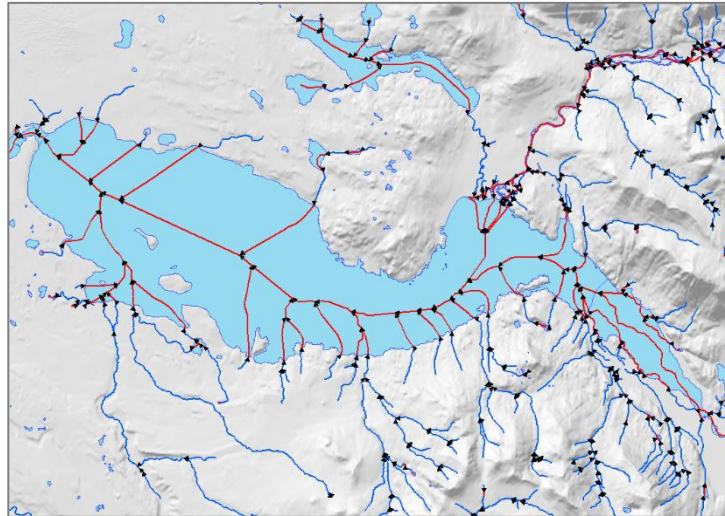


EXERCISE 4

How to designate Artificial Paths



Introduction

Stream networks within the NHD need to maintain connectivity where they encounter or flow through 2D features within either the NHDArea or NHDWaterbody layer. This requirement, however, is challenging because the thalweg (i.e. path of primary flow) of a stream network is not always apparent within an NHDArea or NHDWaterbody feature (e.g. such as a deep lake or a wide braided river system). To accommodate that spatial uncertainty, the NHD uses a coding convention called an Artificial Path to maintain stream connectivity and indicate general flow direction within NHDArea and NHDFeatures. In this exercise, users will learn to identify where these types of features occur within a dataset, as well as how to apply the appropriate NHD attributes to those features for later use in preparing an NHD update. The concept of Artificial Paths is further described here - <https://bit.ly/2JmFBnx>

Objectives

- Learn how to batch select features that meet the NHD's criteria for Artificial Path designation.
- Learn how to apply the appropriate attribute codes to features meeting the NHD's criteria for Artificial Paths.

Required Data

- **USFS_Streams_Subset.gdb** – file geodatabase that contains a number of features created in the previous exercise, as well as the primary featureclass that will be modified over the course of this exercise. The featureclasses contained within the geodatabase include the following:

- **Streams_Subset** – featureclass depicting stream features that were compiled by USFS staff on the Plumas National Forest for use in updating the NHD.
- **HU10_AOI** – featureclass that contains a bounding polygon from the Watershed Boundary Dataset (WBD) and serves as the bounding extent for the area of interest for this exercise. Dataset was created during Exercise 2 of this series.
- **NHDArea_Subset** – this featureclass contains a subset of polygons representing areal hydrographic landmark features that were extracted from the NHD. Any feature in this dataset intersects the HU10_AOI dataset and was created during Exercise 2 of this series.
- **NHDFlowline_Subset** – this featureclass contains a subset of polylines representing 1D routes that make up a linear surface water drainage network and were extracted from the NHD. Any feature in this dataset intersects the HU10_AOI dataset and was created during Exercise 2 of this series.
- **NHDPoint_Subset** – this featureclass contains a subset of points representing NHD hydrographic landmark features that were extracted from the NHD. Any feature in this dataset intersects the HU10_AOI dataset and was created during Exercise 2 of this series.
- **NHDWaterbody_Subset** – this featureclass contains a subset of polygons representing areal NHD hydrographic waterbody features that were extracted from the NHD. Any feature in this dataset intersects the HU10_AOI dataset and was created during Exercise 2 of this series.
- **NHDArea_Waterbody_Combined** – featureclass containing the combined content of the NHDArea_Subset and NHDWaterbody_Subset layers described above.
- **Intersection_Points** – this featureclass contains point features depicting the location of intersections between the Streams_Subset, NHDArea_Subset, and NHDWaterbody_Subset layers described above.
- **Streams_Subset_Split** – primary featureclass for this exercise. The features within this dataset are a subset of data that were compiled by USFS staff on the Plumas National Forest for use in updating the NHD and have been modified to accommodate boundary intersections with existing NHD polygons (see Exercise 3 in this series).

Note: *not all of the datasets listed above will be used within this exercise, but they comprise the full list of content within the USFS_Streams_Subset geodatabase that users will encounter. Some of these datasets were used in previous exercises, some will be used in this exercise, and others will be used in later exercises.*

Prerequisites

- ESRI ArcGIS Desktop v10.5.1 (or newer) will be installed on the user's computer
 - "Standard" or "Advanced" level ArcGIS Desktop license required – exercise will not work with "Basic" level ArcGIS Desktop license.
- User has a basic level of experience with the ArcMap interface.



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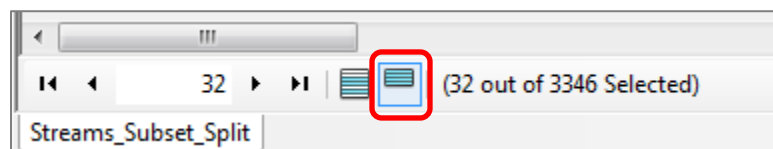
Part 1: Identifying Artifical Path features

As a general rule, NHDFlowline features occurring within NHDArea or NHDWaterbody features are to be coded as Artificial Paths. Each of the features in the original **Streams_Subset** dataset had been assigned an **FCode** attribute value prior to the stream features being split where they overlapped NHDArea or NHDWaterbody content. However, once the stream features were spilt, each of the resulting stream features in the new **Stream_Subset_Split** dataset inherited its predecessors FCode value. In order to futher prepare the streams data to update the NHD (specifically the NHDFlowline layer), editors or data stewards must confirm that any stream features occurring within NHDArea features or within NHDWaterbody features are correctly coded as Artificial Paths.

Note: NHD FCodes are five-digit integer values comprised of the NHD feature type and the combinations of characteristics and values. Via the NHD FCode attribute field (every geospatial feature within the NHD is assigned an FCode value), features can be categorized on the basis of their physical form and function. A full listing of the NHD FCodes is available here - <https://bit.ly/2slzeXW>

A. Identifying features which the NHD considers to be Artificial Paths

1. Either open the ArcMap document created at the end of exercise 3 **OR** navigate to the directory containing the content for exercise 4 and double click the file titled **"Streams_4_NHD_Update.mxd"** to open the required ArcMap document.
2. Once the file is open in ArcMap, click on the **Selection** tab (near the top left corner in ArcMap) and choose **Select by Location**.
3. When the **Select By Location** window opens, choose the **Streams_Subset_Split** dataset as the Target layer, and set the **NHDArea_Waterbody_Combined** dataset as the Source layer. Then set the spatial selection method to **"have their centroid in the source layer feature"** (last option in dropdown menu) and click **OK**.
 - i. The features selected this way constitute every feature within the Streams_Subset_Split dataset that is located within an NHDArea or NHDWaterbod and would be considered an Artificial Path feature in the NHD data model.
4. Since the attrbute table for the **Streams_Subset_Split** layer should already be open in ArcMap (if for whatever reason it is not already open, then open the table by right clicking the layer in the TOC and choosing **Open Attibute Table**), we can quickly assess the results of the spatial selection process. In the lower lefft corner of the attribute table, note that there are 32 records within the dataset selected. Click the **Show Selected Records** button so that only the selected features are visible within the attribute table – see the following graphic.

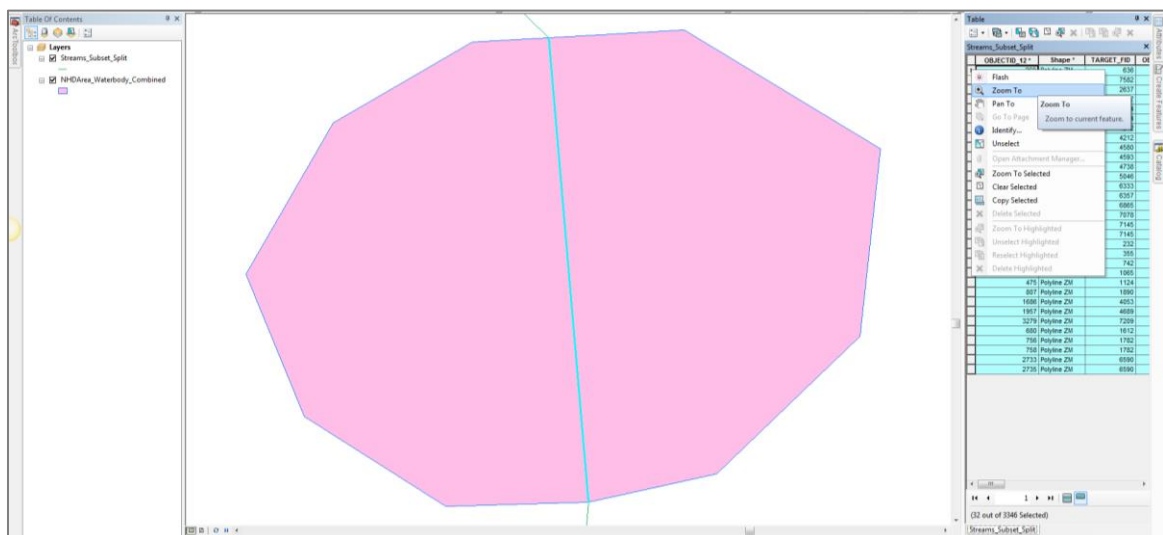


5. To view specific seleccted records, users should right click the small gray box to the left of the first record in the selected set, and then select **Zoom To** as demonstrated below.

Note: depending how ArcMap has sorted the order of the records in the attribute table, users may see a different first record to the example shown below.

OBJECTID_12 *	Shape *	TARGET_FID	OBJECTID_1	OBJECTID	Perr
Flash		636	14292	669667	83087
Zoom To		7582	0	0	
Pan To		2637	56140	670089	83087
Go To Page				670089	83087
Identify...				712637	16419
Unselect				753678	16418
Open Attachment Manager...				795313	16418
Zoom To Selected		4212	88001	795313	16418
Clear Selected		4580	95034	794897	16418
Copy Selected		4593	95253	794907	83086
Delete Selected		4738	98495	794883	83087
Zoom To Highlighted		5046	105092	793611	83086
Unselect Highlighted		6333	134616	878678	16418
Reselect Highlighted		6357	135156	918883	83087
Delete Highlighted		6865	150454	919853	16419
		7078	0	0	
		7145	0	0	
		7145	0	0	
		232	5063	670491	16419
		355	7906	670522	16418
		742	16877	670868	16419
		1065	23940	628490	16418
475 Polyline ZM		1124	25196	628470	16419

6. The map will automatically zoom to the extent of the first selected record in the attribute table, as shown below. This is a classic example of a feature within a stream network that the NHD considers to be an Artificial Path.



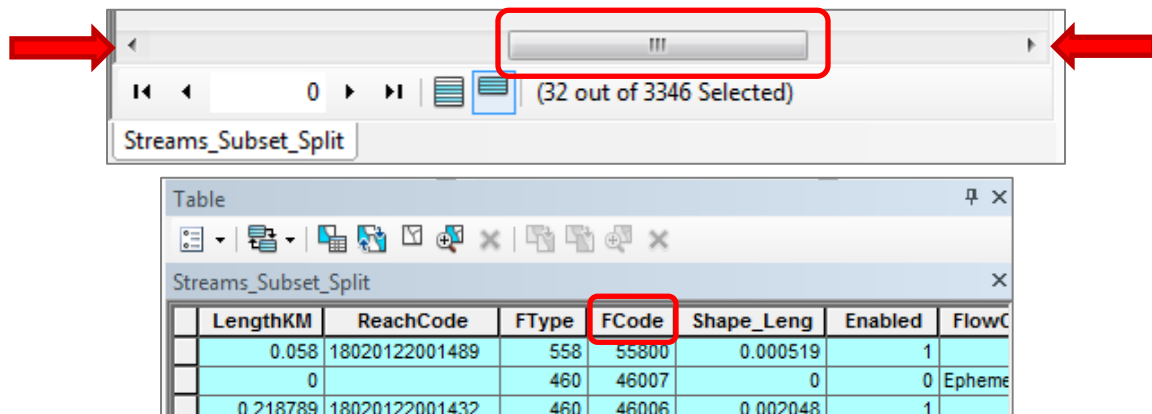
7. Using the right click and Zoom To method described above, users are encouraged to inspect a few more of the selected features to get a sense of where Artificial Path features typically occur within a stream network.

Part 2: Populating FCode and FType values

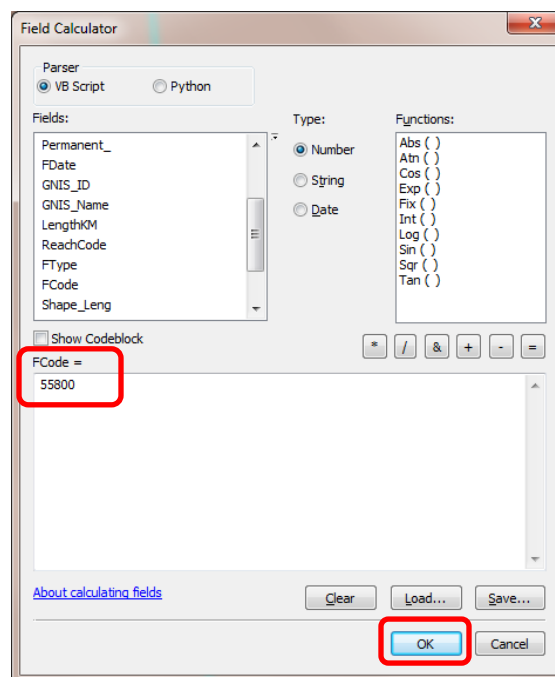
Once users have identified the subset of stream features that are typically characterized as Artificial Paths within the NHD data model, users can then populate the attribute table accordingly so these features will later transfer their Artificial Path designation to the NHD data model. This can be done via the Field Calculator within the attribute table.

A. Using the Field Calculator to populate FCode values

1. In the **Stream_Subset_Split** attribute table, use the slider bar or the arrows at the bottom of the attribute table to find the field titled **FCode**.



2. Right click on the word **FCode** and select **Field Calculator** from the list of available options.
3. When the Field Calculator window opens, type **55800** in the dialog box underneath “**FCode =**” as shown below. Click **OK**.



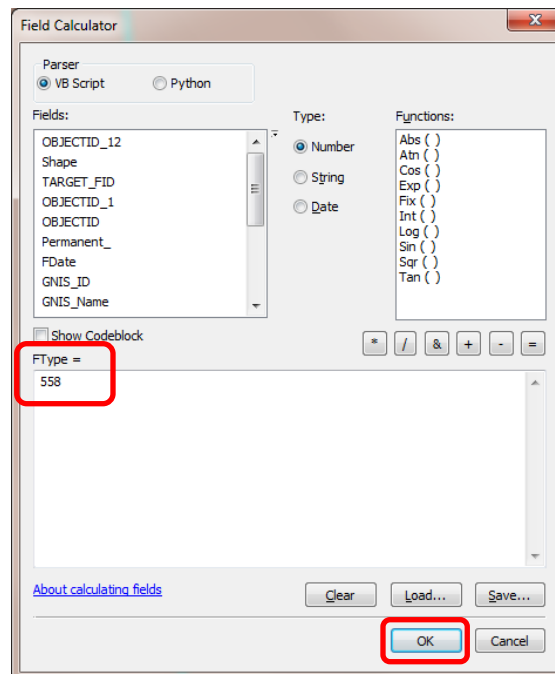
Note: a full list of the FCode values employed within the NHD schema is available via the following link - <https://bit.ly/2slzeXW>

4. Notice that the **FCode** values for each of the selected features now reads as “55800”. We should now update the associated **FType** attribute field due its relation to the FCode attribute field within the NHD data model and so that these attributes can be used to correctly load data into the NHD schema in a later exercise.

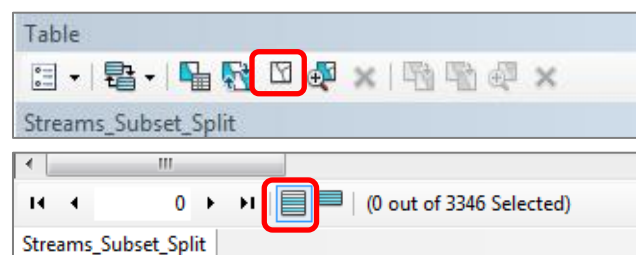
Note: FType attributes may or may not be provided within newly derived streams data and users are not required to fully understand the relationship between FType and FCode attribute values for the purposes

of this exercise. However, since the **FType** attribute is included with this dataset, it's worth matching those value to the related **FCode** values so they don't have to be addressed after loading the features into the NHD schema in a later exercise. The relationship between **FType** and the **FCode** values used within the NHD is described via the following link - <https://nhd.usgs.gov/FeatureDirectory.pdf>

5. Right click on the word **FType** and select **Field Calculator** from the list of available options.
6. When the Field Calculator window opens, type **558** in the dialog box underneath "**FType** =" as shown below. Click **OK**.



7. Notice that the **FType** values for each of the selected features now reads as "558".
8. At the top of the attribute table, click on the **Clear Selection** button to clear the selected records in the table, and then click the **Show All Records** button table at the bottom of the table to see all of the records in the table.



9. Right click on the **Streams_Subset_Split** layer in the TOC and select **Zoom to Layer** so that the full extent of the stream data is visible, then click **File** and **Save**. Finally, close ArcMap.

Congratulations! You have successfully completed this exercise. You have now been introduced to the spatial selection method for identifying features that should be coded as Artificial Paths, as well as how to use the Field Calculator to populate the attributes that will later be used within the NHD data model.