

SE Minnesota LiDAR Update

➔ ● Saturday August 18th – 2007

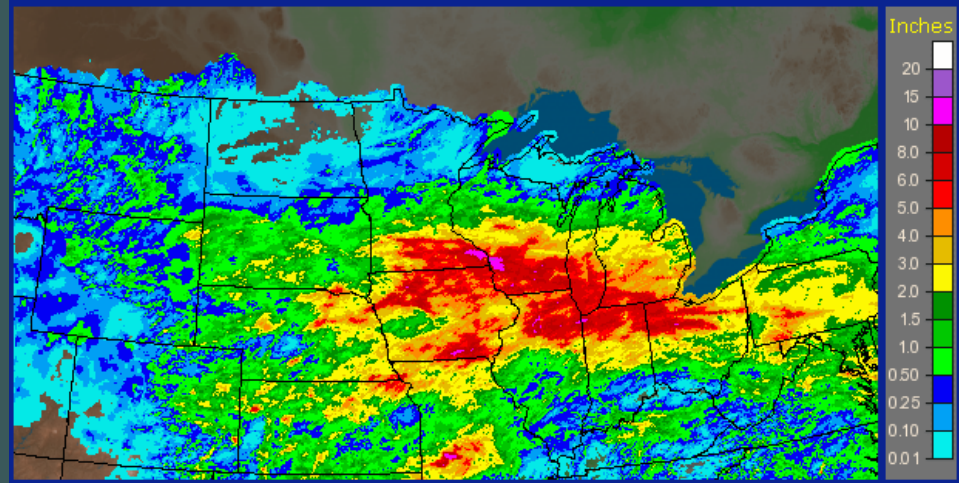
● Tropical Storm Erin

● 24-hour rain totals

- 15.10" Hokah
- 17" – Caledonia
 - (unofficial)



North Central RFC Minneapolis, MN: Current 7-Day Observed Precipitation
Valid at 8/25/2007 1200 UTC - Created 8/25/07 16:04 UTC



SE Minnesota LiDAR Update

● Towns Evacuated

- Stockton, Houston, Elba, Minnesota City and portions of Winona

- Whitewater State Park

● 4,200 Homes Damaged

● 7 Deaths

● \$67 Million Damage

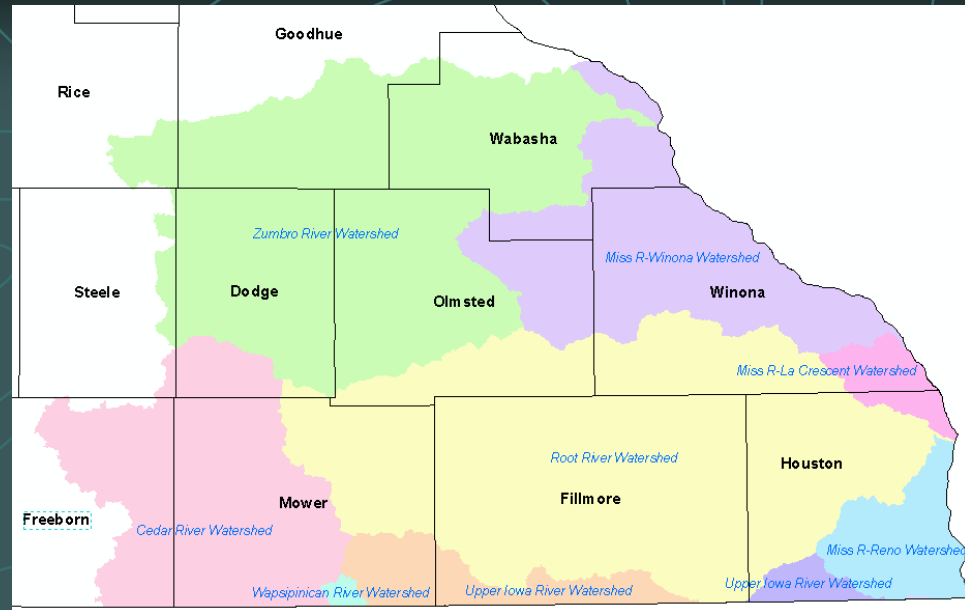


SE MN LiDAR

7 Counties Declared Disaster Areas

Steele, Dodge, Olmsted, Wabasha, Winona, Fillmore, Houston

Special Session
Legislation appropriated monies for flood relief and mitigation





SE Minnesota LiDAR Update

- \$624,000 Surplus funds allocated towards LiDAR
 - Funds expired June 30th, 2008
 - Legislation to Extend deadline until June 30th, 2009
- Contributors on Minnesota Recovers Task Force
 - DNR – Dept. of Natural Resources
 - DEED – Dept. Employment and Economic Development
 - DHS – Dept. of Human Services
 - MHS – Minnesota Historical Society

SE Minnesota LiDAR Update



Objectives

- Highly Accurate Elevation Data
 - 2-foot contours minimum
- FEMA specifications
 - Need updated FEMA DFIRMS
- Publicly available data – no restrictions



SE MN Collect

● Great Example of Cooperation and Partnering

● \$625K – State of MN

- DNR – Project Management and oversight
- DOT – Validation and project support

● \$75K – USGS

● \$122K – Mower and Freeborn Counties

- Shell Rock River Watershed District
- Turtle Creek Watershed District
- Cedar River Watershed District

Elevation and Terrain in the SE Minnesota LiDAR Project

Elevation



In August of 2007, southeast Minnesota experienced a historic rainfall event which led to massive flooding in the region.

In response, the federal government declared the seven counties of Dodge, Fillmore, Houston, Olmsted, Steele, Wabasha and Winona counties disaster areas and the Minnesota Legislature provided appropriations to aid with flood mitigation efforts. This project is being funded by those proceeds and by contributions from the United States Geological Survey.

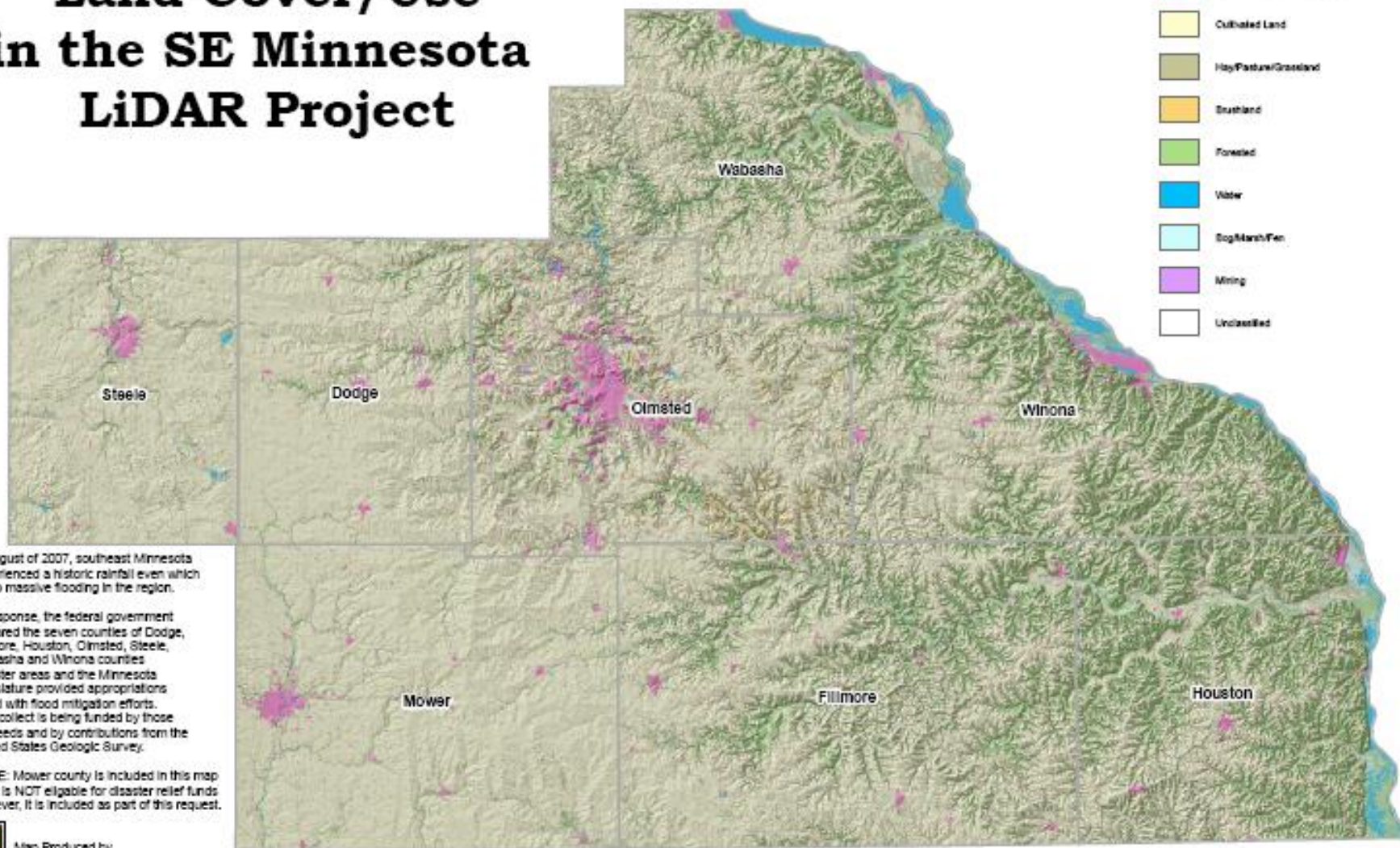
NOTE: Mower county is included in this map but it is NOT eligible for disaster relief funds however, it is included as part of this request.



Map Produced by
Minnesota DNR
5/29/2008

Data Source: USGS 30 Meter DEM products

Land Cover/Use in the SE Minnesota LiDAR Project



In August of 2007, southeast Minnesota experienced a historic rainfall event which led to massive flooding in the region.

In response, the federal government declared the seven counties of Dodge, Fillmore, Houston, Olmsted, Steele, Wabasha and Winona counties disaster areas and the Minnesota Legislature provided appropriations to aid with flood mitigation efforts. This project is being funded by those proceeds and by contributions from the United States Geological Survey.

NOTE: Mower county is included in this map but it is NOT eligible for disaster relief funds however, it is included as part of this request.



Map Produced by
Minnesota DNR
5/29/2008

Data Source: Minnesota Land Use and Cover, a 1990's Census of the Land:
<http://del.dnr.state.mn.us/metadata.html?lo=L390002840604>

Slope of Land in the SE Minnesota LiDAR Project



In August of 2007, southeast Minnesota experienced a historic rainfall event which led to massive flooding in the region.

In response, the federal government declared the seven counties of Dodge, Fillmore, Houston, Olmsted, Steele, Wabasha and Winona counties disaster areas and the Minnesota Legislature provided appropriations to aid with flood mitigation efforts. This project is being funded by those proceeds and by contributions from the United States Geological Survey.

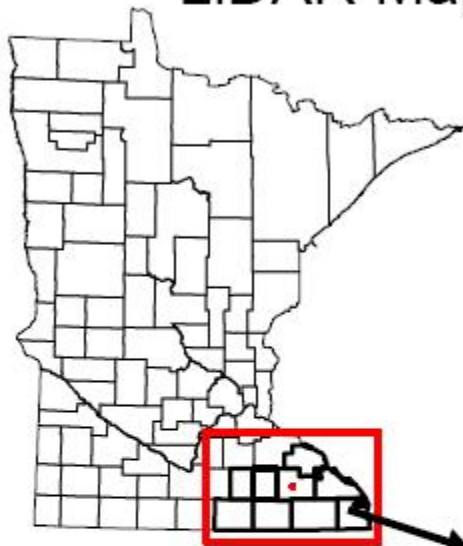
NOTE: Mower county is included in this map but it is NOT eligible for disaster relief funds however, it is included as part of this request.



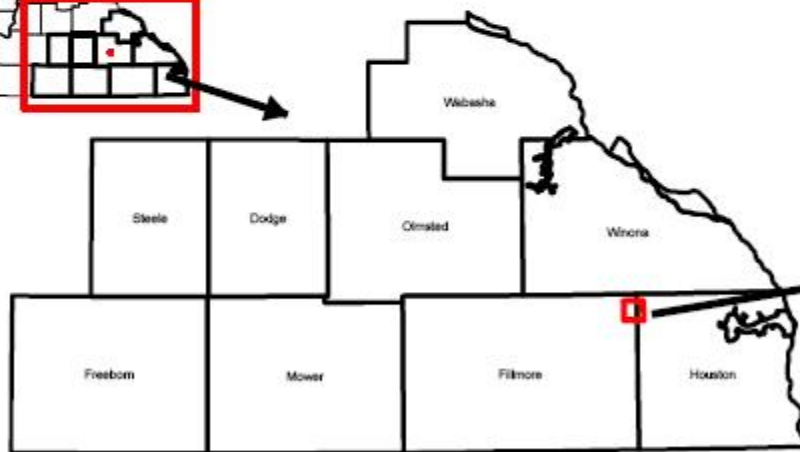
Map Produced by
Minnesota DNR
5/29/2008

Data Source: USGS 30 Meter DEM products

2008 SE Minnesota LiDAR Mapping Initiative



Pilot Project Area





SE Minnesota LiDAR Update

● Deliverables

● Classified LAS Files

- Vegetation, Buildings, Bare Earth, Bridges

● Edge of Water Breaklines

● 2' Contours – Breakline Enforced

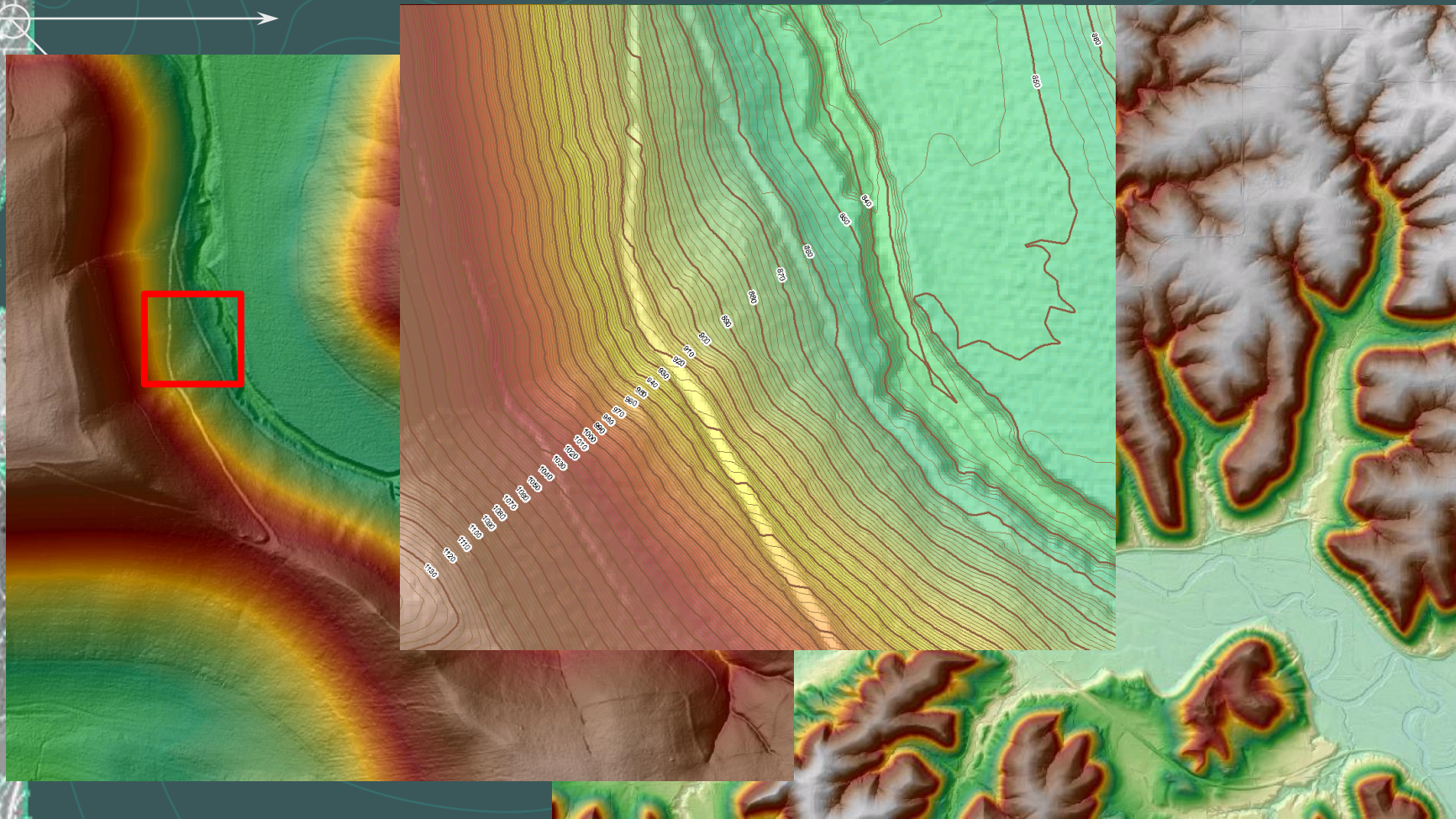
● 1 meter DEM units in meters

● Projection

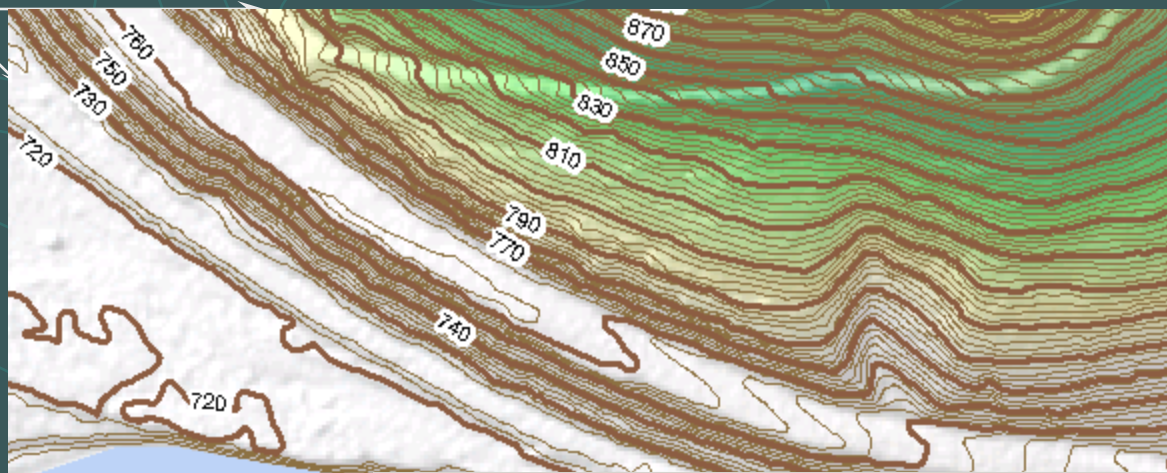
● UTM Zone 15 projection, NAD83 Datum

● Vertical Datum NVD88

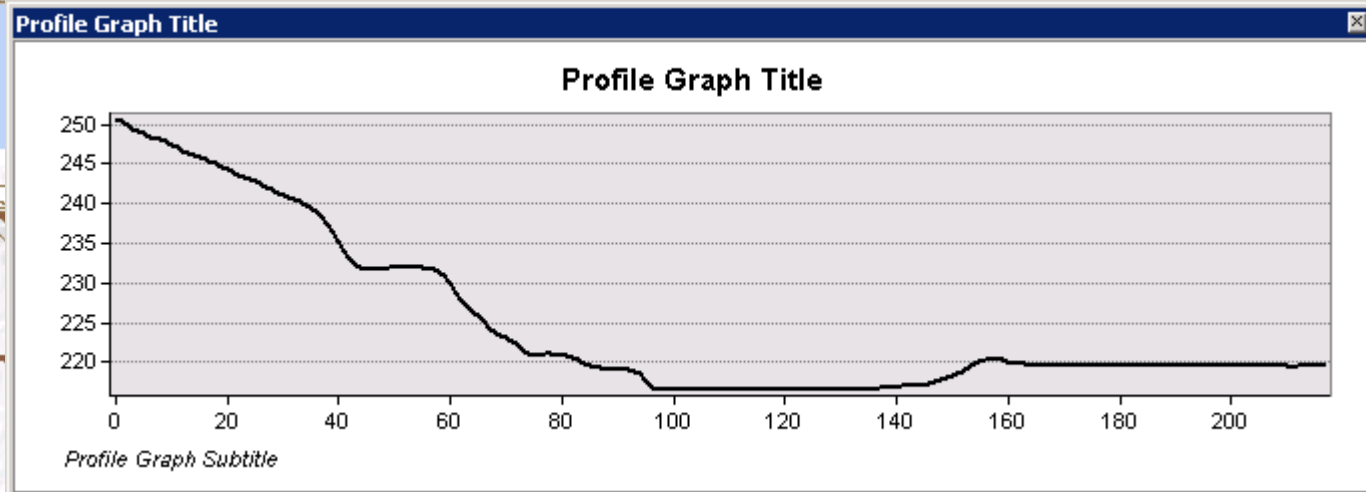
SE Minnesota LiDAR Update



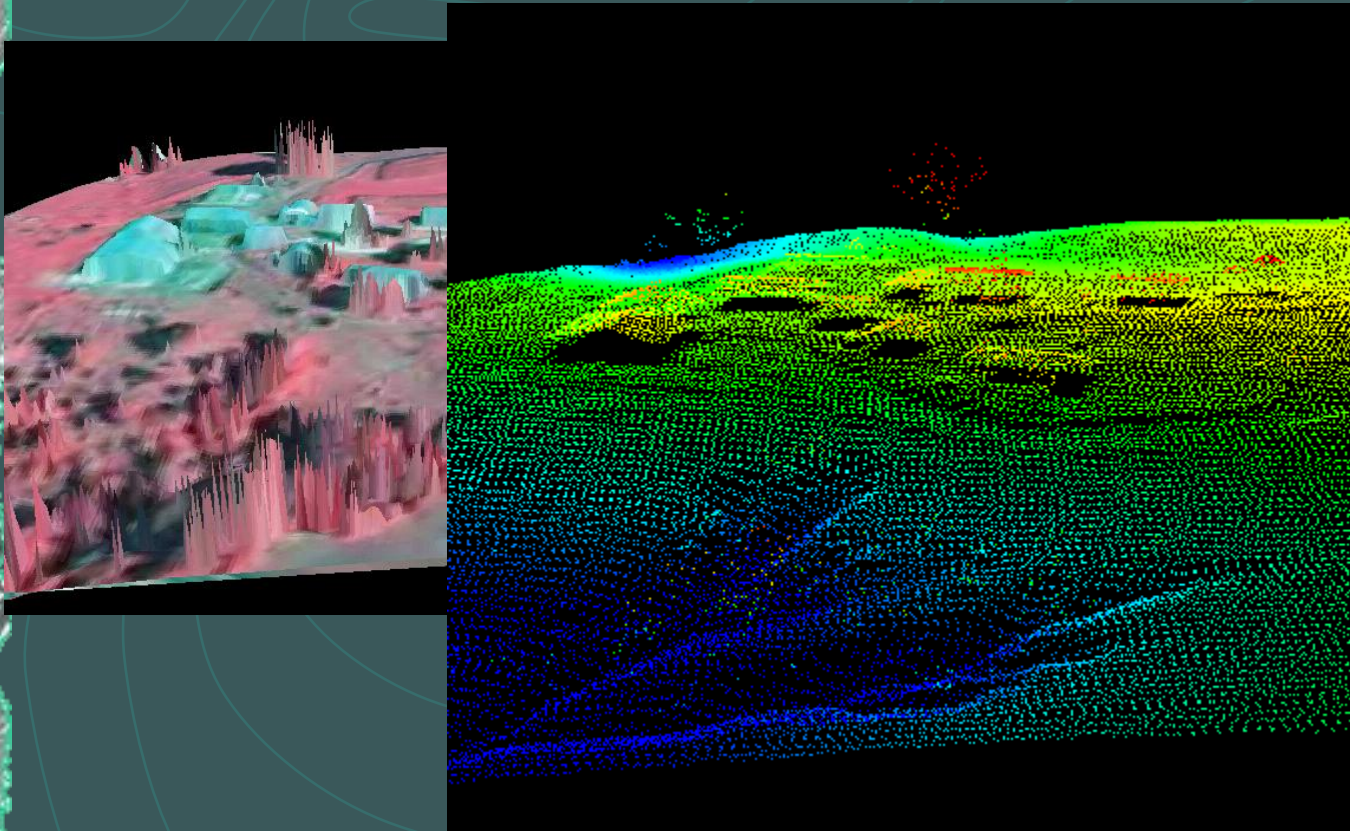
SE Minnesota LiDAR Update



Contours have been enforced using edge of water breaklines



SE Minnesota LiDAR Update



SE Minnesota LiDAR Update



● Data Validation

● 800 Points Total


- 100 Points per County
- 20 points in each of 5 cover categories

● Help from county surveyors and other staff

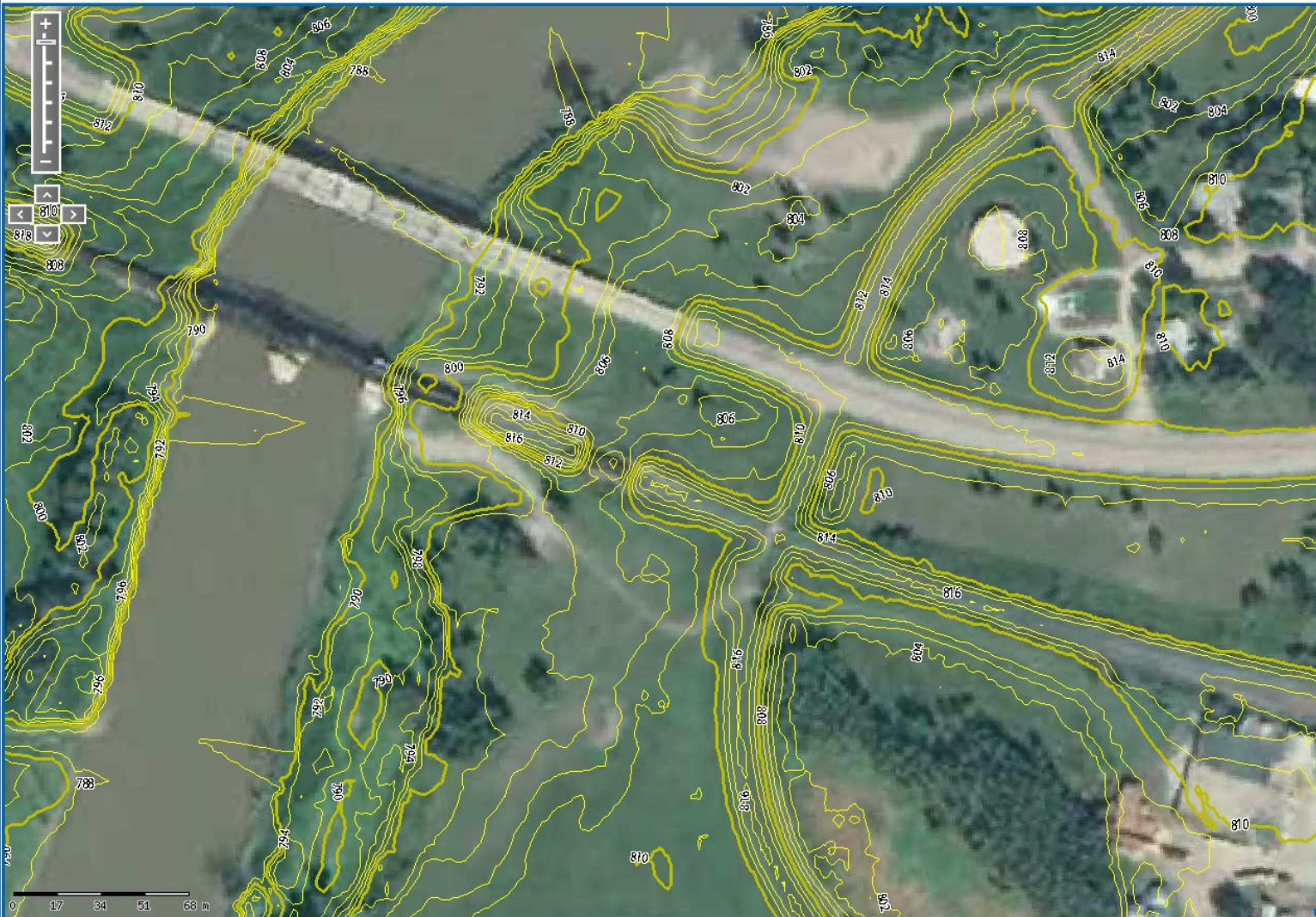
● Purpose:

- Data Validation – we got what we bought
- Data Integrity – we want people to trust the data

SE Minnesota LiDAR Update

- 
- Data will be publicly available
 - DNR Data Deli
 - USGS National Elevation Dataset (NED)
 - Actively exploring web delivery options
 - Print a map with an Air Photo backdrop with 2' contours?
 - Clip and Ship products

RRB LiDAR Product Viewer

[Home](#) | [Contact](#) | Wednesday, April 15,[About](#) [Disclaimer](#) [Help](#) [Courtesy of Houston Engineering](#)

Houston Engineering X,Y: 638164.35,5339610.48 Lat, Long: 48.1946,-97.1407

Scale 1:

1,139

Go!

Developed By Moose Po...

4/11/2009

MIN GIS/LIS Spring workshops



SE Minnesota LiDAR Update

- What is LiDAR?

- Light **D**etection and **R**anging

- Measures distance from source to target

- “Paints” the surface with laser beams

- Up to 150,000 “pulses” per second

- Collects the returns

- Time = distance



SE Minnesota LiDAR Update

- Integrating with GPS determines elevations
 - On-board GPS and navigation
 - On the ground base stations
- GPS is the “weakest” link in the accuracy chain
- On the ground survey units are critical to establish accurate indexing heights
 - Absolute accuracy vs relative accuracy



SE Minnesota LiDAR Update

● Limitations

● Cannot penetrate

- Water
- Heavy canopy cover
- Rain, Snow, Clouds

● Limited window of opportunity to collect

- Vegetation and snow free periods in the spring and fall
- Flooding is bad too!

● The lower the flight height, the more closely spaced the pulses



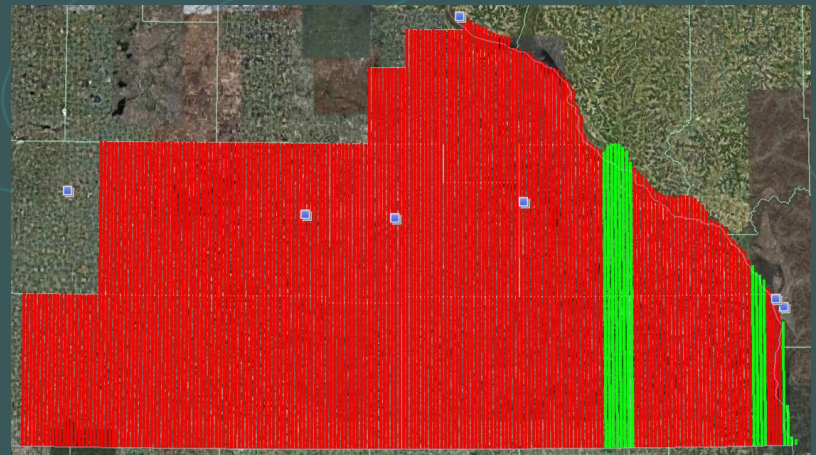
SE Minnesota LiDAR Update

● The typical LiDAR Project involves

- Mission planning
- Mission execution (data collection)
- Calibration and indexing
- Data classification
 - Automated
 - Manual
- Product Generation
- Data Delivery/distribution

SE Minnesota LiDAR Update

- 
- 
- Mission Planning
 - Flight line placement
 - Height of plane
 - Monitoring of local Conditions
 - Weather
 - Antecedent conditions
 - No snow or flooded conditions
 - Leaf cover
 - On or Off
 - Crop conditions (especially in fall collects)
 - Corn and soybean are two crops that greatly affect collection





SE Minnesota LiDAR Update

● Mission Execution

● Generally consist of one or more flight teams

- Flight Crew

- Pilot and data technician

- Ground Crew

- One or more surveyors on the ground with RTK and base stations for high accuracy elevations

- Four hour “lifts” are typical

● Small window of opportunity requires hard work

- Night flights

- Multiple “lifts” in a day



SE Minnesota LiDAR Update

● Calibration and Indexing

- Data is downloaded from aircraft computers
 - LiDAR pulse records
 - GPS – for aircraft position
 - Inertial Measurement Unit – to aircraft attitude
- Different data streams are synchronized
 - Everything has a time stamp
- Data is calibrated to conform with Datum and projection
- Data is indexed to on-the-ground survey data



SE Minnesota LiDAR Update

● Point Classification

- Points are processed to determine what they bounced off of
 - Bare Earth
 - Buildings
 - Cars and other anthropomorphic things
 - Bridge decks
 - Vegetation (High, Medium, and Low)
 - Water
- ASPRS has developed a set of standard classifications for LiDAR derived data



SE Minnesota LiDAR Update

● Point Classification

● Automated Classification

- Can identify features with 70-74% accuracy

● Manual Classification

- Needed to get higher accuracies
- Typically done with Air Photos and other sources of data
- Typically the most time consuming portion of any project and the most likely to be farmed overseas



SE Minnesota LiDAR Update



● Breaklines

- Breaklines identify changes in landscape elevation
 - Too small or continuous to be reliably recorded with LiDAR
 - Stream banks, curbs, centerlines, water/land interface
- Used to influence interpolation for contours
- Can help enforce stream and lake elevations



● Generated from

- Air Photos
- LiDARGrammetry



SE Minnesota LiDAR Update

● Product Generation

- LiDAR sensors produce point data
 - Massive quantities, 1 – 2 meters apart
- Point data can be converted to:
 - TINs
 - Rasters
 - Contours



SE Minnesota LiDAR Update

● Data Delivery and Distribution

● It's a challenge

- Lots of users
- Lots of data formats (dwg, shp, etc)
- Lots of data types (raster, vector, tin)
- Lots of projections (you name it!)
- Lots of places (all over the state)
- Lots of data (voluminous stuff)
- Lots of Lots (you get my drift!)



SE Minnesota LiDAR Update

What will be delivered to partners

Hard-drive with data

- Tiled by 1/16 quarter quadrangle
 - Contours, rasters, points
- County mosaic of 3 meter DEM

Would like county GIS staff to project data to desired projection

- DNR is considering providing tools to help GIS staff work with data (clipping, merging etc)
- DNR Will assist those counties that don't have GIS staff