

## Watershed Delineation

What is the area in hectares of the Chena and Nenana watersheds? What is the total length of the Chena and Nenana Rivers?

You can estimate the watershed area from an elevation raster that is in a planar coordinate system such as meters. In this lab, you will estimate watersheds using a relatively coarse elevation raster (1km pixels).

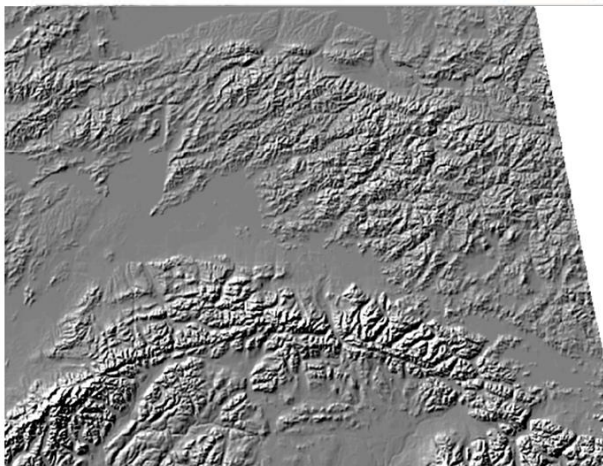
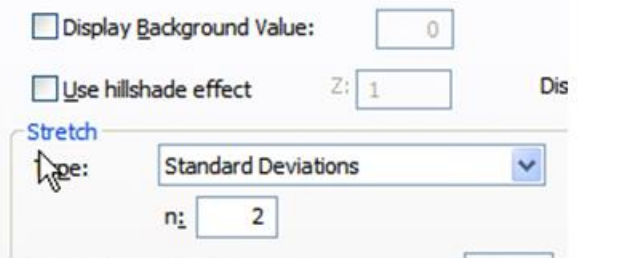
You can download the *watershed\_lab.zip* file for this lab from:

<http://dverbyla.net/nrm435/data/>

## ArcGIS with Spatial Analyst Extension

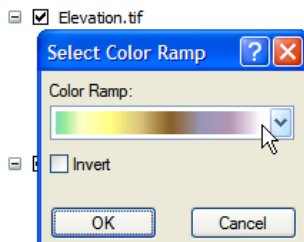
**Step 1) Create hillshade raster and contours.** . Use the **Contour** tool in the Surface Toolset to generate 100-meter contours from your elevation raster. Use the **Hillshade** tool to create a hillshade.

Apply a 2-standard deviation stretch to enhance the contrast in your hillshade:

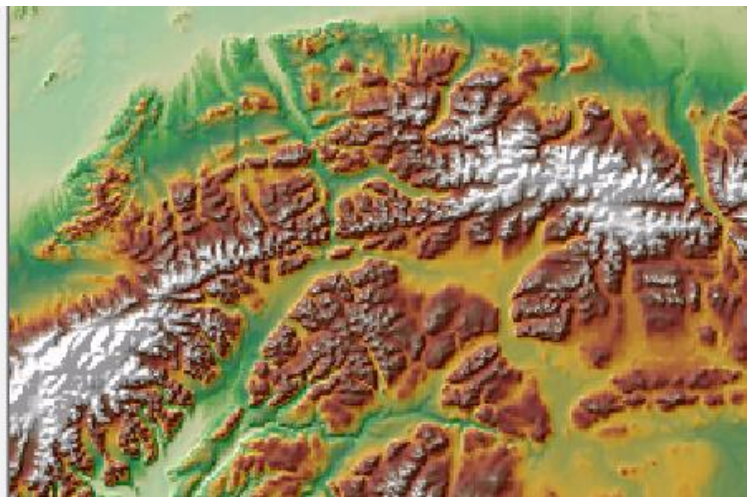
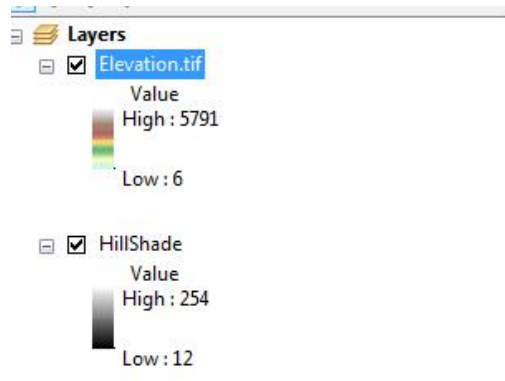
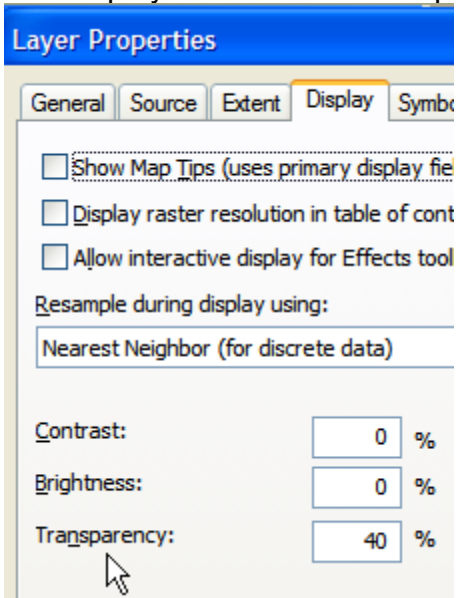


Apply a color ramp to your elevation raster

<http://dverbyla.net/nrm435>

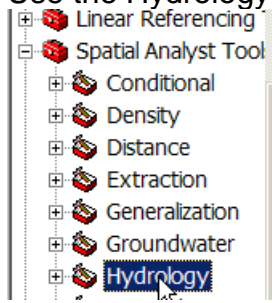


and display this raster with 40 percent transparency on top of your hillshade.



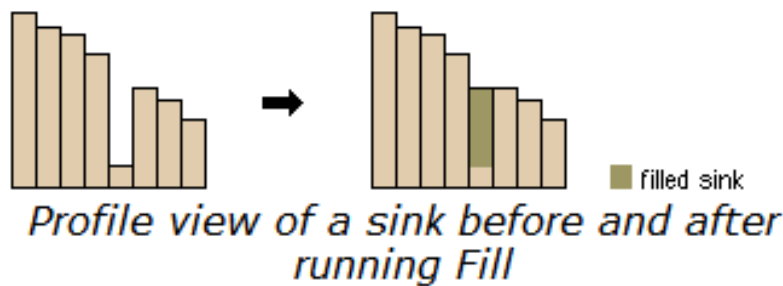
### Watershed Delineation

Use the Hydrology toolset in ArcToolbox the following steps



**Step 1) Fill in any local sinks in your elevation raster.**

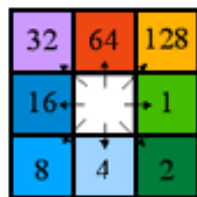
Use the **Fill** tool to check for and fill in any local sinks in your elevation raster.



**Step 2) Compute a direction of flow raster from your filled elevation raster.**

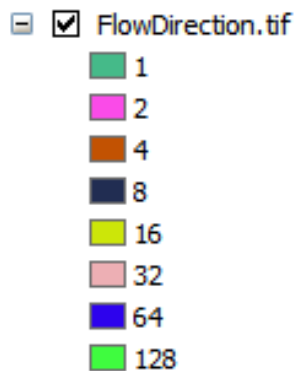
Elevation surface

Flow direction

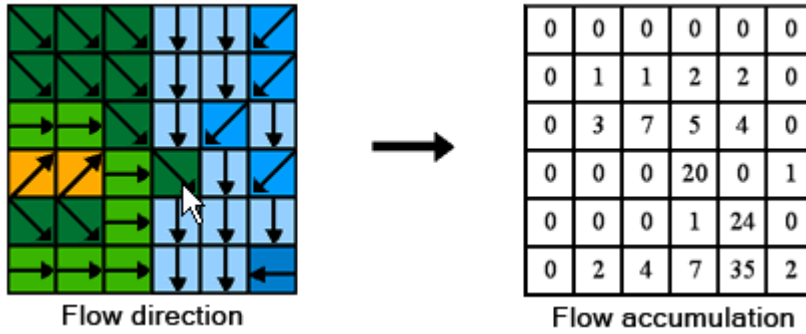


Direction coding

*The coding of the direction of flow*

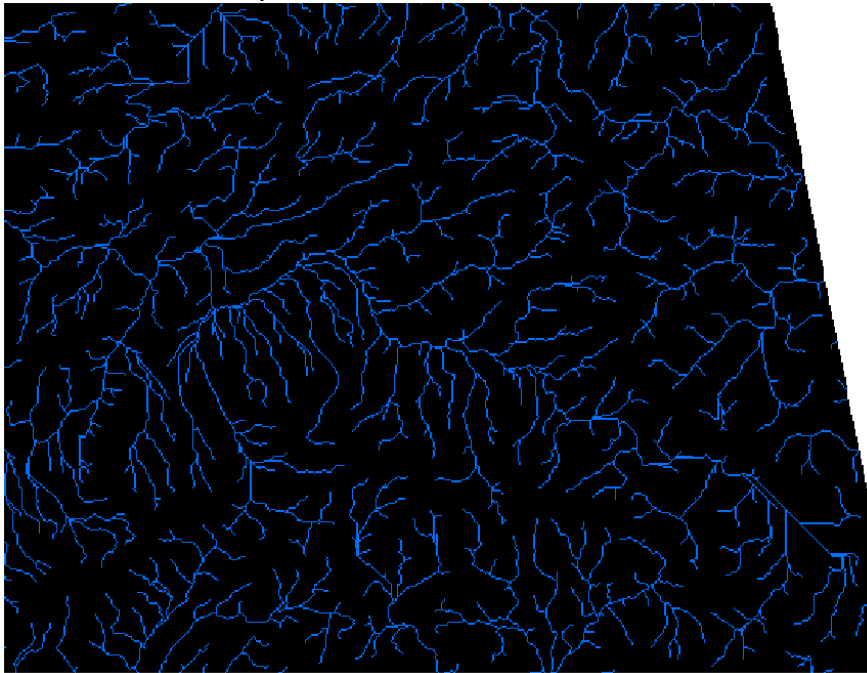


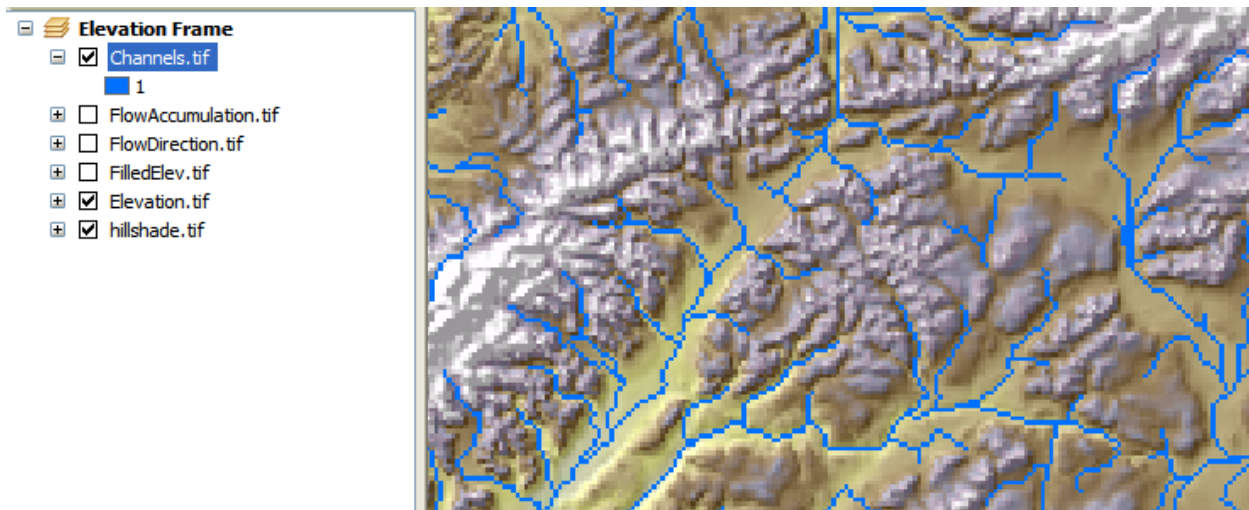
### Step 3) Create a flow accumulation grid from your flow direction raster.



### Step 4) Delineate the channels within your elevation grid area.

Any river pixel will have a high flow accumulation value. We will choose an accumulation of water from 100 cells as defining a “channel” pixel. Use the **Con or SetNull tool** to output 1 for cells with a flow accumulation > 100.





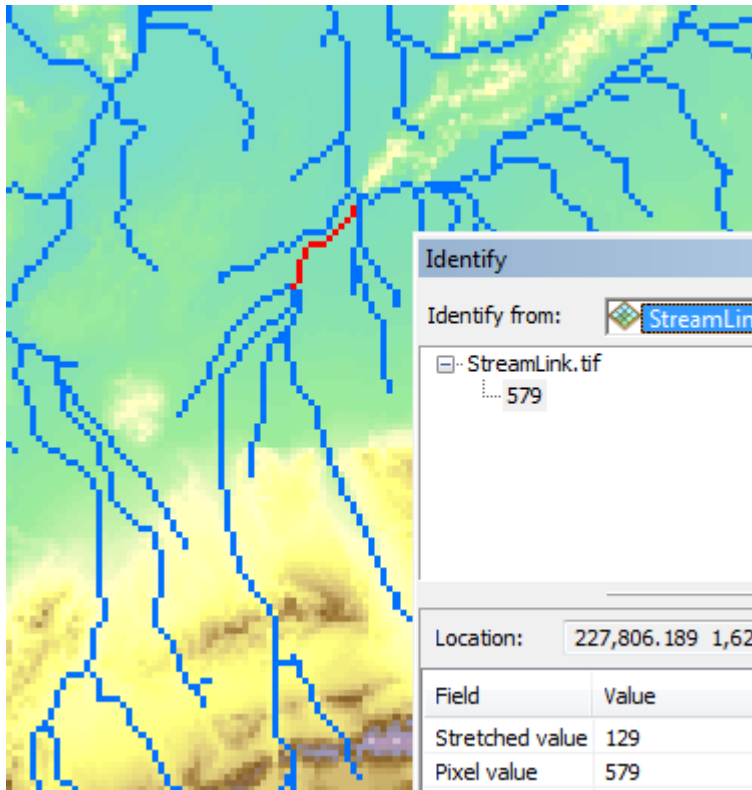
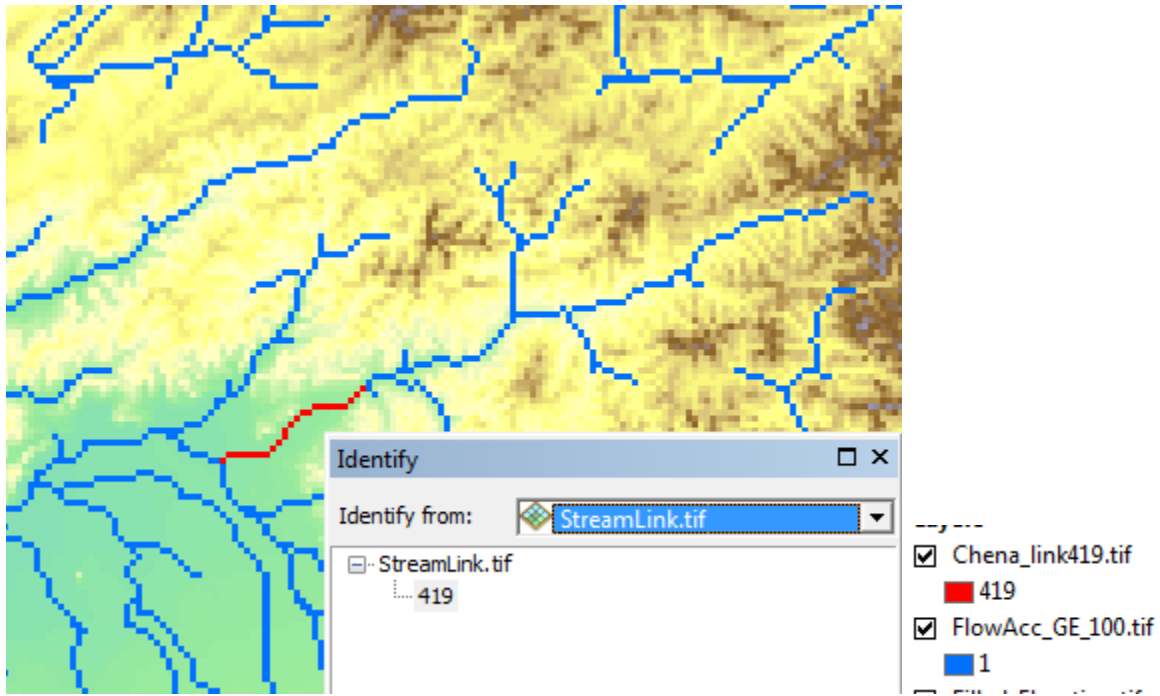
Next we need a unique ID for each channel so we can select the channel at the outlet of each watershed. Use the **Stream Link tool** to assign a unique grid code to each channel in the drainage system.

We have many separate channels...use the identify tool to determine the raster value for the channels at the outlet of the Nenana and Chena rivers.

**Nenana River code is 579 in this example, your stream link may be different**

**Chena River code is 419 in this example, , your stream link may be different**

**Step 5) Delineate watershed outlets.** We need to delineate the watershed outlet or “pour point” for the end of the Nenana and Chena Rivers. Use the **Con** tool to create layers representing the lower stream links on the Nenana and Chena rivers.



Use the **Raster to Polyline** tool to convert these pixels to lines.

**Raster to Polyline**

Input raster  
ChenaRaster

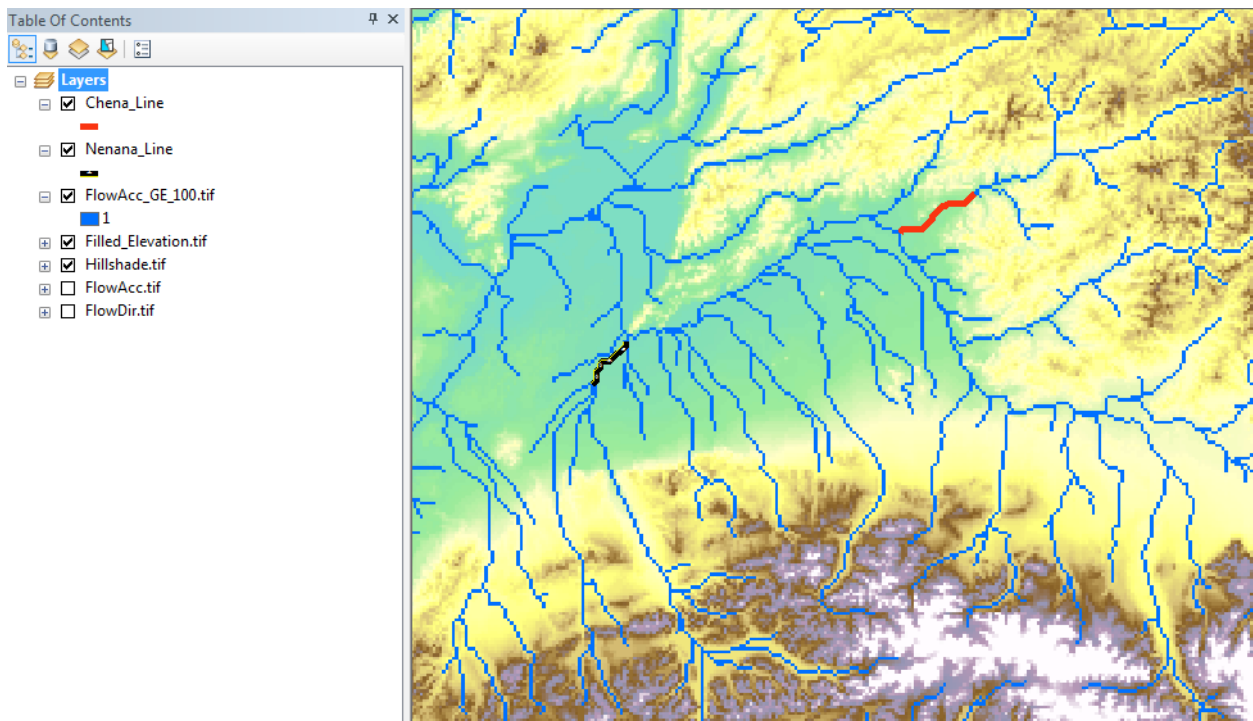
Field (optional)  
Value

Output polyline features  
C:\test\verbyla\watershed\_lab\Chena\_River\_Channel.shp

Background value (optional)  
ZERO

Minimum dangle length (optional)  
0

Simplify polylines (optional)

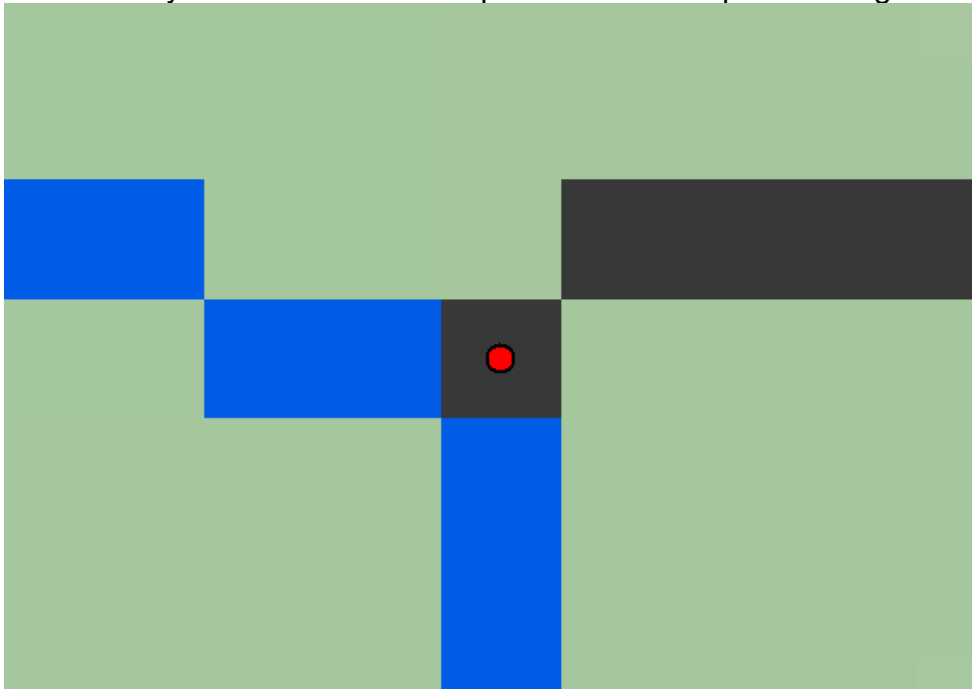


Then use ***the Feature Vertices to Points*** tool to extract the end point from each line...these will be your watershed outlet locations.



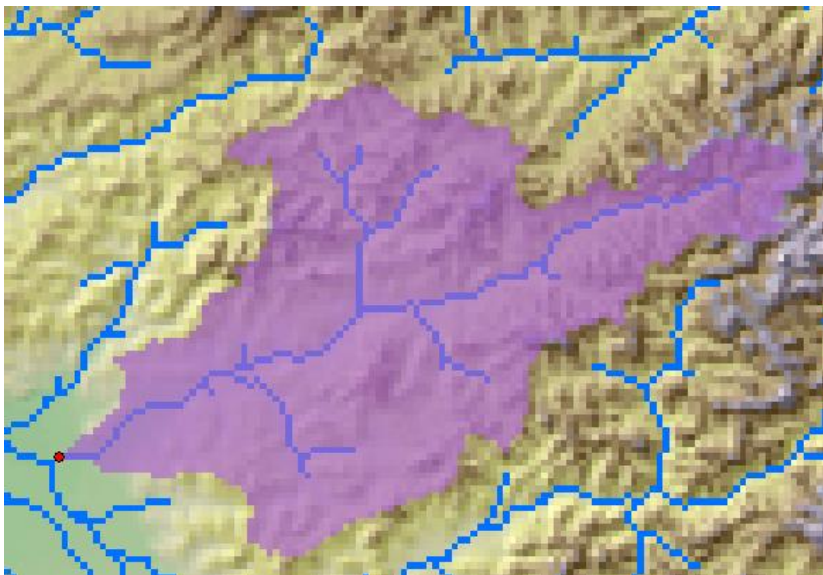
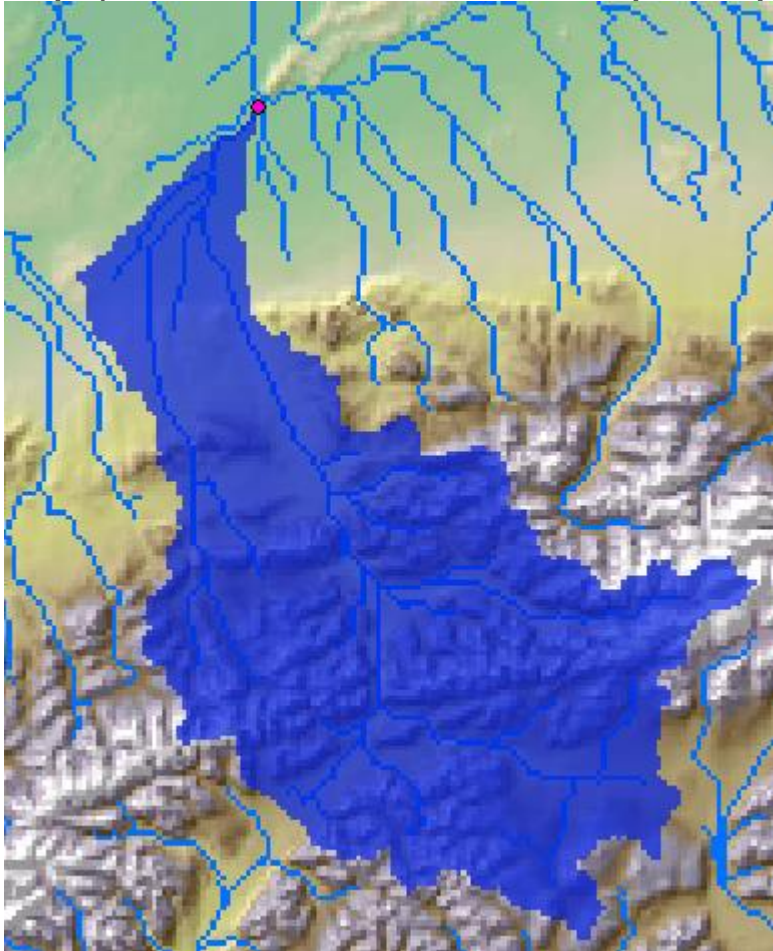
**Step 6 ) Identify watershed outlet pixels.**

Check that your watershed outlet points are inside pixels of high flow accumulation.



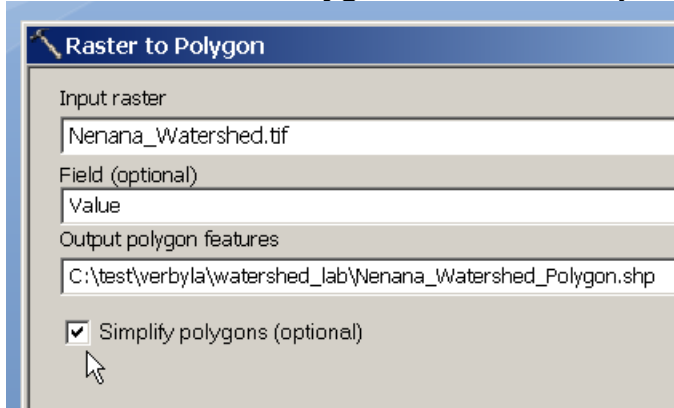


**Step 7) Delineate watersheds from outlet points upstream...use the Watershed tool**



**Step 8) Compute area of watershed in hectares.**

Use the **Raster to Polygon** tool to convert your watershed rasters to polygons.



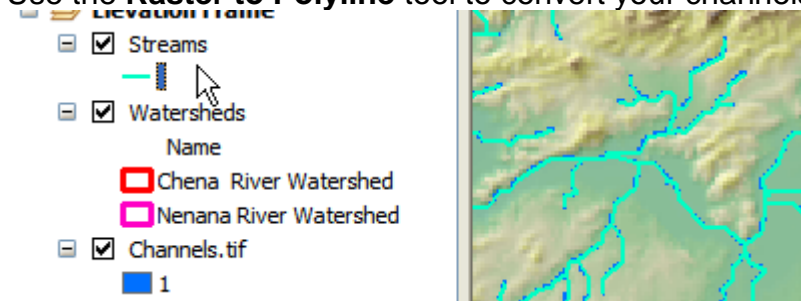
Then use the **Merge tool** to merge together your 2 watershed polygons. Add a field for Name and Hectares and compute these fields.

Watersheds			
	Shape *	Name	Hectares
	Polygon	Chena River Watershed	384,322.8
	Polygon	Nenana River Watershed	934,664.0

Watershed_Polygons			
	Shape *	Watershed	Hectares
	Polygon	Nenana River Watershed	934,664.0
	Polygon	Chena River Watershed	384,621.3

**Step 9) Create stream lines within watershed polygons.**

Use the **Raster to Polyline** tool to convert your channels to lines.



Then use the ***Intersect tool*** to create lines within the watershed polygons.

