CE 3354 Engineering Hydrology
Exercise Set 8

Exercises

1. Figure 1 is a modeling layout for a HEC-HMS analysis of the US-84 crossing (lower right corner of the image).

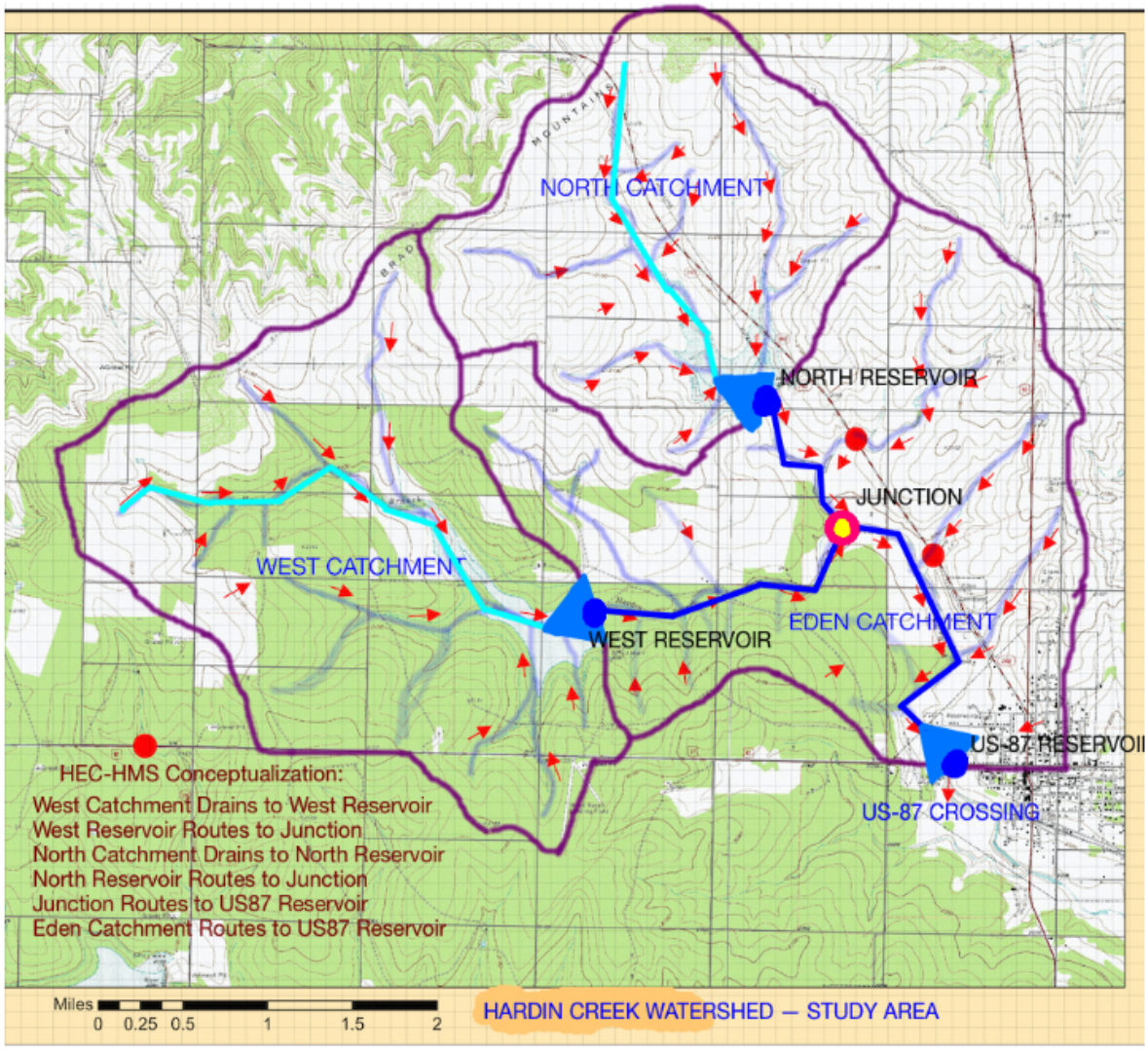

Figure 18. Hardin Creek Watershed with HEC-HMS Conceptualization Overlay

Figure 1: HEC-HMS Configuration for Hardin Creek Analysis

Supporting data are:

Table 1: Unit Hydrograph Parameters for 3 Catchments

Name	Area (sq.mi.)	Length (mi)	Slope	T_c (hrs)	Basin Lag (hrs)
North	3.83	2.74	0.006	5.19	3.11
West	6.04	3.44	0.004	7.98	4.78
Eden	6.95	3.69	0.005	4.76	2.85

Table 2: Elevation-Area for North Reservoir

Pool Elevation (ft)	Surface Area (acres)
2055	0.0
2065	61.44
2070	115.2
2076	192.0

Table 3: Elevation-Area for West Reservoir

Pool Elevation (ft)	Surface Area (acres)
2065	0.0
2075	115.20
2080	235.52
2087	329.60

The outlet(s) for the North and West Reservoirs are 4-foot diameter orifices that activate at 10 feet above the dam base (empty pool) elevation. These drain into the streams on the downstream side of each dam.

Table 4: Elevation-Area for US-87 (Upstream Side of Culverts) as a Reservoir

Pool Elevation (ft)	Surface Area (acres)
2010	0.0
2020	3.29
2030	115.2

Figure 2 is a cross-section view looking downstream at the US-87 Crossing (US-87 Reservoir Outlet) with the existing 2-barrel system depicted. The road profile is the grey region that slopes down to the top of the culverts then back up.

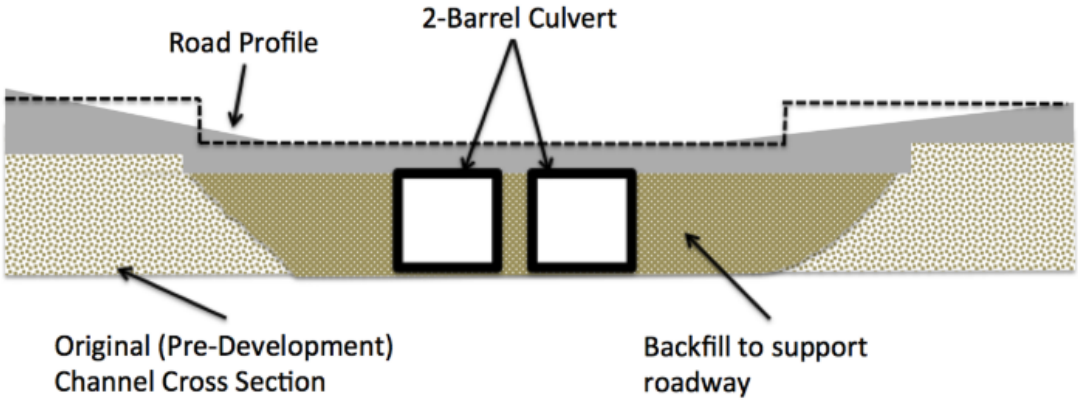

Figure 2: 2-Barrel Culvert configuration at US-87

Figure 3 is s cross-section view looking downstream at the US-87 Crossing (US-87 Reservoir Outlet) with the proposed 4-barrel system depicted.

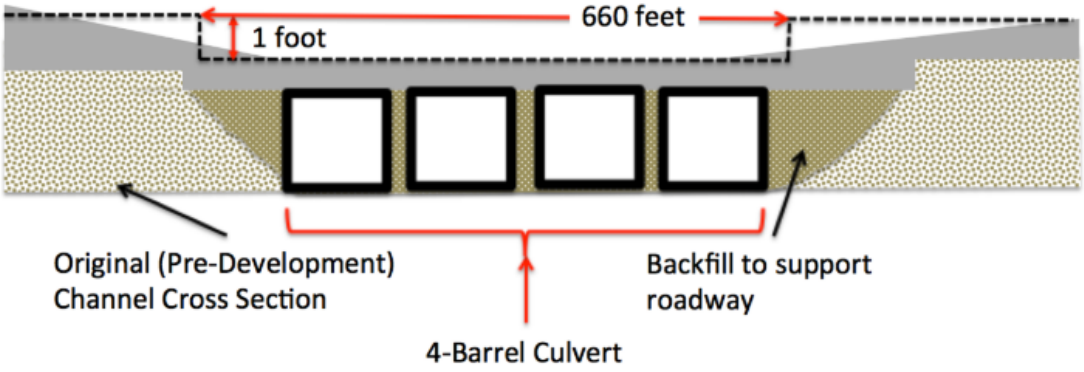

Figure 3: 4-Barrel Culvert configuration at US-87

Figure 4 is a side–view of the roadway crossing showing the embankment and the culvert system, along with the elevations of the upstream end of the culvert, the top of the culvert, and the roadway elevation.

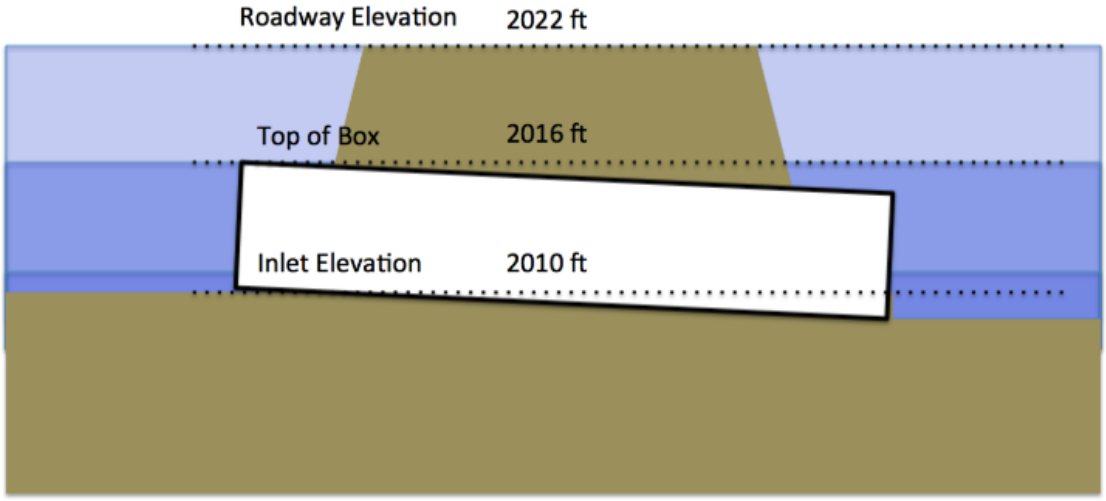

Figure 4: Culvert profile at US-87

The cross section for the channel connecting the outlet of the North Reservoir to the Junction is shown on Figure 5. The channel is a grass-lined channel; Manning's n for the section is 0.035. The average channel slope is 0.6-percent. The length of the channel is 6020 feet.

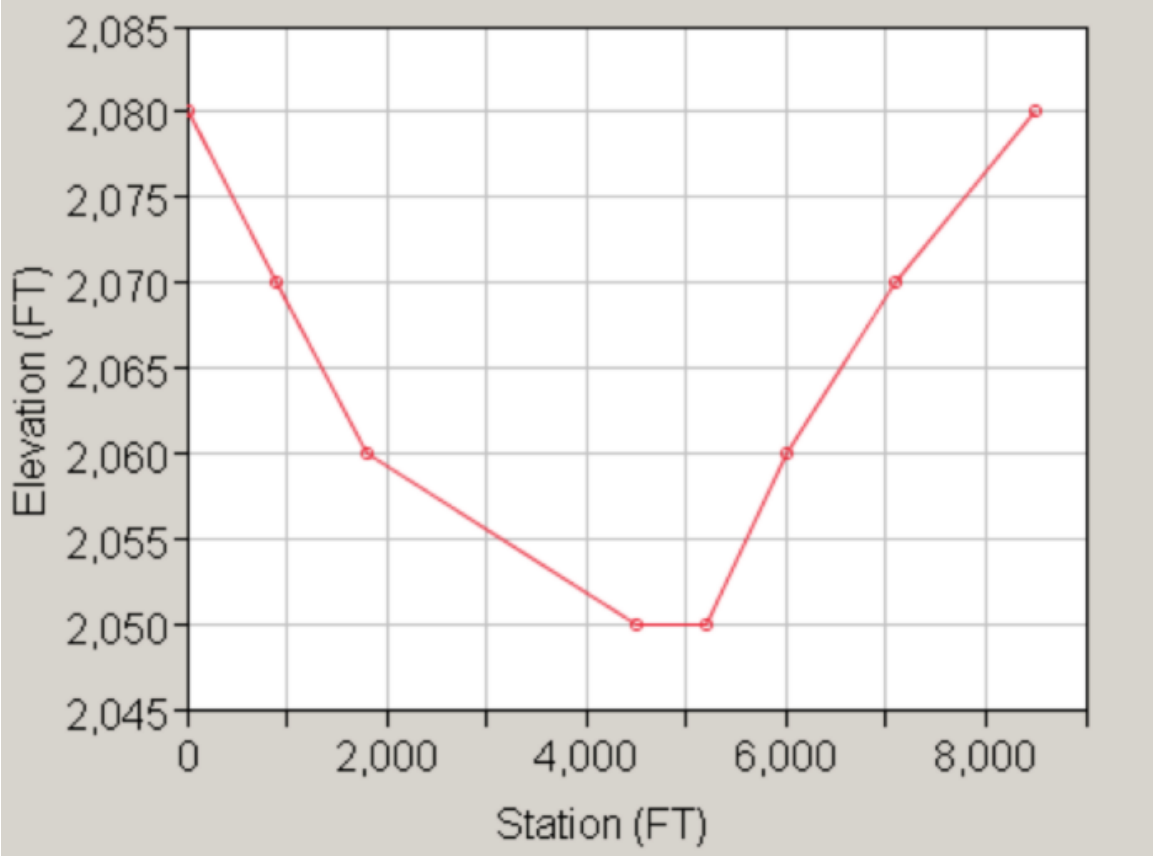

Figure 5: Cross Section North to Junction (Typical)

The cross section for the channel connecting the outlet of the West Reservoir to the Junction is shown on Figure 6. The channel is a grass-lined channel; Manning's n for the section is 0.035. The average channel slope is 0.4-percent. The length of the channel is 8395 feet.

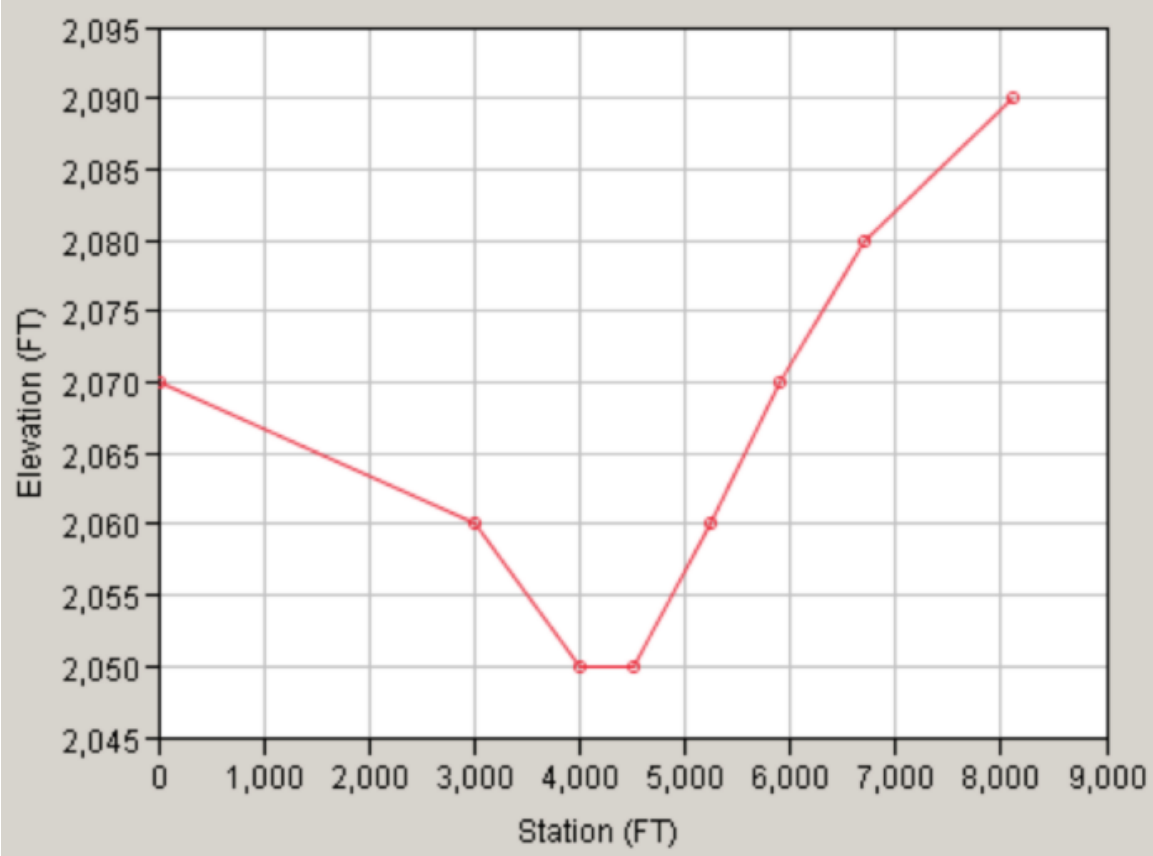

Figure 6: Cross Section West to Junction (Typical)

The cross section for the channel connecting the Junction to the US-87 Forebay is shown on Figure 7. The channel is a grass-lined channel; Manning's n for the section is 0.035. The average channel slope is 0.5-percent. The length of the channel is 9695 feet.

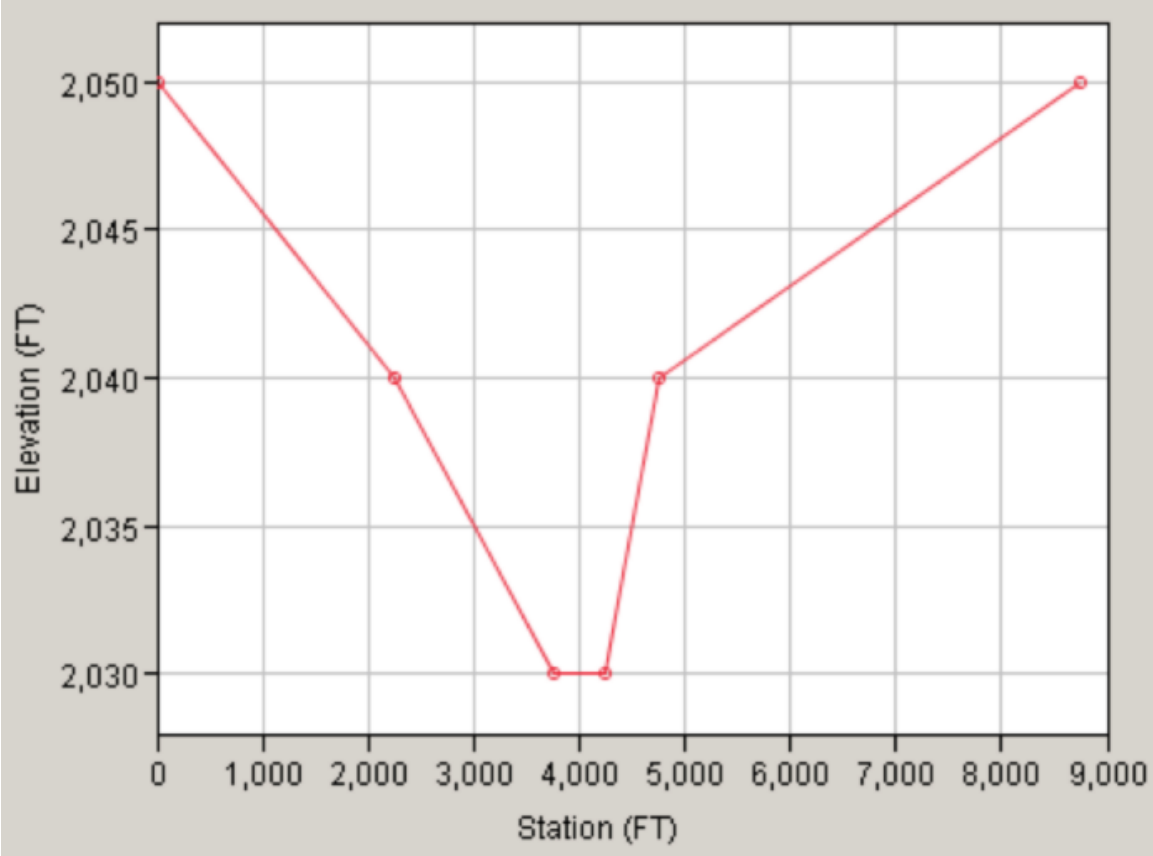

Figure 7: Cross Section Junction to US-87(Typical)

Tasks Construct a HEC-HMS model using the supplied configuration. Use an NRCS Type-II storm distribution, to apply a 24-hour, 50-yr ARI design storm to the watershed.

Determine:

(a) Determine the peak water surface elevation at the US-87 crossing when the two-barrel system is in place.

(b) Determine the peak water surface elevation at the US-87 crossing when the four-barrel system is in place.

Deliverables

(a) A modeling report that shows the model output as hydrographs at US-87 under the different culvert systems, and

(b) Model output showing the water depth in the US-87 Reservoir under the two conditions, and

(c) Recomendation if culvert upgrade is needed.