Area	3.01	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	2.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.72	
Grate Flow Ratio	0.18	
Equivalent Cross Slope	0.04013	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	32.38	ft

Cross Section for DI @ STA 57+25.67, 80.46' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		8.1	ft³/s
Slope		1.31	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.58	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		76.75	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



V: 10
H: 1

Worksheet for DI @ STA 57+30.98, 75.36' LT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		8.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.50	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	85.58	%
Intercepted Flow	6.8	ft³/s
Bypass Flow	1.2	ft³/s
Spread	43.14	ft
Depth	0.33	ft
Flow Area	4.74	ft²
Gutter Depression	0.12	ft
Total Depression	0.28	ft
Velocity	1.69	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.83	
Grate Flow Ratio	0.13	
Equivalent Cross Slope	0.02974	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	27.61	ft

Cross Section for DI @ STA 57+30.98, 75.36' LT- 10 year

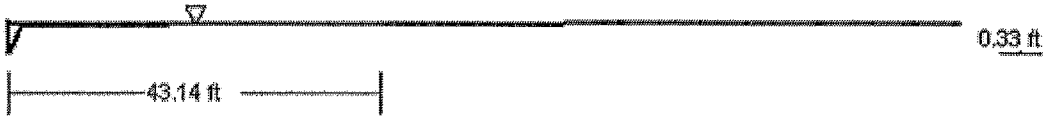
Project Description

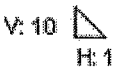
Solve For	Efficiency

Input Data

Discharge		8.0	ft³/s
Slope		0.43	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		0.50	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		85.58	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image





Worksheet for DI @ STA 57+89.74, 80.43' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		3.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	87.88	%
Intercepted Flow	20.7	ft³/s
Bypass Flow	2.8	ft³/s
Spread	18.08	ft
Depth	0.65	ft
Flow Area	5.21	ft²
Gutter Depression	0.08	ft
Total Depression	0.24	ft
Velocity	4.51	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.84	
Grate Flow Ratio	0.23	
Equivalent Cross Slope	0.06831	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	32.45	ft

Cross Section for DI @ STA 57+89.74, 80.43' RT- 10 year

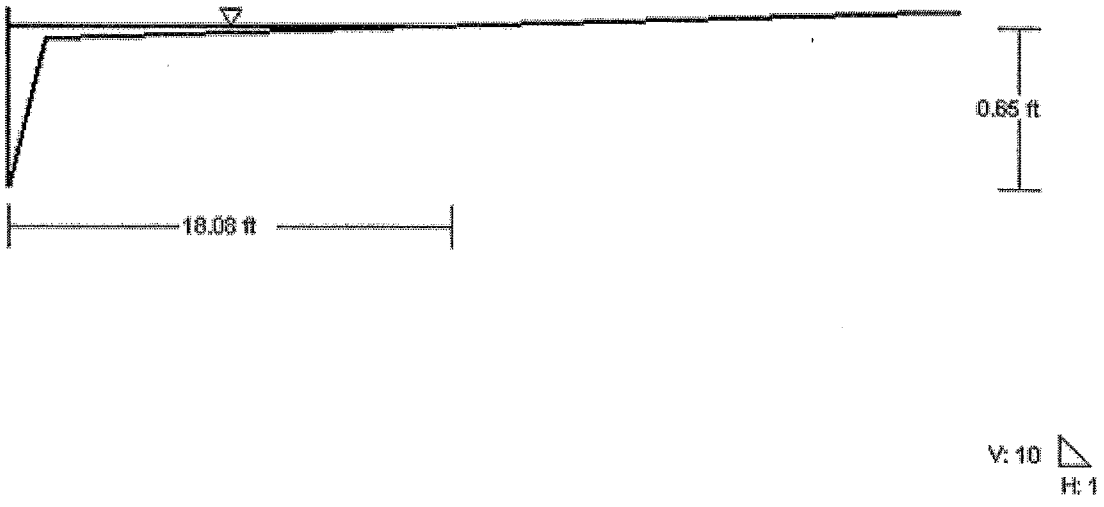
Project Description

Solve For	Efficiency

Input Data

Discharge		23.5	ft³/s
Slope		0.86	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		3.15	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		87.88	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



Worksheet for DI @ STA 58+77.32, 31.91' RT- 10 year

Project Description

Solve For	Efficiency

Input Data

Discharge		4.9	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Efficiency	94.10	%
Intercepted Flow	4.6	ft³/s
Bypass Flow	0.3	ft³/s
Spread	13.98	ft
Depth	0.37	ft
Flow Area	2.03	ft²
Gutter Depression	0.09	ft
Total Depression	0.26	ft
Velocity	2.42	ft/s
Splash Over Velocity	192.12	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.91	
Grate Flow Ratio	0.32	
Equivalent Cross Slope	0.07563	ft/ft
Active Grate Length	13.33	ft
Length Factor	0.00	
Total Interception Length	14.18	ft

Cross Section for DI @ STA 58+77.32, 31.91' RT- 10 year

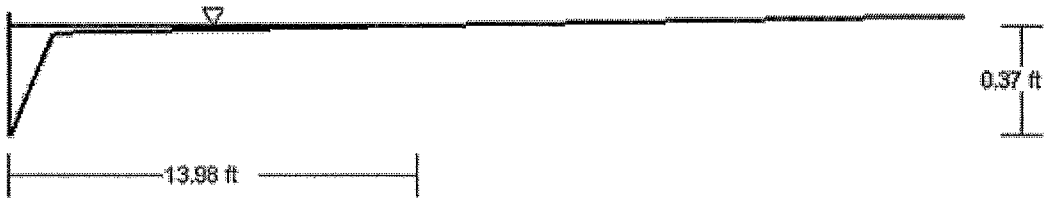
Project Description

Solve For	Efficiency

Input Data

Discharge		4.9	ft³/s
Slope		0.60	%
Gutter Width		1.50	ft
Gutter Cross Slope		8.330	%
Road Cross Slope		2.00	%
Roughness Coefficient		0.016	
Local Depression		2.00	in
Local Depression Width		1.50	ft
Efficiency		94.10	%
Grate Width		1.50	ft
Grate Length		13.33	ft
Grate Type	Curved Vaned		
Clogging		0.00	%
Curb Opening Length		13.34	ft

Cross Section Image



A.4 LATERAL PIPE CALCULATIONS

Lateral Pipe Full Flow Capacity

Ultimate Condition WSPG Models

Interim Condition WSPG Models

Lateral Full Flow Capacity

Worksheet for STA 38+65.04 LT - LAT. 1

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	8.34	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	193	ft^3/s

Results

Discharge	193	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.99	ft
Percent Full	100.0	%
Critical Slope	0.07986	ft/ft
Velocity	27.25	ft/s
Velocity Head	11.54	ft
Specific Energy	14.54	ft
Froude Number	0.00	
Maximum Discharge	207.19	ft^3/s
Discharge Full	192.61	ft^3/s
Slope Full	0.08340	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 38+65.04 LT - LAT. 1

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.99	ft
Channel Slope	8.34	%
Critical Slope	0.07986	ft/ft

Cross Section for STA 38+65.04 LT - LAT. 1

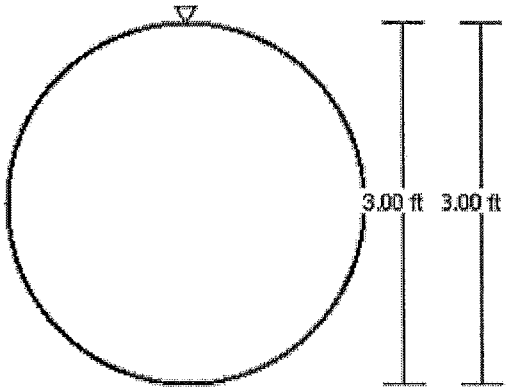
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	8.34	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	193	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 38+93.50 RT- LAT. 2

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	4.40	%
Rise	29.00	in
Span	45.00	in

Results

Discharge	138	ft^3/s
Normal Depth	2.42	ft
Flow Area	7.12	ft^2
Wetted Perimeter	9.79	ft
Top Width	0.00	ft
Critical Depth	2.40	ft
Percent Full	100.0	%
Critical Slope	33614607.36765	ft/ft
Velocity	19.39	ft/s
Velocity Head	5.84	ft
Specific Energy	8.26	ft
Froude Number	0.00	
Maximum Discharge	150.04	ft^3/s
Discharge Full	137.89	ft^3/s
Slope Full	0.04394	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 38+93.50 RT- LAT. 2

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.42	ft
Critical Depth	2.40	ft
Channel Slope	4.40	%
Critical Slope	33614607.36765	ft/ft

Cross Section for STA 38+93.50 RT- LAT. 2

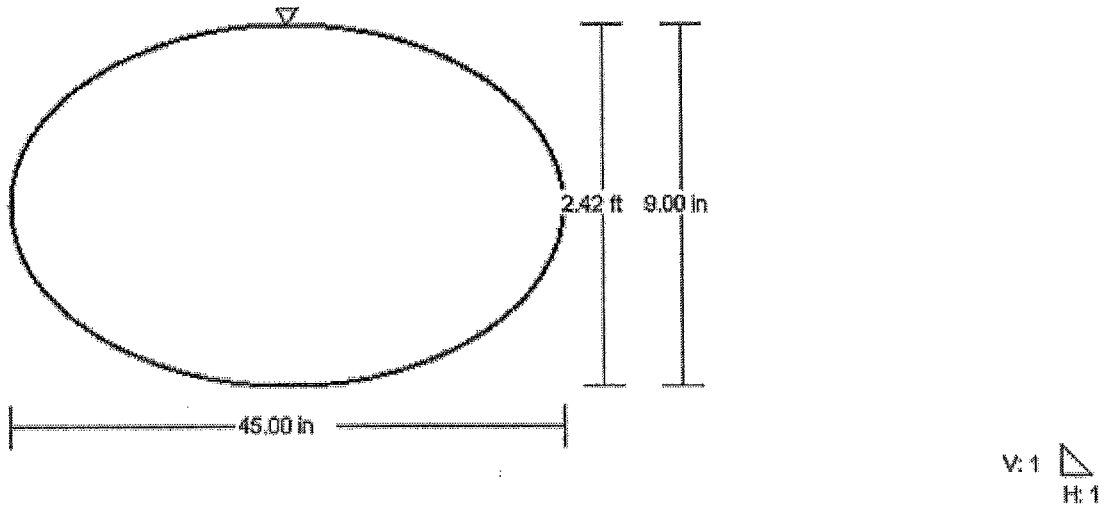
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	4.40	%
Normal Depth	2.42	ft
Rise	29.00	in
Span	45.00	in
Discharge	138	ft³/s

Cross Section Image



Worksheet for STA 39+39.72 LT - LAT. 3

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	7.30	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	180	ft³/s

Results

Discharge	180	ft³/s
Normal Depth	3.00	ft
Flow Area	7.07	ft²
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.99	ft
Percent Full	100.0	%
Critical Slope	0.06948	ft/ft
Velocity	25.49	ft/s
Velocity Head	10.10	ft
Specific Energy	13.10	ft
Froude Number	0.00	
Maximum Discharge	193.84	ft³/s
Discharge Full	180.20	ft³/s
Slope Full	0.07300	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 39+39.72 LT - LAT. 3

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.99	ft
Channel Slope	7.30	%
Critical Slope	0.06948	ft/ft

Cross Section for STA 39+39.72 LT - LAT. 3

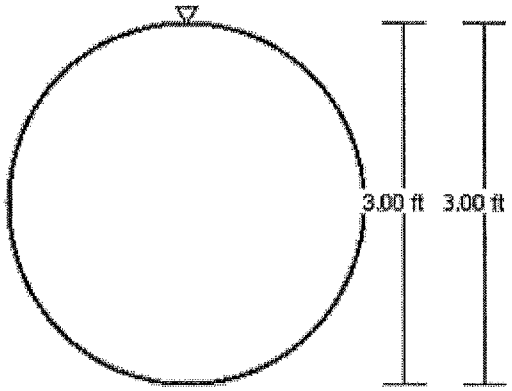
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	7.30	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	180	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 39+39.72 RT- LAT. 3

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	8.30	%
Rise	24.00	in
Span	38.00	in

Results

Discharge	117	ft^3/s
Normal Depth	2.00	ft
Flow Area	4.97	ft^2
Wetted Perimeter	8.21	ft
Top Width	0.00	ft
Critical Depth	2.00	ft
Percent Full	100.0	%
Critical Slope	154961.42951	ft/ft
Velocity	23.58	ft/s
Velocity Head	8.64	ft
Specific Energy	10.64	ft
Froude Number	0.00	
Maximum Discharge	127.68	ft^3/s
Discharge Full	117.19	ft^3/s
Slope Full	0.08289	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 39+39.72 RT- LAT. 3

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	2.00	ft
Channel Slope	8.30	%
Critical Slope	154961.42951	ft/ft

Cross Section for STA 39+39.72 RT- LAT. 3

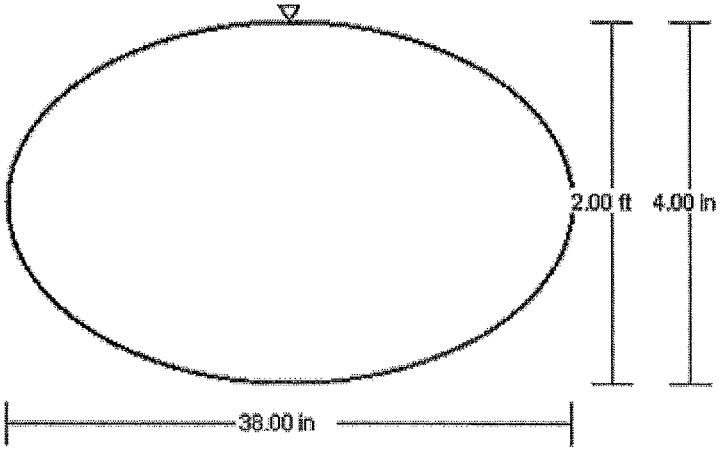
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	8.30	%
Normal Depth	2.00	ft
Rise	24.00	in
Span	38.00	in
Discharge	117	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 47+94.48 LT-LAT. 4

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.80	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	89	ft^3/s

Results

Discharge	89	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.84	ft
Percent Full	100.0	%
Critical Slope	0.01558	ft/ft
Velocity	12.66	ft/s
Velocity Head	2.49	ft
Specific Energy	5.49	ft
Froude Number	0.00	
Maximum Discharge	96.25	ft^3/s
Discharge Full	89.48	ft^3/s
Slope Full	0.01800	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 47+94.48 LT-LAT. 4

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.84	ft
Channel Slope	1.80	%
Critical Slope	0.01558	ft/ft

Cross Section for STA 47+94.48 LT-LAT. 4

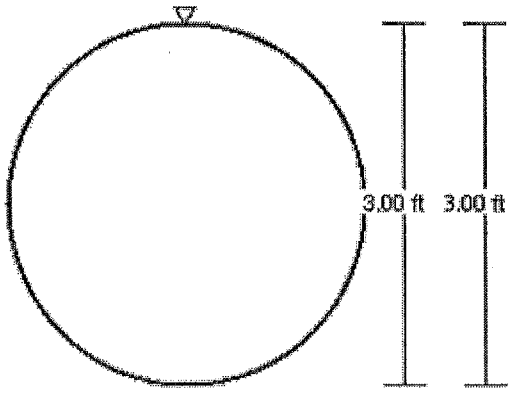
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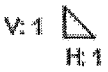
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.80	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	89	ft^3/s

Cross Section Image





Worksheet for STA 48+24.60 LT-LAT.5

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.50	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	82	ft^3/s

Results

Discharge	82	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.79	ft
Percent Full	100.0	%
Critical Slope	0.01298	ft/ft
Velocity	11.56	ft/s
Velocity Head	2.08	ft
Specific Energy	5.08	ft
Froude Number	0.00	
Maximum Discharge	87.87	ft^3/s
Discharge Full	81.68	ft^3/s
Slope Full	0.01500	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 48+24.60 LT-LAT.5

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.79	ft
Channel Slope	1.50	%
Critical Slope	0.01298	ft/ft

Cross Section for STA 48+24.60 LT-LAT.5

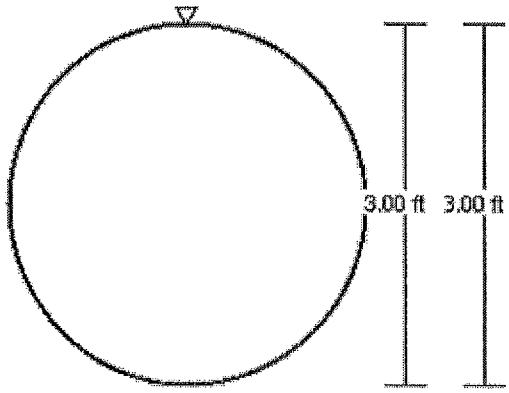
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.50	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	82	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 49+08.50 LT-LAT.6

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	2.20	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	99	ft^3/s

Results

Discharge	99	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.89	ft
Percent Full	100.0	%
Critical Slope	0.01923	ft/ft
Velocity	13.99	ft/s
Velocity Head	3.04	ft
Specific Energy	6.04	ft
Froude Number	0.00	
Maximum Discharge	106.41	ft^3/s
Discharge Full	98.92	ft^3/s
Slope Full	0.02200	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 49+08.50 LT-LAT.6

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.89	ft
Channel Slope	2.20	%
Critical Slope	0.01923	ft/ft

Cross Section for STA 49+08.50 LT-LAT.6

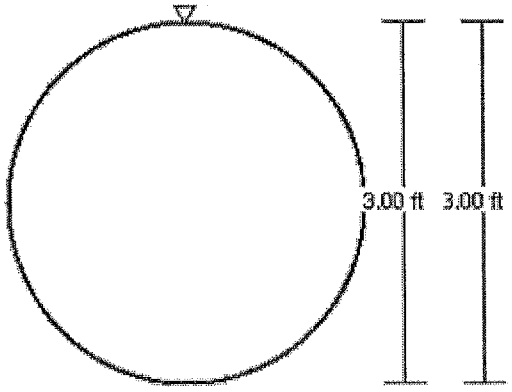
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	2.20	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	99	ft^3/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 49+08.50 RT-LAT.6

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	7.20	%
Rise	29.00	in
Span	45.00	in

Results

Discharge	177	ft³/s
Normal Depth	2.42	ft
Flow Area	7.12	ft²
Wetted Perimeter	9.79	ft
Top Width	0.00	ft
Critical Depth	2.41	ft
Percent Full	100.0	%
Critical Slope	326623.14095	ft/ft
Velocity	24.80	ft/s
Velocity Head	9.56	ft
Specific Energy	11.97	ft
Froude Number	0.00	
Maximum Discharge	191.93	ft³/s
Discharge Full	176.38	ft³/s
Slope Full	0.07190	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 49+08.50 RT-LAT.6

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.42	ft
Critical Depth	2.41	ft
Channel Slope	7.20	%
Critical Slope	326623.14095	ft/ft

Cross Section for STA 49+08.50 RT-LAT.6

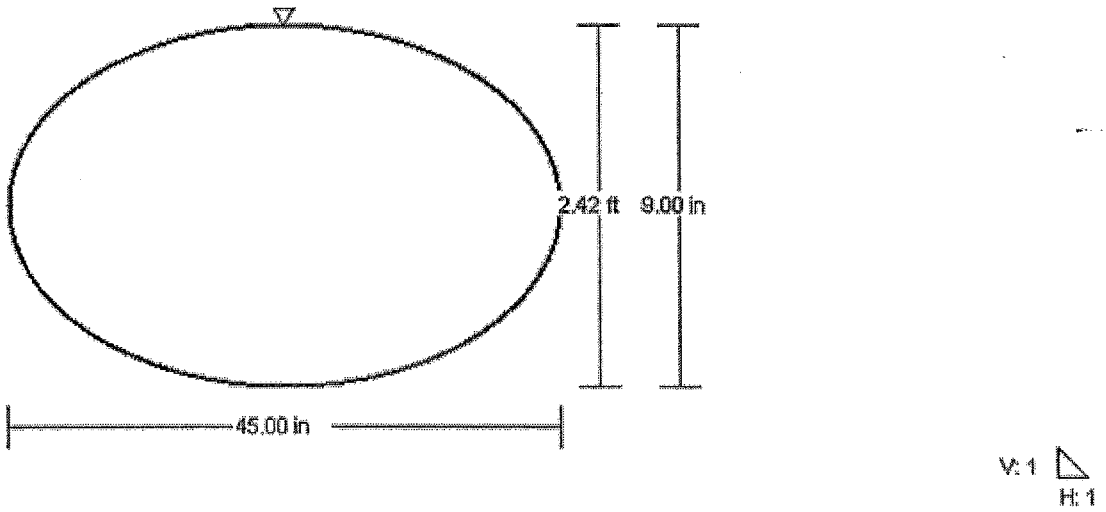
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	7.20	%
Normal Depth	2.42	ft
Rise	29.00	in
Span	45.00	in
Discharge	177	ft³/s

Cross Section Image



Worksheet for STA 51+66.87 RT-LAT.7

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.80	%
Rise	38.00	in
Span	60.00	in

Results

Discharge	124	ft^3/s
Normal Depth	3.17	ft
Flow Area	12.44	ft^2
Wetted Perimeter	12.98	ft
Top Width	0.00	ft
Critical Depth	2.78	ft
Percent Full	100.0	%
Critical Slope	0.00692	ft/ft
Velocity	9.94	ft/s
Velocity Head	1.53	ft
Specific Energy	4.70	ft
Froude Number	0.00	
Maximum Discharge	134.67	ft^3/s
Discharge Full	123.49	ft^3/s
Slope Full	0.00799	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 51+66.87 RT-LAT.7

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	3.17	ft
Critical Depth	2.78	ft
Channel Slope	0.80	%
Critical Slope	0.00692	ft/ft

Cross Section for STA 51+66.87 RT-LAT.7

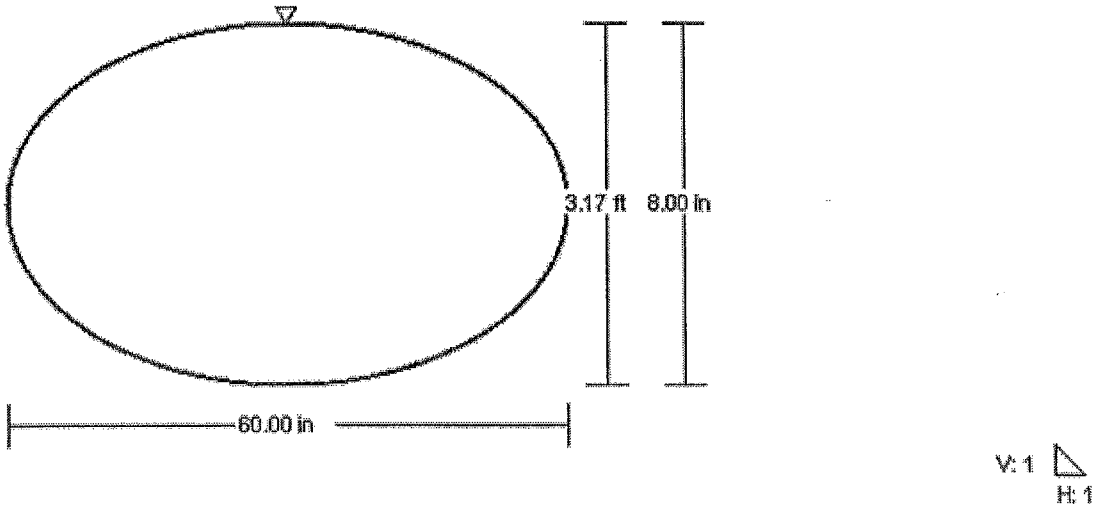
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.80	%
Normal Depth	3.17	ft
Rise	38.00	in
Span	60.00	in
Discharge	124	ft³/s

Cross Section Image



Worksheet for STA 51+66.87 RT-LAT.7

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.90	%
Normal Depth	5.00	ft
Height	5.00	ft
Bottom Width	4.00	ft
Discharge	233	ft^3/s

Results

Flow Area	20.00	ft^2
Wetted Perimeter	18.00	ft
Top Width	4.00	ft
Critical Depth	4.72	ft
Percent Full	100.0	%
Critical Slope	0.00739	ft/ft
Velocity	11.63	ft/s
Velocity Head	2.10	ft
Specific Energy	7.10	ft
Froude Number	0.92	
Discharge Full	232.65	ft^3/s
Slope Full	0.00900	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s

Worksheet for STA 51+66.87 RT-LAT.7

GVF Output Data

Normal Depth	5.00	ft
Critical Depth	4.72	ft
Channel Slope	0.90	%
Critical Slope	0.00739	ft/ft

Cross Section for STA 51+66.87 RT-LAT.7

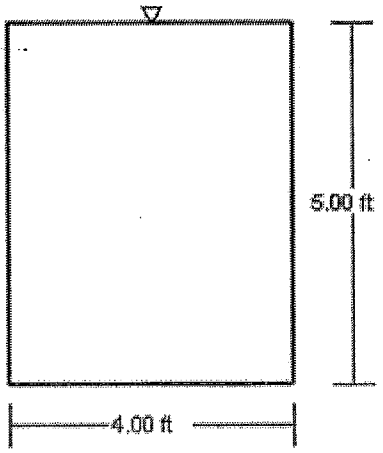
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.90	%
Normal Depth	5.00	ft
Height	5.00	ft
Bottom Width	4.00	ft
Discharge	233	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 51+30 .60 LT-LAT.8

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.30	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	76	ft^3/s

Results

Discharge	76	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.73	ft
Percent Full	100.0	%
Critical Slope	0.01135	ft/ft
Velocity	10.76	ft/s
Velocity Head	1.80	ft
Specific Energy	4.80	ft
Froude Number	0.00	
Maximum Discharge	81.80	ft^3/s
Discharge Full	76.04	ft^3/s
Slope Full	0.01300	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 51+30 .60 LT-LAT.8

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.73	ft
Channel Slope	1.30	%
Critical Slope	0.01135	ft/ft

Cross Section for STA 51+30 .60 LT-LAT.8

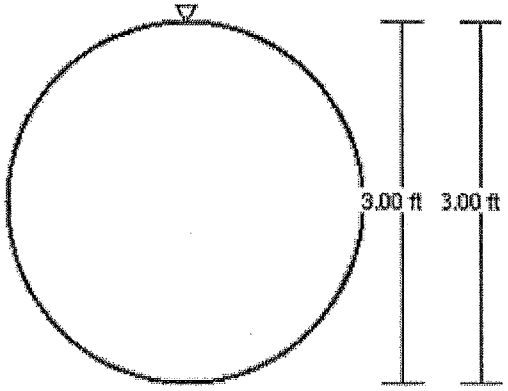
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.30	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	76	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 51+30 .60 RT-LAT.8

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.40	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	79	ft^3/s

Results

Discharge	79	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.76	ft
Percent Full	100.0	%
Critical Slope	0.01215	ft/ft
Velocity	11.16	ft/s
Velocity Head	1.94	ft
Specific Energy	4.94	ft
Froude Number	0.00	
Maximum Discharge	84.89	ft^3/s
Discharge Full	78.91	ft^3/s
Slope Full	0.01400	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 51+30 .60 RT-LAT.8

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.76	ft
Channel Slope	1.40	%
Critical Slope	0.01215	ft/ft

Cross Section for STA 51+30 .60 RT-LAT.8

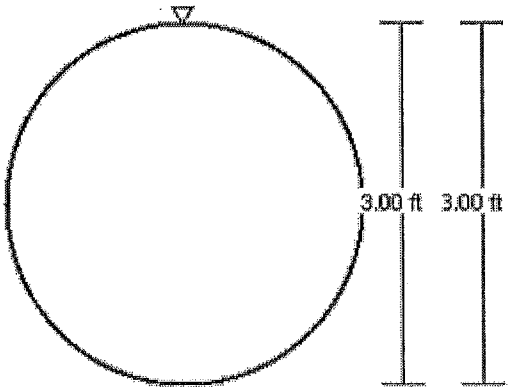
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.40	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	79	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 52+04.74 RT-LAT 9

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Rise	29.00	in
Span	45.00	in

Results

Discharge	66	ft³/s
Normal Depth	2.42	ft
Flow Area	7.12	ft²
Wetted Perimeter	9.79	ft
Top Width	0.00	ft
Critical Depth	2.17	ft
Percent Full	100.0	%
Critical Slope	0.00853	ft/ft
Velocity	9.24	ft/s
Velocity Head	1.33	ft
Specific Energy	3.74	ft
Froude Number	0.00	
Maximum Discharge	71.53	ft³/s
Discharge Full	65.73	ft³/s
Slope Full	0.00999	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 52+04.74 RT-LAT 9

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.42	ft
Critical Depth	2.17	ft
Channel Slope	1.00	%
Critical Slope	0.00853	ft/ft

Cross Section for STA 52+04.74 RT-LAT 9

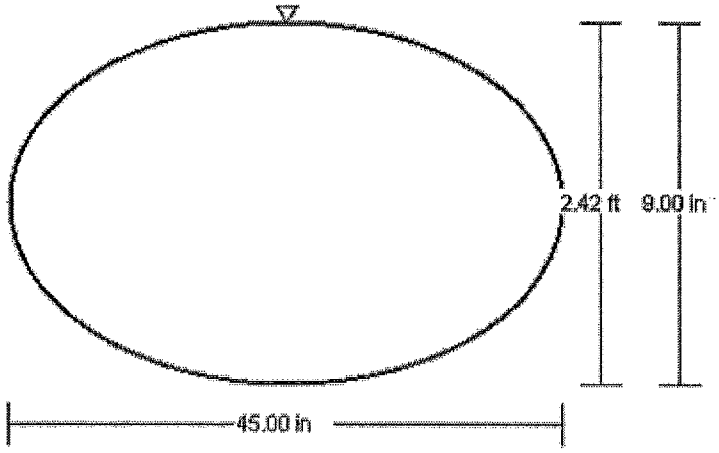
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.42	ft
Rise	29.00	in
Span	45.00	in
Discharge	66	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 52+50.74 RT-LAT 10

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Rise	29.00	in
Span	45.00	in

Results

Discharge	66	ft³/s
Normal Depth	2.42	ft
Flow Area	7.12	ft²
Wetted Perimeter	9.79	ft
Top Width	0.00	ft
Critical Depth	2.17	ft
Percent Full	100.0	%
Critical Slope	0.00853	ft/ft
Velocity	9.24	ft/s
Velocity Head	1.33	ft
Specific Energy	3.74	ft
Froude Number	0.00	
Maximum Discharge	71.53	ft³/s
Discharge Full	65.73	ft³/s
Slope Full	0.00999	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 52+50.74 RT-LAT 10

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.42	ft
Critical Depth	2.17	ft
Channel Slope	1.00	%
Critical Slope	0.00853	ft/ft

Cross Section for STA 52+50.74 RT-LAT 10

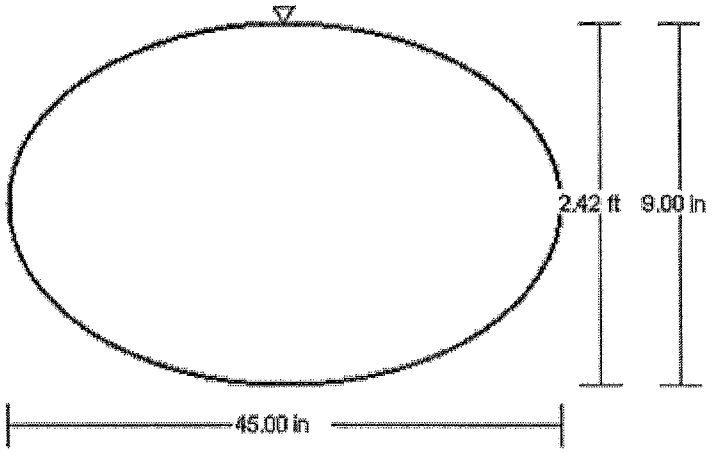
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.42	ft
Rise	29.00	in
Span	45.00	in
Discharge	66	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 56+78.61 LT-LAT 11

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	23	ft^3/s

Results

Discharge	23	ft^3/s
Normal Depth	2.00	ft
Flow Area	3.14	ft^2
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.69	ft
Percent Full	100.0	%
Critical Slope	0.00946	ft/ft
Velocity	7.20	ft/s
Velocity Head	0.81	ft
Specific Energy	2.81	ft
Froude Number	0.00	
Maximum Discharge	24.33	ft^3/s
Discharge Full	22.62	ft^3/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 56+78.61 LT-LAT 11

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.69	ft
Channel Slope	1.00	%
Critical Slope	0.00946	ft/ft

Cross Section for STA 56+78.61 LT-LAT 11

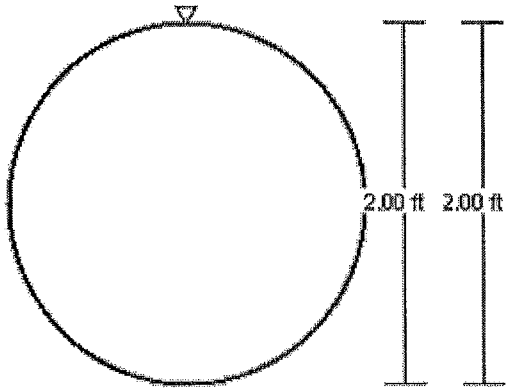
Project Description

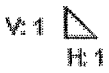
Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	23	ft³/s

Cross Section Image





Worksheet for STA 56+78.61 RT-LAT 11

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Rise	19.00	in
Span	30.00	in

Results

Discharge	22	ft^3/s
Normal Depth	1.58	ft
Flow Area	3.11	ft^2
Wetted Perimeter	6.49	ft
Top Width	0.00	ft
Critical Depth	1.39	ft
Percent Full	100.0	%
Critical Slope	0.00866	ft/ft
Velocity	7.00	ft/s
Velocity Head	0.76	ft
Specific Energy	2.34	ft
Froude Number	0.00	
Maximum Discharge	23.71	ft^3/s
Discharge Full	21.74	ft^3/s
Slope Full	0.00999	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 56+78.61 RT-LAT 11

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.58	ft
Critical Depth	1.39	ft
Channel Slope	1.00	%
Critical Slope	0.00866	ft/ft

Cross Section for STA 56+78.61 RT-LAT 11

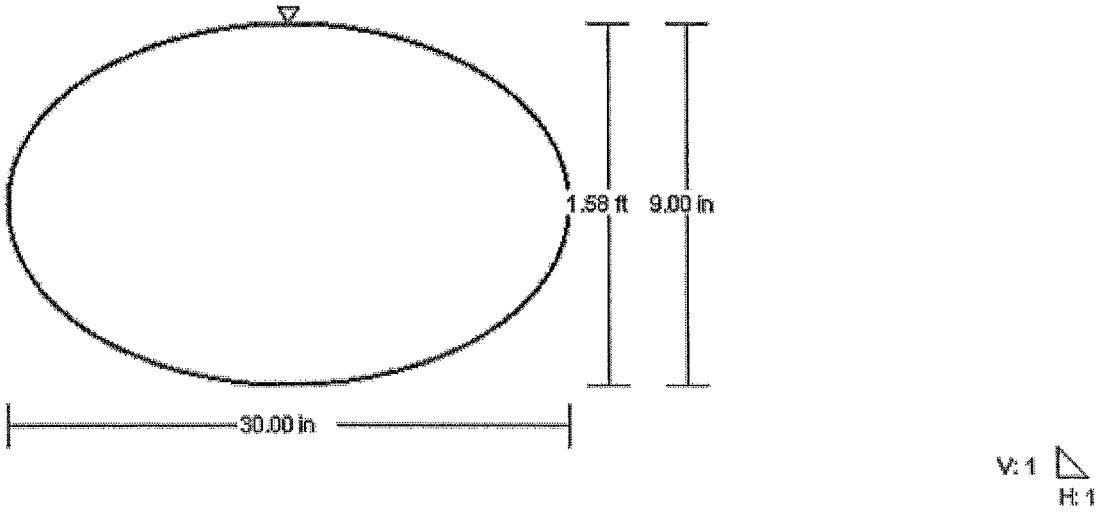
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	1.58	ft
Rise	19.00	in
Span	30.00	in
Discharge	22	ft³/s

Cross Section Image



Worksheet for STA 57+31.44 LT-LAT.12

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	2.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	32	ft^3/s

Results

Discharge	32	ft^3/s
Normal Depth	2.00	ft
Flow Area	3.14	ft^2
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.89	ft
Percent Full	100.0	%
Critical Slope	0.01730	ft/ft
Velocity	10.18	ft/s
Velocity Head	1.61	ft
Specific Energy	3.61	ft
Froude Number	0.00	
Maximum Discharge	34.41	ft^3/s
Discharge Full	31.99	ft^3/s
Slope Full	0.02000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 57+31.44 LT-LAT.12

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.89	ft
Channel Slope	2.00	%
Critical Slope	0.01730	ft/ft

Cross Section for STA 57+31.44 LT-LAT.12

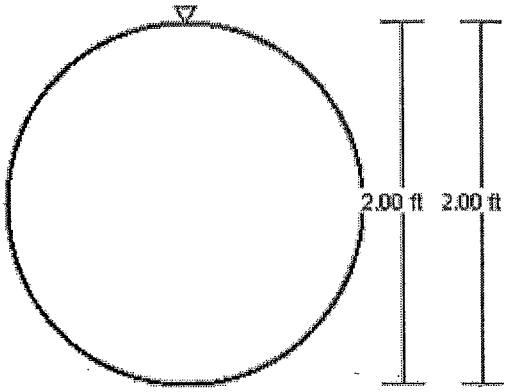
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	2.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	32	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 57+71.08 LT-LAT.13

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	23	ft³/s

Results

Discharge	23	ft³/s
Normal Depth	2.00	ft
Flow Area	3.14	ft²
Wetted Perimeter	6.28	ft
Top Width	0.00	ft
Critical Depth	1.69	ft
Percent Full	100.0	%
Critical Slope	0.00946	ft/ft
Velocity	7.20	ft/s
Velocity Head	0.81	ft
Specific Energy	2.81	ft
Froude Number	0.00	
Maximum Discharge	24.33	ft³/s
Discharge Full	22.62	ft³/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 57+71.08 LT-LAT.13

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.69	ft
Channel Slope	1.00	%
Critical Slope	0.00946	ft/ft

Cross Section for STA 57+71.08 LT-LAT.13

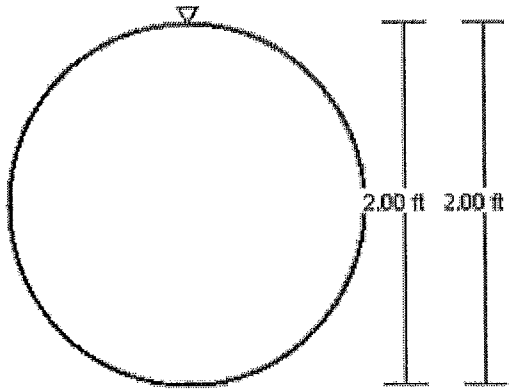
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.00	ft
Diameter	2.00	ft
Discharge	23	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 57+71.08 RT-LAT.13

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.90	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	63	ft^3/s

Results

Discharge	63	ft^3/s
Normal Depth	3.00	ft
Flow Area	7.07	ft^2
Wetted Perimeter	9.42	ft
Top Width	0.00	ft
Critical Depth	2.56	ft
Percent Full	100.0	%
Critical Slope	0.00844	ft/ft
Velocity	8.95	ft/s
Velocity Head	1.25	ft
Specific Energy	4.25	ft
Froude Number	0.00	
Maximum Discharge	68.06	ft^3/s
Discharge Full	63.27	ft^3/s
Slope Full	0.00900	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 57+71.08 RT-LAT.13

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	3.00	ft
Critical Depth	2.56	ft
Channel Slope	0.90	%
Critical Slope	0.00844	ft/ft

Cross Section for STA 57+71.08 RT-LAT.13

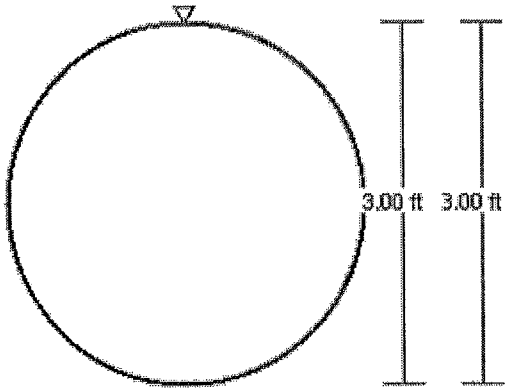
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.90	%
Normal Depth	3.00	ft
Diameter	3.00	ft
Discharge	63	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 58+12.21 RT-LAT.14

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Rise	24.00	in
Span	38.00	in

Results

Discharge	41	ft³/s
Normal Depth	2.00	ft
Flow Area	4.97	ft²
Wetted Perimeter	8.21	ft
Top Width	0.00	ft
Critical Depth	1.78	ft
Percent Full	100.0	%
Critical Slope	0.00856	ft/ft
Velocity	8.18	ft/s
Velocity Head	1.04	ft
Specific Energy	3.04	ft
Froude Number	0.00	
Maximum Discharge	44.32	ft³/s
Discharge Full	40.68	ft³/s
Slope Full	0.00999	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 58+12.21 RT-LAT.14

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	2.00	ft
Critical Depth	1.78	ft
Channel Slope	1.00	%
Critical Slope	0.00856	ft/ft

Cross Section for STA 58+12.21 RT-LAT.14

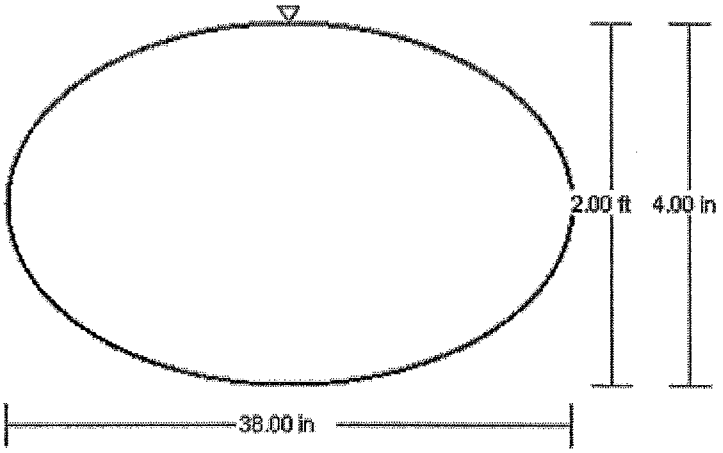
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	2.00	ft
Rise	24.00	in
Span	38.00	in
Discharge	41	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 58+85.57 RT-LAT.15

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.50	%
Rise	19.00	in
Span	30.00	in

Results

Discharge	15	ft³/s
Normal Depth	1.58	ft
Flow Area	3.11	ft²
Wetted Perimeter	6.49	ft
Top Width	0.00	ft
Critical Depth	1.19	ft
Percent Full	100.0	%
Critical Slope	0.00555	ft/ft
Velocity	4.95	ft/s
Velocity Head	0.38	ft
Specific Energy	1.96	ft
Froude Number	0.00	
Maximum Discharge	16.77	ft³/s
Discharge Full	15.38	ft³/s
Slope Full	0.00499	ft/ft
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%
Downstream Velocity	Infinity	ft/s

Worksheet for STA 58+85.57 RT-LAT.15

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.58	ft
Critical Depth	1.19	ft
Channel Slope	0.50	%
Critical Slope	0.00555	ft/ft

Cross Section for STA 58+85.57 RT-LAT.15

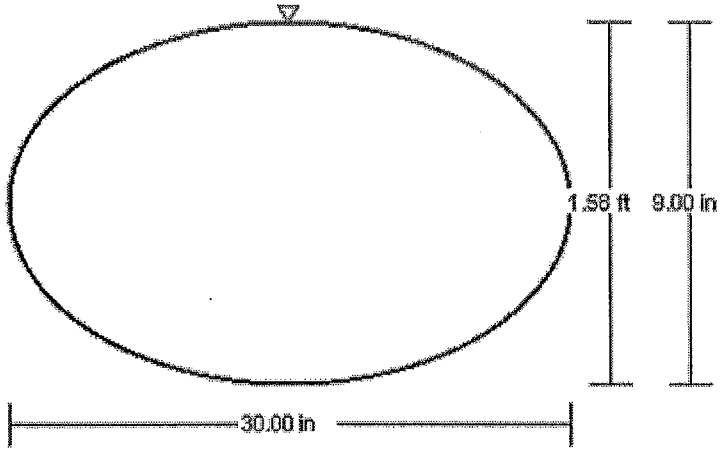
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.50	%
Normal Depth	1.58	ft
Rise	19.00	in
Span	30.00	in
Discharge	15	ft³/s

Cross Section Image



V: 1
H: 1

Worksheet for STA 56+70.47 LT-LAT.16

Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	1.50	ft
Diameter	18.00	in
Discharge	11	ft^3/s

Results

Discharge	11	ft^3/s
Normal Depth	1.50	ft
Flow Area	1.77	ft^2
Wetted Perimeter	4.71	ft
Top Width	0.00	ft
Critical Depth	1.25	ft
Percent Full	100.0	%
Critical Slope	0.00977	ft/ft
Velocity	5.94	ft/s
Velocity Head	0.55	ft
Specific Energy	2.05	ft
Froude Number	0.00	
Maximum Discharge	11.30	ft^3/s
Discharge Full	10.50	ft^3/s
Slope Full	0.01000	ft/ft
Flow Type	SubCritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	100.00	%

Worksheet for STA 56+70.47 LT-LAT.16

GVF Output Data

Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.50	ft
Critical Depth	1.25	ft
Channel Slope	1.00	%
Critical Slope	0.00977	ft/ft

Cross Section for STA 56+70.47 LT-LAT.16

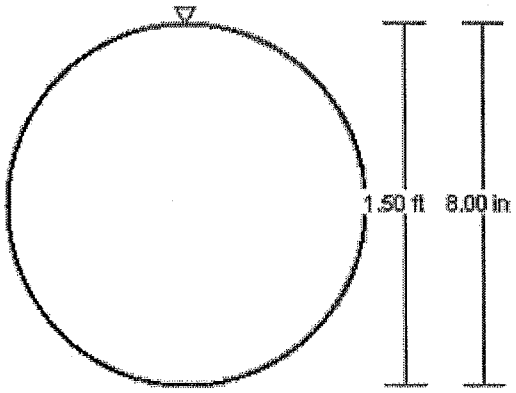
Project Description

Friction Method	Manning Formula
Solve For	Full Flow Capacity

Input Data

Roughness Coefficient	0.013	
Channel Slope	1.00	%
Normal Depth	1.50	ft
Diameter	18.00	in
Discharge	11	ft³/s

Cross Section Image



V: 1
H: 1

Ultimate Condition WSPG Models

```
T1 LATERAL AT STA 'O' 38+57.49,33.26'LT                                    0
T2 ULTIMATE CONDITION - 100 YEAR
SO   1000.0002077.500  1                          2081.765
R    1014.6252078.720  1       .013                          .000    .000 0
R    1029.2502079.940  1       .013                          .000    .000 0
SH   1029.2502079.940  1
CD   1  4   1    .000   3.00    .000  .000  .000   .00
Q             8.800   .0
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Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2077.500	4.265	2081.765	8.80	1.24	.02	2081.79	.00	.94	.00	3.000	.000	.00	1 .0
14.625	.0834					.0002	.00	4.26	.00	.44	.013	.00	.00	PIPE
1014.625	2078.720	3.047	2081.767	8.80	1.24	.02	2081.79	.00	.94	.00	3.000	.000	.00	1 .0
.570	.0834					.0002	.00	3.05	.00	.44	.013	.00	.00	PIPE
1015.195	2078.768	3.000	2081.768	8.80	1.24	.02	2081.79	.00	.94	.00	3.000	.000	.00	1 .0
3.299	.0834					.0002	.00	3.00	.00	.44	.013	.00	.00	PIPE
1018.495	2079.043	2.722	2081.765	8.80	1.31	.03	2081.79	.00	.94	1.74	3.000	.000	.00	1 .0
1.908	.0834					.0002	.00	2.72	.12	.44	.013	.00	.00	PIPE
1020.402	2079.202	2.560	2081.762	8.80	1.37	.03	2081.79	.00	.94	2.12	3.000	.000	.00	1 .0
1.566	.0834					.0002	.00	2.56	.14	.44	.013	.00	.00	PIPE
1021.969	2079.333	2.427	2081.760	8.80	1.44	.03	2081.79	.00	.94	2.36	3.000	.000	.00	1 .0
1.362	.0834					.0002	.00	2.43	.16	.44	.013	.00	.00	PIPE
1023.331	2079.446	2.311	2081.757	8.80	1.51	.04	2081.79	.00	.94	2.52	3.000	.000	.00	1 .0
1.221	.0834					.0002	.00	2.31	.17	.44	.013	.00	.00	PIPE
1024.552	2079.548	2.205	2081.753	8.80	1.58	.04	2081.79	.00	.94	2.65	3.000	.000	.00	1 .0
1.109	.0834					.0002	.00	2.21	.19	.44	.013	.00	.00	PIPE
1025.661	2079.641	2.109	2081.750	8.80	1.66	.04	2081.79	.00	.94	2.74	3.000	.000	.00	1 .0
1.019	.0834					.0003	.00	2.11	.21	.44	.013	.00	.00	PIPE

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1026.680	2079.726	2.020	2081.746	8.80	1.74	.05	2081.79	.00	.94	2.81	3.000	.000	.00	1 .0
.941	.0834					.0003	.00	2.02	.23	.44	.013	.00	.00	PIPE
1027.621	2079.804	1.937	2081.741	8.80	1.82	.05	2081.79	.00	.94	2.87	3.000	.000	.00	1 .0
.873	.0834					.0003	.00	1.94	.25	.44	.013	.00	.00	PIPE
1028.494	2079.877	1.860	2081.736	8.80	1.91	.06	2081.79	.00	.94	2.91	3.000	.000	.00	1 .0
.756	.0834					.0004	.00	1.86	.27	.44	.013	.00	.00	PIPE
1029.250	2079.940	1.792	2081.732	8.80	2.00	.06	2081.79	.00	.94	2.94	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 38+86.44,34.19' RT                                    0
T2 ULTIMATE CONDITION- 100 YEAR
SO   1000.0002077.670  1                          2081.337
R    1014.6202078.330  1      .013                              .000    .000 0
R    1029.2302078.970  1      .013                              .000    .000 0
SH   1029.2302078.970  1                                 .000
CD   1  3   0    .000   2.4100    3.750  .000  .000    .00
Q            25.900   .0
```

LATERAL AT STA 'O' 38+86.44,34.19' RT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2077.670	3.667	2081.337	25.90	2.87	.13	2081.46	.00	1.14	3.75	2.410	3.750	.00	0 .0
14.620	.0452					.0010	.01	3.67	.33	.52	.013	.00	.00	BOX
1014.620	2078.330	3.021	2081.351	25.90	2.87	.13	2081.48	.00	1.14	3.75	2.410	3.750	.00	0 .0
14.253	.0438					.0010	.01	3.02	.33	.52	.013	.00	.00	BOX
1028.873	2078.954	2.410	2081.364	25.90	2.87	.13	2081.49	.00	1.14	3.75	2.410	3.750	.00	0 .0
.357	.0438					.0006	.00	2.41	.33	.52	.013	.00	.00	BOX
1029.230	2078.970	2.392	2081.362	25.90	2.89	.13	2081.49	.00	1.14	3.75	2.410	3.750	.00	0 .0

```
T1 LATERAL AT STA 'O' 39+32.17,33.27' LT                                    0
T2 ULTIMATE CONDITION- 100 YEAR

SO   1000.0002076.520  1                          2080.643
R    1014.6402077.600  1      .013                              .000    .000 0
R    1029.2802078.670  1      .013                              .000    .000 0
SH   1029.2802078.670  1                               .000
CD  1  4   1    .000   3.000     .000  .000  .000   .00
Q             1.200   .0
```

LATERAL AT STA 'O' 39+32.17,33.27' LT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2076.520	4.123	2080.643	1.20	.17	.00	2080.64	.00	.34	.00	3.000	.000	.00	1 .0
14.640	.0738					.0000	.00	4.12	.00	.17	.013	.00	.00	PIPE
1014.640	2077.600	3.043	2080.643	1.20	.17	.00	2080.64	.00	.34	.00	3.000	.000	.00	1 .0
.589	.0731					.0000	.00	3.04	.00	.17	.013	.00	.00	PIPE
1015.229	2077.643	3.000	2080.643	1.20	.17	.00	2080.64	.00	.34	.00	3.000	.000	.00	1 .0
3.791	.0731					.0000	.00	3.00	.00	.17	.013	.00	.00	PIPE
1019.020	2077.920	2.722	2080.642	1.20	.18	.00	2080.64	.00	.34	1.74	3.000	.000	.00	1 .0
2.209	.0731					.0000	.00	2.72	.02	.17	.013	.00	.00	PIPE
1021.230	2078.082	2.560	2080.642	1.20	.19	.00	2080.64	.00	.34	2.12	3.000	.000	.00	1 .0
1.823	.0731					.0000	.00	2.56	.02	.17	.013	.00	.00	PIPE
1023.053	2078.215	2.427	2080.642	1.20	.20	.00	2080.64	.00	.34	2.36	3.000	.000	.00	1 .0
1.595	.0731					.0000	.00	2.43	.02	.17	.013	.00	.00	PIPE
1024.648	2078.331	2.311	2080.642	1.20	.21	.00	2080.64	.00	.34	2.52	3.000	.000	.00	1 .0
1.437	.0731					.0000	.00	2.31	.02	.17	.013	.00	.00	PIPE
1026.085	2078.436	2.205	2080.642	1.20	.22	.00	2080.64	.00	.34	2.65	3.000	.000	.00	1 .0
1.314	.0731					.0000	.00	2.21	.03	.17	.013	.00	.00	PIPE
1027.400	2078.532	2.109	2080.642	1.20	.23	.00	2080.64	.00	.34	2.74	3.000	.000	.00	1 .0
1.217	.0731					.0000	.00	2.11	.03	.17	.013	.00	.00	PIPE

LATERAL AT STA 'O' 39+32.17,33.27' LT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1028.616	2078.621	2.020	2080.641	1.20	.24	.00	2080.64	.00	.34	2.81	3.000	.000	.00	1 .0
.664	.0731					.0000	.00	2.02	.03	.17	.013	.00	.00	PIPE
1029.280	2078.670	1.972	2080.642	1.20	.24	.00	2080.64	.00	.34	2.85	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 39+31.94, 34.12'RT                                    0
T2 ULTIMATE CONDITION-100 YEAR

SO   1000.0002076.870  1                          2080.643
                                1                          2075.940
R    1014.5902078.080  1      .013                              .000    .000 0
R    1029.1702079.290  1      .013                              .000    .000 0
SH   1029.1702079.290  1
CD   1  3   0    .000   2.000     3.160  .000  .000   .00
Q            6.400   .0
```

LATERAL AT STA 'O' 39+31.94, 34.12'RT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2076.870	3.773	2080.643	6.40	1.01	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
14.590	.0829					.0002	.00	3.77	.13	.20	.013	.00	.00	BOX
1014.590	2078.080	2.565	2080.645	6.40	1.01	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
6.823	.0830					.0002	.00	2.57	.13	.20	.013	.00	.00	BOX
1021.413	2078.646	2.000	2080.646	6.40	1.01	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
1.103	.0830					.0001	.00	2.00	.13	.20	.013	.00	.00	BOX
1022.516	2078.738	1.906	2080.644	6.40	1.06	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
1.049	.0830					.0001	.00	1.91	.14	.20	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
1023.565	2078.825	1.817	2080.642	6.40	1.11	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.997	.0830					.0001	.00	1.82	.15	.20	.013	.00	.00	BOX
		---------- WARNING - Flow depth near top of box conduit ----------												
1024.563	2078.908	1.733	2080.640	6.40	1.17	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.948	.0830					.0001	.00	1.73	.16	.20	.013	.00	.00	BOX
1025.510	2078.986	1.652	2080.638	6.40	1.23	.02	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.900	.0830					.0002	.00	1.65	.17	.20	.013	.00	.00	BOX

LATERAL AT STA 'O' 39+31.94, 34.12'RT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1026.410	2079.061	1.575	2080.636	6.40	1.29	.03	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.854	.0830					.0002	.00	1.58	.18	.20	.013	.00	.00	BOX
1027.265	2079.132	1.502	2080.634	6.40	1.35	.03	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.810	.0830					.0002	.00	1.50	.19	.20	.013	.00	.00	BOX
1028.075	2079.199	1.432	2080.631	6.40	1.41	.03	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.768	.0830					.0002	.00	1.43	.21	.20	.013	.00	.00	BOX
1028.843	2079.263	1.365	2080.628	6.40	1.48	.03	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0
.327	.0830					.0003	.00	1.37	.22	.20	.013	.00	.00	BOX
1029.170	2079.290	1.337	2080.627	6.40	1.51	.04	2080.66	.00	.50	3.16	2.000	3.160	.00	0 .0

```
T1 LATERAL AT STA 'O' 47+76.64, 107.11' LT                                  0
T2 ULTIMATE CONDITION- 100 YEAR

SO   1000.0002065.580  1                          2068.373
R    1007.9302065.720  1      .013                              .000    .000 0
R    1015.8502065.860  1      .013                              .000    .000 0
SH   1015.8502065.860  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            27.800   .0
```

LATERAL AT STA 'O' 47+76.64, 107.11' LT
ULTIMATE CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2065.580	2.793	2068.373	27.80	4.06	.26	2068.63	.00	1.70	1.52	3.000	.000	.00	1 .0
7.930	.0176					.0015	.01	2.79	.34	1.15	.013	.00	.00	PIPE
1007.930	2065.720	2.645	2068.365	27.80	4.21	.28	2068.64	.00	1.70	1.94	3.000	.000	.00	1 .0
7.404	.0177					.0016	.01	2.64	.40	1.15	.013	.00	.00	PIPE
1015.334	2065.851	2.498	2068.349	27.80	4.42	.30	2068.65	.00	1.70	2.24	3.000	.000	.00	1 .0
.516	.0177					.0017	.00	2.50	.46	1.15	.013	.00	.00	PIPE
1015.850	2065.860	2.488	2068.348	27.80	4.44	.31	2068.65	.00	1.70	2.26	3.000	.000	.00	1 .0

LAT4794RT.WSW

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T1 LATERAL AT STA 'O' 48+16.37,107.04' LT                                   0
T2 ULTIMATE CONDITION- 100 YEAR

SO    1000.0002070.250  1                          2068.373
R     1009.9802070.490  1       .013                            .000    .000 0
R     1019.9502070.730  1       .013                            .000    .000 0
SH    1019.9502070.730  1                                 .000
CD    1  3    0    .000    2.000     3.160  .000  .000   .00
Q             27.800   .0
```

LATERAL AT STA 'O' 48+16.37,107.04' LT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip Type Ch
1000.000	2070.250	.948	2071.198	27.80	9.28	1.34	2072.54	.00	1.34	3.16	2.000	3.160	.00	0 .0
4.835	.0240					.0126	.06	.95	1.68	.77	.013	.00	.00	BOX
1004.835	2070.366	.981	2071.347	27.80	8.97	1.25	2072.60	.00	1.34	3.16	2.000	3.160	.00	0 .0
5.145	.0240					.0113	.06	.98	1.60	.77	.013	.00	.00	BOX
1009.980	2070.490	1.029	2071.519	27.80	8.55	1.14	2072.65	.00	1.34	3.16	2.000	3.160	.00	0 .0
2.133	.0241					.0102	.02	1.03	1.49	.77	.013	.00	.00	BOX
1012.113	2070.542	1.055	2071.596	27.80	8.34	1.08	2072.68	.00	1.34	3.16	2.000	3.160	.00	0 .0
3.138	.0241					.0092	.03	1.05	1.43	.77	.013	.00	.00	BOX
1015.251	2070.617	1.106	2071.723	27.80	7.95	.98	2072.71	.00	1.34	3.16	2.000	3.160	.00	0 .0
2.200	.0241					.0080	.02	1.11	1.33	.77	.013	.00	.00	BOX
1017.452	2070.670	1.160	2071.830	27.80	7.58	.89	2072.72	.00	1.34	3.16	2.000	3.160	.00	0 .0
1.440	.0241					.0071	.01	1.16	1.24	.77	.013	.00	.00	BOX
1018.892	2070.705	1.217	2071.922	27.80	7.23	.81	2072.73	.00	1.34	3.16	2.000	3.160	.00	0 .0
.803	.0241					.0062	.00	1.22	1.15	.77	.013	.00	.00	BOX
1019.695	2070.724	1.276	2072.000	27.80	6.89	.74	2072.74	.00	1.34	3.16	2.000	3.160	.00	0 .0
.255	.0241					.0054	.00	1.28	1.08	.77	.013	.00	.00	BOX
1019.950	2070.730	1.340	2072.070	27.80	6.57	.67	2072.74	.00	1.34	3.16	2.000	3.160	.00	0 .0

```
T1 LATERAL  AT STA 'O' 47+94.48, 99.41' LT                                  0
T2 ULTIMATE CONDITION- 100 YEAR

SO  -1118.6902063.450  1                          2067.361
R   -1118.6902063.450  1      .013
R   -1076.1402064.070  1      .013
R   -1071.1402064.310  1      .013                              .000  45.000 1
R   -1000.0002065.380  1      .013                              .000    .000 0
SH  -1000.0002065.380  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            55.600   .0
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LATERAL AT STA 'O' 47+94.48, 99.41' LT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
-1118.690	2063.450	3.911	2067.361	55.60	7.87	.96	2068.32	.00	2.42	.00	3.000	.000	.00	1 .0
42.550	.0146					.0069	.30	3.91	.00	1.83	.013	.00	.00	PIPE
-1076.140	2064.070	3.587	2067.657	55.60	7.87	.96	2068.62	.00	2.42	.00	3.000	.000	.00	1 .0
5.000	.0480					.0069	.03	3.59	.00	1.28	.013	.00	.00	PIPE
-1071.140	2064.310	3.572	2067.882	55.60	7.87	.96	2068.84	.00	2.42	.00	3.000	.000	.00	1 .0
70.726	.0150					.0069	.49	3.57	.00	1.81	.013	.00	.00	PIPE
-1000.414	2065.374	3.000	2068.374	55.60	7.87	.96	2069.33	.00	2.42	.00	3.000	.000	.00	1 .0
.414	.0150					.0068	.00	3.00	.00	1.81	.013	.00	.00	PIPE
-1000.000	2065.380	2.996	2068.375	55.60	7.87	.96	2069.34	.00	2.42	.23	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 49+00.94,31.01' LT                                    0
T2 ULTIMATE CONDITION-100 YEAR
SO   1000.0002063.550  1                              2065.565
R    1014.9702063.880  1      .013                                .000    .000 0
R    1029.9302064.210  1      .013                                .000    .000 0
SH   1029.9302064.210  1                                    .000
CD  1  4   1    .000   3.000     .000  .000  .000   .00
Q           10.200   .0
```

LATERAL AT STA 'O' 49+00.94,31.01' LT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2063.550	2.015	2065.565	10.20	2.02	.06	2065.63	.00	1.01	2.82	3.000	.000	.00	1 .0
3.524	.0220					.0004	.00	2.01	.27	.65	.013	.00	.00	PIPE
1003.524	2063.628	1.932	2065.560	10.20	2.12	.07	2065.63	.00	1.01	2.87	3.000	.000	.00	1 .0
3.262	.0220					.0004	.00	1.93	.29	.65	.013	.00	.00	PIPE
1006.786	2063.699	1.855	2065.554	10.20	2.22	.08	2065.63	.00	1.01	2.91	3.000	.000	.00	1 .0
3.025	.0220					.0005	.00	1.85	.31	.65	.013	.00	.00	PIPE
1009.811	2063.766	1.782	2065.548	10.20	2.33	.08	2065.63	.00	1.01	2.95	3.000	.000	.00	1 .0
2.817	.0220					.0006	.00	1.78	.34	.65	.013	.00	.00	PIPE
1012.628	2063.828	1.713	2065.541	10.20	2.44	.09	2065.63	.00	1.01	2.97	3.000	.000	.00	1 .0
2.342	.0220					.0006	.00	1.71	.36	.65	.013	.00	.00	PIPE
1014.970	2063.880	1.655	2065.535	10.20	2.55	.10	2065.64	.00	1.01	2.98	3.000	.000	.00	1 .0
2.445	.0221					.0007	.00	1.65	.39	.65	.013	.00	.00	PIPE
1017.415	2063.934	1.593	2065.526	10.20	2.68	.11	2065.64	.00	1.01	2.99	3.000	.000	.00	1 .0
2.263	.0221					.0008	.00	1.59	.42	.65	.013	.00	.00	PIPE
1019.678	2063.984	1.533	2065.517	10.20	2.81	.12	2065.64	.00	1.01	3.00	3.000	.000	.00	1 .0
2.090	.0221					.0009	.00	1.53	.45	.65	.013	.00	.00	PIPE
1021.767	2064.030	1.477	2065.507	10.20	2.94	.13	2065.64	.00	1.01	3.00	3.000	.000	.00	1 .0
1.920	.0221					.0011	.00	1.48	.48	.65	.013	.00	.00	PIPE

LATERAL AT STA 'O' 49+00.94,31.01' LT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1023.688	2064.073	1.423	2065.496	10.20	3.09	.15	2065.64	.00	1.01	3.00	3.000	.000	.00	1 .0
1.749	.0221					.0012	.00	1.42	.52	.65	.013	.00	.00	PIPE
1025.437	2064.111	1.372	2065.483	10.20	3.24	.16	2065.65	.00	1.01	2.99	3.000	.000	.00	1 .0
1.590	.0221					.0014	.00	1.37	.56	.65	.013	.00	.00	PIPE
1027.027	2064.146	1.323	2065.469	10.20	3.40	.18	2065.65	.00	1.01	2.98	3.000	.000	.00	1 .0
1.418	.0221					.0015	.00	1.32	.60	.65	.013	.00	.00	PIPE
1028.446	2064.177	1.276	2065.453	10.20	3.56	.20	2065.65	.00	1.01	2.97	3.000	.000	.00	1 .0
1.247	.0221					.0018	.00	1.28	.64	.65	.013	.00	.00	PIPE
1029.692	2064.205	1.231	2065.436	10.20	3.74	.22	2065.65	.00	1.01	2.95	3.000	.000	.00	1 .0
.238	.0221					.0019	.00	1.23	.68	.65	.013	.00	.00	PIPE
1029.930	2064.210	1.222	2065.432	10.20	3.77	.22	2065.65	.00	1.01	2.95	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA '0' 49+00.71,33.53' RT                                    0
T2 ULTIMATE CONDITION- 100 YEAR

SO   1000.0002063.690  1                          2065.565
R    1011.2702064.510  1       .013                          .000    .000 0
R    1022.5302065.320  1       .013                          .000    .000 0
SH   1022.5302065.320  1                                .000
CD   1  3   0     .000   2.410     3.750  .000  .000   .00
Q             0.700   .0
```

LATERAL AT STA 'O' 49+00.71,33.53' RT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2063.690	1.875	2065.565	.70	.10	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
1.199	.0728					.0000	.00	1.88	.01	.05	.013	.00	.00	BOX
1001.199	2063.777	1.788	2065.565	.70	.10	.00	2065.56	.00	.10	3.75	2.410	3.750	.00	0 .0
1.143	.0728					.0000	.00	1.79	.01	.05	.013	.00	.00	BOX
1002.342	2063.860	1.705	2065.565	.70	.11	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
1.090	.0728					.0000	.00	1.70	.01	.05	.013	.00	.00	BOX
1003.432	2063.940	1.625	2065.565	.70	.11	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
1.039	.0728					.0000	.00	1.63	.02	.05	.013	.00	.00	BOX
1004.471	2064.015	1.550	2065.565	.70	.12	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.991	.0728					.0000	.00	1.55	.02	.05	.013	.00	.00	BOX
1005.462	2064.087	1.477	2065.565	.70	.13	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.945	.0728					.0000	.00	1.48	.02	.05	.013	.00	.00	BOX
1006.406	2064.156	1.409	2065.565	.70	.13	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.901	.0728					.0000	.00	1.41	.02	.05	.013	.00	.00	BOX
1007.307	2064.222	1.343	2065.565	.70	.14	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.859	.0728					.0000	.00	1.34	.02	.05	.013	.00	.00	BOX
1008.166	2064.284	1.281	2065.565	.70	.15	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.819	.0728					.0000	.00	1.28	.02	.05	.013	.00	.00	BOX

LATERAL AT STA 'O' 49+00.71,33.53' RT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1008.984	2064.344	1.221	2065.565	.70	.15	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.780	.0728					.0000	.00	1.22	.02	.05	.013	.00	.00	BOX
1009.765	2064.401	1.164	2065.565	.70	.16	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.744	.0728					.0000	.00	1.16	.03	.05	.013	.00	.00	BOX
1010.509	2064.455	1.110	2065.565	.70	.17	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.709	.0728					.0000	.00	1.11	.03	.05	.013	.00	.00	BOX
1011.218	2064.506	1.058	2065.565	.70	.18	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.052	.0728					.0000	.00	1.06	.03	.05	.013	.00	.00	BOX
1011.270	2064.510	1.056	2065.565	.70	.18	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.682	.0719					.0000	.00	1.06	.03	.05	.013	.00	.00	BOX
1011.952	2064.559	1.006	2065.565	.70	.19	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.650	.0719					.0000	.00	1.01	.03	.05	.013	.00	.00	BOX
1012.603	2064.606	.960	2065.565	.70	.19	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.620	.0719					.0000	.00	.96	.03	.05	.013	.00	.00	BOX
1013.222	2064.651	.915	2065.565	.70	.20	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.591	.0719					.0000	.00	.91	.04	.05	.013	.00	.00	BOX
1013.813	2064.693	.872	2065.565	.70	.21	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.563	.0719					.0000	.00	.87	.04	.05	.013	.00	.00	BOX

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1014.377	2064.734	.832	2065.565	.70	.22	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.537	.0719					.0000	.00	.83	.04	.05	.013	.00	.00	BOX
1014.914	2064.772	.793	2065.565	.70	.24	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.512	.0719					.0000	.00	.79	.05	.05	.013	.00	.00	BOX
1015.426	2064.809	.756	2065.565	.70	.25	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.488	.0719					.0000	.00	.76	.05	.05	.013	.00	.00	BOX
1015.914	2064.844	.721	2065.565	.70	.26	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.465	.0719					.0000	.00	.72	.05	.05	.013	.00	.00	BOX
1016.379	2064.878	.687	2065.565	.70	.27	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.443	.0719					.0000	.00	.69	.06	.05	.013	.00	.00	BOX
1016.822	2064.910	.655	2065.565	.70	.28	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.422	.0719					.0000	.00	.66	.06	.05	.013	.00	.00	BOX
1017.244	2064.940	.625	2065.565	.70	.30	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.402	.0719					.0000	.00	.62	.07	.05	.013	.00	.00	BOX
1017.646	2064.969	.596	2065.565	.70	.31	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.383	.0719					.0000	.00	.60	.07	.05	.013	.00	.00	BOX
1018.030	2064.997	.568	2065.565	.70	.33	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.365	.0719					.0000	.00	.57	.08	.05	.013	.00	.00	BOX

Program Package Serial Number: 1537
WATER SURFACE PROFILE LISTING Date: 1- 7-2008 Time: 4:28: 7

LATERAL AT STA 'O' 49+00.71,33.53' RT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1018.395	2065.023	.542	2065.565	.70	.34	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.348	.0719					.0000	.00	.54	.08	.05	.013	.00	.00	BOX
1018.743	2065.048	.516	2065.564	.70	.36	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.331	.0719					.0000	.00	.52	.09	.05	.013	.00	.00	BOX
1019.075	2065.072	.492	2065.564	.70	.38	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.316	.0719					.0000	.00	.49	.10	.05	.013	.00	.00	BOX
1019.390	2065.095	.469	2065.564	.70	.40	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.300	.0719					.0000	.00	.47	.10	.05	.013	.00	.00	BOX
1019.691	2065.116	.448	2065.564	.70	.42	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.286	.0719					.0001	.00	.45	.11	.05	.013	.00	.00	BOX
1019.977	2065.137	.427	2065.564	.70	.44	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.272	.0719					.0001	.00	.43	.12	.05	.013	.00	.00	BOX
1020.249	2065.156	.407	2065.563	.70	.46	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.259	.0719					.0001	.00	.41	.13	.05	.013	.00	.00	BOX
1020.508	2065.175	.388	2065.563	.70	.48	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.246	.0719					.0001	.00	.39	.14	.05	.013	.00	.00	BOX
1020.754	2065.193	.370	2065.563	.70	.50	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.234	.0719					.0001	.00	.37	.15	.05	.013	.00	.00	BOX

Program Package Serial Number: 1537
WATER SURFACE PROFILE LISTING Date: 1- 7-2008 Time: 4:28: 7
LATERAL AT STA 'O' 49+00.71,33.53' RT
ULTIMATE CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1020.988	2065.210	.353	2065.563	.70	.53	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.222	.0719					.0001	.00	.35	.16	.05	.013	.00	.00	BOX
1021.211	2065.226	.336	2065.562	.70	.56	.00	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.211	.0719					.0001	.00	.34	.17	.05	.013	.00	.00	BOX
1021.422	2065.241	.321	2065.562	.70	.58	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.201	.0719					.0002	.00	.32	.18	.05	.013	.00	.00	BOX
1021.623	2065.255	.306	2065.561	.70	.61	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.190	.0719					.0002	.00	.31	.19	.05	.013	.00	.00	BOX
1021.813	2065.269	.292	2065.561	.70	.64	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.180	.0719					.0002	.00	.29	.21	.05	.013	.00	.00	BOX
1021.993	2065.282	.278	2065.560	.70	.67	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.171	.0719					.0002	.00	.28	.22	.05	.013	.00	.00	BOX
1022.164	2065.294	.265	2065.559	.70	.70	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.161	.0719					.0003	.00	.27	.24	.05	.013	.00	.00	BOX
1022.325	2065.306	.253	2065.559	.70	.74	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.152	.0719					.0003	.00	.25	.26	.05	.013	.00	.00	BOX
1022.478	2065.317	.241	2065.558	.70	.77	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0
.052	.0719					.0004	.00	.24	.28	.05	.013	.00	.00	BOX

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING Date: 1- 7-2008 Time: 4:28: 7

LATERAL AT STA 'O' 49+00.71,33.53' RT
ULTIMATE CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1022.530	2065.321	.237	2065.557	.70	.79	.01	2065.57	.00	.10	3.75	2.410	3.750	.00	0 .0

```
T1 LATERAL AT STA 'O'51+43.91' 80.18' RT                                    0
T2 ULTIMATE CONDITION- 100 YEAR
SO   1000.0002063.660  1                          2070.418
R    1004.3302063.720  1      .013                              .000    .000 0
R    1008.6602063.780  1      .013                              .000    .000 0
SH   1008.6602063.780  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            79.00   .0
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LATERAL AT STA 'O'51+43.91' 80.18' RT
ULTIMATE CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth. Prs/Pip / Type Ch
1000.000	2063.660	6.758	2070.418	79.00	11.18	1.94	2072.36	.00	2.76	.00	3.000	.000	.00	1 .0
4.330	.0139					.0140	.06	6.76	.00	2.47	.013	.00	.00	PIPE
1004.330	2063.720	6.759	2070.479	79.00	11.18	1.94	2072.42	.00	2.76	.00	3.000	.000	.00	1 .0
4.330	.0139					.0140	.06	6.76	.00	2.47	.013	.00	.00	PIPE
1008.660	2063.780	6.759	2070.540	79.00	11.18	1.94	2072.48	.00	2.76	.00	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 51+43.89, 126.18' RT                                    0
T2 ULTIMATE CONDITION, 100-YEAR FLOW
T3
SO    992.3002061.520  1                          2067.535
R    1004.7102061.610  1      .013                              .000    .000 0
R    1029.2802061.900  1      .013                            27.000    .000 0
R    1058.2302062.540  1      .013                            33.000    .000 0
JX   1070.2902062.860  3  2   .013   79.000         2063.660    90.0        .000
R    1096.2602063.590  3      .013                             .000    .000 0
JX   1116.2602064.150  5  4   .013     .100         2064.150    90.0      -90.000
R    1121.8402064.440  5      .013                             .000    .000 0
SH   1121.8402064.440  5                          2064.440
CD   1  3   0    .000   5.000    5.000  .000  .000   .00
CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  3   0    .000   5.000    5.000  .000  .000   .00
CD   4  3   0    .000   5.000    5.000  .000  .000   .00
CD   5  4   1    .000   4.000     .000  .000  .000   .00
Q           123.900   .0
```

LATERAL AT STA 51+43.89, 126.18' RT
ULTIMATE CONDITION, 100-YEAR FLOW

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
992.300	2061.520	6.015	2067.535	203.00	8.12	1.02	2068.56	.00	3.71	5.00	5.000	5.000	.00	0 .0
12.410	.0073					.0037	.05	6.01	.64	3.30	.013	.00	.00	BOX
1004.710	2061.610	5.971	2067.581	203.00	8.12	1.02	2068.61	.00	3.71	5.00	5.000	5.000	.00	0 .0
24.570	.0118					.0037	.09	.00	.64	2.74	.013	.00	.00	BOX
1029.280	2061.900	5.886	2067.786	203.00	8.12	1.02	2068.81	.00	3.71	5.00	5.000	5.000	.00	0 .0
28.950	.0221					.0037	.11	.00	.64	2.16	.013	.00	.00	BOX
1058.230	2062.540	5.478	2068.018	203.00	8.12	1.02	2069.04	.00	3.71	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0265					.0014	.02	5.48	.64		.013	.00	.00	BOX
1070.290	2062.860	6.473	2069.333	124.00	4.96	.38	2069.71	.00	2.67	5.00	5.000	5.000	.00	0 .0
25.970	.0281					.0014	.04	6.47	.39	1.39	.013	.00	.00	BOX
1096.260	2063.590	5.779	2069.369	124.00	4.96	.38	2069.75	.00	2.67	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0280					.0044	.09	.00	.39		.013	.00	.00	BOX
---------- WARNING - Junction Analysis - Change in Channel Type ----------														
1116.260	2064.150	4.305	2068.455	123.90	9.86	1.51	2069.96	.00	3.34	.00	4.000	.000	.00	1 .0
5.580	.0520					.0074	.04	4.30	.00	1.71	.013	.00	.00	PIPE
1121.840	2064.440	4.056	2068.496	123.90	9.86	1.51	2070.01	.00	3.34	.00	4.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 51+97.37,33.31'RT                    0
T2 ULTIMATE CONDITIONS-100 YEAR
SO    1000.0002061.880  1                          2065.273
R     1011.1502062.000  1       .013                          .000     .000 0
R     1022.2902062.110  1       .013                          .000     .000 0
SH    1022.2902062.110  1                                .000
CD    1  3    0     .000    2.410      3.750  .000  .000    .00
Q              42.800    .0
```

LATERAL AT STA 'O' 51+97.37,33.31'RT 0
ULTIMATE CONDITIONS-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip Type Ch
1000.000	2061.880	3.393	2065.273	42.80	4.74	.35	2065.62	.00	1.59	3.75	2.410	3.750	.00	0 .0
11.150	.0108					.0026	.03	3.39	.54	1.19	.013	.00	.00	BOX
1011.150	2062.000	3.302	2065.302	42.80	4.74	.35	2065.65	.00	1.59	3.75	2.410	3.750	.00	0 .0
11.140	.0099					.0026	.03	3.30	.54	1.23	.013	.00	.00	BOX
1022.290	2062.110	3.221	2065.331	42.80	4.74	.35	2065.68	.00	1.59	3.75	2.410	3.750	.00	0 .0

```
T1 LATERAL AT STA 'O' 52+43.37,33.14' RT                    0
T2 ULTIMATE CONDITION-100 YEAR

SO    1000.0002061.570  1                          2064.501
R     1011.1102061.690  1       .013                              .000     .000 0
R     1022.2202061.800  1       .013                              .000     .000 0
SH    1022.2202061.800  1                                  .000
CD    1  3    0     .000    2.410     3.750  .000  .000    .00
Q             13.8      .0
```

LATERAL AT STA 'O' 52+43.37,33.14' RT 0
ULTIMATE CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2061.570	2.931	2064.501	13.80	1.53	.04	2064.54	.00	.75	3.75	2.410	3.750	.00	0 .0
11.110	.0108					.0003	.00	2.93	.17	.55	.013	.00	.00	BOX
1011.110	2061.690	2.814	2064.504	13.80	1.53	.04	2064.54	.00	.75	3.75	2.410	3.750	.00	0 .0
11.110	.0099					.0003	.00	2.81	.17	.56	.013	.00	.00	BOX
1022.220	2061.800	2.707	2064.507	13.80	1.53	.04	2064.54	.00	.75	3.75	2.410	3.750	.00	0 .0

LAT5678LT.WSW

```
T1 LATERAL AT STA 'O' 56+70.47, 31.98' LT                                0
T2 ULTIMATE CONDITION-100 YEAR
SO   1000.0002056.590  1          .                2060.085
R    1015.5102056.730  1       .013                                .000    .000 0
R    1031.0202056.890  1       .013                                .000    .000 0
SH   1031.0202056.890  1                                  .000
CD   1  4   1    .000   2.000     .000  .000  .000   .00
Q            13.1    .0
```

LATERAL AT STA 'O' 56+70.47, 31.98' LT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2056.590	3.495	2060.085	13.10	4.17	.27	2060.35	.00	1.30	.00	2.000	.000	.00	1 .0
15.510	.0090					.0034	.05	3.49	.00	1.13	.013	.00	.00	PIPE
1015.510	2056.730	3.407	2060.137	13.10	4.17	.27	2060.41	.00	1.30	.00	2.000	.000	.00	1 .0
15.510	.0103					.0034	.05	3.41	.00	1.08	.013	.00	.00	PIPE
1031.020	2056.890	3.299	2060.189	13.10	4.17	.27	2060.46	.00	1.30	.00	2.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 56+70.25, 33.28' RT                    0
T2 ULTIMATE CONDITION-100 YEAR

SO   1000.0002057.080  1                          2060.085
R    1011.1502057.190  1      .013                                .000    .000 0
R    1022.3002057.300  1      .013                                .000    .000 0
SH   1022.3002057.300  1                                 .000
CD   1  3   0    .000   1.580     2.50  .000  .000   .00
Q            13.800   .0
```

LATERAL AT STA 'O' 56+70.25, 33.28' RT 0
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2057.080	3.005	2060.085	13.80	3.49	.19	2060.27	.00	.98	2.50	1.580	2.500	.00	0 .0
11.150	.0099					.0025	.03	3.00	.49	.79	.013	.00	.00	BOX
1011.150	2057.190	2.922	2060.112	13.80	3.49	.19	2060.30	.00	.98	2.50	1.580	2.500	.00	0 .0
11.150	.0099					.0025	.03	2.92	.49	.79	.013	.00	.00	BOX
1022.300	2057.300	2.840	2060.140	13.80	3.49	.19	2060.33	.00	.98	2.50	1.580	2.500	.00	0 .0

```
T1 LATERAL AT STA 'O' 57+30.98,75.36' LT                                    0
T2 ULTIMATE CONDITION-100 YEAR
SO    1000.0002055.680  1                          2061.993
R     1033.1802056.350  1       .013                              .000    .000 0
R     1066.3502057.010  1       .013                              .000    .000 0
SH    1066.3502057.010  1                                  .000
CD    1  4    1     .000   2.000      .000  .000  .000    .00
Q             17.900    .0
```

FILE: LAT5731LT.WSW

W S P G W - CIVILDESIGN Version 14.06
Program Package Serial Number: 1537
WATER SURFACE PROFILE LISTING

Date: 1- 7-2008 Time: 4:37:39

LATERAL AT STA 'O' 57+30.98,75.36' LT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2055.680	6.313	2061.993	17.90	5.70	.50	2062.50	.00	1.52	.00	2.000	.000	.00	1 .0
33.180	.0202					.0063	.21	6.31	.00	1.07	.013	.00	.00	PIPE
1033.180	2056.350	5.851	2062.201	17.90	5.70	.50	2062.70	.00	1.52	.00	2.000	.000	.00	1 .0
33.170	.0199					.0063	.21	5.85	.00	1.07	.013	.00	.00	PIPE
1066.350	2057.010	5.398	2062.408	17.90	5.70	.50	2062.91	.00	1.52	.00	2.000	.000	.00	1 .0

LAT5771LT.WSW

```
T1 LATERAL AT STA 57+25.67,80.46' RT                                    0
T2 ULTIMATE CONDITION-100 YEAR
SO   1000.0002056.900  1                          2061.226
R    1021.7252057.100  1       .013                                .000    .000 0
R    1043.4402057.320  1       .013                                .000    .000 0
SH   1043.4402057.320  1                                  .000
CD   1  4   1    .000   2.000     .000  .000  .000   .00
Q            15.000   .0
```

FILE: LAT5771LT.WSW

W S P G W - CIVILDESIGN Version 14.06
Program Package Serial Number: 1537
WATER SURFACE PROFILE LISTING

Date: 1- 7-2008 Time: 4:44: 7

LATERAL AT STA 57+25.67,80.46' RT
ULTIMATE CONDITION-100 YEAR

0

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2056.900	4.326	2061.226	15.00	4.77	.35	2061.58	.00	1.40	.00	2.000	.000	.00	1 .0
21.725	.0092					.0044	.10	4.33	.00	1.22	.013	.00	.00	PIPE
1021.725	2057.100	4.221	2061.322	15.00	4.77	.35	2061.68	.00	1.40	.00	2.000	.000	.00	1 .0
21.715	.0101					.0044	.10	4.22	.00	1.18	.013	.00	.00	PIPE
1043.440	2057.320	4.097	2061.417	15.00	4.77	.35	2061.77	.00	1.40	.00	2.000	.000	.00	1 .0

LAT5771RT.WSW

```
T1 LATERAL AT STA "O" 57+89.74, 80.43' RT                                    0
T2 ULTIMATE CONDITION-100 YEAR
SO   1000.0002056.730  1                          2061.226
R    1007.8002056.800  1      .013                              .000    .000 0
R    1015.6002056.870  1      .013                              .000    .000 0
SH   1015.6002056.870  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q           43.000   .0
```

FILE: LAT5771RT.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING

Date: 1- 7-2008 Time: 4:44:30

LATERAL AT STA "O" 57+89.74, 80.43' RT
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2056.730	4.496	2061.226	43.00	6.08	.57	2061.80	.00	2.14	.00	3.000	.000	.00	1 .0
7.800	.0090					.0042	.03	4.50	.00	1.81	.013	.00	.00	PIPE
1007.800	2056.800	4.458	2061.259	43.00	6.08	.57	2061.83	.00	2.14	.00	3.000	.000	.00	1 .0
7.800	.0090					.0042	.03	4.46	.00	1.81	.013	.00	.00	PIPE
1015.600	2056.870	4.421	2061.291	43.00	6.08	.57	2061.87	.00	2.14	.00	3.000	.000	.00	1 .0

LAT5812RT.WSW

```
T1 LATERAL AT STA '0' 57+25.28,126.53' RT                              0
T2 ULTIMATE CONDITION-100 YEAR
SO     852.0602054.460  1                          2059.073
R      899.2802054.980  1       .013                                  00.0    .000 0
R      905.2802055.470  1       .013                                 -60.0    .000 1
R      943.3302056.330  1       .013                                  00.0    .000 0
JX     948.3302056.570  2  3  4.013   15.000   43.0002056.9002056.730-90.0 90.0    .000
R     1000.0002057.660  2       .013                                  90.0    .000 1
R     1043.3202058.090  5       .013                                  00.0    .000 0
SH    1043.3202058.090  5
CD    1  3   0    .000   2.830    4.410  .000  .000   .00

CD    2  4   1    .000   3.000     .000  .000  .000   .00
CD    3  4   1    .000   2.000     .000  .000  .000   .00
CD    4  4   1    .000   3.000     .000  .000  .000   .00
CD    5  3   0    .000   2.000    3.160  .000  .000   .00
Q            29.400   .0
```

LATERAL AT STA '0' 57+25.28,126.53' RT 0
ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
852.060	2054.460	4.613	2059.073	87.40	7.00	.76	2059.83	.00	2.30	4.41	2.830	4.410	.00	0 .0
47.220	.0110					.0046	.22	4.61	.73	1.70	.013	.00	.00	BOX
899.280	2054.980	4.309	2059.289	87.40	7.00	.76	2060.05	.00	2.30	4.41	2.830	4.410	.00	0 .0
6.000	.0817					.0046	.03	.00	.73	.84	.013	.00	.00	BOX
905.280	2055.470	4.009	2059.479	87.40	7.00	.76	2060.24	.00	2.30	4.41	2.830	4.410	.00	0 .0
38.050	.0226					.0046	.17	4.01	.73	1.31	.013	.00	.00	BOX
943.330	2056.330	3.323	2059.653	87.40	7.00	.76	2060.41	.00	2.30	4.41	2.830	4.410	.00	0 .0
JUNCT STR	.0480					.0033	.02	.00	.73		.013	.00	.00	BOX
		WARNING - Junction Analysis - Change in Channel Type												
948.330	2056.570	4.656	2061.226	29.40	4.16	.27	2061.49	.00	1.76	.00	3.000	.000	.00	1 .0
51.670	.0211					.0019	.10	.00	.00	1.13	.013	.00	.00	PIPE
1000.000	2057.660	3.733	2061.393	29.40	4.65	.34	2061.73	.00	1.39	3.16	2.000	3.160	.00	0 .0
43.320	.0099					.0032	.14	3.73	.58	1.09	.013	.00	.00	BOX
1043.320	2058.090	3.441	2061.531	29.40	4.65	.34	2061.87	.00	1.39	3.16	2.000	3.160	.00	0 .0

```
T1 LATERAL AT STA 'O' 58+77.32,31.91 RT                0
T2 ULTIMATE CONDITION-100 YEAR
SO   1000.0002055.190  1                          2059.146
R    1009.9602055.240  1       .013                          .000    .000 0
R    1019.9202055.290  1         .013                          .000    .000 0
SH   1019.9202055.290  1
CD   1  3   0    .000   1.5800    2.500  .000  .000   .00
Q            15.000   .0
```

FILE: LAT5885RT.WSW

W S P G W - CIVILDESIGN Version 14.06

Program Package Serial Number: 1537

WATER SURFACE PROFILE LISTING

Date: 1- 7-2008 Time: 4:45:41

LATERAL AT STA 'O' 58+77.32,31.91 RT 0

ULTIMATE CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2055.190	3.956	2059.146	15.00	3.80	.22	2059.37	.00	1.04	2.50	1.580	2.500	.00	0 .0
9.960	.0050					.0029	.03	3.96	.53	1.07	.013	.00	.00	BOX
1009.960	2055.240	3.935	2059.175	15.00	3.80	.22	2059.40	.00	1.04	2.50	1.580	2.500	.00	0 .0
9.960	.0050					.0034	.03	3.93	.53	1.13	.014	.00	.00	BOX
1019.920	2055.290	3.918	2059.208	15.00	3.80	.22	2059.43	.00	1.04	2.50	1.580	2.500	.00	0 .0

Interim Condition WSPG Models

```
T1 LATERAL AT STA 'O' 38+57.49,33.26'LT                                        0
T2 INTERIM CONDITION - 100 YEAR
SO   1000.0002077.500  1                          2099.335
R    1014.6252078.720  1       .013                          .000    .000 0
R    1029.2502079.940  1       .013                          .000    .000 0
SH   1029.2502079.940  1
CD   1  4   1    .000   3.00    .000  .000  .000   .00
Q            135.200
```

FILE: LAT3865LT.WSW W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING Date: 1- 3-2008 Time: 3: 7:23

LATERAL AT STA 'O' 38+57.49,33.26'LT
INTERIM CONDITION - 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2077.500	21.835	2099.335	135.20	19.13	5.68	2105.02	.00	2.97	.00	3.000	.000	.00	1 .0
14.625	.0834					.0411	.60	21.83	.00	1.85	.013	.00	.00	PIPE
1014.625	2078.720	21.216	2099.936	135.20	19.13	5.68	2105.62	.00	2.97	.00	3.000	.000	.00	1 .0
14.625	.0834					.0411	.60	21.22	.00	1.85	.013	.00	.00	PIPE
1029.250	2079.940	20.597	2100.537	135.20	19.13	5.68	2106.22	.00	2.97	.00	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 38+86.44,34.19' RT                                    0
T2 INTERIM CONDITION- 100 YEAR
SO   1000.0002077.670  1                          2097.567
R    1014.6202078.330  1       .013                          .000    .000 0
R    1029.2302078.970  1       .013                          .000    .000 0
SH   1029.2302078.970  1                                .000
CD   1  3   0    .000   2.4100    3.750  .000  .000   .00
Q            102.400   .0
```

FILE: LAT3893RT.WSW W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING Date: 1- 3-2008 Time: 3:10:54

LATERAL AT STA 'O' 38+86.44,34.19' RT
INTERIM CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2077.670	19.897	2097.567	102.40	11.33	1.99	2099.56	.00	2.41	3.75	2.410	3.750	.00	0 .0
14.620	.0452					.0149	.22	19.90	1.29	1.33	.013	.00	.00	BOX
1014.620	2078.330	19.454	2097.784	102.40	11.33	1.99	2099.78	.00	2.41	3.75	2.410	3.750	.00	0 .0
14.610	.0438					.0149	.22	19.45	1.29	1.34	.013	.00	.00	BOX
1029.230	2078.970	19.031	2098.001	102.40	11.33	1.99	2099.99	.00	2.41	3.75	2.410	3.750	.00	0 .0

```
T1 LATERAL AT STA 'O' 39+32.17,33.27' LT                                    0
T2 INTERIM CONDITION- 100 YEAR

SO   1000.0002076.520  1                          2090.053
R    1014.6402077.600  1      .013                              .000    .000 0
R    1029.2802078.670  1      .013                              .000    .000 0
SH   1029.2802078.670  1                               .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            75.400   .0
```

LATERAL AT STA 'O' 39+32.17,33.27' LT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2076.520	13.533	2090.053	75.40	10.67	1.77	2091.82	.00	2.72	.00	3.000	.000	.00	1 .0
14.640	.0738					.0128	.19	13.53	.00	1.35	.013	.00	.00	PIPE
1014.640	2077.600	12.640	2090.240	75.40	10.67	1.77	2092.01	.00	2.72	.00	3.000	.000	.00	1 .0
14.640	.0731					.0128	.19	12.64	.00	1.35	.013	.00	.00	PIPE
1029.280	2078.670	11.757	2090.427	75.40	10.67	1.77	2092.19	.00	2.72	.00	3.000	.000	.00	1 .0

LAT3939RT.WSW

```
T1 LATERAL AT STA 'O' 39+31.94, 34.12'RT                                    0
T2 INTERIM CONDITION-100 YEAR

SO   1000.0002076.870  1                          2090.053
                          1                                2075.940
R    1014.5902078.080  1      .013                              .000    .000 0
R    1029.1702079.290  1      .013                              .000    .000 0
SH   1029.1702079.290  1
CD   1  3   0    .000   2.000     3.160  .000  .000   .00
Q            75.400   .0
```

FILE: LAT3939RT.WSW W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING Date: 1- 3-2008 Time: 3:16: 3

LATERAL AT STA 'O' 39+31.94, 34.12'RT
ULTIMATE CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2076.870	13.183	2090.053	75.40	11.93	2.21	2092.26	.00	2.00	3.16	2.000	3.160	.00	0 .0
14.590	.0829					.0209	.31	13.18	1.49	1.00	.013	.00	.00	BOX
1014.590	2078.080	12.279	2090.359	75.40	11.93	2.21	2092.57	.00	2.00	3.16	2.000	3.160	.00	0 .0
14.580	.0830					.0209	.31	12.28	1.49	1.00	.013	.00	.00	BOX
1029.170	2079.290	11.374	2090.664	75.40	11.93	2.21	2092.87	.00	2.00	3.16	2.000	3.160	.00	0 .0

```
T1 LATERAL  AT STA 'O' 47+94.48, 99.41' LT                                  0
T2 INTERIM CONDITION- 100 YEAR

SO  -1118.6902063.450  1                          2065.302
R   -1118.6902063.450  1      .013
R   -1076.1402064.070  1      .013
R   -1071.1402064.310  1      .013                                  .000  45.000 1
R   -1000.0002065.380  1      .013                                  .000    .000 0
SH  -1000.0002065.380  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q           55.600   .0
```

LATERAL AT STA 'O' 47+94.48, 99.41' LT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1118.690	2063.450	1.831	2065.281	55.60	12.30	2.35	2067.63	.00	2.42	2.93	3.000	.000	.00	1 .0
42.550	.0146					.0146	.62	1.83	1.74	1.83	.013	.00	.00	PIPE
-1076.140	2064.070	1.829	2065.899	55.60	12.32	2.36	2068.25	.00	2.42	2.93	3.000	.000	.00	1 .0
1.204	.0480					.0144	.02	1.83	1.75	1.28	.013	.00	.00	PIPE
-1074.936	2064.128	1.849	2065.977	55.60	12.16	2.30	2068.27	.00	2.42	2.92	3.000	.000	.00	1 .0
3.796	.0480					.0134	.05	1.85	1.71	1.28	.013	.00	.00	PIPE
-1071.140	2064.310	1.926	2066.236	55.60	11.59	2.09	2068.32	.00	2.42	2.88	3.000	.000	.00	1 .0
2.267	.0150					.0125	.03	1.93	1.58	1.81	.013	.00	.00	PIPE
-1068.872	2064.344	1.930	2066.274	55.60	11.56	2.08	2068.35	.00	2.42	2.87	3.000	.000	.00	1 .0
32.556	.0150					.0118	.38	1.93	1.57	1.81	.013	.00	.00	PIPE
-1036.316	2064.834	2.013	2066.847	55.60	11.02	1.89	2068.73	.00	2.42	2.82	3.000	.000	.00	1 .0
18.375	.0150					.0105	.19	2.01	1.45	1.81	.013	.00	.00	PIPE
-1017.941	2065.110	2.101	2067.211	55.60	10.51	1.72	2068.93	.00	2.42	2.75	3.000	.000	.00	1 .0
10.560	.0150					.0094	.10	2.10	1.34	1.81	.013	.00	.00	PIPE
-1007.381	2065.269	2.197	2067.466	55.60	10.02	1.56	2069.03	.00	2.42	2.66	3.000	.000	.00	1 .0
5.677	.0150					.0084	.05	2.20	1.22	1.81	.013	.00	.00	PIPE
-1001.705	2065.354	2.301	2067.655	55.60	9.55	1.42	2069.07	.00	2.42	2.54	3.000	.000	.00	1 .0
1.705	.0150					.0076	.01	2.30	1.11	1.81	.013	.00	.00	PIPE

LATERAL AT STA 'O' 47+94.48, 99.41' LT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
-1000.000	2065.380	2.418	2067.798	55.60	9.11	1.29	2069.09	.00	2.42	2.37	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 47+76.64, 107.11' LT                                  0
T2 INTERIM CONDITION- 100 YEAR

SO    1000.0002065.580  1                          2067.798
R     1007.9302065.720  1       .013                          .000    .000 0
R     1015.8502065.860  1       .013                          .000    .000 0
SH    1015.8502065.860  1                                .000
CD    1  4    1    .000    3.000      .000  .000  .000    .00
Q             27.800    .0
```

LATERAL AT STA 'O' 47+76.64, 107.11' LT
INTERIM CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2065.580	2.218	2067.798	27.80	4.96	.38	2068.18	.00	1.70	2.63	3.000	.000	.00	1 .0
3.888	.0176					.0023	.01	2.22	.60	1.15	.013	.00	.00	PIPE
1003.888	2065.649	2.120	2067.769	27.80	5.20	.42	2068.19	.00	1.70	2.73	3.000	.000	.00	1 .0
3.114	.0176					.0026	.01	2.12	.66	1.15	.013	.00	.00	PIPE
1007.002	2065.704	2.031	2067.735	27.80	5.46	.46	2068.20	.00	1.70	2.81	3.000	.000	.00	1 .0
.928	.0176					.0028	.00	2.03	.71	1.15	.013	.00	.00	PIPE
1007.930	2065.720	2.002	2067.722	27.80	5.55	.48	2068.20	.00	1.70	2.83	3.000	.000	.00	1 .0
1.127	.0177					.0029	.00	2.00	.73	1.15	.013	.00	.00	PIPE
1009.057	2065.740	1.962	2067.702	27.80	5.68	.50	2068.20	.00	1.70	2.85	3.000	.000	.00	1 .0
HYDRAULIC JUMP														
1009.057	2065.740	1.463	2067.203	27.80	8.12	1.02	2068.23	.00	1.70	3.00	3.000	.000	.00	1 .0
2.859	.0177					.0071	.02	1.46	1.34	1.15	.013	.00	.00	PIPE
1011.917	2065.791	1.519	2067.310	27.80	7.74	.93	2068.24	.00	1.70	3.00	3.000	.000	.00	1 .0
2.321	.0177					.0063	.01	1.52	1.25	1.15	.013	.00	.00	PIPE
1014.238	2065.832	1.577	2067.409	27.80	7.38	.85	2068.25	.00	1.70	3.00	3.000	.000	.00	1 .0
1.220	.0177					.0055	.01	1.58	1.16	1.15	.013	.00	.00	PIPE
1015.458	2065.853	1.639	2067.492	27.80	7.04	.77	2068.26	.00	1.70	2.99	3.000	.000	.00	1 .0
.392	.0177					.0049	.00	1.64	1.08	1.15	.013	.00	.00	PIPE

LATERAL AT STA 'O' 47+76.64, 107.11' LT
INTERIM CONDITION- 100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1015.850	2065.860	1.705	2067.565	27.80	6.70	.70	2068.26	.00	1.70	2.97	3.000	.000	.00	1 .0

LAT4794RT.WSW

```
T1 LATERAL AT STA 'O' 48+16.37,107.04' LT                                  0
T2 INTERIM CONDITION- 100 YEAR

SO   1000.0002070.250  1                          2067.798
R    1009.9802070.490  1      .013                              .000    .000 0
R    1019.9502070.730  1      .013                              .000    .000 0
SH   1019.9502070.730  1                               .000
CD   1  3   0    .000   2.000     3.160  .000  .000    .00
Q           27.800   .0
```

FILE: LAT4794RT.WSW W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING Date: 1- 4-2008 Time: 1:25:27

LATERAL AT STA 'O' 48+16.37,107.04' LT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2070.250	.948	2071.198	27.80	9.28	1.34	2072.54	.00	1.34	3.16	2.000	3.160	.00	0 .0
4.832	.0240					.0126	.06	.95	1.68	.77	.013	.00	.00	BOX
1004.832	2070.366	.981	2071.347	27.80	8.97	1.25	2072.60	.00	1.34	3.16	2.000	3.160	.00	0 .0
5.148	.0240					.0113	.06	.98	1.60	.77	.013	.00	.00	BOX
1009.980	2070.490	1.029	2071.519	27.80	8.55	1.14	2072.65	.00	1.34	3.16	2.000	3.160	.00	0 .0
2.127	.0241					.0102	.02	1.03	1.49	.77	.013	.00	.00	BOX
1012.107	2070.541	1.055	2071.596	27.80	8.34	1.08	2072.68	.00	1.34	3.16	2.000	3.160	.00	0 .0
3.140	.0241					.0092	.03	1.05	1.43	.77	.013	.00	.00	BOX
1015.247	2070.617	1.106	2071.723	27.80	7.95	.98	2072.71	.00	1.34	3.16	2.000	3.160	.00	0 .0
2.202	.0241					.0081	.02	1.11	1.33	.77	.013	.00	.00	BOX
1017.449	2070.670	1.160	2071.830	27.80	7.58	.89	2072.72	.00	1.34	3.16	2.000	3.160	.00	0 .0
1.441	.0241					.0071	.01	1.16	1.24	.77	.013	.00	.00	BOX
1018.890	2070.705	1.217	2071.921	27.80	7.23	.81	2072.73	.00	1.34	3.16	2.000	3.160	.00	0 .0
.804	.0241					.0062	.00	1.22	1.15	.77	.013	.00	.00	BOX
1019.694	2070.724	1.276	2072.000	27.80	6.89	.74	2072.74	.00	1.34	3.16	2.000	3.160	.00	0 .0
.256	.0241					.0054	.00	1.28	1.08	.77	.013	.00	.00	BOX
1019.950	2070.730	1.340	2072.070	27.80	6.57	.67	2072.74	.00	1.34	3.16	2.000	3.160	.00	0 .0

FILE: LAT4908RT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 3-2008 Time: 3:36:23

LATERAL AT STA 'O' 49+00.71,33.53' RT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2063.690	5.427	2069.117	31.10	3.44	.18	2069.30	.00	1.29	3.75	2.410	3.750	.00	0 .0
11.270	.0728					.0014	.02	5.43	.39	.50	.013	.00	.00	BOX
1011.270	2064.510	4.622	2069.132	31.10	3.44	.18	2069.32	.00	1.29	3.75	2.410	3.750	.00	0 .0
11.260	.0719					.0014	.02	4.62	.39	.50	.013	.00	.00	BOX
1022.530	2065.320	3.828	2069.148	31.10	3.44	.18	2069.33	.00	1.29	3.75	2.410	3.750	.00	0 .0

LAT5167RT.WSW

```
T1 LATERAL AT STA 51+43.89, 126.18' RT                                    0
T2 INTERIM CONDITION, 100-YEAR FLOW
T3
SO    992.3002061.520  1                          2067.535
R    1004.7102061.610  1      .013                              .000    .000 0
R    1029.2802061.900  1      .013                            27.000    .000 0
R    1058.2302062.540  1      .013                            33.000    .000 0
JX   1070.2902062.860  3  2   .013   79.000         2063.660     90.0        .000
R    1096.2602063.590  3      .013                              .000    .000 0
JX   1116.2602064.150  5  4   .013     .100         2064.150     90.0      -90.000
R    1121.8402064.440  5      .013                              .000    .000 0
SH   1121.8402064.440  5                          2064.440
CD   1  3   0    .000   5.000    5.000  .000  .000   .00
CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  3   0    .000   5.000    5.000  .000  .000   .00
CD   4  3   0    .000   5.000    5.000  .000  .000   .00
CD   5  4   1    .000   4.000     .000  .000  .000   .00
Q           123.900   .0
```

LATERAL AT STA 51+43.89, 126.18' RT
INTERIM CONDITION, 100-YEAR FLOW

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
992.300	2061.520	6.015	2067.535	203.00	8.12	1.02	2068.56	.00	3.71	5.00	5.000	5.000	.00	0 .0
12.410	.0073					.0037	.05	6.01	.64	3.30	.013	.00	.00	BOX
1004.710	2061.610	5.971	2067.581	203.00	8.12	1.02	2068.61	.00	3.71	5.00	5.000	5.000	.00	0 .0
24.570	.0118					.0037	.09	.00	.64	2.74	.013	.00	.00	BOX
1029.280	2061.900	5.886	2067.786	203.00	8.12	1.02	2068.81	.00	3.71	5.00	5.000	5.000	.00	0 .0
28.950	.0221					.0037	.11	.00	.64	2.16	.013	.00	.00	BOX
1058.230	2062.540	5.478	2068.018	203.00	8.12	1.02	2069.04	.00	3.71	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0265					.0014	.02	5.48	.64		.013	.00	.00	BOX
1070.290	2062.860	6.473	2069.333	124.00	4.96	.38	2069.71	.00	2.67	5.00	5.000	5.000	.00	0 .0
25.970	.0281					.0014	.04	6.47	.39	1.39	.013	.00	.00	BOX
1096.260	2063.590	5.779	2069.369	124.00	4.96	.38	2069.75	.00	2.67	5.00	5.000	5.000	.00	0 .0
JUNCT STR	.0280					.0044	.09	.00	.39		.013	.00	.00	BOX

---------- WARNING - Junction Analysis - Change in Channel Type ----------

1116.260	2064.150	4.305	2068.455	123.90	9.86	1.51	2069.96	.00	3.34	.00	4.000	.000	.00	1 .0
5.580	.0520					.0074	.04	4.30	.00	1.71	.013	.00	.00	PIPE
1121.840	2064.440	4.056	2068.496	123.90	9.86	1.51	2070.01	.00	3.34	.00	4.000	.000	.00	1 .0

LAT5130RT.WSW

```
T1 LATERAL AT STA 'O' 51+43.91, 80.18' RT                                    0
T2 INTERIM CONDITION- 100 YEAR
SO   1000.0002063.660  1                          2068.466
R    1004.3302063.720  1       .013                          .000    .000 0
R    1008.6602063.780  1       .013                          .000    .000 0
SH   1008.6602063.780  1                                .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            79.00   .0
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FILE: LAT5130RT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 3-2008 Time: 3:42:51

LATERAL AT STA 'O' 51+43.91, 80.18' RT
INTERIM CONDITION- 100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2063.660	4.806	2068.466	79.00	11.18	1.94	2070.41	.00	2.76	.00	3.000	.000	.00	1 .0
4.330	.0139					.0140	.06	4.81	.00	2.47	.013	.00	.00	PIPE
1004.330	2063.720	4.807	2068.527	79.00	11.18	1.94	2070.47	.00	2.76	.00	3.000	.000	.00	1 .0
4.330	.0139					.0140	.06	4.81	.00	2.47	.013	.00	.00	PIPE
1008.660	2063.780	4.808	2068.588	79.00	11.18	1.94	2070.53	.00	2.76	.00	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 51+97.37,33.31'RT                    0
T2 INTERIM CONDITIONS-100 YEAR
SO   1000.0002062.380  1                          2067.014
R    1011.1502062.500  1      .013                              .000    .000 0
R    1022.2902062.610  1      .013                              .000    .000 0
SH   1022.2902062.610  1                                 .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            42.800   .0
```

FILE: LAT5205RT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 3-2008 Time: 4: 2: 1

LATERAL AT STA 'O' 51+97.37,33.31'RT 0

INTERIM CONDITIONS-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS) / SF Ave	Vel Head / HF	Energy Grd.El. / SE Dpth	Super Elev / Froude N	Critical Depth / Norm Dp	Flow Top Width / "N"	Height/Dia.-FT / X-Fall	Base Wt or I.D. / ZR	ZL	No Wth Prs/Pip / Type Ch
1000.000	2062.380	4.634	2067.014	42.80	6.05	.57	2067.58	.00	2.13	.00	3.000	.000	.00	1 .0
11.150	.0108				.0041	.05	4.63	.00	1.71	.013	.00	.00		PIPE
1011.150	2062.500	4.560	2067.060	42.80	6.05	.57	2067.63	.00	2.13	.00	3.000	.000	.00	1 .0
11.140	.0099				.0041	.05	4.56	.00	1.75	.013	.00	.00		PIPE
1022.290	2062.610	4.496	2067.106	42.80	6.05	.57	2067.68	.00	2.13	.00	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 52+43.37,33.14' RT                    0
T2 INTERIM CONDITION-100 YEAR

SO   1000.0002062.070  1                          2065.898
R    1011.1102062.190  1      .013                                .000    .000 0
R    1022.2202062.300  1      .013                                .000    .000 0
SH   1022.2202062.300  1                               .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q           13.8     .0
```

FILE: LAT5251RT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 3-2008 Time: 4: 3:57

LATERAL AT STA 'O' 52+43.37,33.14' RT 0

INTERIM CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2062.070	3.828	2065.898	13.80	1.95	.06	2065.96	.00	1.18	.00	3.000	.000	.00	1 .0
11.110	.0108					.0004	.00	3.83	.00	.91	.013	.00	.00	PIPE
1011.110	2062.190	3.713	2065.903	13.80	1.95	.06	2065.96	.00	1.18	.00	3.000	.000	.00	1 .0
11.110	.0099					.0004	.00	3.71	.00	.93	.013	.00	.00	PIPE
1022.220	2062.300	3.607	2065.907	13.80	1.95	.06	2065.97	.00	1.18	.00	3.000	.000	.00	1 .0

LAT5678LT.WSW

```
T1 LATERAL AT STA 'O' 56+70.47, 31.98' LT                                0
T2 INTERIM CONDITION-100 YEAR
SO   1000.0002056.590  1                          2062.856
R    1015.5102056.730  1      .013                                .000    .000 0
R    1031.0202056.890  1      .013                                .000    .000 0
SH   1031.0202056.890  1                                  .000
CD   1  4   1    .000   2.000     .000  .000  .000   .00
Q            23.0    .0
```

LATERAL AT STA 'O' 56+70.47, 31.98' LT 0
INTERIM CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2056.590	6.266	2062.856	23.00	7.32	.83	2063.69	.00	1.71	.00	2.000	.000	.00	1 .0
15.510	.0090					.0103	.16	6.27	.00	1.82	.013	.00	.00	PIPE
1015.510	2056.730	6.286	2063.016	23.00	7.32	.83	2063.85	.00	1.71	.00	2.000	.000	.00	1 .0
15.510	.0103					.0103	.16	6.29	.00	1.64	.013	.00	.00	PIPE
1031.020	2056.890	6.287	2063.177	23.00	7.32	.83	2064.01	.00	1.71	.00	2.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 56+70.25, 33.26' RT                    0
T2 INTERIM CONDITION-100 YEAR

SO    1000.0002057.080  1                          2062.856
R     1011.1502057.190  1       .013                              .000    .000 0
R     1022.3002057.300  1       .013                              .000    .000 0
SH    1022.3002057.300  1                                 .000
CD    1  4    1    .000    2.000      .000  .000  .000    .00
Q              9.200    .0
```

LATERAL AT STA 'O' 56+70.25, 33.26' RT 0
INTERIM CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2057.080	5.776	2062.856	9.20	2.93	.13	2062.99	.00	1.08	.00	2.000	.000	.00	1 .0
11.150	.0099					.0017	.02	5.78	.00	.89	.013	.00	.00	PIPE
1011.150	2057.190	5.684	2062.875	9.20	2.93	.13	2063.01	.00	1.08	.00	2.000	.000	.00	1 .0
11.150	.0099					.0017	.02	5.68	.00	.89	.013	.00	.00	PIPE
1022.300	2057.300	5.593	2062.893	9.20	2.93	.13	2063.03	.00	1.08	.00	2.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 57+30.98,75.36' LT                                    0
T2 INTERIM CONDITION-100 YEAR
SO   1000.0002055.680  1                          2061.993
R    1033.1802056.350  1      .013                              .000    .000 0
R    1066.3502057.010  1      .013                              .000    .000 0
SH   1066.3502057.010  1                               .000
CD   1  4   1    .000   2.000     .000  .000  .000    .00
Q           17.900   .0
```

FILE: LAT5731LT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 3-2008 Time: 4:19: 8

LATERAL AT STA 'O' 57+30.98,75.36' LT
INTERIM CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2055.680	6.313	2061.993	17.90	5.70	.50	2062.50	.00	1.52	.00	2.000	.000	.00	1 .0
33.180	.0202					.0063	.21	6.31	.00	1.07	.013	.00	.00	PIPE
1033.180	2056.350	5.851	2062.201	17.90	5.70	.50	2062.70	.00	1.52	.00	2.000	.000	.00	1 .0
33.170	.0199					.0063	.21	5.85	.00	1.07	.013	.00	.00	PIPE
1066.350	2057.010	5.398	2062.408	17.90	5.70	.50	2062.91	.00	1.52	.00	2.000	.000	.00	1 .0

```
T1 LATERAL AT STA 57+25.67,80.46' RT                                    0
T2 INTERIM CONDITION-100 YEAR
SO   1000.0002056.900  1                          2060.780
R    1021.7252057.100  1      .013                                .000    .000 0
R    1043.4402057.320  1      .013                                .000    .000 0
SH   1043.4402057.320  1                               .000
CD   1  4   1    .000   2.000     .000  .000  .000   .00
Q            15.000   .0
```

FILE: LAT5771LT.WSW

W S P G W - CIVILDESIGN Version 14.01

Program Package Serial Number: 1280

WATER SURFACE PROFILE LISTING

Date: 1- 4-2008 Time: 1:35:26

LATERAL AT STA 57+25.67,80.46' RT 0

INTERIM CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2056.900	3.880	2060.780	15.00	4.77	.35	2061.13	.00	1.40	.00	2.000	.000	.00	1 .0
21.725	.0092					.0044	.10	3.88	.00	1.22	.013	.00	.00	PIPE
1021.725	2057.100	3.775	2060.875	15.00	4.77	.35	2061.23	.00	1.40	.00	2.000	.000	.00	1 .0
21.715	.0101					.0044	.10	3.78	.00	1.18	.013	.00	.00	PIPE
1043.440	2057.320	3.651	2060.971	15.00	4.77	.35	2061.32	.00	1.40	.00	2.000	.000	.00	1 .0

```
T1 LATERAL AT STA "O" 57+89.74, 80.43' RT                                    0
T2 INTERIM CONDITION-100 YEAR
SO   1000.0002056.730  1                          2061.226
R    1007.8002056.800  1      .013                              .000    .000 0
R    1015.6002056.870  1      .013                              .000    .000 0
SH   1015.6002056.870  1                               .000
CD   1  4   1    .000   3.000     .000  .000  .000   .00
Q            43.000   .0
```

LATERAL AT STA "O" 57+89.74, 80.43' RT
INTERIM CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
1000.000	2056.730	4.496	2061.226	43.00	6.08	.57	2061.80	.00	2.14	.00	3.000	.000	.00	1 .0
7.800	.0090					.0042	.03	4.50	.00	1.81	.013	.00	.00	PIPE
1007.800	2056.800	4.458	2061.259	43.00	6.08	.57	2061.83	.00	2.14	.00	3.000	.000	.00	1 .0
7.800	.0090					.0042	.03	4.46	.00	1.81	.013	.00	.00	PIPE
1015.600	2056.870	4.421	2061.291	43.00	6.08	.57	2061.87	.00	2.14	.00	3.000	.000	.00	1 .0

```
                                                                LAT5812RT.WSW
T1 LATERAL AT STA '0' 57+25.28,126.53' RT                       0
T2 INTERIM CONDITION-100 YEAR
SO    852.0602054.530  1                          2059.073
R     899.2802055.050  1       .013                                  00.0   .000 0
R     905.2802055.470  1       .013                                 -60.0   .000 1
R     943.3302056.330  1       .013                                  00.0   .000 0
JX    948.3302056.570  2  3  4.013   15.000   43.0002056.9002056.730-90.0 90.0    .000
R    1000.0002057.660  2       .013                                  90.0   .000 1
R    1043.3202058.090  2       .013                                  00.0   .000 0
SH   1043.3202058.090  2       .013                        .000
CD   1  3   0    .000   2.830    4.410  .000  .000   .00

CD   2  4   1    .000   3.000     .000  .000  .000   .00
CD   3  4   1    .000   2.000     .000  .000  .000   .00
CD   4  4   1    .000   3.000     .000  .000  .000   .00
Q           29.400   .0
```

LATERAL AT STA '0' 57+25.28,126.53' RT 0
INTERIM CONDITION-100 YEAR

Station / L/Elem	Invert Elev / Ch Slope	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head / SF Ave	Energy Grd.El. / HF	Super Elev / SE Dpth	Critical Depth / Froude N	Flow Top Width / Norm Dp	Height/ Dia.-FT / "N"	Base Wt or I.D. / X-Fall	ZL / ZR	No Wth Prs/Pip / Type Ch
852.060	2054.530	4.543	2059.073	87.40	7.00	.76	2059.83	.00	2.30	4.41	2.830	4.410	.00	0 .0
47.220	.0110					.0046	.22	4.54	.73	1.70	.013	.00	.00	BOX
899.280	2055.050	4.239	2059.289	87.40	7.00	.76	2060.05	.00	2.30	4.41	2.830	4.410	.00	0 .0
6.000	.0700					.0046	.03	.00	.73	.89	.013	.00	.00	BOX
905.280	2055.470	4.009	2059.479	87.40	7.00	.76	2060.24	.00	2.30	4.41	2.830	4.410	.00	0 .0
38.050	.0226					.0046	.17	4.01	.73	1.31	.013	.00	.00	BOX
943.330	2056.330	3.323	2059.653	87.40	7.00	.76	2060.41	.00	2.30	4.41	2.830	4.410	.00	0 .0
JUNCT STR	.0480					.0033	.02	.00	.73		.013	.00	.00	BOX
		---------- WARNING - Junction Analysis - Change in Channel Type ----------												
948.330	2056.570	4.656	2061.226	29.40	4.16	.27	2061.49	.00	1.76	.00	3.000	.000	.00	1 .0
51.670	.0211					.0019	.10	.00	.00	1.13	.013	.00	.00	PIPE
1000.000	2057.660	3.733	2061.393	29.40	4.16	.27	2061.66	.00	1.76	.00	3.000	.000	.00	1 .0
43.320	.0099					.0019	.08	3.73	.00	1.40	.013	.00	.00	PIPE
1043.320	2058.090	3.387	2061.477	29.40	4.16	.27	2061.75	.00	1.76	.00	3.000	.000	.00	1 .0

```
T1 LATERAL AT STA 'O' 58+77.32,31.91 RT                0
T2 INTERIM CONDITION-100 YEAR
SO   1000.0002055.190  1                          2059.146
R    1009.9602055.240  1      .013                              .000    .000 0
R    1019.9202055.290  1       .013                               .000    .000 0
SH   1019.9202055.290  1
CD   1  3   0    .000   1.5800    2.500  .000  .000   .00
Q           15.000   .0
```

LATERAL AT STA 'O' 58+77.32,31.91 RT 0
INTERIM CONDITION-100 YEAR

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1000.000	2055.190	3.956	2059.146	15.00	3.80	.22	2059.37	.00	1.04	2.50	1.580	2.500	.00	0 .0
9.960	.0050					.0029	.03	3.96	.53	1.07	.013	.00	.00	BOX
1009.960	2055.240	3.935	2059.175	15.00	3.80	.22	2059.40	.00	1.04	2.50	1.580	2.500	.00	0 .0
9.960	.0050					.0034	.03	3.93	.53	1.13	.014	.00	.00	BOX
1019.920	2055.290	3.918	2059.208	15.00	3.80	.22	2059.43	.00	1.04	2.50	1.580	2.500	.00	0 .0

Appendix B

Meeting Minutes

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Meeting Notes

Subject:	Meeting Notes - Coordination Meeting #4 - Workshop
Client:	City of Las Vegas
Project:	Oakey Storm Drain - Birch to Cahlan
Project No:	(Hansen No.) 06-11273
Meeting Date:	12/06/2007
Meeting Location:	HDR Large Conf Room
Notes by:	Tom Craig & Raj Hanumanthaiah

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Attendees:

Valerie Flock, City of Las Vegas - Design	702-229-6740	vflock@LasVegasNevada.gov
Rosa Cortez, City of Las Vegas – Design	702-229-6264	rcortez@LasVegasNevada.gov
Peter Jackson, City of Las Vegas – Flood	702-229-5266	pjackson@LasVegasNevada.gov
Tim Parks, City of Las Vegas – Sanitary Sewer	702-229-2178	tparks@LasVegasNevada.gov
Terry Parker, City of Las Vegas – Construction	702-229-2433	tparker@LasVegasNevada.gov
Todd Myers, CCRFCD	702-455-3139	tmyers@ccrfcd.org
Dave Salter, Kleinfelder	702-736-2936	dsalter@kleinfelder.com
Lolene Terry, HDR Engineering	702-938-6002	lolene.terry@hdrinc.com
Mark Forest, HDR Engineering	775-337-4710	mark.forest@hdrinc.com
Huagao Tan, HDR Engineering	702-938-6014	huagao.tan@hdrinc.com
Raj Hanumanthaiah, HDR Engineering	702-938-6043	rajanish.hanumanthaiah@hdrinc.com
Tom Craig, HDR Engineering	702-938-6062	thomas.craig@hdrinc.com

Purpose of Meeting:

The purpose of the Meeting was to review current design, discuss, and incorporate various design suggestions and to obtain buy in from all stakeholder on final design direction.

Introductions –

Exchange of Information – Tom Craig/HDR provided the CD and Report for the sewer line inspection performed by ProPipe.

Topics of Discussion:

Geotechnical

The Groundwater Level as shown in the Report Detail is to be revised.

The bedding detail for the box culvert will reflect the following two scenarios:

In those areas where the soils are saturated and 'soft', which is approximately 70% of the project, 1-foot of over excavation will be specified along with the placement of 2-feet of bedding material (Granular backfill, 3-inch minus). The first foot of material will be 'pressed' into the 'soft'. This 'pressing' of the material into the soil will introduce additional fines into the voids of the 3-inch minus and will create a foundation for the balance (1-foot) of additional material.

In those areas where the soils are cemented, which is approximately 30% of the project, 1-foot of over excavation will be specified along with the placement of 1-foot of bedding material (Granular backfill, 3-inch minus).

Dewatering – Specifications will direct the contractor to refer to the Dewatering Memo and the Geotechnical Report. The contractor will have to avoid the waterline by keeping all Dewatering and other excavations 4-feet away. HDR will incorporate Cheng Shih/CLV and Kleinfelder text into the Specifications. In addition, the Dewatering paid as a Lump Sum item.

It was determined, through conversations with the Geotech's dewatering expert that, Vacuum Wells (the preferred method of dewatering) placed within 1-foot of excavation trenches. This information along with placing the responsibility of Dewatering on the Contractor has eliminated the need to relocate approximately 1500 LF of waterline from Station 38+00 to 53+00.

Sanitary Sewer

Peter Jackson/CLV presented the following design concept to eliminate the need for installation of Sanitary Sewer on the south side from Station 38+00 to 56+00:

At the nearest upstream Sanitary Sewer Manhole from Station 38+00, begin installation of 8" Sanitary Sewer at a minimum .3% slope to west of Station 38+00 at approximately Station 38+39. At this location cross over the proposed 5-foot X 5-foot box culvert with the Sanitary Sewer and connect to the north side Sewer. If necessary, the 5-foot X 5-foot box culvert slope flattened to facilitate the crossover. The Sanitary Sewer on the north side replaced with a 12" line to handle the increased flows.

As there are no houses beyond Station 38+00 to south until approximately Station 56+00, this concept should eliminate the need to construct the south side Sanitary Sewer.

Tim Parks/CLV will determine if a Sanitary Sewer lateral at Bob Baskin Park exists. If so, the connection to the north side Sanitary Sewer will have to be determined.

The common trench for Box Culvert and Sanitary Sewer utilized where possible throughout the project limits. Tim Parks/CLV wants the Sanitary Sewer as far away from the Box Culvert as possible. Near the 5-foot X 5-foot box culvert, it appears that a minimum distance of 3-feet, 5-inches can be obtained. This would allow for 1-foot, 6-inches between box culvert and bench for the Sanitary Sewer, 3-feet, 6-inches between box culvert and outside of Sanitary Sewer pipe, 2-feet from bench to outside of Sanitary Sewer pipe and 1-foot from outside of Sanitary Sewer pipe to edge of pavement patch.

Dewatering at Inlet Boxes

There is a concern about water draw down at inlet boxes especially in those areas where Swimming pools are within 20' of Drop Inlets. The Contractor will be directed in the Specifications to document existing conditions and will be held liable for any settlement due to Dewatering activities.

In order to minimize depth of Drop Inlet depth it was suggested to decrease the distance between Storm Drain Laterals and Sanitary Sewer from 18" down to 6". This can be accomplished if the Sanitary Sewer is encased in grout (this is the case as CLV directed HDR to bed all Sanitary Sewers in Grout because of existing Soil conditions) or if the Laterals are of water quality material. In addition, ease of construction can be facilitated by utilizing one length of water quality pipe instead of segments of RCP to create laterals.

At Villa De Conde, there is an opportunity to make the storm drain lateral steeper, as there is a waterline at this location that should be relocated to the west.

It was agreed that the concept of precasting the lateral and the lateral insert to the 'trunk line' was acceptable. (2 – 8-foot segments with the inlet opening equally divided between the segments)

Rancho Intersection

Create a smaller scale 'blow up' detail of the drainage work occurring in this intersection.
The existing nuisance Drop Inlet will be replaced and piped to the proposed Drop Inlet just further west of the existing inlet.
Remove the pipe that ties into the existing Sanitary Sewer.
Plug the 'bubbler system' (within project limits) and remove the existing DI's on the south side.

Remove all existing utility lines in Rancho that are not necessary.

Do not install 'Nuisance' Drop Inlet at Strong as it is very close (<2 feet from 8" ACP waterline).

Laterals
Use water quality pipe where they are steep or to alleviate clearance issues between existing/proposed utilities.

East of Rancho
Analyze the south side sewer to determine if a common trench can be constructed with the box culvert. During the discussion, it appeared that the sewer distance from the box was too great to include it in a single trench. This also brought up the fact that separate asphalt 'patch' would be needed for this line.

Specifications and Inclusion of Items in Construction of the Box Culvert

The CLV Specifications for the Elkhorn project present the desired language. CLV will provide to HDR.

Separate AC / Removal from box culvert – cost
Include
- Structure ex
- Backfill
- Bedding
- CSLM (Flowable backfill)

Hydraulics
The proposed resizing of the box culvert and shifting of transitions analysis is to be performed.

Revised WSPG - Calcs
(*Energy Grade Line – needs to stay below finished grade)
Section 7- Drainage Report revise by replacing certain pages.

Move 5x5 to 8x8 transition to Lateral at Strong

Move the 8x8 to 10x8 Box Culvert transition down to 57+90.

The proposal to install a 5-foot x 5-foot box culvert instead of a 6-foot x 6-foot was acceptable. In addition, the revisions to the box culvert transitions were also acceptable.

Cost Estimate
Todd Myers/CCRFCD provided cost opinions for the various sized box culverts that included installation and the box culvert. These were significantly less then what has been estimated by HDR. It was discussed that something in-between the two costs could be utilized. HDR will further examine estimated costs and will provide a breakdown of what is included in the unit prices. Valerie Flock/CLV asked that estimated costs not be cut so much so that enough money would be allocated for the project.

HDR will review recent bids for both CCPW and NDOT projects.

Project Presentations
Prior to presentations to the CAC, TAC and Board the following must be completed:
-All comments
-R/W -19 AEP's
-Cost
-Specs
-Plans

Dates of February/March Meetings –
TAC 2/28
CAC 3/03
RFCD 3/13

Pre Final 100% Submittal

- Any issues or questions concerning project design and direction between now and until submittal need to immediately be brought up to the CLV
- Due date is January 11, 2007
- Deliverables are Plans, Draft Specifications (Electronic version) and Estimate

Proposed Sewer Relocation Upstream of Project

Lateral at sewer (Park) Plan note – relocate sewer lateral if needed

Necessary -- 1 sheet of plan with profile would be required
Small 8 x 11 pdf of trench sheet

Use C905 pipe instead of Ductile iron Pipe (D.I.P.) for Waterline. Check with LVVWD.

Valerie authorized $5,000 for additional Survey costs (350 feet west of project limits).

*Presentation draft Feb 5th, Tom Craig/HDR and Rob Welch/CLV coordinate on content.

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Meeting Notes

Subject:	Meeting Notes - Progress Meeting #15
Client:	City of Las Vegas
Project:	Oakey Storm Drain - Birch to Cahlan
Project No:	(Hansen No.) 06-11273
Meeting Date:	10/25/2007
Meeting Location:	CE Small Conference Room
Notes by:	Tom Craig, Raj Hanumanthaia & Huagao Tan

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Attendees:

Rosa Cortez, City of Las Vegas – Design	702-229-6264	rcortez@LasVegasNevada.GOV
Peter Jackson, City of Las Vegas – Flood Control	702-229-5266	pjackson@LasVegasNevada.GOV
Tim Parks, City of Las Vegas – Sewer	702-229-2180	tparks@LasVegasNevada.GOV
Todd Myers, CCRFCD	702-455-3139	tmyers@ccrfcd.org
Raj Hanumanthaiah - HDR Engineering	702-938-6043	rajanish.Hanumanthaiah@hdrinc.com
Huagao Tan - HDR Engineering	702-938-6014	huagao.tan@hdrinc.com
Tom Craig - HDR Engineering	702-938-6062	thomas.craig@hdrinc.com

Purpose of Meeting:

The purpose of the Progress Meeting was to discuss the 90% Progress Plans and to provide information and/or reach agreement on the various issues raised at Progress Meeting #14.

Introductions –

Exchange of Information – HDR provided an Agenda, sign-in-sheet and 90% Progress Plans.

Topics of Discussion:

90% Progress Plans:

Tom Craig/HDR presented the plans and the following Issues were reviewed/discussed:

- **20' Maximum Length of Drop Inlets (DIs)** – All concurred that this has been incorporated into the 90% submittal plans.

  Drop Inlet Flow Calculations – Tom Craig/HDR began the discussion by paraphrasing Mark Forest/HDR West Region Director of Water Resources. "Capture and bypass is complex, especially when the flows are this high. We know that the methods are not perfect, but they are the standard methods generally accepted as the state-of-the-art. Our problem, is that there is a limited number of acceptable methods for estimating capture. So, we are not saying that the FHWA methods are accurate or representative, but they are standard. We can not use an alternative method, unless it is considered to be a standard method". Peter Jackson/CLV concurred and he along with Todd Myers/CCRFCD indicated that an explanation of the HEC-22 analysis of inlet capacity be provided in the Final Design Report. They also requested an exhibit showing the flow captured at inlets and flows bypassing the inlets for the project limits be added to the report .
- **Additional DI's/Inlet East of Rancho/Final Drainage Report** – Per the 70% comments, Peter Jackson/CLV reiterated that additional Drop Inlets should be installed in those storm drain runs where the spacing of the DI's is greater than 600'. Peter Jackson/CLV indicated that he and Rob Welch/CLV discussed the issues and had identified nuisance inlet location(s). However, after review, they both agreed on one location at the intersection of Strong Drive and Oakey Boulevard. It was also indicated that an Inlet would not be installed east of Rancho Drive where there is no curb and gutter. Peter Jackson/CLV provided HDR a plan markup showing the location of the proposed nuisance inlet. It was indicated that the

inlet grate needs to be a type DM inlet with an opening of 2.5 feet. It was also indicated that calculations would not have to be done for the inlet because this inlet will capture nuisance flows but that it should be mentioned in the Final Drainage Report. Peter Jackson/CLV asked if the flow from Villa de Conde was flowing across Oakey Boulevard to the north side of the street. Huagao Tan/HDR indicated that this was not the case and that the 'crown' of the road contained the flow.

- **Drop Inlet Height/Dewatering** – Inlet height revision by lowering the sanitary sewer trench to 12' was discussed. Raj Hanumanthaia/HDR presented a schematic showing a DI, the sanitary sewer (trench to 12' depth) and the lateral intercepting the 6'x6' RCB above it. This was to show that even by adjusting the sewer trench to 12' depth pipes would not intercept the top of the box culverts. Raj Hanumanthaia/HDR also indicated that lowering the south sanitary sewer trench depth to 12' would also require relocation of existing Sanitary Sewer Laterals at Rambla Court, Rancho Drive and Bryn Mawr Avenue. Todd Myers asked it the 6'x6' RCB could be raised 2' and if it would help in reducing the inlet depth. It was indicated that it may help in one or two locations, overall it would not work at Villa De Conde Way and Rancho Drive where box culvert laterals intercept the main facility. It was also discussed that other conflicts still exist with the Sewer Laterals at Rambla Court, Rancho Drive and Bryn Mawr Avenue. In addition, RajHanumanthaia/HDR indicated that he had spoken to Tony Lopez/Rinker Materials about the interception point of the laterals and the main RCB's. It was indicated that the RCB would be reinforced with 'hoop' rebar and that a pipe could essentially be placed so that it rests on the floor of the RCB. It was indicated that HDR has adjusted the DI's/laterals to provide a minimum 6" of separation from floor of RCB to outside wall of lateral pipe.

  Raj Hanumanthaia/HDR indicated that dewatering for inlets on the south curb of Oakey Boulevard could be accomplished by the drawdown produced by mainline dewatering and he referred to Table 1 of the Kleinfelder Dewatering Memo. Further he indicated Kleinfelder had indicated that localized dewatering could be utilized with Sumps or Trenches (listed as one of the options of dewatering in the Memo) and that this localized approach should not affect surrounding properties adversely. Raj Hanumanthaia/HDR indicated that it would be up to the Contractor to formulate and use a safe approach to dewatering for the inlets and other trench activities for the project.

- **Manhole Spacing** – Peter Jackson/CLV indicated that Manholes should be placed at all RCB transitions and that spacing should be referenced to these points. He indicated that generally 400 feet to 450 feet spacing was acceptable. Huagao Tan/HDR indicated that HDR would move the first RCB access manhole closer the beginning of the RCB and adjust spacing accordingly.

Record of Survey/Exhibits for Authorization to Enter Property (AEP):

Tom Craig/HDR indicated that Horizon Survey has been working on the Record of Survey and AEP's and would be providing this information to HDR as soon as possible. Raj Hanumanthaia/HDR also indicated that as requested the APN's will be shown on the 90% plans.

Sanitary Sewer Service – 8" Line Cahlan Drive to Strong Drive:

Tim Parks/CLV directed HDR to have the 8" Sanitary Sewer line from Cahlan Drive to Strong Drive on the north side of the street inspected/televised. Raj Hanumanthaia/HDR indicated the length of the line is approximately 900 feet.

8" ACP Waterline within StrongDrive:

It was questioned if the 8" ACP along Strong Drive, which crosses the proposed storm Drain Trench, could be supported or would it have to be replaced. Rosa Cortez/CLV requested that HDR contact Alex de los Santos (LVVWD) discuss this issue to determine a course of action during construction.

Oakey Boulevard Structural Section:

Rosa Cortez/CLV requested that open-graded bituminous surface as indicated on the plans be replaced with UTACS. She indicated that the CLV would be obtaining R-Values for subgrade material and Traffic Counts on Oakey Boulevard. It was not determined at this time if this information would be utilized by CLV personnel to determine the Roadway or structural section or if this information would be provided to HDR to determine the section. Raj Hanumanthaia/HDR indicated that HDR would use the assumed section of 5/8" UTACS, 4" Bituminous Surface and 12" Type II aggregate base for the 90% submittal.

Traffic Control:

Raj Hanumanthaia/HDR presented schematics showing the bounds of the construction trench for the various size box culverts and distances outside of the Portable Pre-cast Concrete Barrier Rail (PPBCBR). He also indicated he went out in the field and essentially the roadway width is approximately a ½-foot wider on either side. This will help somewhat but for the 10'x8' we still do not get 12' from face of barrier to lip of gutter on the south side of Oakey Boulevard between Rancho Drive and Birch Street.

Action Items:

- HDR – provide a simple explanation of the HEC-22 analysis of inlet capacity in the Final Design Report.
- HDR – provide an exhibit showing the flow captured at inlets and flows bypassing the inlets for the project limits added to the Final Design Report.
- HDR - not to install an inlet East of Rancho Drive where there is no curb and gutter.
- HDR - Add a nuisance inlet at Strong Drive and Oakey Boulevard (Type DM inlet with an opening of 2.5 feet). Flows would not have to be calculated for the inlet but it should be mentioned in the Final Design Report.
- HDR – provide Manholes at all RCB transitions reference spacing to these points. (Generally, 400 feet to 450 feet spacing was acceptable).
- HDR – continue coordinating with Horizon Survey regarding the Record of Survey and AEP's.
- HDR – Contact ProPipe, sewer Inspection subconsultant to schedule televising of the existing 8" sanitary sewer from Cahlan Drive to Strong Drive.
- HDR – Contact Alex de los Santos (LVVWD) regarding the 8" ACP waterline within Strong Drive.

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Meeting Notes

Subject: Meeting Notes - Progress Meeting #16	
Client: City of Las Vegas	
Project: Oakey Storm Drain - Birch to Cahlan	Project No: (Hansen No.) 06-11273
Meeting Date: 12/20/2007	Meeting Location: CE Small Conference Room
Notes by: Tom Craig & Raj Hanumanthaiah	

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Attendees:

Valerie Flock, City of Las Vegas – Design	**702-229-6740**	**vflock@LasVegasNevada.GOV**
Rosa Cortez, City of Las Vegas – Design	**702-229-6264**	**rcortez@LasVegasNevada.GOV**
Rob Welch, City of Las Vegas – Flood Control	**702-229-2177**	**rwelch@LasVegasNevada.GOV**
Tim Parks, City of Las Vegas – Sewer	**702-229-2180**	**tparks@LasVegasNevada.GOV**
Raj Hanumanthaiah - HDR Engineering	**702-938-6043**	**rajanish.Hanumanthaiah@hdrinc.com**
Huagao Tan - HDR Engineering	**702-938-6014**	**huagao.tan@hdrinc.com**
Tom Craig - HDR Engineering	**702-938-6062**	**thomas.craig@hdrinc.com**

Purpose of Meeting:

The purpose of the Progress Meeting was to discuss the Pre Final 100% Progress Plans as well as review the Design Review Workshop meeting minutes.

Introductions –

Exchange of Information – HDR provided an Agenda, sign-in-sheet and DRAFT Pre Final 100% Progress Plans.

Topics of Discussion:

Pre Final 100% Progress Plans:

Raj Hanumanthaia/HDR presented the plans and the following Issues were reviewed/discussed:

- **10' Maximum Depth of Drop Inlets (DIs)** – Raj Hanumanthaia/HDR indicated that based upon the recent design direction from the 'Workshop' Meeting of December 6, 2007 and phone conversation of December 11, 2007, the process of minimizing DI depth has begun. At this time it appears that several DIs are at a depth of greater than 10', however HDR will review further to attempt to eliminate any DIs over 10'. If any DI's are to be designed then it should be indicated on, the lateral profile and reference made to special details. It was also suggested to indicate above the DI it's location north or south of the centerline.
- **Villa de Conde Drainage System** – Current plans show a 5' wide x 4' height box culvert lateral at Villa de Conde Way, which replaced in a previous design a 'squash' concrete pipe. The purpose of replacing the pipe was to assure that the lateral and lateral connection could be precast. CLV minimum height box culvert is 5' and CLV directed HDR to install the larger box culvert. Pothole data at the waterline in this location indicated a depth of 2' plus. This depth is being questioned by HDR as potholes on either side of this location show depths of 3' plus to 4'. Installation of a larger 5' x 5' culvert could be dependent upon the outcome of waterline potholing.

Action Items:

- HDR – Further, review minimizing DI depths. (Maximizing lateral slopes, utilizing C905 Water Quality pipe and/or utilizing 'squash' pipe).
- HDR – install a 5' x 5' RCB lateral at Villa de Conde if after Potholing, information indicates adequate pipe depth.

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Meeting Notes

Subject:	DRAFT Meeting Notes - Progress Meeting #17
Client:	City of Las Vegas
Project:	Oakey Storm Drain - Birch to Cahlan
Project No:	(Hansen No.) 06-11273
Meeting Date:	1/3/2008
Meeting Location:	CE Small Conference Room
Notes by:	Tom Craig

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Attendees:

Rosa Cortez, City of Las Vegas – Design	**702-229-6264**	**rcortez@LasVegasNevada.gov**
Tim Parks, City of Las Vegas – Sewer	**702-229-2180**	**tparks@LasVegasNevada.gov**
Oh Sang Kwon, City of Las Vegas – Flood	**702-229-1815**	**okwon@lasvegasnevada.gov**
Terry Parker, City of Las Vegas – Construction	**702-229-2433**	**tparker@lasvegasnevada.gov**
Raj Hanumanthaiah - HDR Engineering	**702-938-6043**	**rajanish.Hanumanthaiah@hdrinc.com**
Tom Craig - HDR Engineering	**702-938-6062**	**thomas.craig@hdrinc.com**

Purpose of Meeting:

The purpose of the Progress Meeting was to discuss the DRAFT Pre Final 100% Progress Plans and other issues.

Introductions –

Exchange of Information – HDR provided an Agenda, sign-in-sheet and DRAFT Pre Final 100% Progress Plans.

Topics of Discussion:

DRAFT Pre Final 100% Progress Plans:

HDR presented the plans and the following Issues were reviewed/discussed:

- **Sanitary Sewer Encasement** – Tom Craig/HDR asked for clarification/direction on proposed bedding for new Sanitary Sewer. It was understood that the Sanitary Sewer would be C905 water quality pipe and encased in CLSM in those areas where proximity to the waterline required it. In addition, in those areas that the Sanitary Sewer could be installed with the RCB in a joint trench, CLSM would encase the pipe other then the point of contact with bedding material. However, it was still unclear as to depth of and type of bedding for the saturated soils that would be encountered. Tim Parks/CLV referred to the Sanitary Sewer standard detail SD-16B that directs the designer to put 4" minimum standard bedding with an Additional unspecified depth of Drain Rock. He indicated that he would discuss in-house the gradation and depth of Drain Rock and need for encasement with CLSM. Tom Craig/HDR indicated he would consult with the project Geotechnical Engineer and get a recommendation. He would then forward to Tim Parks/CLV for concurrence or other direction.

- **Record of Survey** – Tom Craig/HDR indicated that the Survey subconsultant anticipates having the Record of Survey completed by January 11th. Rosa Cortez/CLV indicated that the Record of Survey would be at the front of the plan set at the Legend and Abbreviations and just prior to the Construction Plans. In addition, it was determined that approximately 10 of 19 AEPs (Authorization Enter Property) were not necessary as the project limits front a block wall. Rosa Cortez/CLV indicated that only those AEPs necessary would be shown on the Record of Survey.

- **Pavement – Structural Section & Oakey/Rancho reconstruction** - Rosa Cortez/CLV indicated that the pavement structural section would be provided on Monday, January 7th. Regarding reconstruction of the Oakey/Rancho intersection as requested by CLV Traffic Engineering, Rosa Cortez/CLV indicated that at this time only the western half of this intersection would be reconstructed and patching on the east for laterals. In addition, on Construction Plans all sawcut lines, patching for laterals and all proposed utilities will be shown. It was also suggested to 'double up' viewports on not only the construction plans but also the striping plans. This would eliminate approximately 6 sheets from the plans.
- **Drainage Plans** – Rosa Cortez/CLV asked - instead of showing pipe inverts in those areas where pipe/utility separation is unknown for crossing utilities indicate a +/- clear distance.
- **Existing Signal Conduit** – Raj Hanumanthaia/HDR indicated the only information for the Oakey/Rancho signal shown on plans was the FAST conduit. Other conduit for the signal is unknown at this time. Rosa Cortez/CLV asked that for now a conduit 'box' should be shown on the plans until verification could be made with CLV utilities as to what is existing.
- **Traffic Notes** – Traffic Notes WILL be shown as requested by CLV Traffic, on the plans, as Signal conduit will be affected by installation of the drainage system at both the Oakey/Rancho intersection and Bob Baskin Park.
- **Nuisance Drop Inlet @ northwest corner of Oakey/Rancho** – Terry Parker/CLV asked if with this project the Curb/gutter and sidewalk ramp were being reconstructed at the northwest corner due to removal of the DI. HDR indicated that the DI was being replaced and that Curb/gutter and the sidewalk ramp may be replaced. Rosa Cortez/CLV mentioned the need for the 'tactile warning' warning panel on the ramp if the ramp was being reconstructed. Terry Parker/CLV also enquired as to whether or not the proposed DIs to the north and west of this existing DI could be moved closer to the curb returns. Tom Craig/HDR indicated that moving of the DI's would be looked at along with need for reconstruction of the Ramp. In addition, as built-plans would be reviewed to determine if possible removal of the DI was an option along with minor grading of that portion of the intersection.

Action Items:

- CLV - discuss in-house the gradation and depth of Drain Rock and need for encasement with CLSM for Sewer Pipes
- HDR - consult with the project Geotechnical Engineer and get recommendation Sanitary Sewer pipe encasement and bedding. Forward to Tim Parks/CLV for concurrence or other direction.
- CLV - only those AEPs necessary for completion of the project would be shown on the Record of Survey.
- CLV - indicated that the pavement structural section would be provided on Monday, January 7th.
- CLV - indicated that at this time only the western half of the Oakey/Rancho intersection would be reconstructed along with patching on the east for laterals.
- HDR – show on Construction Plans all sawcut lines, patching for laterals and all proposed utilities.
- HDR - 'double up' viewports on both the construction and striping plans.
- HDR - instead of showing pipe inverts in those areas where pipe/utility separation is unknown for crossing utilities indicate a +/- clear distance.
- HDR - show a conduit 'box' on the plans at the Oakey/Rancho intersection until verification could be made with CLV utilities as to what is existing.
- HDR - Traffic Notes WILL be shown as requested by CLV Traffic on the plans.
- HDR – investigate moving the DI's at the northwest corner of Oakey and Rancho along with need for reconstruction of the Ramp. In addition, as built-plans would be reviewed to determine if possible removal of the DI was an option along with minor grading of that portion of the intersection.

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Meeting Notes

Subject: DRAFT Meeting Notes - Coordination Meeting #5 - LVVWD	
Client: City of Las Vegas	
Project: Oakey Storm Drain - Birch to Cahlan	Project No: (Hansen No.) 06-11273
Meeting Date: 12/27/2007	Meeting Location: LVVWD Conf Room
Notes by: Tom Craig & Raj Hanumanthaiah	

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Attendees:

Valerie Flock, City of Las Vegas – Design	**702-229-6740**	**vflock@LasVegasNevada.GOV**
Joseph Morgan, LVVWD – Engineering	**702-822-8373**	**joseph.morgan@lvvwd.com**
Alex de los Santos, LVVWD – Engineering	**702-822-8471**	**alex.de_los_santos@lvvwd.com**
Raj Hanumanthaiah, HDR Engineering	**702-938-6043**	**rajanish.hanumanthaiah@hdrinc.com**
Russ McNaught, HDR Engineering	**702-938-6000**	**russell.mcnaught@hdrinc.com**
Tom Craig, HDR Engineering	**702-938-6062**	**thomas.craig@hdrinc.com**

Purpose of Meeting:

The purpose of the Meeting was to update LVVWD on reduction of waterline relocation and get buy-in.

Introductions –

Exchange of Information – Raj Hanumanthaia/HDR provided Preliminary Pre Final 100% showing revised waterline relocation concept.

Topics of Discussion:

LVVWD Waterline -

- Raj Hanumanthaiah/HDR presented utility plans for the project and discussed revised relocation of LVVWD waterline.
  - Due to revisions to project, Dewatering requirements relocation of the waterline minimized.
  - Revisions to Dewatering requirements have eliminated the need to relocate Sanitary Sewer from Station 38+00 to Station 53+00 on the south side of the street. Relocated Sanitary Sewer in proximity to the LVVWD waterline will be of water quality C905 pipe and encased in 4-inch minimum grout.
  - Waterline Relocation is now only from Station 53+00 to Station 57+60 (+/-) a reduction of 1,500 linear feet.
  - Plans and Specs will indicate the Contractor is required to maintain 4-foot distance from outside of trench to outside of waterline.
  - Potholes will be shown on Sanitary Sewer plans and a table included identifying pothole number, utility, and depth to utility.
  - Two full size sets of Pre Final 100% plans will be sent to LVVWD for checking purposes. Current LVVWD check prints and comments based upon previous design will be forwarded to HDR.
- LVVWD indicated that the revisions to the waterline relocation were acceptable and preferences were always not to relocate the waterline.

- HDR also indicated that the required cover of 4 feet for the relocated 20-inch waterline, from approximately Station 53+00 to 53+60 could not be provided. This was as a cause of connecting to the existing 18" waterline, which has only 2.5 feet of cover. LVVWD indicated that this was acceptable and that Class 53 DIP be utilized per the UDACS.

Action Items:

- HDR – Specify for relocated Sanitary Sewer in proximity to the LVVWD waterline, water quality C905 pipe and encasement in 4-inch minimum grout.
- HDR – Indicate on Plans and Specs, Contractor is required to maintain 4-foot distance from outside of trench to outside of waterline.
- HDR - Potholes will be shown on plans and a table included identifying pothole number, utility, and depth to utility.
- HDR – Send two full size sets of Pre Final 100% plans to LVVWD for checking purposes.
- LVVWD - Current check prints and comments based upon previous design will be forwarded to HDR.

Appendix C

Response to Comments

Oakey Storm Drain – Cahlan Dr to Birch St
REVIEW COMMENTS

REVIEWER	Todd L. Myers, CCRFCD	PROJECT No.	45800
REPORT DATED	November 26, 2007	PROJECT LEVEL	90 % Submittal

NO.	SHEET NO.	REVIEW COMMENTS	*TYPE	DESIGNER RESPONSE
1.		**The plans provided in the 90% submittal package are not acceptable for funding purposes. The engineer has not provided adequate responses to 70% review comments, has not provided construction/structural details necessary to construct facility, has not provided acceptable investigation into cost saving design alternatives, nor has he provided adequate justification for certain design decisions outlined below. District performed a cursory review of plans. A more detailed review will be performed when the following items have been thoroughly addressed.**		**A Design Workshop was held on 12/06/07 and the issues in question have been thoroughly investigated and addressed. The design direction has been agreed upon by all parties (CCRFCD, CLV and HDR)**
2.		**Based on invert elevation of existing 8-inch sanitary sewer (SS) located on south side of proposed RCBC alignment, it appears that by reducing slope of proposed RCBC to approximately 1% between Stations 43+30 and 38+30 the SS can be shifted to the north side of proposed RCBC. It may also be possible to maintain a steeper slope by transitioning to 7-ft x 5-ft RCBC instead of 6-ft x 6-ft RCBC. The vertical alignments of both the existing SS and proposed RCBC will allow SS lateral to cross over RCBC at Rambla Court, eliminating need for new SS on south side of RCBC until SS lateral near Station 56+80. This would not only eliminate parallel SS's upstream of Rancho Drive, but would also eliminate need to relocate existing 18-inch water line located on south side of RCBC between Stations 38+00 and 57+00. It is likely that SS on north side of RCBC will require replacement due to existing pipe material and inability to support in place during RCBC construction. Therefore, upsizing northern SS, if necessary, and replacing only one SS would result in highly significant cost savings. Also, I suggest that consultant investigate benching trench to construct SS and RCBC in common trench.**		**Due to revisions to dewatering recommendations with respect to the location of dewatering wells, a new option for SS relocation (Option 3) was conceived. Option salient points:** ***1.*** **No relocation of South Sanitary Sewer between 38+00 and 57+59.** ***2.*** **Additional Sewer length from 38+00 to 48+00(+/-) for the north sewer** ***3.*** **South Sewer revised from 12" to 8" dia.** ***4.*** **North Sewer revised from 8" to 12" dia. from 44 +72** ***5.*** **Potential savings from not needing relocation of existing south sanitary sewer for approx. 2000 feet for the future extension between Calhan Drive and Barnard Drive.**

*TYPE: 'F'=FATAL FLAW REVISION MANDATORY.
'S'=SERIOUS PROBLEM ADDRESS IMMEDIATELY. COULD RISE TO AN 'F' IF DISREGARDED.
'C'=COORDINATION PROBLEM. DISCIPLINE NEEDS TO TALK.
'N'=NOTE TO DESIGNER. NOT MANDATORY TO INCORPORATE, BUT COULD RESULT IN AN IMPROVED PRODUCT.

		This has proven to be a more constructible and less costly solution on several City projects with similar constraints. Thoroughly investigate these alternatives.		
3.		Further investigate alternatives for dewatering during construction. City's construction management staff indicated that simplified methods of dewatering were utilized during construction of existing facility downstream of Station 68+21. I recommend that geotechnical engineer attend next progress meeting to discuss alternatives.		Geotechnical consultant, Kleinfelder has indicated that the contractor can be instructed to present a dewatering plan with the requirement that all dewatering work stays at least four feet away from existing/proposed waterlines.
4.	TY-01	The response to the following comment from District's 70% review is has not been adequately addressed. Please address the following comment: The geotechnical report provides three alternatives for overexcavation and backfilling trench sections in areas containing cemented soils. The first recommendation is to overexcavate to one foot below the bottom of RCBC and replace with structural fill. Justify engineer's direction contained in Storm Drain Note No.3, which appears to be the most expensive and complex alternative provided in the geotechnical report. It has been District's experience that a more standard bedding section, such as first alternative provided in geotechnical report, has had satisfactory performance on past projects with similar groundwater conditions. Additionally, responses to 70% review comments indicate that RCBC extensions will no longer be utilized. As an alternative, slurry backfill will be placed to 1-ft above storm drain to prevent floating. Revise trench details to reflect this change. Provide a minimum clearance from outside of RCB to trench wall based on using slurry cement backfill. Storm drain Note No. 1 specifies Selected and Granular backfill above pipe zone. Does native material meet specifications for select and granular backfill? Provide recommendation.		In those areas where the soils are saturated and 'soft', which is approximately 70% of the project, 1-foot of over excavation will be specified along with the placement of 2-feet of bedding material (Granular backfill, 3-inch minus). The first foot of material will be 'pressed' into the 'soft'. This 'pressing' of the material into the soil will introduce additional fines into the voids of the 3-inch minus and will create a foundation for the balance (1-foot) of additional material.
5.	SD-01	See Comment No.2 above. Label pipe material for existing SS on north side or RCBC.		Concur.
6.	SD-02	Provide pipe material for existing 8-inch water line crossing storm drain (SD) lateral on west side of Strong Drive. If it is ACP it is likely that contractor will not be able to support during SD lateral construction. Provide instructions to contractor.		Alex De Los Santos (LVVWD) mentioned that it is up to the contractor to support an exposed ACP or other waterline pipe during trench work in the field and the LVVWD inspector will approve it as needed.

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'N'=NOTE TO DESIGNER. NOT MANDATORY TO INCORPORATE, BUT COULD RESULT IN AN IMPROVED PRODUCT.

7.	SD-03	Provide manhole at mainline and 5-ft x 4-ft RCBC junction. Provide provisions for constructing bend sections with precast units. Provide acceptable unit lengths for precast sections around bends, acceptable deflections for pulled joints, and joint treatments around bends.		A RCB access Manhole has been provided at 51+66.87.. Based on recommendations from a pre-cast RCB manufacturer, the unit length has been set at 2 segment length (16 feet) at this location.
8.	SD-04	The RCBC alignment is extremely close to existing SS vault at Rancho Drive intersection. Based on the hydraulic grade line (HGL), it appears that the 8-ft x 8-ft to 10-ft x 8-ft RCBC transition could be moved to east side of Rancho Drive intersection in order to provide additional clearance. This comment was provided in 70% review comments but was not addressed in engineer's responses. Show existing drop inlet just west of Rancho Drive on Oakey Boulevard.		The transition structure (8x8 to 10x8) has been moved from 55+90 to 57+90 to provide additional clearance between the existing sanitary sewer junction box and proposed RCB.
9.	SD-06	Provide construction detail for connection of existing RCBC to proposed facility.		Connection detail has been provided on sheet DT-03.
10.	SD-07 thru SD-12	It appears that the majority of the proposed drop inlets can be constructed to a shallower depth and still allow for utility crossings. This item has been discussed at length during regular project progress meetings, and I still do not agree that this item has been adequately resolved. Based on lateral profiles drop inlet and lateral depths can be reduced significantly, resulting in a more constructible and less costly project to build. Please address and justify proposed drop inlet/ lateral depths.		Removing the Dewatering location constraint of 4 feet from the edge of the Storm Drain trench reduced the relocation of the 18" waterline by 75% and has saved the south sewer from relocation between 38+00 and 57+58. This has allowed HDR to adjust the laterals. This has resulted in reducing the "D" value of all DM drop inlets to less than ten (10) feet
11.	DT-02	Provide structural details for pipe junctions, transitions, drop inlets constructed deeper than 10-ft and pipe penetrations. Based on City/Consultant contract scope, structural details were to be included in 70% design submittal.		Structural details for the inlet over 10 feet are not required since all DM inlets are less than 10-feet deep. Pipe penetration details provided on sheet DT-03.
12.	SS-01	See Comment No.2 regarding SS alignment. As indicated above, the SS lateral crossing RCBC at Rambla has adequate clearance over proposed RCBC; however, I suggest that SS elevation be checked at first SSMH south of Oakey. If lateral can be raised, it may be possible to raise profile of mainline, resulting in more cost effective design. Verify proposed pipe material for 12-inch SS.		The proposed south sanitary sewerin option 3 does cross the RCBC over to the north side and ties into the proposed north sanitary sewer line. All proposed sanitary sewer material will be PVC (C905).
13.	SS-03	Profile indicates utilizing PVC for 'SS1', and DIP for 'SS2'; why are two different pipe materials specified? Verify preferred material and revise accordingly.		All proposed sanitary sewer material will be PVC (C905).

*TYPE: 'F'=FATAL FLAW REVISION MANDATORY.
'S'=SERIOUS PROBLEM ADDRESS IMMEDIATELY. COULD RISE TO AN 'F' IF DISREGARDED.
'C'=COORDINATION PROBLEM. DISCIPLINE NEEDS TO TALK.
'N'=NOTE TO DESIGNER. NOT MANDATORY TO INCORPORATE, BUT COULD RESULT IN AN IMPROVED PRODUCT.

14.	SS-04	See Comment No.8 regarding existing SS vault.		The transition structure (8x8 to 10x8) has been moved from 55+90 to 57+90 to provide additional clearance between the existing sanitary sewer junction box and proposed RCB
15.	UT-04	Provide profile of 8-inch water line east of Rancho Drive. There are several service lateral crossings from the south that need to be considered in vertical alignment.		8" Waterline profile has been provided on sheets UT-04 to UT-06.
16.	Cost Estimate	Verify unit prices for RCBC sections provided in cost estimate. Bid tabulations for recent projects indicate that estimated prices are more than double recent bids for similar RCBC sizes. I understand that field conditions (groundwater, caliche...etc.) will result in higher cost than typical projects, however, doubling the cost appears inflated. Verify, and revise accordingly.		Unit prices for RCBC have been adjusted down to reflect the current market trend.

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REGIONAL FLOOD
CONTROL DISTRICT

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General Manager/Chief Engineer

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November 26, 2007

Rosa Cortez, P.E.
Engineering Project Manager
City of Las Vegas
Department of Public Works
400 Stewart Avenue
Las Vegas, Nevada 89101

Re: Oakey Storm Drain Extension – Birch to Cahlan

Dear Ms. Cortez:

Clark County Regional Flood Control District, has reviewed *Oakey Storm Drain Extension – Birch Street to Cahlan Drive* 90% plans dated October 29, 2007 prepared by HDR Engineering for City of Las Vegas (City). Improvements include approximately 2700-ft of reinforced concrete box culvert (RCBC) and appurtenant facilities. This facility is labeled FWOK 0020 on District's 2002 Master Plan Update (MPU). The following comments are offered for your consideration as the project proceeds:

General

1. The plans provided in the 90% submittal package are not acceptable for funding purposes. The engineer has not provided adequate responses to 70% review comments, has not provided construction/structural details necessary to construct facility, has not provided acceptable investigation into cost saving design alternatives, nor has he provided adequate justification for certain design decisions outlined below. District performed a cursory review of plans. A detailed review will be performed when the following items have been thoroughly addressed.

2. Based on invert elevation of existing 8-inch sanitary sewer (SS) located on south side of proposed RCBC alignment, it appears that by reducing slope of proposed RCBC to approximately 1% between Stations 43+30 and 38+30 the SS can be shifted to the north side of proposed RCBC. It may also be possible to maintain a steeper slope by transitioning to 7-ft x 5-ft RCBC instead of 6-ft x 6-ft RCBC. The vertical alignments of both the existing SS and proposed RCBC will allow SS lateral to cross over RCBC at Rambla Court, eliminating need for new SS on south side of RCBC until SS lateral near Station 56+80. This would not only eliminate parallel SS's upstream of Rancho Drive, but would also eliminate need to relocate

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existing 18-inch water line located on south side of RCBC between Stations 38+00 and 57+00. It is likely that SS on north side of RCBC will require replacement due to existing pipe material and inability to support in place during RCBC construction. Therefore, upsizing northern SS, if necessary, and replacing only one SS would result in highly significant cost savings. Also, I suggest that consultant investigate benching trench to construct SS and RCBC in common trench. This has proven to be a more constructible and less costly solution on several City projects with similar constraints. Thoroughly investigate these alternatives.

3. Further investigate alternatives for dewatering during construction. City's construction management staff indicated that simplified methods of dewatering were utilized during construction of existing facility downstream of Station 68+21. I recommend that geotechnical engineer attend next progress meeting to discuss alternatives.

4. Provide project specifications for District review.

5. Identify and provide status of all required right-of-way and/or easements, including temporary construction easements, required for the completion of this project. All rights-of-entry must be obtained to meet District's requirements for construction funding.

Plans

6. Sheet TY-01: The response to the following comment from District's 70% review has not been adequately addressed. Please address the following comment: *The geotechnical report provides three alternatives for overexcavation and backfilling trench sections in areas containing cemented soils. The first recommendation is to overexcavate to one foot below the bottom of RCBC and replace with structural fill. Justify engineer's direction contained in Storm Drain Note No.3, which appears to be the most expensive and complex alternative provided in the geotechnical report.* It has been District's experience that a more standard bedding section, such as first alternative provided in geotechnical report, has had satisfactory performance on past projects with similar groundwater conditions. Additionally, responses to 70% review comments indicate that RCBC extensions will no longer be utilized. As an alternative, slurry backfill will be placed to 1-ft above storm drain to prevent floating. Revise trench details to reflect this change. Provide a minimum clearance from outside of RCBC to trench wall based on using slurry cement backfill. Storm Drain Note No. 1 specifies Selected and Granular Backfill above pipe zone. Does

native material meet specifications for select and granular backfill? Provide recommendation.

7. Sheet SD-01: See Comment No.2 above. Label pipe material for existing SS on north side or RCBC.

8. Sheet SD-02: Provide pipe material for existing 8-inch water line crossing storm drain (SD) lateral on west side of Strong Drive. If it is ACP it is likely that contractor will not be able to support during SD lateral construction. Provide instructions to contractor.

9. Sheet SD-03: Provide manhole at mainline and 5-ft x 4-ft RCBC junction. Provide provisions for constructing bend sections with precast units. Provide acceptable unit lengths for precast sections around bends, acceptable deflections for pulled joints, and joint treatments around bends.

10. Sheet SD-04: The RCBC alignment is extremely close to existing SS vault at Rancho Drive intersection. Based on the hydraulic grade line (HGL), it appears that the 8-ft x 8-ft to 10-ft x 8-ft RCBC transition could be moved to east side of Rancho Drive intersection in order to provide additional clearance. This comment was provided in 70% review comments but was not addressed in engineer's responses. Show existing drop inlet just west of Rancho Drive on Oakey Boulevard.

11. Sheet SD-06: Provide construction detail for connection of existing RCBC to proposed facility.

12. Sheet SD-07 thru SD-12: It appears that the majority of the proposed drop inlets can be constructed to a shallower depth and still allow for utility crossings. This item has been discussed at length during regular project progress meetings, and I still do not agree that this item has been adequately resolved. Based on lateral profiles, drop inlet and lateral depths can be reduced significantly, resulting in a more constructible and less costly project to build. Please address and justify proposed drop inlet/ lateral depths.

13. Sheet DT-02: Provide structural details for pipe junctions, transitions, drop inlets constructed deeper than 10-ft and pipe penetrations. Based on City/Consultant contract scope, structural details were to be included in 70% design submittal.

14. Sheet SS-01: See Comment No.2 regarding SS alignment. As indicated above, the SS lateral crossing RCBC at Ramble has adequate clearance over proposed RCBC;

however, I suggest that SS elevation be checked at first SSMH south of Oakey. If lateral can be raised, it may be possible to raise profile of mainline, resulting in more cost effective design. Verify proposed pipe material for 12-inch SS.

15. Sheet SS-03: Profile indicates utilizing PVC for 'SS1', and DIP for 'SS2'; why are two different pipe materials specified? Verify preferred material and revise accordingly.

16. Sheet SS-04: See Comment No.8 regarding existing SS vault.

17. Sheet UT-04: Provide profile of 8-inch water line east of Rancho Drive. There are several service lateral crossings from the south that need to be considered in vertical alignment.

18. Cost Estimate: Verify unit prices for RCBC sections provided in cost estimate. Bid tabulations for recent projects indicate that estimated prices are more than double recent bids for similar RCBC sizes. I understand that field conditions (groundwater, caliche...etc.) will result in higher cost than typical projects, however, double the cost appears inflated. Verify, and revise accordingly.

If you have any questions, please give me a call.

GALE WM. FRASER, II, P.E.
General Manager/Chief Engineer

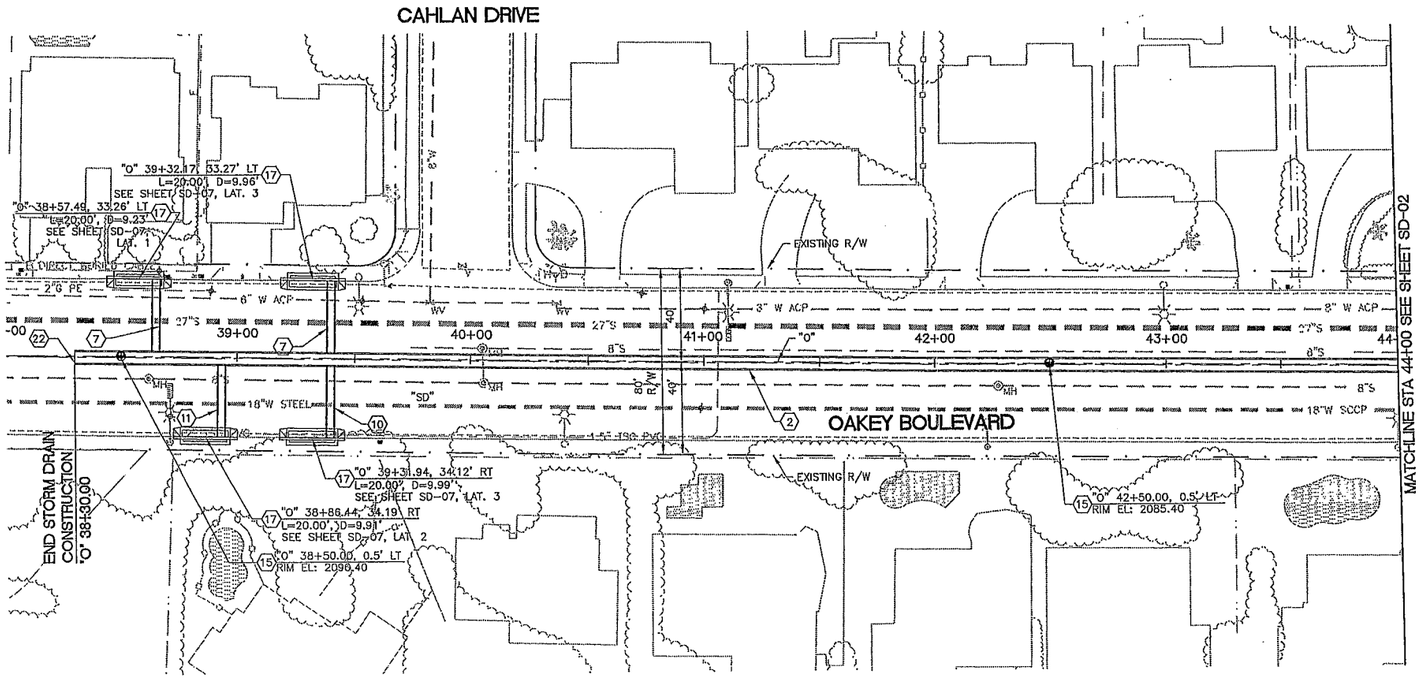
BY: _____
Todd L. Myers, P.E.
Engineering Project Manager

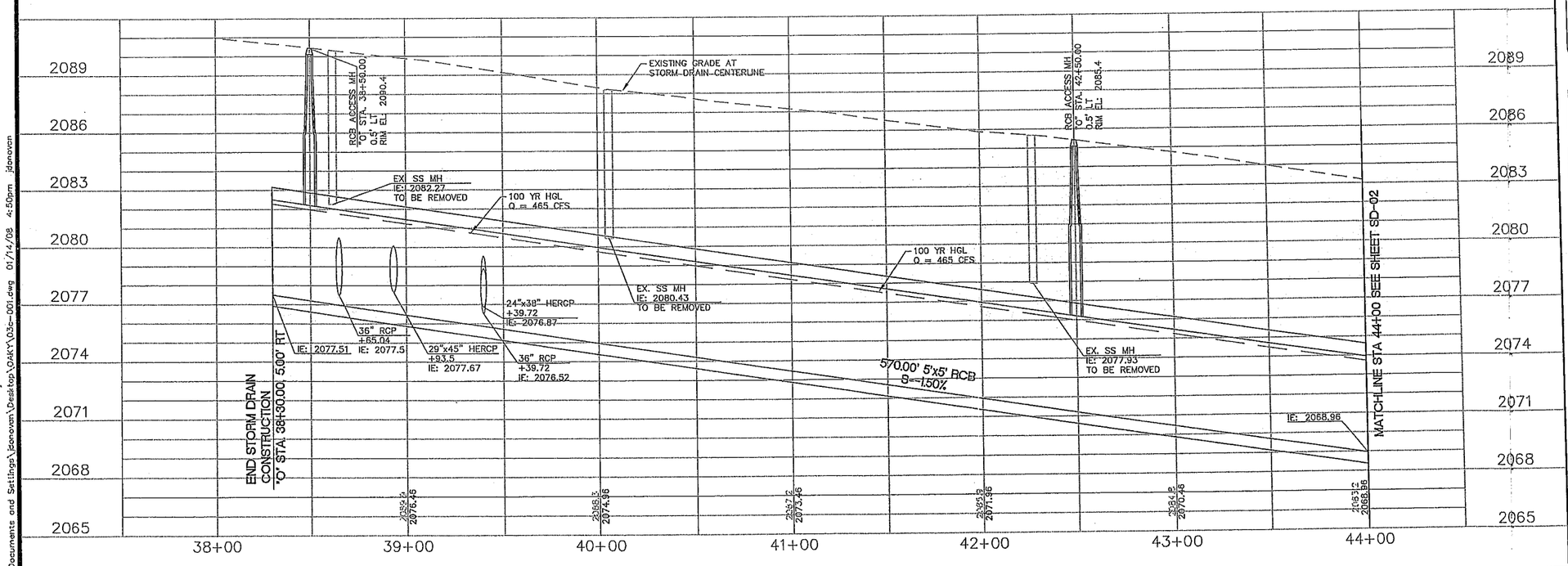
c: Stephen Roberts, P.E., CCRFCD
Peter Jackson, CLV
Thomas Craig, P.E., HDR
Raj Hanumanthaiah, P.E., HDR

TLM:ll

Appendix D

Plan and Profile Sheets





DRAINAGE NOTES

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LAS VEGAS VALLEY WATER DISTRICT DATE

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NO.	DATE:	DESCRIPTION		

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

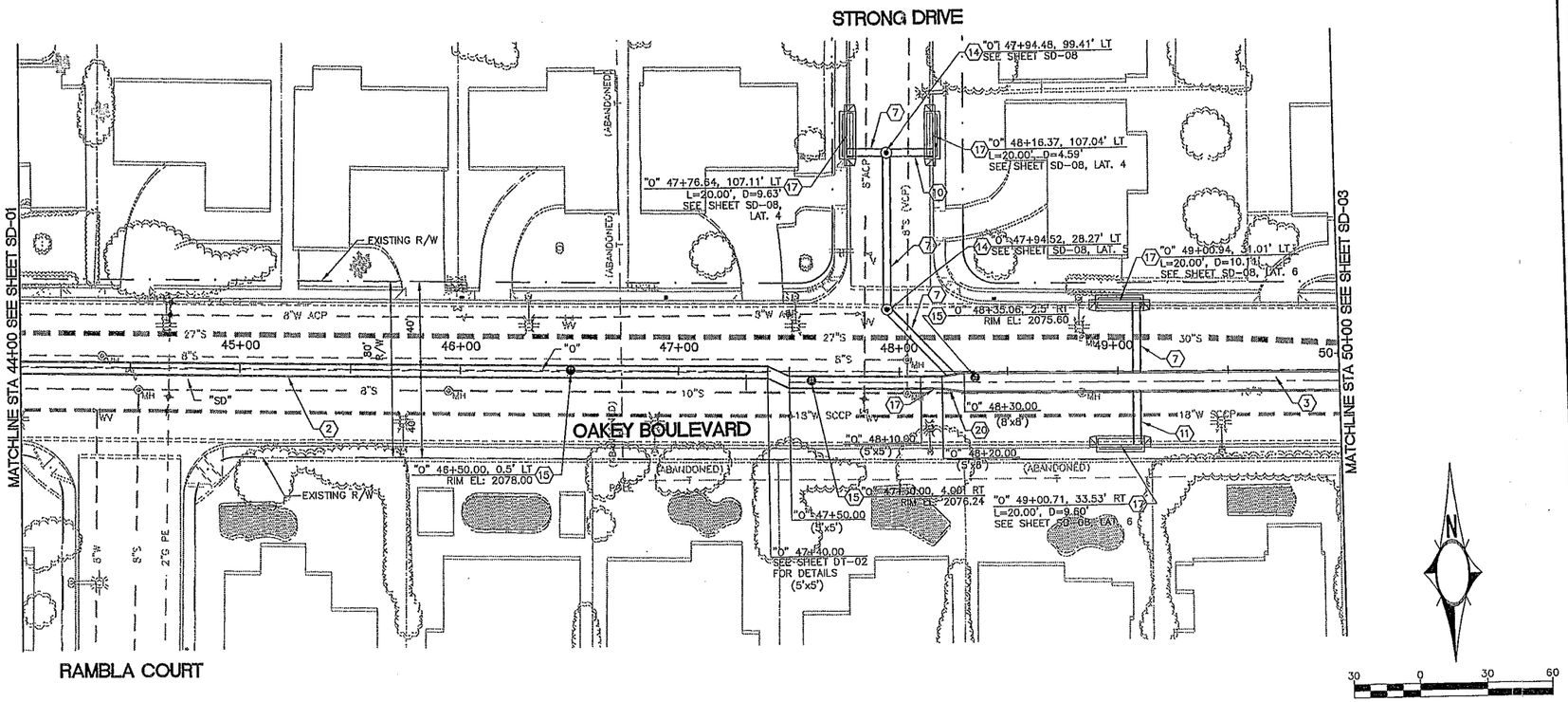
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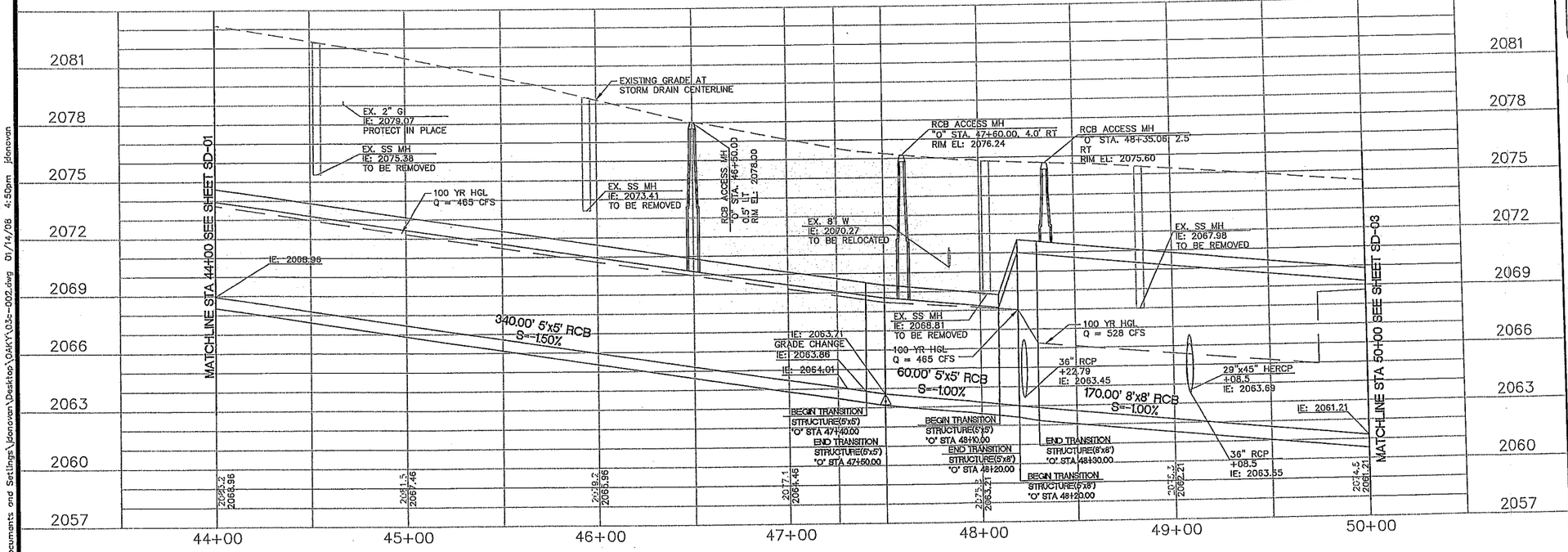
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Sheet SD-01
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LAS VEGAS VALLEY WATER DISTRICT DATE

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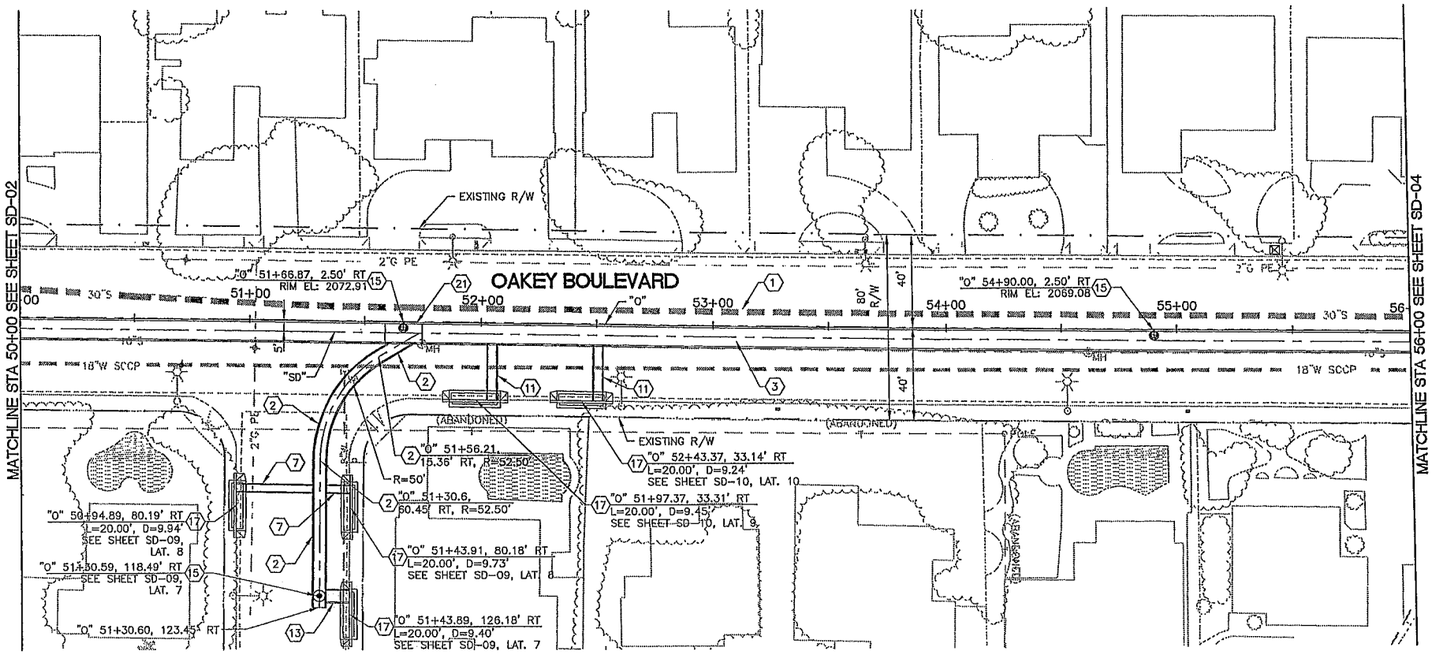
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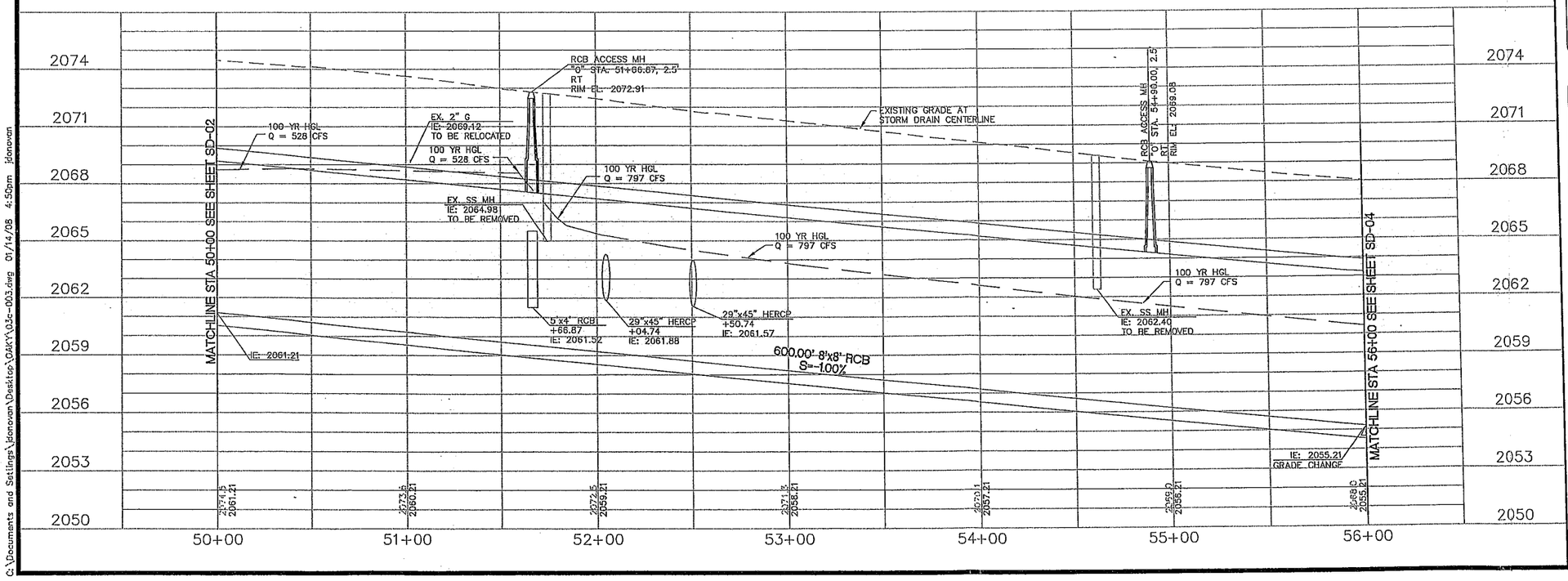
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PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 08-30-09
CIVIL
No. 017671

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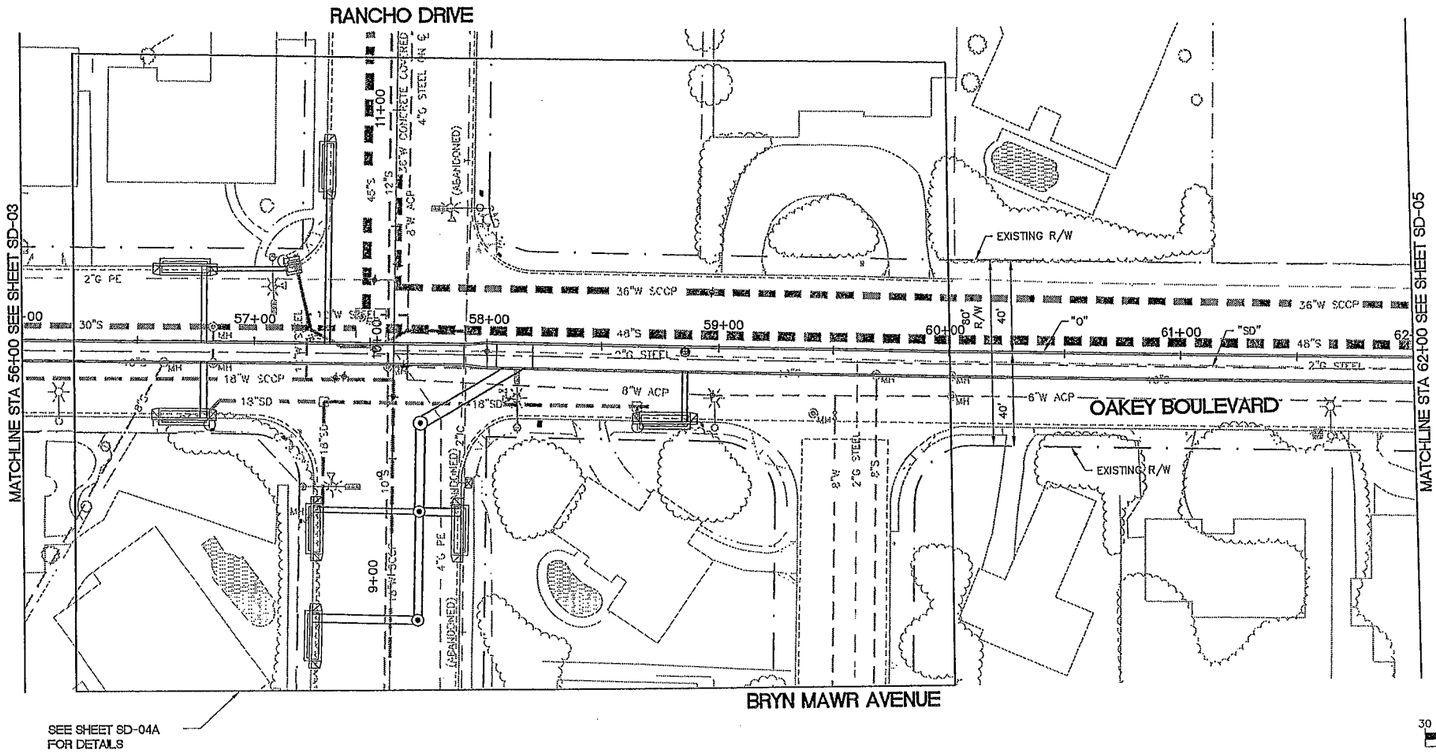
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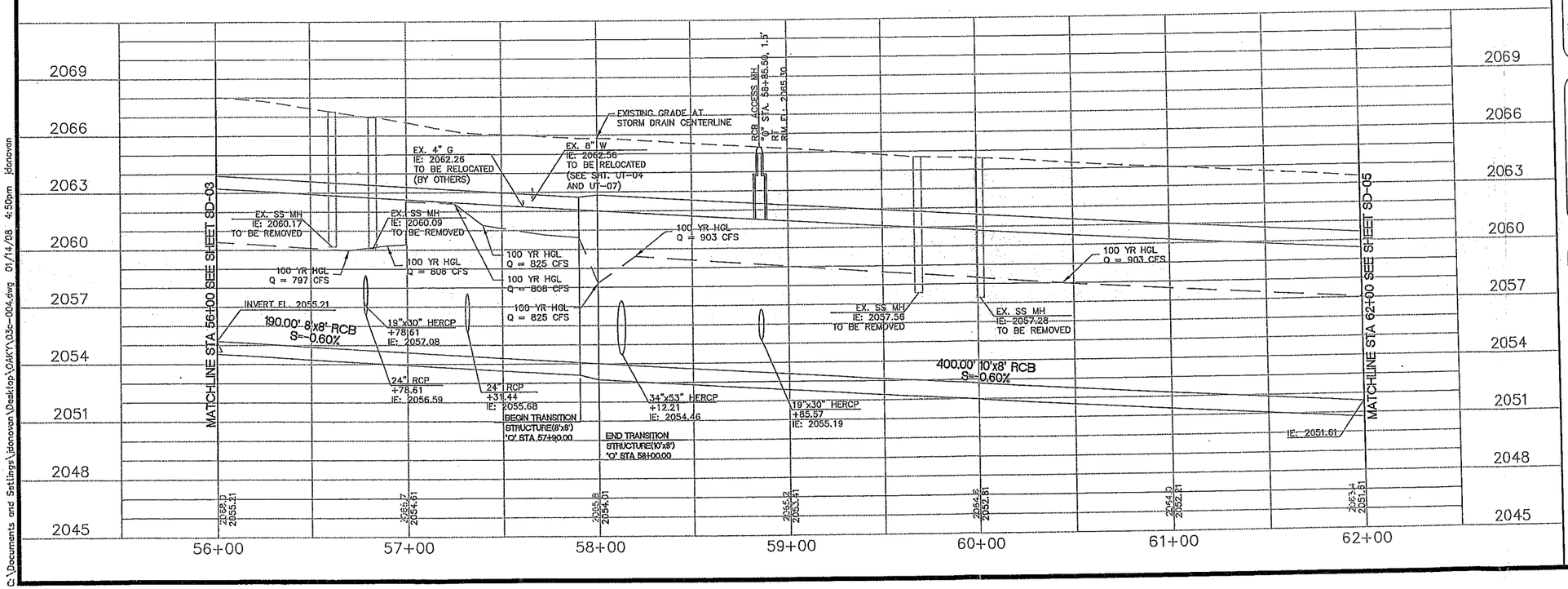
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RAJANISH HANUMANTHAIAH Exp. 06-30-09 CIVIL No. 017671 PROFESSIONAL ENGINEER STATE OF NEVADA

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2. ALL LATERAL PIPE LENGTHS MEASURED ALONG PIPE CENTERLINE TO CENTER OF MANHOLE OR INSIDE EDGE OF DI, RCB, OR STRUCTURE.

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100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you Dig 811 Call 1-800-227-2600 1-702-455-7511

Call before you UnderGround 1-702-455-7511 1-702-592-5300

Call before you OVERHEAD 1-702-593-6111

REVISIONS			
NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2006

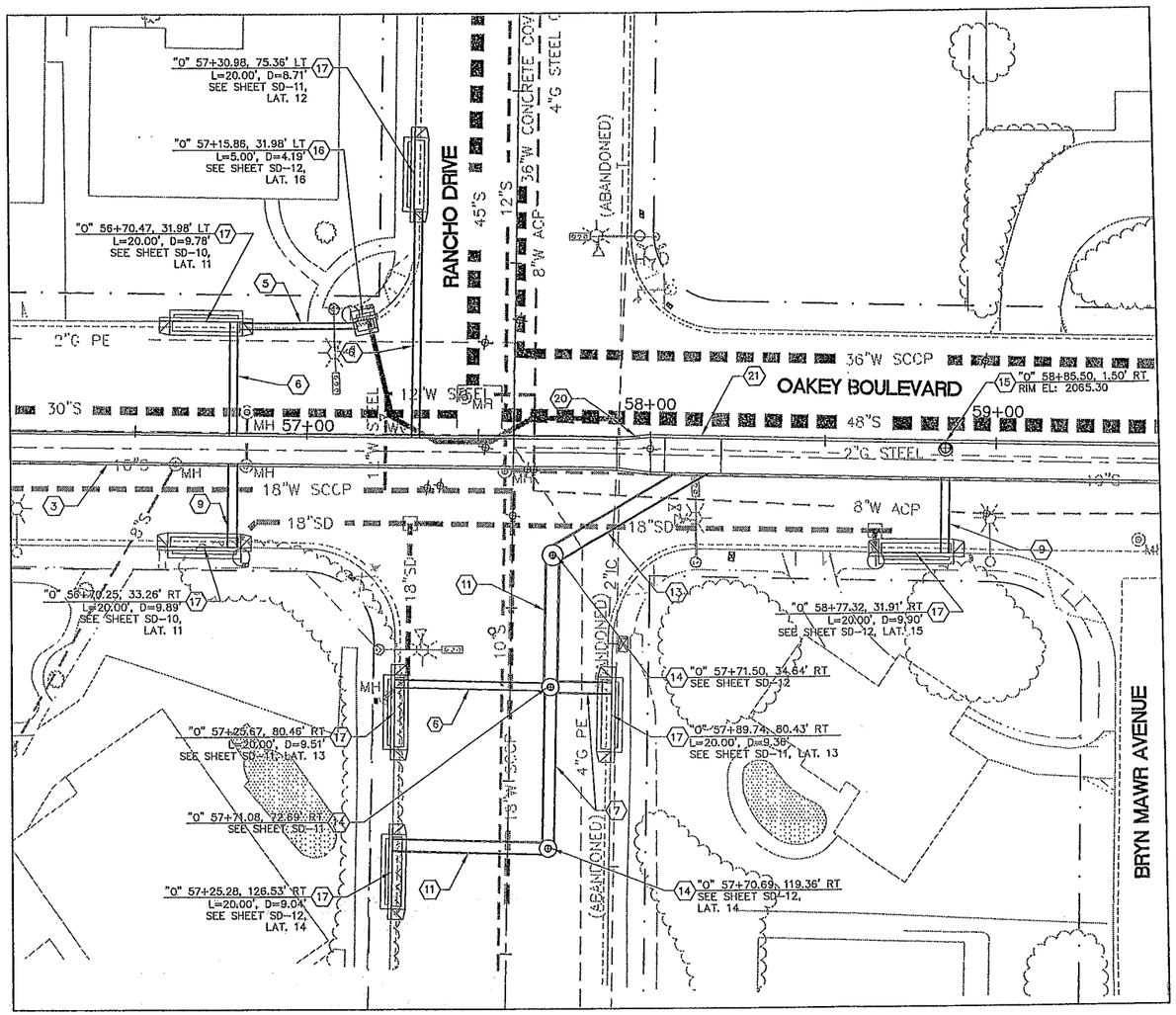
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BIRCH STREET TO CAHLAN DRIVE

SHEET: STORM DRAIN PLAN AND PROFILE
STA 56+00.00 TO STA 62+00.00

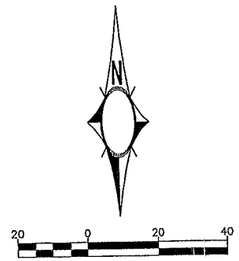
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671
STATE OF NEVADA
PROFESSIONAL ENGINEER

Sheet SD-04
12 of 43
DRAWING NO. XXXXXX

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OAKEY-RANCHO INTERSECTION DETAILS



DRAINAGE NOTES

1. PROTECT-IN-PLACE
2. CONSTRUCT 5'x5' PRECAST RCB
3. CONSTRUCT 8'x8' PRECAST RCB
4. CONSTRUCT 10'x8' PRECAST RCB
5. CONSTRUCT 18" RCP (CLASS III)
6. CONSTRUCT 24" RCP (CLASS III)
7. CONSTRUCT 36" RCP (CLASS III)
8. CONSTRUCT 42" RCP (CLASS III)
9. CONSTRUCT 19"x30" HERCP (CLASS III)
10. CONSTRUCT 24"x38" HERCP (CLASS III)
11. CONSTRUCT 29"x45" HERCP (CLASS III)
12. CONSTRUCT 34"x53" HERCP (CLASS III)
13. CONSTRUCT 38"x60" HERCP (CLASS III)
14. CONSTRUCT PRECAST 60" (TYPE II) STORM DRAIN MANHOLE PER USDCCA STD DWG No. 405
15. CONSTRUCT PRECAST RCB ACCESS MANHOLE PER DETAIL ON DT-02
16. CONSTRUCT 5' TYPE "DM" DROP INLET PER DETAIL ON DT-01
17. CONSTRUCT 20' TYPE 'DM' DROP INLET PER DETAIL ON SHEET DT-01
18. CONSTRUCT 5'X5' TO 5'X8' PRECAST RCB TRANSITION STRUCTURE (REFER TO SHEET DT-03 FOR DETAILS).
19. CONSTRUCT 5'X8' TO 8'X8' PRECAST RCB TRANSITION STRUCTURE (REFER TO SHEET DT-03 FOR DETAILS).
20. CONSTRUCT 8'X8' TO 10'X8' PRECAST RCB TRANSITION STRUCTURE (REFER TO SHEET DT-03 FOR DETAILS).
21. CONSTRUCT PRECAST RCB WYE (REFER TO SHEET DT-04 FOR DETAILS).
22. CONSTRUCT PLUG FOR RCB (REFER TO SHEET DT-05 FOR DETAILS).
23. REMOVE EXISTING RCB PLUG AND TIE INTO EXISTING RCB (REFER TO SHEET DT-05 FOR CONNECTION DETAILS).

LAS VEGAS VALLEY WATER DISTRICT DATE

STORM DRAIN NOTES:

1. ALL STORM SEWER STATION AND OFFSETS ARE TAKEN FROM THE OAKEY BOULEVARD ("O") ALIGNMENT.
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100% SUBMITTAL
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JAN 11, 2008

Call before you UnderGround 1-702-455-7511 1-702-432-5300

Call 811 1-800-227-2600 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS			
NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=20'
VERTICAL SCALE: 1"=2'
DATE: 1/11/2008

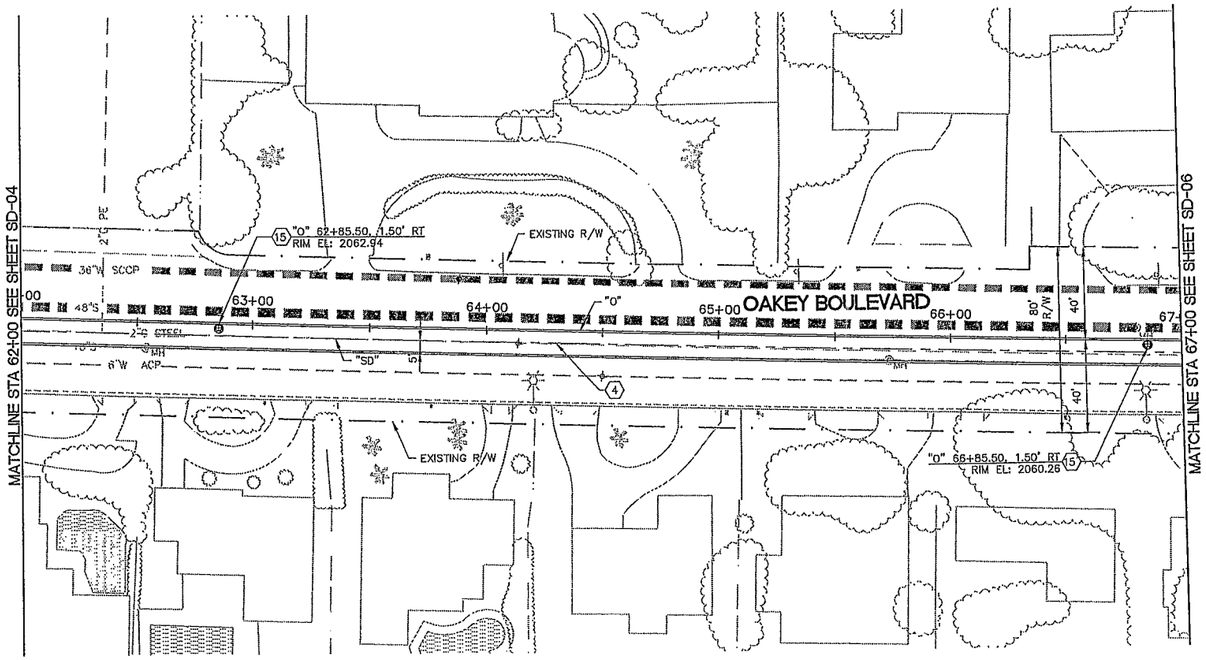
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BIRCH STREET TO CAHLAN DRIVE

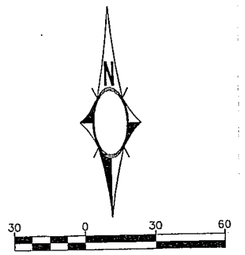
SHEET: OAKEY - RANCHO INTERSECTION

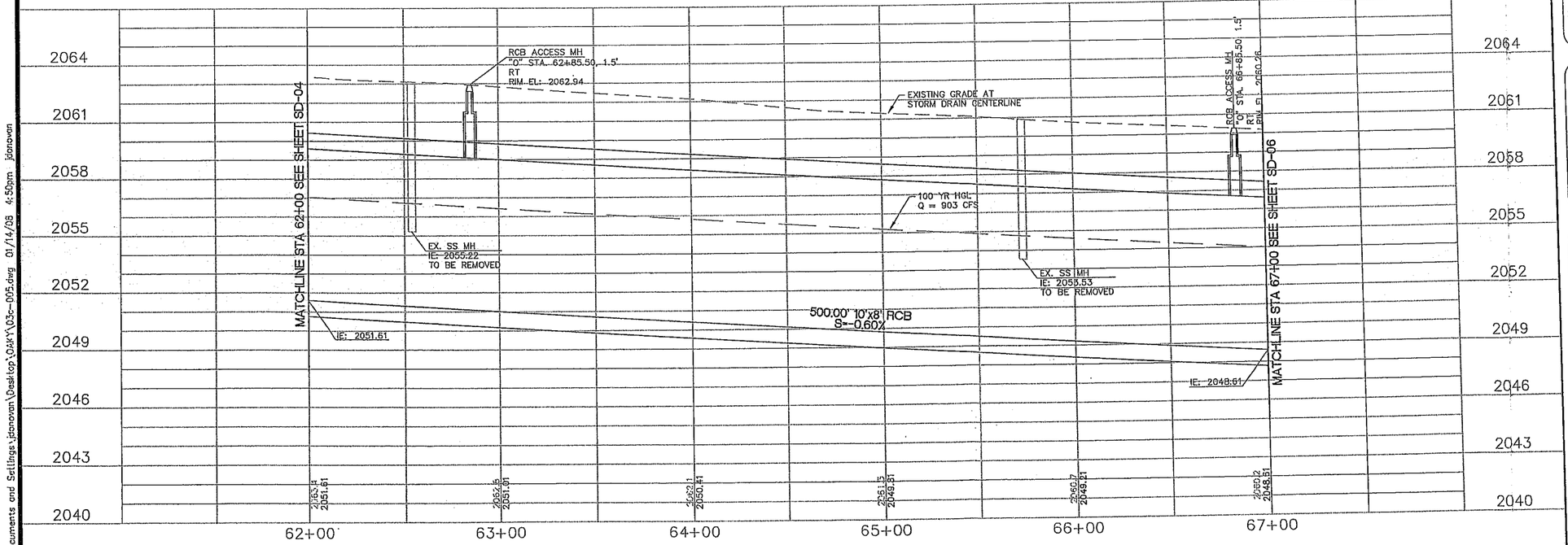
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

Sheet SD-04A
24 of 43
DRAWING NO. XXXXXX

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DRAINAGE NOTES

1. PROTECT-IN-PLACE
2. CONSTRUCT 5'x5' PRECAST RCB
3. CONSTRUCT 8'x8' PRECAST RCB
4. CONSTRUCT 10'x8' PRECAST RCB
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21. CONSTRUCT PRECAST RCB WYE (REFER TO SHEET DT-04 FOR DETAILS).
22. CONSTRUCT PLUG FOR RCB (REFER TO SHEET DT-05 FOR DETAILS).
23. REMOVE EXISTING RCB PLUG AND TIE INTO EXISTING RCB (REFER TO SHEET DT-05 FOR CONNECTION DETAILS).

LAS VEGAS VALLEY WATER DISTRICT DATE

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100% SUBMITTAL
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JAN 11, 2008

Call before you Dig Underground 1-702-455-7511 1-702-537-5300
Call 811 1-800-227-2600 1-702-455-7511
Call before you OVERHEAD 1-702-593-8111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

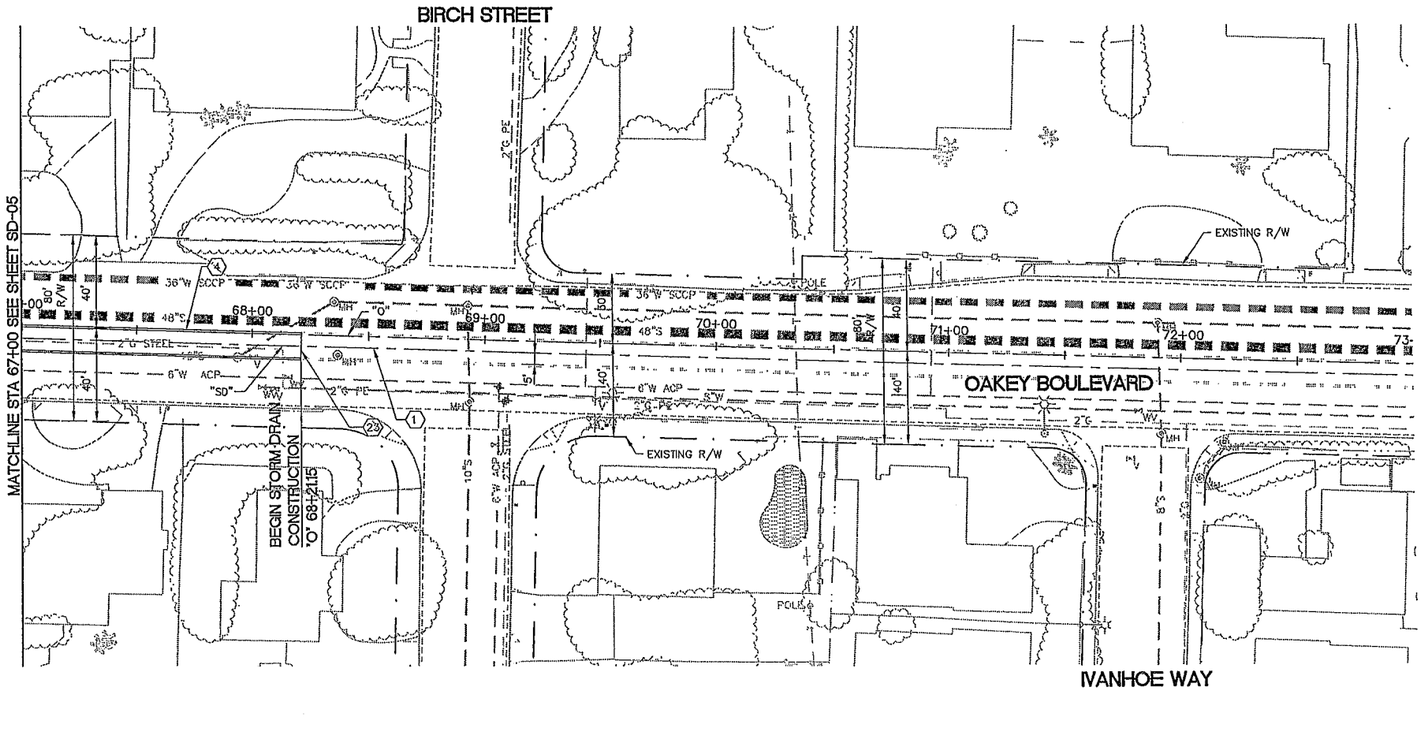
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

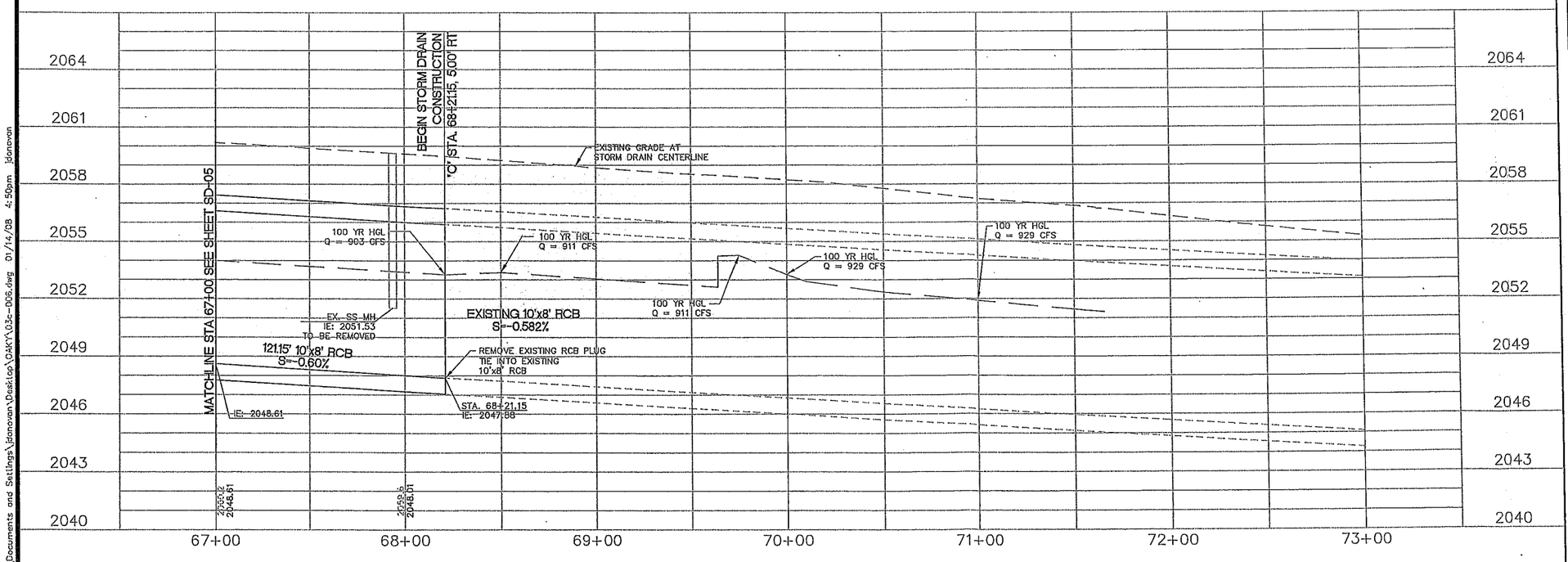
SHEET: STORM DRAIN PLAN AND PROFILE
STA 62+00.00 TO STA 67+00.00

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

Sheet SD-05
13 of 43
DRAWING NO. XXXXXX

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DRAINAGE NOTES

1. PROTECT-IN-PLACE
2. CONSTRUCT 5'x5' PRECAST RCB
3. CONSTRUCT 8'x8' PRECAST RCB
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LAS VEGAS VALLEY WATER DISTRICT DATE

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100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you Dig Underground 1-702-455-7511 / 1-702-432-5300

Call 811 or 1-800-227-2600 / 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

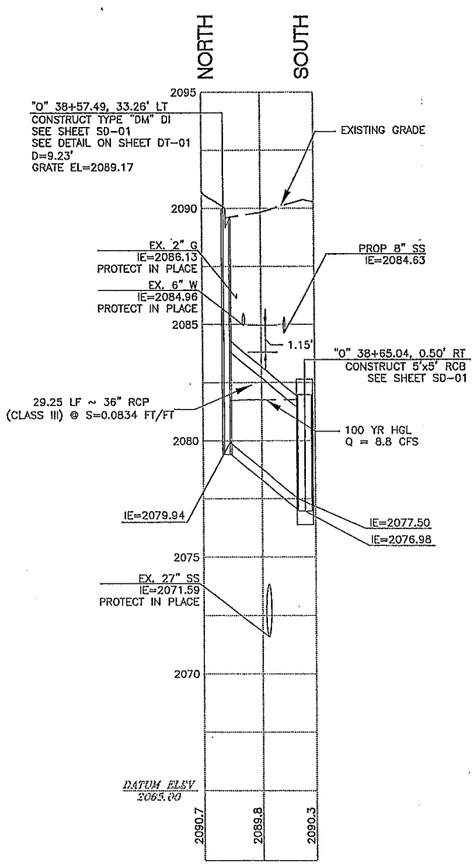
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BIRCH STREET TO CAHLAN DRIVE

SHEET: STORM DRAIN PLAN AND PROFILE
STA 68+00.00 TO STA 68+21.15

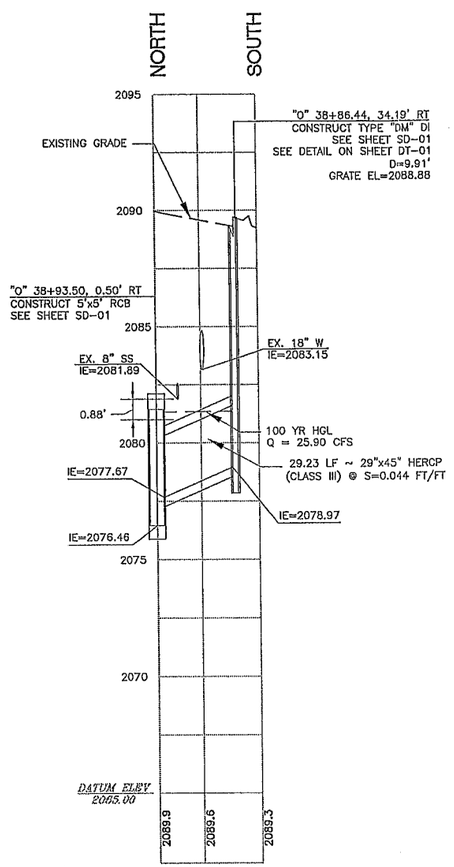
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017617

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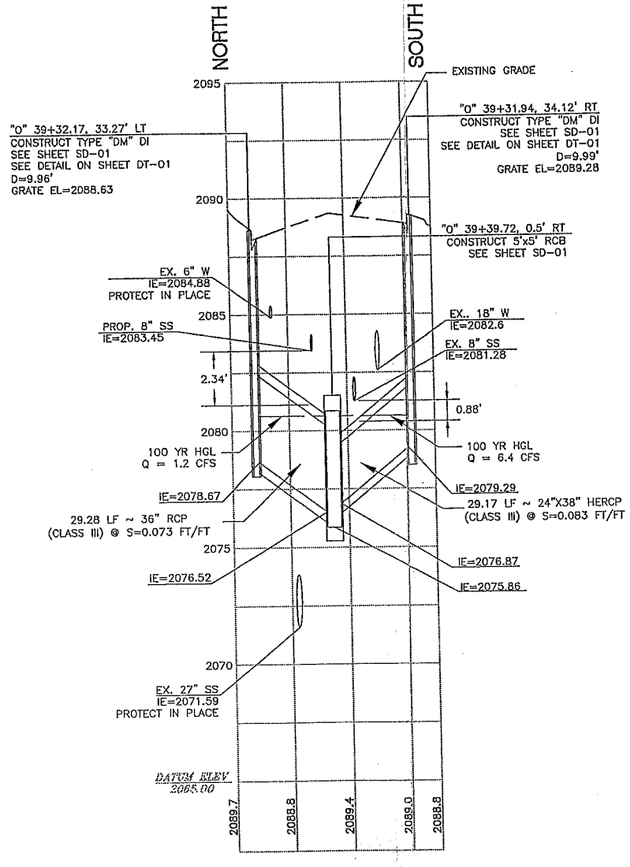
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LATERAL PROFILE "O" STA. 38+65.04 LT
LAT. 1



LATERAL PROFILE "O" STA. 38+93.50 RT
LAT. 2



LATERAL PROFILE "O" STA. 39+39.72
LAT. 3

LVVWD DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you UnderGround 1-702-455-7511 / 1-702-432-5300
Call 811 1-800-227-2600 / 1-702-455-7544
Call before you OVERHEAD 1-702-593-6111

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER:
PROJECT MANAGER: JORGE CERVANTES, P.E.
ROSA CORTEZ, P.E.
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/17/2008
DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH

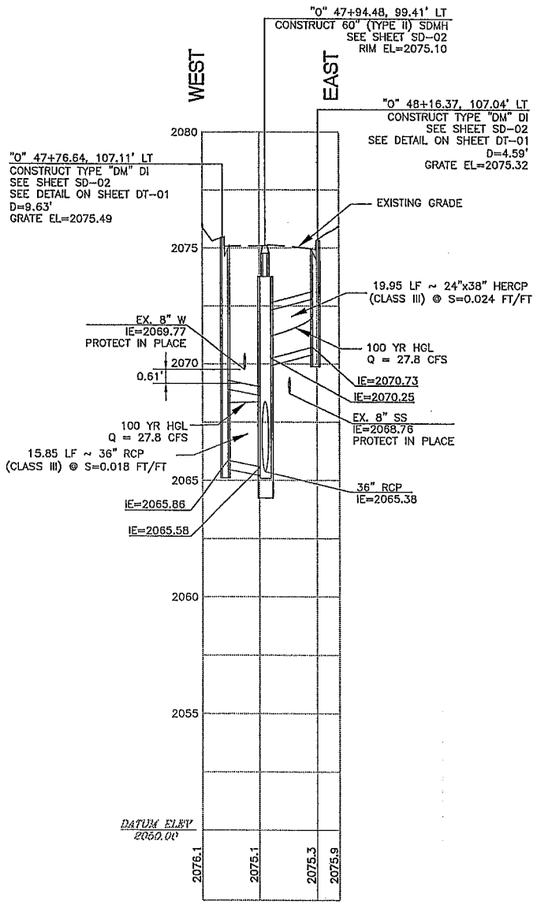
NO.	DATE	DESCRIPTION	APP'D
		REVISIONS	

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: STORM DRAIN LATERAL PROFILES

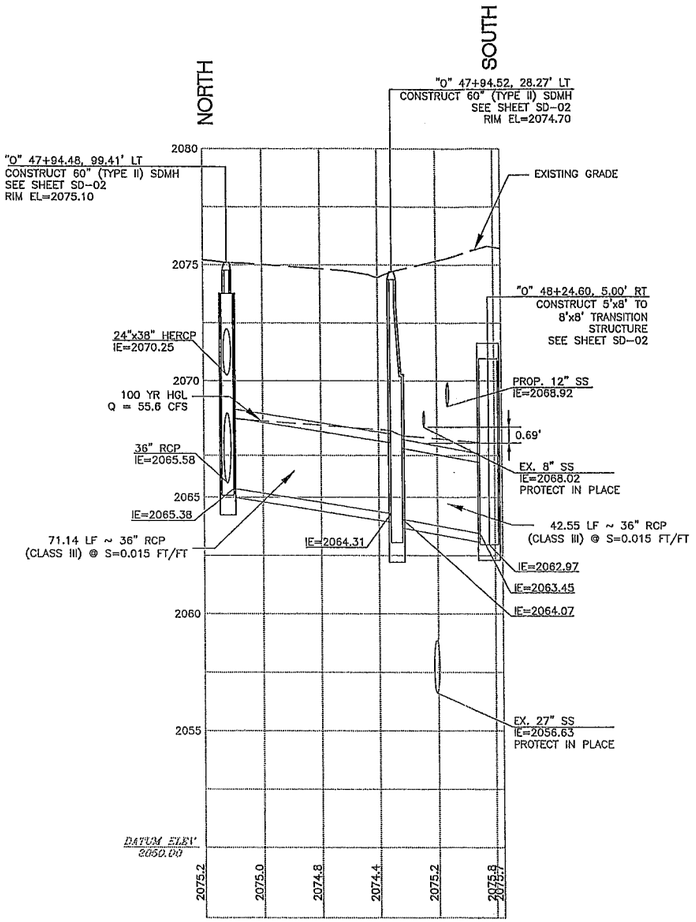
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Exp. 06-30-09
CIVIL
No. 017671
PROFESSIONAL ENGINEER - STATE OF NEVADA

Sheet SD-07
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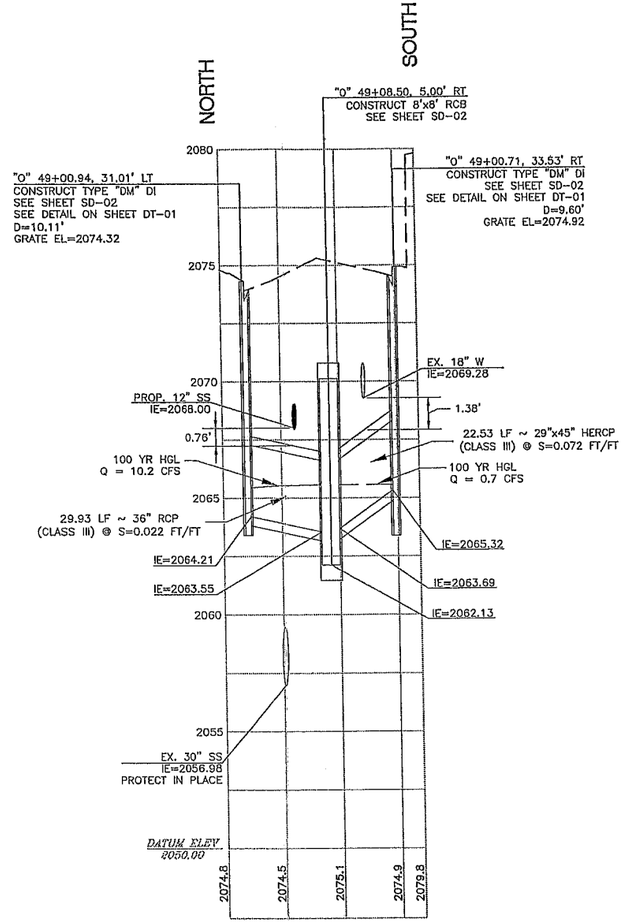
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LAT. 4



LATERAL PROFILE "O" STA. 48+24.60 LT
LAT. 5



LATERAL PROFILE "O" STA. 49+08.50
LAT. 6

LVVWD DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call Before you Underground 1-702-455-7511 (Clark County) 1-702-629-5300 (Nevada and all other areas)

Call before you Dig 811 1-800-227-2600 (Nevada) 1-702-455-7944 (Clark County)

Call before you OVERHEAD 1-702-593-6111

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

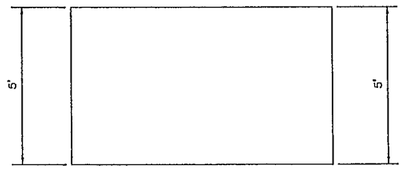
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET: STORM DRAIN LATERAL PROFILES

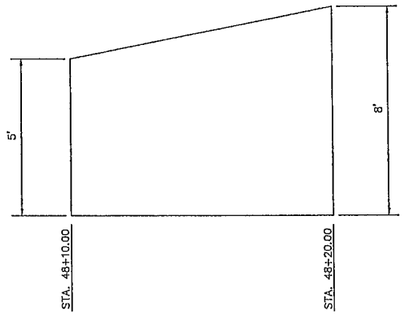
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
No. 017671
CIVIL

Sheet SD-08
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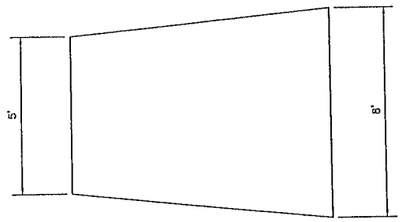


PLAN

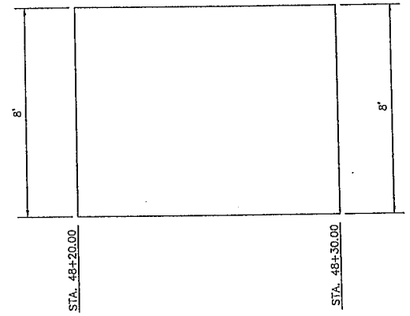


PROFILE

PRECAST RCB TRANSITION FROM 5'x5' TO 5'x8'



PLAN

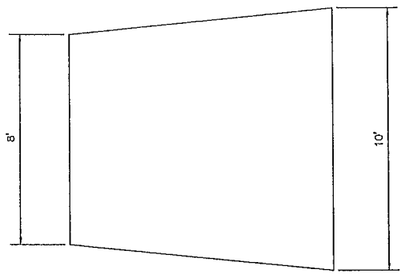


PROFILE

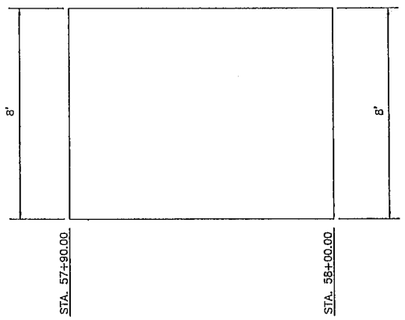
PRECAST RCB TRANSITION FROM 5'x8' TO 8'x8'

NOTE:

REFER TO SECTION 502 OF THE SPECIAL PROVISIONS CONCRETE STRUCTURES FOR PRECAST REINFORCED CONCRETE STRUCTURE REQUIREMENTS.

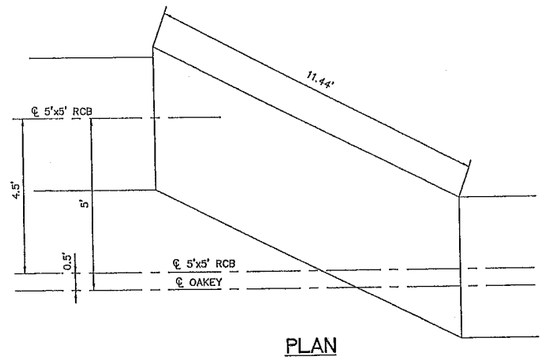


PLAN

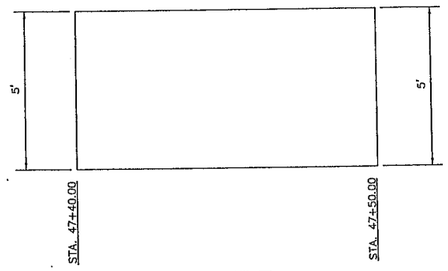


PROFILE

PRECAST RCB TRANSITION FROM 8'x8' TO 10'x8'



PLAN



PROFILE

PRECAST RCB TRANSITION FROM 5'x5' TO 5'x5'

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET: PRECAST RCB TRANSITION DETAILS

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

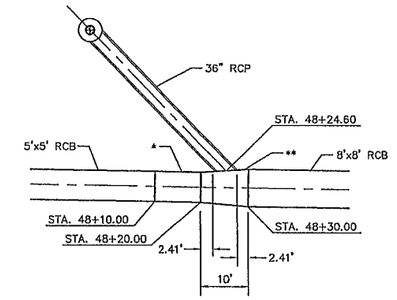
Sheet DT-03
12 of 43
DRAWING NO. XXXXXX

Call before you Dig
Underground
1-702-455-7511
1-702-432-5300

Call 811
1-800-227-2600
1-702-455-7511

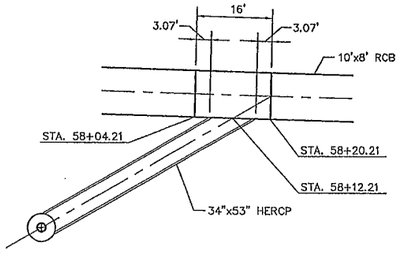
Call before you
OVERHEAD
1-702-593-6111

C:\Documents and Settings\jdonovan\Desktop\OAKEY\04-003.dwg 01/14/08 4:51pm jdonovan

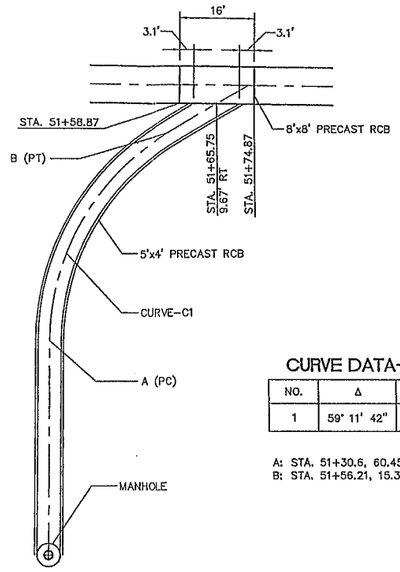


* 5'x5' TO 5'x8' PRECAST RCB TRANSITION STRUCTURE
** 5'x8' TO 8'x8' PRECAST RCB TRANSITION STRUCTURE

PRECAST WYE AT STA. 48+24.60



PRECAST WYE AT STA. 58+12.21

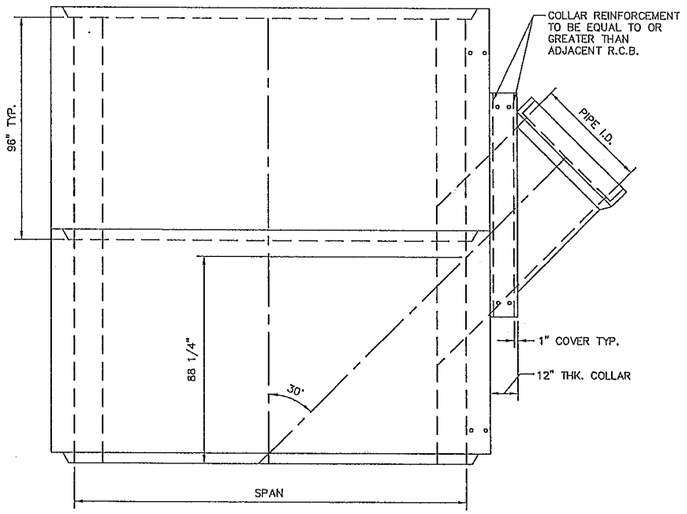


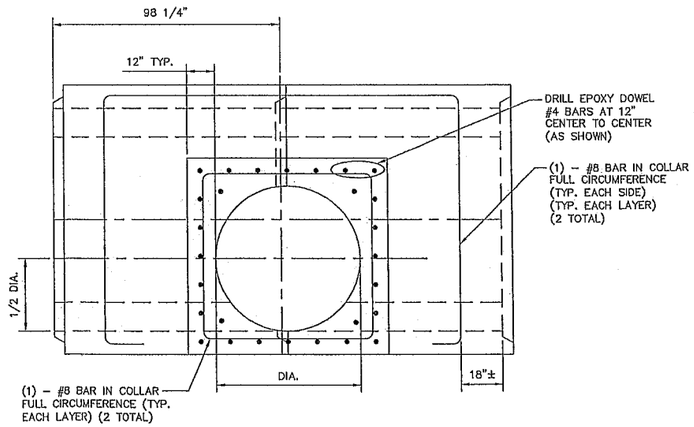
CURVE DATA-C1

NO.	Δ	R	L	T
1	59° 11' 42"	52.5'	54.24'	29.82'

A: STA. 51+30.6, 60.45' RT
B: STA. 51+56.21, 15.36' RT

PRECAST WYE AT STA. 51+65.75





PRECAST RCB/RCP CONNECTION DETAILS

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: MG
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET: PRECAST RCB CONNECTION AND WYE DETAILS

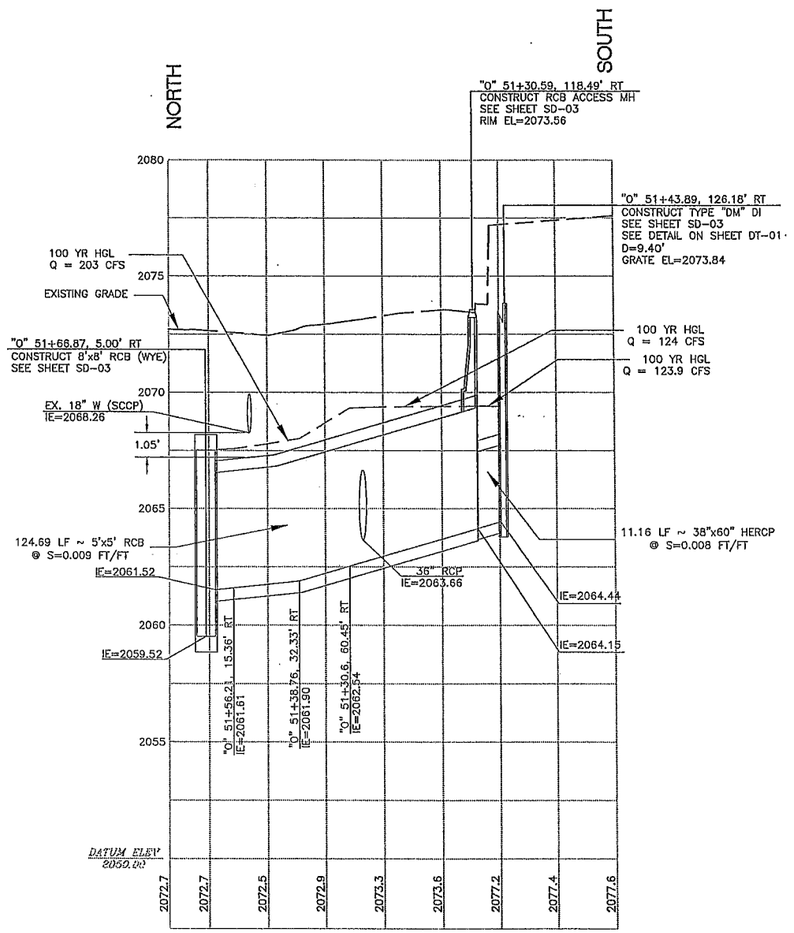
100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

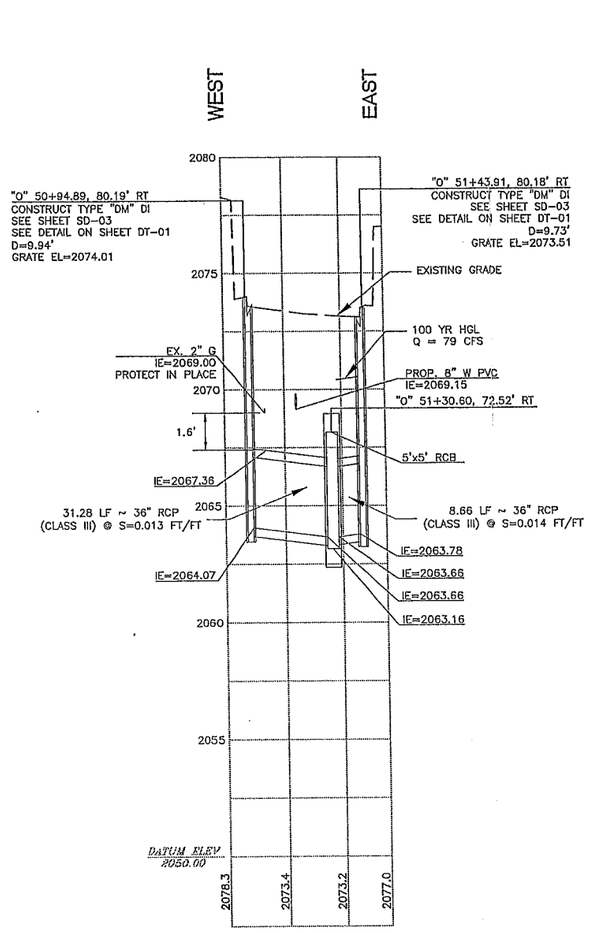
Sheet DT-04
12 of 43
DRAWING NO. XXXXXX

Call before you Dig Underground 1-702-455-7511 1-702-432-5300
Call before you Dig 811 1-800-227-2600 1-702-455-7544
Call before you OVERHEAD 1-702-593-6111

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LATERAL PROFILE "O" STA. 51+66.87 RT
LAT. 7



LATERAL PROFILE "O" STA. 51+30.60 RT
LAT. 8

LVWD DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call UnderGround before you dig 1-702-455-7511 Southern Nevada Water Authority 1-702-822-5300

Call before you Dig 811 1-800-227-2600 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH
HDR
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

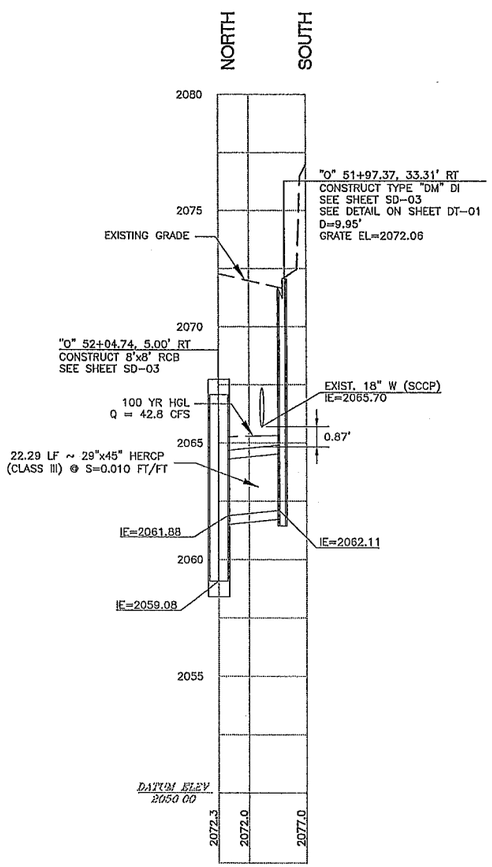
CITY OF LAS VEGAS NEVADA

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: STORM DRAIN LATERAL PROFILES

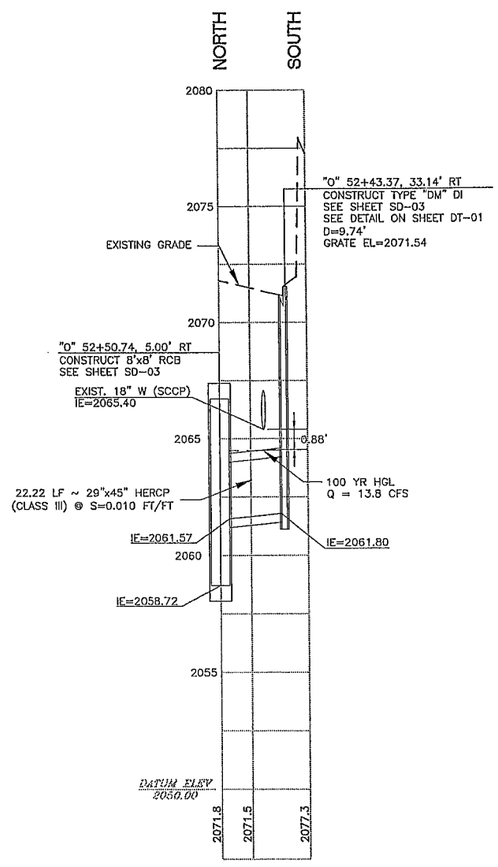
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

Sheet
SD-09
17 of 43
DRAWING NO.
XXXXXX

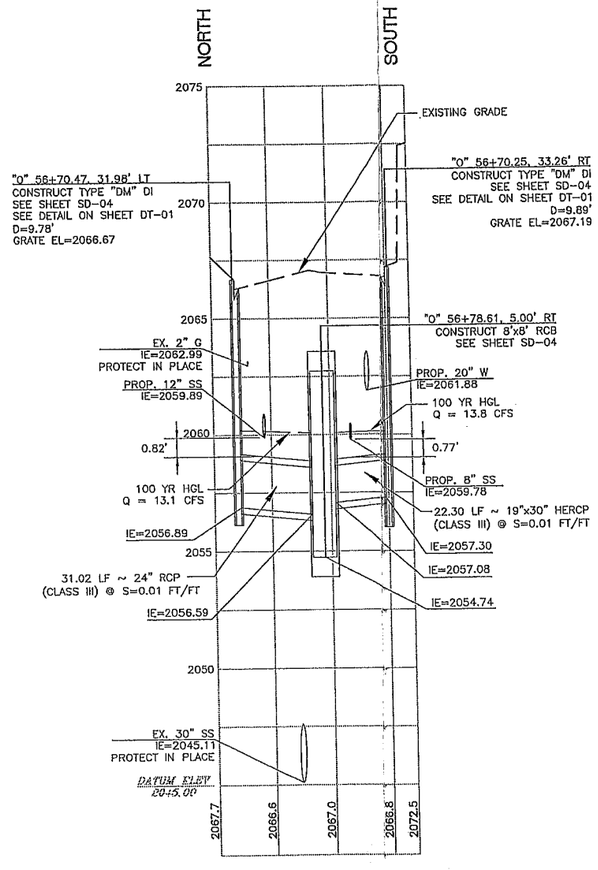
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LATERAL PROFILE "O" STA. 52+04.74 RT
LAT. 9



LATERAL PROFILE "O" STA. 52+50.74 RT
LAT. 10



LATERAL PROFILE "O" STA. 56+78.61
LAT. 11

LVVWD

DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you UnderGround
1-702-455-7511
1-702-432-5300

Call 811
1-800-227-2600
1-702-455-7544

Call before you OVERHEAD
1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

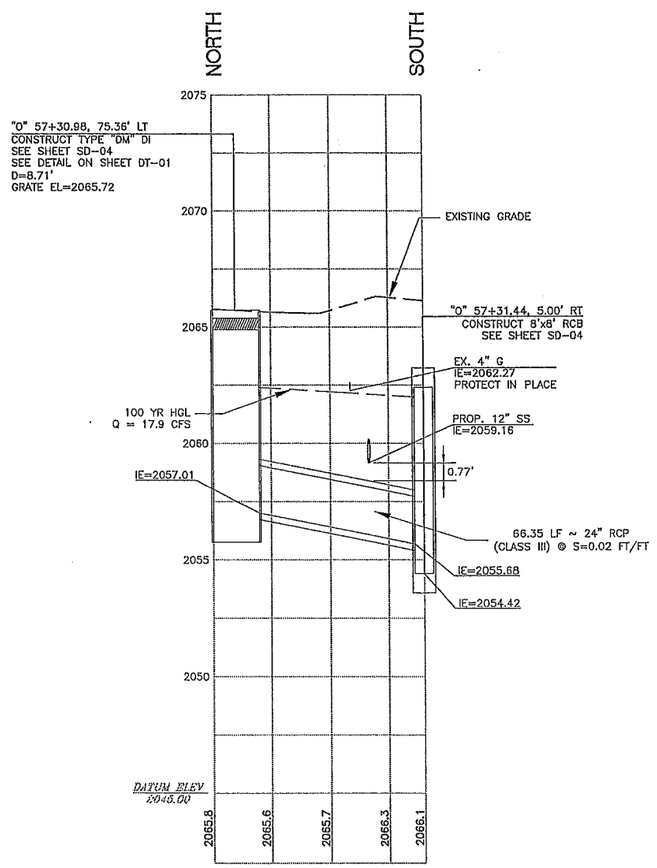
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: STORM DRAIN LATERAL PROFILES

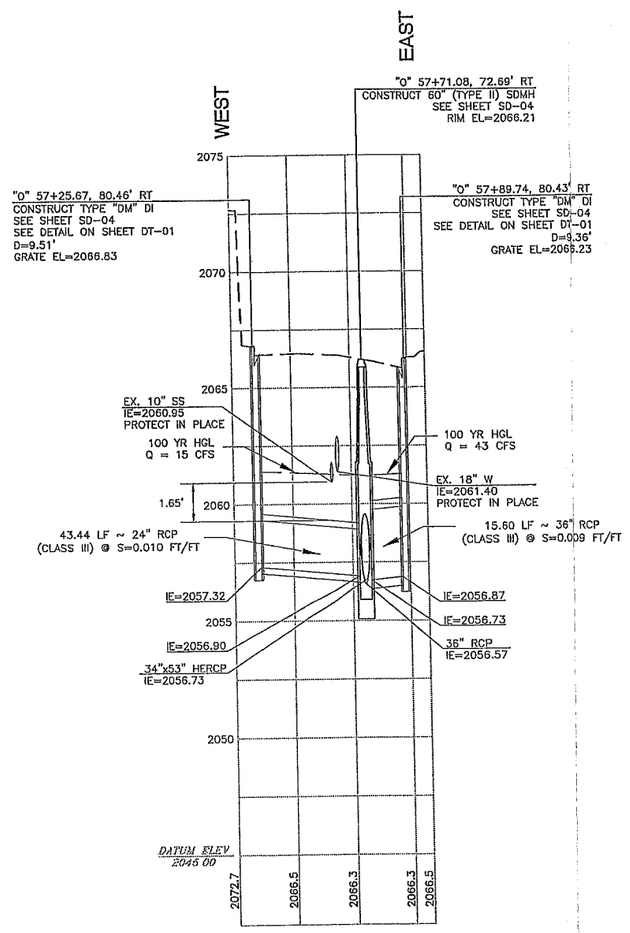
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017571

Sheet
SD-10
18 of 43
DRAWING NO.
XXXXXX

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LATERAL PROFILE "O" 57+31.44 LT
LAT. 12



LATERAL PROFILE "O" 57+71.08 RT
LAT. 13

LVVWD DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you UnderGround 1-702-455-7511 or 1-702-732-5300

Call 811 or 1-800-227-2600 or 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS			
NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY OF LAS VEGAS NEVADA

CITY ENGINEER:
PROJECT MANAGER: JORGE CERVANTES, P.E.
ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

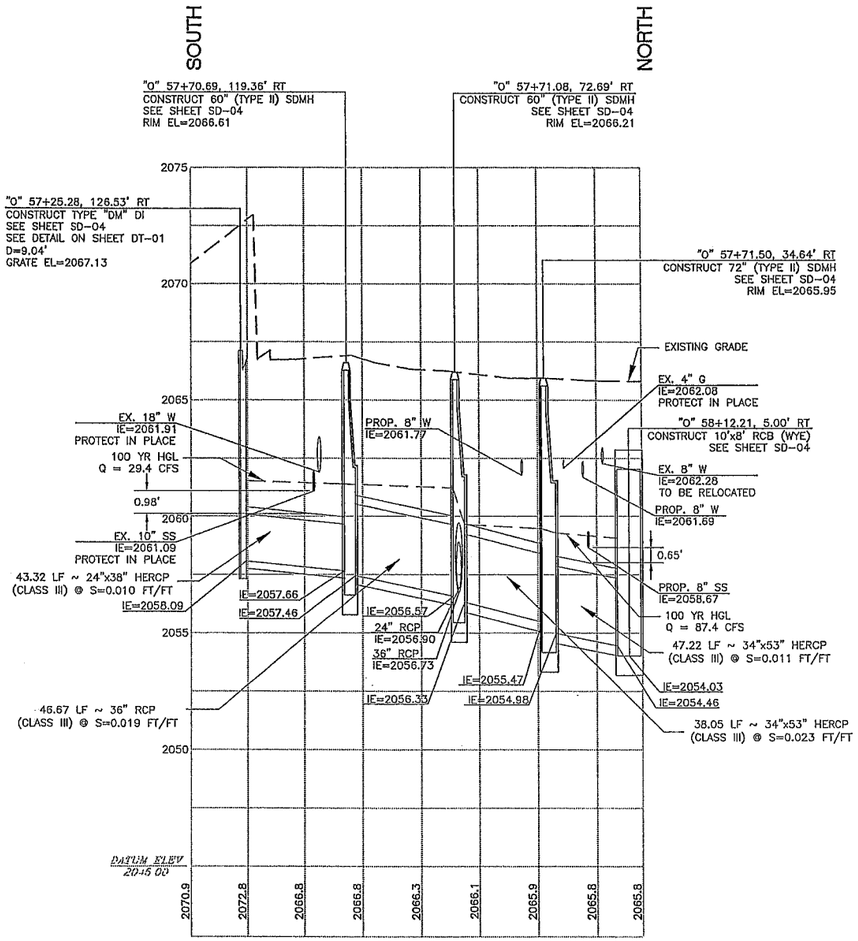
SHEET: STORM DRAIN LATERAL PROFILES

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

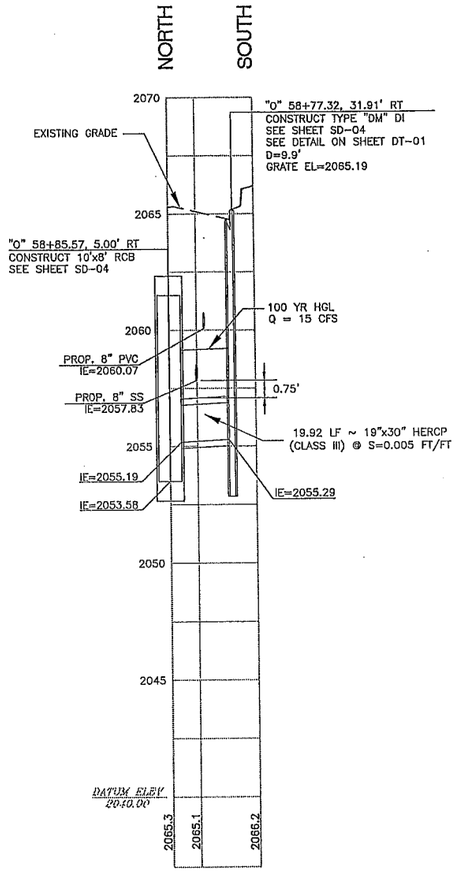
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SD-11
19 of 43

DRAWING NO.
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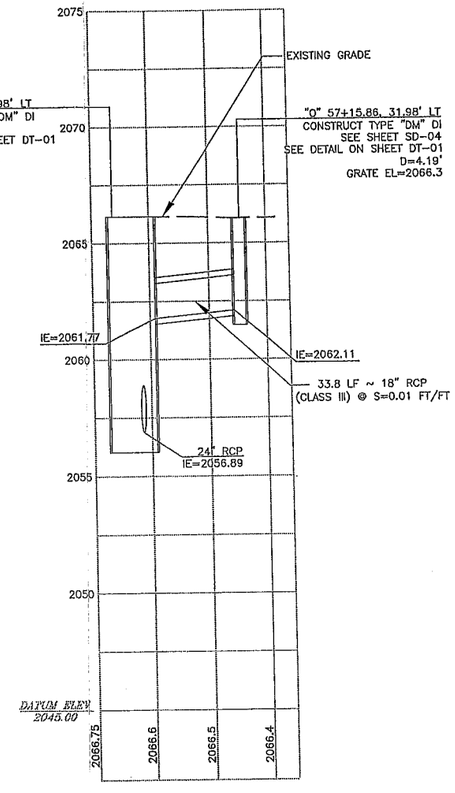
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LATERAL PROFILE "O" 58+12.21 RT
LAT. 14



LATERAL PROFILE "O" STA. 58+85.57 RT
LAT. 15



LATERAL PROFILE "O" STA. 56+70.47 LT
TO "O" STA. 57+15.86 LT
LAT. 16

LVVWD DATE

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you Dig Underground 1-702-455-7511 1-702-432-5300

Call 811 before you Dig 1-800-227-2600 1-702-455-7511

Call before you OVERHEAD 1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

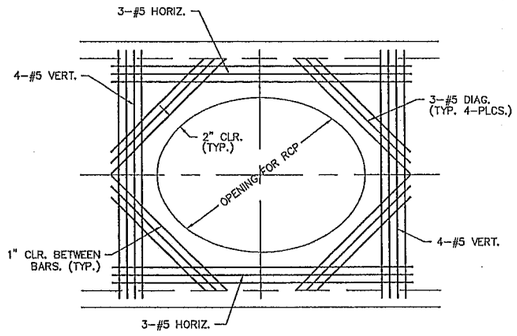
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: VP
CHECKED BY: RH
HDR
HDR Engineering, Inc.
HORIZONTAL SCALE: 1"=30'
VERTICAL SCALE: 1"=3'
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: STORM DRAIN LATERAL PROFILES

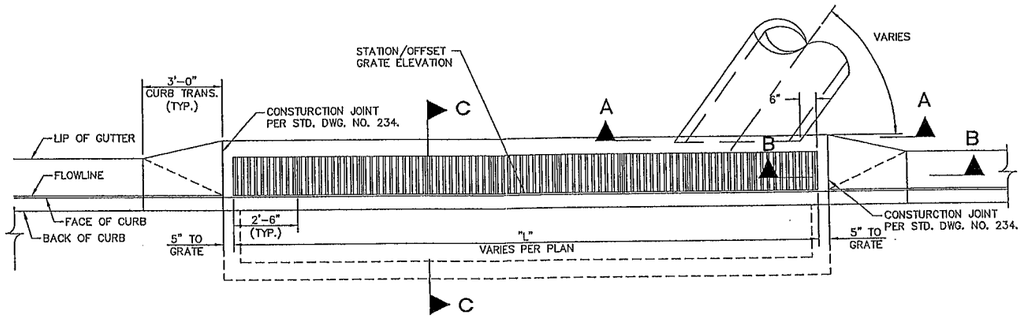
PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

Sheet SD-12
20 of 43
DRAWING NO. XXXXXX

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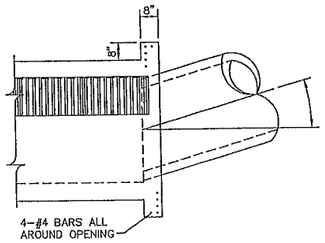
SECTION "A"
NTS



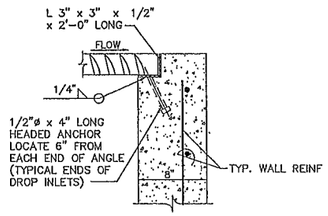
DROP INLET LAYOUT PLAN
NTS

NOTES:

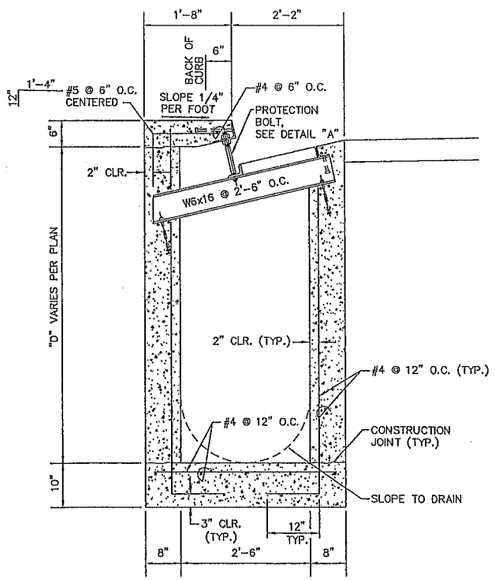
1. ALL EXPOSED METALS SHALL BE HOT DIP GALVANIZED AFTER FABRICATION.
2. PROVIDE 1/2" (MIN.) CLEARANCE ALL AROUND THE STEEL BEAM, DRY PACK AFTER INSTALLATION.
3. WHEN REQUIRED BY LENGTH OF OPENING, PLATE ANGLE MAYBE DELIVERED IN SECTIONS AND BUTT WELDED IN PLACE.
4. ALL GALVANIZING DAMAGED BY WELDING SHALL RECEIVE TWO COATS OF GALVALLOY OR EQUAL.
5. CONCRETE SHALL BE MODIFIED CLASS DA, SEE SPECIAL PROVISIONS SECTION 501.
6. ANGLE ANCHORS SHALL BE EMBEDDED MIDPOINT IN EACH ENDWALL AND EVENLY SPACED. (MAXIMUM SPACING OF 2')



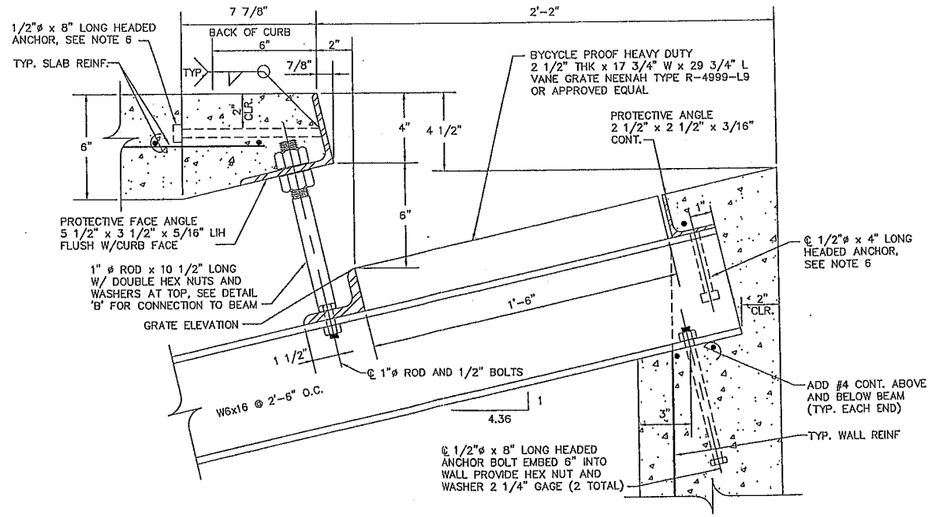
ALTERNATE CONNECTION DETAIL
NTS



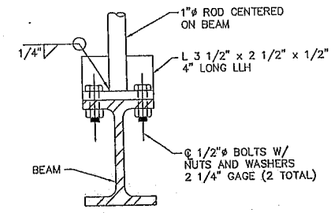
SECTION "B"
NTS



SECTION "C"
NTS



PROTECTIVE FACE + ROD - DETAIL "A"
NTS



DETAIL "B"
NTS

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

Call before you UnderGround 1-702-455-7511
1-702-870-5300
Call 811 1-800-227-2600
1-702-455-7944
Call before you OVERHEAD 1-702-593-6111

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

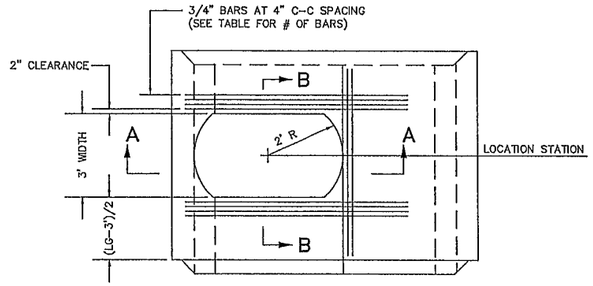
DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION
CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
HORIZONTAL SCALE: NTS
VERTICAL SCALE: NTS
DATE: 1/11/2008
DESIGNED BY: VP
DRAWN BY: MC
CHECKED BY: RH
HDR Engineering, Inc.

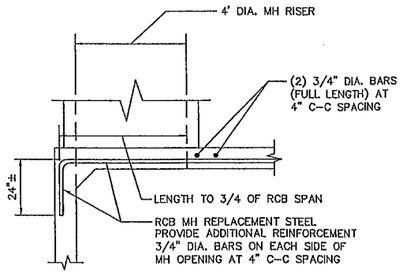
TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE
SHEET: DROP INLET DETAILS

RAJANISH HANUMANTHAIAH
Exp. 08-30-09
CIVIL
No. 017671
STATE OF NEVADA
PROFESSIONAL ENGINEER

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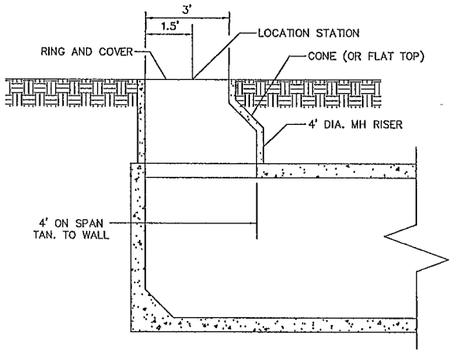
STEEL AREAS (IN^2)

	# OF BARS					
BAR DIA.	1	2	3	4	5	6
1/2"	0.196	0.392	0.588	0.784	0.980	1.176
5/8"	0.307	0.614	0.921	1.228	1.535	1.842
3/4"	0.442	0.884	1.326	1.768	2.210	2.652
7/8"	0.601	1.202	1.803	2.404	3.005	3.606
1"	0.785	1.570	2.355	3.140	3.925	4.710

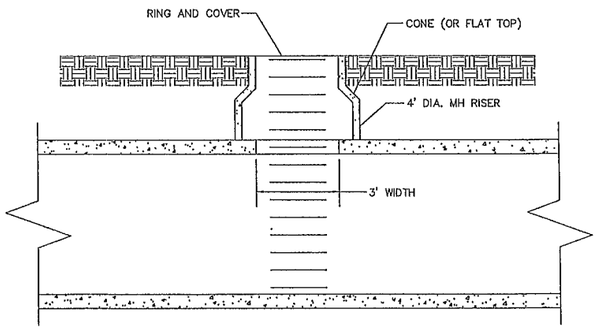
PRECAST RCB ACCESS MANHOLE NOTES:

1. SEE DRAINAGE PLANS SD-01 TO SD-6 FOR LOCATIONS.
2. MANHOLE FRAME AND LID SHALL BE NEENAH FOUNDRY COMPANY CATALOG NUMBER R-5901-H FOR GRATE LID OR R5900-H FOR SOLID LID OR APPROVED EQUAL.

PRECAST RCB ACCESS MANHOLE



SECTION A-A



SECTION B-B

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.

DESIGNED BY: VP
DRAWN BY: MC
CHECKED BY: RH

HDR Engineering, Inc.

HORIZONTAL SCALE: NTS
VERTICAL SCALE: NTS
DATE: 1/11/2008

NO.	DATE:	DESCRIPTION	APP'D
		REVISIONS	

TITLE:
OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET:
PRECAST RCB ACCESS MANHOLE

100%
SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

PROFESSIONAL ENGINEER STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

Sheet
DT-02
22 of 43

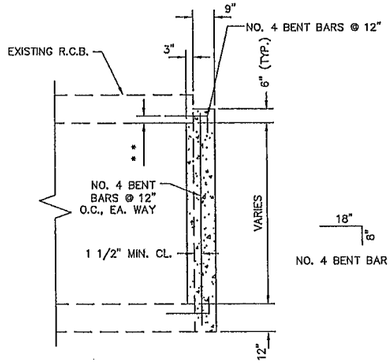
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1-702-455-7511
1-702-432-5300

Call before you Dig
Call 811
1-800-227-2600
1-702-455-7944

Call before you OVERHEAD
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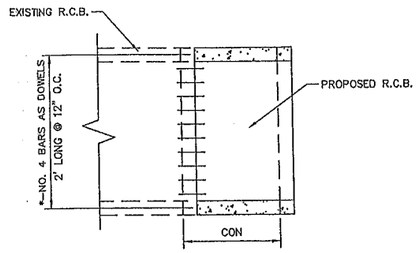
C:\Documents and Settings\jdonovan\Desktop\OAKEY\04c-002.dwg 01/14/08 4:51pm jdonovan



* *-3" TO CENTER OF HOLE

NOTE:
WIDTH AND HEIGHT VARIES

SECTION - METHOD OF PLUGGING R.C.B.

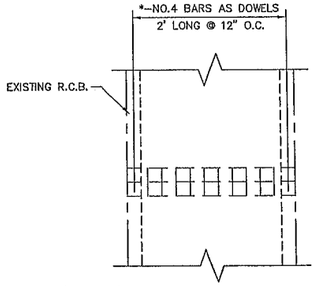


* - PLACE BARS IN CENTER OF WALLS AND SLABS

NOTE:

DOWELLING: DOWEL HOLES SHALL BE DRILLED 12" INTO EXISTING CONCRETE. DIAMETER OF HOLE SHALL BE 0.25" LARGER THAN DIAMETR OF BAR. HOLE MAY BE INCLINED NO MORE THAN 5° OFF THE HORIZONTAL. DOWELS SHALL BE EPOXIED INTO CLEAN HOLES.

PART LONGITUDINAL SECTION
RCB CULVERT EXTENSION



* - PLACE BARS IN CENTER OF WALLS AND SLABS

PLAN
RCB CULVERT EXTENSION

REVISIONS

NO.	DATE:	DESCRIPTION	APP'D

DEPARTMENT OF PUBLIC WORKS
ENGINEERING DESIGN SECTION

CITY ENGINEER: JORGE CERVANTES, P.E.
PROJECT MANAGER: ROSA CORTEZ, P.E.
DESIGNED BY: VP
DRAWN BY: MC
CHECKED BY: RH
HDR Engineering, Inc.
HORIZONTAL SCALE: NTS
VERTICAL SCALE: NTS
DATE: 1/11/2008

TITLE: OAKEY STORM DRAIN
BIRCH STREET TO CAHLAN DRIVE

SHEET: RCB PLUG AND EXTENSION DETAILS

100% SUBMITTAL
NOT FOR CONSTRUCTION
JAN 11, 2008

PROFESSIONAL ENGINEER - STATE OF NEVADA
RAJANISH HANUMANTHAIAH
Exp. 06-30-09
CIVIL
No. 017671

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Call before you Dig 811 1-800-227-2600 1-702-455-7444

Call before you OVERHEAD 1-702-593-6111

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