



CULVERT DESIGN

THE FOUNTAINS OF FAIRFIELD TOWNSHIP

Prepared: 7-18-08

PER DETENTION STUDY @ ANALYSIS POINT

$$Q_{50} = 631$$

$$Q_{100} = 750$$

Table 1 - Summary of Culvert Flows at Crossing: Culvert 1

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
699.50	0.00	0.00	0.00	1
702.09	60.00	60.00	0.00	1
703.24	120.00	120.00	0.00	1
704.20	180.00	180.00	0.00	1
705.08	240.00	240.00	0.00	1
705.91	300.00	300.00	0.00	1
706.72	360.00	360.00	0.00	1
707.56	420.00	420.00	0.00	1
708.44	480.00	480.00	0.00	1
708.86	506.60	506.60	0.00	1
710.43	600.00	600.00	0.00	1
710.55	606.67	606.67	0.00	Overtopping

50Yr. Elev.
100Yr. Elev.

$Q_{50} = 631$
 $Q_{100} = 750$

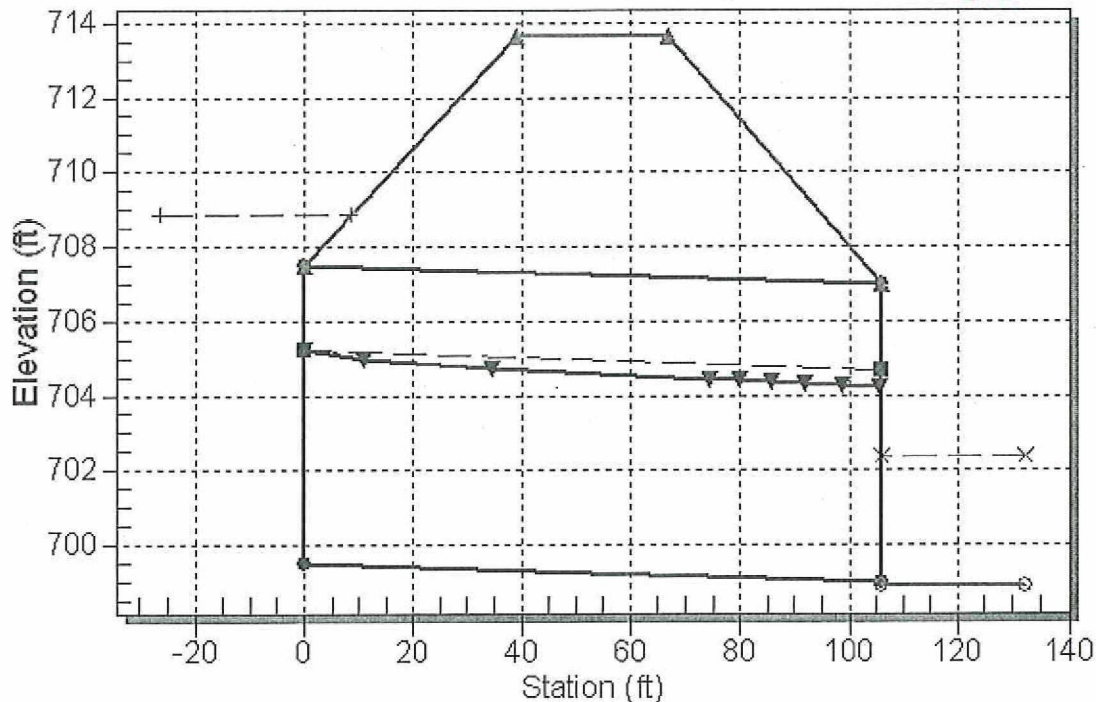
> DETENTION REPORT

Water Surface Profile Plot for Culvert: Culvert 1

Crossing - Culvert 1, Design Discharge - 506.6 cfs

Culvert - Culvert 1, Culvert Discharge - 506.6 cfs Q_{50}

$V_{50} = 10.01$ FPS



$Q_{100} = 600$

Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 699.50 ft

Outlet Station: 106.00 ft

Outlet Elevation: 698.97 ft

Number of Barrels: 1

$V_{100} = 11.94$ FPS

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 8.00 ft

Barrel Material: Corrugated Steel

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

CLOSEST TO SECTION #2
IN FLOOD STUDY

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	699.50	0.000	0.000	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
60.00	60.00	702.09	2.588	0.664	1-S2n	1.578	1.864	1.583	1.264	8.499	5.399
120.00	120.00	703.24	3.743	1.182	1-S2n	2.220	2.689	2.327	1.782	9.855	6.511
180.00	180.00	704.20	4.704	1.562	1-S2n	2.747	3.337	2.897	2.162	10.928	7.247
240.00	240.00	705.08	5.580	1.873	1-S2n	3.229	3.884	3.409	2.473	11.745	7.813
300.00	300.00	705.91	6.408	2.141	1-S2n	3.649	4.358	3.865	2.741	12.467	8.278
360.00	360.00	706.72	7.224	2.379	1-S2n	4.068	4.812	4.301	2.979	13.080	8.673
420.00	420.00	707.56	8.061	2.594	5-S2n	4.465	5.197	4.697	3.194	13.694	9.018
480.00	480.00	708.44	8.944	2.790	5-S2n	4.867	5.582	5.108	3.390	14.187	9.336
506.60	506.60	708.86	9.356	2.873	5-S2n	5.050	5.725	5.275	3.473	14.430	9.461
600.00	600.00	710.43	10.928	3.143	5-S2n	5.713	6.217	5.875	3.743	15.198	9.879

 Inlet Elevation (Invert): 699.50 ft, Outlet Elevation (Invert): 698.97 ft

Culvert Length: 106.00 ft, Culvert Slope: 0.0050

Culvert Performance Curve Plot: Culvert 1

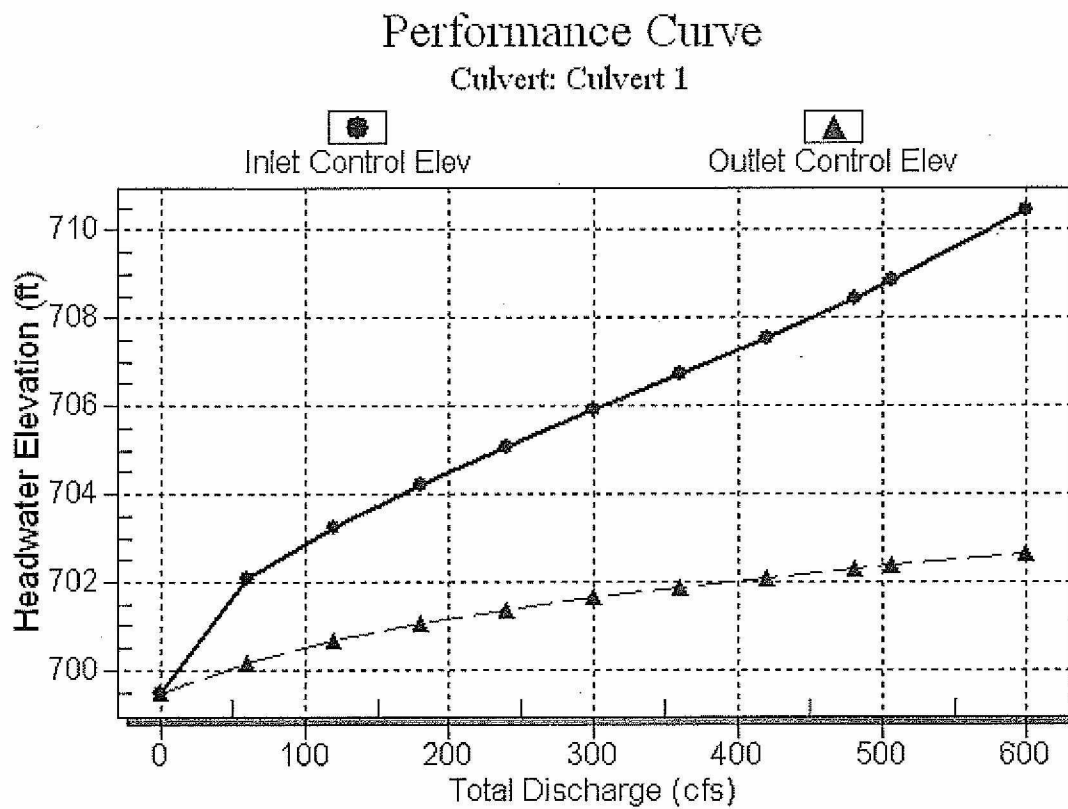


Table 3 - Downstream Channel Rating Curve (Crossing: Culvert 1)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
0.00	698.90	0.00	0.00	0.00	0.00
60.00	700.16	1.26	5.40	2.05	1.01
120.00	700.68	1.78	6.51	2.89	1.06
180.00	701.06	2.16	7.25	3.51	1.09
240.00	701.37	2.47	7.81	4.01	1.11
300.00	701.64	2.74	8.28	4.45	1.12
360.00	701.88	2.98	8.67	4.83	1.13
420.00	702.09	3.19	9.02	5.18	1.14
480.00	702.29	3.39	9.34	5.50	1.15
506.60	702.37	3.47	9.46	5.63	1.16
600.00	702.64	3.74	9.88	6.07	1.17

Tailwater Channel Data - Culvert 1

Tailwater Channel Option: Trapezoidal Channel

Bottom Width: 5.00 ft → *SCALES AT 11' ON FLOOD STUDY*

Side Slope (H:V): 3.00 (-1)

Channel Slope: 0.0260

Channel Manning's n: 0.0400

Channel Invert Elevation: 698.90 ft

*SECTION #2
9' BOTTOM*

SECTION #1 & 3

SECTION #2

1.0% IN FLOOD STUDY 1.4%

LOW HEAVY BRUSH ON BANKS 0.05 TO

**0.06*

Roadway Data for Crossing: Culvert 1

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
1	3000.00	713.63
2	3025.00	712.56
3	3050.00	711.73
4	3075.00	711.11
5	3100.00	710.73
6	3125.00	710.56
7	3130.56	710.55
8	3150.00	710.63
9	3175.00	710.80
10	3200.00	710.98
11	3223.19	711.14

Roadway Surface: Paved

Roadway Top Width: 28.00 ft

*2 USE SINCE
THE IS SOME
WEAVER*

<u>Hyd.</u>	<u>Origin</u>	<u>Description</u>
1	SCS Runoff	WM Store/ Area Behind Loes
2	SCS Runoff	Lowes Outlots
3	SCS Runoff	Lowes Parking Lot
4	SCS Runoff	Area Around Lowes
5	SCS Runoff	Lowes Store
6	SCS Runoff	Detention Area
7	Combine	Walmart Inflow to Basin
8	Reservoir	Offsite Area 1 WalMart
9	SCS Runoff	Onsite Post-Developed
10	SCS Runoff	Offsite Area 2
11	SCS Runoff	Offsite Area 3
12	Reservoir	Proposed Basin Outlet
13	Combine	Post-Developed Flow at Analysis Point
14	Combine	Culvert Design Flow

Hydrograph Report

Hydraflow Hydrographs by Intelisolve v9.2

Friday, Jul 18, 2008

Hyd. No. 14

Culvert Design Flow

Hydrograph type = Combine
Storm frequency = 50 yrs
Time interval = 2 min
Inflow hyds. = 8, 9, 10

Peak discharge = 506.58 cfs
Time to peak = 724 min
Hyd. volume = 1,600,295 cuft
Contrib. drain. area = 156.800 ac

Hydrograph Discharge Table

(Printed values >= 5.00% of Qp.)

Time (min)	Hyd. 8 + (cfs)	Hyd. 9 + (cfs)	Hyd. 10 + (cfs)	Outflow (cfs)
656	4.464	13.56	7.662	25.69
658	4.551	13.90	7.957	26.41
660	4.641	14.24	8.263	27.14
662	4.733	14.58	8.581	27.90
664	4.828	14.95	8.915	28.69
666	4.927	15.35	9.266	29.54
668	5.008	15.80	9.639	30.45
670	5.081	16.31	10.04	31.43
672	5.158	16.88	10.46	32.50
674	5.240	17.51	10.92	33.67
676	5.328	18.19	11.41	34.93
678	5.420	18.91	11.94	36.27
680	5.503	19.67	12.51	37.68
682	5.588	20.45	13.12	39.15
684	5.678	21.24	13.76	40.69
686	5.772	22.05	14.45	42.28
688	5.853	22.86	15.18	43.90
690	5.919	23.68	15.95	45.55
692	5.990	24.78	16.83	47.60
694	6.062	26.72	17.98	50.76
696	6.006	30.06	19.58	55.64
698	5.932	35.38	21.82	63.13
700	6.185	43.27	24.92	74.37
702	6.582	53.89	29.10	89.57
704	7.071	66.94	34.63	108.65
706	7.644	82.26	41.84	131.74
708	8.279	100.53	51.40	160.20
710	8.976	122.56	63.99	195.52
712	9.766	149.18	80.27	239.22
714	10.66	181.24	100.94	292.84
716	11.61	216.48	125.43	353.53
718	12.61	248.40	151.73	412.74
720	13.59	270.37	177.64	461.60
722	14.48	277.73 <<	201.79	493.99
724	15.24	267.73	223.61	506.58 <<
726	15.84	242.37	241.97	500.17
728	16.29	208.48	255.53	480.30
730	16.62	173.01	262.81 <<	452.44
732	16.85	139.67	262.19	418.71
734	16.99	109.60	254.03	380.62
736	17.08	83.94	240.98	342.00
738	17.14	63.89	225.90	306.93
740	17.18	50.66	210.30	278.14
742	17.21	43.64	194.33	255.18

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Hydrograph Discharge Table

Time (min)	Hyd. 8 + (cfs)	Hyd. 9 + (cfs)	Hyd. 10 + (cfs)	Outflow (cfs)
744	17.24	40.36	178.09	235.70
746	17.26	38.34	161.74	217.35
748	17.28	36.33	145.42	199.03
750	17.29	34.32	129.29	180.91
752	17.30	32.33	113.55	163.18
754	17.30 <<	30.41	98.43	146.14
756	17.30	28.61	84.38	130.29
758	17.29	26.98	71.95	116.22
760	17.29	25.56	61.71	104.56
762	17.28	24.37	54.31	95.95
764	17.26	23.37	49.64	90.27
766	17.25	22.53	46.74	86.52
768	17.23	21.83	44.57	83.63
770	17.22	21.24	42.59	81.04
772	17.20	20.72	40.78	78.70
774	17.18	20.25	39.14	76.56
776	17.16	19.79	37.64	74.59
778	17.14	19.33	36.28	72.74
780	17.11	18.87	35.04	71.02
782	17.09	18.41	33.92	69.42
784	17.06	17.96	32.90	67.92
786	17.04	17.53	31.97	66.53
788	17.01	17.12	31.12	65.25
790	16.98	16.74	30.35	64.07
792	16.95	16.39	29.63	62.98
794	16.92	16.07	28.97	61.97
796	16.89	15.77	28.36	61.02
798	16.86	15.49	27.77	60.13
800	16.83	15.23	27.21	59.27
802	16.80	14.97	26.68	58.44
804	16.76	14.72	26.16	57.65
806	16.73	14.47	25.67	56.87
808	16.70	14.22	25.20	56.11
810	16.66	13.97	24.74	55.37
812	16.63	13.73	24.30	54.65
814	16.59	13.48	23.87	53.94
816	16.55	13.24	23.45	53.25
818	16.52	13.01	23.05	52.58
820	16.48	12.79	22.67	51.94
822	16.44	12.58	22.29	51.31
824	16.40	12.38	21.92	50.70
826	16.37	12.18	21.57	50.11
828	16.33	11.99	21.22	49.54
830	16.29	11.81	20.88	48.98
832	16.25	11.63	20.55	48.43
834	16.21	11.45	20.23	47.88
836	16.17	11.27	19.91	47.35
838	16.13	11.09	19.60	46.82
840	16.08	10.92	19.30	46.30
842	16.04	10.74	19.00	45.78
844	16.00	10.57	18.70	45.27
846	15.96	10.41	18.42	44.78
848	15.91	10.26	18.14	44.32
850	15.87	10.12	17.88	43.88
852	15.83	10.01	17.63	43.46
854	15.78	9.905	17.39	43.08

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Hydrograph Report

Hydraflow Hydrographs by Intellisolve v9.2

Friday, Jul 18, 2008

Hyd. No. 14

Culvert Design Flow

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Storm frequency = 100 yrs
Time interval = 2 min
Inflow hyds. = 8, 9, 10

Peak discharge = 599.59 cfs
Time to peak = 724 min
Hyd. volume = 1,600,295 cuft
Contrib. drain. area = 156.800 ac

Hydrograph Discharge Table

(Printed values >= 5.00% of Qp.)

Time (min)	Hyd. 8 + (cfs)	Hyd. 9 + (cfs)	Hyd. 10 + (cfs)	Outflow (cfs)
652	5.104	15.25	10.06	30.40
654	5.169	15.63	10.41	31.21
656	5.237	16.01	10.77	32.03
658	5.307	16.40	11.15	32.86
660	5.380	16.79	11.55	33.72
662	5.451	17.19	11.96	34.60
664	5.515	17.62	12.38	35.51
666	5.581	18.08	12.83	36.49
668	5.650	18.60	13.31	37.56
670	5.723	19.19	13.82	38.73
672	5.800	19.86	14.36	40.02
674	5.859	20.59	14.94	41.39
676	5.915	21.38	15.57	42.86
678	5.974	22.21	16.24	44.43
680	6.037	23.09	16.97	46.09
682	6.041	23.99	17.75	47.78
684	5.999	24.91	18.57	49.48
686	5.954	25.84	19.45	51.25
688	5.962	26.78	20.37	53.12
690	6.119	27.72	21.34	55.19
692	6.284	29.00	22.46	57.74
694	6.462	31.24	23.92	61.63
696	6.667	35.12	25.96	67.75
698	6.921	41.30	28.82	77.04
700	7.243	50.46	32.75	90.46
702	7.646	62.78	38.05	108.48
704	8.128	77.90	45.04	131.07
706	8.676	95.61	54.11	158.40
708	9.309	116.69	66.08	192.07
710	10.03	142.05	81.76	233.84
712	10.86	172.64	101.89	285.39
714	11.75	209.40	127.26	348.41
716	12.73	249.73	157.15	419.60
718	13.76	286.16	189.07	488.99
720	14.76	311.12	220.38	546.26
722	15.69	319.29 <<	249.44	584.42
724	16.46	307.57	275.56	599.59 <<
726	17.09	278.26	297.35	592.71
728	17.56	239.24	313.23	570.02
730	17.89	198.43	321.43 <<	537.75
732	18.13	160.11	320.06	498.29
734	18.28	125.56	309.60	453.43
736	18.37	96.11	293.28	407.77
738	18.44	73.12	274.56	366.11

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Hydrograph Discharge Table

Time (min)	Hyd. 8 + (cfs)	Hyd. 9 + (cfs)	Hyd. 10 + (cfs)	Outflow (cfs)
740	18.48	57.95	255.24	331.67
742	18.52	49.91	235.49	303.92
744	18.55	46.16	215.47	280.19
746	18.58	43.85	195.36	257.79
748	18.60	41.55	175.34	235.49
750	18.62	39.24	155.61	213.47
752	18.63	36.97	136.39	191.99
754	18.64	34.77	117.99	171.40
756	18.64 <<	32.71	100.95	152.31
758	18.64	30.84	85.92	135.40
760	18.64	29.22	73.58	121.43
762	18.63	27.85	64.68	111.16
764	18.62	26.71	59.08	104.41
766	18.61	25.75	55.61	99.97
768	18.60	24.95	53.01	96.56
770	18.58	24.27	50.64	93.50
772	18.57	23.68	48.48	90.73
774	18.55	23.14	46.51	88.20
776	18.53	22.61	44.72	85.87
778	18.52	22.08	43.09	83.69
780	18.50	21.56	41.61	81.67
782	18.48	21.03	40.27	79.78
784	18.45	20.52	39.05	78.02
786	18.43	20.03	37.94	76.40
788	18.41	19.56	36.92	74.89
790	18.38	19.13	36.00	73.51
792	18.36	18.73	35.15	72.24
794	18.33	18.36	34.36	71.06
796	18.31	18.02	33.63	69.95
798	18.28	17.70	32.93	68.90
800	18.25	17.39	32.26	67.90
802	18.22	17.10	31.62	66.94
804	18.19	16.81	31.01	66.01
806	18.16	16.53	30.42	65.11
808	18.13	16.24	29.85	64.23
810	18.10	15.96	29.30	63.37
812	18.07	15.68	28.78	62.52
814	18.04	15.40	28.27	61.70
816	18.01	15.13	27.77	60.90
818	17.97	14.86	27.29	60.13
820	17.94	14.61	26.83	59.38
822	17.91	14.37	26.38	58.65
824	17.87	14.13	25.95	57.95
826	17.84	13.91	25.52	57.27
828	17.80	13.70	25.11	56.61
830	17.77	13.49	24.71	55.96
832	17.73	13.28	24.31	55.32
834	17.69	13.08	23.93	54.70
836	17.66	12.87	23.55	54.08
838	17.62	12.67	23.18	53.47
840	17.58	12.46	22.82	52.87
842	17.54	12.26	22.46	52.27
844	17.50	12.07	22.12	51.69
846	17.47	11.88	21.78	51.13
848	17.43	11.71	21.45	50.59
850	17.39	11.56	21.14	50.08

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