Culvert Rating Curve using HY-8

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Introduction

This tutorial describes how to create a rating curve for a box culvert on IH-10 using the HY-8 culvert hydraulic analysis program. The program can be obtained from:

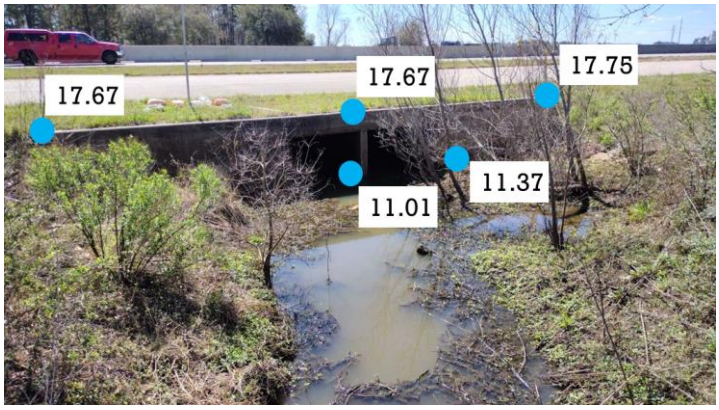
https://www.fhwa.dot.gov/engineering/hydraulics/software/hy8/

This tutorial uses information from an ArcGIS description of how to create a 3D culvert at:

https://www.caee.utexas.edu/prof/maidment/RoadElevationModel/Culvert/IH10Culvert.pdf

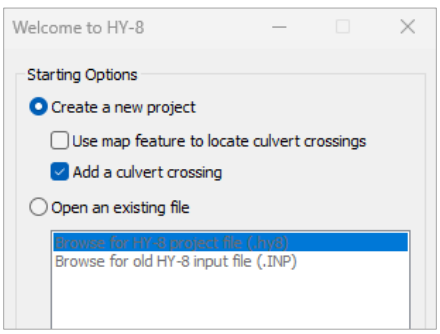
Data

The culvert structure consists of two adjacent concrete box culverts that are 6ft wide and 5 ft high. The culvert is 293 ft long and passes under IH-10 southwest of Beaumont, Texas. The culvert invert is flat and is at elevation 11.35 ft. The overlaying road is also flat and is at elevation 17.71 ft. There is square edged entrance and a flat head wall.

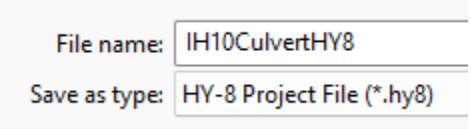


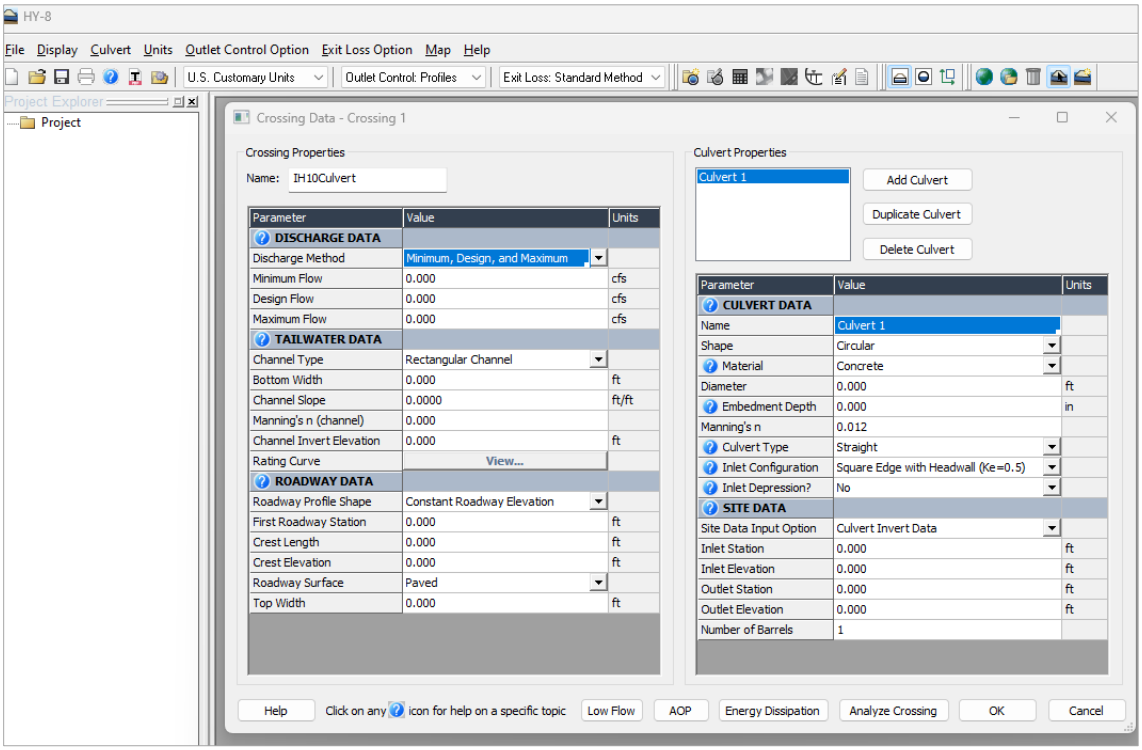
Procedure

1. Open the HY-8 program and Create a new Project and add a culvert crossing called IH10Culvert.

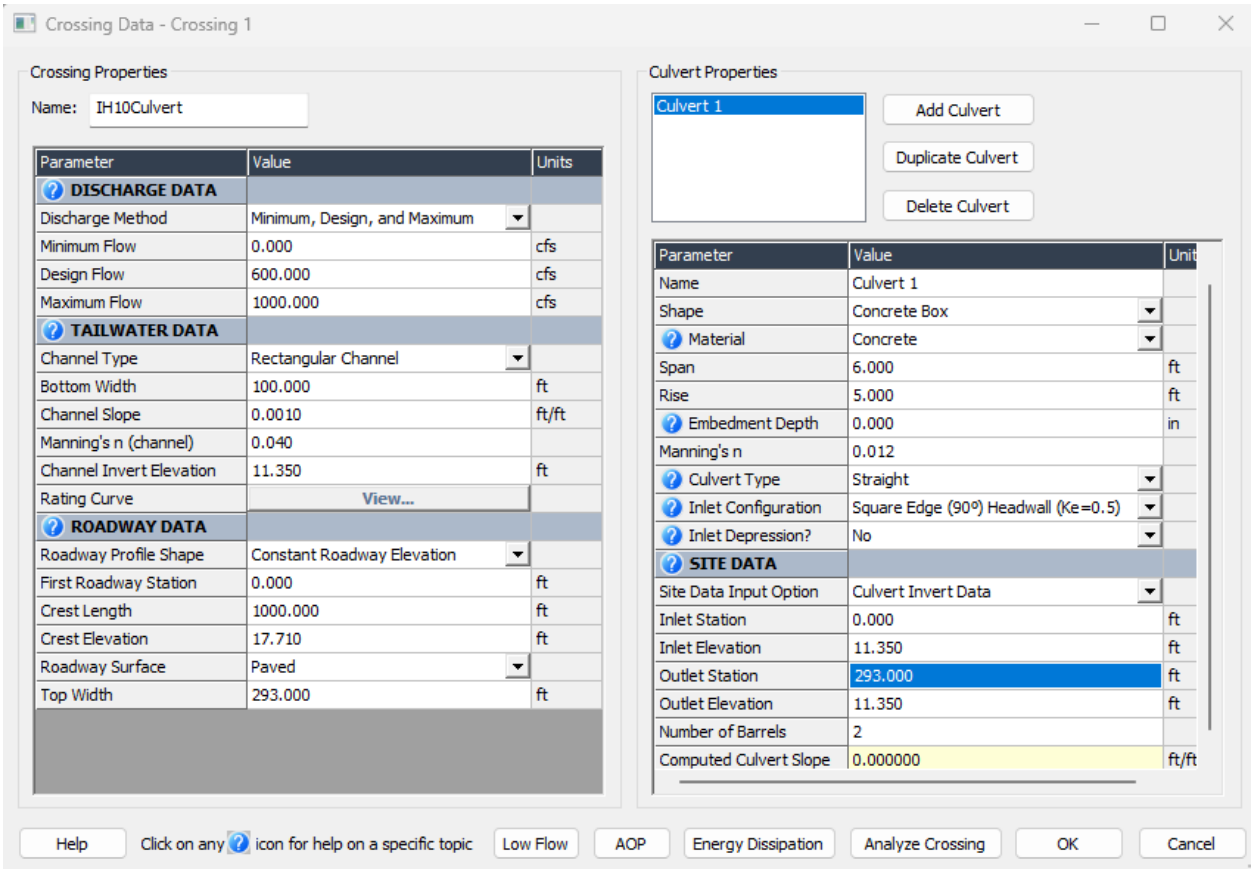


Use File/Save to save the file as **IH10CulvertHY8**





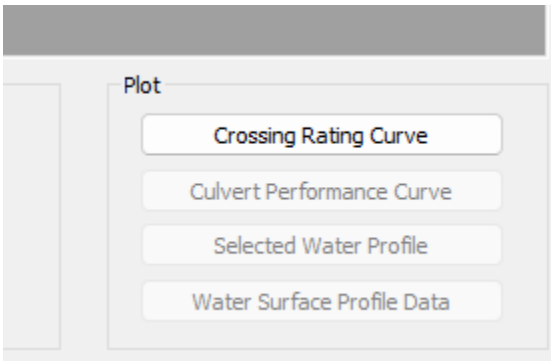
Fill in the input data for the culvert as shown below. Note that this is one culvert with two barrels.



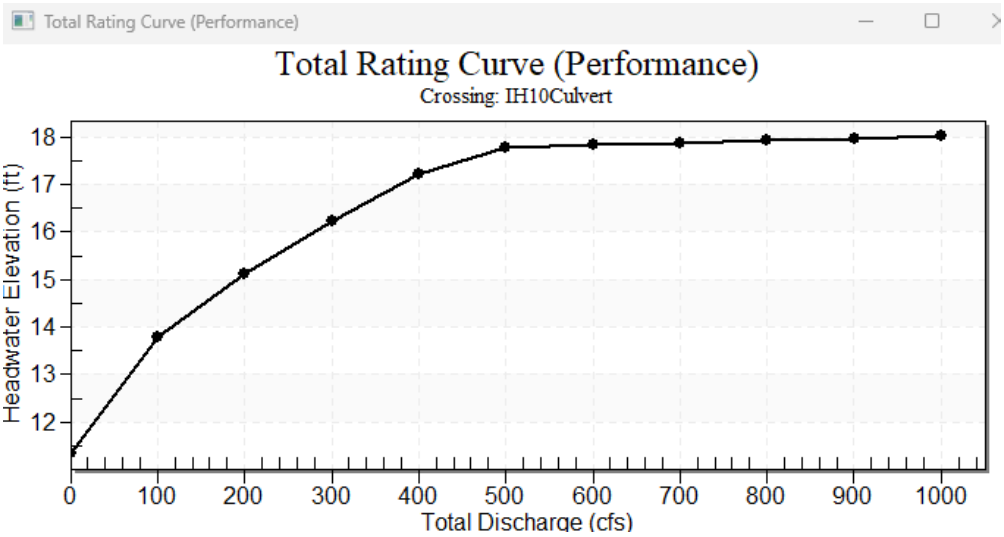
Hit the button at the bottom of the screen that says **Analyze Crossing** and the following result appears

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
11.35	0.00	0.00	0.00	1
13.78	100.00	100.00	0.00	1
15.11	200.00	200.00	0.00	1
16.22	300.00	300.00	0.00	1
17.21	400.00	400.00	0.00	1
17.76	500.00	466.60	31.83	18
17.83	600.00	477.75	120.32	5
17.88	700.00	486.41	211.74	4
17.93	800.00	491.97	307.02	4
17.97	900.00	495.74	403.81	4
18.01	1000.00	499.14	499.30	3
17.71	458.34	458.34	0.00	Overtopping

Select Plot Crossing Rating Curve



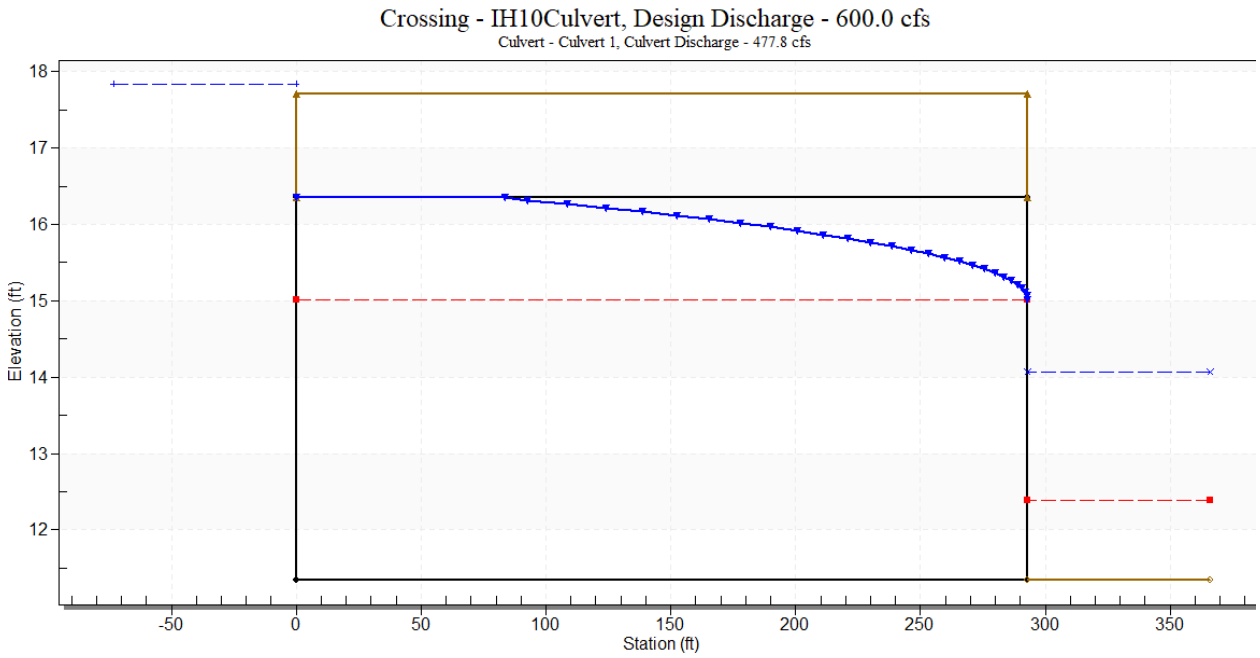
And the resulting rating curve appears as:



Use File/Save to resave the file as **IH10CulvertHY8**

Results

The water surface profile within the culvert for a discharge of 600 cfs is shown below. Of this, 477.75 cfs passes through the pipe and 120.32 cfs across the road. The water surface elevation on the road is 17.83 ft, compared to the road surface elevation of 17.71 ft, so the depth of water on the road is 0.12 ft, or 1.4 inches. For a discharge of 1000 cfs, about half the water goes through the culvert and half over the road, the depth on the road surface being 18.01 – 17.71 = 0.3 ft or about 4 inches.


Crossing - IH10Culvert, Design Discharge - 600.0 cfs
Culvert - Culvert 1, Culvert Discharge - 477.8 cfs
Elevation (ft)
18
17
16
15
14
13
12
-50
0
50
100
150
200
250
300
350
Station (ft)