

# Session 25: LiDAR & Hydrography

Friday October 9th, 8:30 am - 10:00 am Ballroom MN

## Watercourse Hydrography Development from LiDARderived Products - Creating Next Generation Watercourse Hydrography (NXGHydro) for Minnesota's Landscape.

**Sean Vaughn**

GIS Hydrologist | LiDAR Steward

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Research Analysis Specialist

**Rick Moore**

LiDAR/Watershed Data Steward

**Steve Kloiber**

NWI



# Updating Watercourse Hydrography in Minnesota's Lake Superior Coastal Watersheds

## Project Partners:

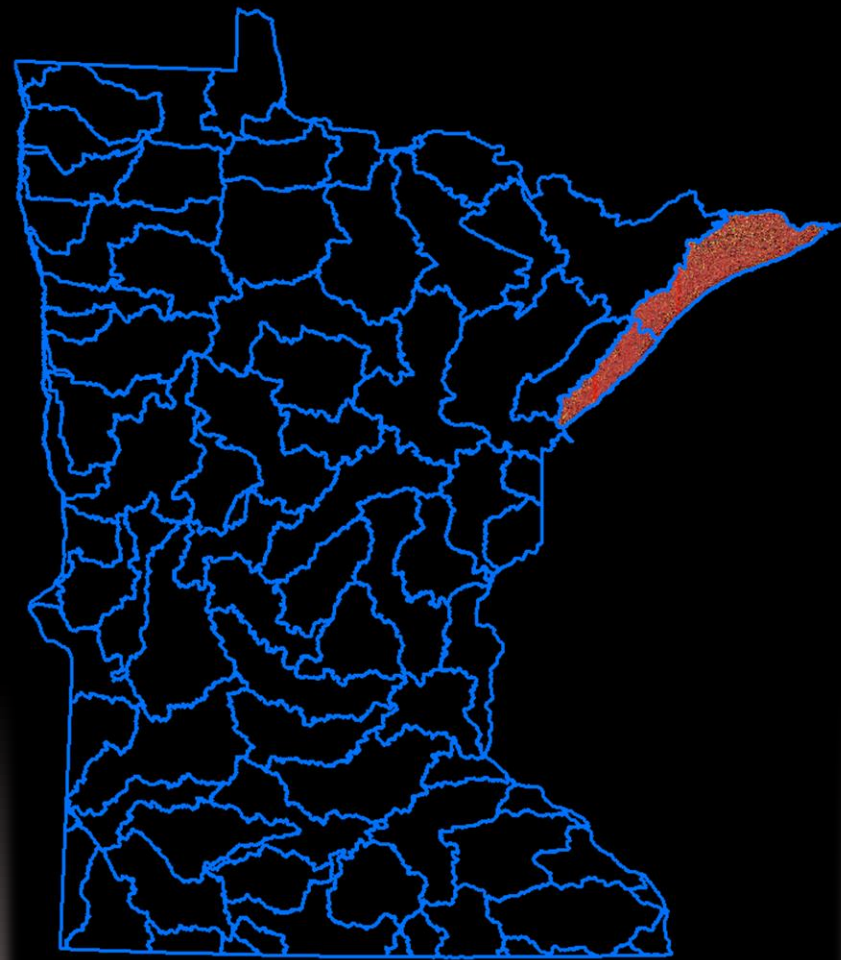
DNR Water Resources Team (WRT)

<http://www.dnr.state.mn.us/watersheds/wrt.html>



Tyler Kaebisch  
Minnesota DNR  
Resource Assessment Office

Clint Little and  
John Jereczek  
Minnesota DNR  
Minnesota Lake Superior  
Coastal Program



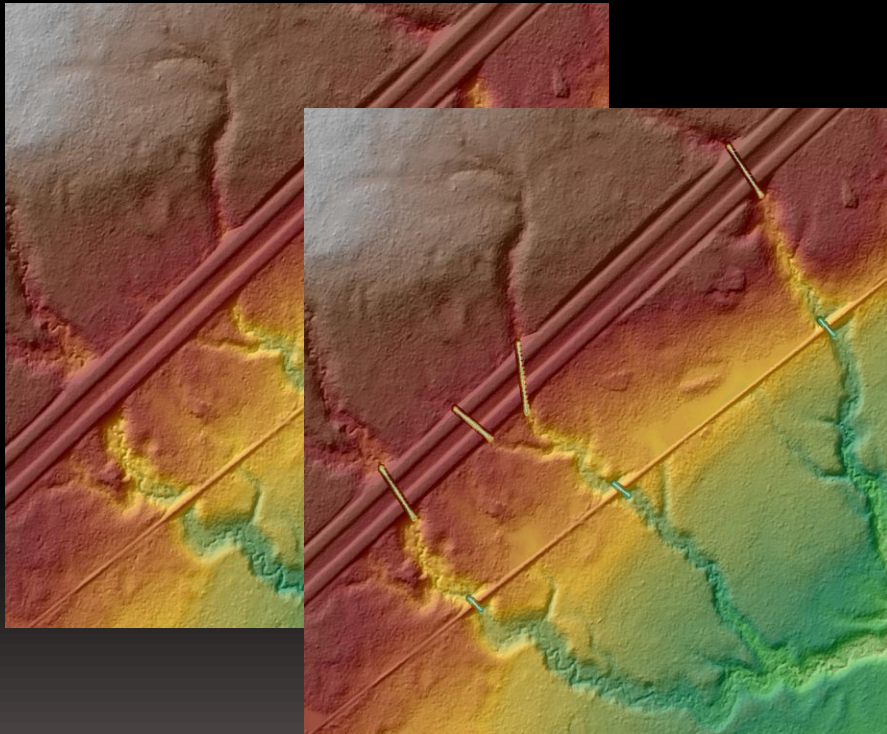
## Project Purpose:

Update watercourse hydrography for the DNR 24k Stream and River Centerline Inventory utilizing LiDAR DEMs by assessing digital dams across the landscape to replicate concentrated stream flow



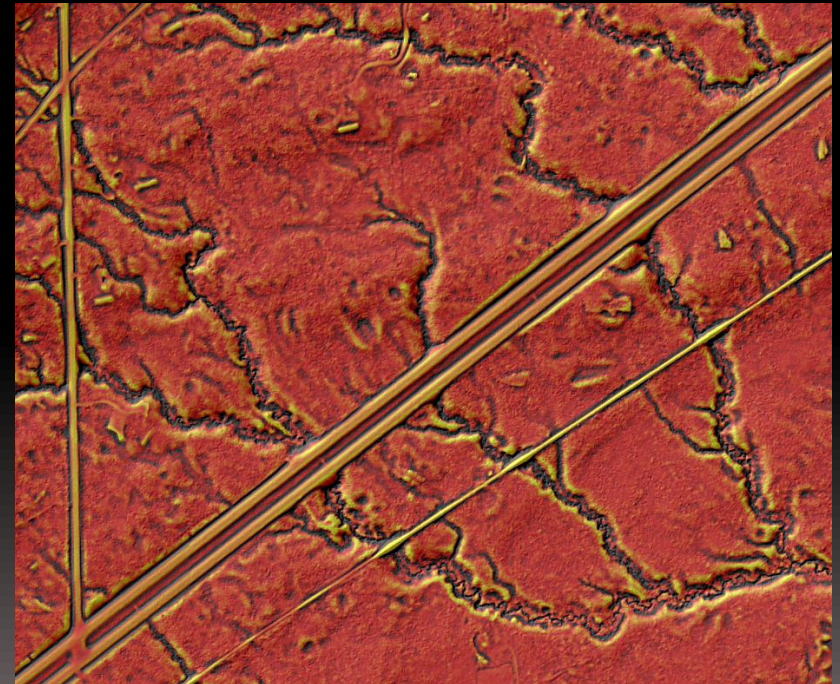
## Current 24k Stream and River Centerline Inventory

Derived from USGS Topo Quad Maps, 1960s



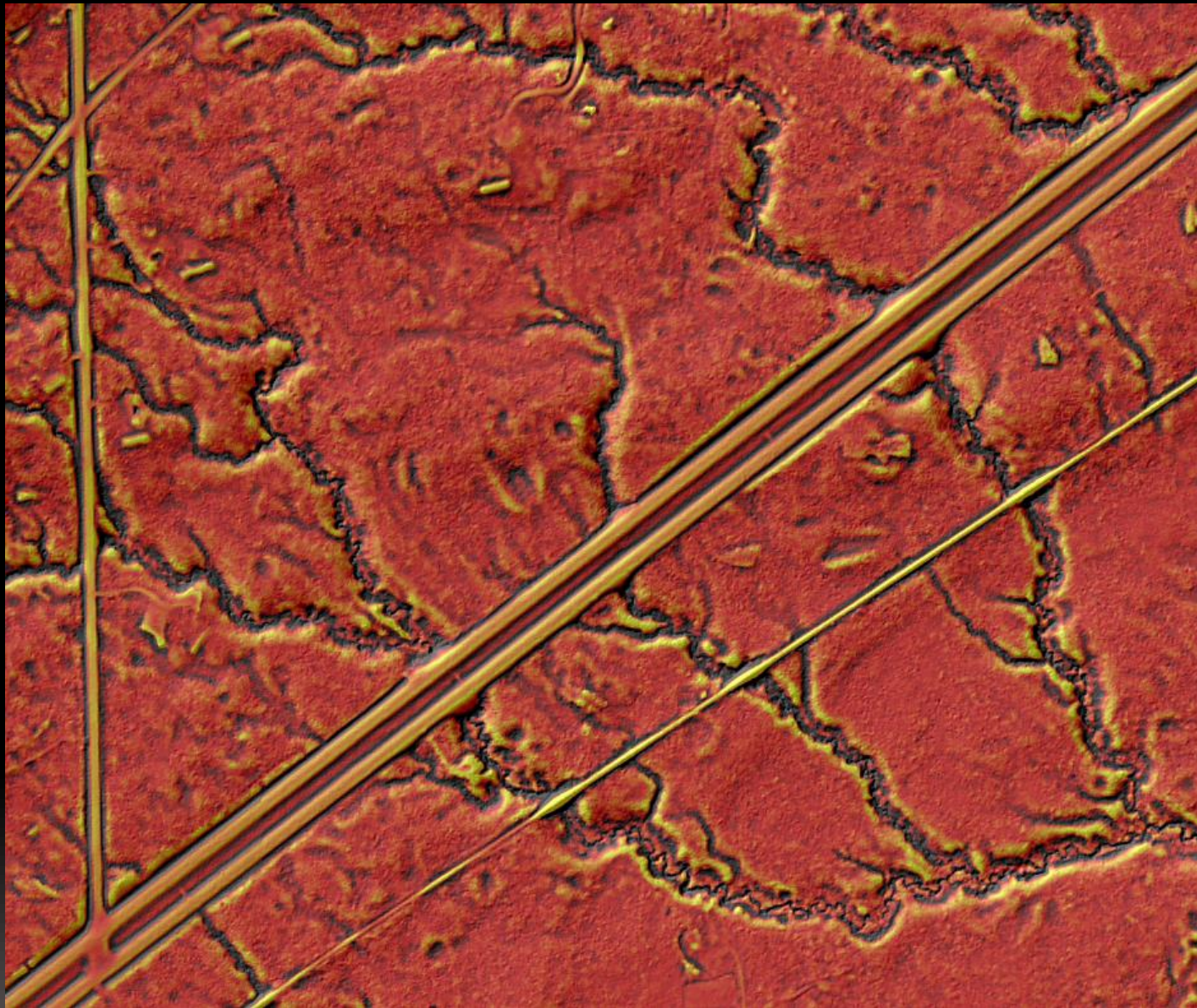
## DEM Enforcement of Digital Dam Breach Lines

Level 3 DEM Modification is Required



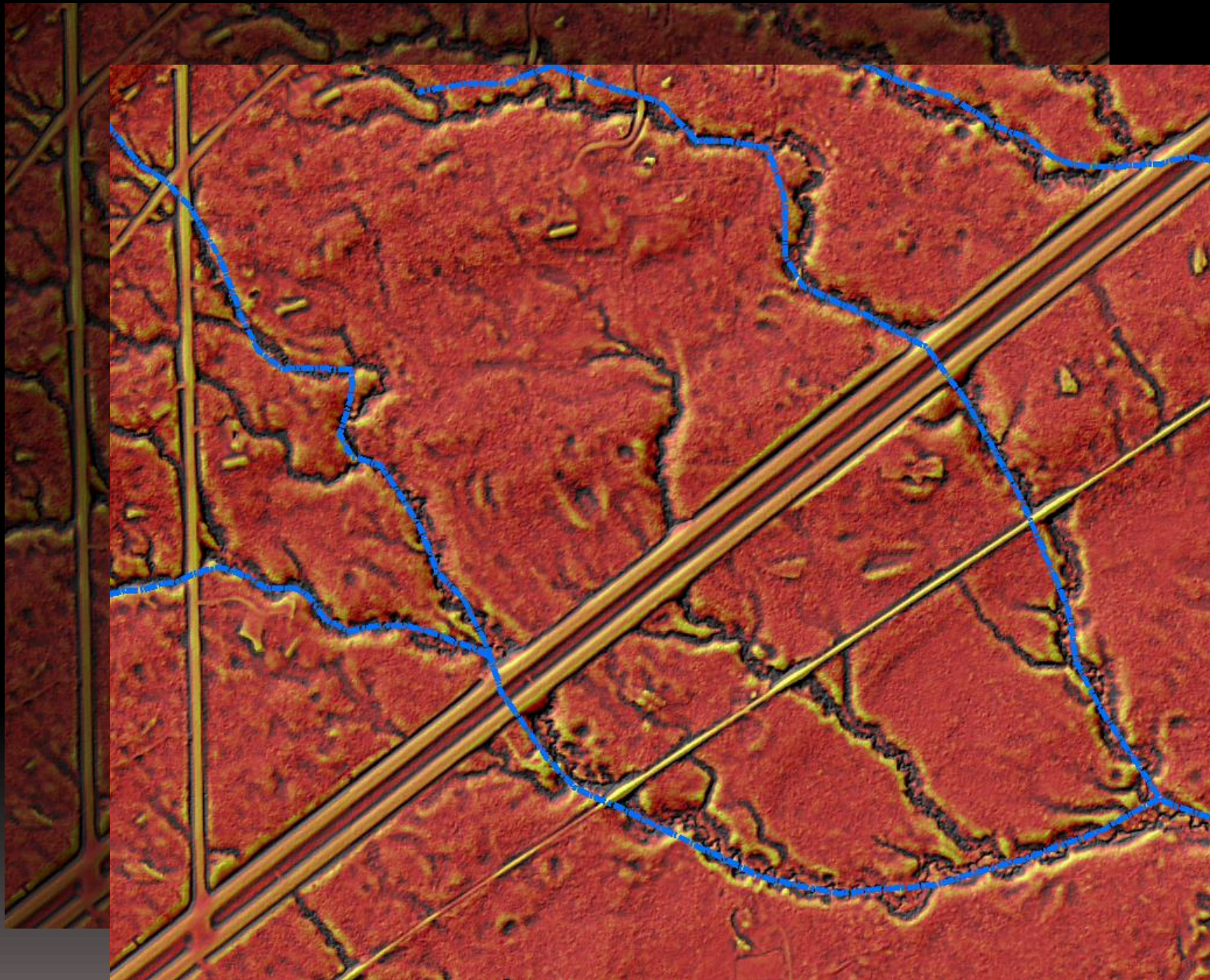
## Replicating Stream Flow Across DEM Landscape





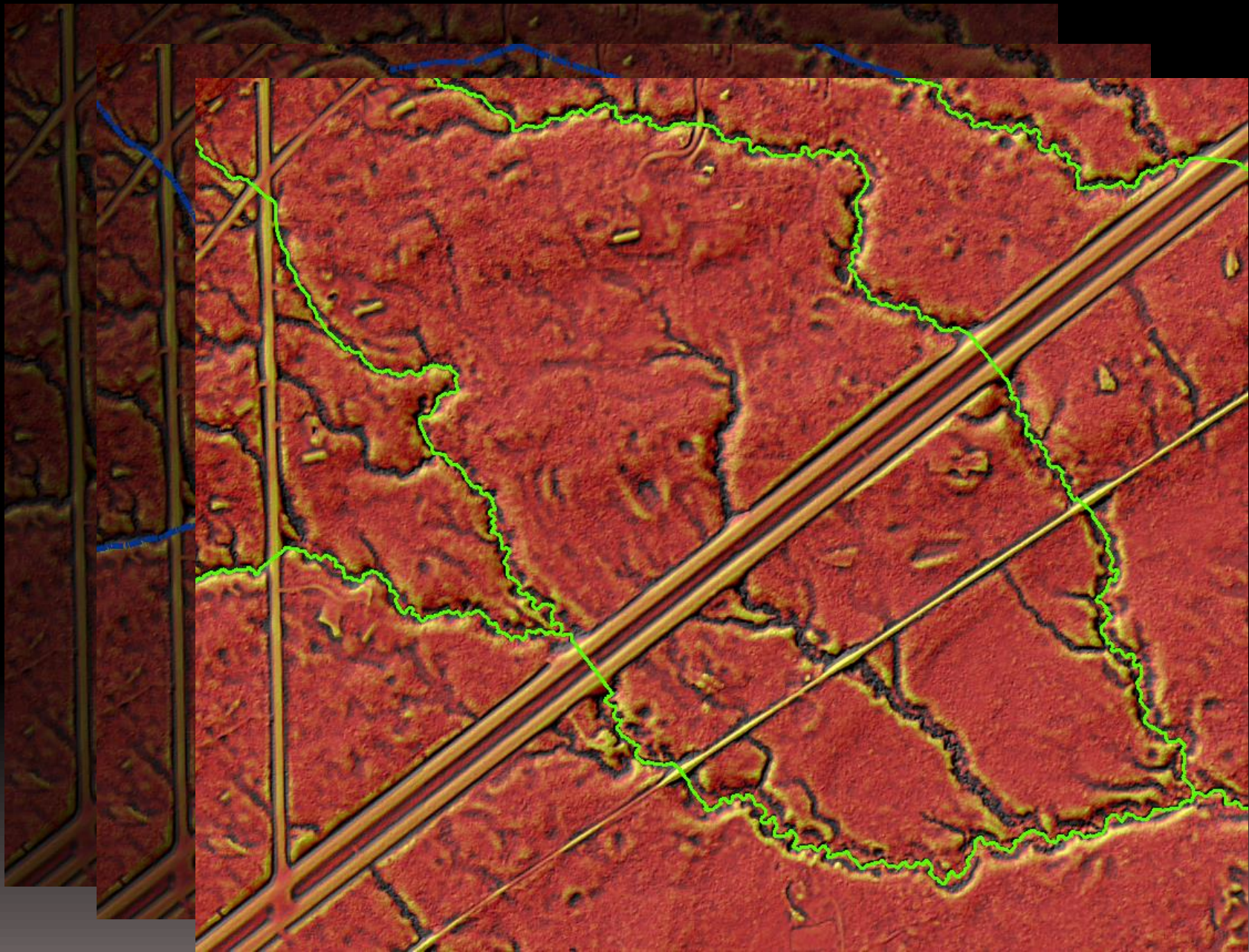
LiDAR derived products provide a great amount of detail for hydrographic features





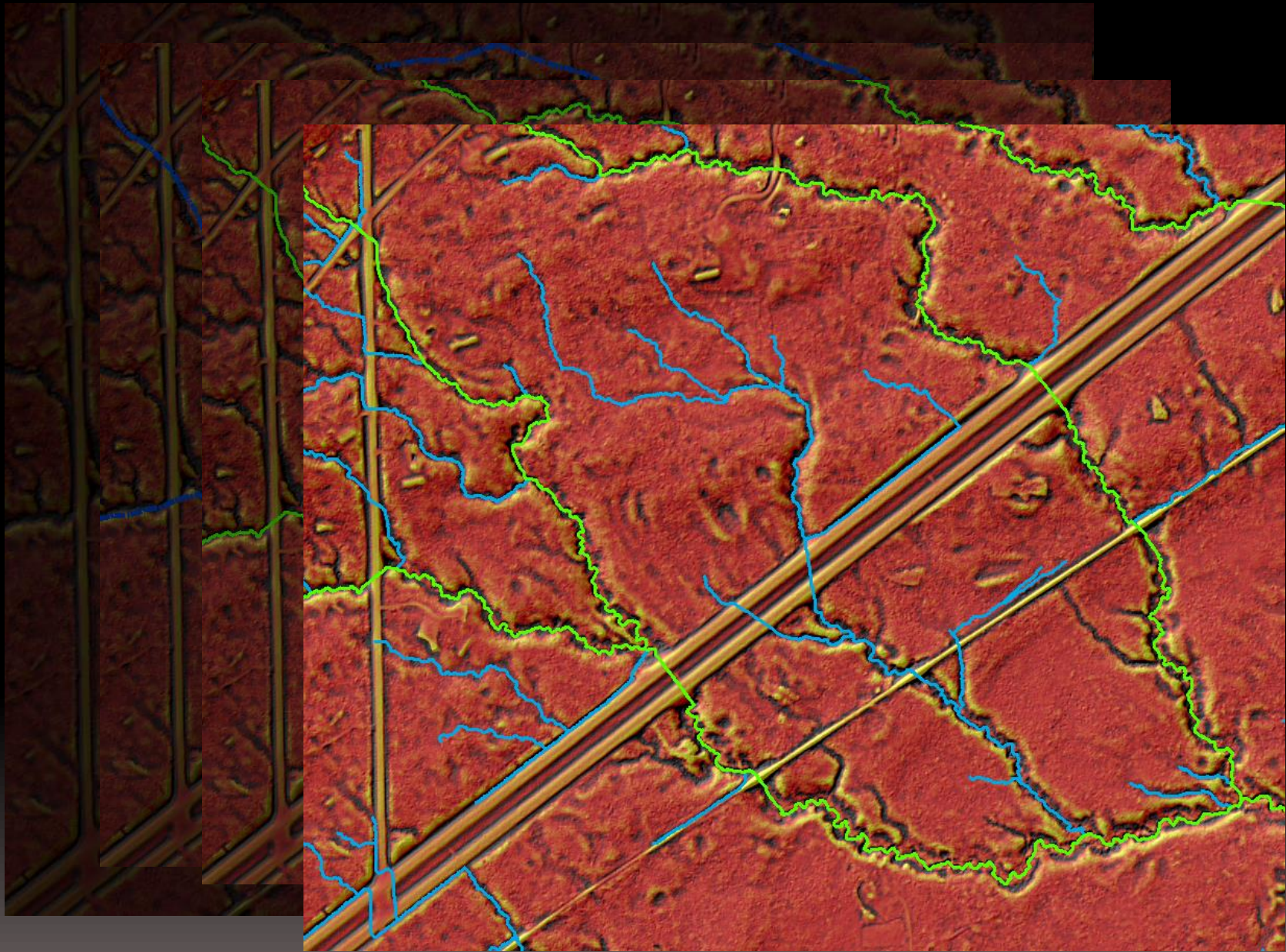
Current stream inventories do not accurately represent or encompass all water conveyance features across the landscape





DEM enforcement of LiDAR products can provide detail when updating current inventories





Analysis can go beyond current inventories to provide an extended network of water conveyance features



# Digital Dam Sources

## Minnesota DOT

- HydInfra: MnDOT's hydraulic infrastructure data used to manage inventory, inspect and maintain storm drainage features
- MnDOT' Bridge and Culvert Inventory
- Railroad Inventory

## DNR Wheels Database

- DNR Culvert Inventory
- DNR Bridge Inventory

## Hydrography Related Water Features

- Hydrologic Dams from GNIS
- Inventory of Hydrologic Dams in Minnesota

## St. Louis County Survey Grade Culvert Inventory

## Beaver Dams and Additional Culverts





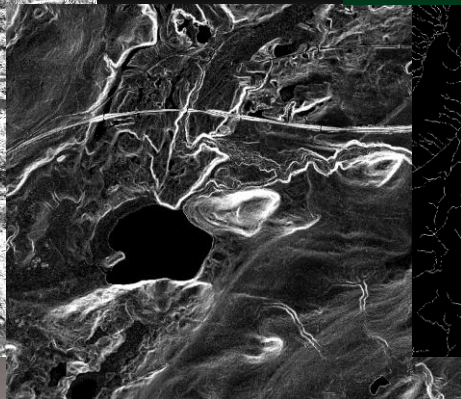
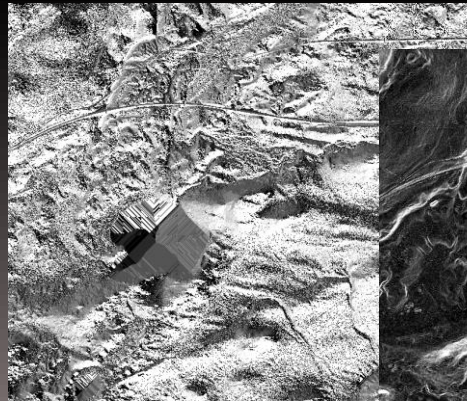
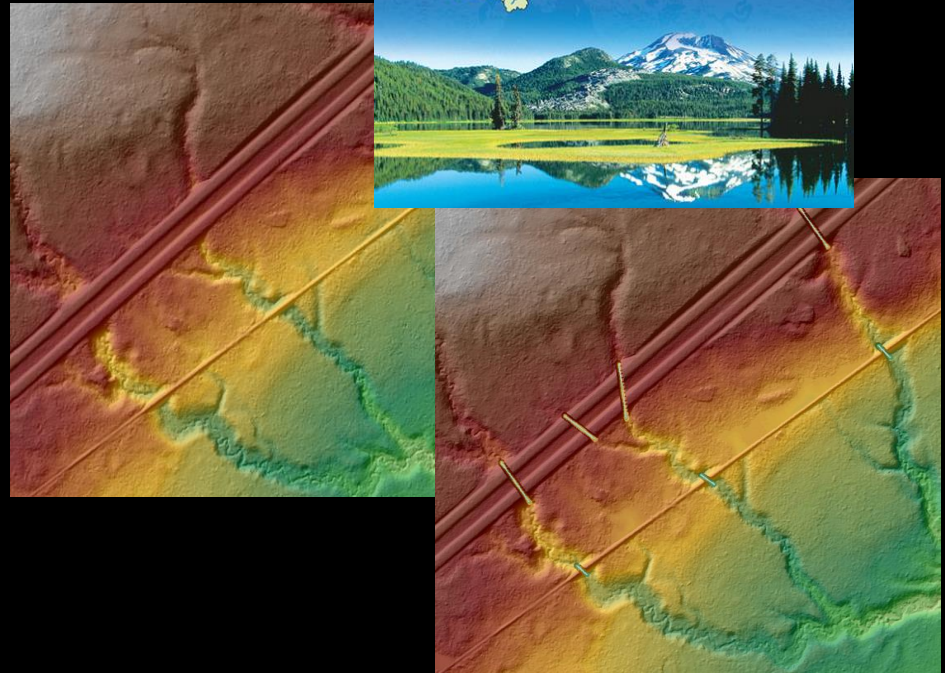
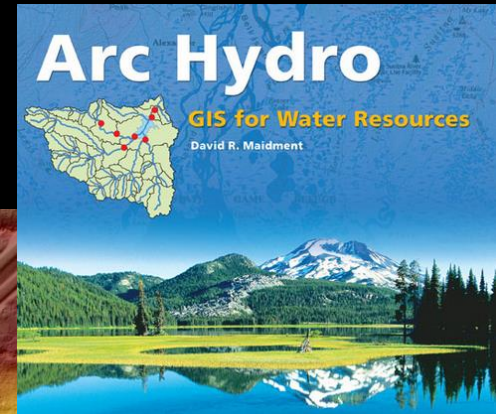
# Methods within ArcGIS:

## DEM Enforcement

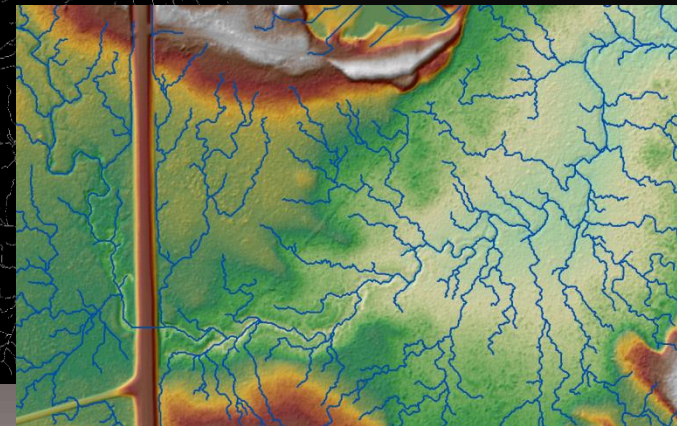
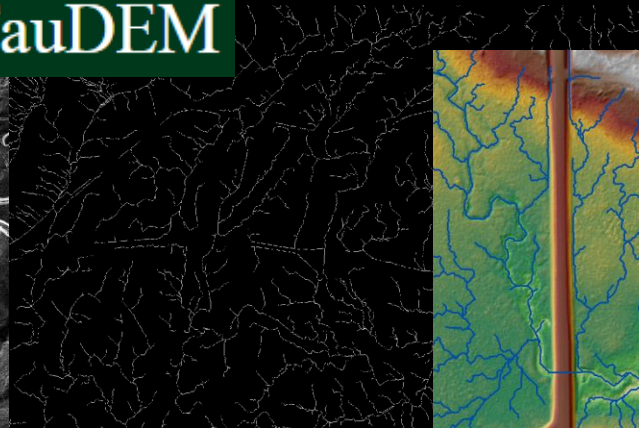
- ArcHydro for Enforcement of Digital Dam Breech Lines, Lvl 3 DEM Modification

## Stream Analysis

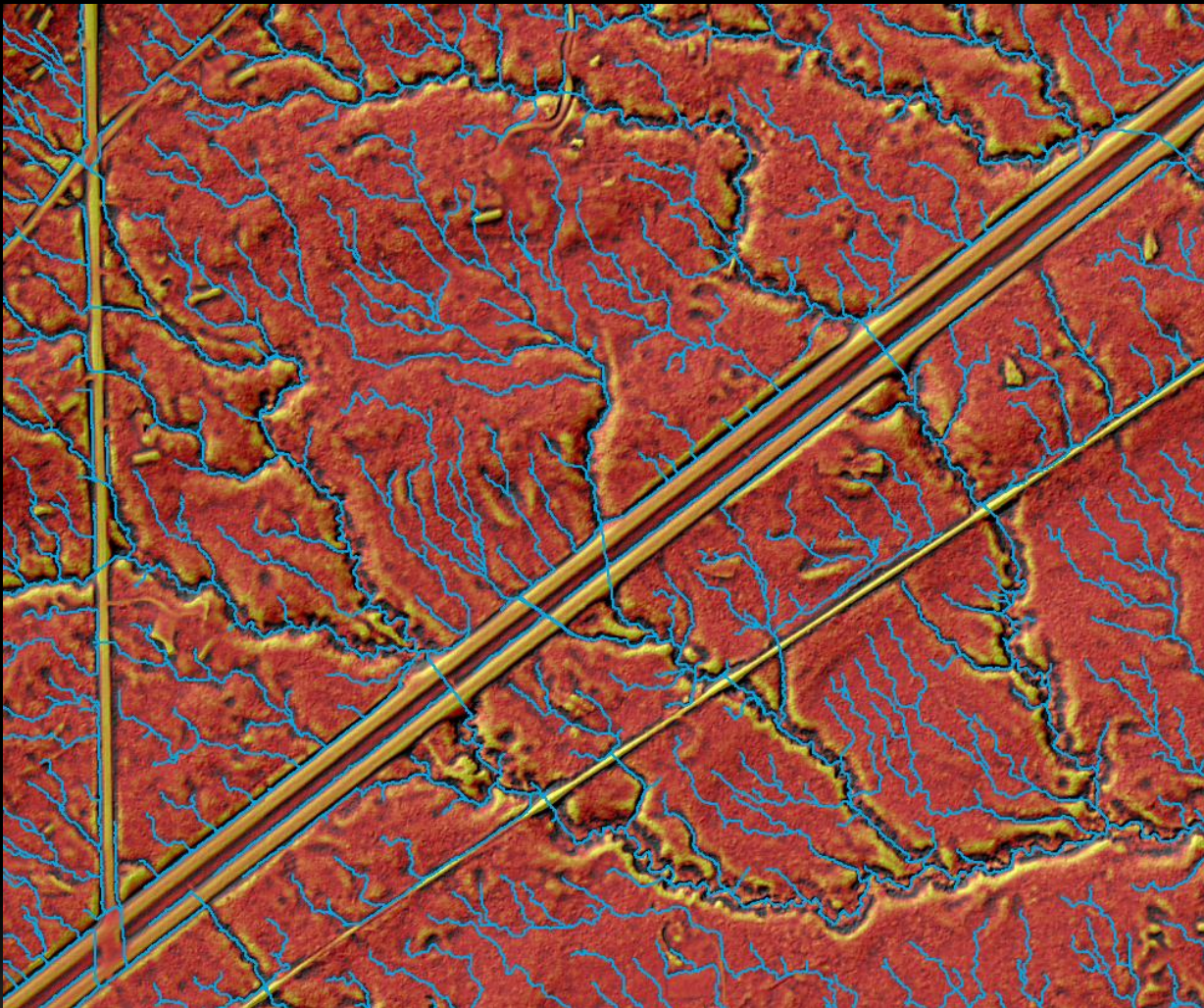
- TauDEM (Utah State University)
  - Depressional Analysis
  - Flow Direction
  - Contributing Area
  - Stream Definition by Threshold
    - Threshold of 1000 meters<sup>2</sup>
  - Stream Reach and Watershed



TauDEM



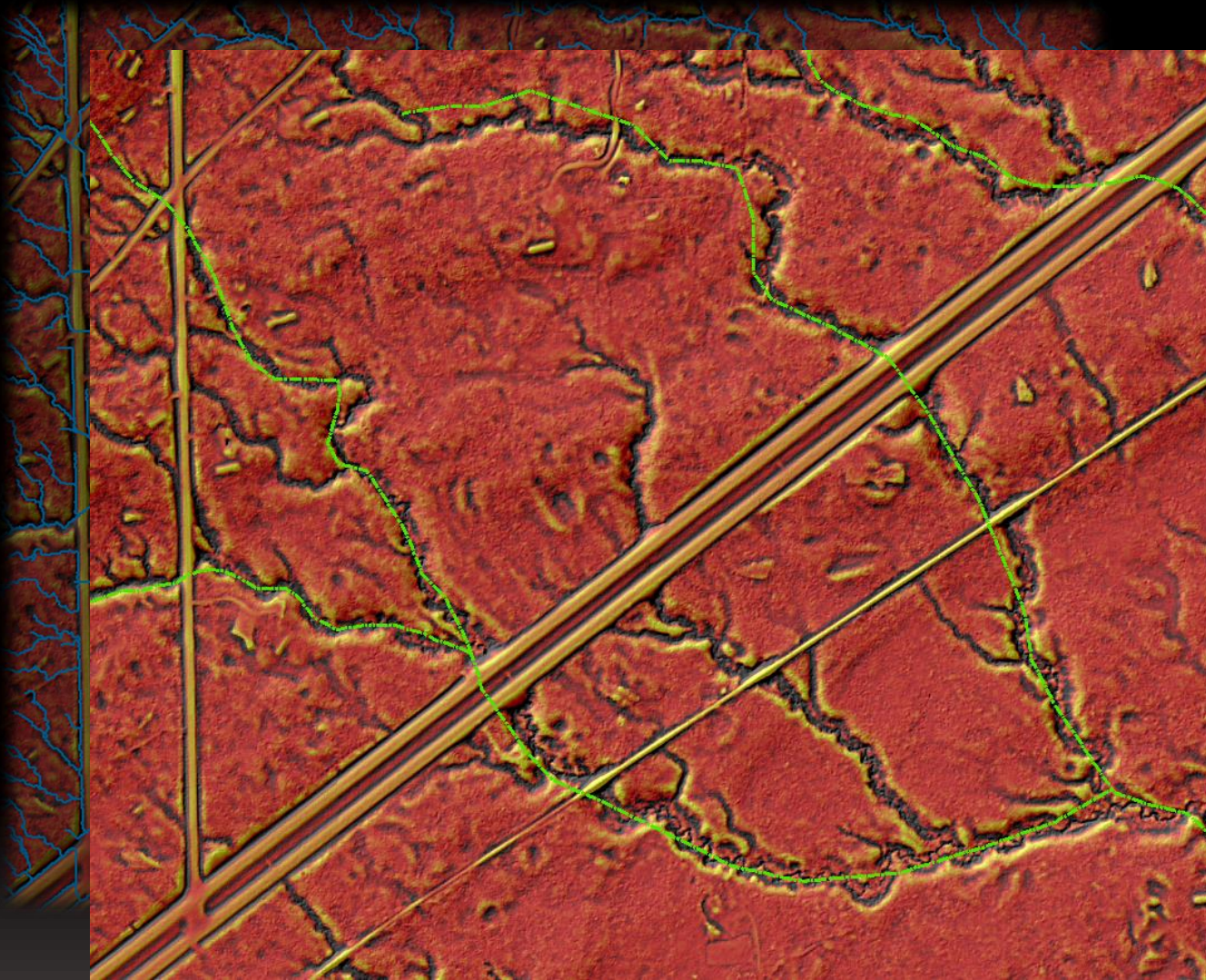




### Initial Stream Reach Analysis Vector Output

- Contributing Area Flow Threshold of 1000 meter<sup>2</sup> to produce concentrated flow stream lines
- Vector Lines contain stream order attribute information which can be used to query stream lines of interest

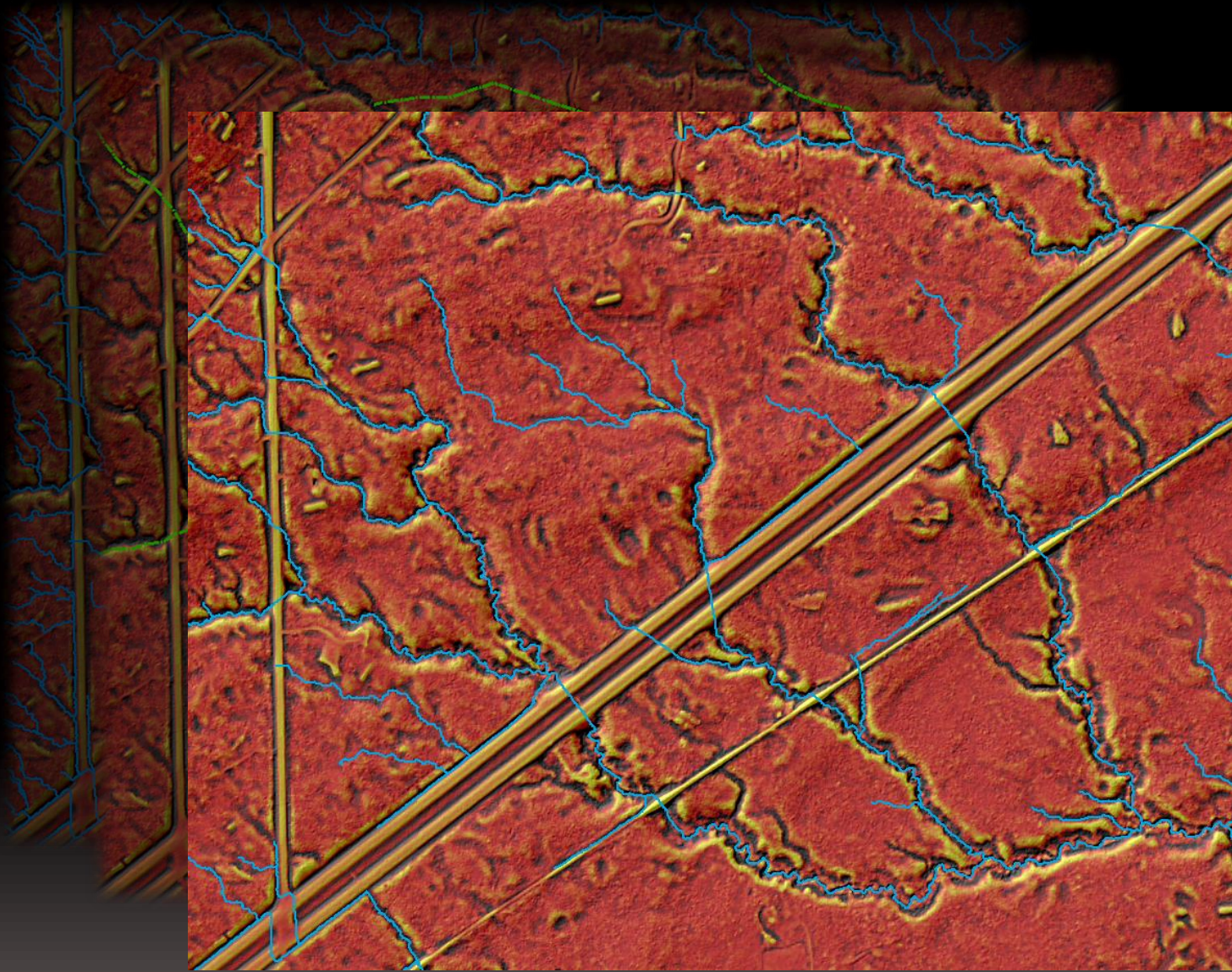




Specific Data Need for this Project:

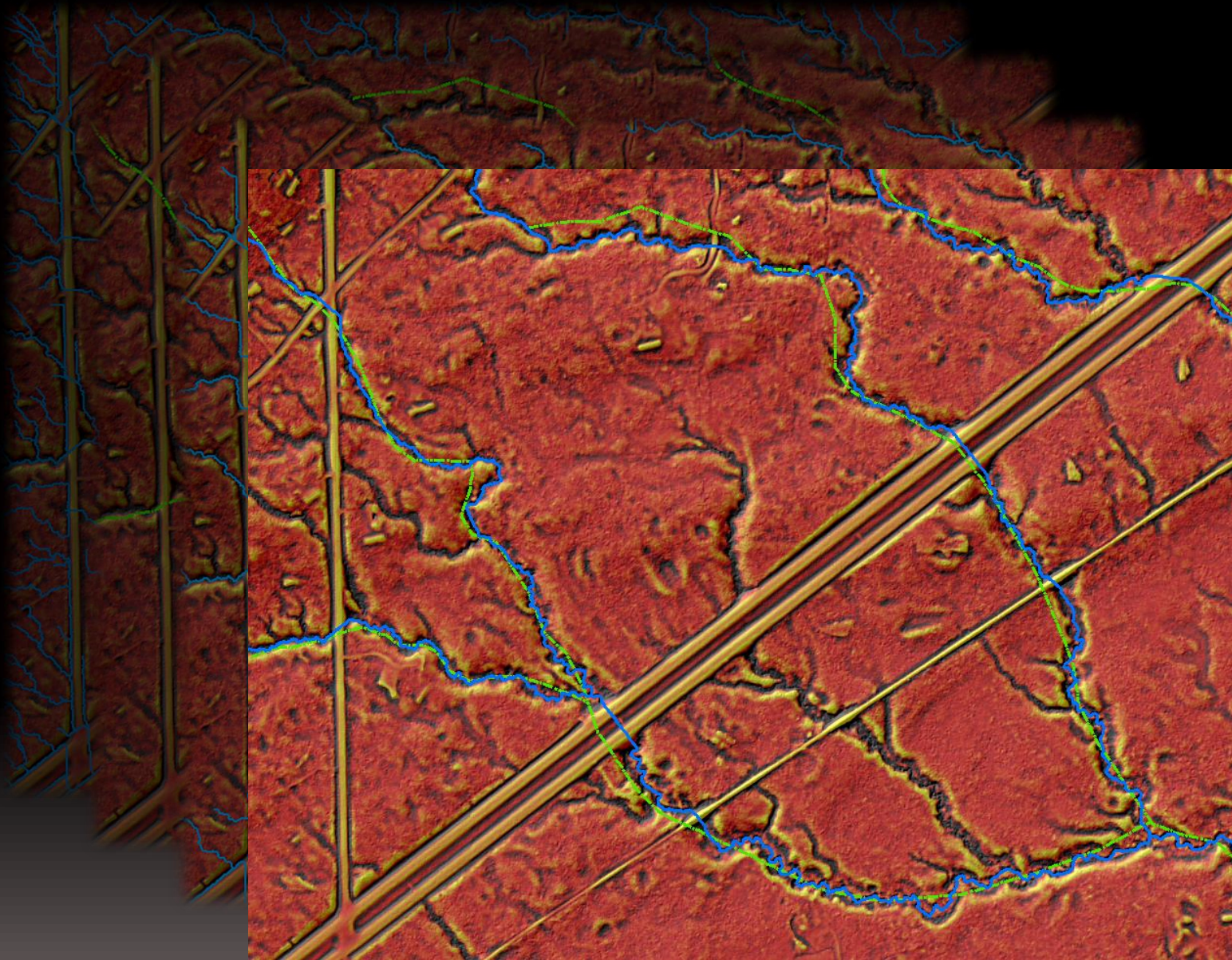
Update the current DNR 24k Stream and River Centerline Dataset





Used Stream Order Attribute to Thin the Stream Network for better representation of concentrated flow for the features of interest



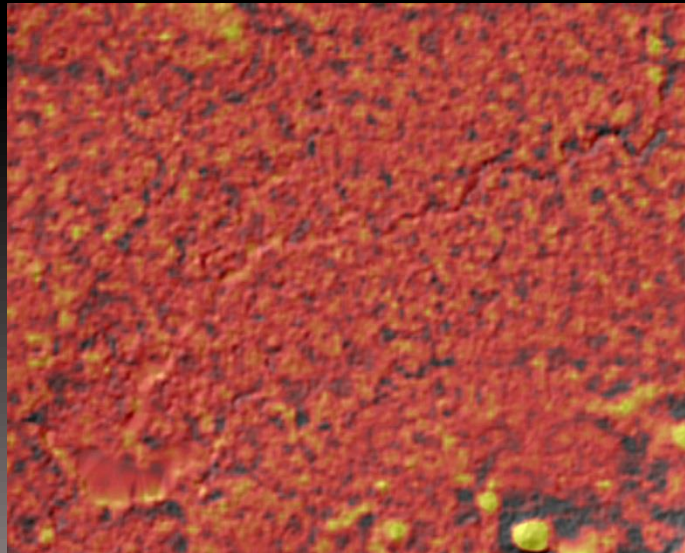
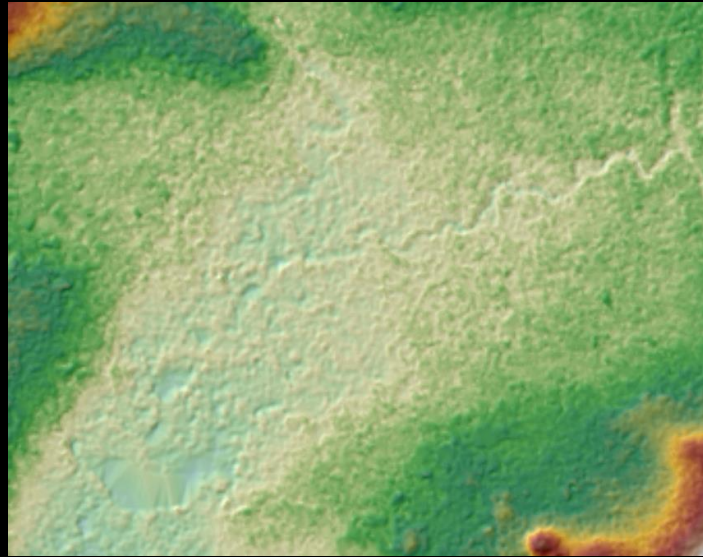


Specific Stream Lines can then be added to an Updated  
Stream and River Centerline Inventory



## QA/QC: Areas of Concern

- Wetlands and Backwater Areas are difficult to analyze due to fluctuations in water year, flooding. Bathymetric LiDAR may help solve this issue.
- Problem areas were edited manually with the aid of LiDAR DEMs, HPIs, Hillshades and NAIP Images



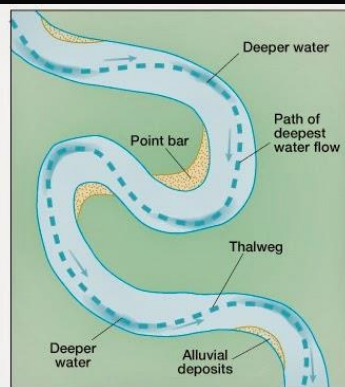
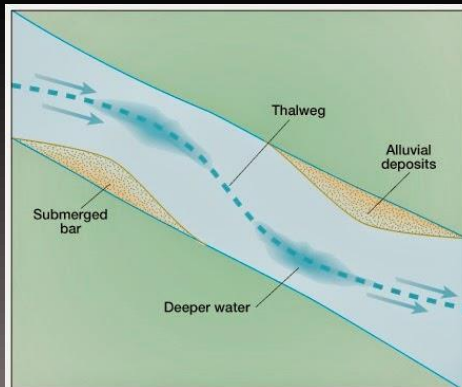
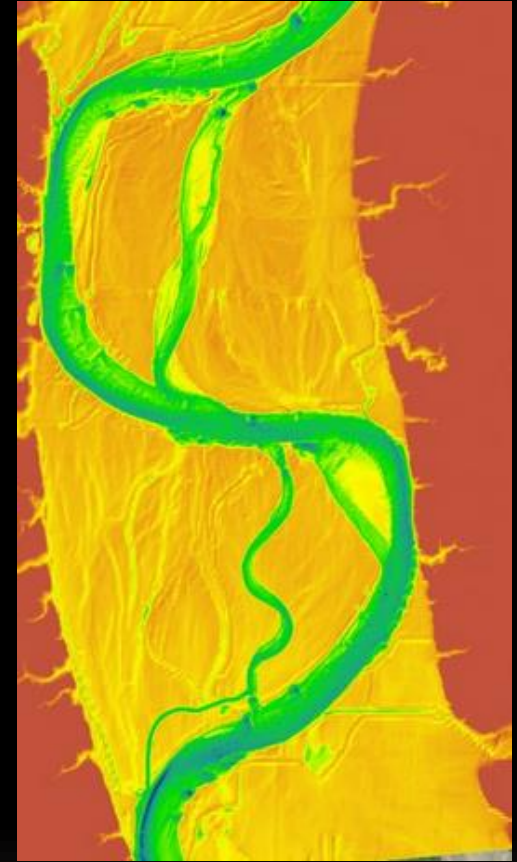


# A Stream is a Dynamic Feature

Stream and river channels change with seasonal variance and major water events like flooding; therefore, highly accurate stream centerline inventory data is also dynamic, and can be updated after significant water events with new LiDAR collects.

## Future LiDAR Collects:

- Bathymetric LiDAR will help define true Thalweg of Stream Channel
- May help with seasonal inundated wetlands

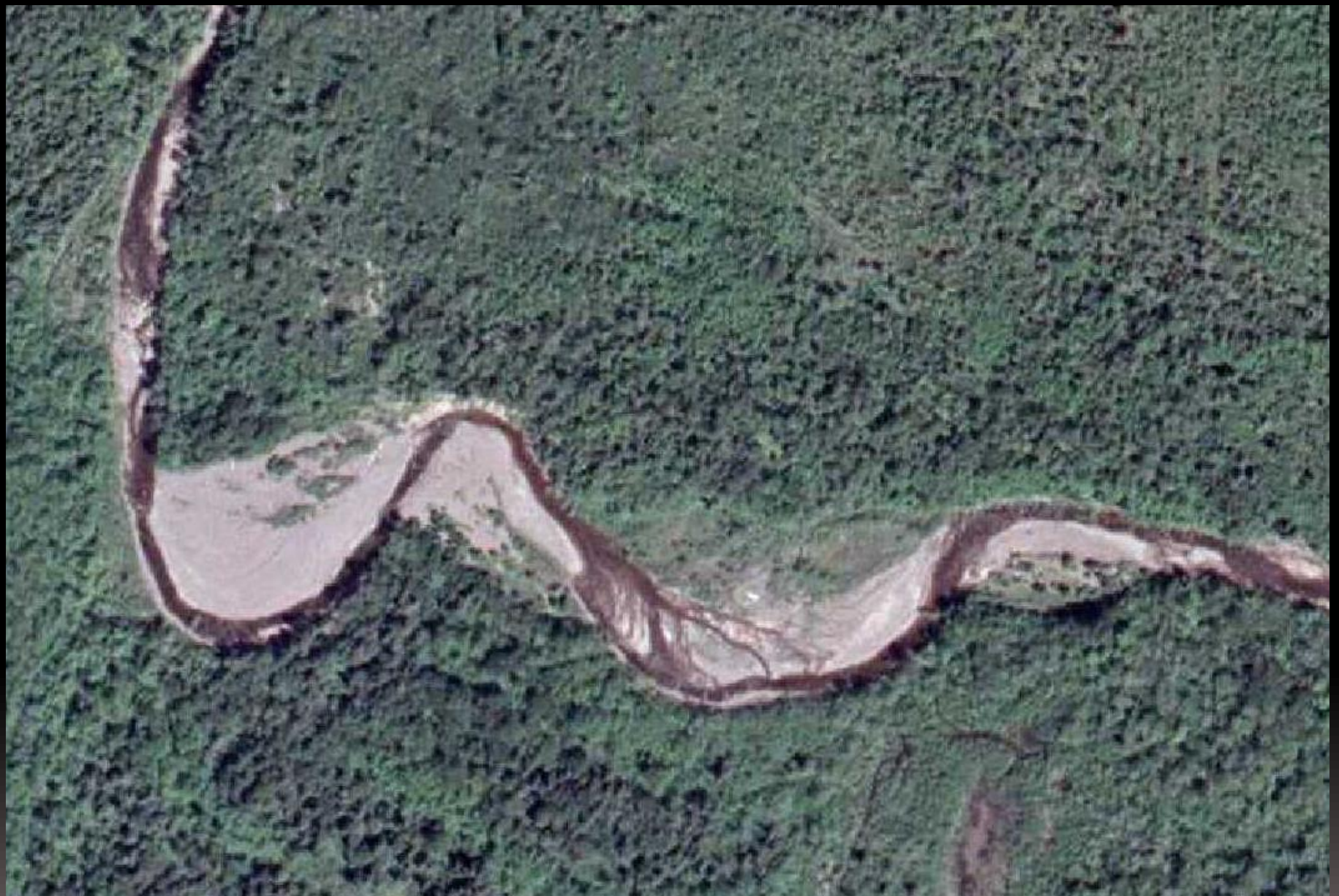






1991









2008





2013





LiDAR Updated 24k Stream Inventory