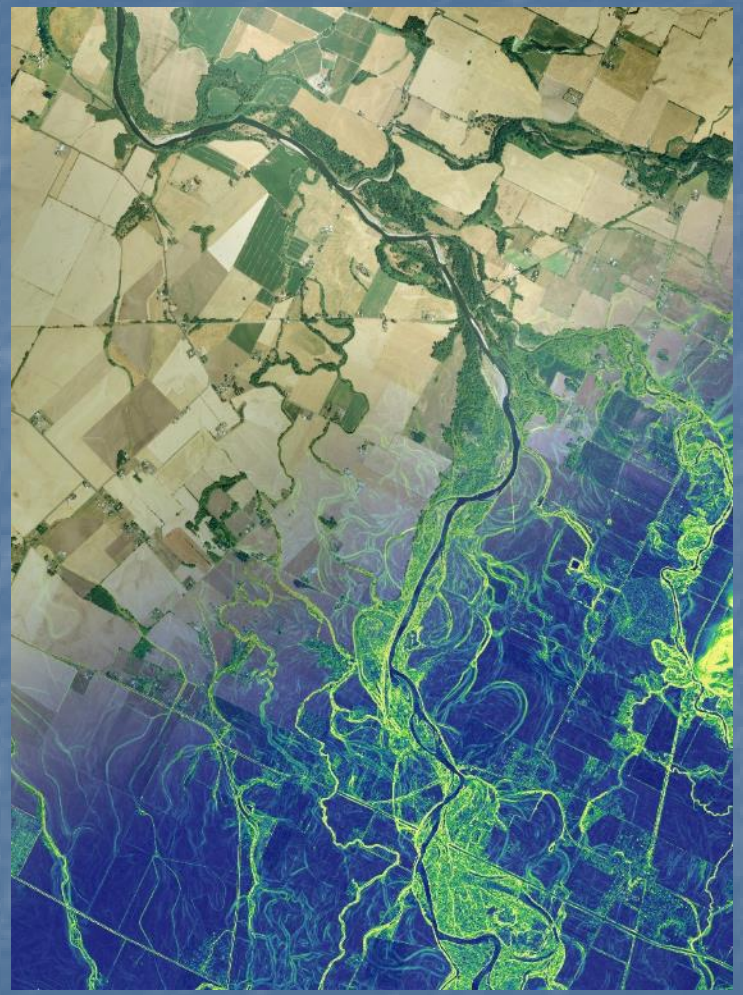
USGS New NHD Standardization Program

Quick Introduction: Jacob Edwards
Elevation FIT Chair/ DOGAMI
(971) 865-1073
Jacob.edwards@oregon.gov

Technical Presentation: Andrew Brenner, Ph.D.
Senior Program Director
(734) 680-6424
abrenner@quantumspatial.com

Mischa Hey
Senior Technical Domain Expert
(541) 632-6572
mhey@quantumspatial.com



South Santiam River

USGS New NHD Standardization Program

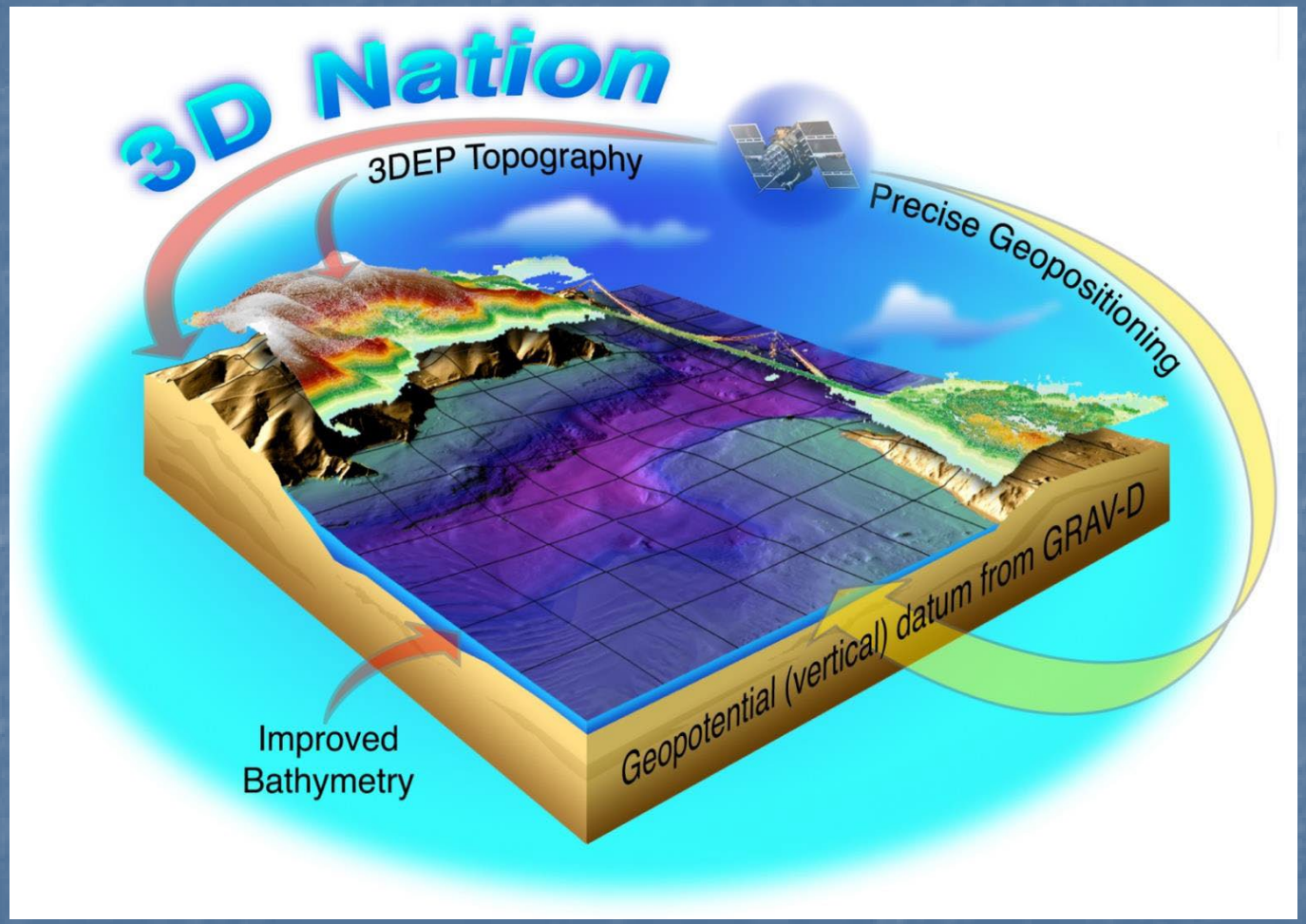


Image from MAPPS January 2020 Conference presentation by:

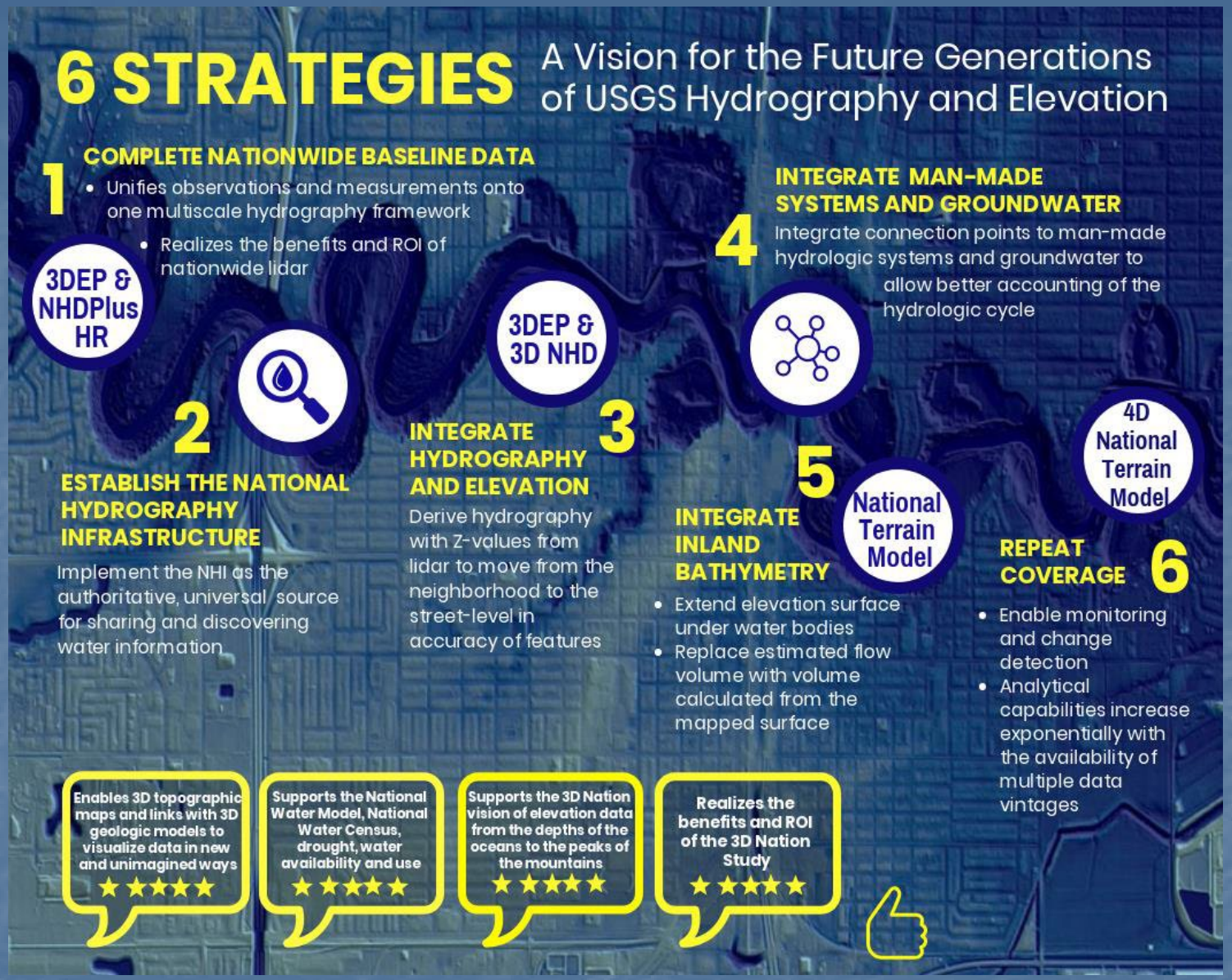
Miki Schmidt, NOAA
Vicki Lukas, USGS

The 3D Nation Concept

Building a modern elevation foundation from the peaks of our mountains to the depths of our waters. For a stronger, more resilient communities and U.S. economy

3D Elevation Program (3DEP)

"the goal of 3DEP is to complete acquisition of nationwide lidar (IfSAR in AK) by 2023 to provide the first-ever national baseline of consistent high-resolution elevation data."



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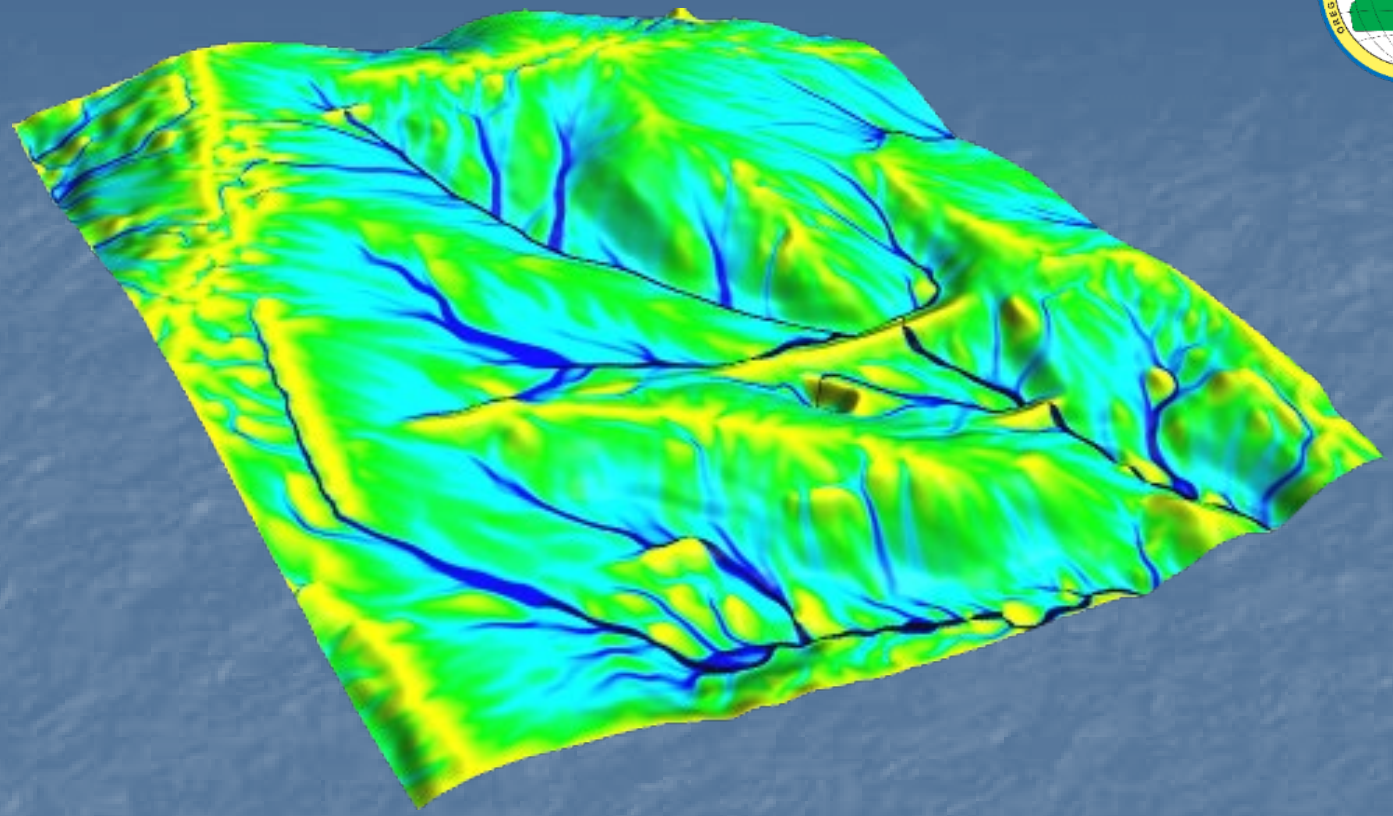
USGS is moving toward the notion of WBD/NHD workflow follow immediately after lidar collection as part of 3DEP & 3D Nation.

USGS 3DEP will likely include some seed funding for NHD development and products in the next BAA cycle (summer 2020).

There will still be a desire by USGS for agencies to bring in local matching funds –

State Funding??



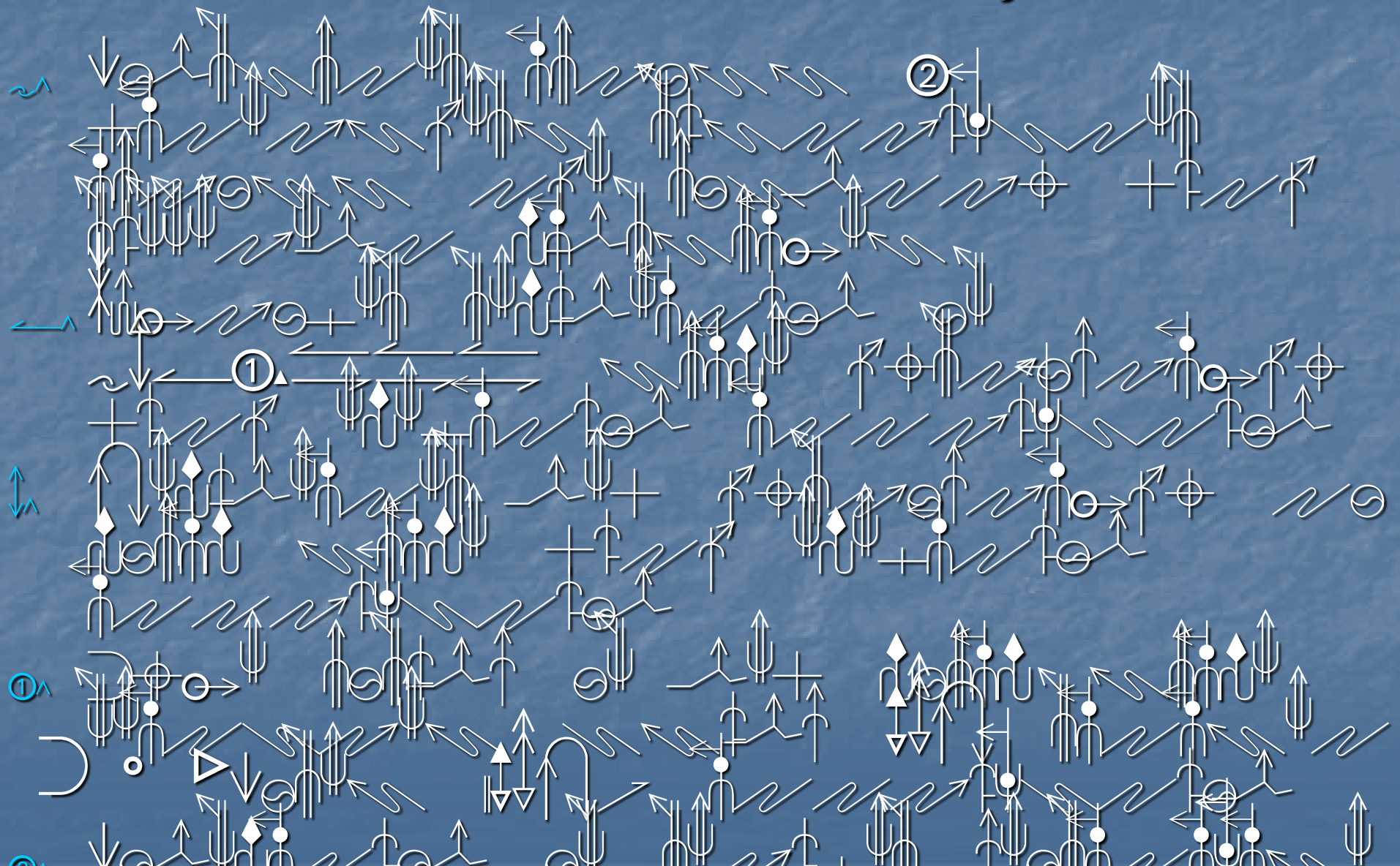
Hydrography and LiDAR

TECHNICAL APPROACHES

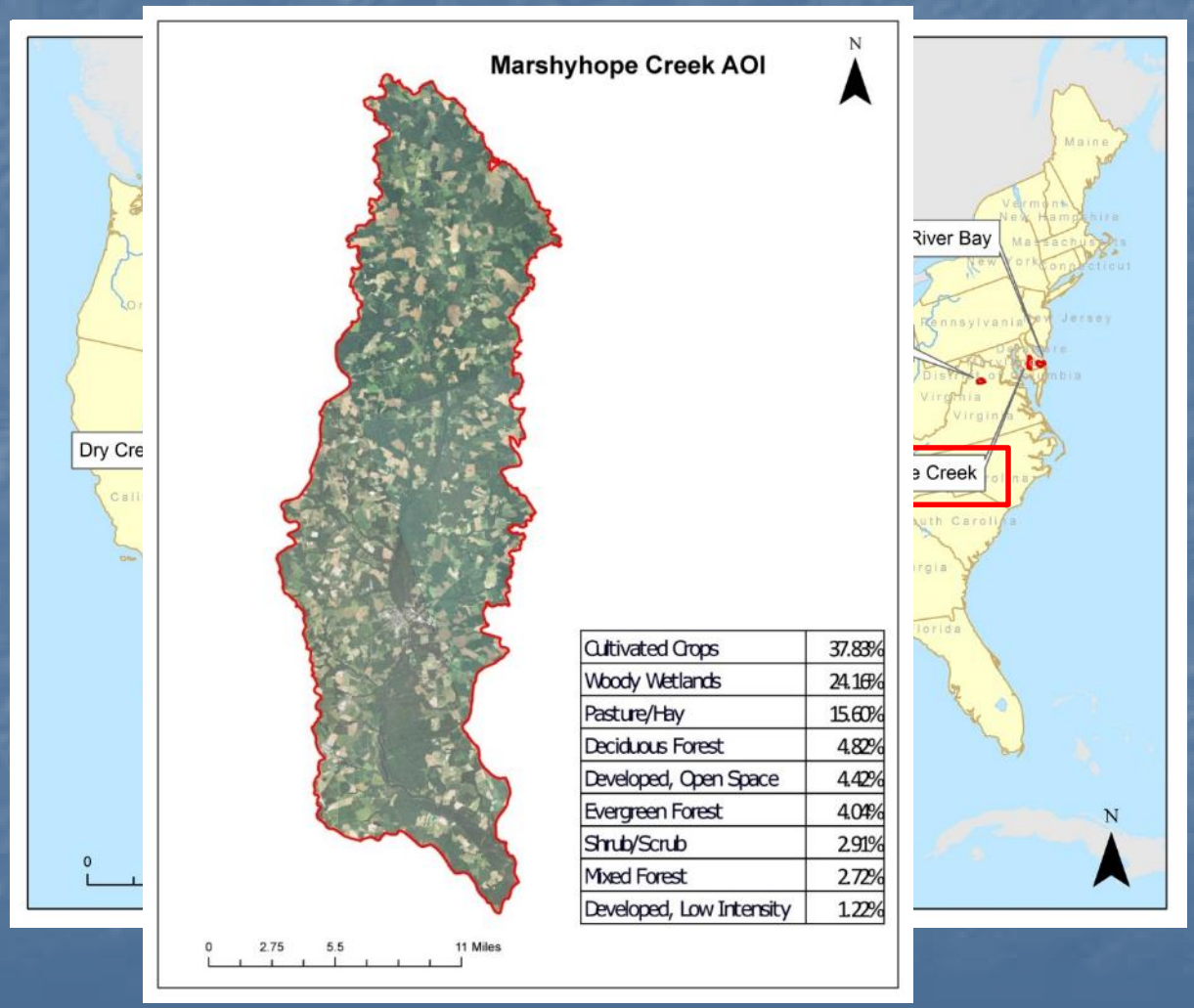
What is Elevation Derived Hydrology?

- Making sure the elevation and the hydrology match
  - i.e. rivers do not go up the side of the mountain.
- Bringing NHD attributes to a higher resolution dataset
- EDH can be at a 1:24,000 scale or a local scale
- EDH can be derived from lidar or IfSAR (specific to AK)
- Allows data to be derived using mechanistic computational methods
- All data still needs to be reviewed and quality controlled

USGS's EDH Pilot Projects



Source Data & AOIs



Cultivated Crops	37.83%
Woody Wetlands	24.16%
Pasture/Hay	15.60%
Deciduous Forest	4.82%
Developed, Open Space	4.42%
Evergreen Forest	4.04%
Shrub/Scrub	2.91%
Mixed Forest	2.72%
Developed, Low Intensity	1.22%

LiDAR – DEM – Hydro-enforced DEM

Run ArcHydro Routine

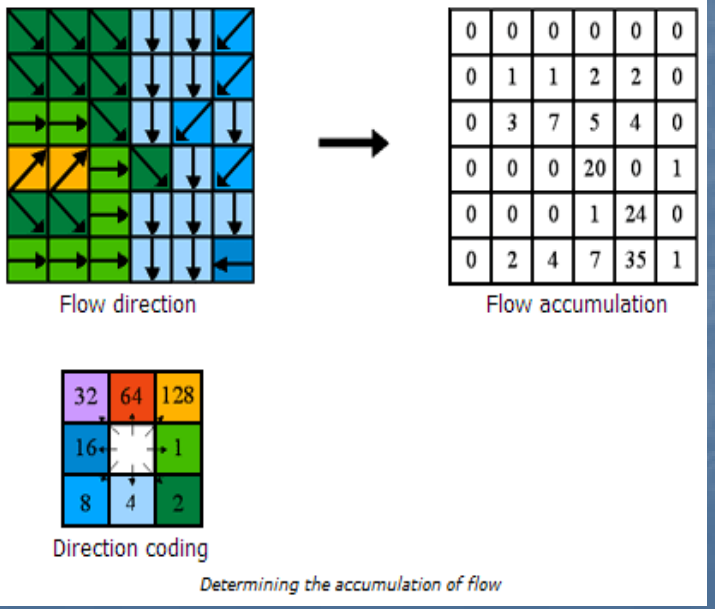
Examine the resulting stream definition for areas where flow appears artificially impeded

Create Hydro-Enforcement Breaklines

Enforce Breaklines in Model

Re-run Archydro Routine

1) Fill Sinks
2) Calculate Flow Direction Grid
3) Calculate Flow Accumulation Grid
4) Define Stream Definition Threshold



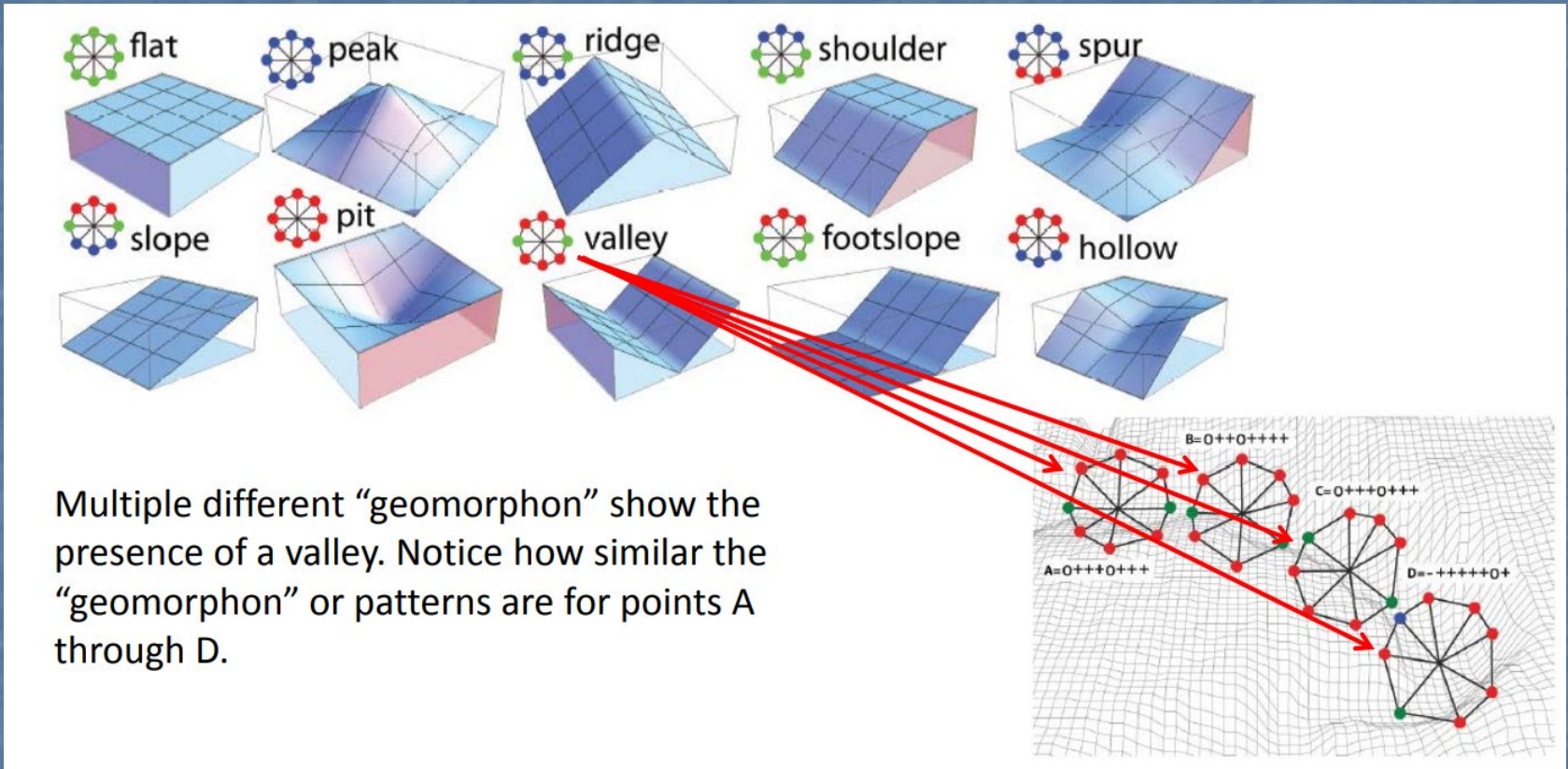
0	0	0	0	0	0
0	1	1	2	2	0
0	3	7	5	4	0
0	0	0	20	0	1
0	0	0	1	24	0
0	2	4	7	35	1

32	64	128
16		1
8	4	2

Automated Flowlines to edit

Geomorphons

- Map whether there is a river channel
- Geomorphons can be run at multiple scales
  - Large landforms
  - River valley
  - Tributaries
  - Erosion channels

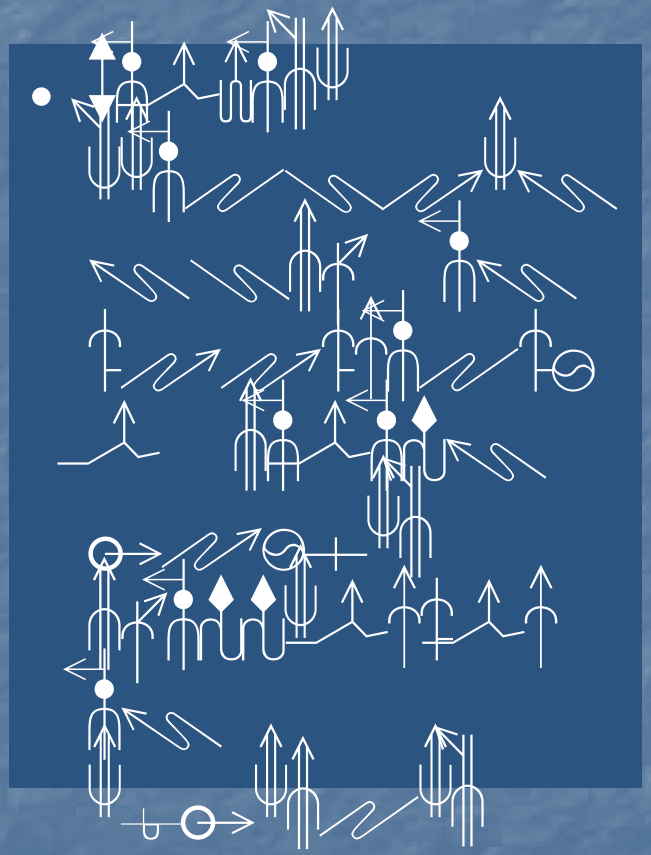


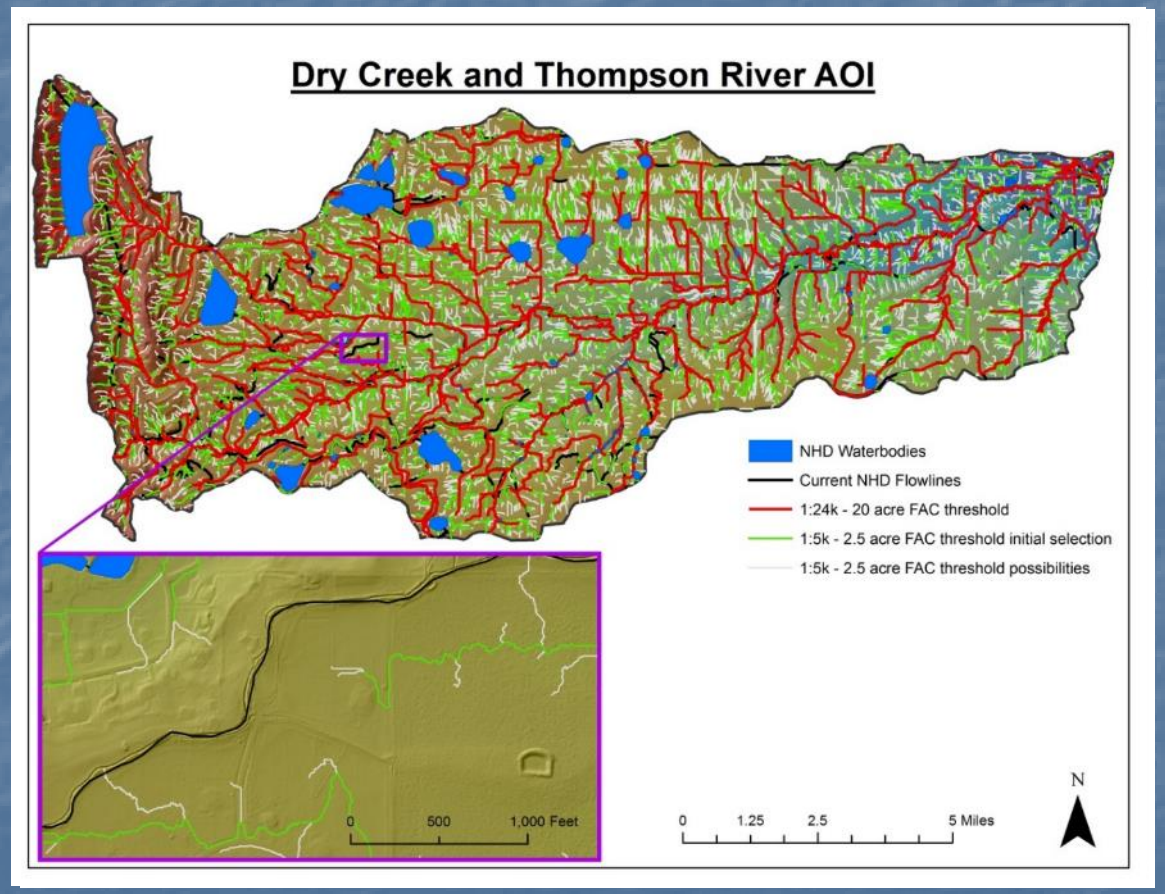
Multiple different "geomorphon" show the presence of a valley. Notice how similar the "geomorphon" or patterns are for points A through D.

Source: Jasiewicza and Stepinski, 2012

When is a Stream a Stream?

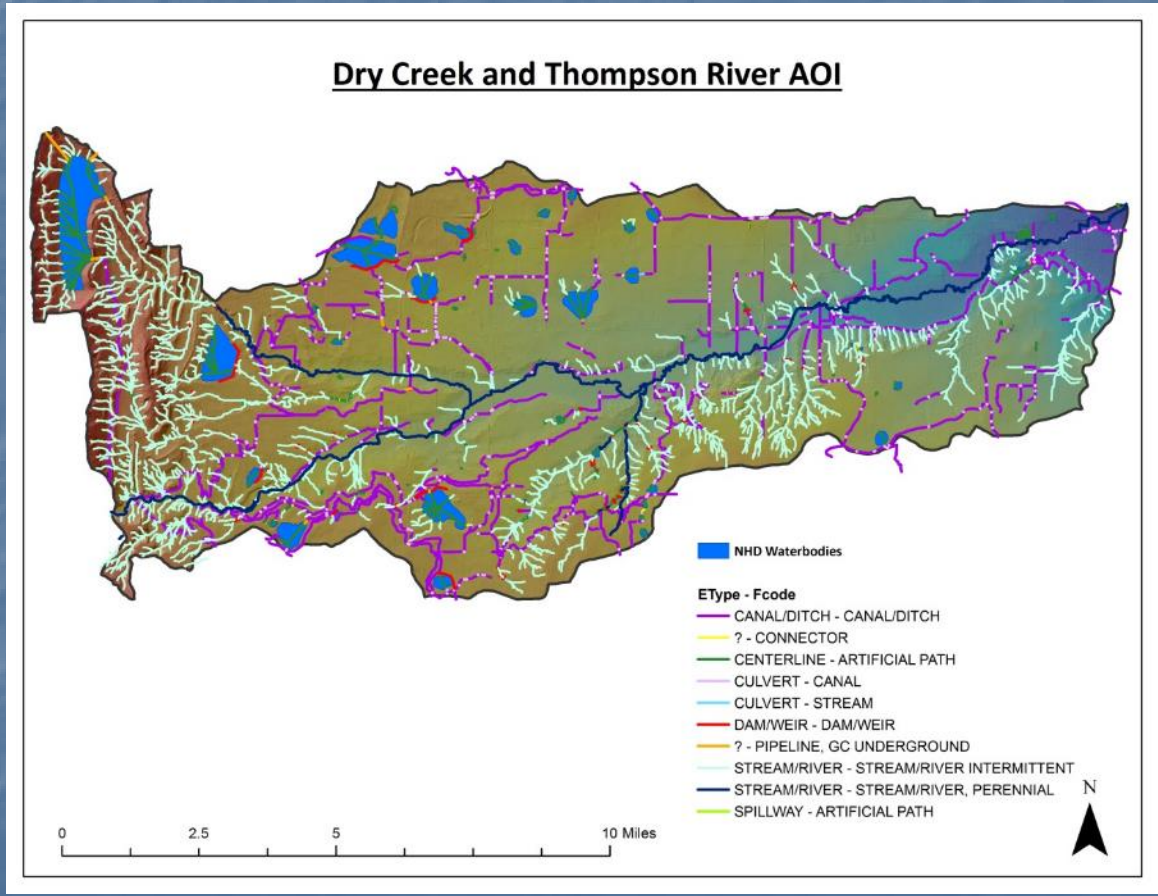
Select out all true flowlines



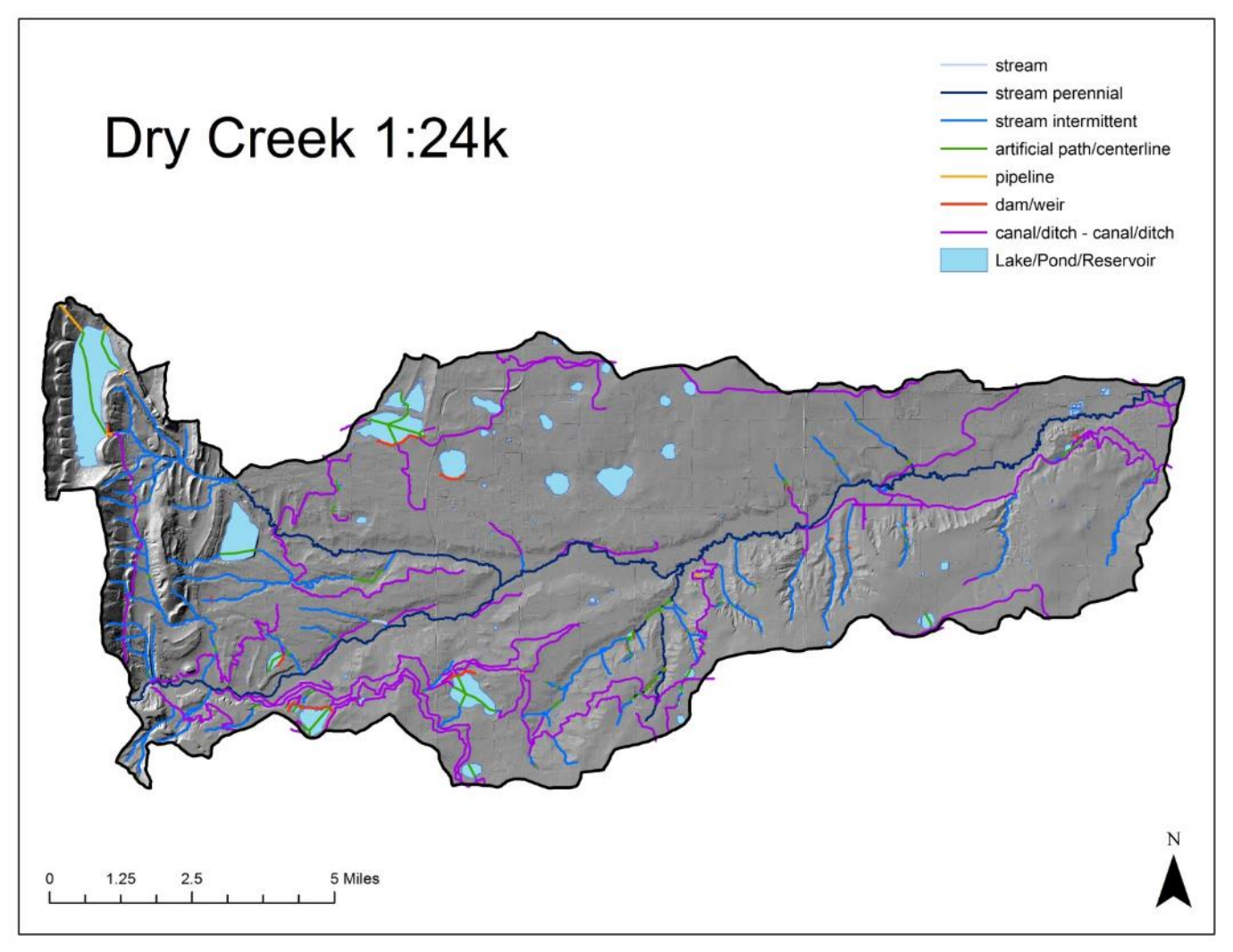


EDH Flowline Workflow

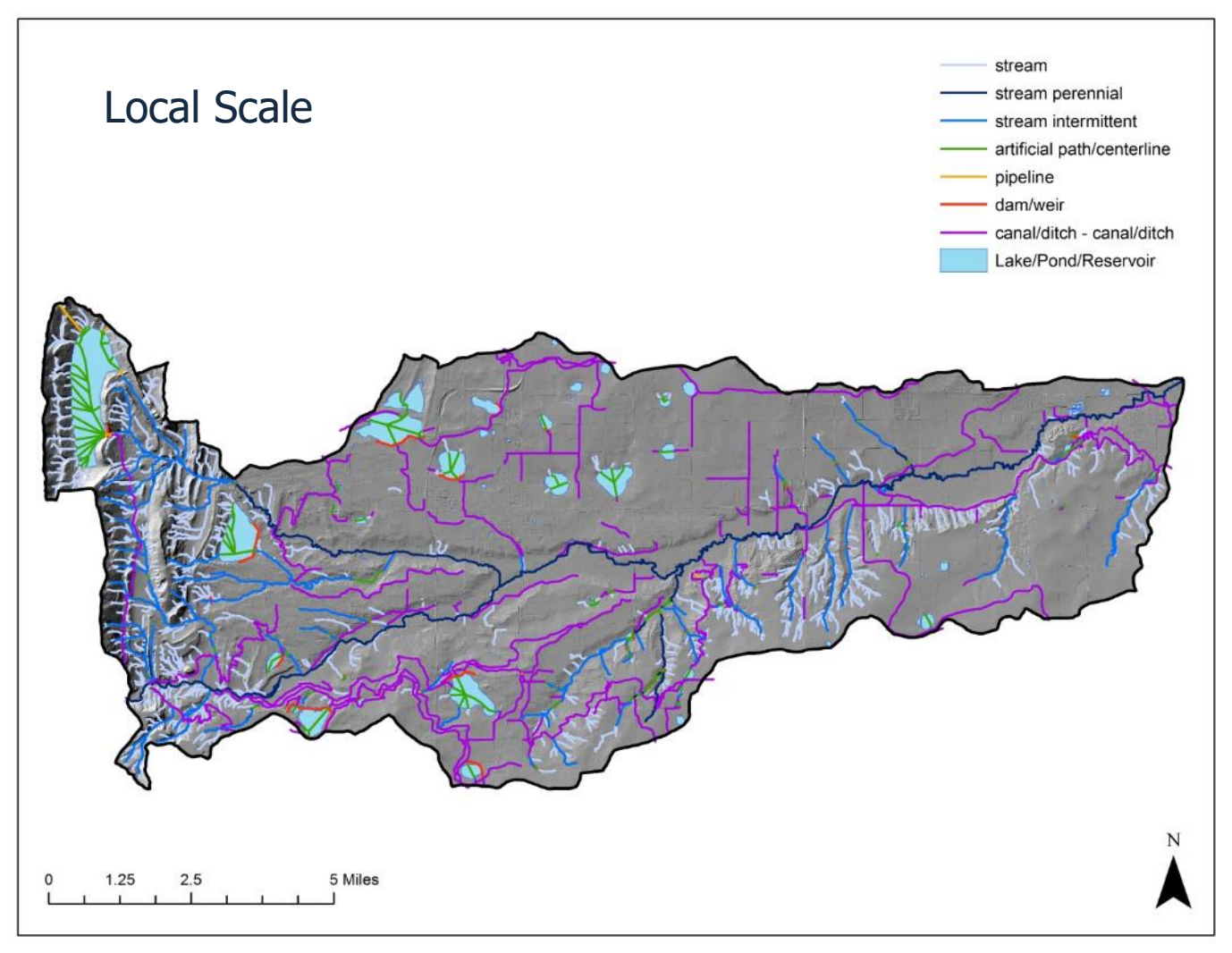
- Initial spatial join of current NHD attribution
- Initial NHD information is consolidated as necessary to match FCodes
- Detail is preserved in the attribute table for additional FCode attribution



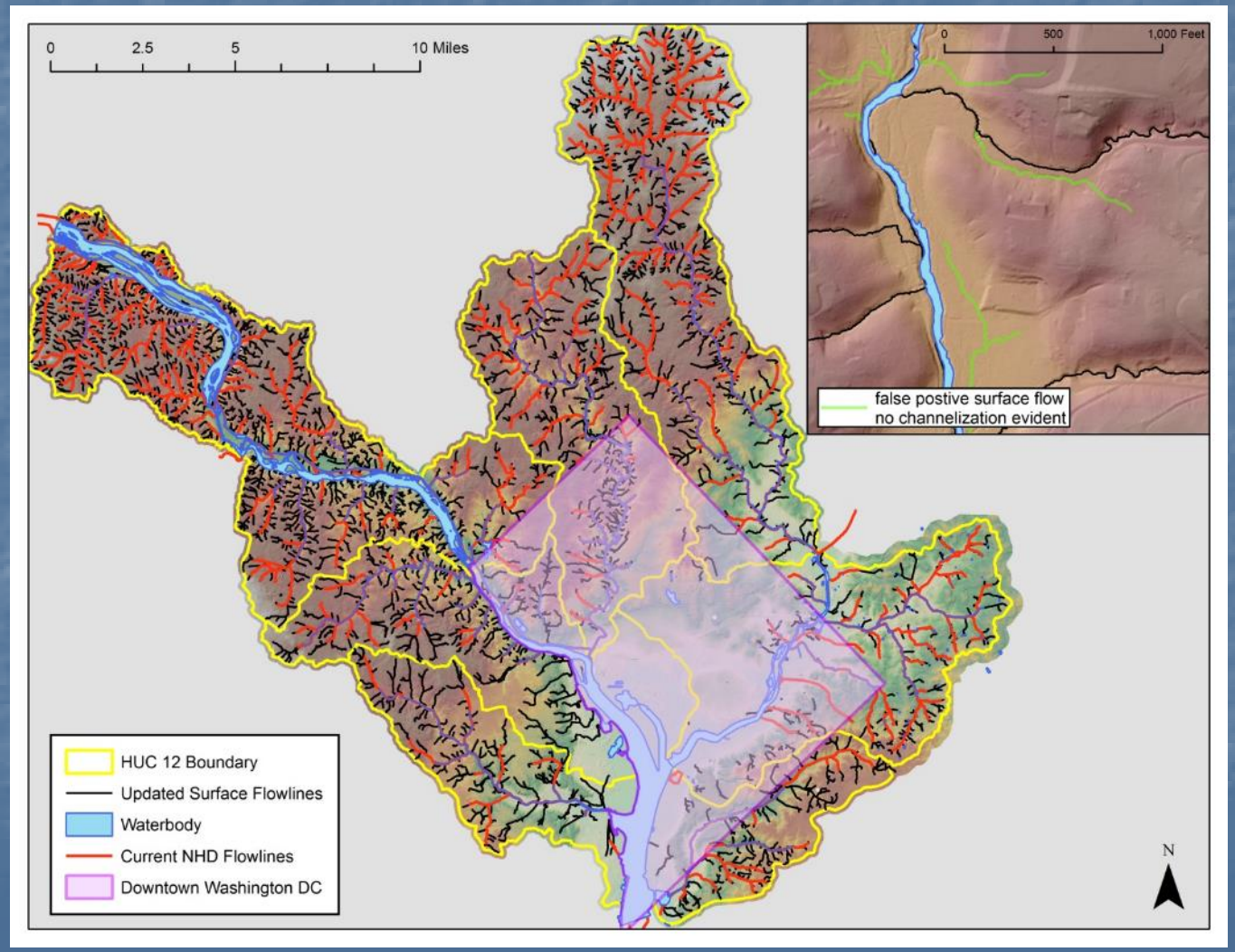
Dry Creek 1:24,000



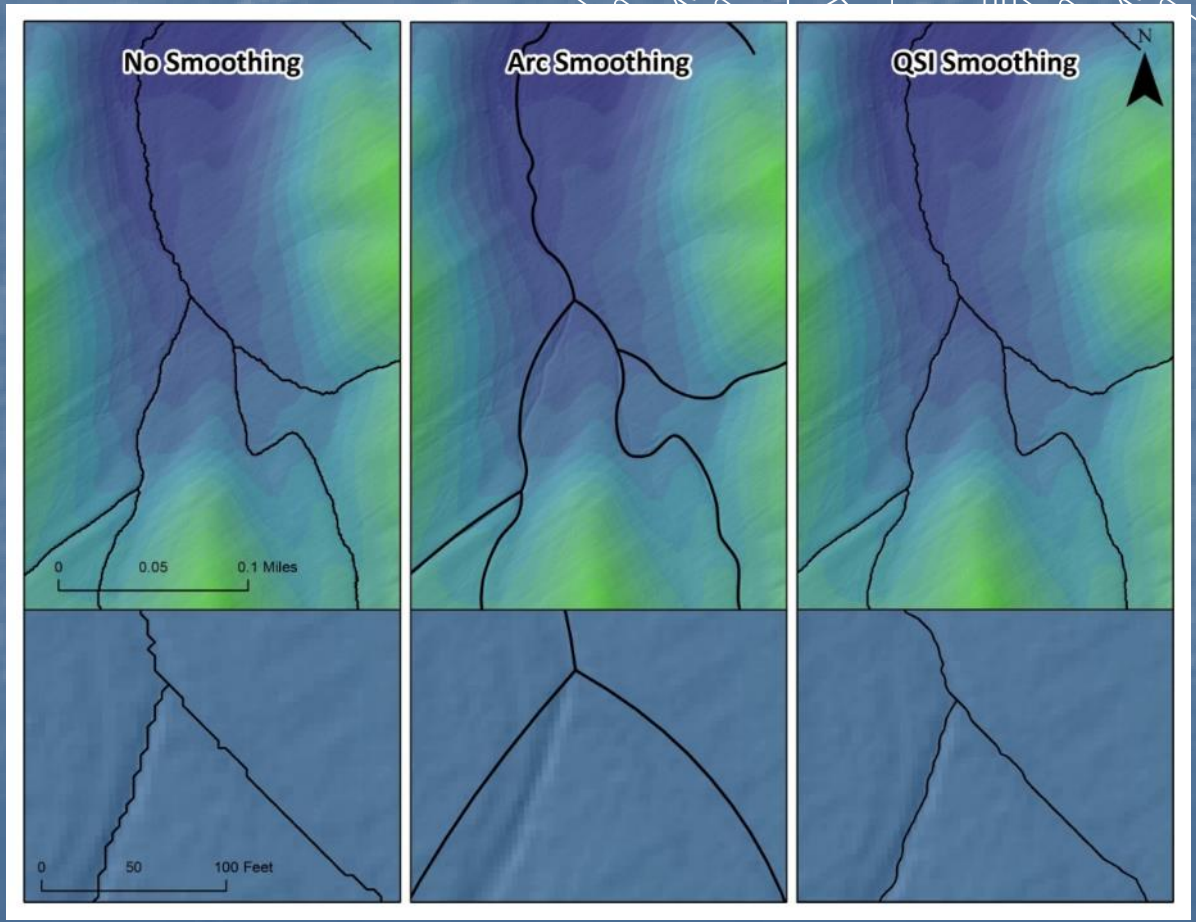
Dry Creek Local Scale

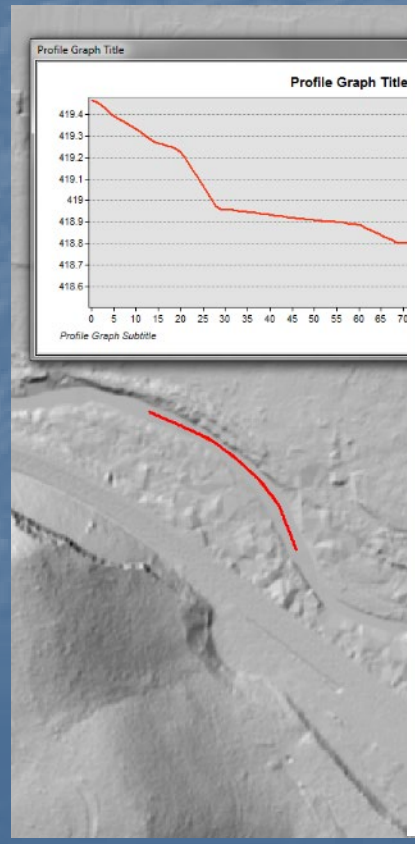


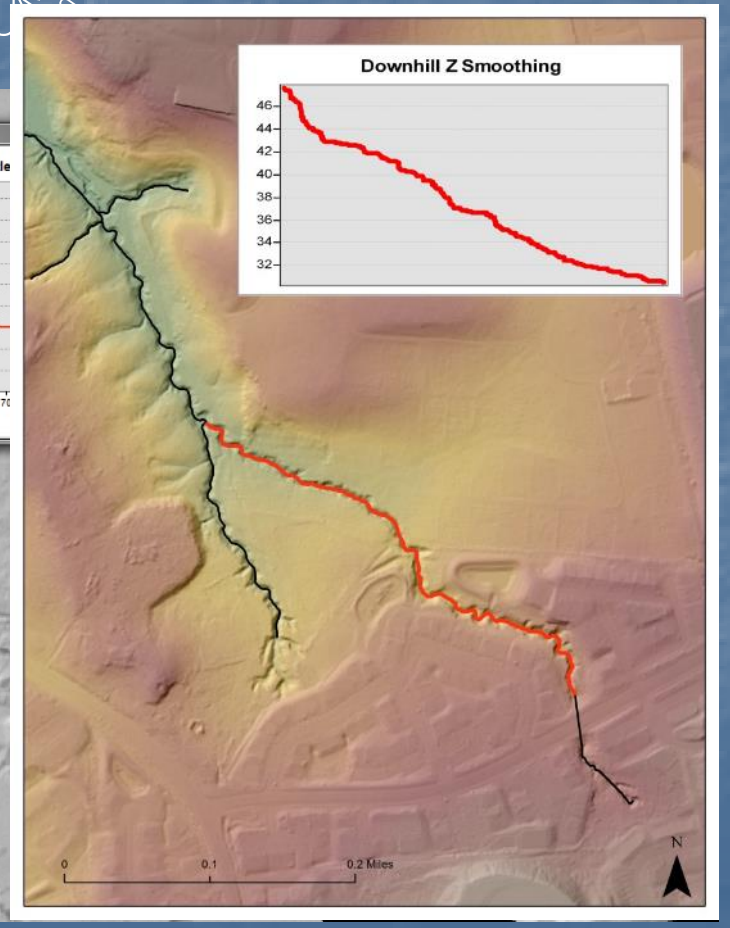
Manual Edit and QC of Surface Flowlines



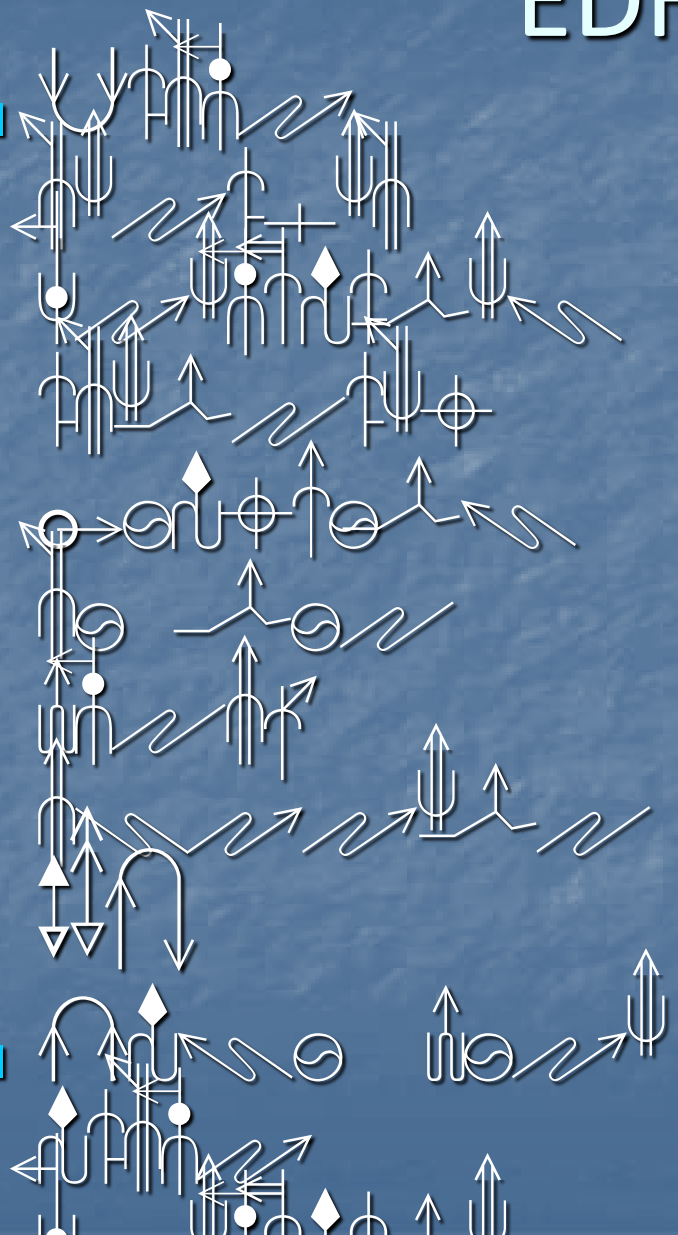
XYZ Smoothing of Surface Flowlines

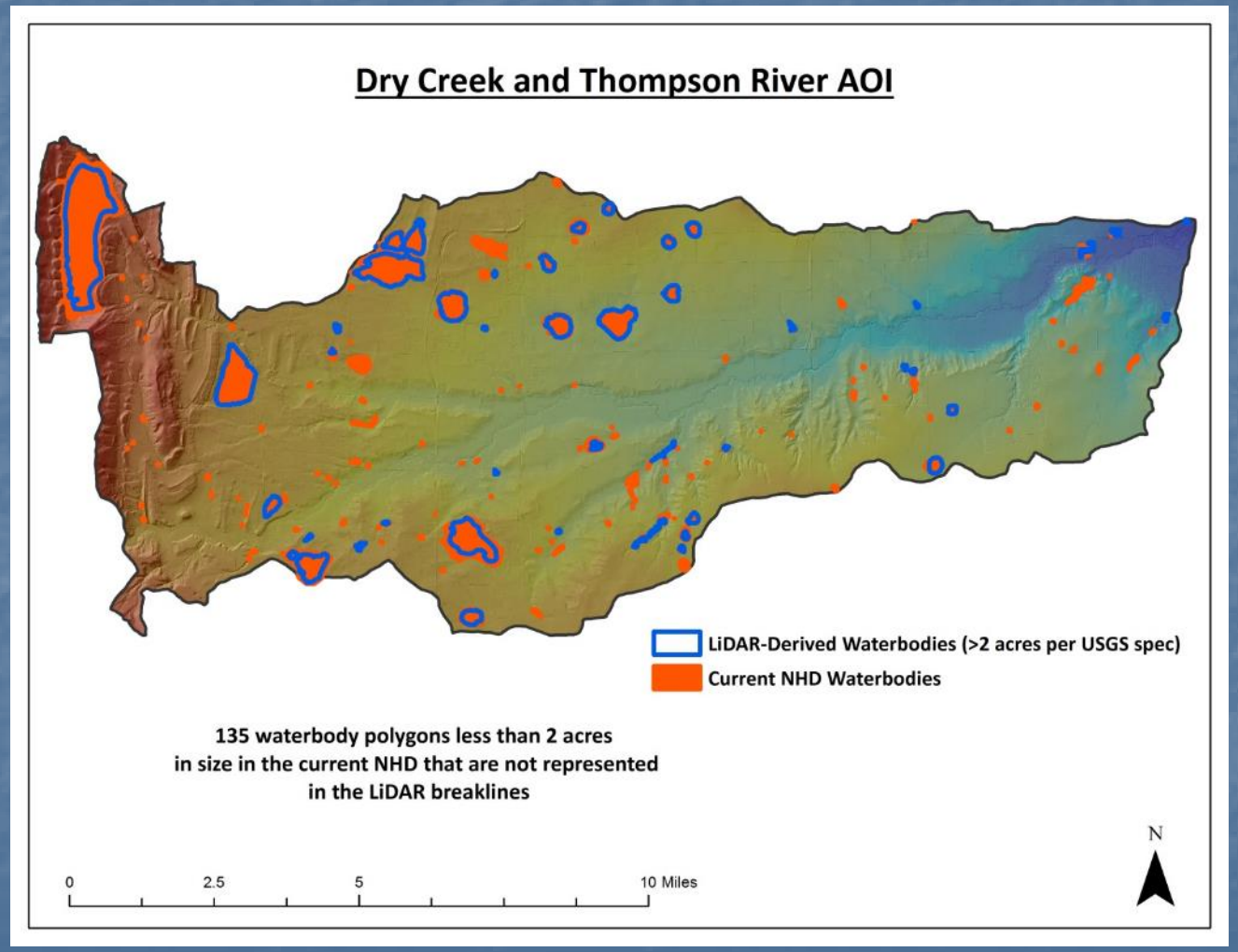






EDH Waterbody Workflow





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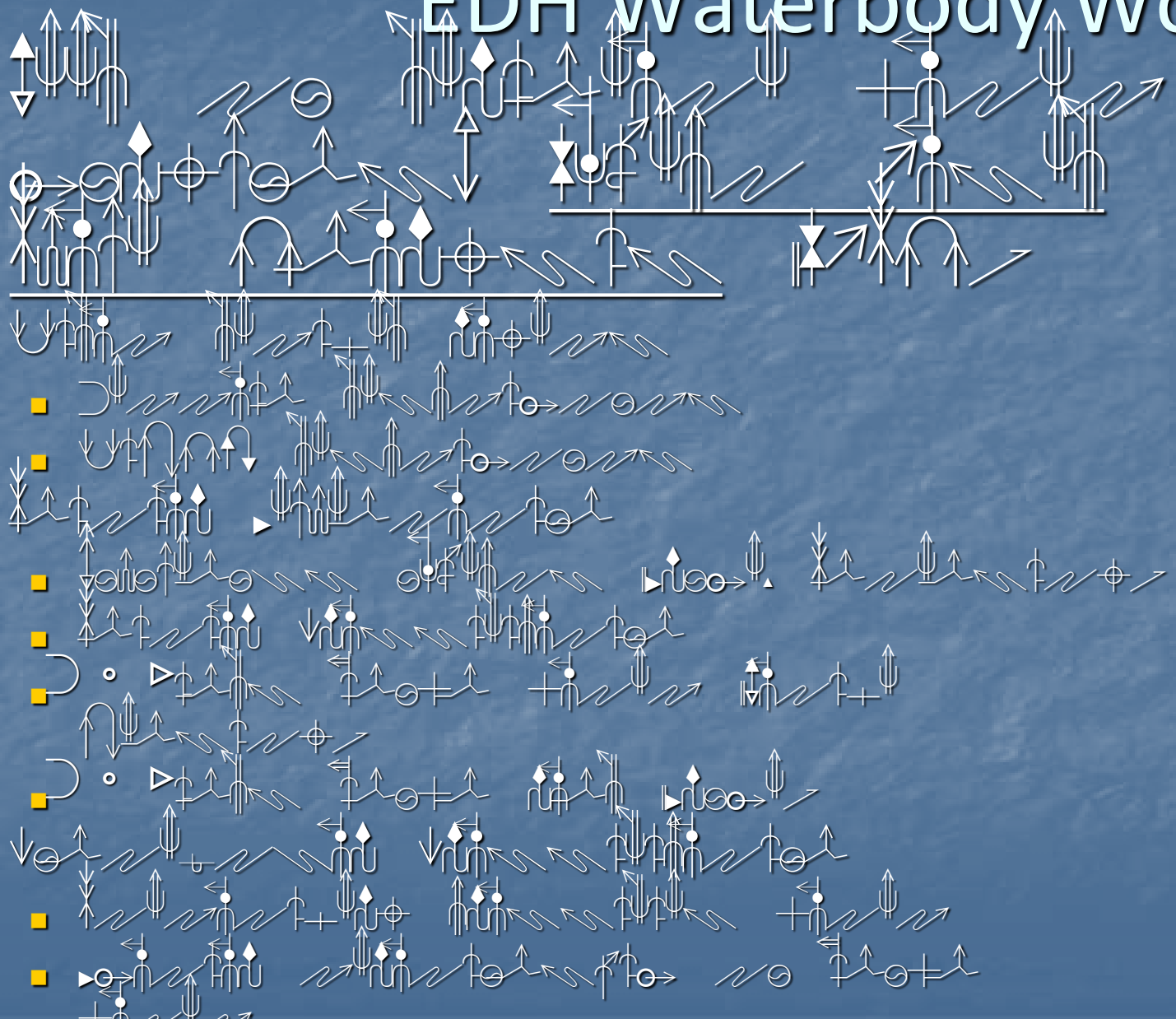
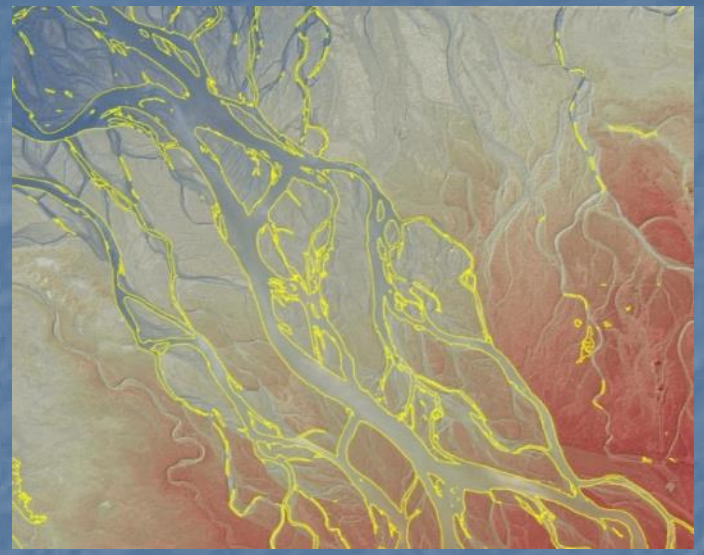
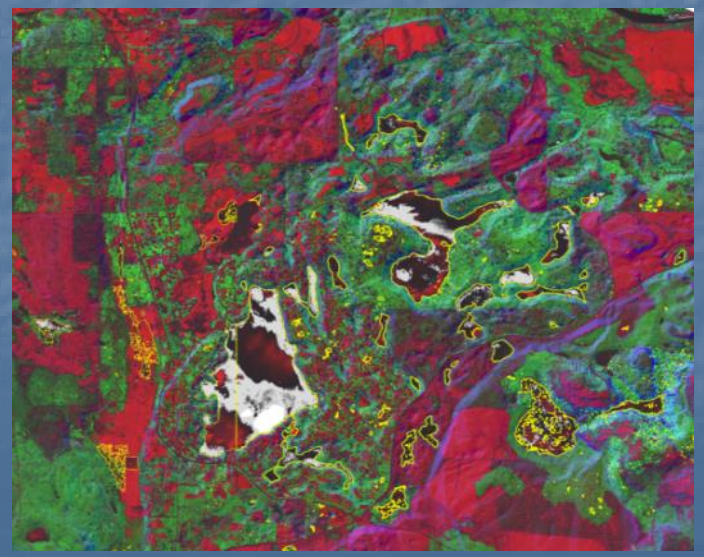
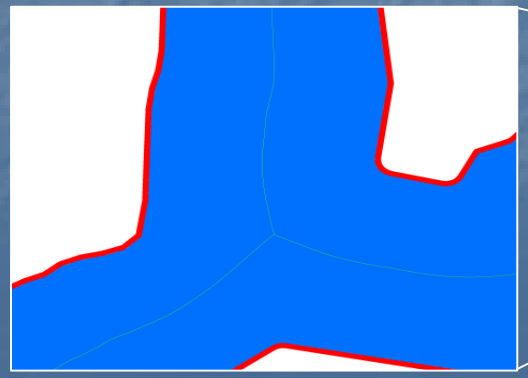


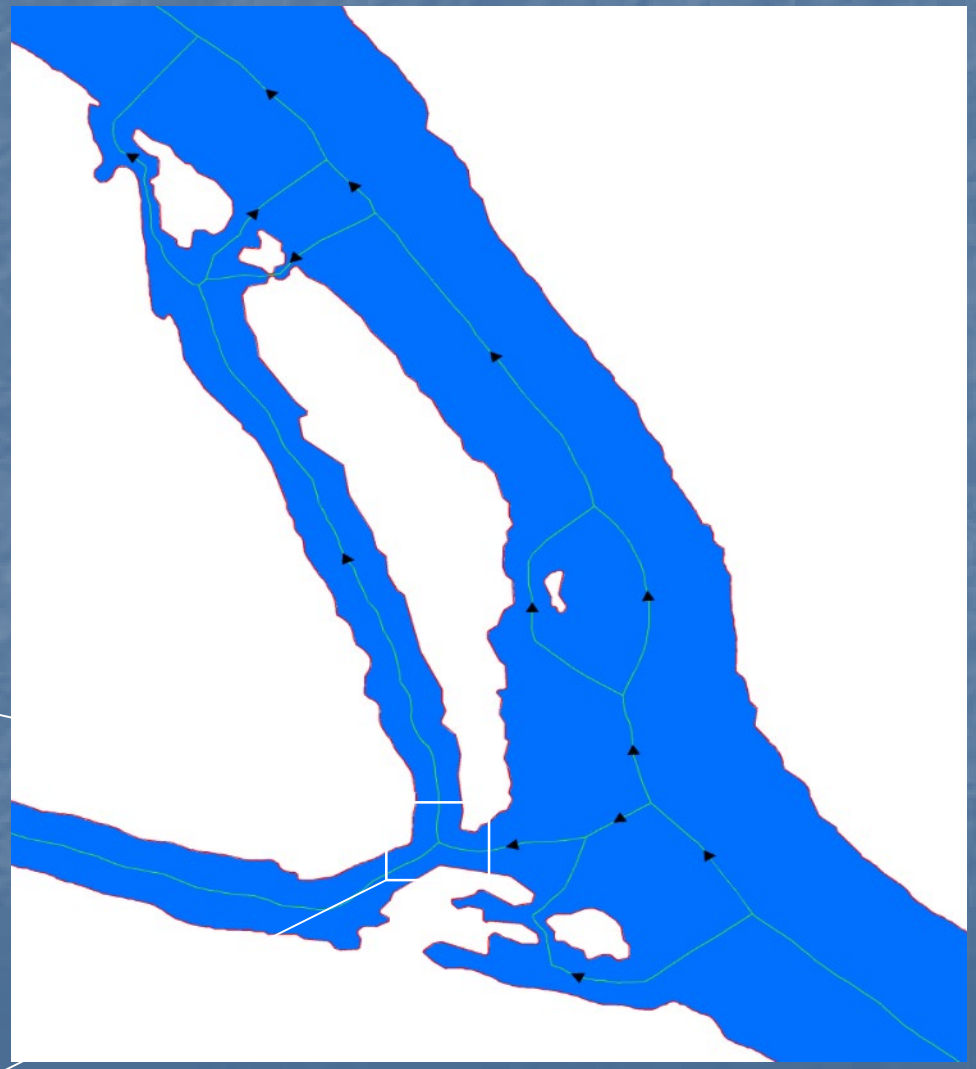




Waterbody Delineation and Artificial Paths

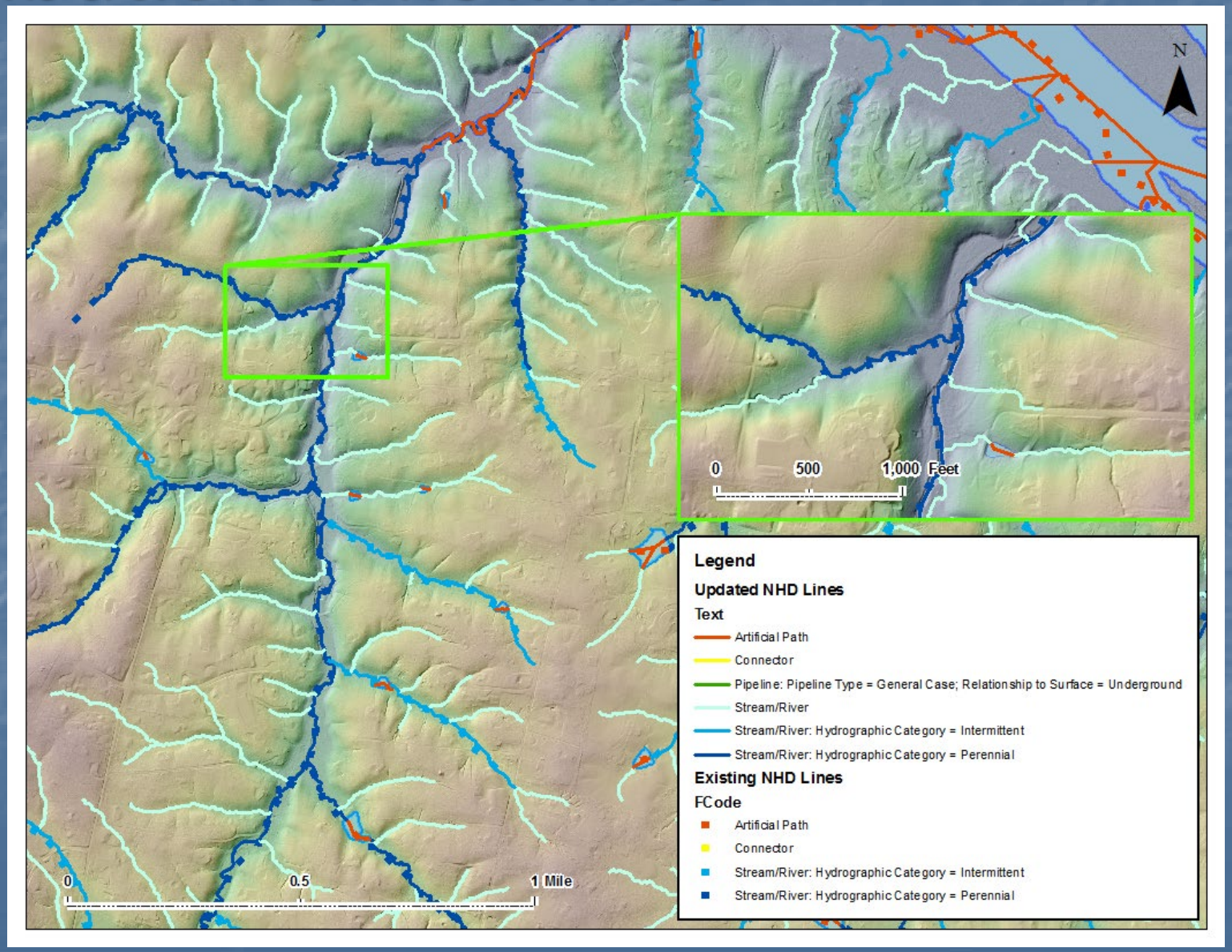
- Centerline generation
- Automated process
- Rivers and lakes
- Extracts elevation from lidar to enforce direction
- Ensures no peaks or sinks in flow
- Integrated with outside line work
- Consistent and reproducible



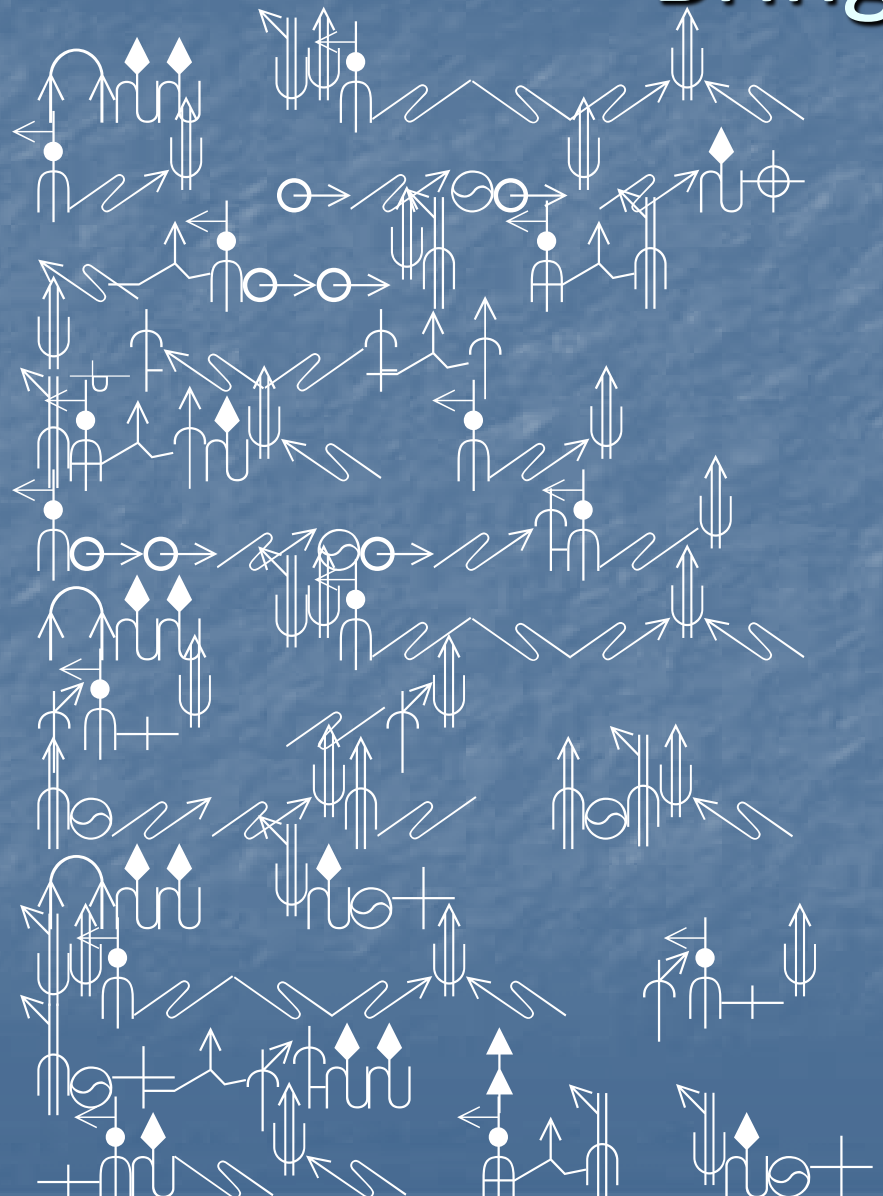


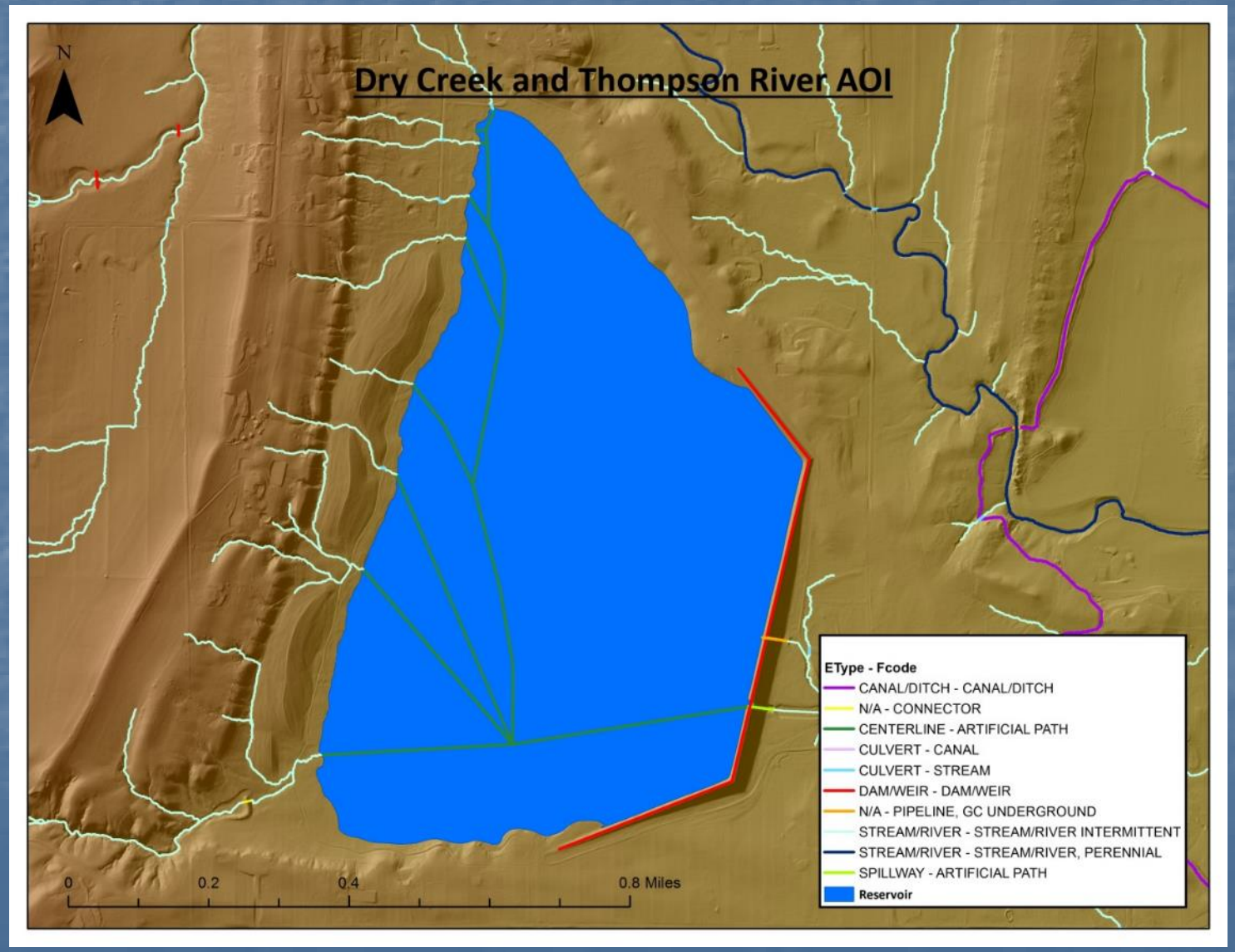
Attribution of flowlines

- Initial spatial join of current NHD attribution.
- Visual inspection to ensure previous attribution (local knowledge) of perennial or intermittent is maintained.
- New Stream lines are given generic “Stream” attribution.

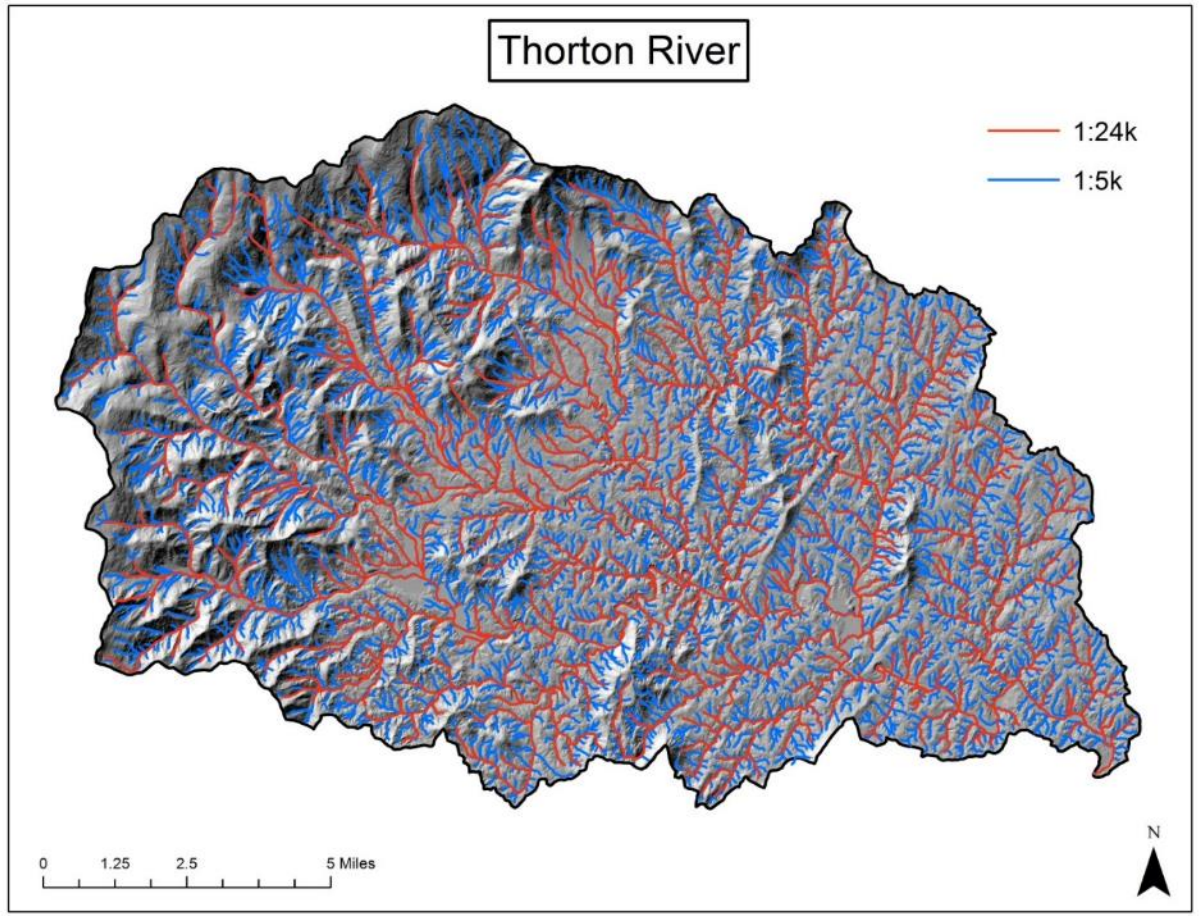


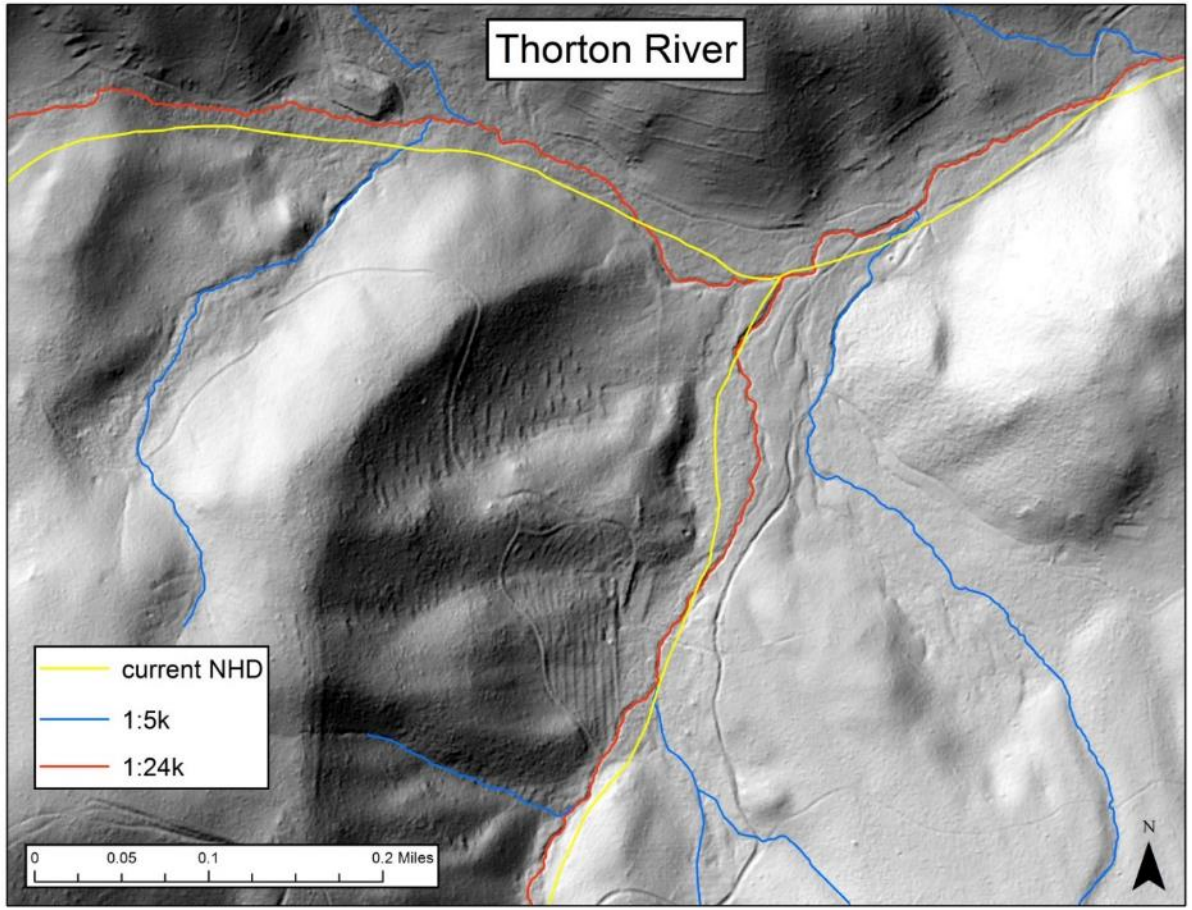
Bringing it All Together



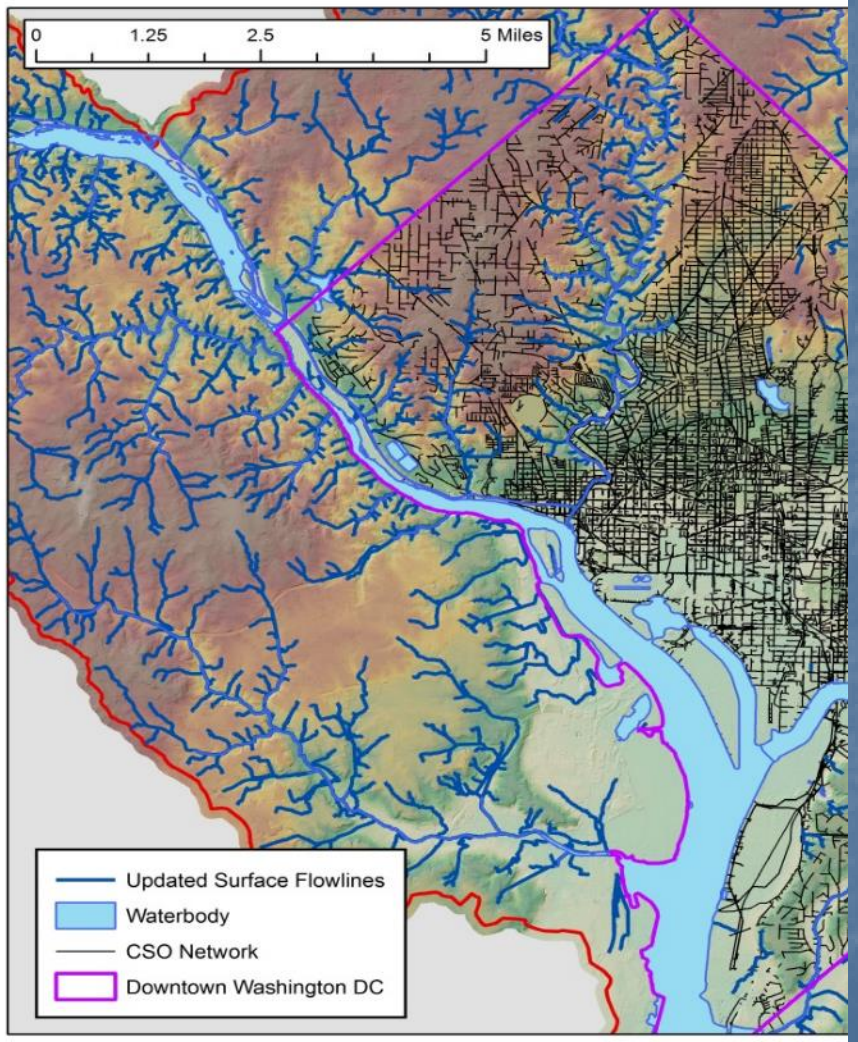


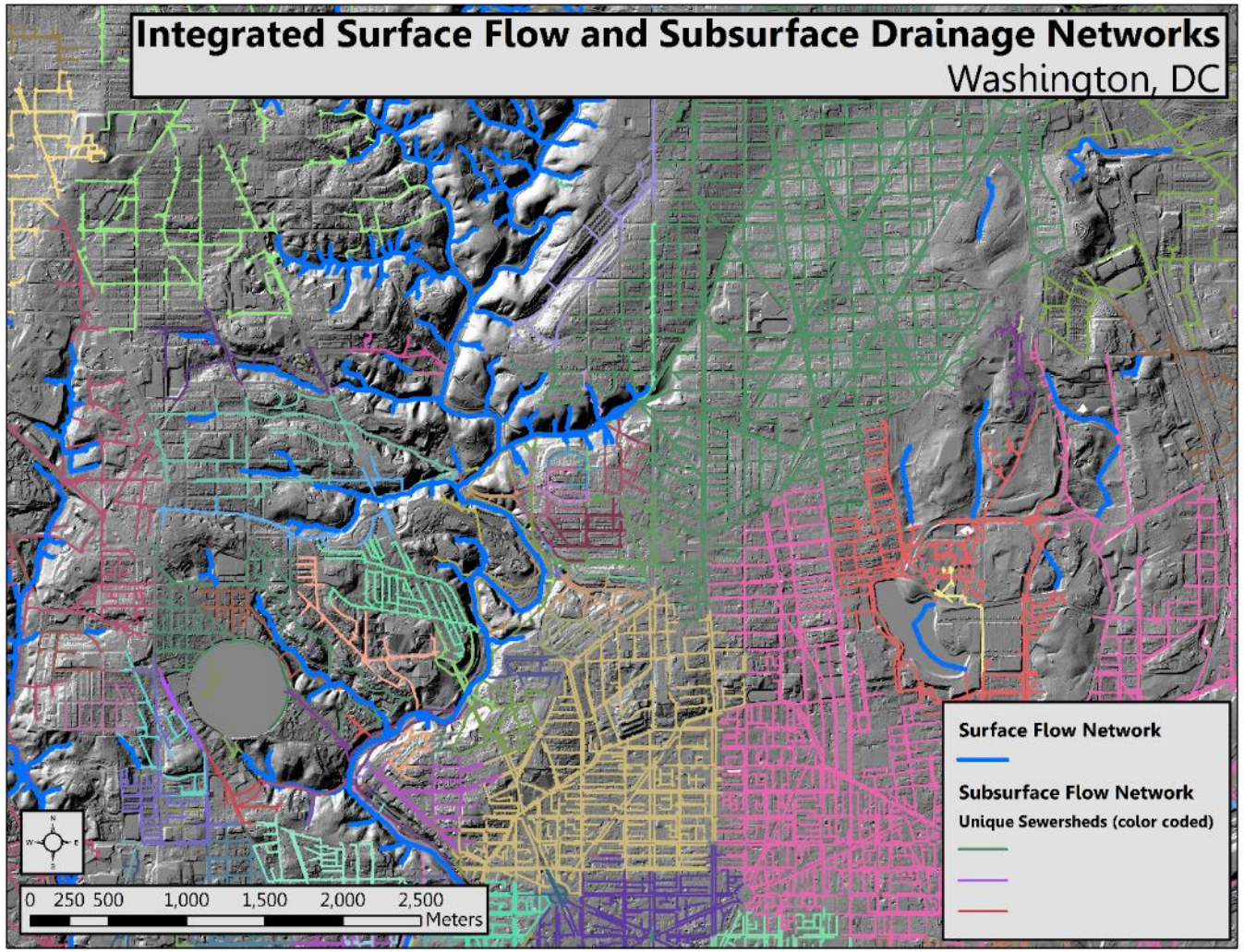
Improved Detail, Accuracy and Currency





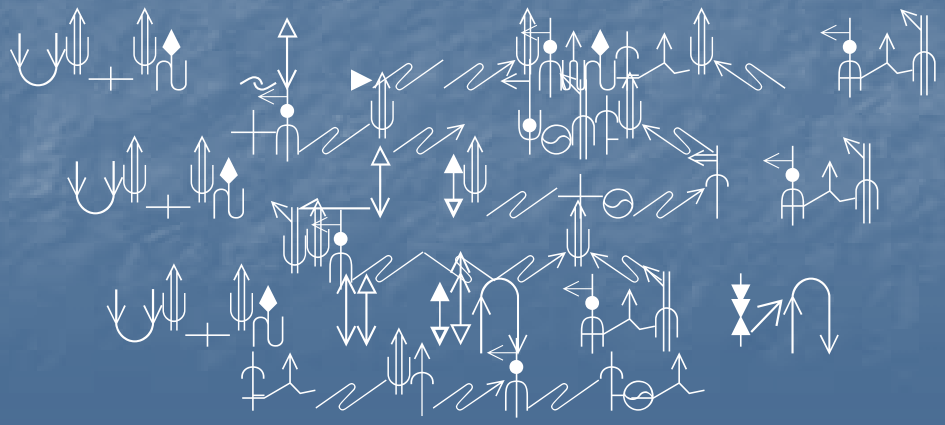
Integration of Sewers





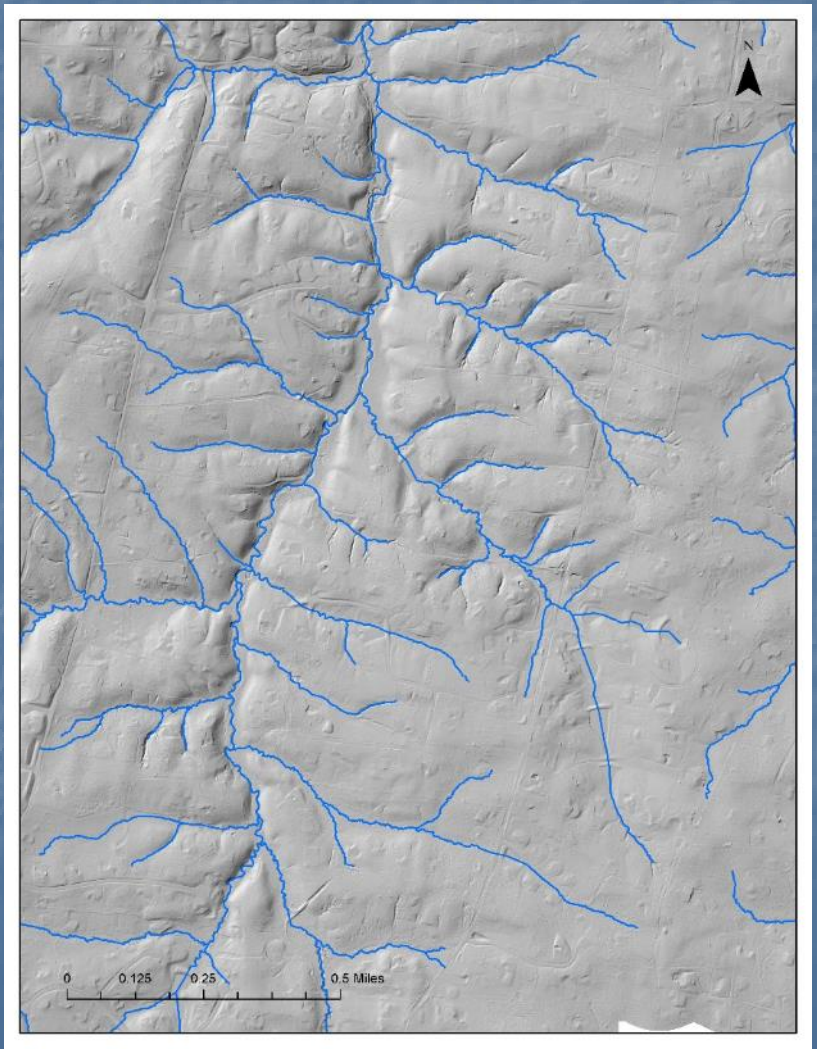
Hydrography and LiDAR

LEVELS



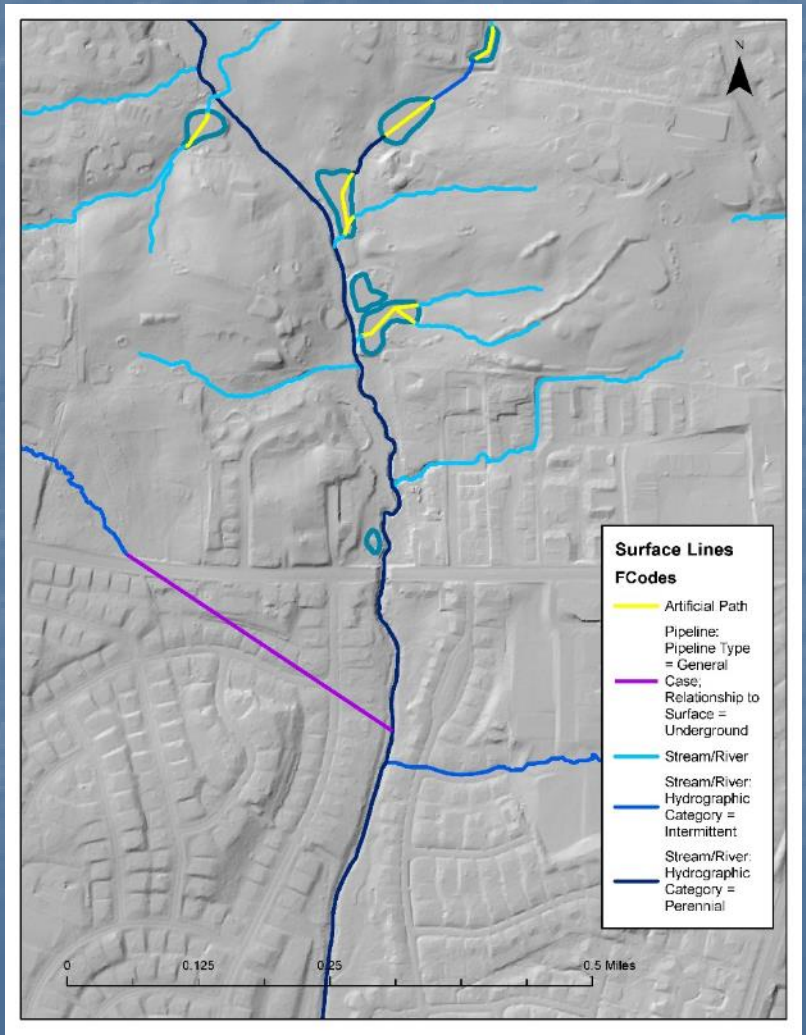
Level 1: Streamlines and Water Bodies

- Creates the streamlines from the lidar, connects surface streams with visible channelization together
- Only underground features represented are culverts
- Will include delineating waterbodies
- Will have topologically correct network smoothing (x,y smoothing) for visible channels
- Does not include any attribution
- Creation of culvert location database is possible



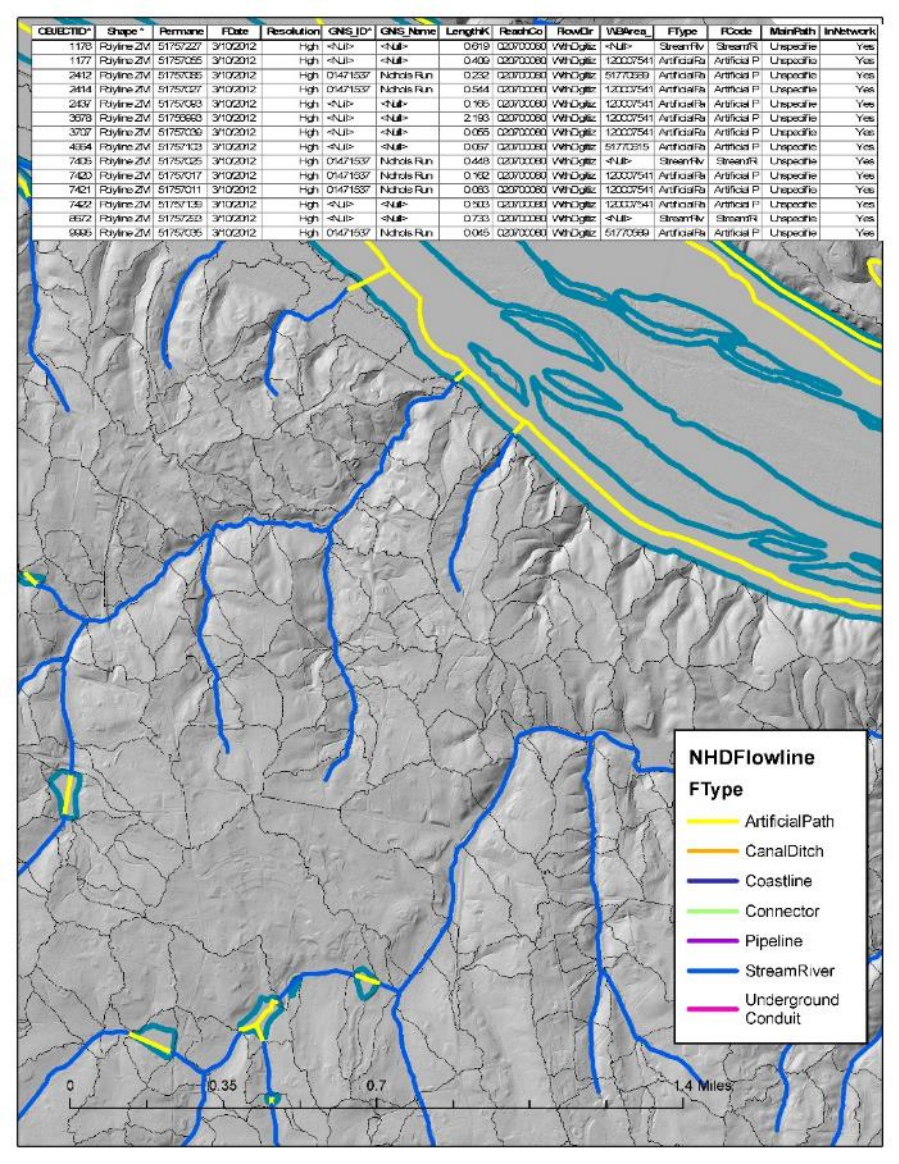
Level 2: Network and Features

- Creates network connectivity elements that are not characterized by visible surface flow features. Adds below ground pipes where data available (not storm sewer systems)
- Will include centerlines/artificial paths through waterbody polygons
- Integrates attribution from current NHD
- Assign elevation values and enforce topologically consistent downstream flow (z smoothing) for full network connectivity
- Attribution of features based on available data with type of streamline or water body (Feature Types and Feature Codes)
- Creation of watershed boundaries



Level 3: NHD and WBD Integration

- Capture additional features such as dikes, weirs, dams and other connectors (exclusive of CSO pipelines)
- GeoConflate (Assign Geographic names and Reachcodes) to features
- Runs through NHD QC tools and post data to USGS for incorporation into NHD
- Iterative work with State steward to get data approved by USGS for NHD approval
- Load data into NHD
- Attribution of watershed boundaries and integration into the Watershed Database (WBD)



Level 4: Integration of storm sewers

Jacob Edwards
Elevation FIT Chair/ DOGAMI
(971) 865-1073
Jacob.edwards@oregon.gov

Andrew Brenner
734-680-6424
abrenner@quantumspatial.com