CE 3354 Engineering Hydrology
Exercise Set 2 : By-GIS Solution

This solution is a by-hand approach; GIS based approach will be in a seperate document, there is considerable overlap - either way is fine, although in modern practice, its far more likely you will use GIS tools.

Some of the original figures are omitted to reduce the file size.

Exercises

1. Using a GIS (i.e. QGIS) load an OpenStreetMap layer and locate the "Assessment Point"

   ### By-GIS Approach

   Following workflow in `http://54.243.252.9/ce-3354-webroot/ce-3354-webbook-2024/my3354notes/lessons/05-Watersheds/GISWorkflowHardinBranchNotes.pdf`

   Figure 1 is a screen capture of Completed GIS analysis to include Lat-Lon location coordinates.

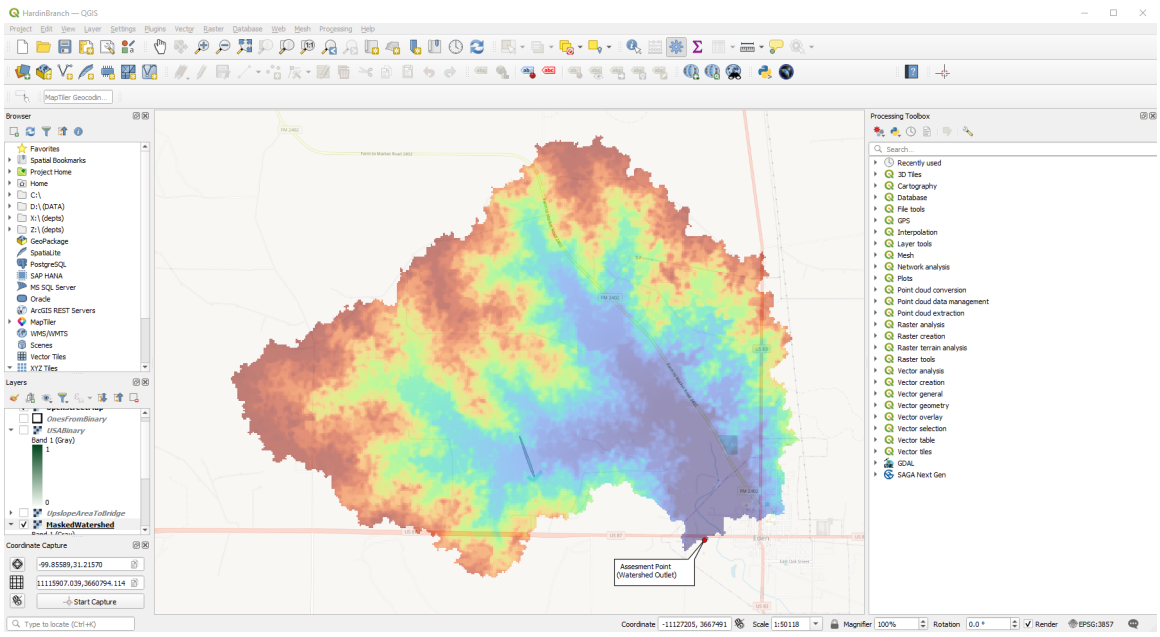

Figure 1: Assessment point coordinates (UTM Zone 14 -11115907.039 Easting,3660794.114 Northing)

2. Draw the boundary of the entire watershed area (i.e delineate the watershed)

   By-GIS Approach

   Following workflow in `http://54.243.252.9/ce-3354-webroot/ce-3354-webbook-2024/my3354notes/lessons/05-Watersheds/GISWorkflowHardinBranchNotes.pdf`

   Figure 2 shows the result of watershed delineation using SAGA Upslope Area, after suitable conversions of projections, clipping the DEM to reduce processing area, trial-and-error to find suitable pour point.

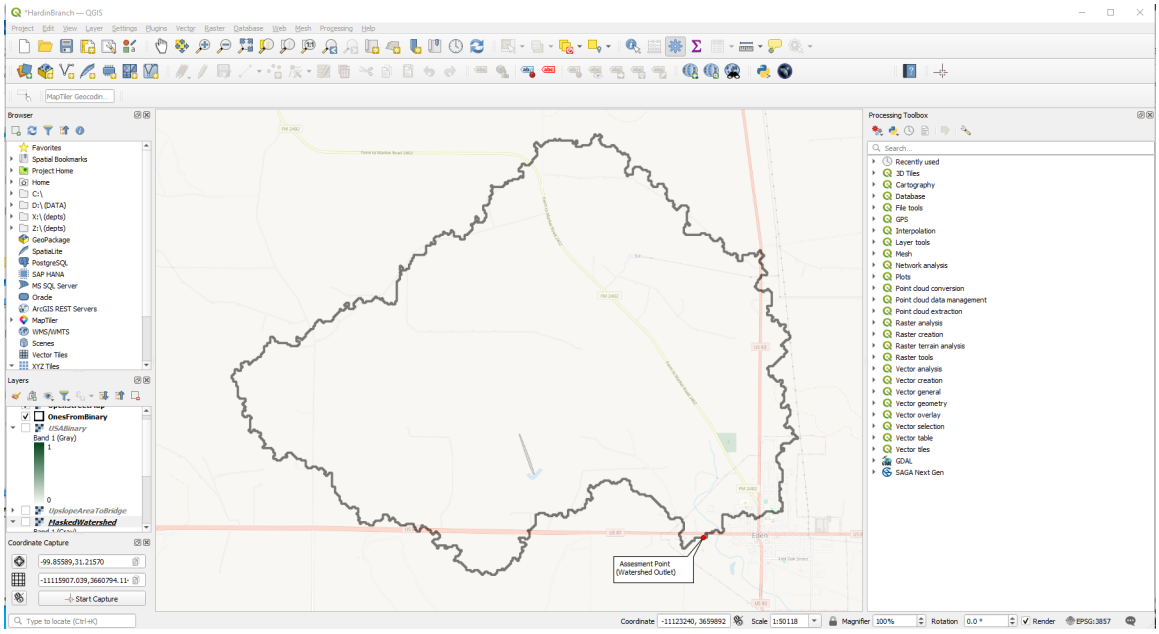

Figure 2: Study Area Boundary - Entire Hardin Branch Study area without distinction of the two SCS reservoirs in the study.

3. Determine the drainage area of the watershed in square miles.

   By-GIS Approach The entire watershed area can be computed by numerical planimetry, or counting the pixels contained within the watershed.

   Figure 3 is a scanned image of the watershed with various square counts. The estimated area is 17.66 square miles. This is the total drainage area including all catchments. The sub-catchment area determinations portions are not shown on this exhibit.

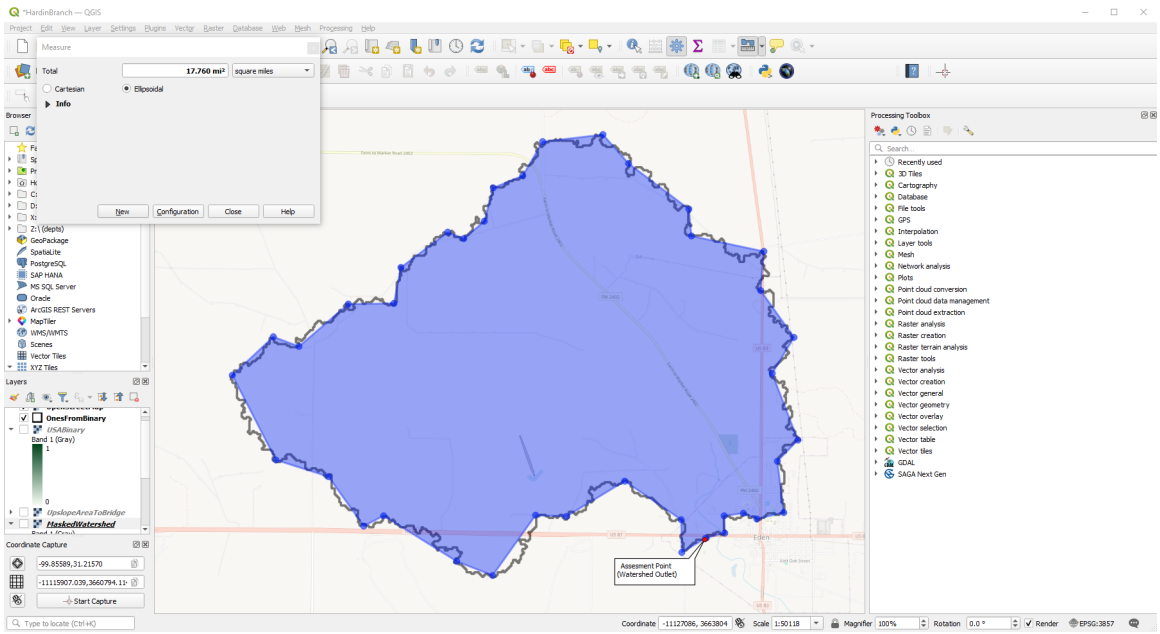

Figure 3: Study Area – with measuring tool activated (actual measurement should use more faithful representation of the boundary, or count non-zero pixels and multiply count by pixel size)

4. Find the coordinates of the two outlet risers for the two SCS impoundments in the area; GoogleEarth might be helpful; a proper USGS Topographic map would also be helpful. You will need these coordinates for future homework/project.

   GIS Approach This step can be accomplished using Google Earth (or similar tool) as illustrated

   For the West reservoir the location is found in Google Earth as shown in Figure 4. The elevations are taken from the USGS 7.5 minute Topographic Map (the supplied basemap) and confirmed in Google Earth - the Google Earth are within a foot or two of the paper map values.

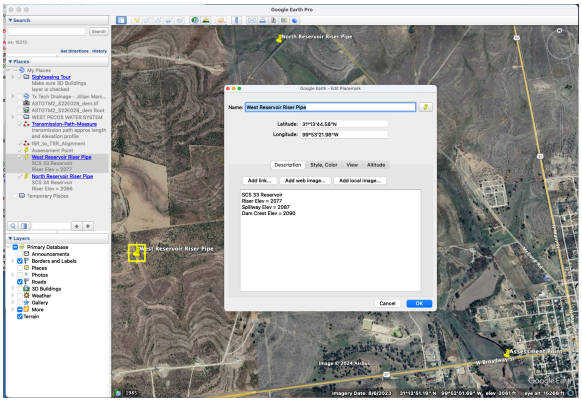

Figure 4: West Reservoir riser pipe location, elevations from USGS 7.5 minute basemap, verfied on Google Earth as "close enough"

Then a coordinate transformation as shown in Figure 5

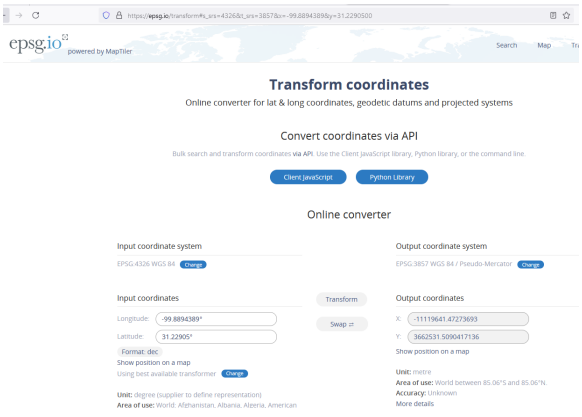

Figure 5: West Reservoir DMS to UTM conversion

For the North reservoir the location is found in Google Earth as shown in Figure 6. The elevations are taken from the USGS 7.5 minute Topographic Map (the supplied basemap) and confirmed in Google Earth - the Google Earth are within a foot or two of the paper map values.

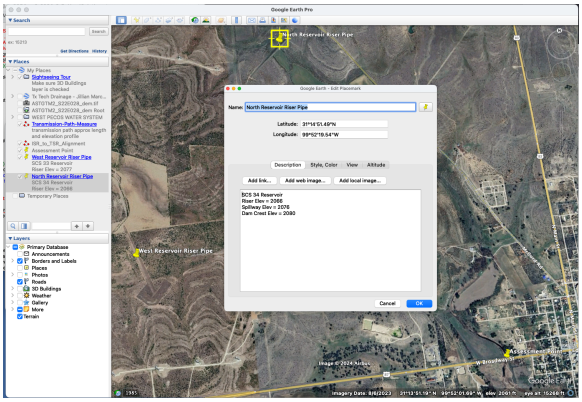

Figure 6: North Reservoir riser pipe location, elevations from USGS 7.5 minute basemap, verfied on Google Earth as "close enough"

Then a coordinate transformation as shown in Figure 7

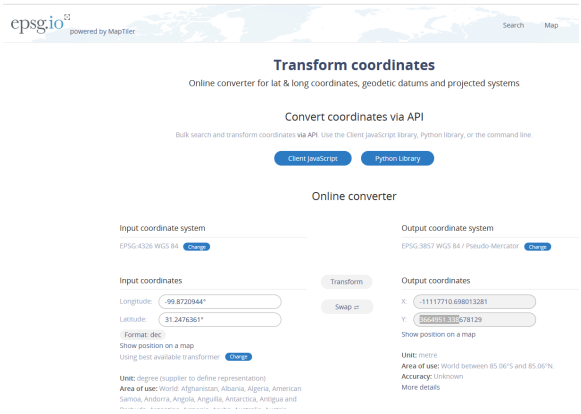

Figure 7: North Reservoir DMS to UTM conversion

Table 1 summarizes the information so far.

Table 1: Location Summary

Location	Latitude (Northing Meters)	Longitude (Easting Meters)	Elevation (feet)
Assessment Point	3660868.901	-11115601.188	2024
West Riser Pipe	3662531.509	-11119641.472	2077
North Riser Pipe	3664951.338	-11117710.698	2066

The next step is to find these locations and leave annotations in the annotation layer, as shwon on Figure 8

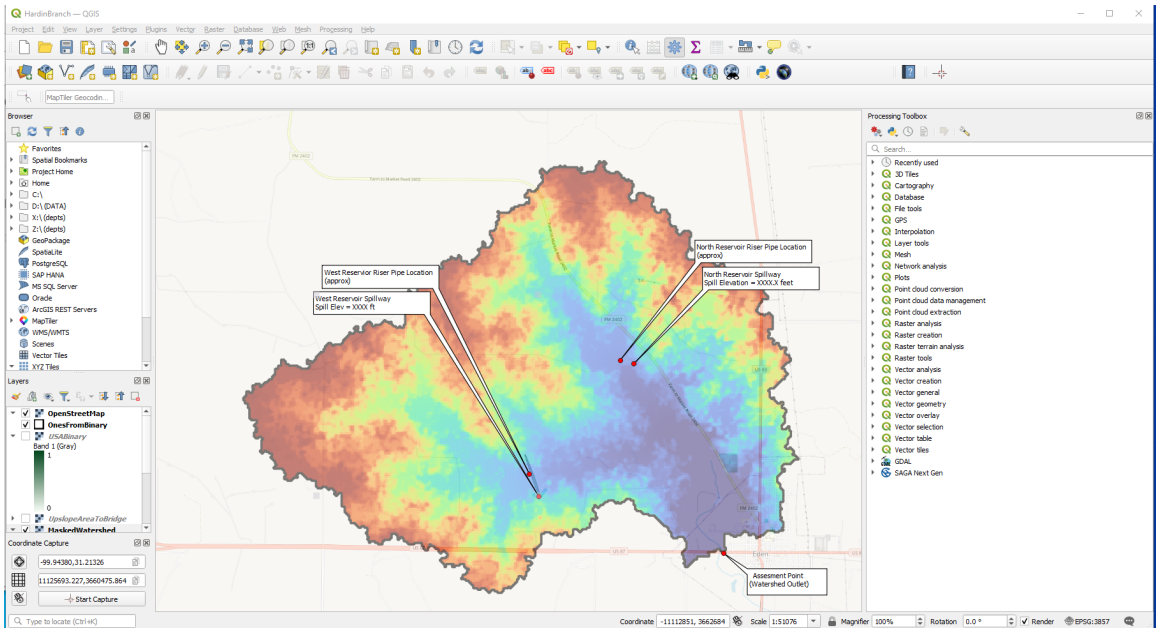

Figure 8: Hardin Branch showing riser pipe and spillway locations

5. Determine the channel lengths from the watershed boundary to the SCS impoundments outlets.

   By-GIS Approach

   Use either the measuring tool, or the elevation profile tool (the profile tool is more useful in my opinion).

6. Determine the channel lengths from the SCS impoundment outlets to the junction where the two separate streams combine into the single stream (Hardin Branch).

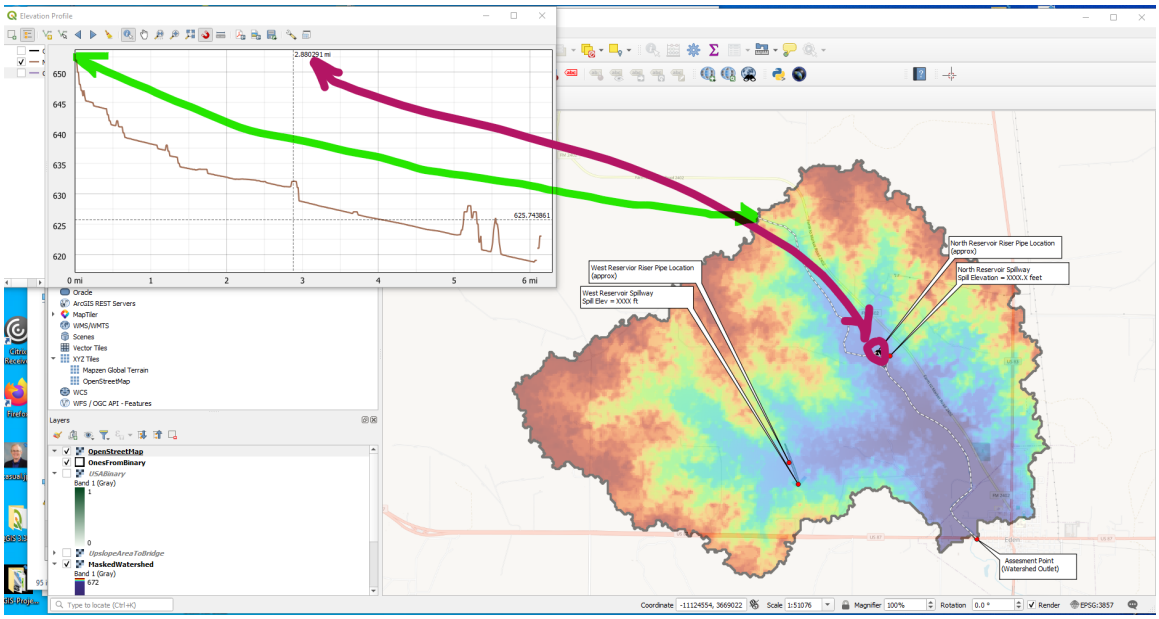

Figure 9: Profile tool North boundary to Riser Pipe Location */approx* 2.88 miles

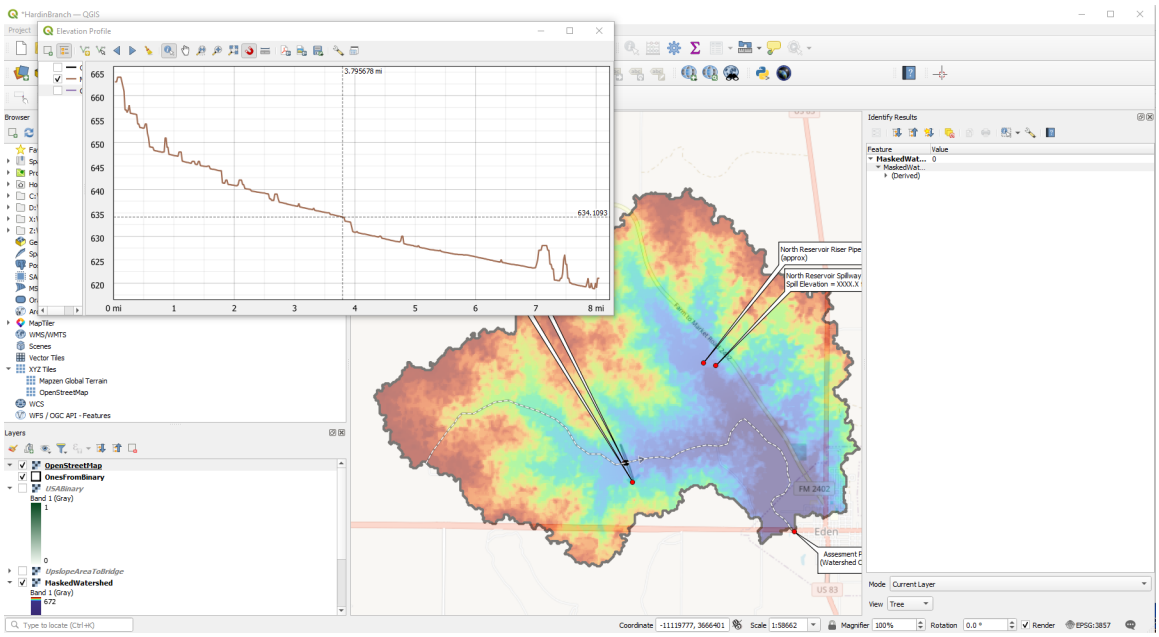

Figure 10: Profile tool West boundary to Riser Pipe Location */approx* 3.79 miles

GIS Approach Using distances from the profile tool shown in both Figures 9 and 10 the North riser to junction is about 3.9 miles, and the West outlet to junction is about 5.8 miles.

7. Determine the channel length from the junction to the Bridge/culvert on US 87.

   GIS Approach

   Using distances from the profile tool shown in both Figures 9 and 10 on eiother path the distance is about 2.07 miles.

8. Determine elevation profiles along the two longest paths.

   GIS Approach The profiles are shown in both Figures 9 and 10.[1]

[1]The GIS analyst should redraw the two paths to go around the high spots at the outlet end indicated in the profiles. For this assgnment acknowledgement that these high spots are artifacts of manual drawing of a path is sufficient.