Preparing a NFIE-Geo Database for Travis County

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Contents

Introduction

The National Flood Interoperability Experiment (NFIE) is being undertaken by the academic community and the National Weather Service and its federal partners to demonstrate how a high spatial resolution flood forecasting system for the United States could be developed at the National Water Center, newly opened on the Tuscaloosa campus of the University of Alabama. It is assumed that this new system will cover the continental United States and be based on a high spatial resolution geospatial database that is being assembled to support the NFIE by federal agencies coordinated by the Subcommittee on Spatial Water Data.

The purpose of this exercise is to assemble a local copy called NFIE-Geo of this federal information for Travis County, Texas. More local information about Travis County will later to be added to NFIE-Geo to support flood emergency response planning.

Original data sources for the federal information include:

1. National Hydrography Dataset Plus: http://www.horizon-systems.com/NHDPlus/NHDPlusV2_data.php
2. National Flood Hazard Layer: https://msc.fema.gov/portal

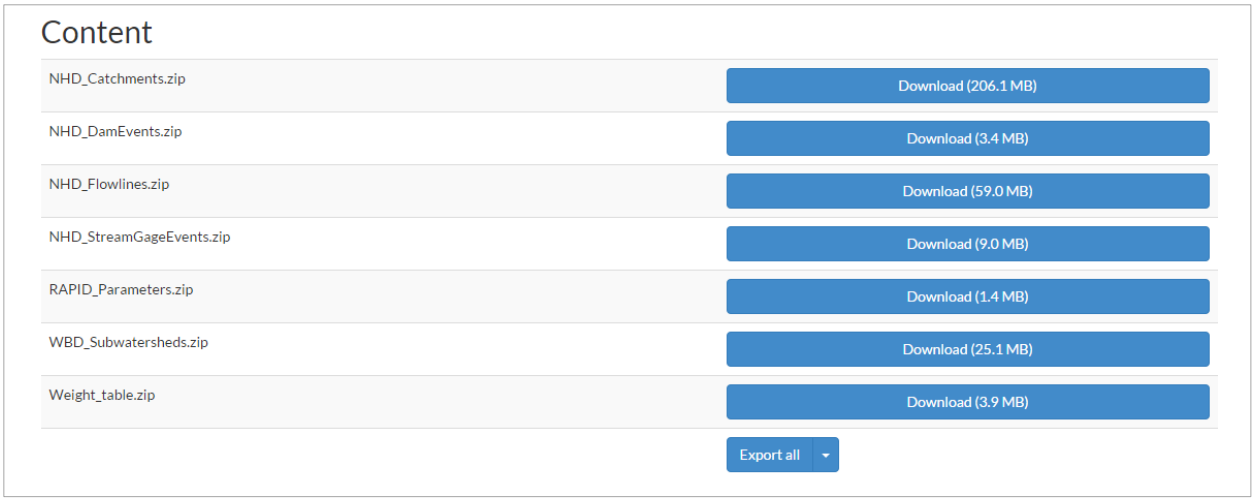
Some of this information has been assembled into packaged datasets at: https://www.arcgis.com/home/webmap/viewer.html?webmap=2c30160429984a59873f26b9d118dbfe which can also be found under the title "ArcGIS NFIE Hydro Regions Map" at http://www.cuahsi.org/NFIE

This procedure requires at least 5GB of free space on your computer and access to ArcGIS version 10.2.2. It also requires a good internet connection!

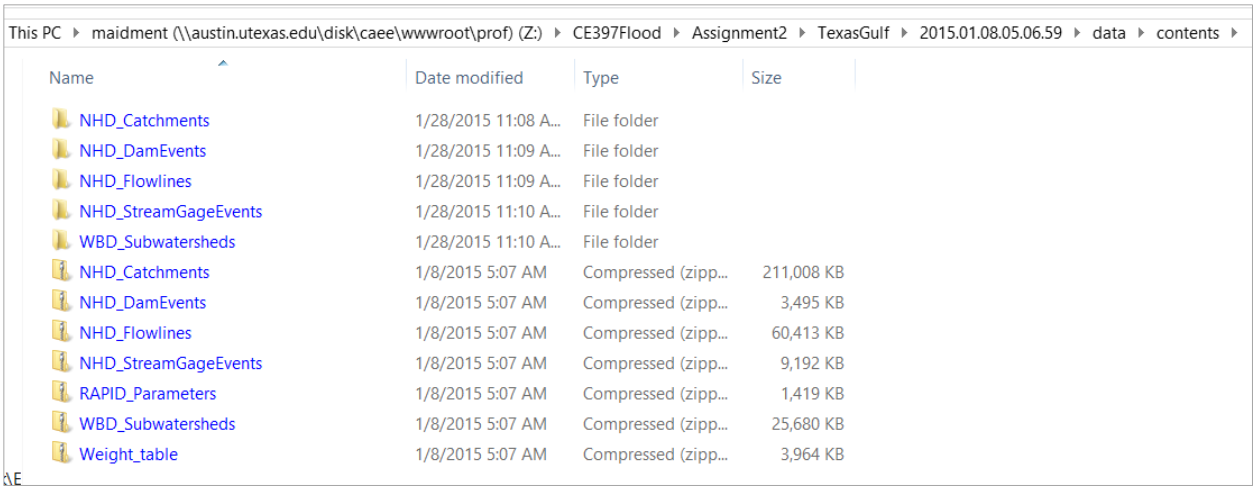
Step 1. Download and unzip the NFIE data package for the Texas-Gulf Region.

Go to https://www.arcgis.com/home/webmap/viewer.html?webmap=2c30160429984a59873f26b9d118dbfe and select the Texas-Gulf region

Click on "Get the Data from HydroShare" and use "Export All" to get everything in one zipped package

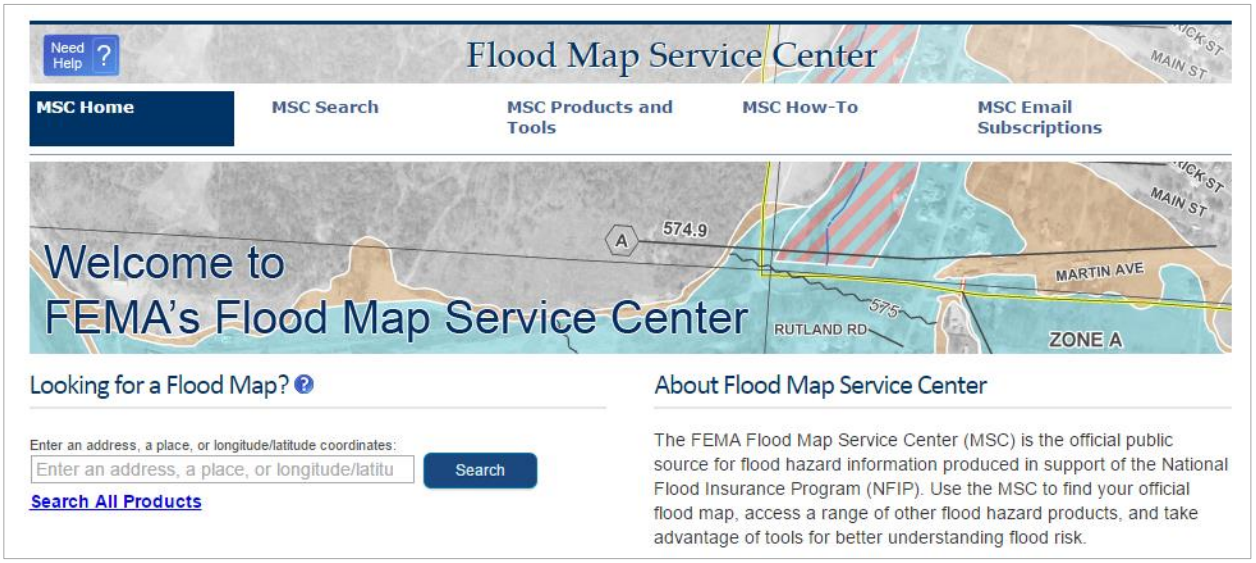


The NHD **Catchments, DamEvents, Flowlines, StreamGageEvents**, and **Subwatersheds** are what we'll use for this assignment. Unzip those files. The RAPID Parameters and Weight Table are for hydrologic computations and we'll cover those later.

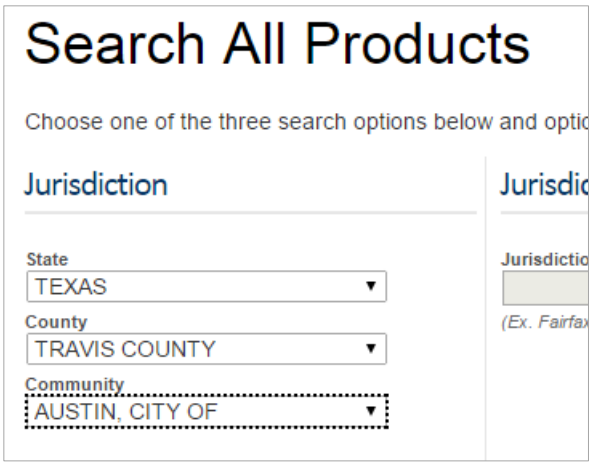


Step 2. Download the National Flood Hazard Layer for Texas and Travis County

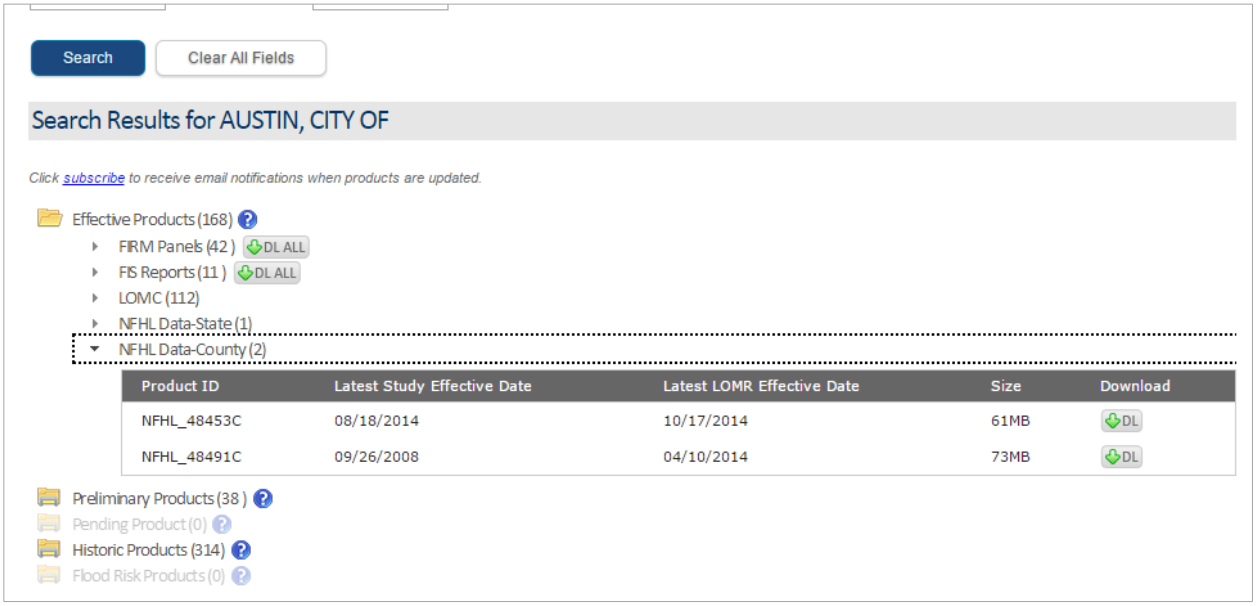
Go to the FEMA Map Service Portal https://msc.fema.gov/portal and click on "Search All Products"



Select the State as **Texas** and County as **Travis** in and select a community within that county as **Austin, City of**



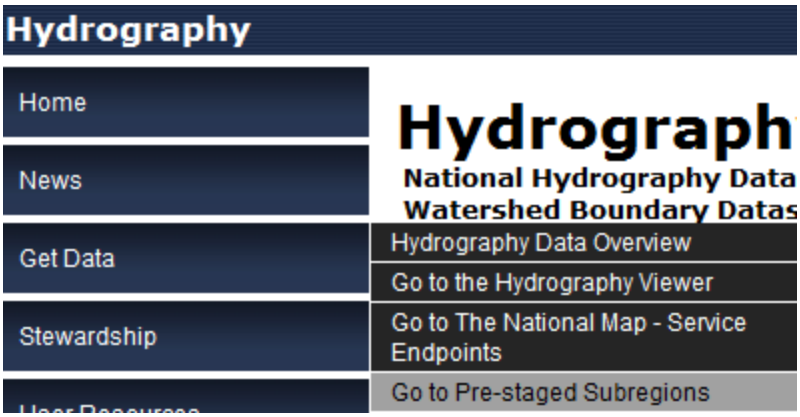
And hit "Search". Expand the search results to find the most recent National Flood Hazard Layer (NFHL) for your county **NFHLData-County** and download it. Do the same for your **NFHLData-State.** These downloads take a while.



Unzip the resulting files. The first is for Travis County, the second for the state of Texas.

Step 3. Get the 24K NHD for Region 1209

Go to http://nhd.usgs.gov/ and select "Go to Pre-Staged Subregions"

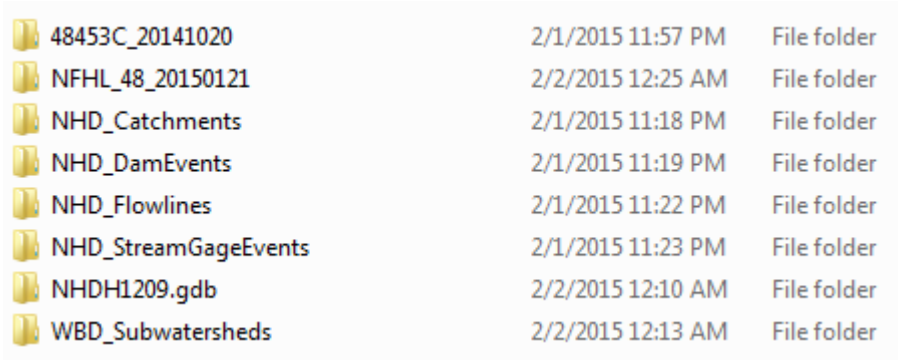


Select "File Geodatabase" and "High Resolution" to locate the following list of files. Within this list, select **NHD1209_931v220.zip**

```
01/25/2015  06:53AM        20,291,690 NHDH1205_931v220.zip
01/25/2015  09:24AM        73,040,352 NHDH1206_931v220.zip
01/25/2015  08:43AM        72,732,492 NHDH1207_931v220.zip
01/25/2015  07:44AM        17,834,806 NHDH1208_931v220.zip
01/25/2015  08:25PM        86,367,630 NHDH1209_931v220.zip
01/25/2015  03:49AM        58,765,019 NHDH1210_931v220.zip
```

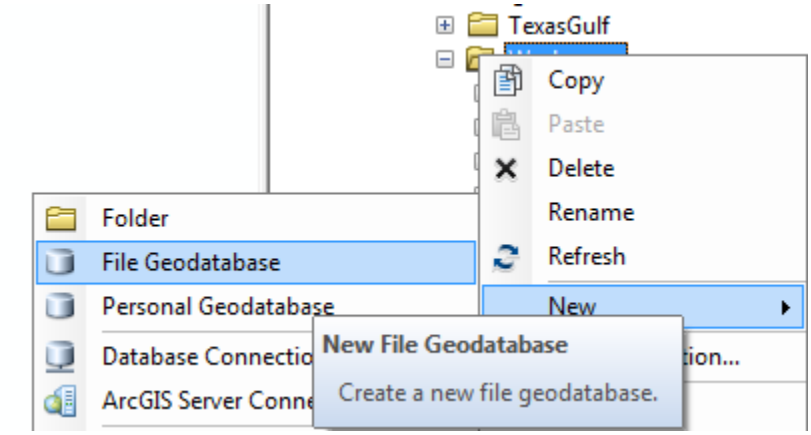
Unzip this file to show the **NHDH1209.gdb** as a geodatabase

Step 4. Create a NFIE-Geo Database for Travis County

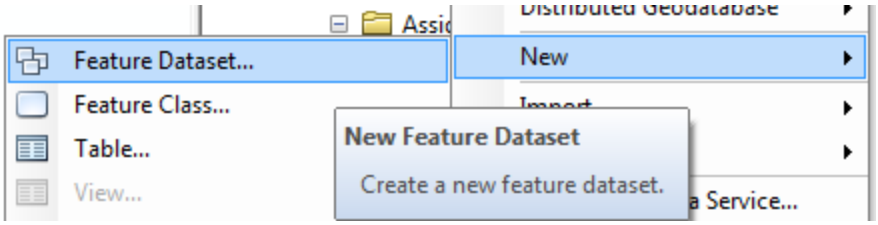


Ok, now we've got all the required data, lets proceed with building our geodatabase.

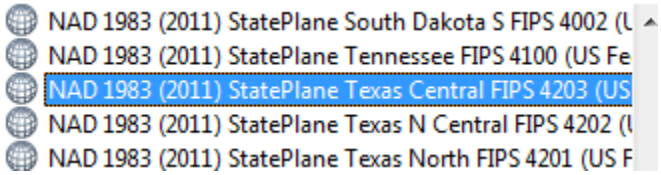
Open ArcMap and in the Catalog tab, within the Workspace Directory, Create a New File Geodatabase



And call this **NFIEGeo**



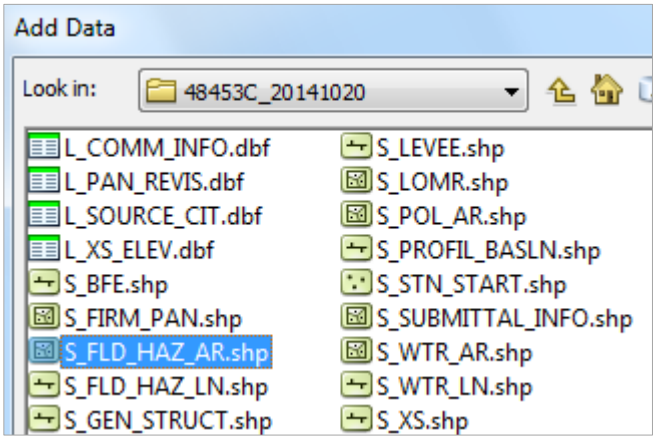
And name it **Travis**. Choose the NAD 1983 (2011) StatePlane coordinate system Texas Central zone.



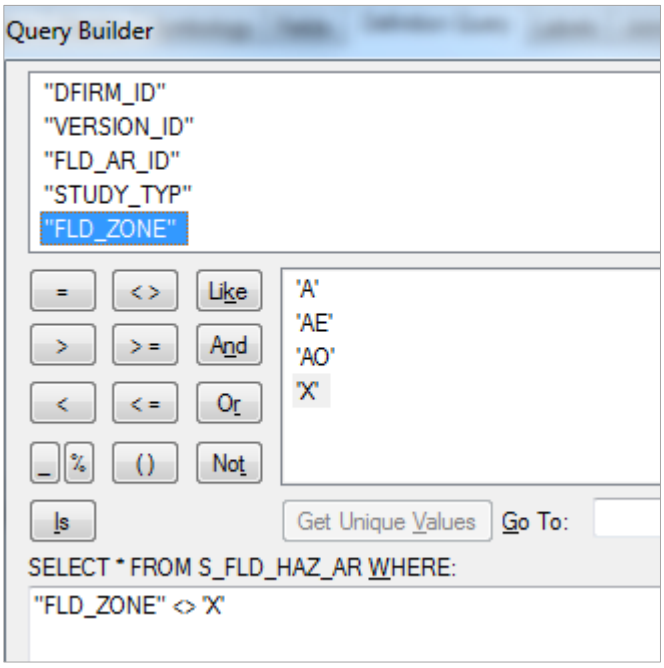
This will be the repository and provide a common coordinate system for the information that we've acquired.

Step 5. Flood Hazard Zone for Travis County

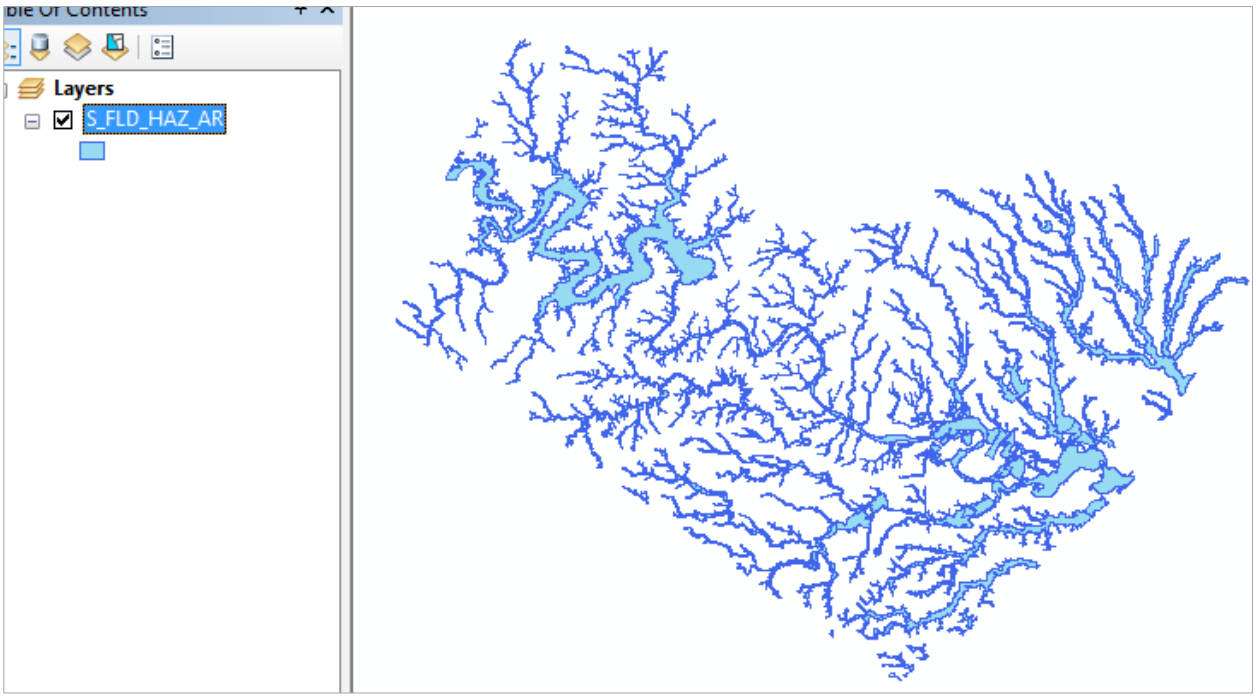
From folder **48453C_20141020**, add the feature class **S_FLD_HAZ_AR.shp** to ArcMap



Under Definition Query, use the Query Builder to select out the “FLD_Zone <> ‘X’ which deletes the zone of minimal flood risk

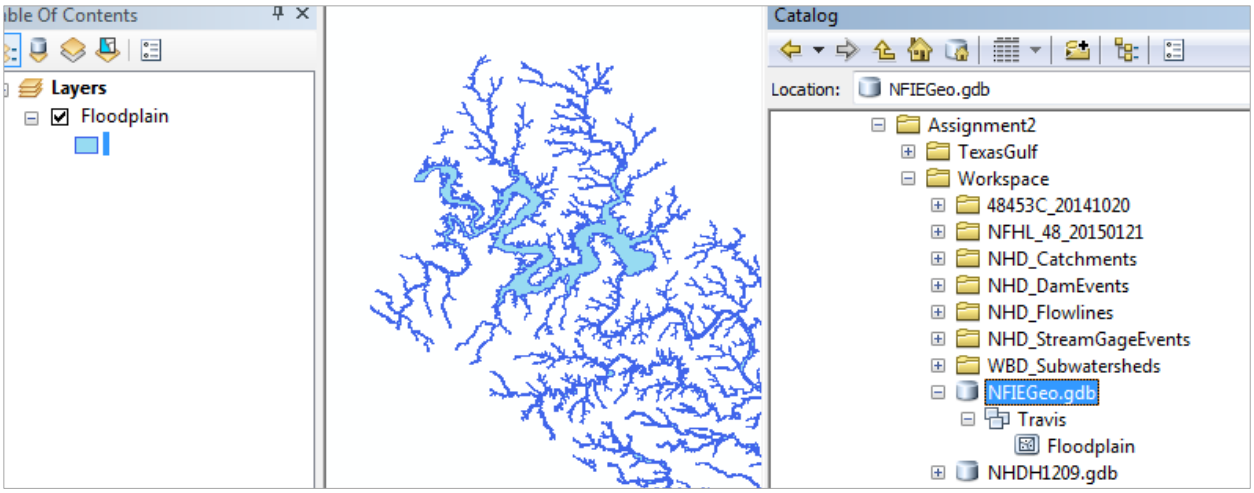


Which leaves just the areas of flood risk for Travis County



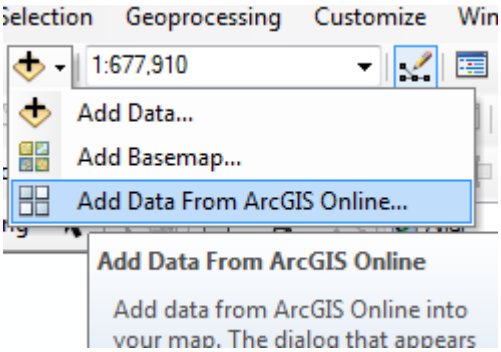
Export these data to your Travis geodatabase and give the resulting feature class the name **Floodplain.** Symbolize this with the symbol for Lake.

Save your ArcMap Document as **Travis.mxd**

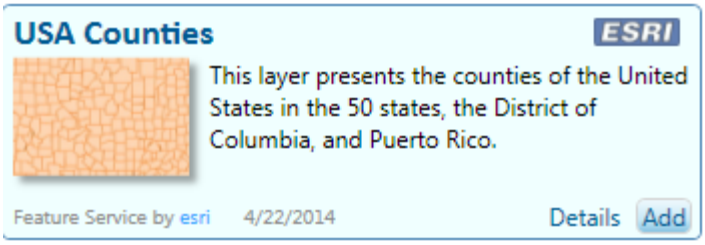


Step 6. Add a County Boundary

In ArcMap, add data from ArcGIS Online

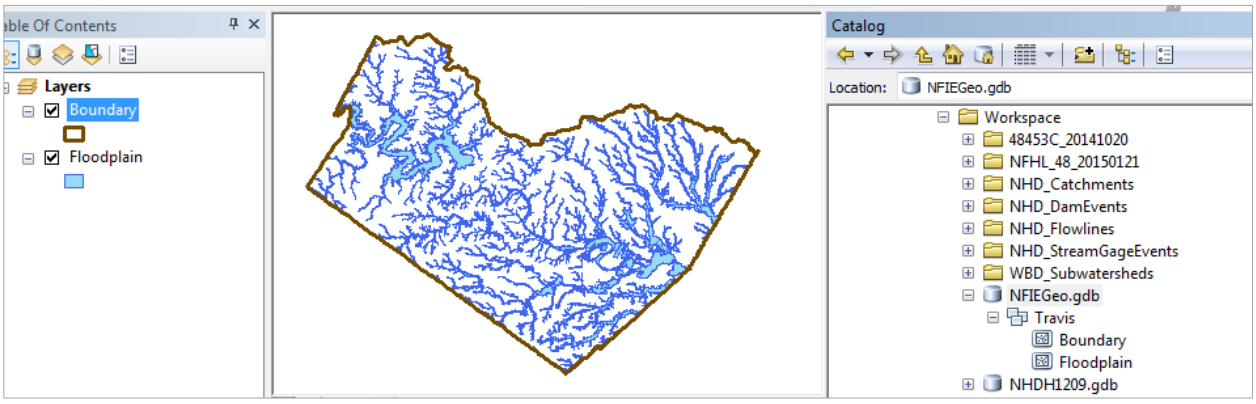


Search for “USA Counties” and add this layer to your map display



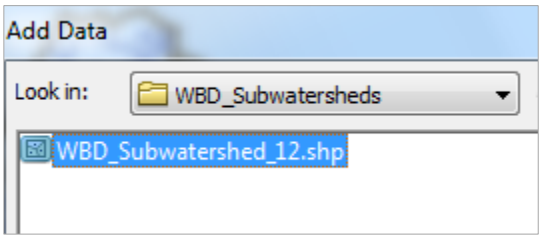
Select the outline for Travis County, and export it to the NFIEGeo geodatabase as **Boundary**

Now your NFIEGeo database contains both the Boundary and the Floodplain feature classes. Symbolize the boundary as hollow with a Brown color 2pt line weight.

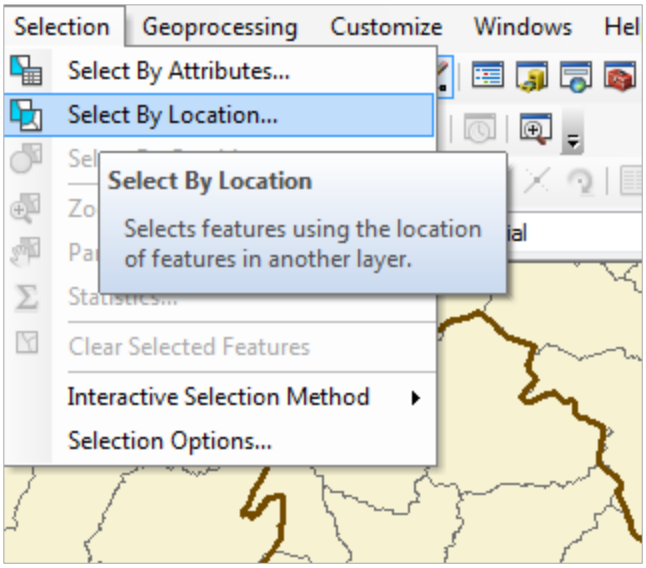


Step 7. Add your Subwatersheds

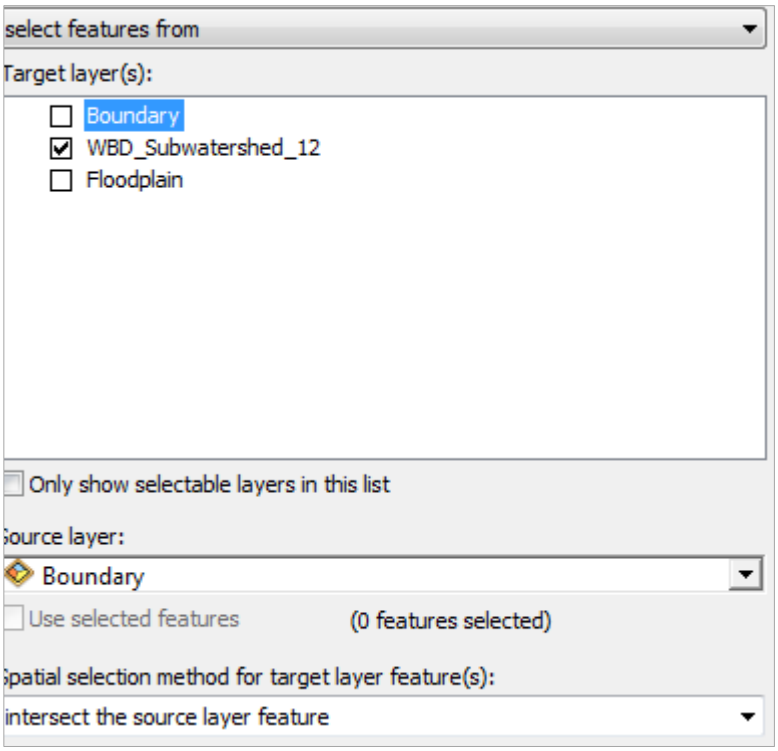
From the **WBD_Subwatersheds** folder, add the **WBD_Subwatersheds_12.shp** to ArcMap. This information is from the Watershed Boundary Dataset of the United States. These are also called the HUC12 Subwatersheds because they are uniquely identified by a 12-digit code.



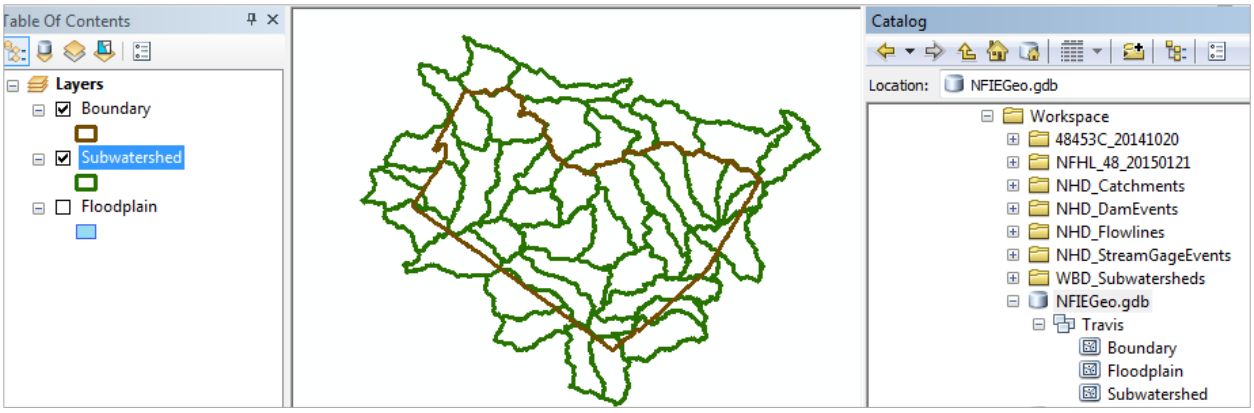
Use **Selection/Select by Location**



To select those Subwatersheds that **Intersect** the **Boundary** of Travis County

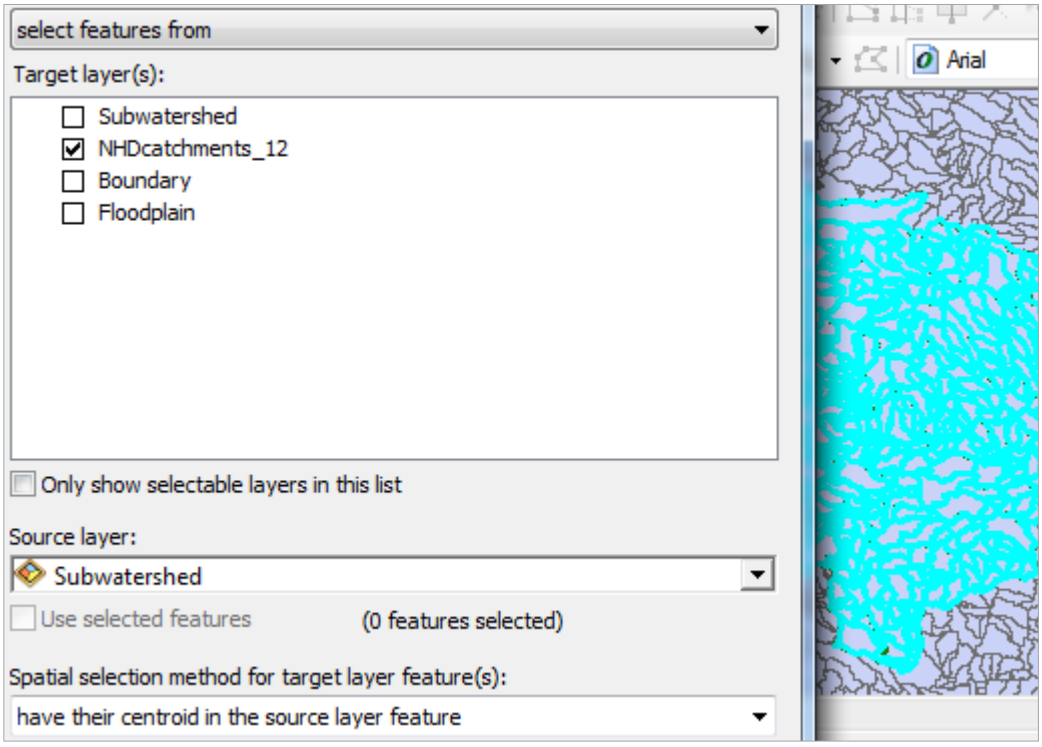


Export the selected features to the NFIEGeo geodatabase as **Subwatershed.** Symbolize them hollow with a Green outline, 2 pt line weight.

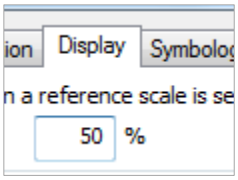


Step 8. Add your Catchments

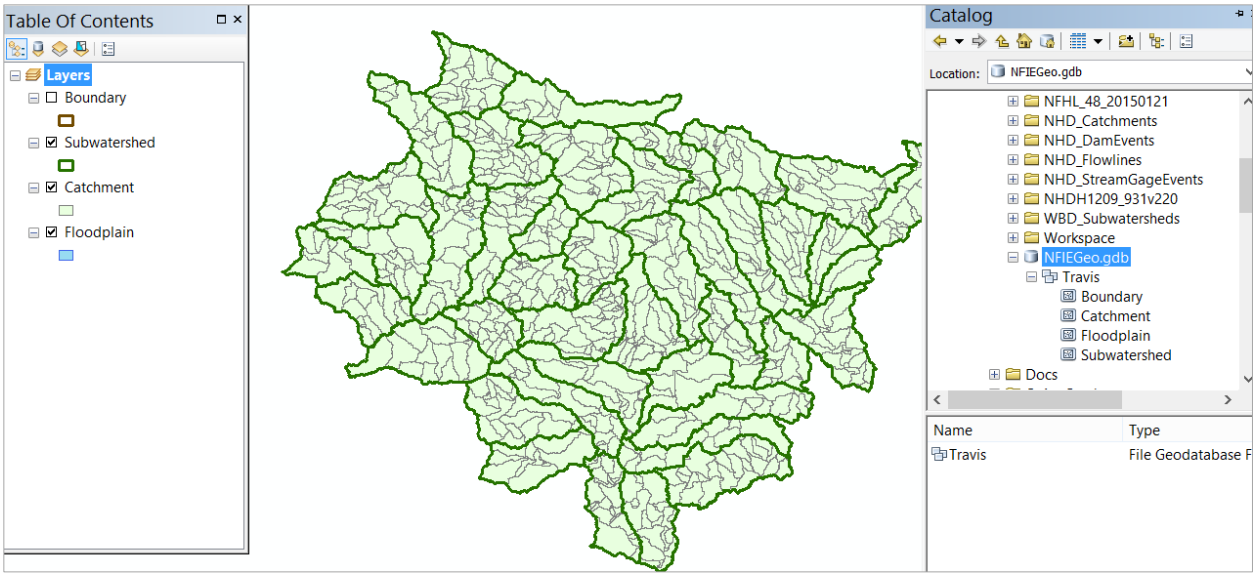
From the **NHD_Catchments** folder, add the **NHDCatchments_12.shp** shape file to ArcMap. Use Select by Location to select from the **NHDCatchments_12** feature class those catchments that **"have their centroid in the source layer feature"** (right at the bottom of the available selection options) the **Subwatershed** feature class.



And Export these to the NFIEGeo geodatabase as **Catchment.** Color them green and make the display visibility 50%.

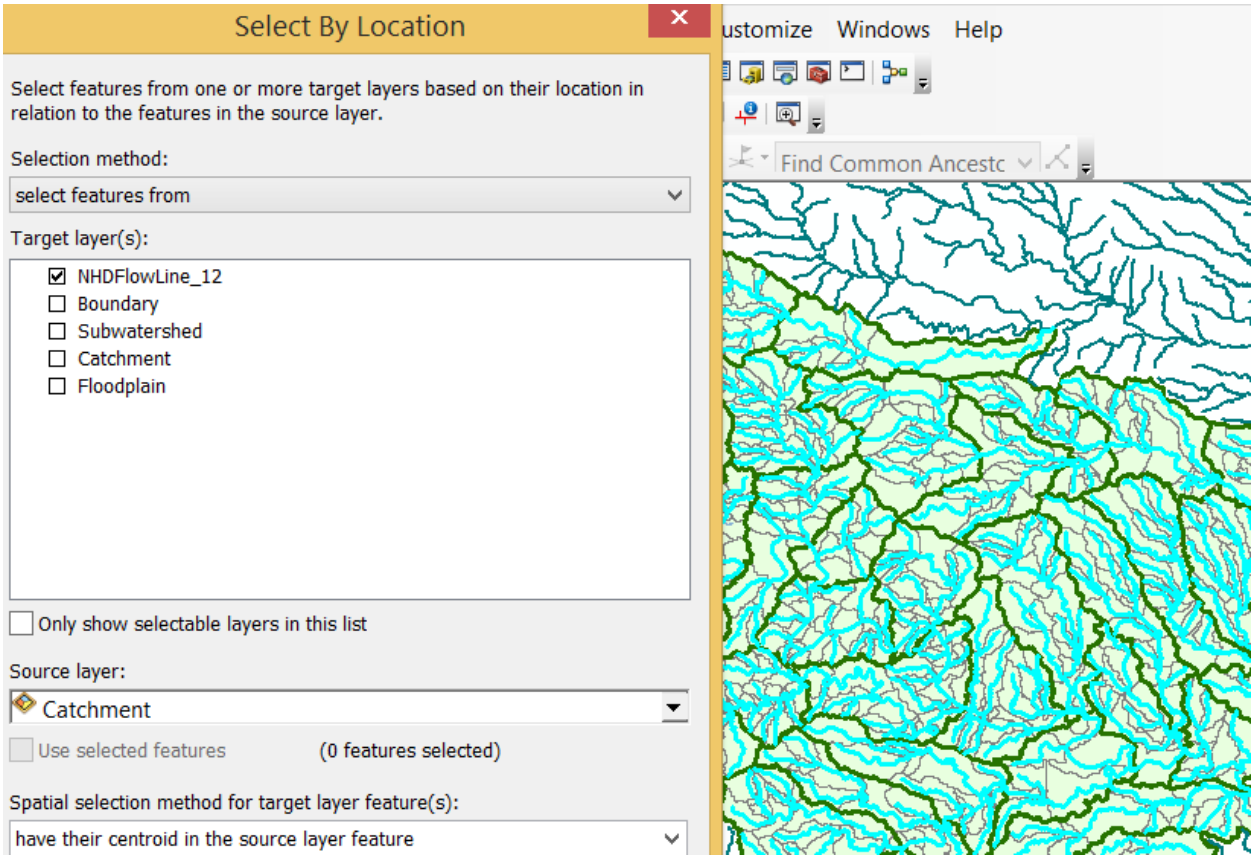


The result should appear something like this:

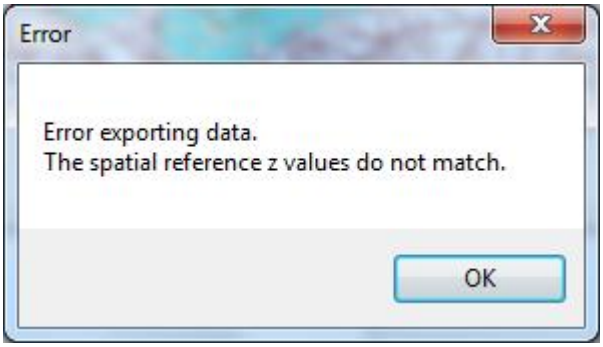


Step 9. Add your Flowlines

From the **NHD_Flowlines** folder, add the **NHDFlowLine_12.shp** shape file to ArcMap. Use same Select by Location method as for Catchments to get the flowlines whose centroid lie within the Catchments coverage:

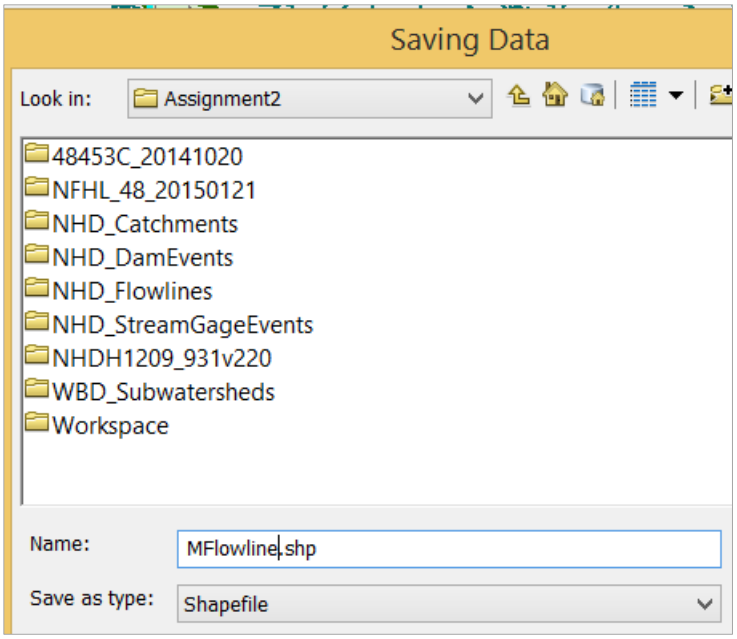


When you try to export the selected flowlines you get an error message:

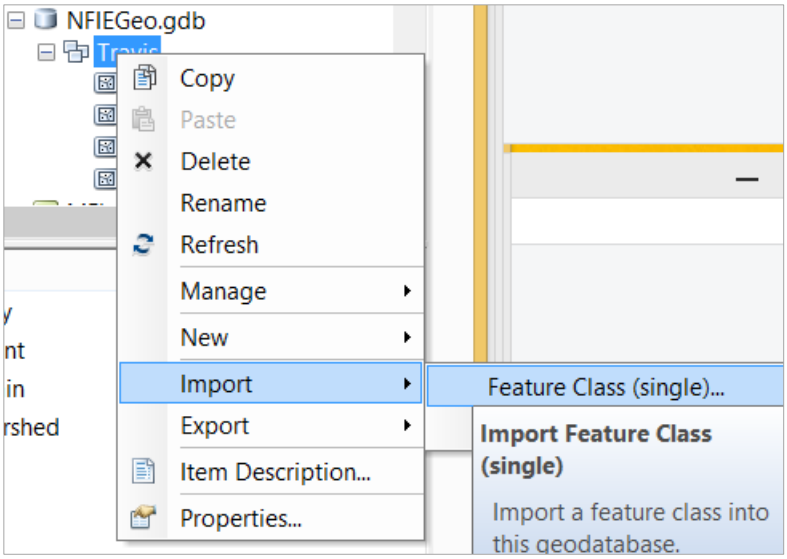


This is an annoying issue and requires two steps to get around it.

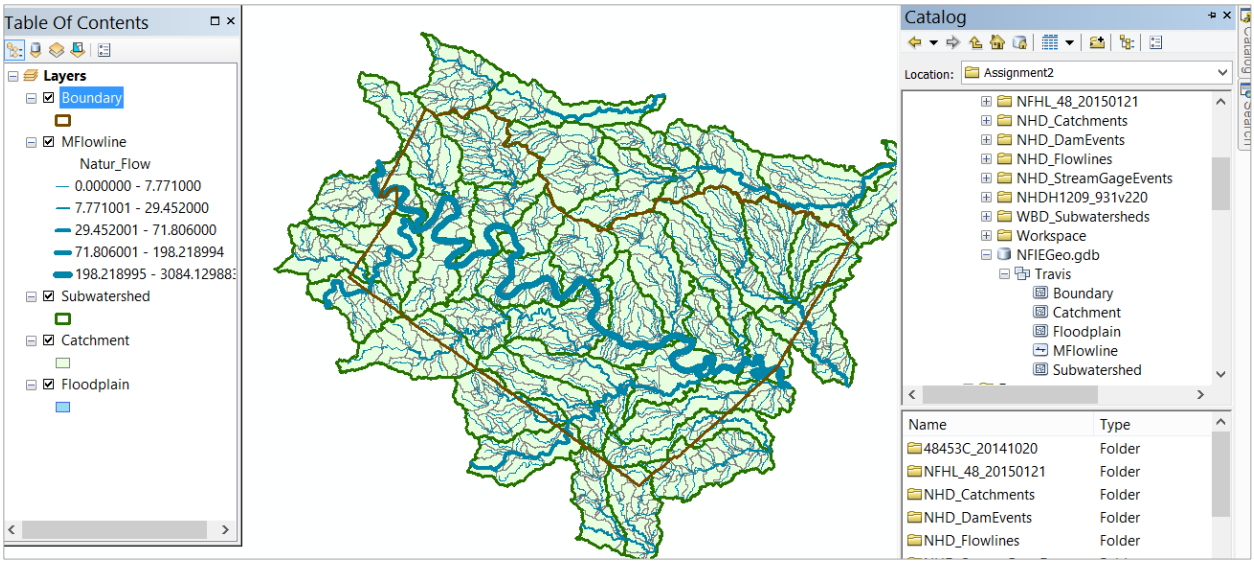
Export the selected flowlines to a shape file called **MFlowline.shp** The prefix “M” is used because these are the flowlines from the **Medium Resolution** or 100K National Hydrography Dataset Plus. Later we’ll get the comparable flowlines from the High Resolution National Hydrography Dataset.

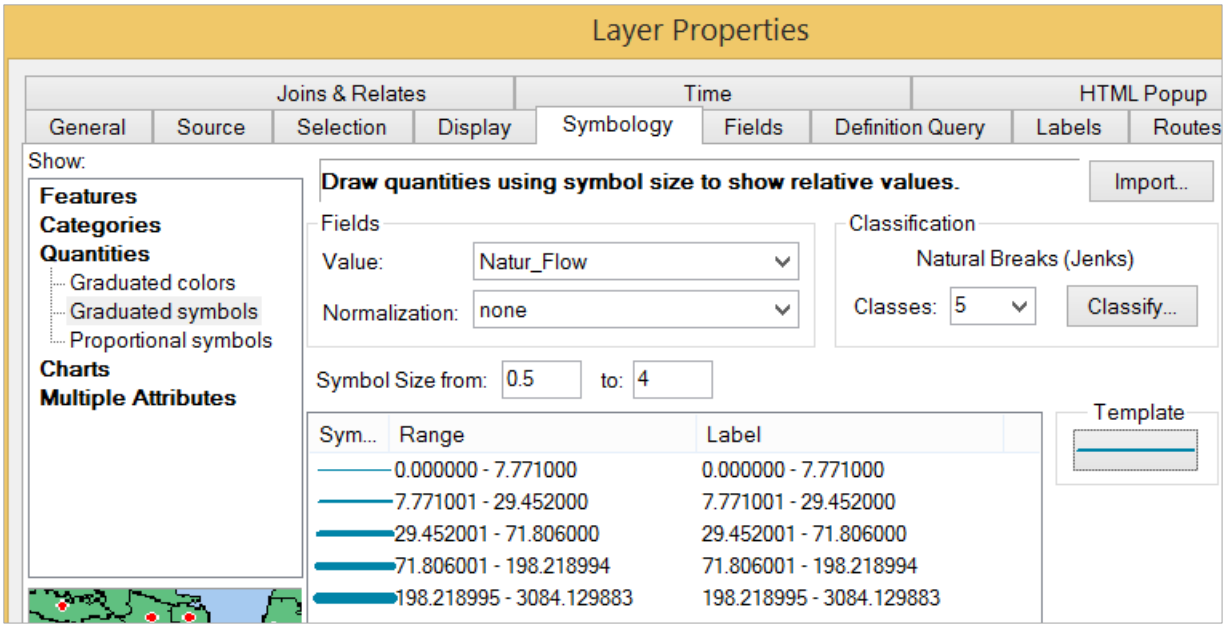


Then import this into the NFIEGeo geodatabase



Symbolize the resulting **MFlowline** layer using Graduate Symbols in blue for the attribute **Natur_Flow** which is an estimate of the Mean Annual Flow in cfs. You can get a sense from this map of the main drainage features of this area – the Colorado River and its tributaries flowing through Austin, and Brushy Creek to the north of Travis County that flows through Williamson County and Round Rock, TX.

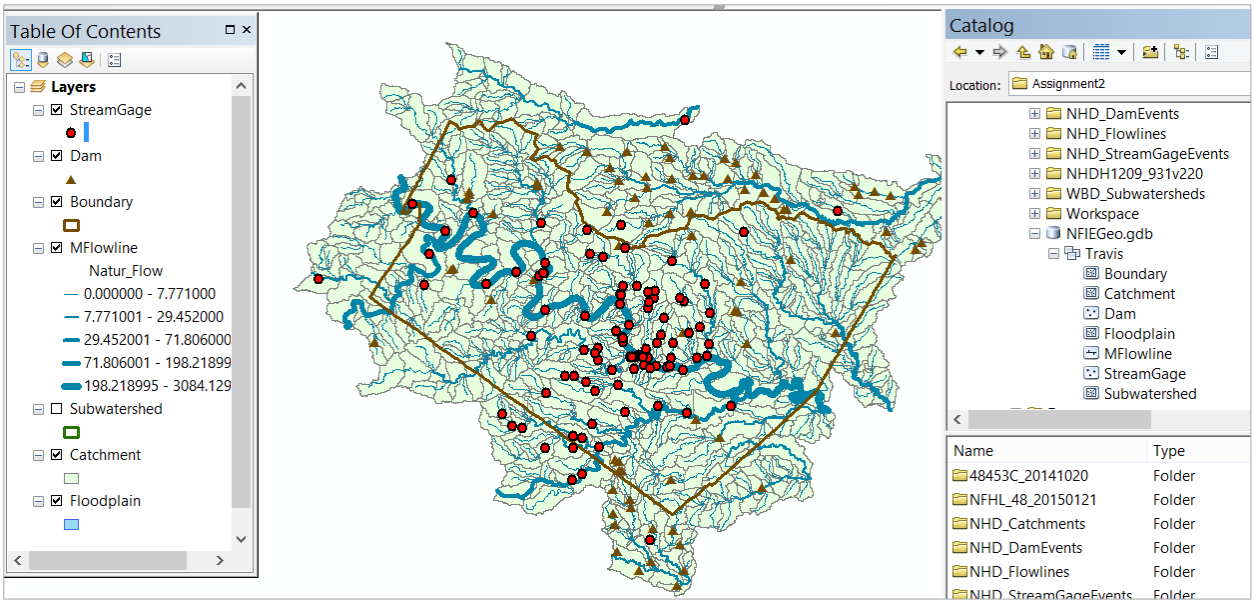




Step 10. Add your Dams and Streamgages

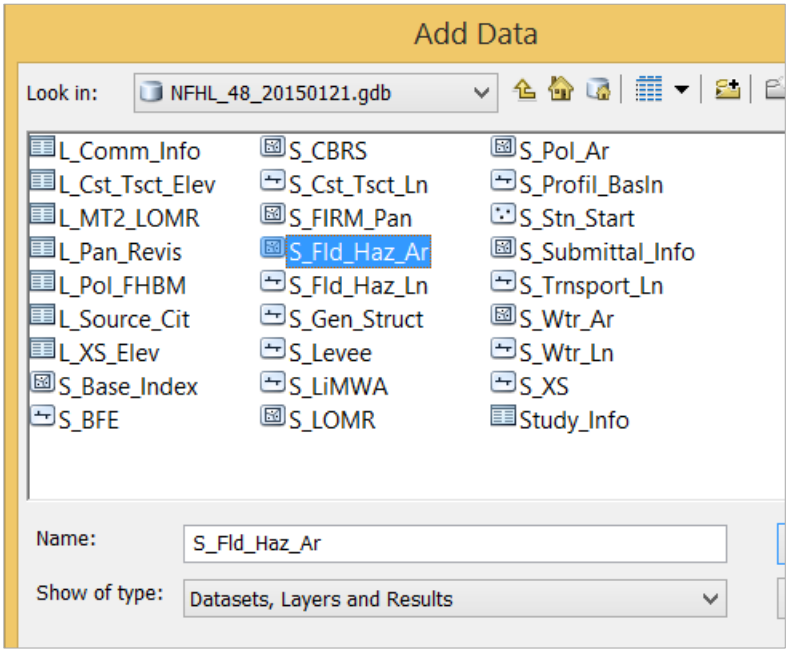
Use the same process as just described to add **NHD_DamEvents** and **NHD_StreamGageEvents** to the map, select the features within the Subwatershed domain, and add them to the NFIEGeo Geodatabase as feature classes **Dam** and **StreamGage**, respectively. The word "Event" is used in the title of these files because when points are located exactly on a flow line, a method called "Linear Referencing" is used in which a point such as a Stream Gage located near a flowline becomes a "Point Event" on the flowline.

Symbolize the Dams as brown triangles and the StreamGages as red dots. Notice how many dams there are in Williamson County – these are flood control dams built by the USDA Natural Resources Conservation Service when this was rural land, but now it is urbanized so these large structures are providing flood protection to a large urban population.

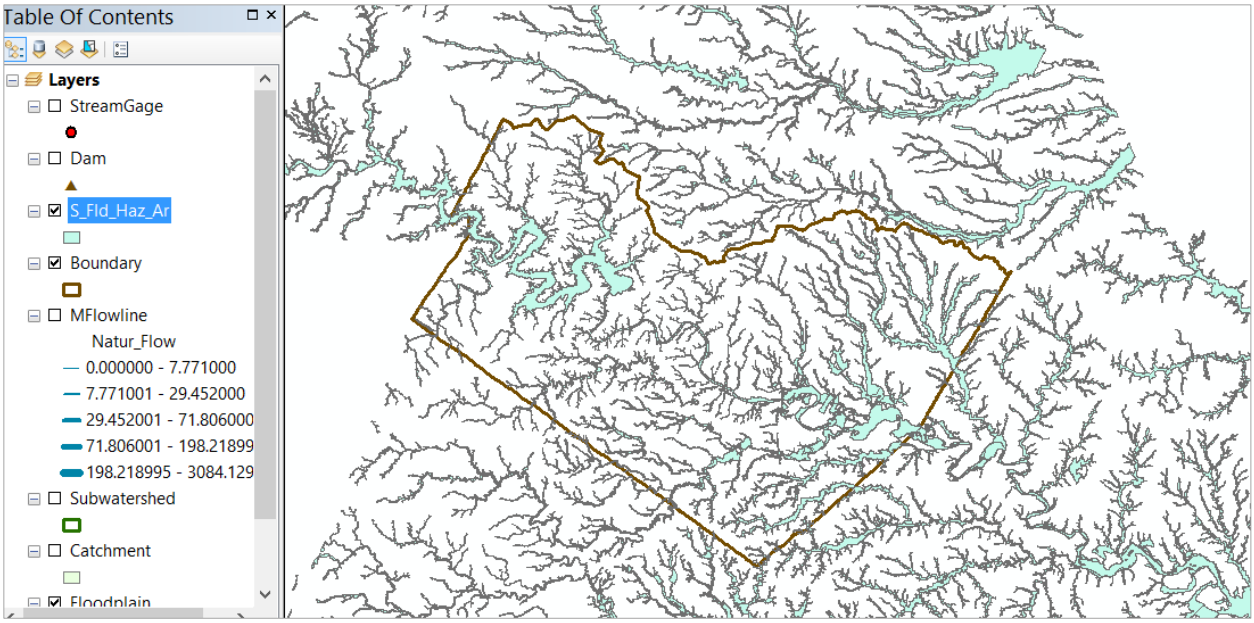


Step 11. Form the Reach Flood Warning Zones

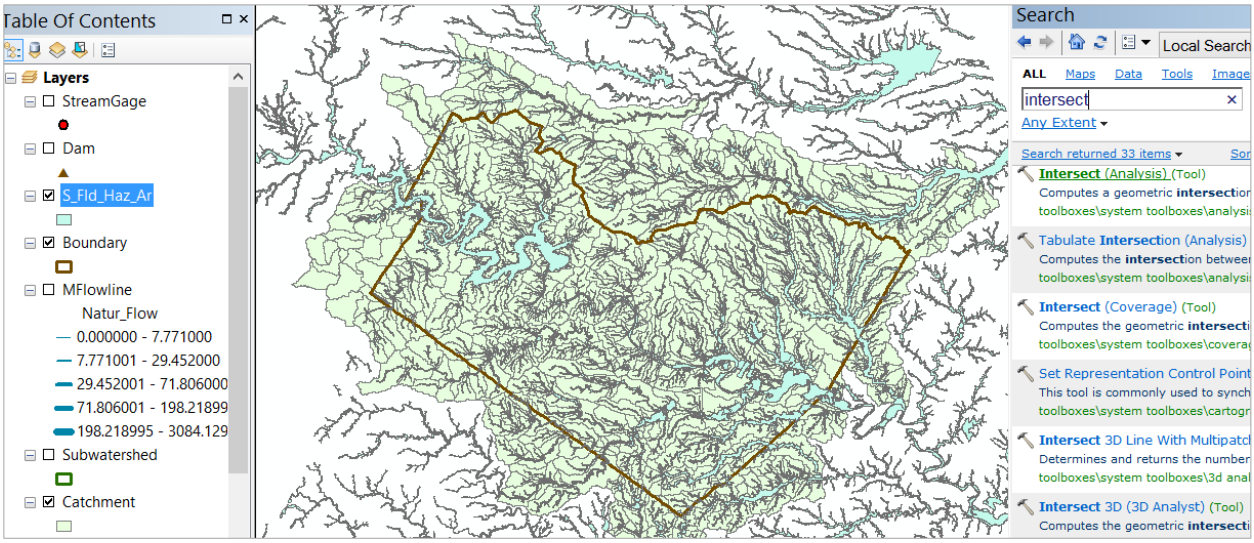
Now we're going to use the National Flood Hazard Layer for Texas to create reach flood warning zones for each catchment. From **NFHL_48_20150210.gdb**, add the **S_Fld_Haz_Ar** layer.



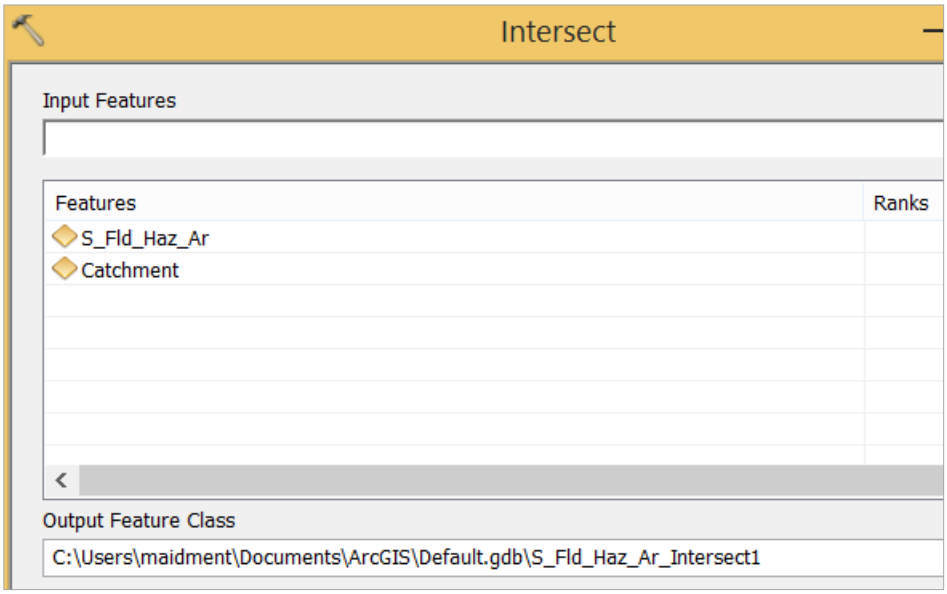
Use a Definition Query to select out the 'X' zone as in Step 6. Notice that the map is blank to the west of Travis County, in Blanco County, and to the east, in Milam County. These counties do not yet have approved Flood Insurance Rate Maps in the National Flood Hazard Layer.



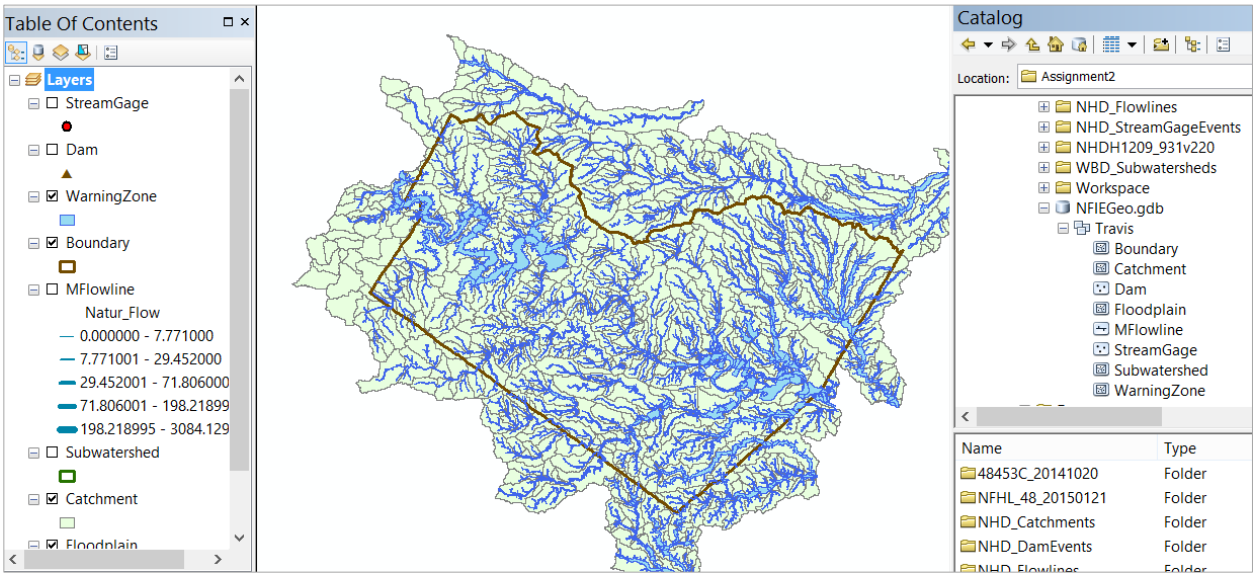
Use **Search** to find the **Intersect** tool, and select the **Intersect (Analysis)** version



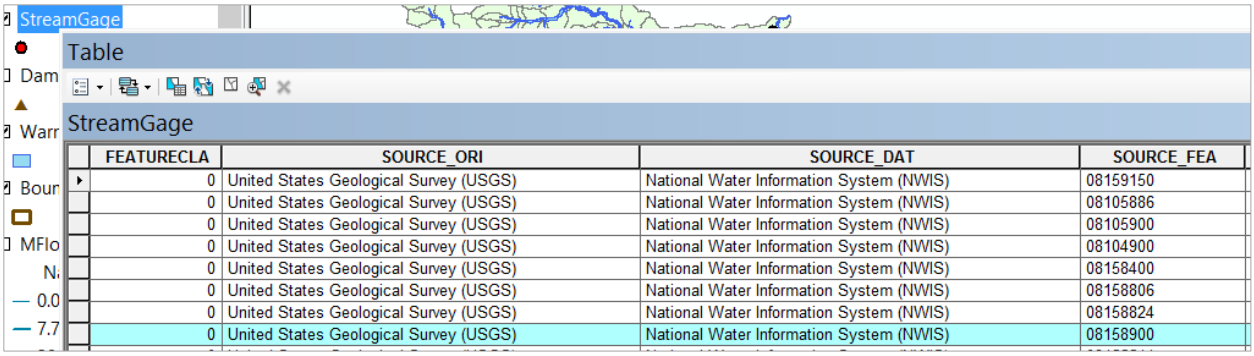
Select **S_Fld_Haz_Ar** and **Catchment** as the layers to be intersected. Leave the output feature class at its designated default location.



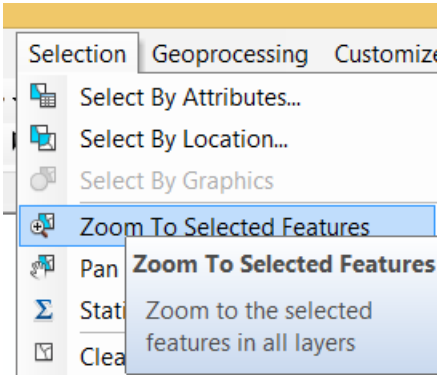
Export the resulting intersected layer to the NFIEGeo geodatabase as **WarningZone**.



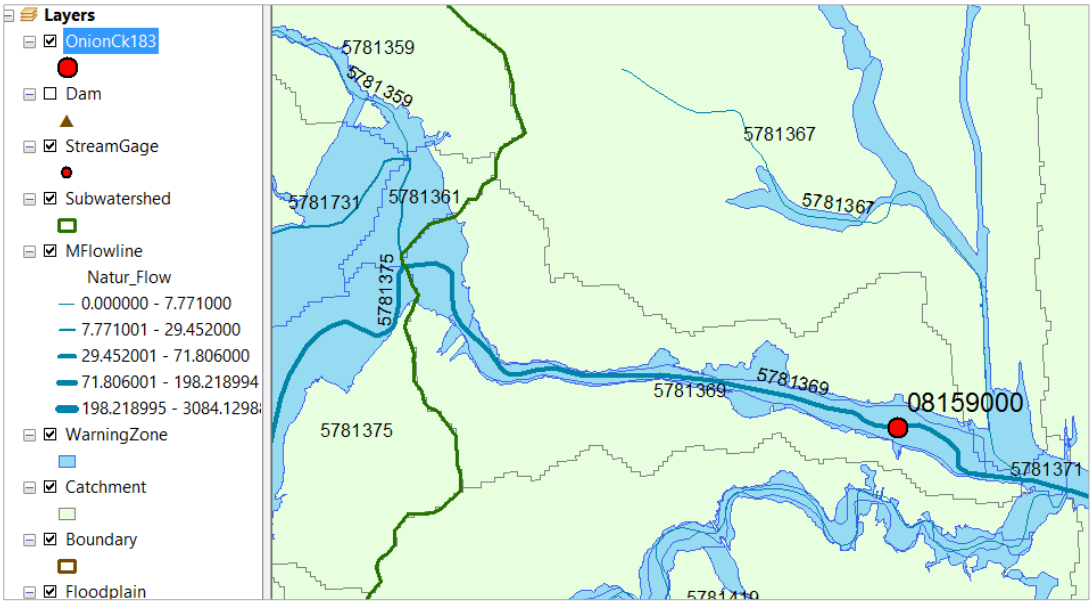
Now, let's take a look and see what we have got. Open the attribute table for the StreamGages, and select the stream gage with **Source_Fea = 08159000**, which is the gage on Onion Creek at Highway 183.



Use **Selection/Zoom to Selected Features** to zoom to that location.

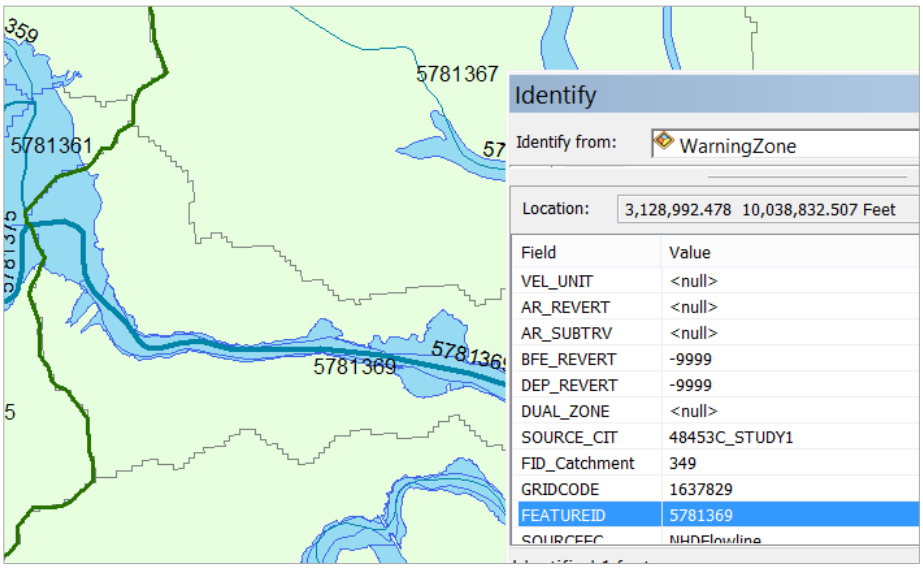


Export the selected gage to NFIEGeo as OnionCk183, and in the map label it with its Source_Fea attribute at 14pt type. Similarly label the **Catchment** feature class with **FeatureID** and the **MFlowline** feature class with **COMID** at 10pt type. You'll see that Gage 08159000 is located in Catchment 5781369 which has MFlowline 5781369, which is connected upstream and downstream with similarly labeled flowlines. If you click on the WarningZone feature class, you'll see that its features are particular to this Catchment.



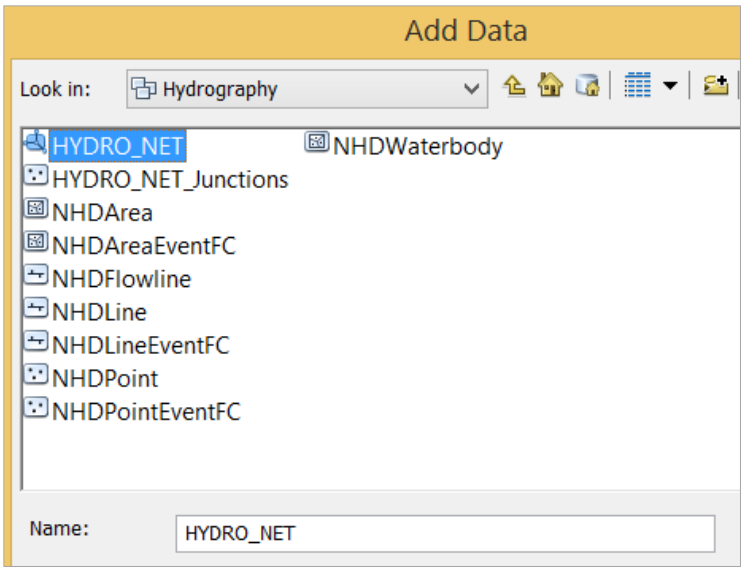
And if you use the Identify tool on the WarningZone, you'll see that it carries the identifier FeatureID = 5781369 that links it to the Catchment containing it.

Ok, that is pretty cool. We have a NFIE-Geo database that can be linked to the NFIE-Hydro flood forecasting model, and we can assess flood risk and color in the WarningZone accordingly.

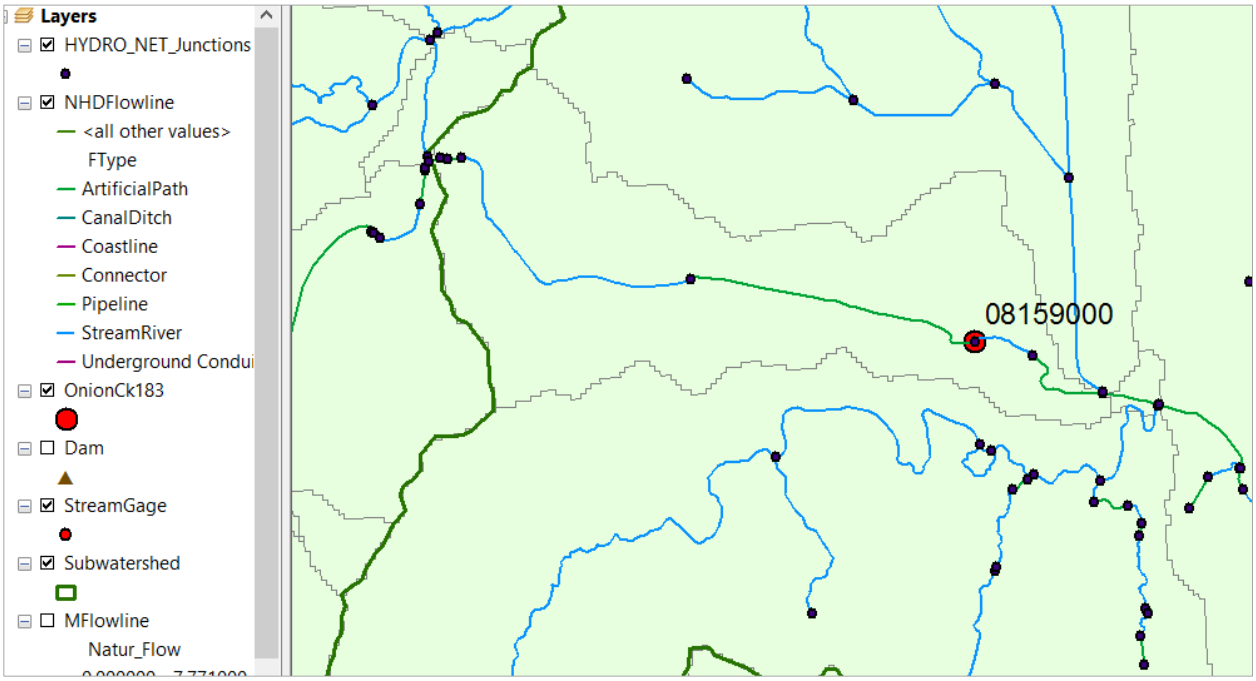


Step 12. Adding the 24K NHD Flow Network

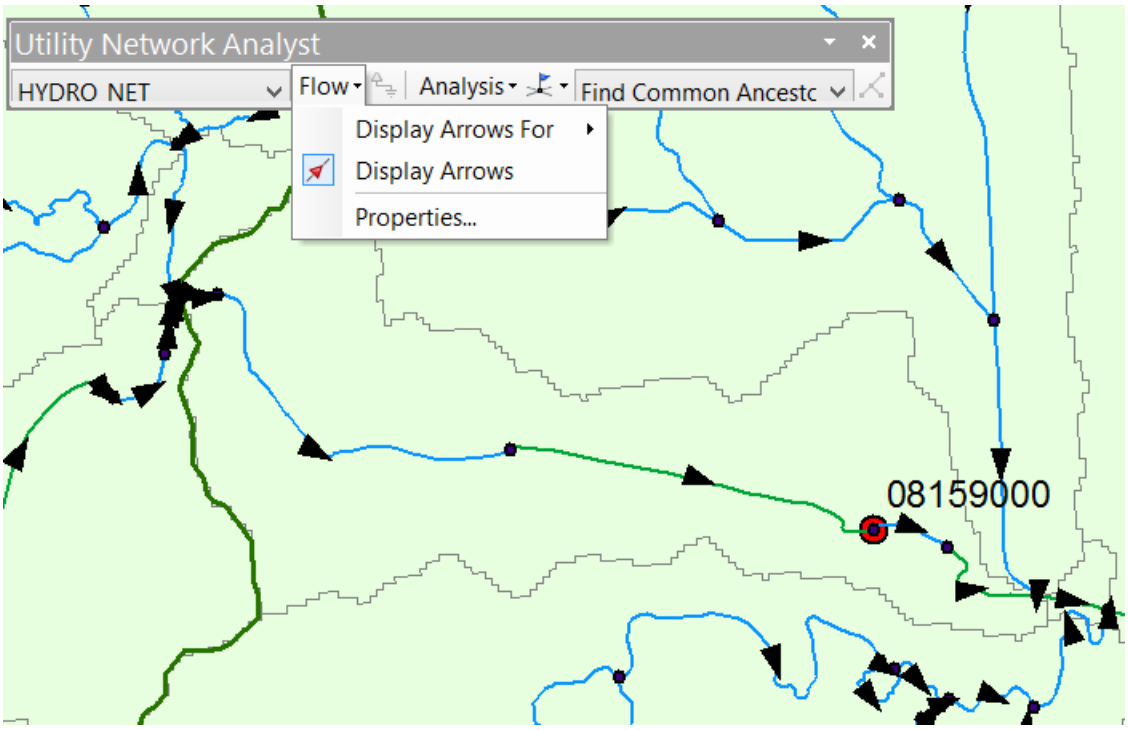
What you have just processed for 100K NHDPlus data is adequate for hydrologic computations and forecasting. If we want to add hydraulic modeling, the 24K NHD HydroNetwork is helpful. Go to the NHDH1209_v31v220 folder, the NHDH1209.gdb geodatabase, Hydrography feature dataset and add the Hydro_Net geometric network.



This provides a more detailed flow network where the lines are joined by junctions, and the lines are Subtyped to give a sense of their function in the network. **StreamRiver** is the one we'll mostly be concerned with. **ArtificialPath** goes through waterbodies and streams represented as polygons.



Right click in the gray area at the top of the ArcMap display and add the Utility Network Analyst toolbar. Use Show Arrows, to indicate the flow direction on the network. This is a more sophisticated and detailed view of the flow network that we'll explore further when we study NFIE-River.



To be turned in:

(1) Prepare a nice map showing the Travis County NFIE-Geo database.

(2) How many Subwatersheds are in this database? How many Catchments? How many Flowlines? How many catchments are there in a Subwatershed, on average?

(3) What is the average area (km^2) of the Subwatersheds and of the Catchments? The map units are in feet so you'll need to do some conversions here.

(4) What is the average length of the MFlowlines (km)?