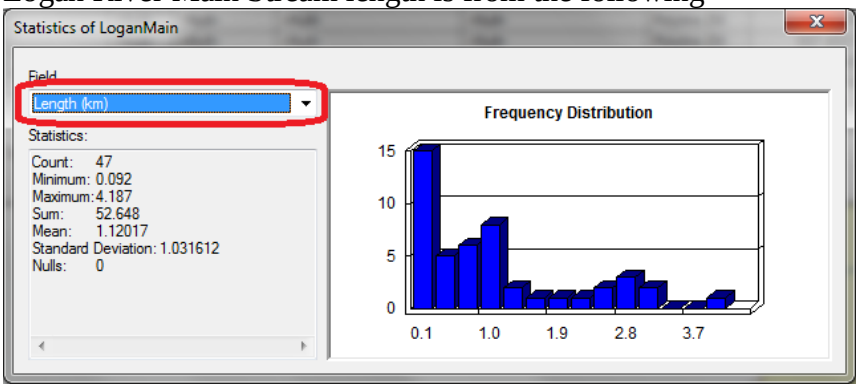
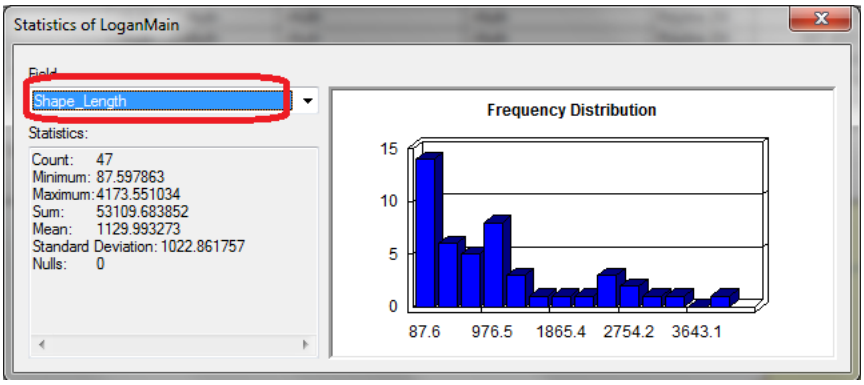
**GIS in Water Resources  Exercise #4  Solution**

1. *Report the main stream length, total stream length, basin area and drainage density for the Logan River Basin as determined from NHDPlus flowlines.*

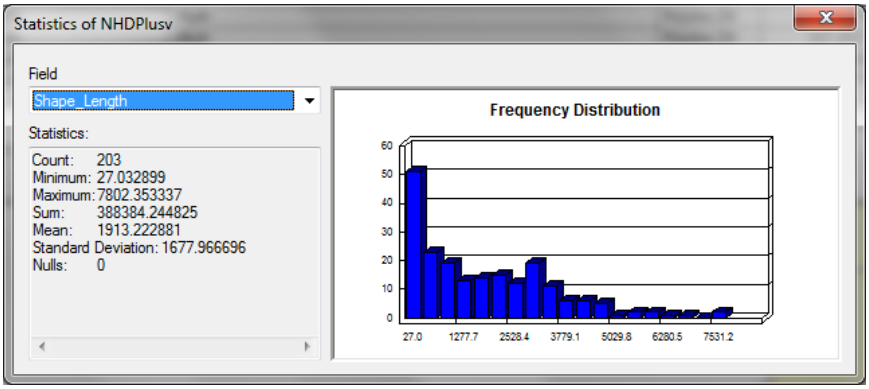
Logan River Main Stream length is from the following



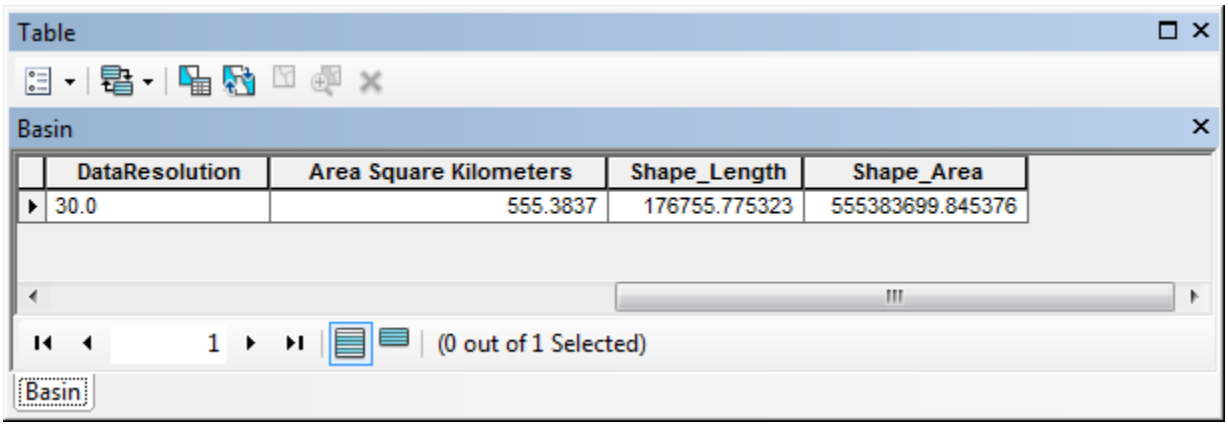




52.6 km is the sum of lengths reported by NHDPlus.  53109 m = 53.1 km is from Shape_Length evaluated using the coordinate system of the Basemap feature dataset.  I will use the latter for consistency with basin area computed in this coordinate system.

Total stream length is from



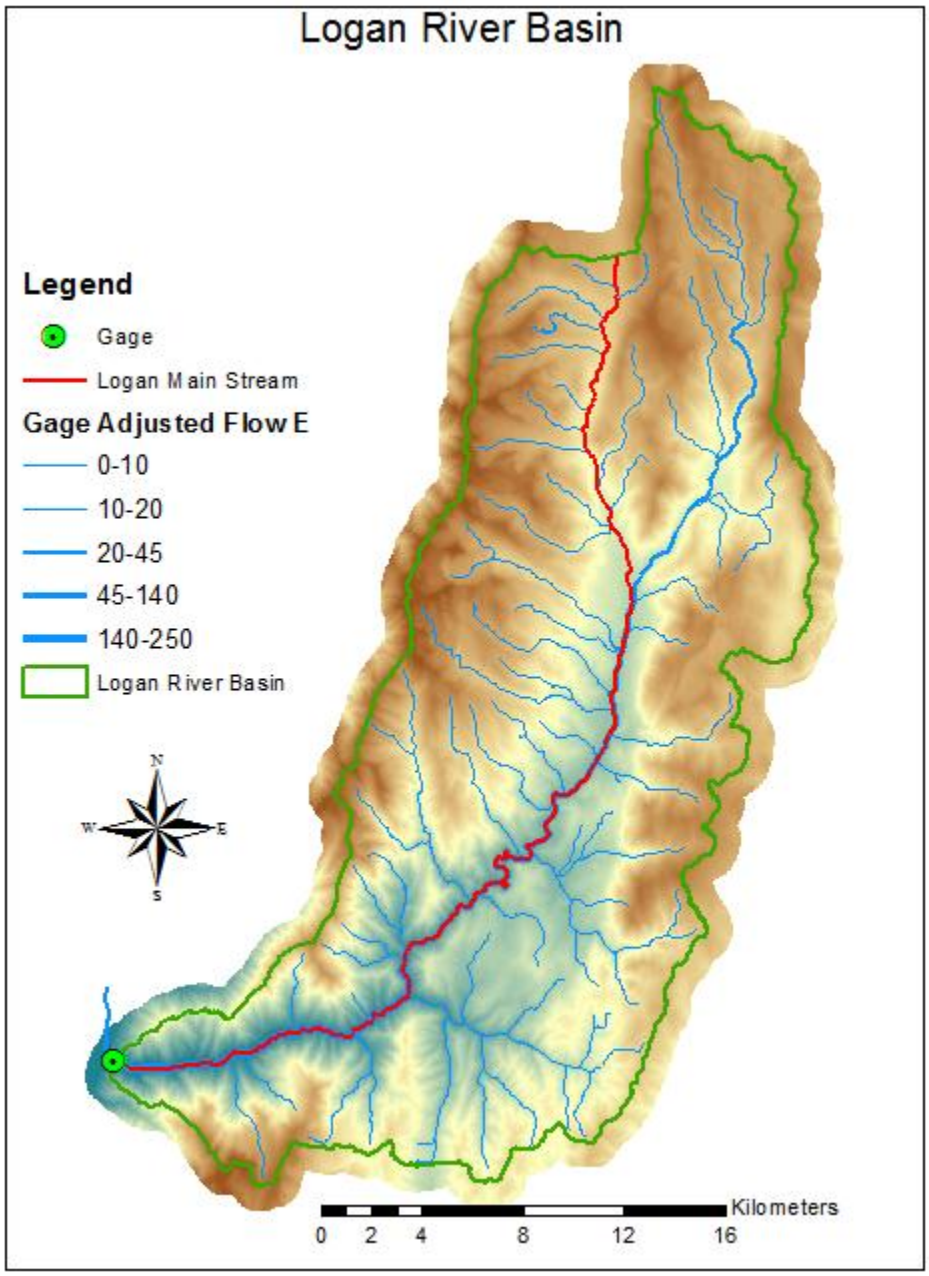
Basin area is from




Drainage density is total stream length/basin area
Summary Table

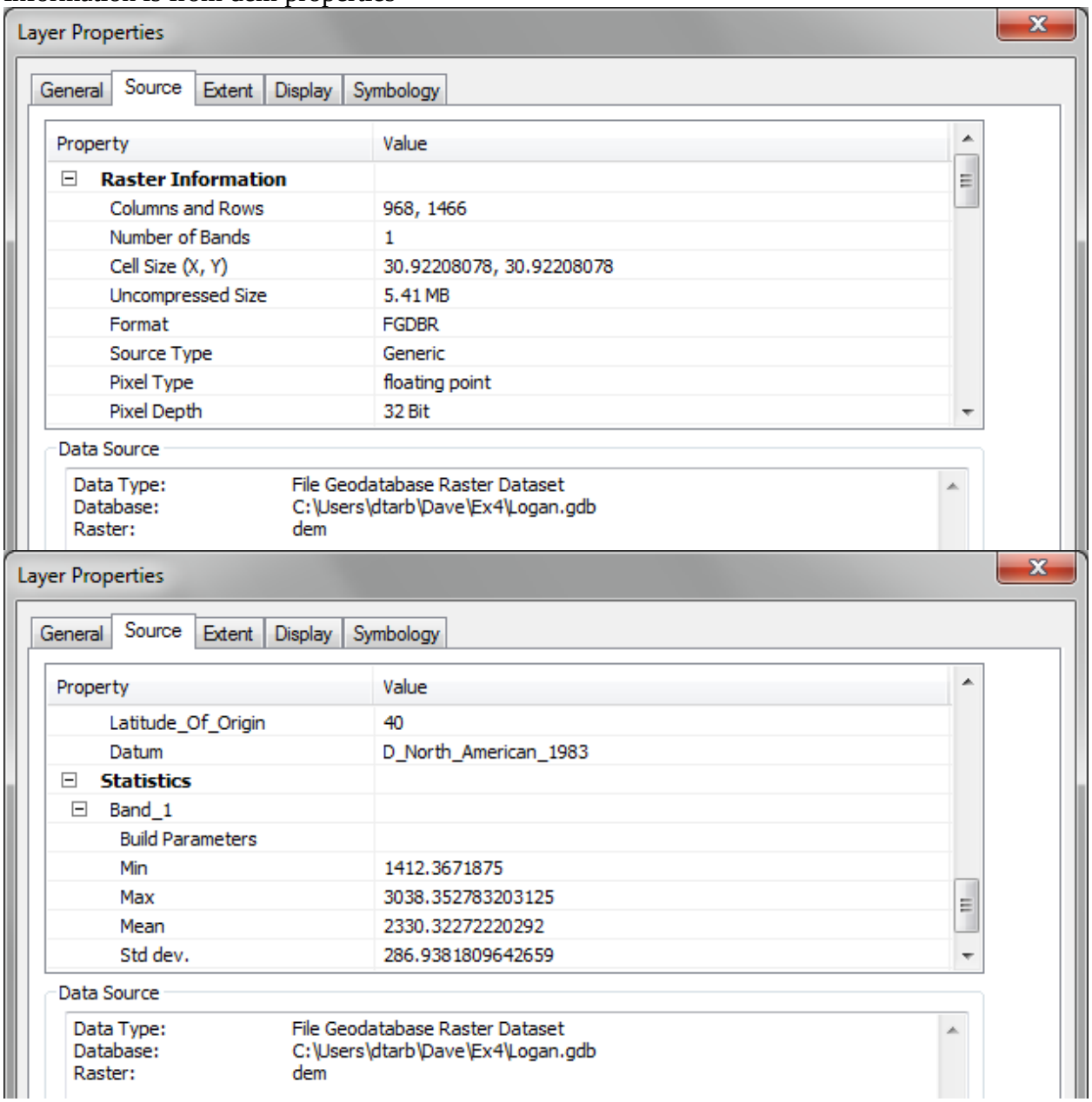
| | m | km |
|---|---|---|
| Main stream length | 53109 | 53.1 |
| Total stream length ($L_T$) | 388384 | 388.4 |
| Basin area | 555383700 $m^2$ | 555.38 $km^2$ |
| Drainage density ($L_T/A$) | 0.000699 $m^{-1}$ | 0.699 $km^{-1}$ |

2. *Prepare a layout showing the topography, Basin Outline, NHDPlusv streams and Logan River Main stem stream for the Logan River Basin. Include a scale bar and North arrow and appropriate title, labeling and legend so that the map is self-describing.*



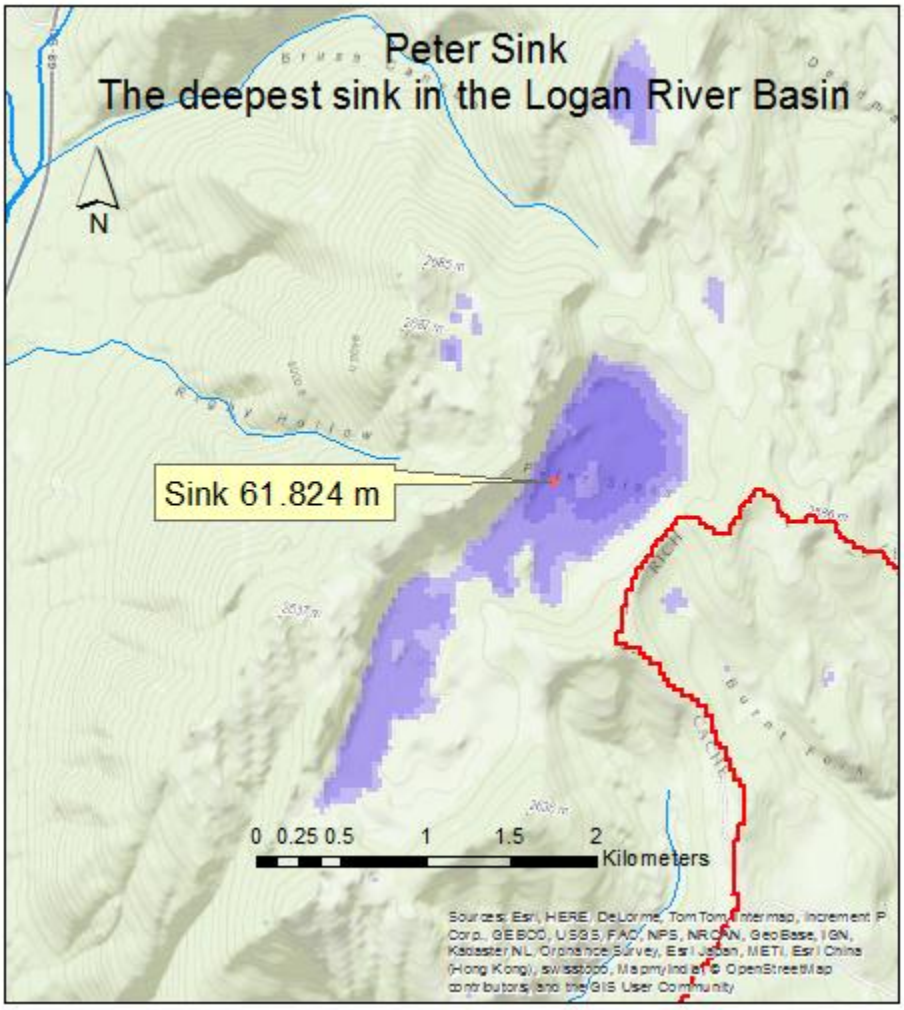
3. *The number of columns and rows, and grid cell size in the Logan DEM. The minimum and maximum elevation values in the Logan DEM.*

Information is from dem properties




Number of rows: 1466
Number of columns: 968
Cell Size: 30.922 m
Min Elevation: 1412.4 m
Max Elevation 3038.35 m

4. *A layout showing the deepest sink in the Logan River basin. Report the depth of the deepest sink as determined by fil-dem.*




The depth of Peter Sink, the deepest sink is 61.82 m

5. *Make a screen capture of the attribute table of fdr and give an interpretation for the values in the Value field using a sketch.*

Table

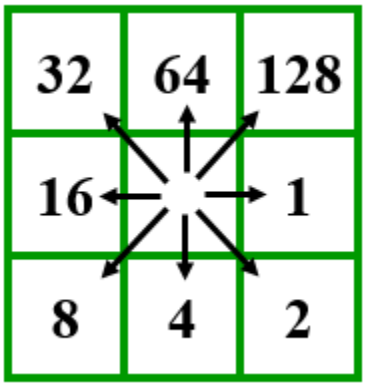
fdr

| OBJECTID * | Value | Count |
|---|---|---|
| 1 | 1 | 120985 |
| 2 | 2 | 89373 |
| 3 | 4 | 94913 |
| 4 | 8 | 79342 |
| 5 | 16 | 112640 |
| 6 | 32 | 74308 |
| 7 | 64 | 71722 |
| 8 | 128 | 79821 |

1

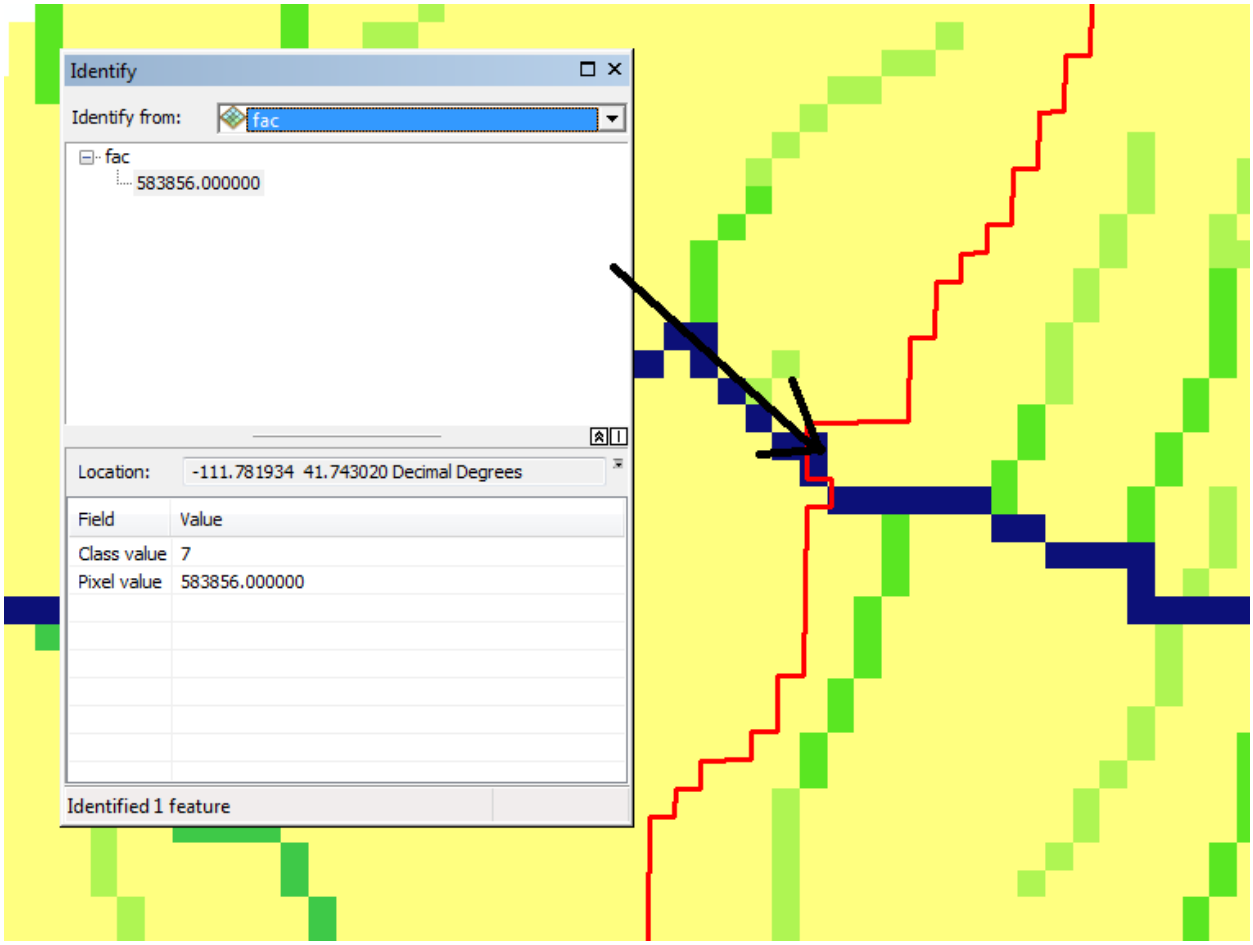
(0 out of 8 Selected)

fdr




Interpretation of flow directions encoded in the Value Field

6. *Report the drainage area of the Logan River basin in both number of 30.92 m grid cells and km$^2$ as estimated by flow accumulation. Report the area of the Logan River basin in km$^2$ as calculated by the arcgis.com watershed function. Report the area of the Logan River basin in km$^2$ as reported by the USGS for the Logan River stream site. Discuss reasons for any differences.*

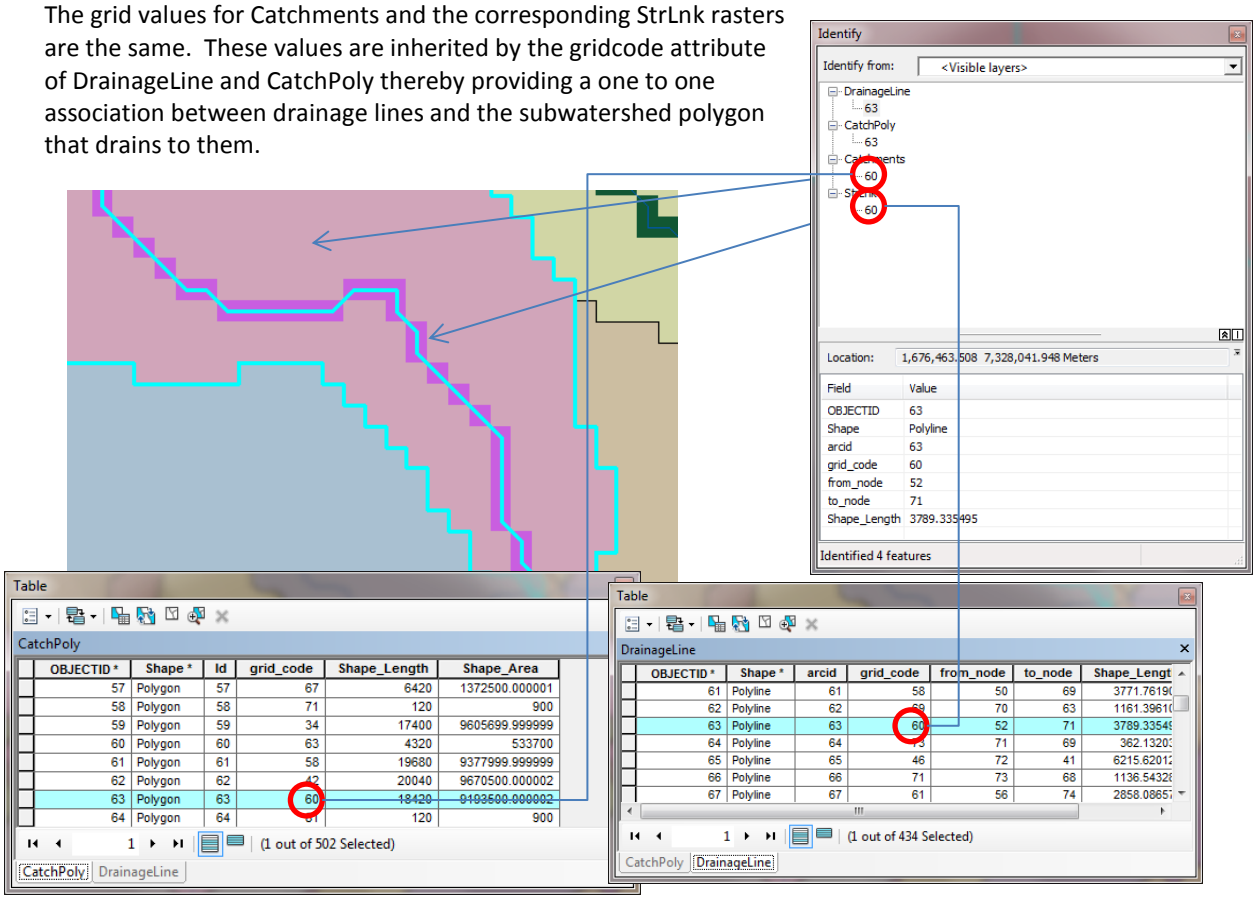



Flow accumulation: 583856 grid cells = 558.2 km$^2$
AreaSqKm reported by ArcGIS.com watershed function = 555.38 km$^2$
USGS Area 214 mi$^2$ = 554 km$^2$

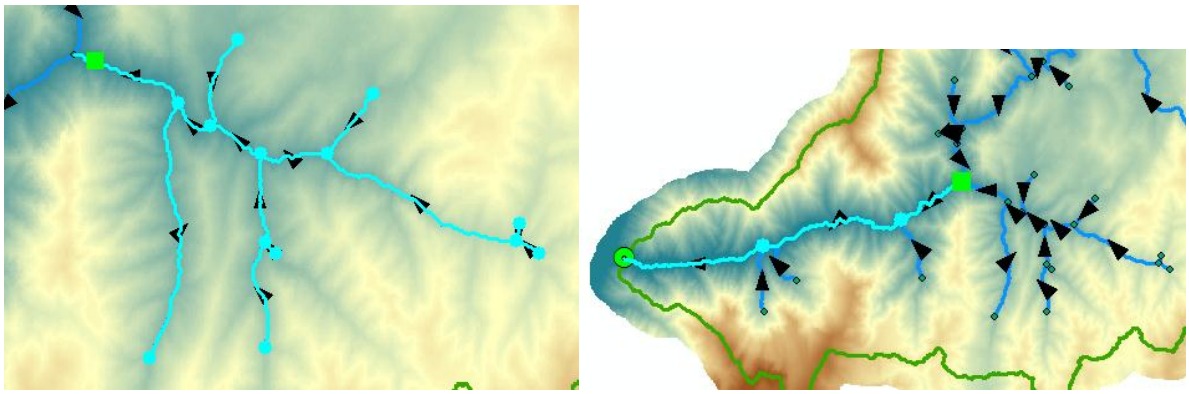
These differences are small and arise due to rounding and small difference in flow directions along the edges of the watershed.

7. *Describe (with simple illustrations) the relationship between StrLnk, DrainageLine, Catchment and CatchPoly attribute and grid values. What is the unique identifier in each that allows them to be relationally associated?*

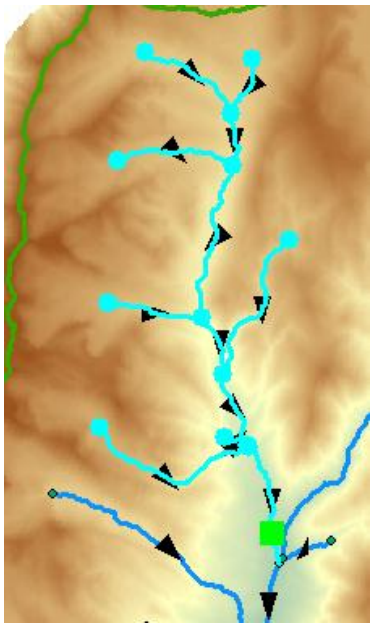
The grid values for Catchments and the corresponding StrLnk rasters are the same. These values are inherited by the gridcode attribute of DrainageLine and CatchPoly thereby providing a one to one association between drainage lines and the subwatershed polygon that drains to them.



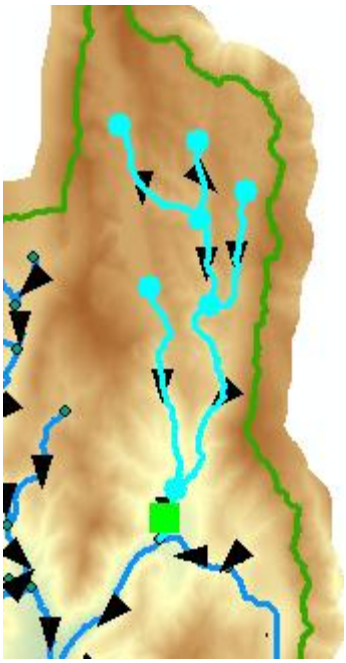

8. *A table giving for each of the tributaries identified above the number of upstream stream links, the total length of upstream stream links, the total upstream area, drainage density (total length/total area), number of downstream links along path to outlet, distance to outlet along the streams.*



Right hand fork traces. For upstream (left), I used edge flag. For downstream (right) I used junction flag so as not to get the extra length in the tributary stream.



Franklin Basin



Beaver Mountain

| | Right Hand Fork | Franklin Basin | Beaver Mountain |
|---|---|---|---|
| Number of upstream links | 13 | 13 | 7 |
| Length Upstream (km) | 20.2 | 33.6 | 29.3 |
| Area Upstream ($km^2$) | 65.8 | 89.97 | 67.1 |
| Drainage Density ($km/km^2$) | 0.307 | 0.373 | 0.437 |
| Number of downstream links | 3 | 16 | 18 |
| Length Downstream (km) | 14.45 | 39.58 | 45.49 |

9. *A layout illustrating the longest flow path in the Logan River Basin and giving the length in km.*