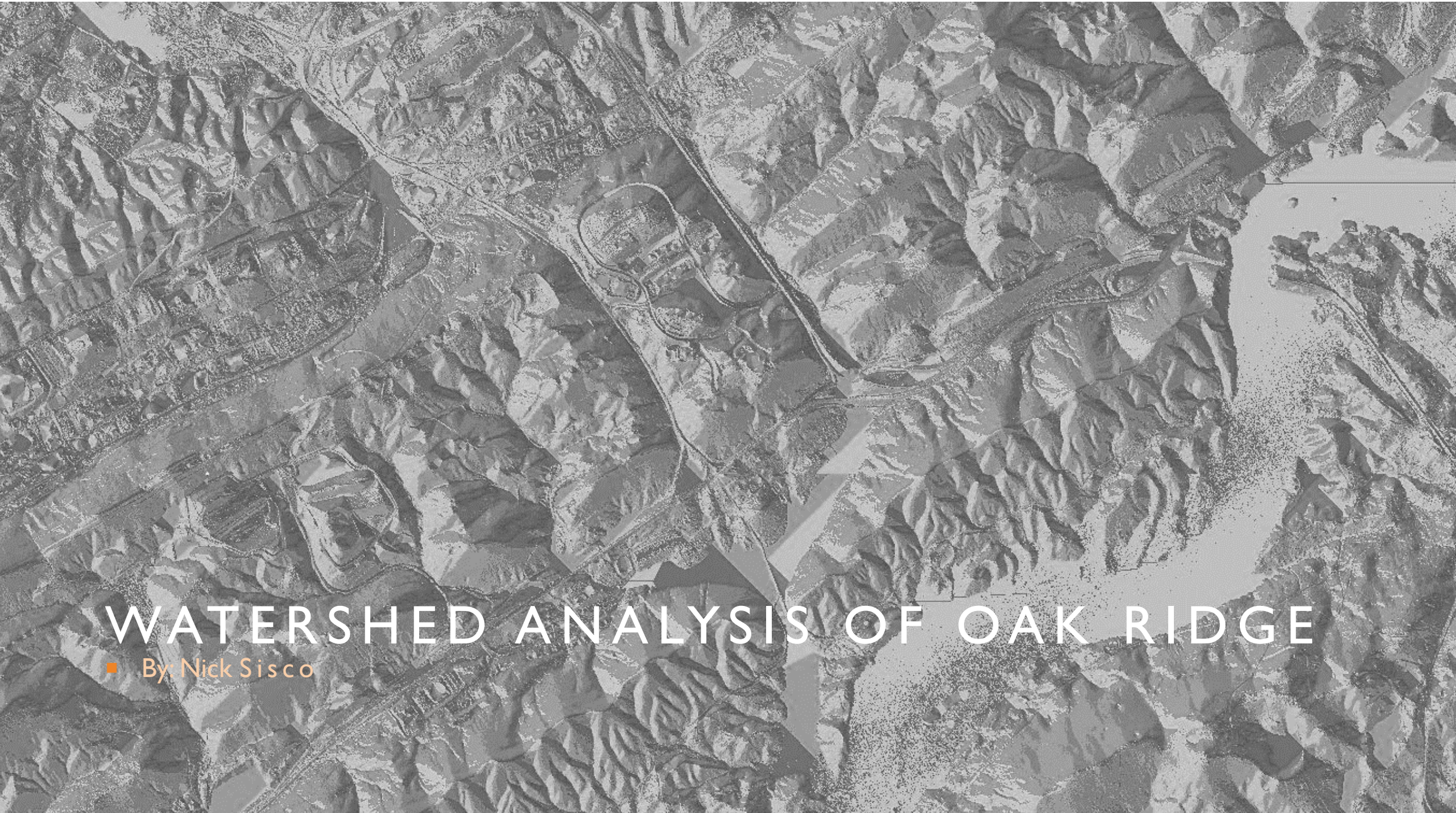
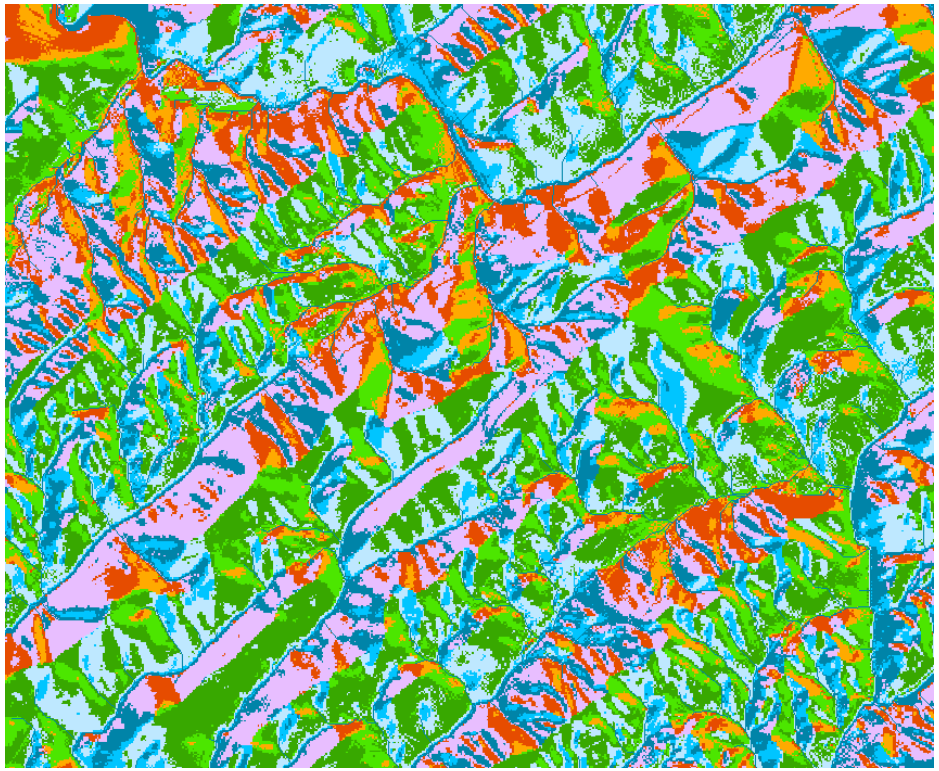


WATERSHED ANALYSIS OF OAK RIDGE

- By: Nick Sisco

OBJECTIVES

- Delineate streams and tributaries
- Delineate watersheds
- Create streamlined process for future analysis
- Map outfalls remotely to compare with GPS data
- Compare watershed boundaries



WORK FLOW

- Obtain and create DEM
  - Flow Direction
    - Fill
    - Sink
  - Flow Direction
    - Flow Accumulation
      - Threshold
        - Stream Order
          - Stream polylines
            - Vertices to points
              - Watershed
                - Raster to polygons

- Create Model and Instructions for future analysis
- Compare Outfalls with GPS field data
- Compare watershed boundaries with existing data

WATERSHED ANALYSIS

USING THE ARCGIS HYDROLOGY TOOLSET

DIGITAL ELEVATION MODELS

Roane County

- USGS quarter quadrangle DEMs
- 10ft resolution
- Mosaic To New Raster

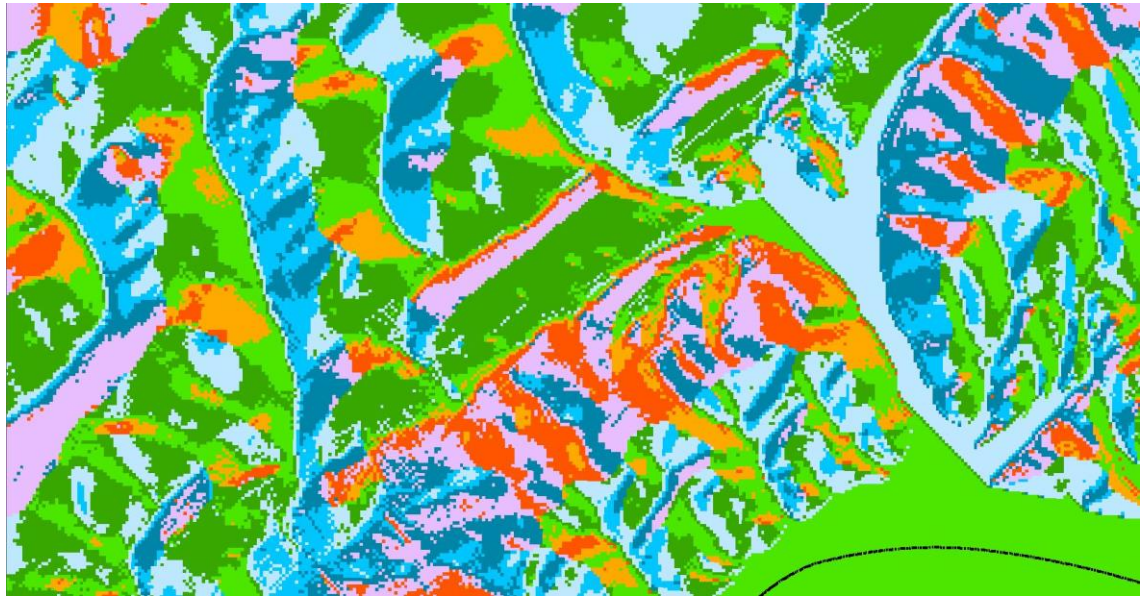
Anderson County

- LiDAR points converted into DEMs
  - Natural Neighbor
    - Focal Statistics
      - Con(IsNull("myraster"),FocalStatistics("myraster",NbrRectangle(2,2),"MEAN"),"myraster")
- 1ft resolution
- Mosaic to New Raster

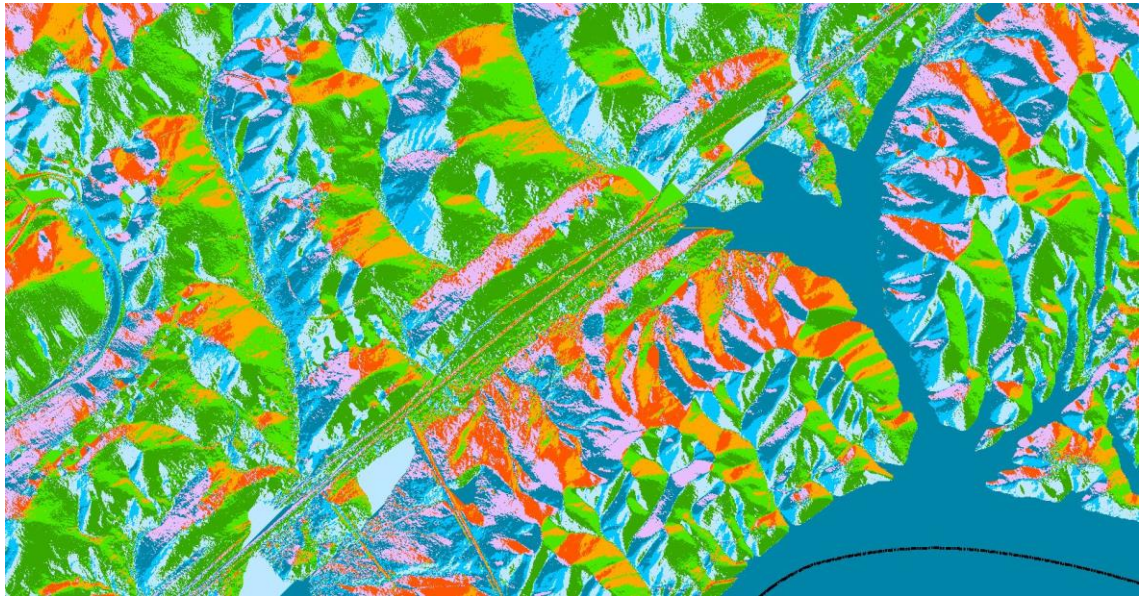
RESOLUTION DIFFERENCES 1:8,000 AERIAL REFERENCE

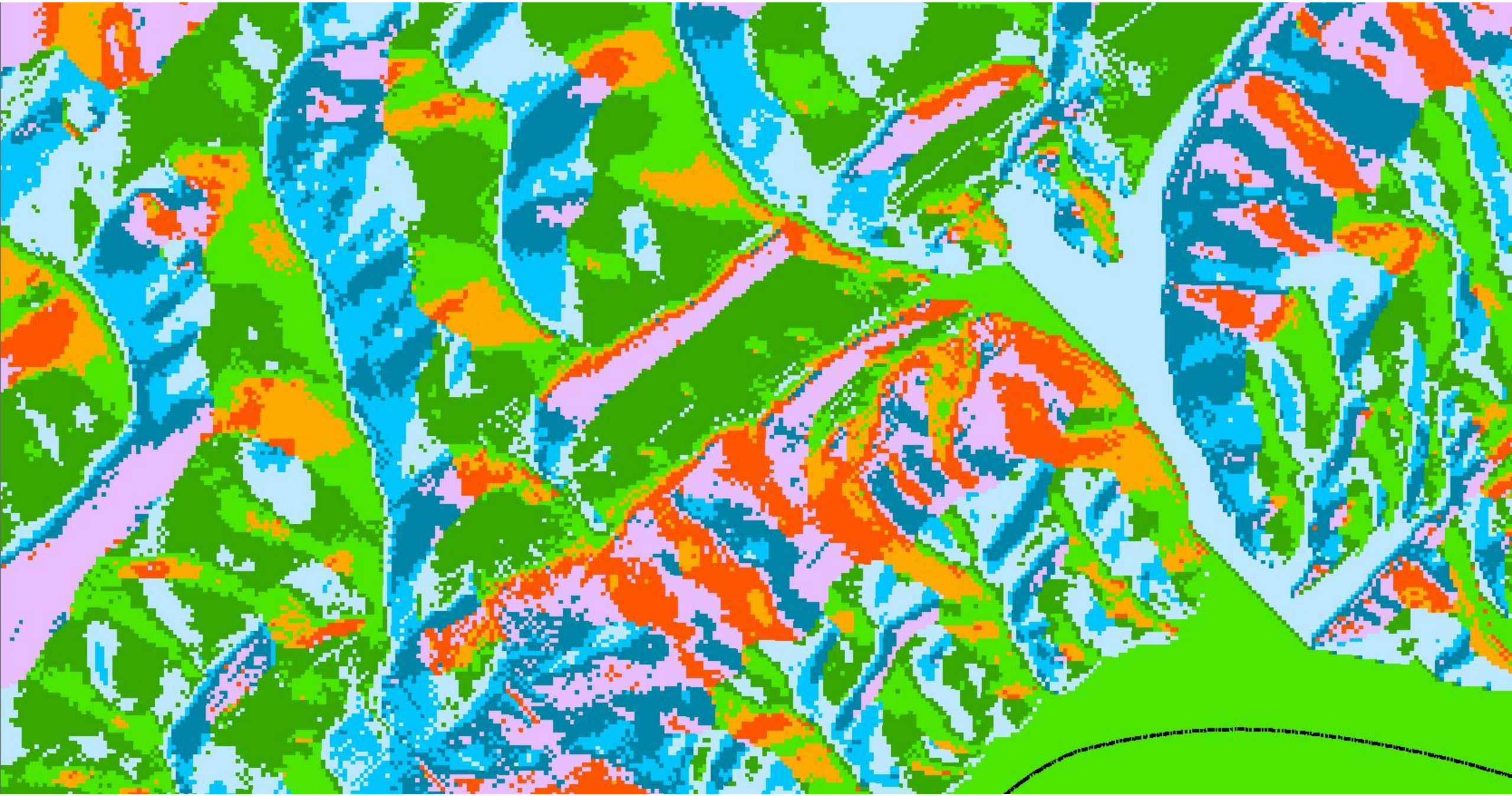
RESOLUTION DIFFERENCES 1:8,000

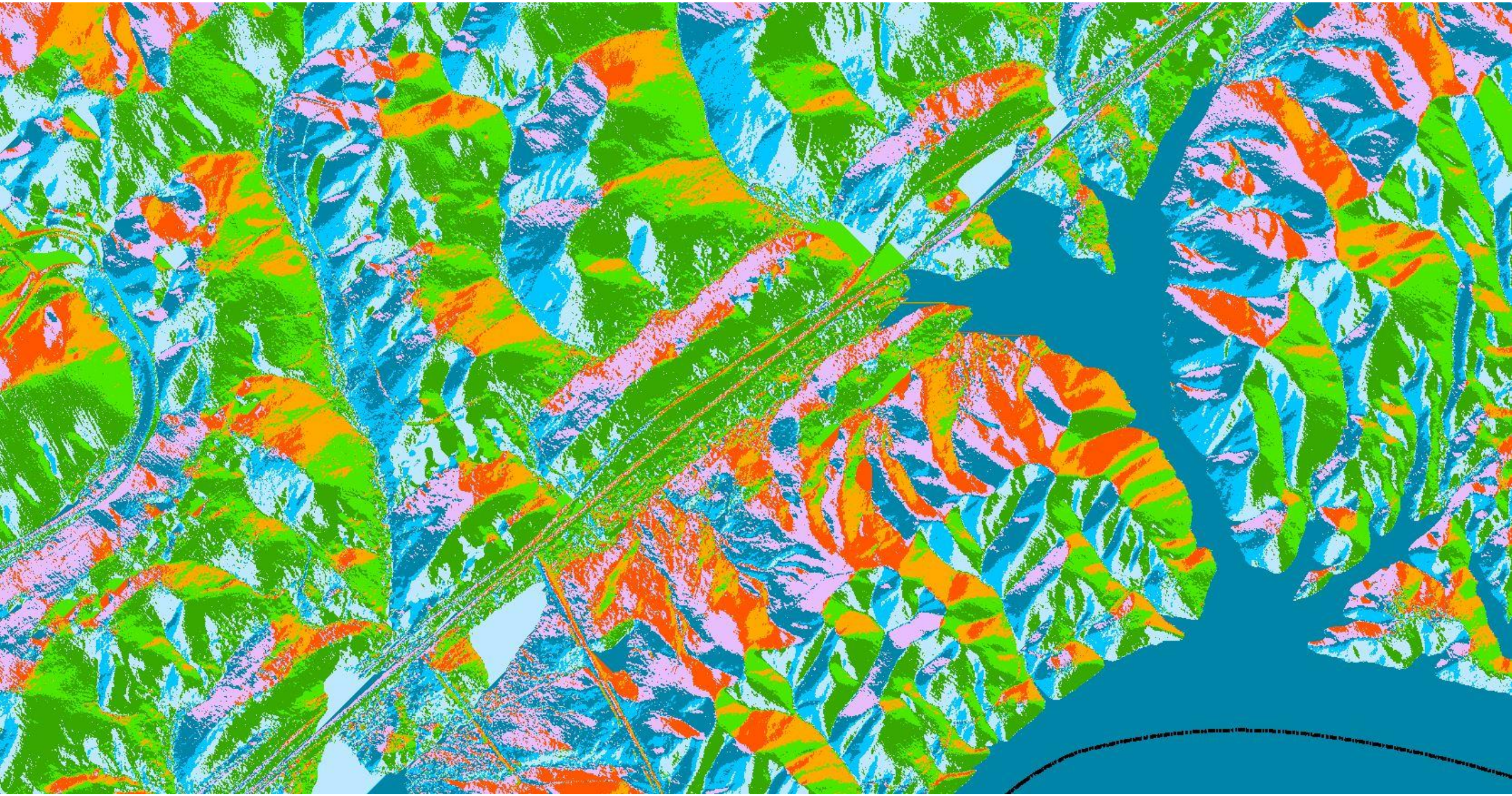
Roane County

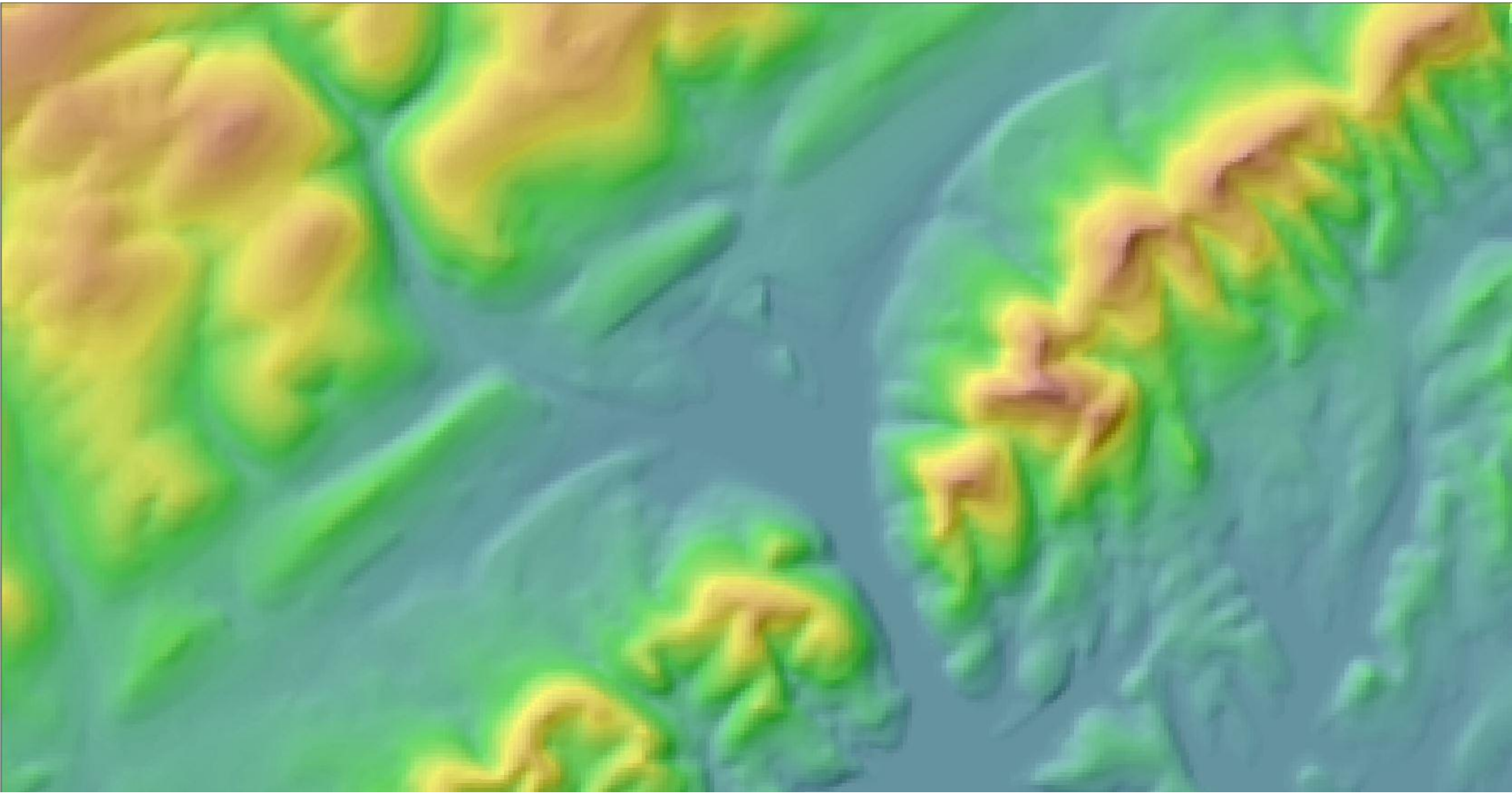


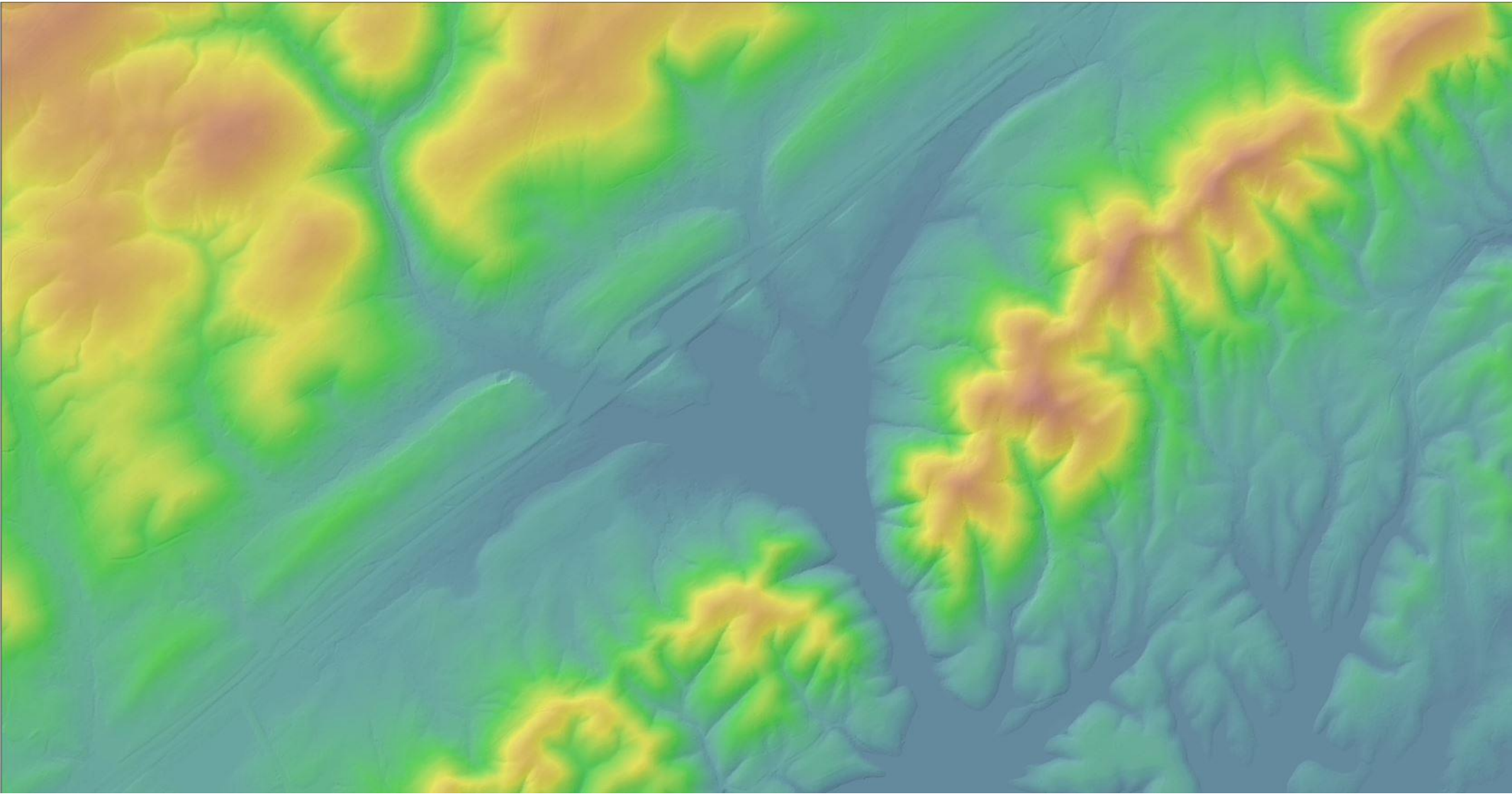
Anderson County





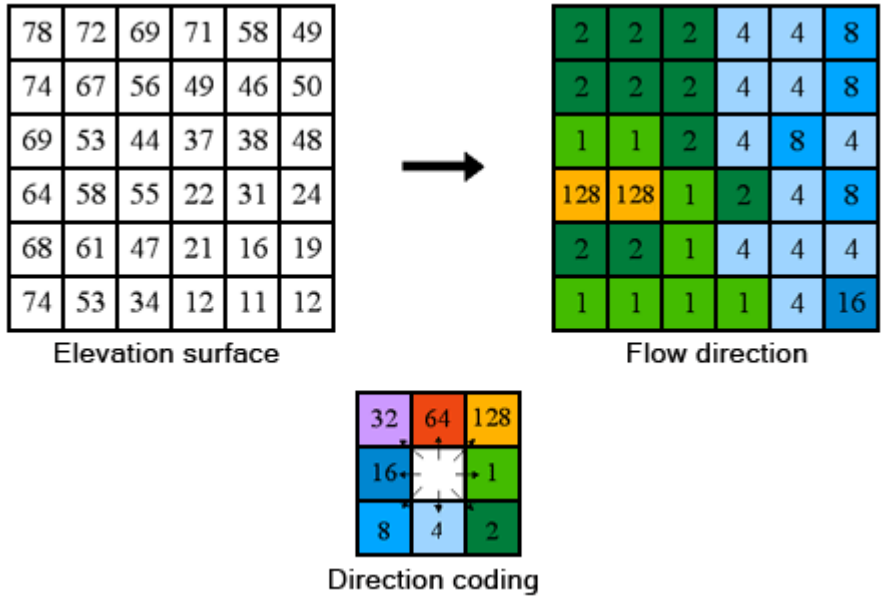






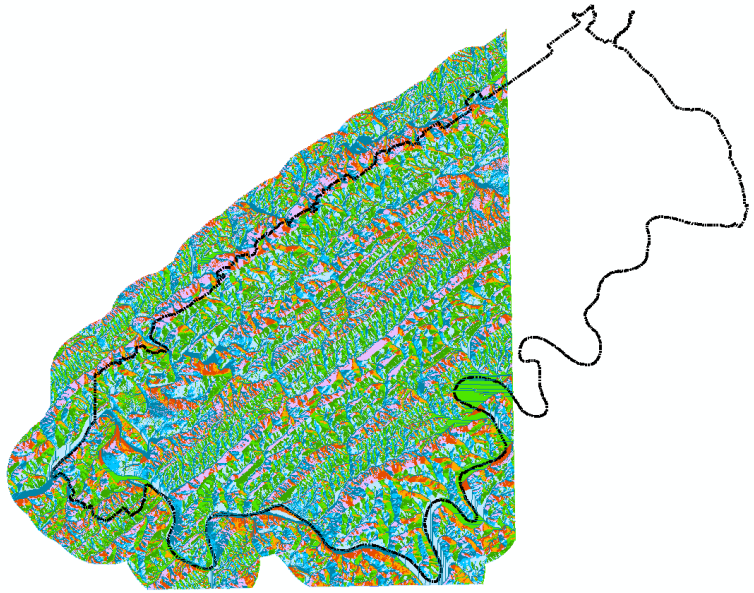
FLOW DIRECTION

- Calculates the direction of flow by assigning separate cell values for each direction.

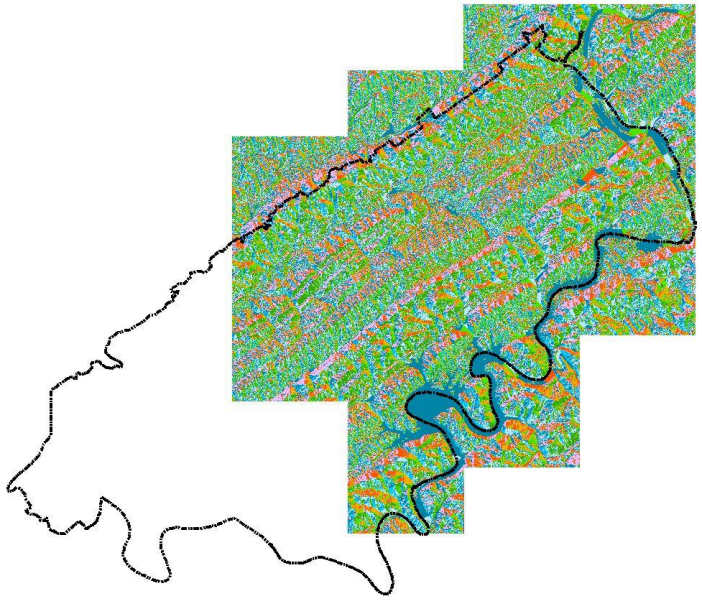


FLOW DIRECTION

Roane County



Anderson County



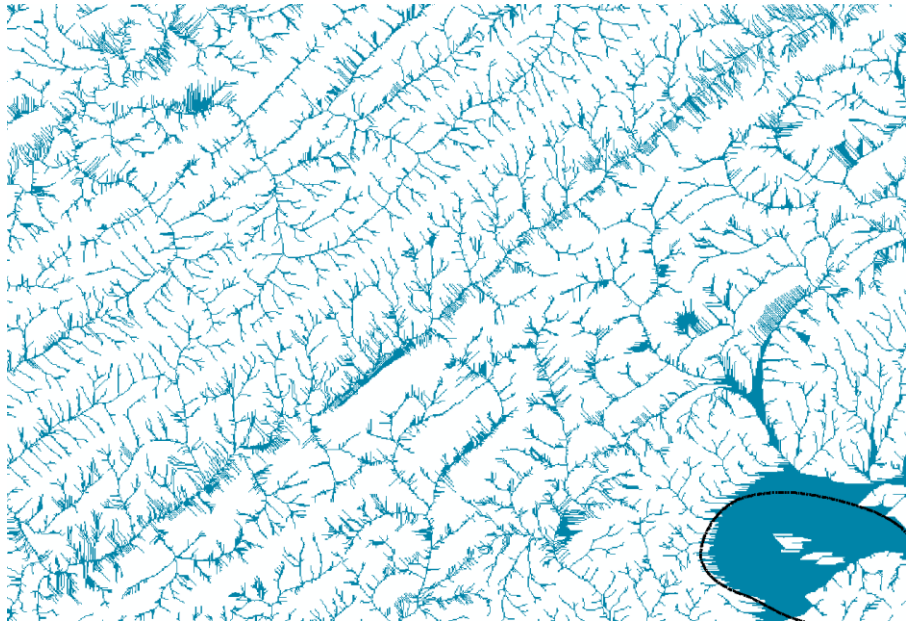
FLOW ACCUMULATION

- Calculates the theoretical accumulation each cell would accrue
- A threshold is required to delineate streams and to determine level of tributary detail

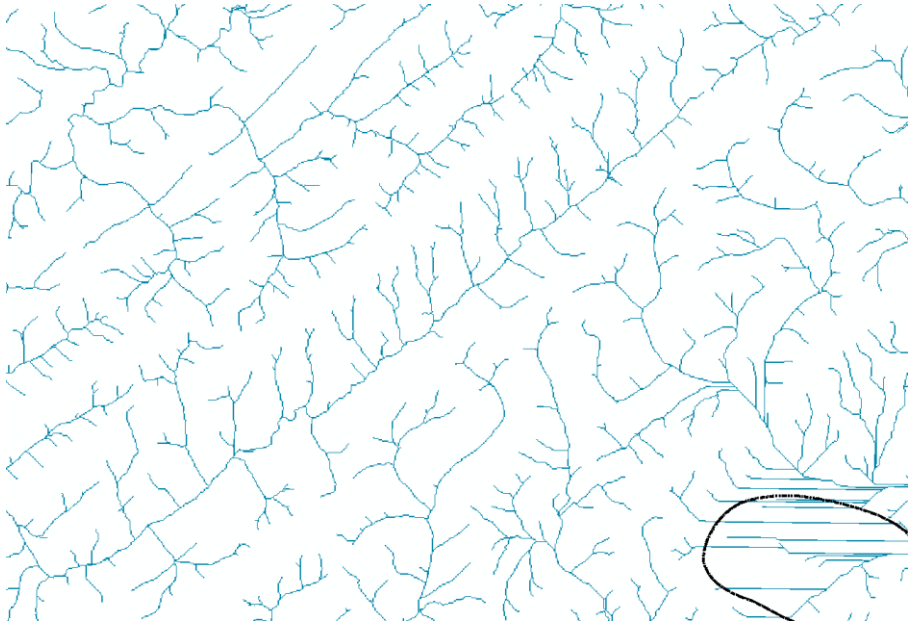
- The Con tool is used to determine threshold by using a conditional statement
  - "Value <= (threshold #)" is null

THRESHOLD COMPARISON

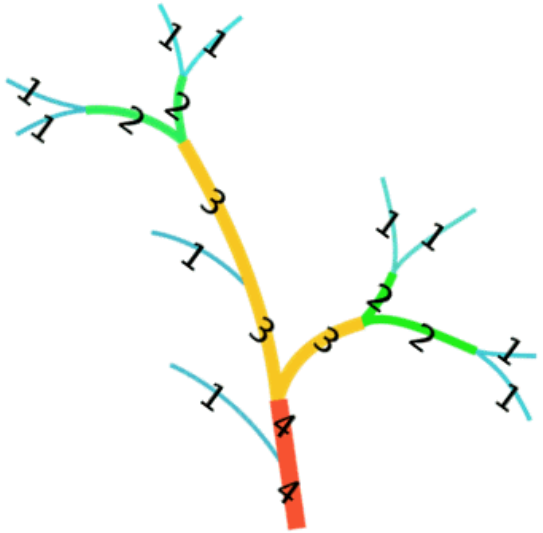
Value <= 15



Value <= 200



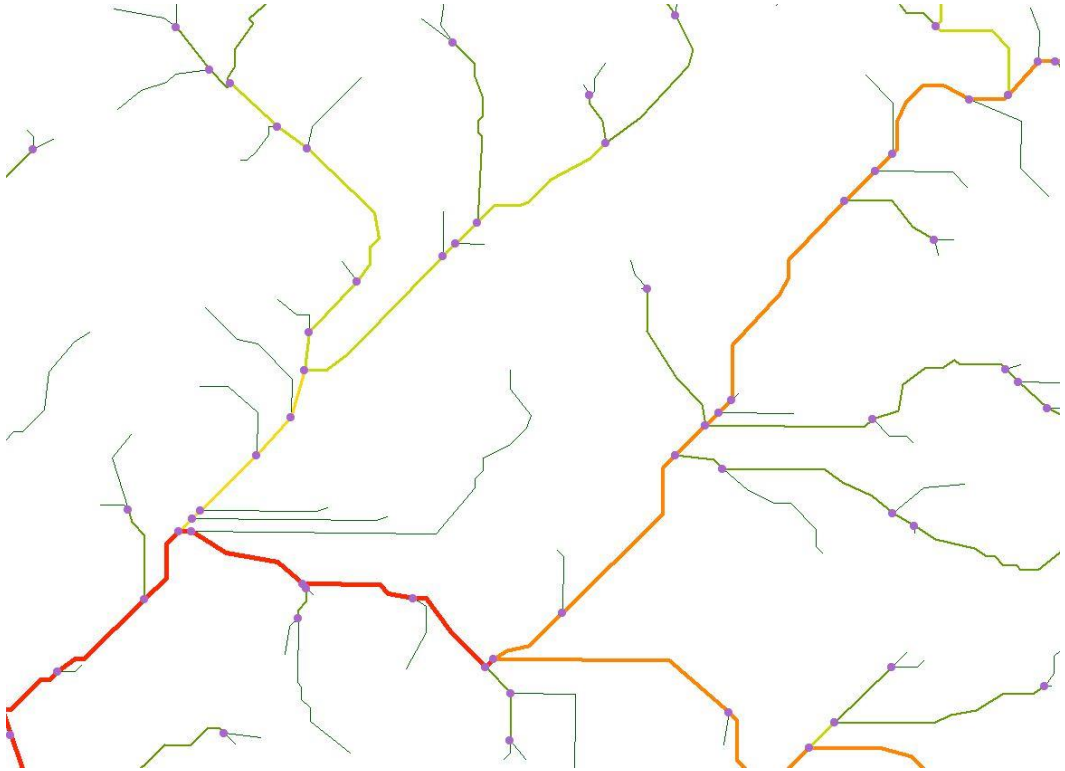
STREAM ORDER



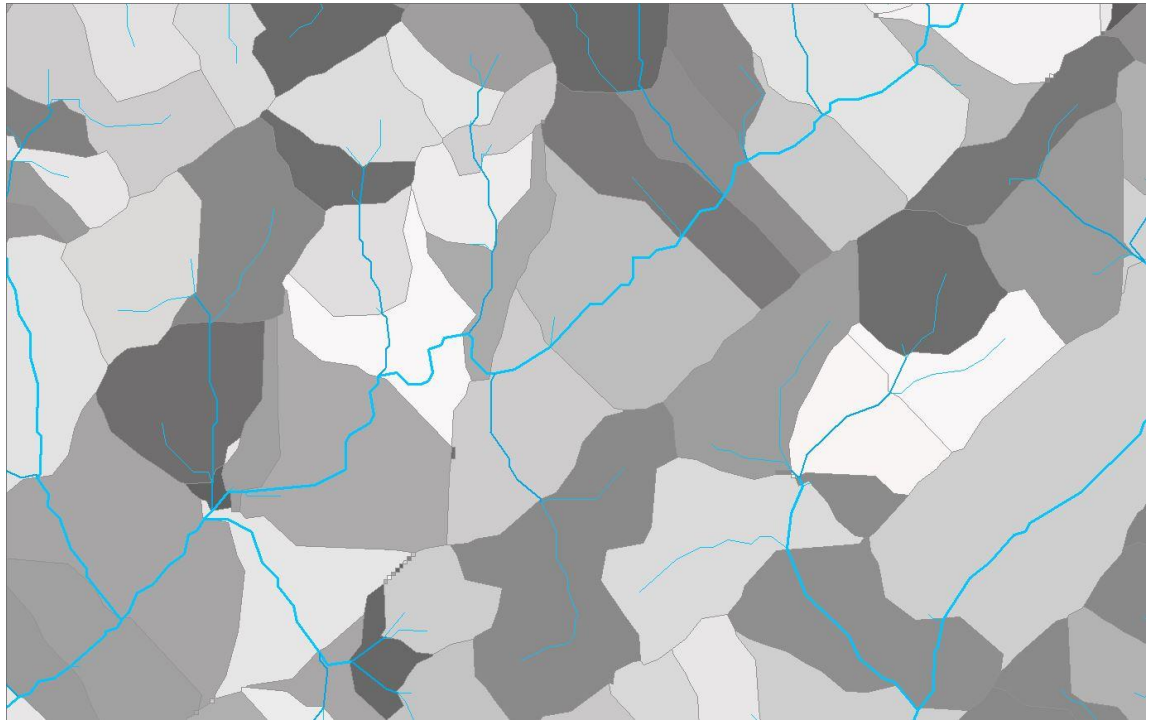
- Strahler Method of stream ordering
- Distinguishes tributaries from streams and rivers

FEATURE VERTICES TO POINTS

- The line end-points are converted to a point shapefile
- These points will act as watershed outlets, pour points, or stream convergence points



WATERSHED DELINEATION



- Ridgelines are delineated using the flow direction raster and pour point shapefile
- The watershed raster is converted polygons

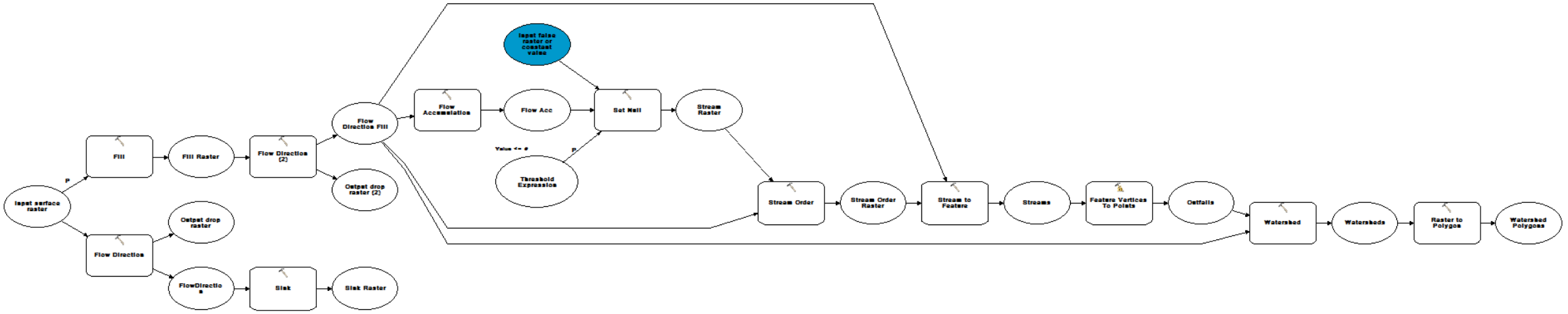
AUTOMATING THE ANALYSIS

MODEL BUILDING FOR FUTURE ANALYSIS

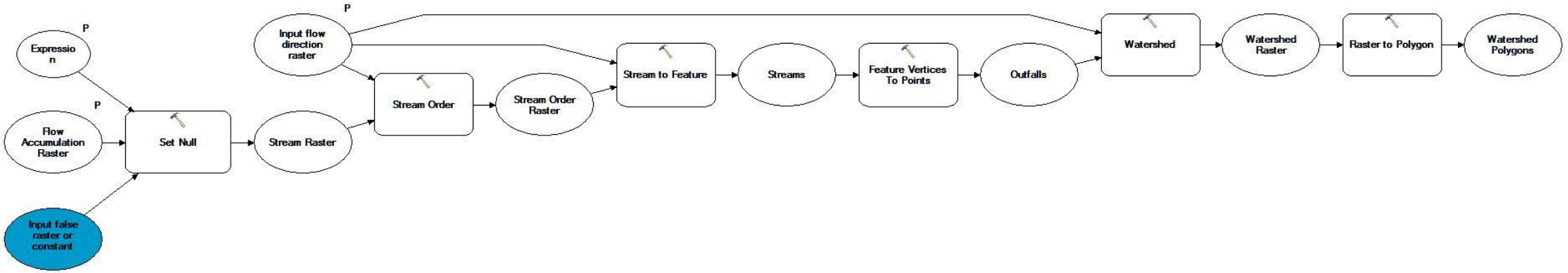
BUILDING THE MODELS

- Two models were built to expedite analysis process
- These models can be used for future analysis with updated DEMs
- The first model completes the entire analysis from DEM to watershed polygons
- The second allows the user to experiment with different threshold values

WATERSHED ANALYSIS MODEL



SET NULL TO WATERSHED MODEL

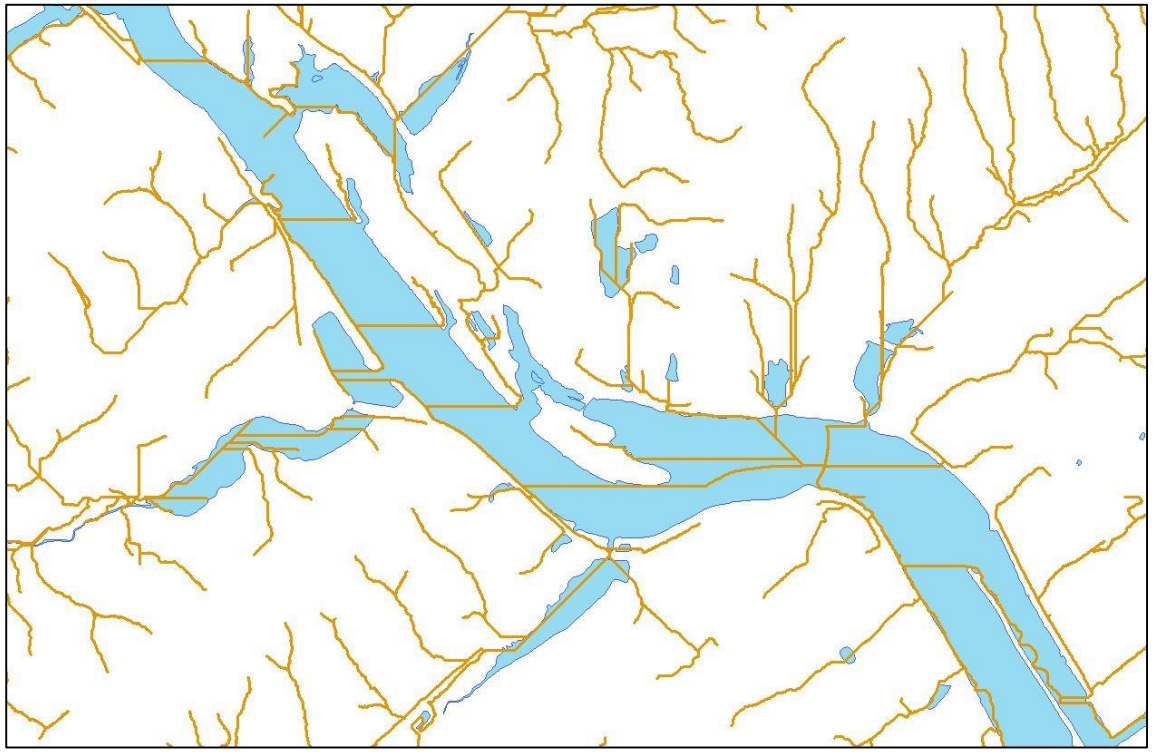


COMPARING THE DATA

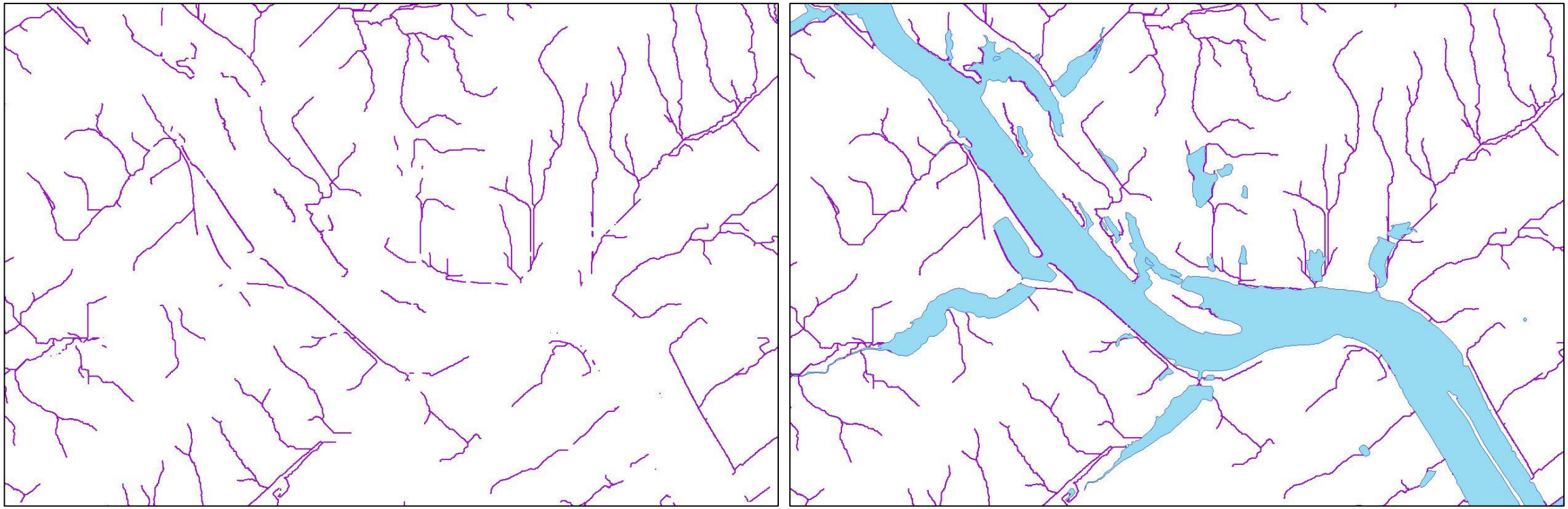
FIELD DATA COMPARISON AND ANALYZING RESULTS

DATA CLEAN UP

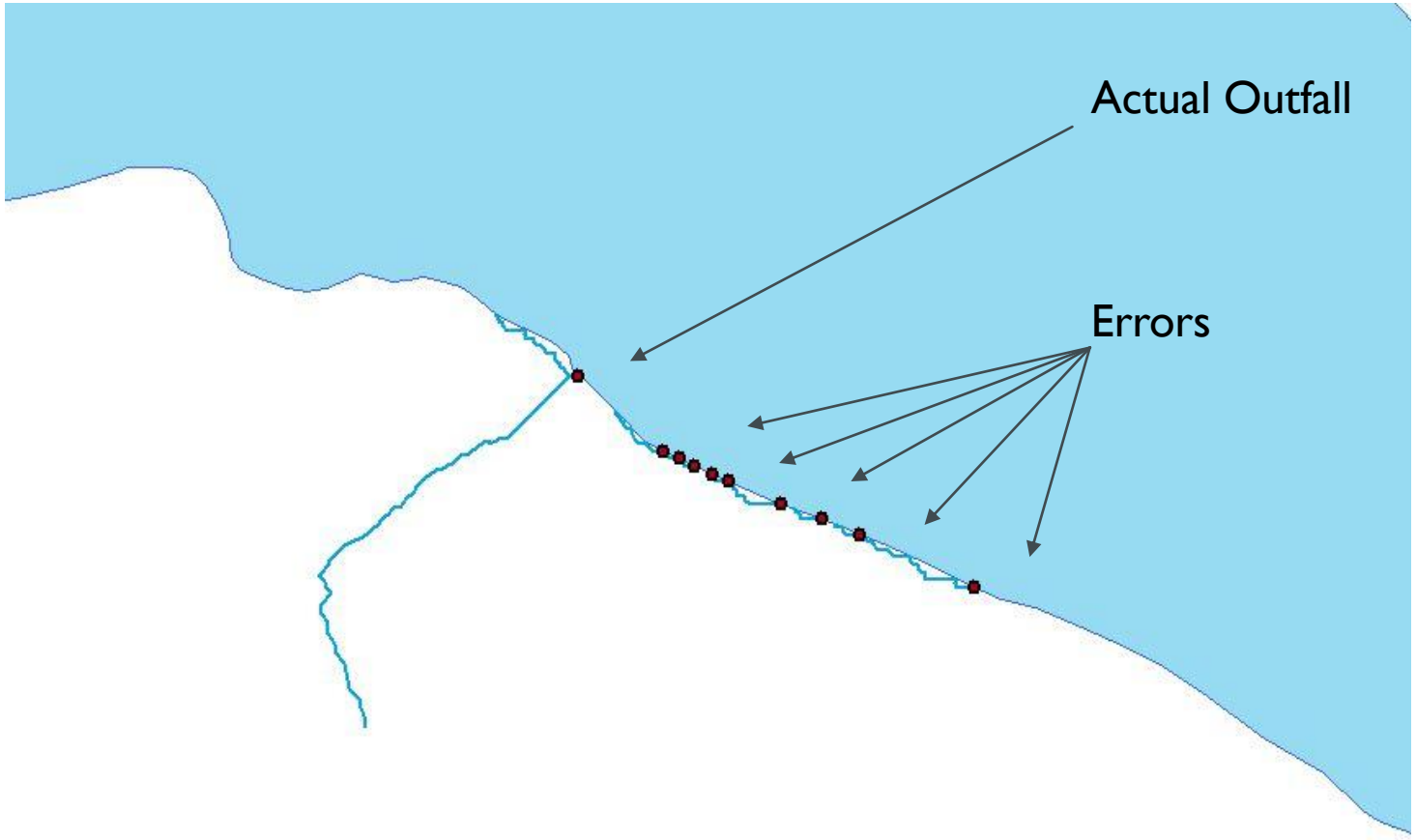
- Some streams were delineated in the river, which need to be removed.



DATA CLEAN UP

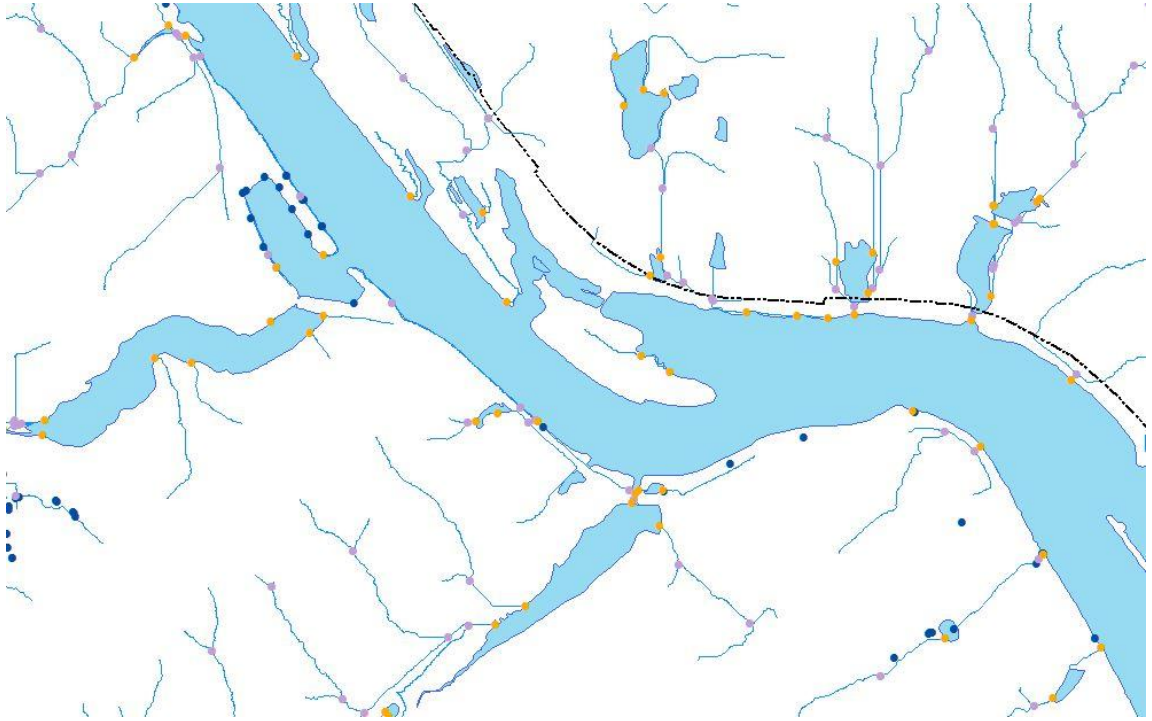


ERRORS



- Of the 7,166 stream vertices, 1,527 intersected the river/waterbody shapefile.
- 571 points were deemed erroneous and removed.
- Leaving 956 potential river outfalls in the Anderson County side of Oak Ridge.

DATA COMPARISON



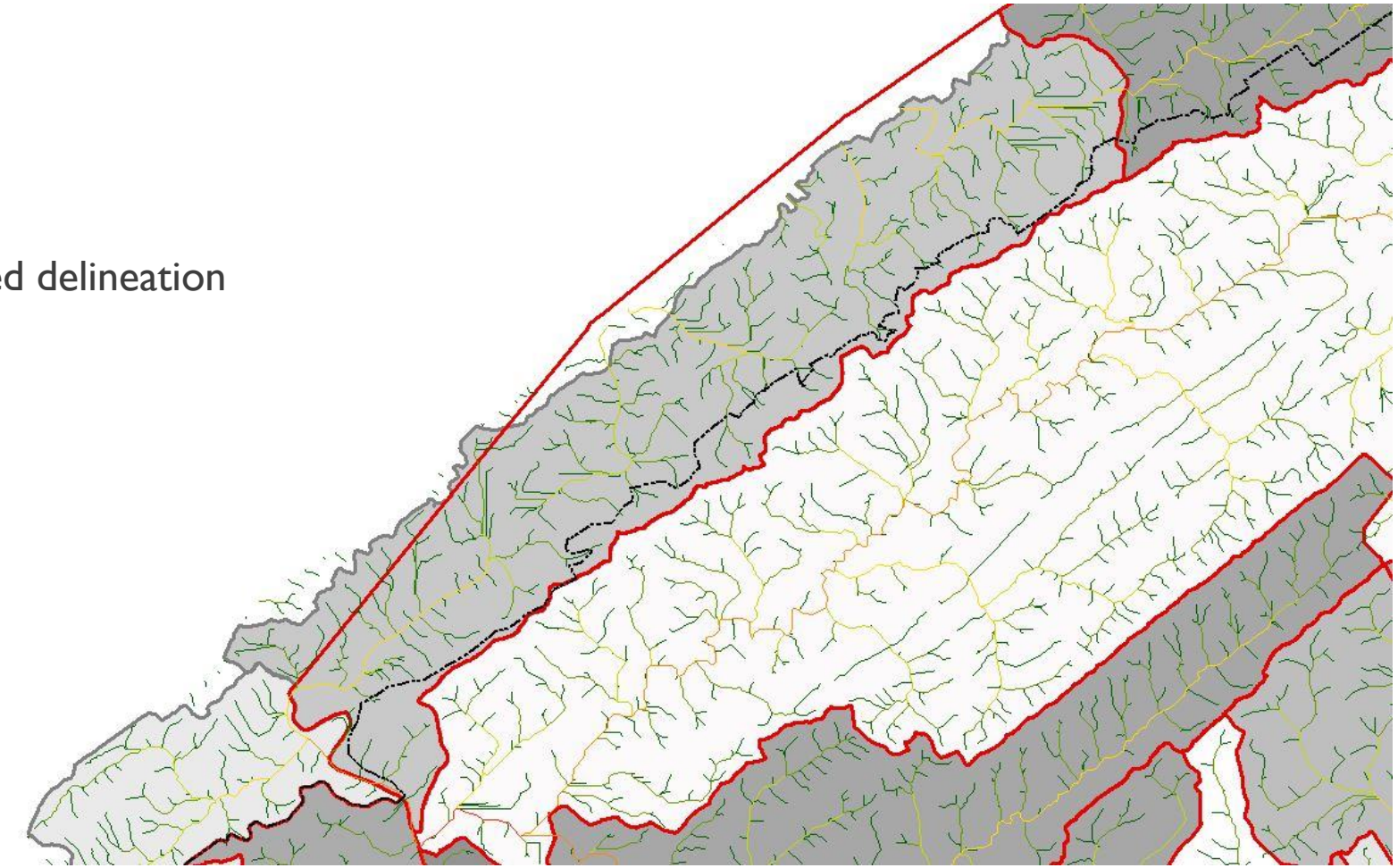
- Blue Points: GPS Outfall
- Orange Points: River Outfall Via Analysis
- Purple Points: Stream Convergences

DATA COMPARISON

- With river outfalls and stream convergences mapped and compared to observed data…
  - GPS data acquisition can be planned
  - Blue lines can be reassessed for accuracy
  - Outfalls can be reported to the state in compliance with EPA NPDES Phase II MS4

WATERSHED COMPARISON

- Allows for more detailed watershed delineation



FUTURE CONSIDERATIONS

NEW LIDAR IMPLEMENTATION

TERRAIN DATASET

Benefits to Terrain Datasets

- Can store large quantities of data
- Break lines can better delineate road cuts, curbs and shorelines
- Higher accuracy and precision of surface modelling
- Multi-resolution data display and interpolation
- Potential for 3D Analysis