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

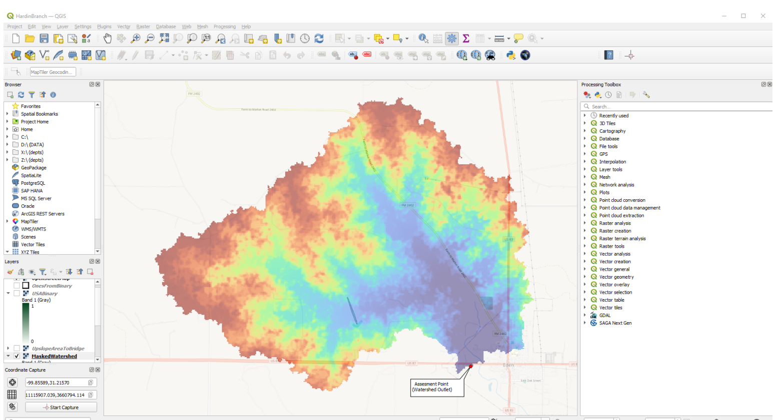

Figure 1: Assessment point coordinates (UTM Zone 14 -11115907.039 Easting,3660794.114 Northing)

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 **??** 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.

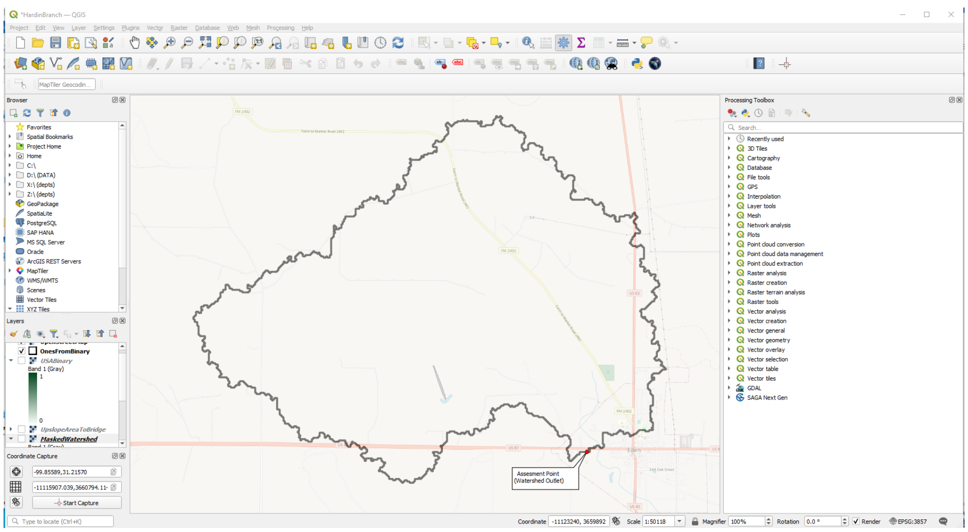

Figure 2: Study Area Boundary - Entire Hardin Branch Study area without distinction of the two SCS reservoirs in the study.

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 **??** 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.

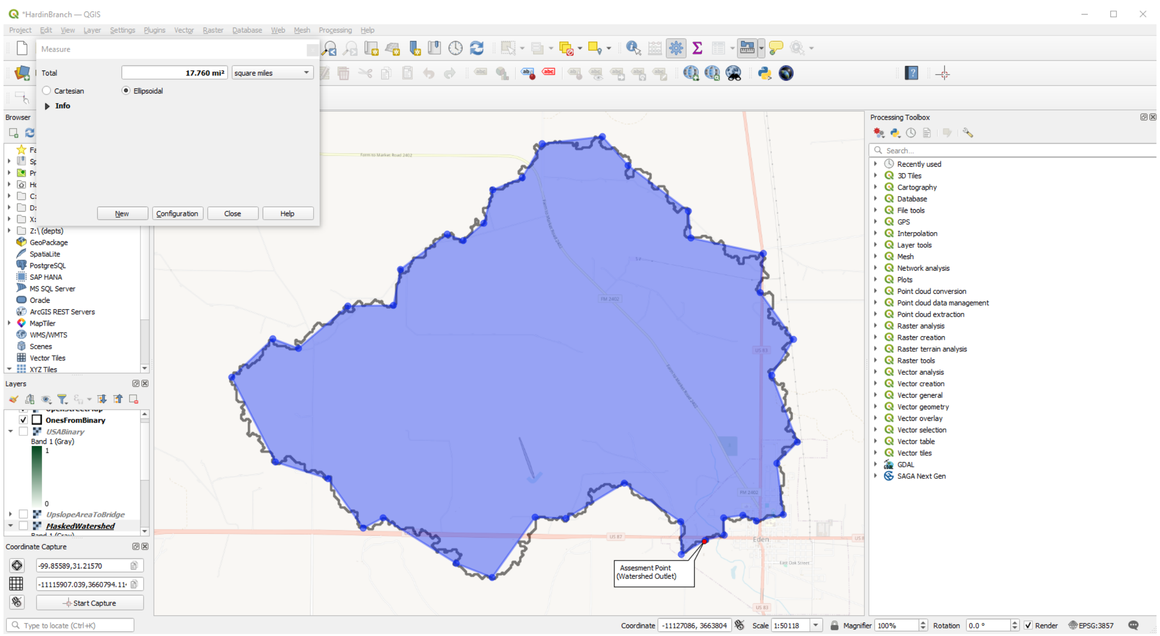

Figure 3: Study Area – with measuring tool activated (actual measurement should use more faithful representation of the boundary, or count non-zero pixels and multiply count by pixel size)

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 **??**. 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.

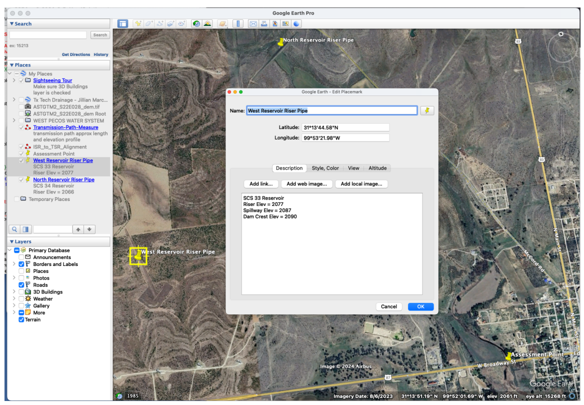

Figure 4: West Reservoir riser pipe location, elevations from USGS 7.5 minute basemap, verfied on Google Earth as "close enough"

Then a coordinate transformation as shown in Figure **??**

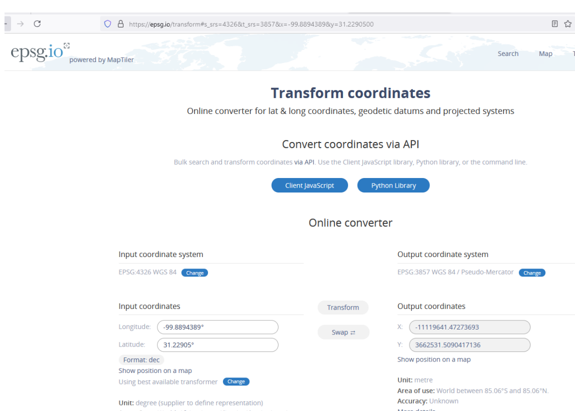

Figure 5: West Reservoir DMS to UTM conversion

For the North reservoir the location is found in Google Earth as shown in Figure ??. 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.

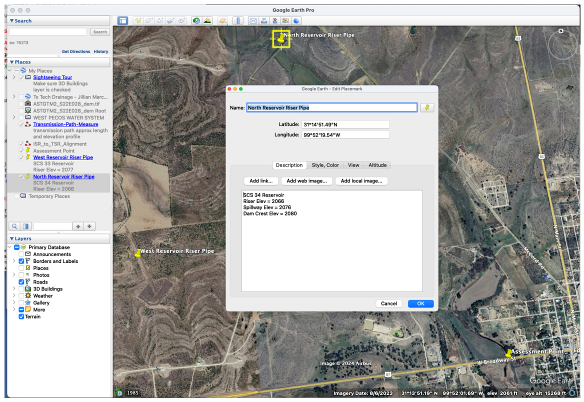

Figure 6: North Reservoir riser pipe location, elevations from USGS 7.5 minute basemap, verfied on Google Earth as "close enough"

Then a coordinate transformation as shown in Figure ??

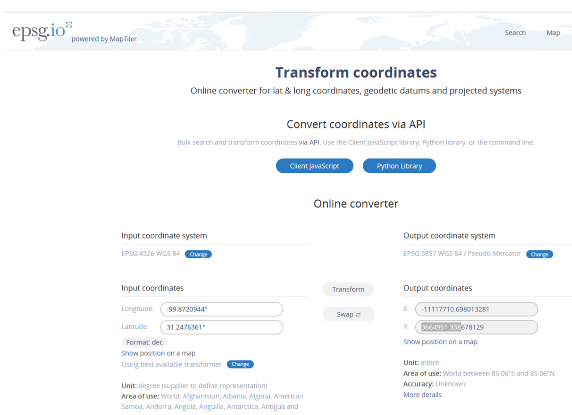

Figure 7: North Reservoir DMS to UTM conversion

Table **??** 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 woul be to find these locations and leave annotations in the annotation layer.

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).

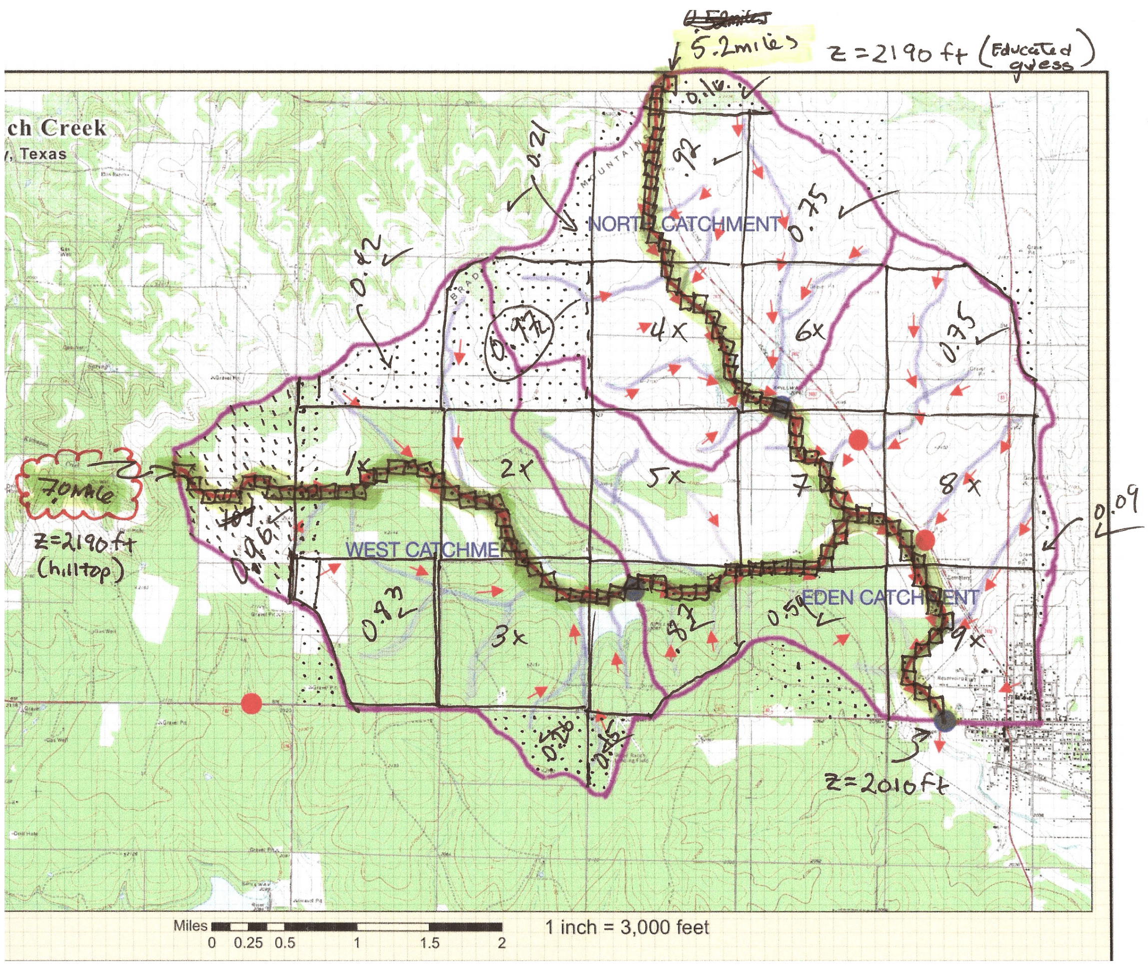

Figure 8: Study Area – with grid overlay, outlet (Blue Dot), and subcatchments identified. Various flow paths are indicted in transparent blue. 1,693 Squares counted to estimate watershed area. Two long channel paths identified. Main channel is the longer path (assuming flow passes through the dam).

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).

   By Hand Approach Figure **??** is a scanned image of the watershed with two possible main channel paths identified. Measure the portion from the riser(s) to the junction, and report the result(s). In this case the distance from the West riser pipe to the junction is about 19 cells, each cell has a diagonal of about 0.14 miles, so the distance is roughly 2.66 miles along the creek path.

   For the North riser, the distance to the junction is about 9 cells, each cell has a diagonal of about 0.14 miles, so the distance is roughly 1.26 miles along the creek path.

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

   By Hand Approach Figure **??** is a scanned image of the watershed with two possible main channel paths identified. Measure the portion from the junction to the outlet, and report the result. In this case about 18 cells from junction to outlet, each cell has a diagonal of about 0.14 miles, so the distance is roughly 2.52 miles along the creek path.

8. Determine elevation profiles along the two longest paths.

   By Hand Approach