

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: User Defined

Site Data - Existing Culvert

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 143.60 ft

Outlet Station: 48.00 ft

Outlet Elevation: 140.70 ft

Number of Barrels: 1

Culvert Data Summary - Existing Culvert

Barrel Shape: User Defined

Barrel Span: 11.00 ft

Barrel Rise: 6.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0380 (bottom)

Culvert Type: Straight

Inlet Configuration: Square Edge with Headwall

Inlet Depression: None

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

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Existing Culvert Discharge (cfs)	Roadway Discharge (cfs)	Iterations
144.14	Q1.1	14.80	14.80	0.00	1
145.14	Q10	75.30	75.30	0.00	1
145.48	Q25	100.90	100.90	0.00	1
145.73	Q50	122.10	122.10	0.00	1
145.99	Q100	145.00	145.00	0.00	1
146.62	Q500	205.40	205.40	0.00	1
152.40	Overtopping	762.67	762.67	0.00	Overtopping

Table 2 - Culvert Summary Table: Existing Culvert

Discharge Names	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)
Q1.1	14.80	14.80	144.14	0.537	0.0*	1-S2n	0.299	0.377	0.299	0.251	4.388	6.642
Q10	75.30	75.30	145.14	1.544	0.0*	1-S2n	0.801	1.132	0.801	0.651	8.330	11.819
Q25	100.90	100.90	145.48	1.879	0.0*	1-S2n	0.957	1.383	0.957	0.771	9.341	13.021
Q50	122.10	122.10	145.73	2.134	0.0*	1-S2n	1.076	1.573	1.076	0.860	10.053	13.851
Q100	145.00	145.00	145.99	2.392	0.0*	1-S2n	1.193	1.760	1.246	0.949	10.310	14.630
Q500	205.40	205.40	146.62	3.017	0.0*	1-S2n	1.476	2.219	1.534	1.141	11.857	16.558

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert

Inlet Elevation (invert): 143.60 ft, Outlet Elevation (invert): 140.70 ft

Culvert Length: 48.09 ft, Culvert Slope: 0.0604

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

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.80	142.25	0.25	6.64	3.13	2.41
75.30	142.65	0.65	11.82	8.13	2.77
100.90	142.77	0.77	13.02	9.62	2.83
122.10	142.86	0.86	13.85	10.74	2.87
145.00	142.95	0.95	14.63	11.84	2.90
205.40	143.14	1.14	16.56	14.24	3.03

Tailwater Channel Data - Existing Culvert

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.2000

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	146.00	0.0800
2	11.65	145.00	0.0800
3	14.95	144.00	0.0800
4	18.27	143.00	0.0380
5	21.64	142.00	0.0380
6	29.97	142.00	0.0800
7	31.04	143.00	0.0800
8	32.12	144.00	0.0800
9	33.19	145.00	0.0800
10	34.26	146.00	0.0800

Roadway Data for Crossing: Existing Culvert

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	153.10
1	48.00	152.40
2	100.00	152.60

Roadway Surface: Paved

Roadway Top Width: 40.00 ft

HY-8 Culvert Analysis Report

Crossing Discharge Data

Discharge Selection Method: User Defined

Site Data - Three Frame 13' x 3'

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 144.57 ft

Outlet Station: 100.00 ft

Outlet Elevation: 140.26 ft

Number of Barrels: 1

Culvert Data Summary - Three Frame 13' x 3'

Barrel Shape: User Defined

Barrel Span: 13.00 ft

Barrel Rise: 5.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120 (top and sides)

Manning's n: 0.0380 (bottom)

Culvert Type: Straight

Inlet Configuration: Beveled Edge

Inlet Depression: None

Table 1 - Summary of Culvert Flows at Crossing: Three Frame 13' x 3'

Headwater Elevation (ft)	Discharge Names	Total Discharge (cfs)	Three Frame 13' x 3' Discharge (cfs)	Roadway Discharge (cfs)	Iterations
145.06	Q1.1	14.80	14.80	0.00	1
145.97	Q10	75.30	75.30	0.00	1
146.27	Q25	100.90	100.90	0.00	1
146.50	Q50	122.10	122.10	0.00	1
146.73	Q100	145.00	145.00	0.00	1
147.30	Q500	205.40	205.40	0.00	1
154.50	Overtopping	879.05	879.05	0.00	Overtopping

Table 2 - Culvert Summary Table: Three Frame 13' x 3'

Discharge Names	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)
Q1.1	14.80	14.80	145.06	0.491	0.0*	1-S2n	0.341	0.352	0.341	0.234	3.519	5.690
Q10	75.30	75.30	145.97	1.399	0.0*	1-S2n	0.915	1.078	0.915	0.614	6.680	10.320
Q25	100.90	100.90	146.27	1.700	0.0*	1-S2n	1.091	1.309	1.091	0.729	7.513	11.418
Q50	122.10	122.10	146.50	1.928	0.0*	1-S2n	1.223	1.482	1.223	0.815	8.106	12.179
Q100	145.00	145.00	146.73	2.162	0.0*	1-S2n	1.356	1.662	1.356	0.902	8.681	12.896
Q500	205.40	205.40	147.30	2.732	0.0*	1-S2n	1.672	2.138	1.672	1.104	9.973	14.443

* Full Flow Headwater elevation is below inlet invert.

Straight Culvert

Inlet Elevation (invert): 144.57 ft, Outlet Elevation (invert): 140.26 ft

Culvert Length: 100.09 ft, Culvert Slope: 0.0431

Table 3 - Downstream Channel Rating Curve (Crossing: Three Frame 13' x 3')

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)	Velocity (ft/s)	Shear (psf)	Froude Number
14.80	141.23	0.23	5.69	2.28	2.12
75.30	141.61	0.61	10.32	5.99	2.44
100.90	141.73	0.73	11.42	7.11	2.50
122.10	141.82	0.82	12.18	7.95	2.53
145.00	141.90	0.90	12.90	8.79	2.56
205.40	142.10	1.10	14.44	10.77	2.62

Tailwater Channel Data - Three Frame 13' x 3'

Tailwater Channel Option: Irregular Channel

Channel Slope: 0.1563

User Defined Channel Cross-Section:

Coord No.	Station (ft)	Elevation (ft)	Manning's n
1	0.00	144.00	0.0800
2	18.86	144.00	0.0800
3	21.01	143.00	0.0800
4	23.17	142.00	0.0800
5	25.47	141.00	0.0380
6	36.10	141.00	0.0800
7	37.88	142.00	0.0800
8	39.23	143.00	0.0800
9	40.58	144.00	0.0800
10	41.93	145.00	0.0800
11	43.27	146.00	0.0800
12	44.62	147.00	0.0800

Roadway Data for Crossing: Three Frame 13' x 3'

Roadway Profile Shape: Irregular Roadway Shape (coordinates)

Irregular Roadway Cross-Section:

Coord No.	Station (ft)	Elevation (ft)
0	0.00	156.00
1	50.00	155.20
2	100.00	154.50

Roadway Surface: Paved

Roadway Top Width: 40.00 ft