

Stream Crossings Course Project Instructions:

The course project walks you through the design steps to a completed culvert and at-grade crossing design. In order for me to grade the project, I need you to email me a pdf of your work. I can be reached at: tim.clark@agriculture.ny.gov.

The crossing is located at:

Lat/Long: 42.51598 N, -76.25594 E

UTM: Zone 18, 4707832 N, 396830 E

Address: 2219 Gee Hill Road, Virgil, NY

The packet you send to me should look like the one marked deliverables, but with your design info filled in. If you get stuck feel free to use the course message board, email, or call the state office at 1-518-485-5010. Here I'll describe how to do each page:

Page 1: Soils Watershed Map

Creating this map will show me that you are comfortable delineating a watershed and creating a soils map from it. Your map should look similar to the example, which is from a different watershed. Remember that you want Hydrologic Soil groups displayed, not just the soil names.

1. Use USGS Streamstats to create a shapefile of the watershed. <https://vimeo.com/99745450> could be helpful. Use the watershed Streamstats gives you, and ignore any impacts Gee Hill Road might have on the delineation.

2. Extract the contents of the zipped shapefile and discard the point data. Streamstats creates data for the point and the watershed, but you only want the watershed.

3. Load the shapefile into Web Soil Survey to create an area of interest

4. Navigate to Hydrologic Soil Group and view results. Click: "Soil Data Explorer" -> "Soil Properties and Qualities" -> "Soil Qualities and Features"

5. Create a pdf of the Hydrologic Soil Group ratings map and include as the first page in your packet

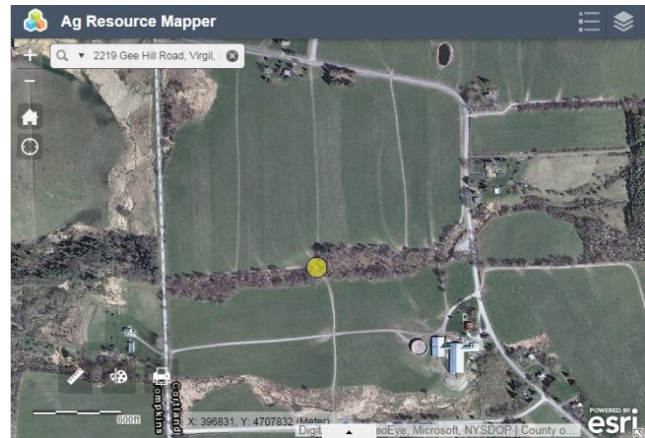


Figure 1: Project Location Map

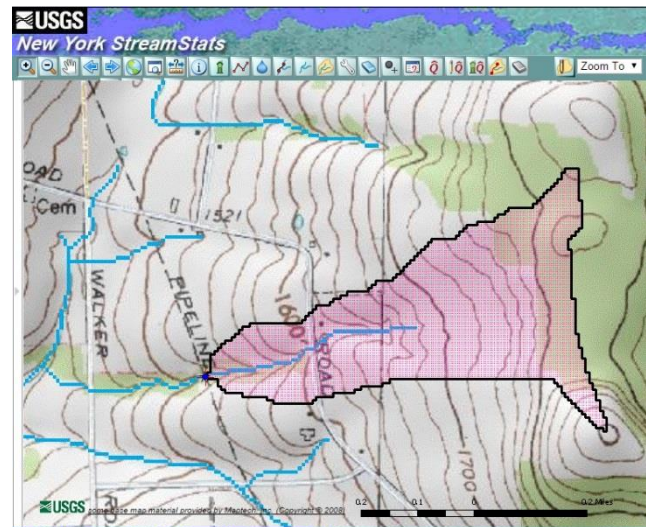


Figure 2: USGS Streamstats Watershed view

Page 2: Hydrology Data

The watershed does have some storage in a small pond and behind two culverts upstream of the project. Ignore this potential storage and assume that all runoff flows freely down to the site. In other words, just do a basic hydrologic design.

The watershed is made up of B, C and D soils (treat the C/D as D), with cover types of Pasture/Grassland/Range(Good) and Woods(Good). Divide the watershed into sub-areas and compute the amount of acres in each of the 6 types. I prefer to measure areas by drawing them in CAD over an aerial photo, and many people prefer the same approach in ArcGIS. If you do not have access to ArcGIS or CAD, you can try a google maps planimeter (<http://acme.com/planimeter/>) and estimate the hydrologic soil group boundaries based on the shapes of the fields and treelines.

Fill in the chart with your totals (in Acres).

The efh2 method also requires watershed length and slope. The length can be measured in CAD/GIS or off your scaled soil map. The average watershed slope can be computed using the total contour length method or by computing the weighted average of uniformly sloped areas.

Enter your watershed length and slope into the boxes.

Now you'll need to run EFH2 and give me your results. If you do not have EFH2 installed on your computer, here are the relevant links. If you need a brief overview this will help: <https://vimeo.com/100920872>. If you work outside NY state, you can download the NY county and rainfall data files from the NY NRCS website below:

EFH2 download:

<http://www.nrcs.usda.gov/wps/portal/nrcs/detailfull/national/water/manage/hydrology/?cid=telprdb1042921>

NY NRCS EFH2 data files/instructions:

<http://www.nrcs.usda.gov/wps/portal/nrcs/main/ny/technical/engineering/>

The HEC-RAS box can be filled in after your shear stress analysis is completed in HEC-RAS. Remember to refer back to lecture 3 for the tutorial on how to do this.

Page 3-4: 10-year Storm flow depth

Using the 10-year peak storm discharge from your hydrology analysis, compute the in-stream flow depth using the NRCS Cross Section Analyzer spreadsheet. This technique was covered earlier in the video. Check the roadway profile page to get the stream cross section that should be input into the spreadsheet.

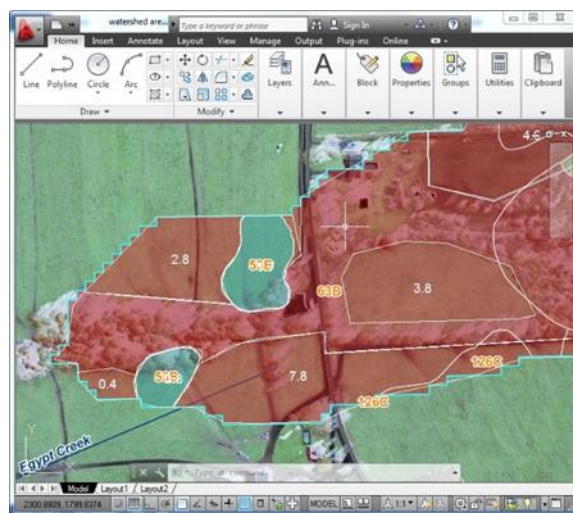


Figure 3: Delineating cover/soil areas in CAD

Screenshot or print the rating table and cross section sheets. The rating table should have your calculated discharge and water surface elevation listed (circled in red).

*Note: Use **0.08** for the stream slope.*

Enter the storm flow depth and shear stress into the boxes on page 2. Using, "Stability Thresholds for Stream Restoration Materials," (page 5), select a suitable rip rap size and enter that in the box as well. "Stability Thresholds for Stream Restoration Materials" is found in the course downloads root folder.

Page 5: Culvert Sizing

Remember culvert design is iterative. You'll need to draft a culvert size and roadway profile and test it in HY-8 to see if it will pass the 2-year flow without overtopping. If not, then redesign. Once you've completed your design, print out this report page to hand in. This report page can be generated in HY-8 by going to Culvert->Create Report, and choosing *Water Surface Profile Plot, Site Data, and Culvert Data*.

Pages 6-9: Plans, Profiles and Cross Sections

When you've finished your hydrology/hydraulics calcs, use these sheets to sketch in plan views, profiles and cross sections. Create a draft design for a cattle slat crossing and a culvert crossing. Scan in your sketches and send them to me. Here are some design notes for each:

At-Grade Crossing:

Material: Cattle-slats that are 8'x5'x8". Draw the outline of each slat in each view.

Roadway Depth: 8" slats over 6" of drainage stone and geotextile. Draw and label all components.

Roadway Width: 16'

Maximum cattle slat slope is 12%.

Downstream edge should be reinforced with rip rap of size needed to resist 10-year shear stress

Culvert Crossing:

Material: Crushed Gravel for roadway (NYSDOT 667.03 & 667.01), Smooth Interior Corrugated Polyethylene for the culvert. I find culverts difficult to draw when vert scale < horz scale, so sample pipe cross sections are provided above the profile to help you.

Roadway Depth: 12" – 9" of 667.03 and 3" of 667.01 for the wearing surface. Draw materials separately on profile and section.

Roadway Width: 16'

Roadway Sideslopes: 1V:3H

No headwalls or flared end sections

Stone outlet protections should be sized based on the New York State Standards and Specifications for Sediment and Erosion Control, Rock Outlet Projection, minimum tailwater condition. See figure 5B.12 at the end of the deliverables packet for sizing info.

Summary:

At the end of the project you should have 9 pages of work to send me:

1. Soils map showing hydrologic soil group for each soil region
2. Hydrology & Hydraulics Data
3. A hydraulic rating table for the 10-year flow from the NRCS cross section spreadsheet
4. A 10-year flow cross section view from the NRCS cross section spreadsheet
5. A 2-year flow cross section report from HY-8
6. Profile view of cattle slat crossing
7. Cross section and plan view of cattle slat crossing
8. Profile view of culvert crossing
9. Cross section and plan view of culvert crossing

If you can combine all the sheets into one pdf, that's great. If not, send an email with all 8 sheets as separate attachments to tim.clark@agriculture.ny.gov. If you don't have access to a scanner my mailing address is:

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I sincerely hope that you are able to learn something from this project, and as always, send any comments or suggestions my way.

-Tim