Exercise 2 — Linking Data to the NHD – Last Updated on 3/12/2014

Within this document, the term NHDPlus is used when referring to NHDPlus Version 2.1 (unless otherwise noted).

The NHDSnapshot component of NHDPlus contains a linear referencing system in NHDFlowline.shp. The route identifier is NHDFlowline.Reachcode and the route measures are stored as m-values with the coordinates. Additional information about linear referencing is contained in the ArcGIS documentation.

In Steps 1-3 of this exercise, you will create a point dataset. In Step 4, you will reference to NHDSnapshot Reachcode and measures. An existing point dataset may be used instead of creating a new one. The input point dataset should be in geographic coordinates using the datum and other projection parameters of the NHDSnapshot\Hydrography\NHDFlowline.shp. The results will be reviewed and saved in steps 5 and 6.

Step 7 provides instructions for rendering the NHDPlus linear event table, BurnLineEvents.dbf, as linear events on NHDSnapshot.

1. Using ArcCatalog, create a new point shapefile.
    a. Right-click on the NHDPlusMS\NHDPlus06 folder, go to **New**, **Shapefile**. In the **Create New Shapefile** dialog,
        i. Give the shapefile a **Name** of PointsOfInterest.
        ii. Use the **Feature Type** pull down to select **Point.**
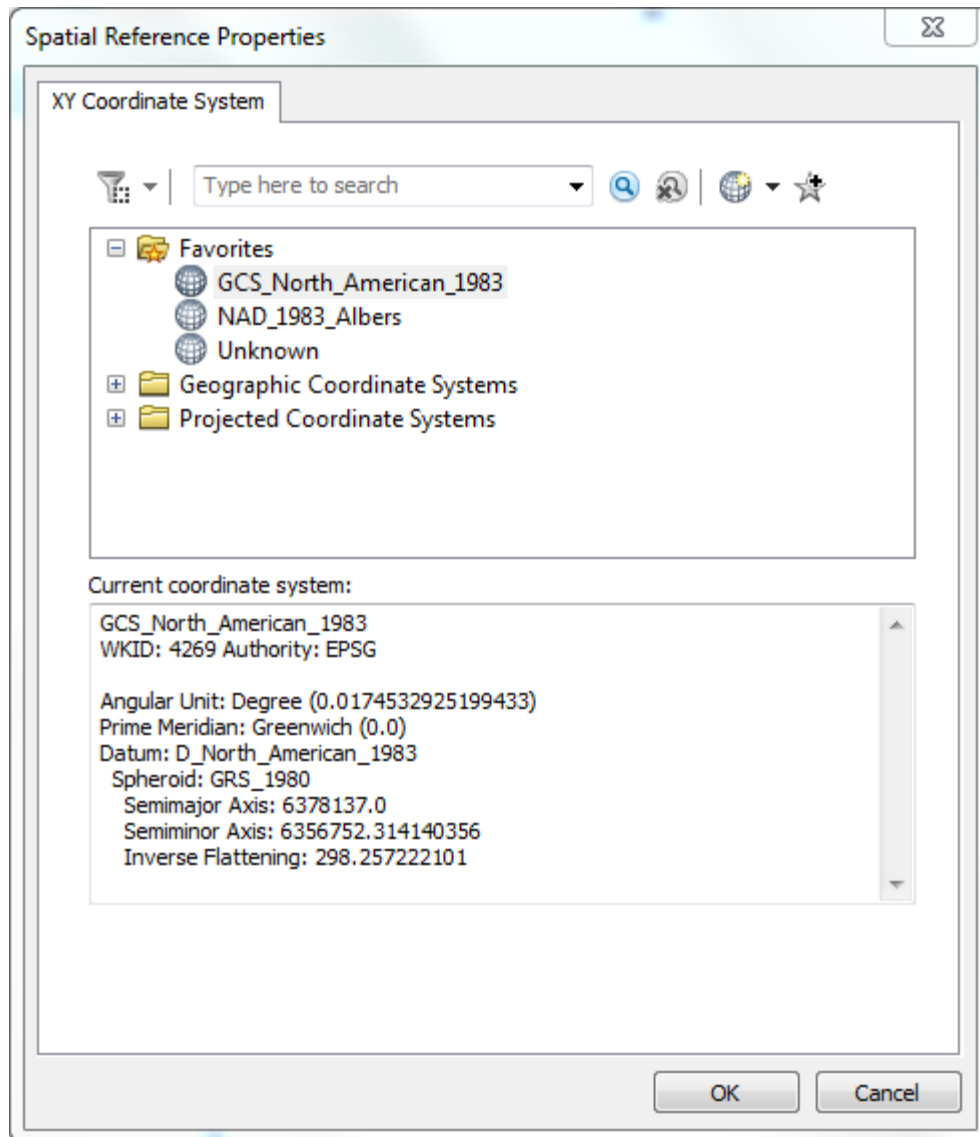   iii. Click **Edit** to create a **Spatial Reference** for the shapefile.
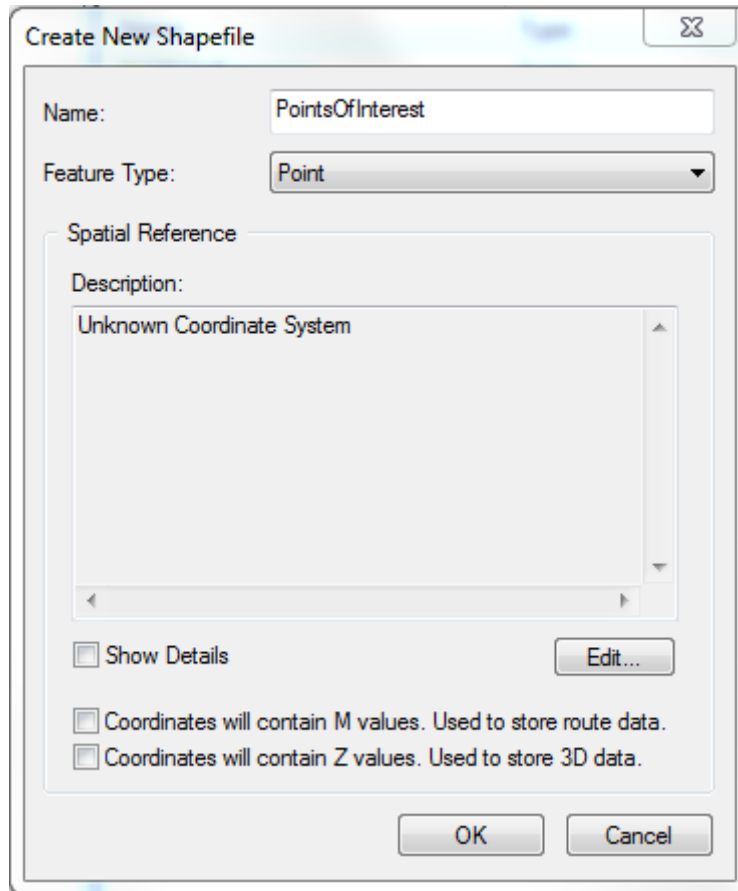
iv. In the **Spatial Reference Properties** window, click **Import** from the Add Coordinate System pull-down menu.
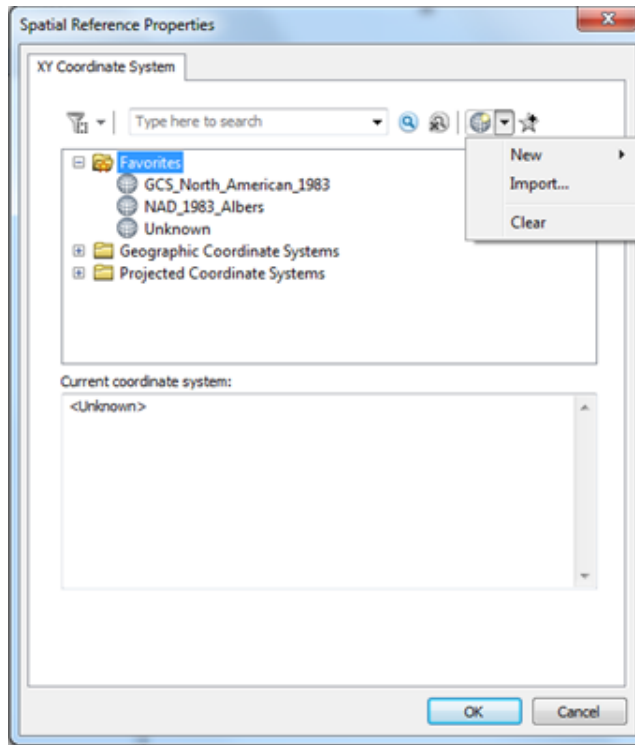
v. In the **Browse For Datasets or Coordinate Systems** window, browse to the NHDPlusMS\NHDPlus06\NHDSnapshot\Hydrography folder and select NHDFlowline.shp. Click **Add**.
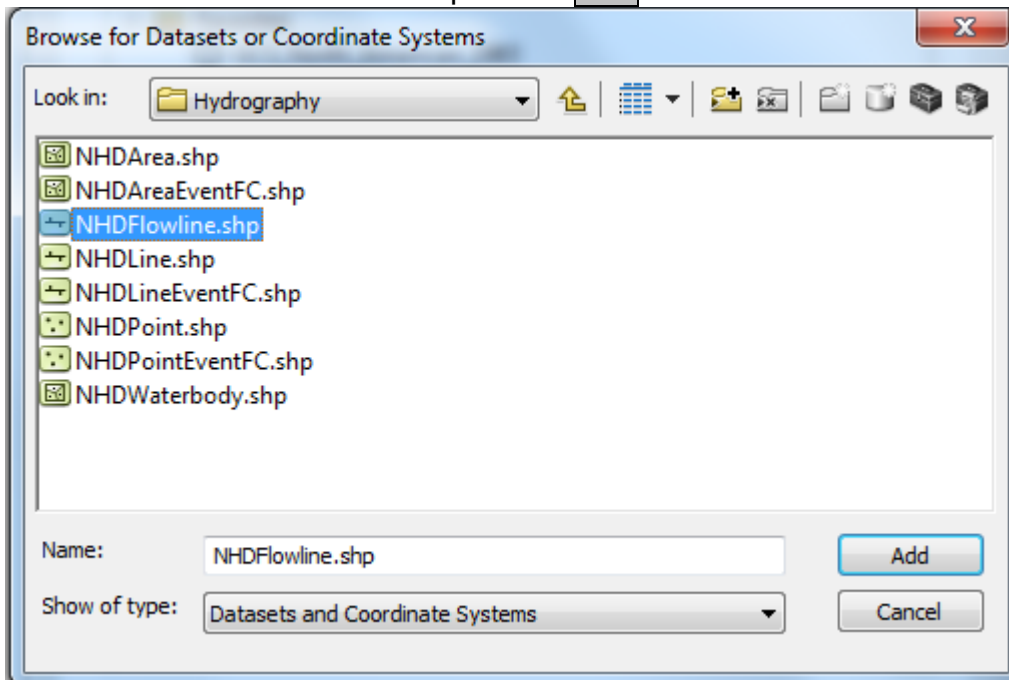
vi. The **Spatial Reference Properties** dialog will now contain the same spatial reference as the NHDFlowlines. Click **OK**.

Spatial Reference Properties

XY Coordinate System

Type here to search

- Favorites
  - GCS_North_American_1983
  - NAD_1983_Albers
  - Unknown
- Geographic Coordinate Systems
- Projected Coordinate Systems

Current coordinate system:

```
GCS_North_American_1983
WKID: 4269 Authority: EPSG

Angular Unit: Degree (0.0174532925199433)
Prime Meridian: Greenwich (0.0)
Datum: D_North_American_1983
  Spheroid: GRS_1980
    Semimajor Axis: 6378137.0
    Semiminor Axis: 6356752.314140356
    Inverse Flattening: 298.257222101
```

OK   Cancel

      vii. The **Create New Shapefile** dialog is now complete. Click **OK**.

b. Close ArcCatalog.

2. In ArcMap:
   a. Use the **File**, **Add Data** menu. In the **Add Data** dialog, navigate to the NHDPlusMS\NHDPlus06\NHDSnapshot\Hydrography folder, select NHDFlowline.shp, and click Add.

   b. Use the **File**, **Add Data** menu. In the **Add Data** dialog, navigate to the NHDPlusMS\NHDPlus06 folder, select PointsofInterest.shp and click Add.

   c. At this point, the content of your map should look like this:
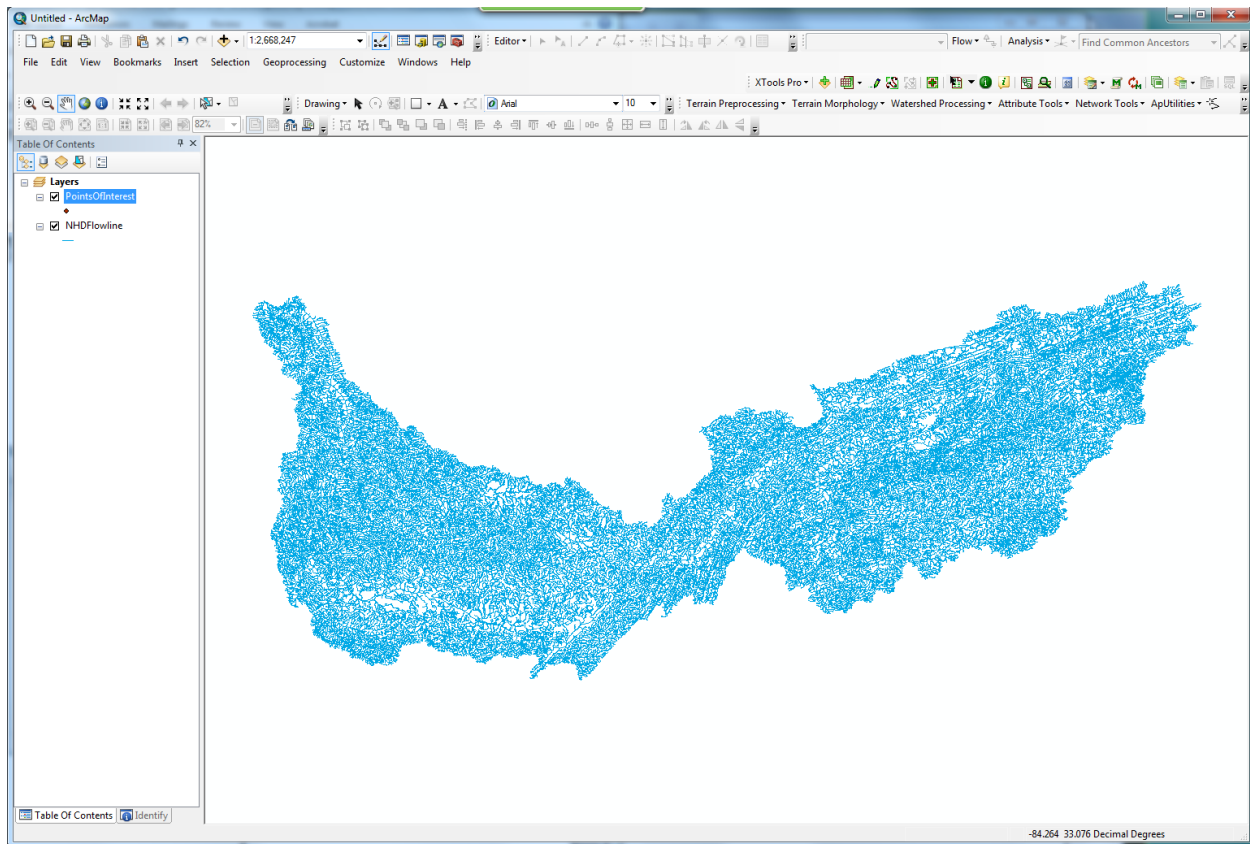
3. Use the ArcMap editor to create point features in PointsOfInterest.
   a. Add the **Editor** toolbar if it is not present in ArcMap. Click on **Editor** and select **Start Editing**. In the top window of the **Start Editing** dialog, the \NHDPlus06 directory should be selected and PointsOfInterest should appear in the bottom window. Click **OK**.
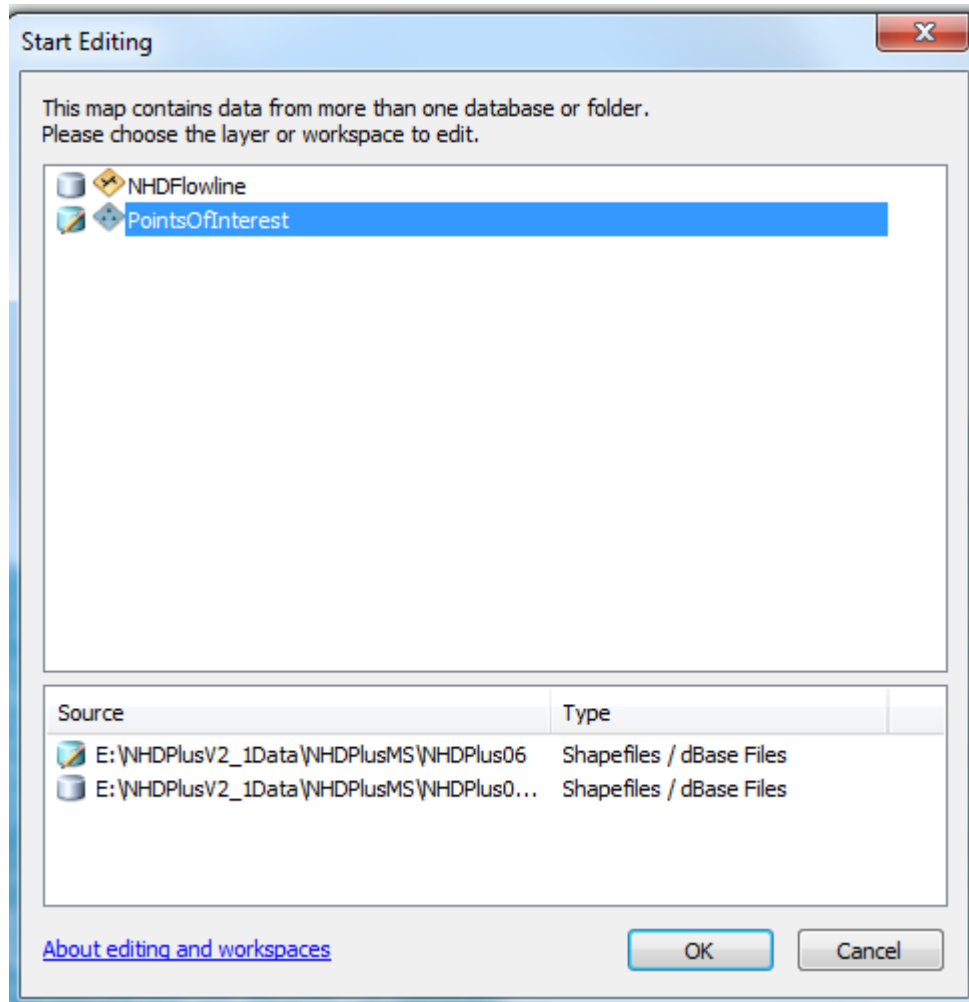

   b. Use the zoom-in tool , to zoom in to an area in the NHDFlowline layer.

c. On the **Editor toolbar**, Open the **Create Features** window [icon]. From the
    Create Features window, choose **PointsOfInterest** and **Point** from the
    Construction Tools.
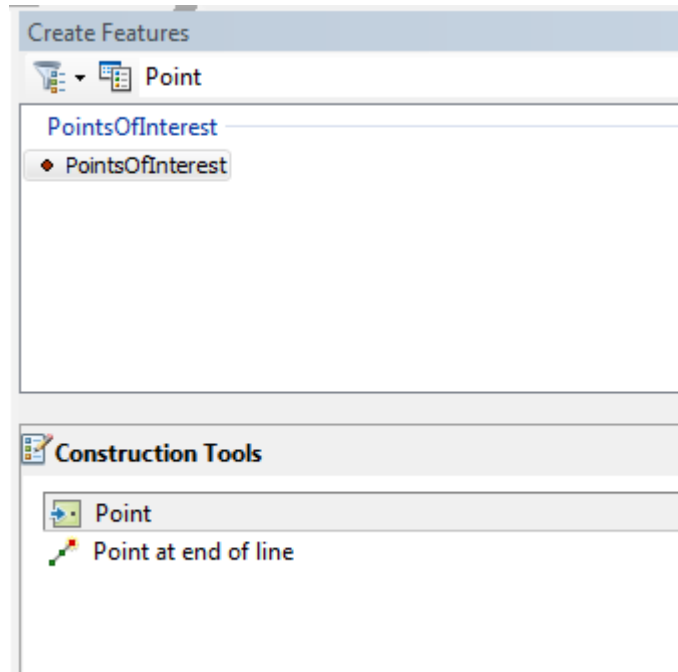
d. It's convenient to snap the new points to the NHDFlowlines. To set the
    snapping environment, select **Snapping On** in the Snapping Toolbar window
   (Editor pulldown menu > Snapping).
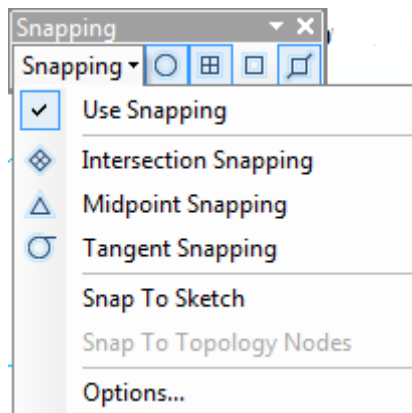
e. With **Point** selected in the Construction Tools of the Create Features window.
    Point at various locations on NHDFlowlines and click to create point features
    in the PointsOfInterest layer. Also, add some points that do not snap to a
   flowline.
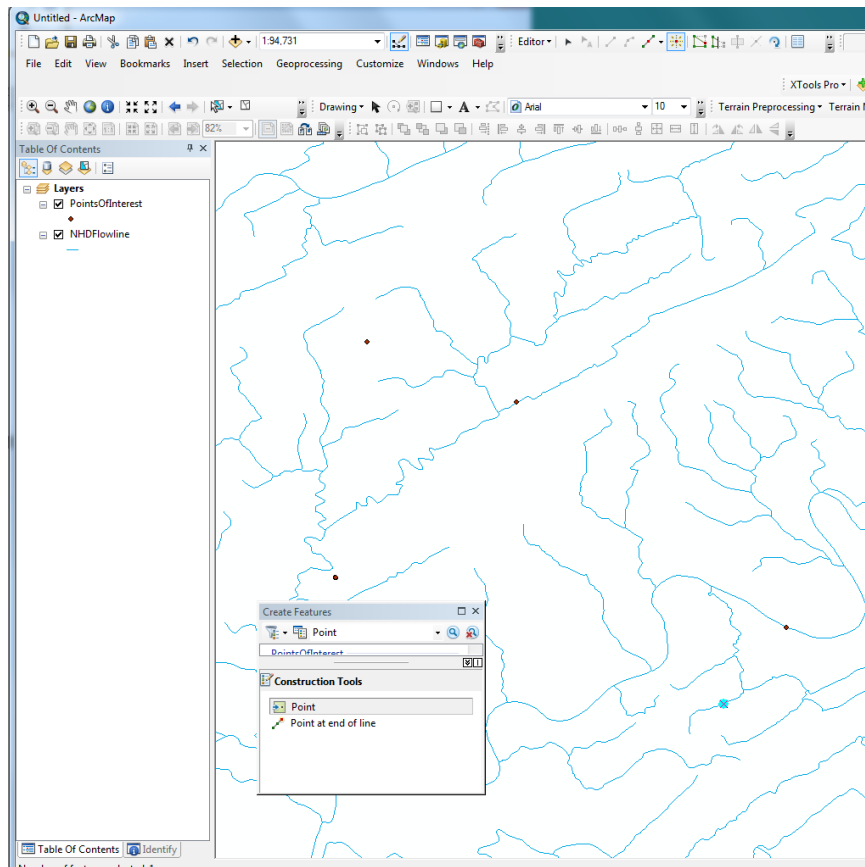
f. Click on **Editor** and select **Stop Editing** and click **Yes** on the **Save** dialog.

4. **Making an Event Table**
    To turn PointsOfInterest into a point event table, From ArcToolbox Window,
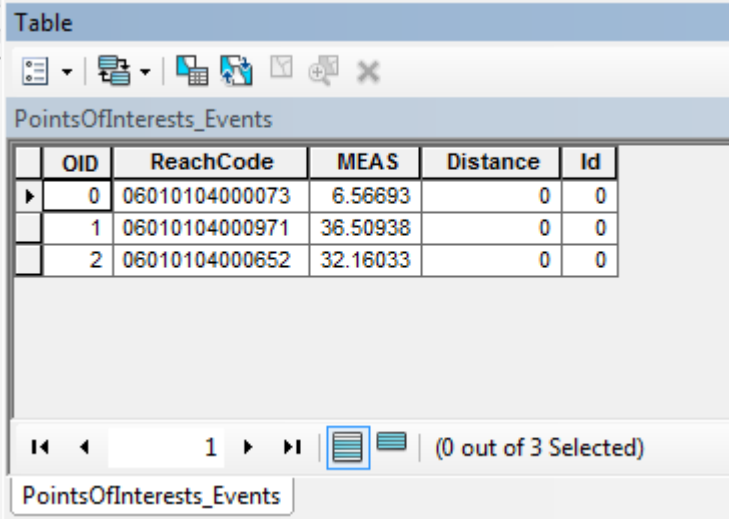   Expand the **Linear Referencing Tools** list.
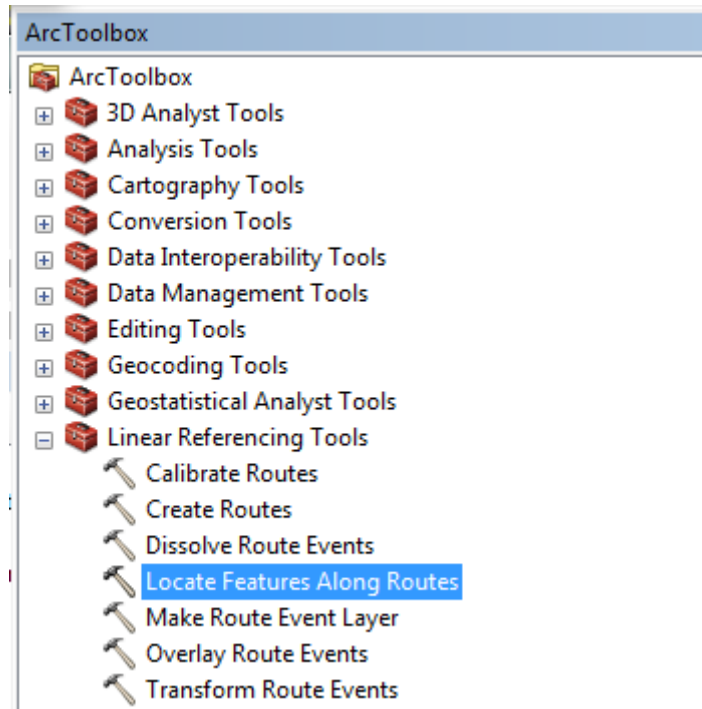
a. Double click on **Locate Features Along Routes** to open the dialog. In the dialog,
   i.   Use the **Input Features** pull down to select **PointsOfInterest** as the feature class that will be located along routes.
   ii.   Use the **Input Route Features** pull down to select **NHDFlowline** which is the route class of the NHD.
   iii. Use the **Route Identifier Field** pull down to select **Reachcode** which is the route identifier for the NHD.
   iv.   Set the **Search Radius** to **.001 decimal degrees** (approx. 370 ft). This will make sure that PointsOfInterest that are not located exactly on an NHDFlowline will be snapped to the nearest NHDFlowline within the search radius.
   v.   In the options listed at the bottom of the dialog, make sure "Include distance field on output table" is toggled on
   vi.   Output Event Table: NHDPlusMS\NHDPlus06**PointsOfInterest_Events.dbf**
   vii. Type **ReachCode into** the Route Identifier Field
   viii. Click OK and the **Locate Features Along Routes** tool will execute
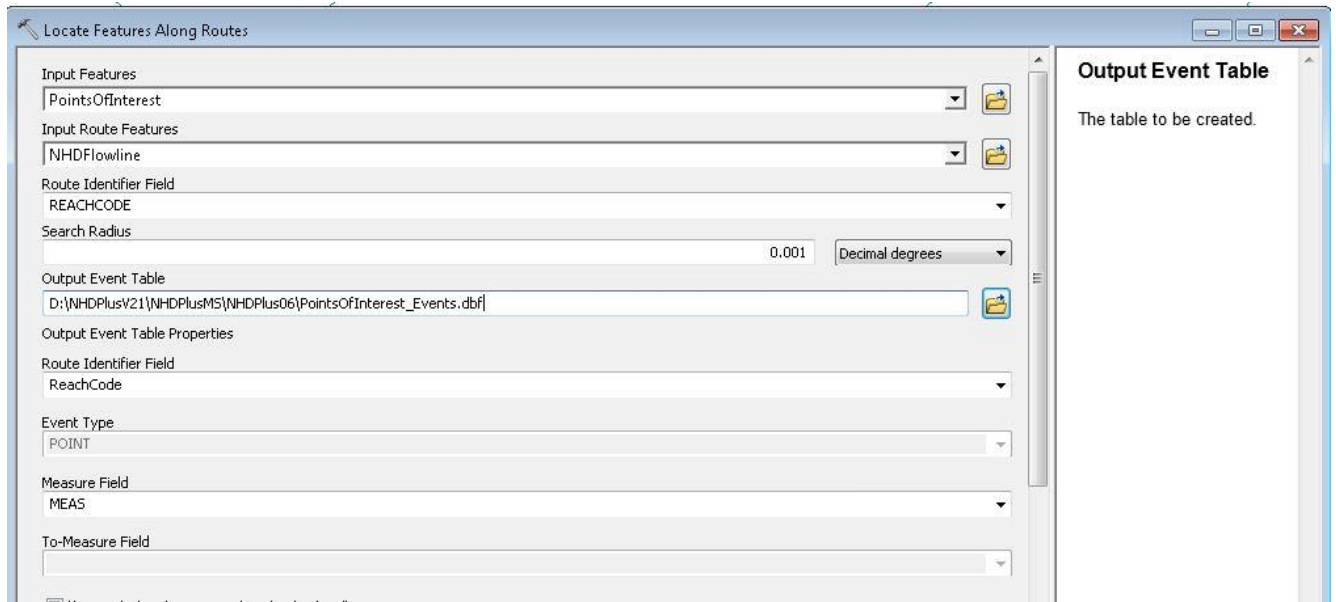
b. There now exists an event table called PointsOfInterest_Events.dbf. Use **File**, **Add Data**, to add this event table to the map if it has not already been added automatically.

c. Right click on PointsOfInterest_Events in the Layers list and select **Open** to display the attribute table for PointsOfInterest_Events. Note the ReachCode field which tells us which reach each point is located on and the Meas field which tells us where along the reach the point is located. The Distance field tells us how far (in decimal degrees), the point was moved in order to snap it to the nearest NHDFlowline.

Notice that points added and snapped to a flowline in the Create features
step, have a distance value of zero, meaning no snapping occurred during the
Locate Route Features. If any of the input points are beyond the linear
referencing tool search radius (0.001 decimal degrees), those points are not
snapped by the tool and not listed in the event table.

Table

PointsOfInterests_Events

|	OID	ReachCode	MEAS	Distance	Id
▶	0	06010104000073	6.56693	0	0
	1	06010104000971	36.50938	0	0
	2	06010104000652	32.16033	0	0

1   (0 out of 3 Selected)

PointsOfInterests_Events

d. Render (draw) the events using the Reachcodes and measures to determine a point shape for each event. Open the ArcToolbox Linear Referencing Tools, "**Make Route Event Layer**"
   i. Specify the routes referenced by the events in the table: For Input Route Features select **NHDFlowline** and Route Identifier Field: **REACHCODE**
   ii. Specify the table containing the route events: Input Event Table: **PointsofInterest_Events.** Route Identifier Field: **ReachCode**
   iii. Select **Point** for Event Type.
   iv. Measure Field: **MEAS**
   v. Provide a Layer Name for the rendered points. For this example, Layer Name is **PointsSnappedToNHD**
   vi. Leave the remaining items at their default values.
   vii. Click **OK**.
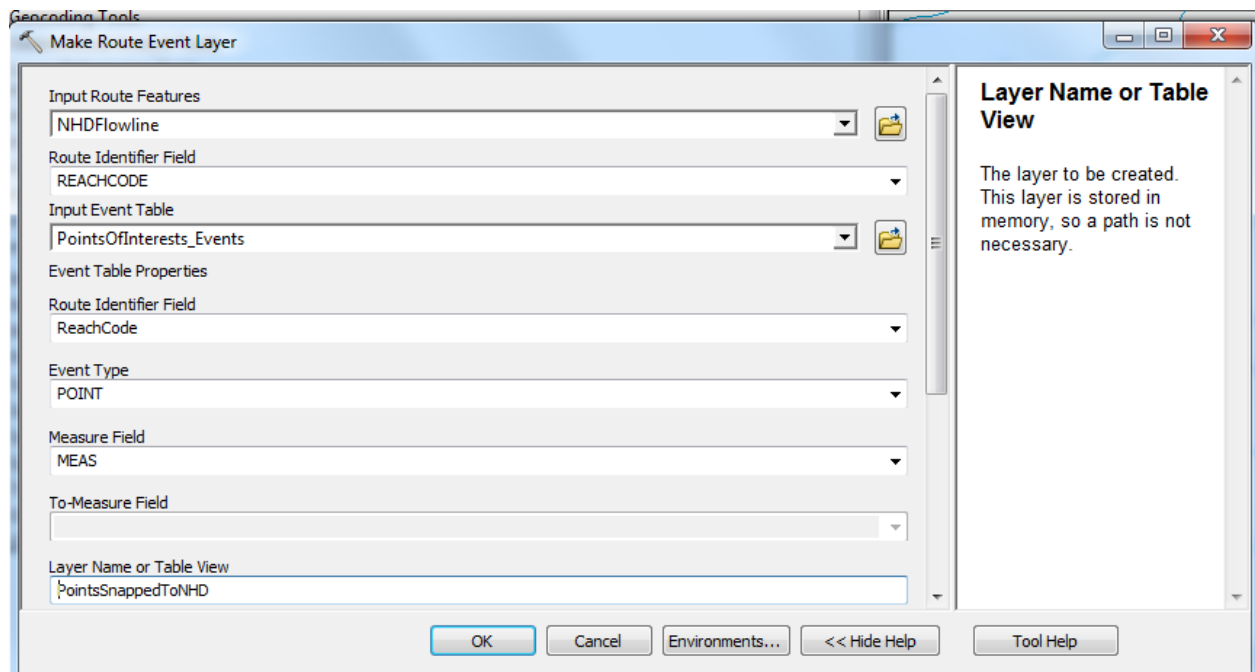
5. **Reviewing Results**

   a. Change the symbol for the PointsOfInterest to Circle 2 by double-clicking on the symbol in the Table of Contents window. Select Circle 2 and click OK. Make sure PointsSnapped to NHD is also turned on.

      To examine the results, zoom very close to some of the points. Note that in some cases, even though the PointsOfInterest point may be slightly off of the NHDFlowline, the snapped point in PointsSnappedtoNHD is exactly on the NHDFlowline.
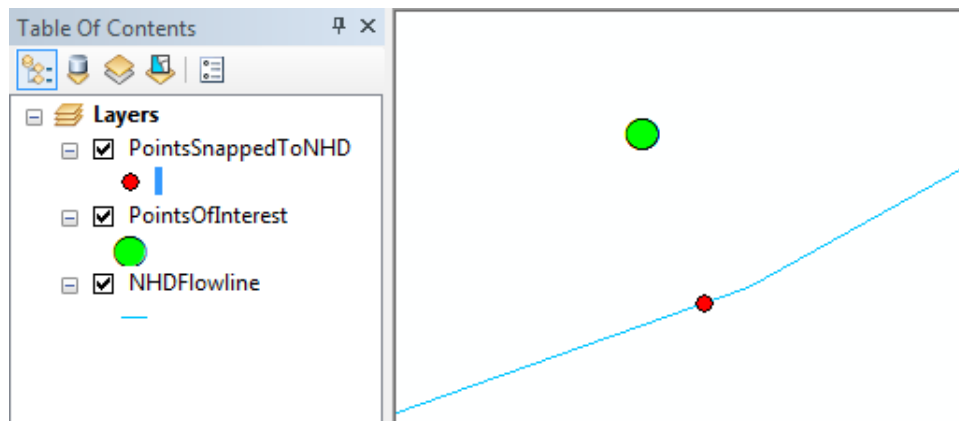
   b. If we use the Identify tool to click on a point in PointsSnappedtoNHD, we see that the point is on a specific Reachcode at a specific measure.
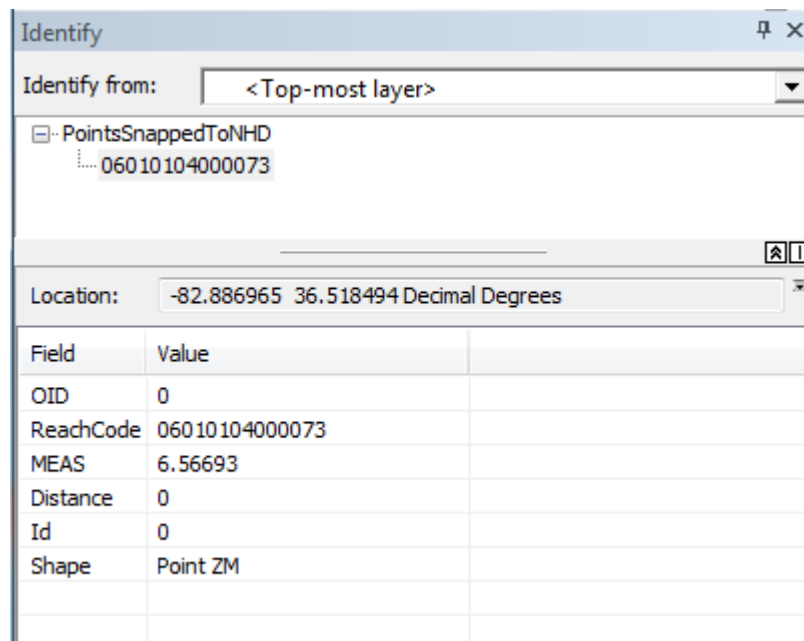
6. **Saving Results as a Shapefile**

   PointsSnappedtoNHD is a layer file in memory. To save these results as a shapefile, right click the name of the layer in the Table of Contents and choose **Data > Export Data.**

7. **Linear Events**

   Linear events, ones that are linked to a stretch along a reach, can be created in a similar manner as points.

   NHDPlus provides a linear event table that represents a version of the networked NHDFlowlines used for building the HydroDEM and catchments. This table named BurnLiveEvent.dbf is found in the NHDPlus BurnComponents folder for a given VPU. Below is an example of using **Make Route Event Layer** to render BurnLineEvent.