Advanced LiDAR Workshop

2012 Missouri LiDAR Partners Project

MGISAC / MOMAPPERS / Washington University

August 21, 2012

2012 MO LiDAR Project

Presenter

- **Wade Williams, C.P.**

  Project Manager

2012 MO LiDAR Project

Presentation Topics

- Project Partners & Overview
- LiDAR Acquisition
- Survey Ground Control
- Accuracy Results
- LiDAR Data Post Processing
- Hydro Enforced Breaklines
- Project Deliverables
- Data Availability

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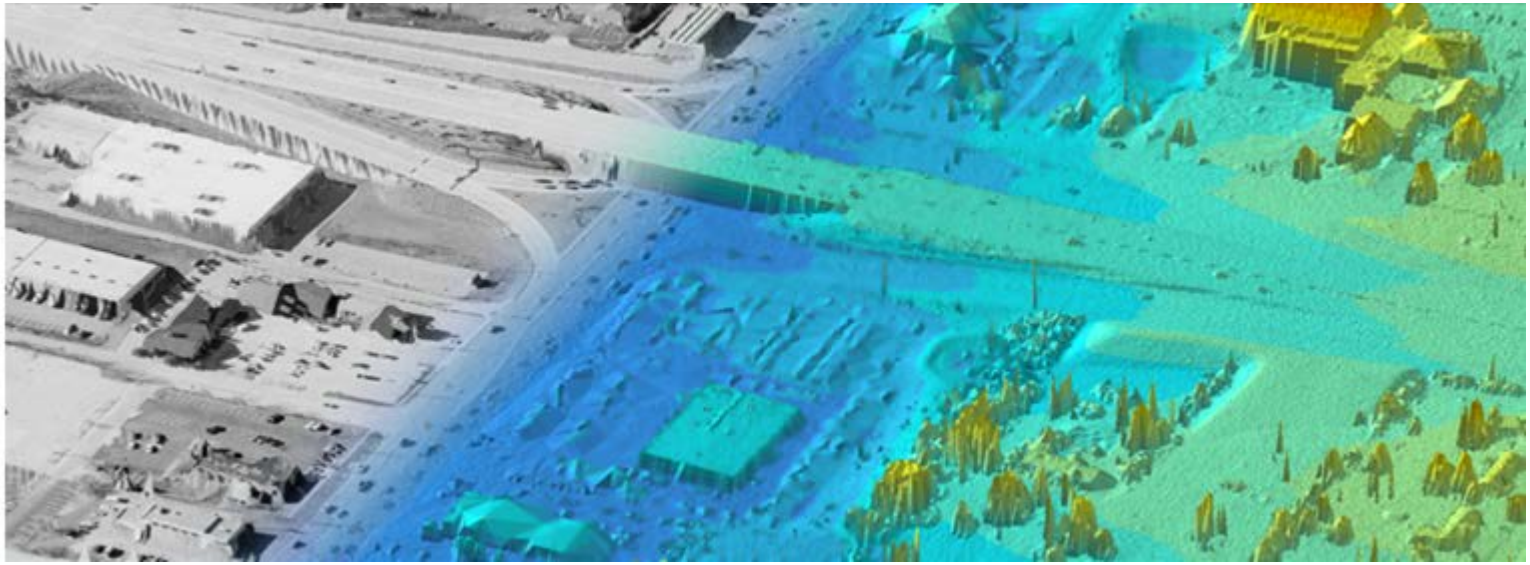
Project Partners

- U.S. Army Corps of Engineers (USACE, *Contract Manager*)
- Natural Resources Conservation Service (NRCS)
- State Emergency Management Agency (SEMA)
- United States Geological Survey (USGS)
- MO Department of Natural Resources (DNR)
- Metropolitan Sewer District (MSD)

2012 MO LiDAR Project

Project Overview

- Referred to as the MO Grand LiDAR Project
- Project Area: portions of 15 Missouri Counties totaling 6,576 square miles
- Purpose: high resolution LiDAR data to generate bare-earth models & hydrologic break lines



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Project Counties

- St. Louis, St. Francois, Lincoln, Montgomery, Audrain, Monroe, Cooper, Howard, Randolph, Macon, Adair, Putnam, Sullivan, Livingston & Ray

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Project Specifications

- 1 meter LiDAR ground sample distance
- Collected leaf-off, snow-free, water at normal or below normal levels
- Data processing follows USGS V13 Base LiDAR standards
- Data accuracies follow NDEP guidelines, V1.0 for NSSDA of 95% confidence for 2’ contours and ASPRS Class I standards
- Hydro Enforced breaklines collected for ponds 2+ acres and rivers 100’ or wider

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LiDAR Acquisition

- Cessna 335 & Leica ALS50-II

Performance Specifications

- **Operating Altitude** 200m – 6000m AGL
- **Accuracy** (see graph at right, example for 40-degree FOV, including 10cm GPS error)
- **Number of Returns** 4 (first, second, third, last)
- **Number of Intensities** 3 (first, second, third)
- **Intensity Digitization** 8 bit intensity + 8-bit AGC level + continuously variable laser output
- **Maximum FOV** 75 degrees full angle
- **Roll Stabilization** automatic adaptive, range = 75 minus current FOV
- **Laser Divergence** 0.22mr @ $1/e^2$ (~0.15mr @1/e)
- **Recording Media** 300GB HDD (~17 hours at maximum pulse rate)
- **Waveform Profiling** 8 bits @ 1nsec interval @ 50kHz (option)

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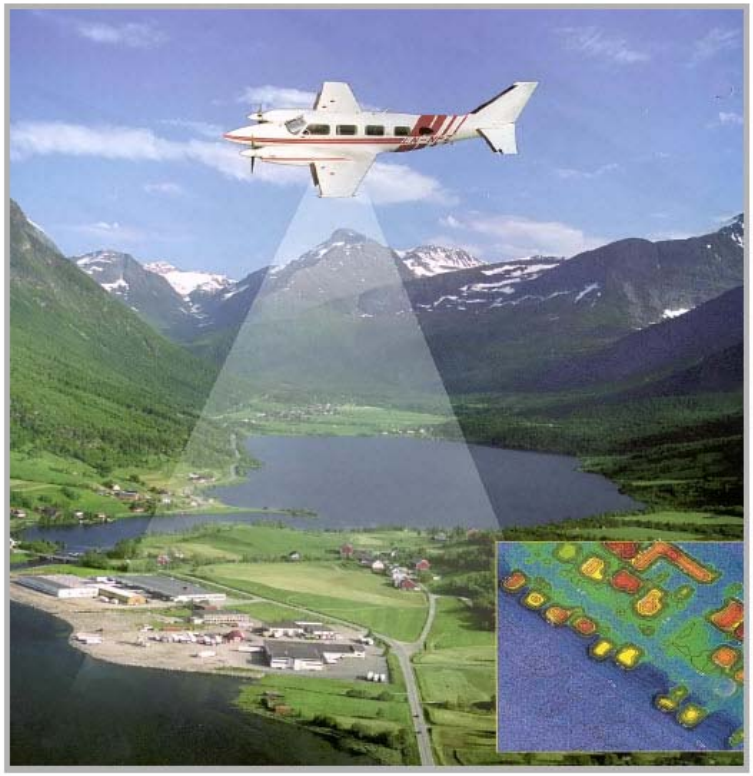
LiDAR Acquisition

- Data Acquired from November 14, 2011 - March 6, 2012
- Flight Altitude ~6,000’ AGL
- Airspeed: 150 knots
- Average Point Spacing: .90m
- Returns Per Pulse: 4+ Intensity
- Field of View: 34 degrees
- Minimum Line Overlap: 10%
- Scan Frequency: 49.0 Hertz
- Airborne GPS: 25 mile max.



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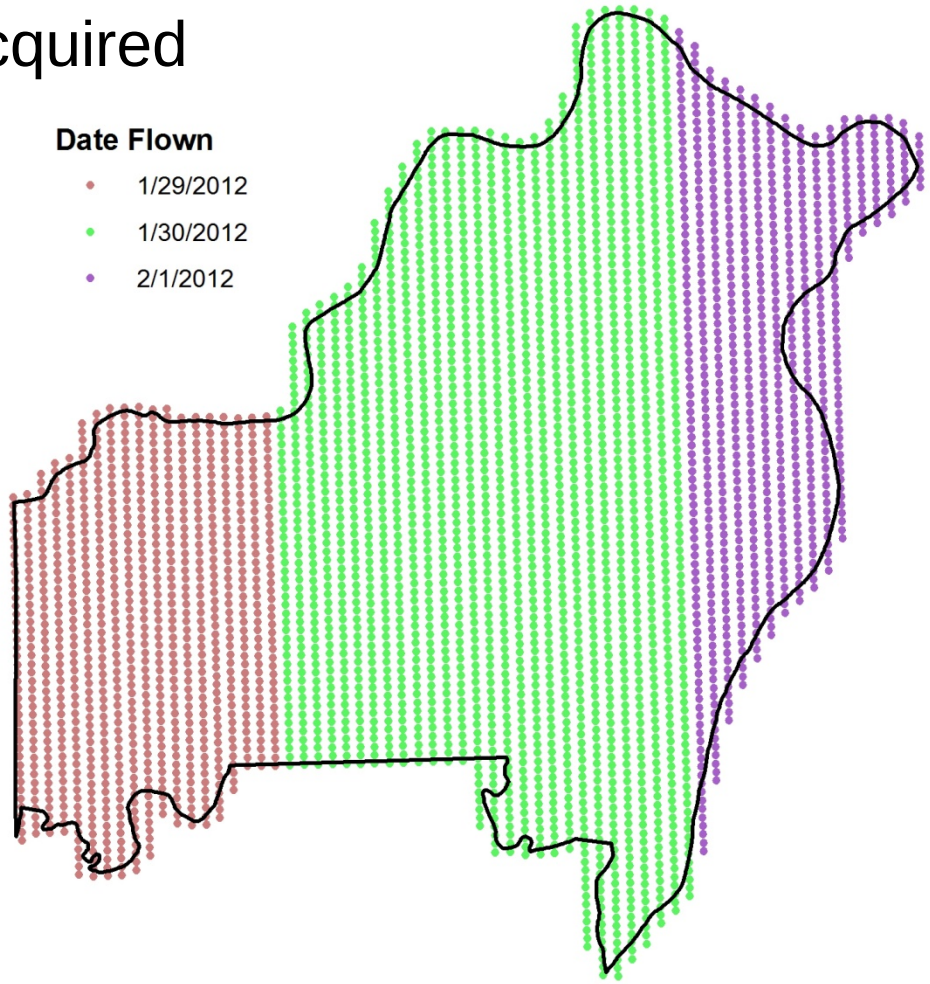
LiDAR Acquisition

- St. Louis County & City Acquired

Jan. 29 to Feb. 1, 2012



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Survey Ground Control

- 90+/- Survey points collected per ~500 sq. mile delivery area (hard surface, grass, trees)
- Used the MODOT GNSS Network (CORS)

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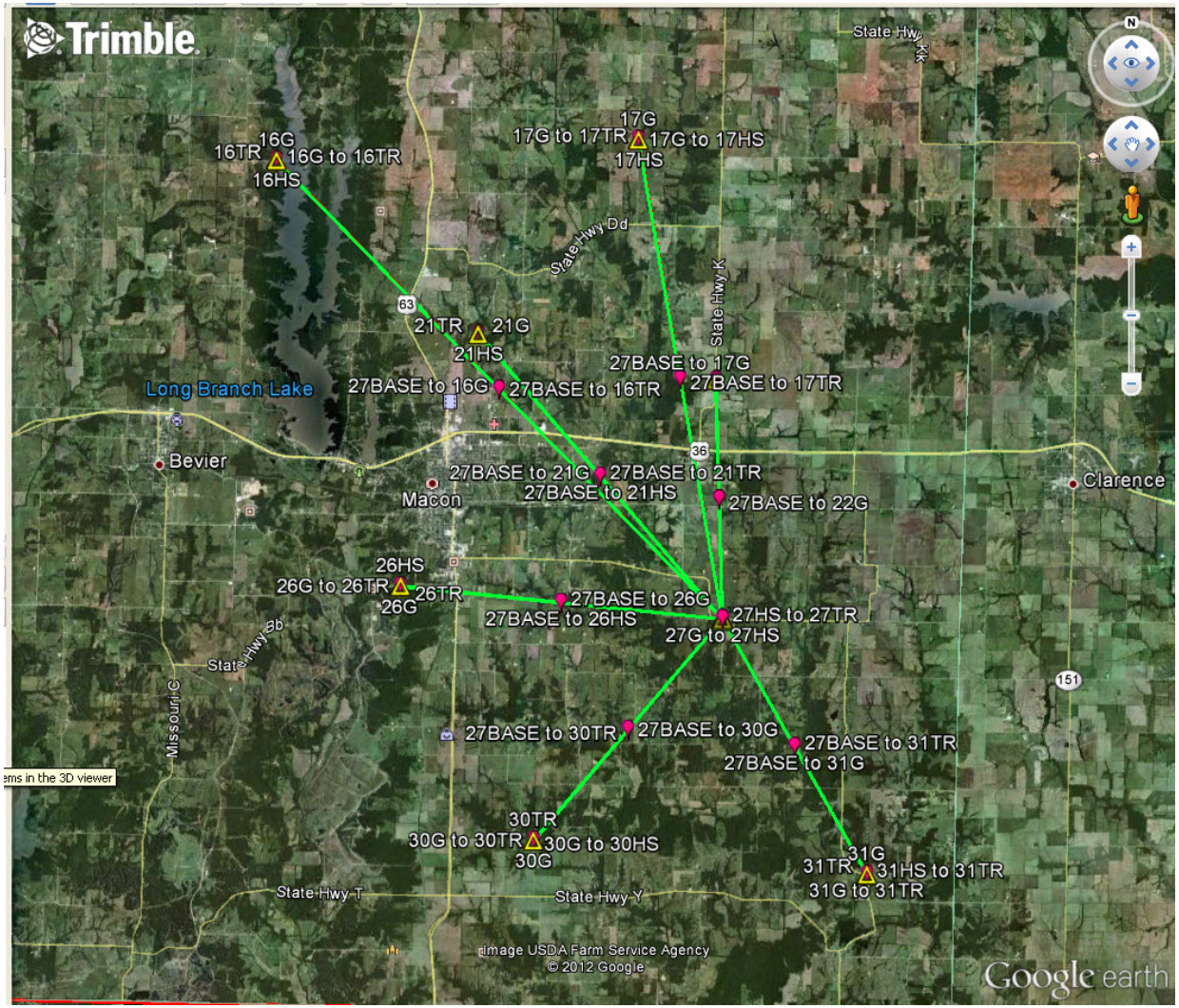
Survey Ground Control



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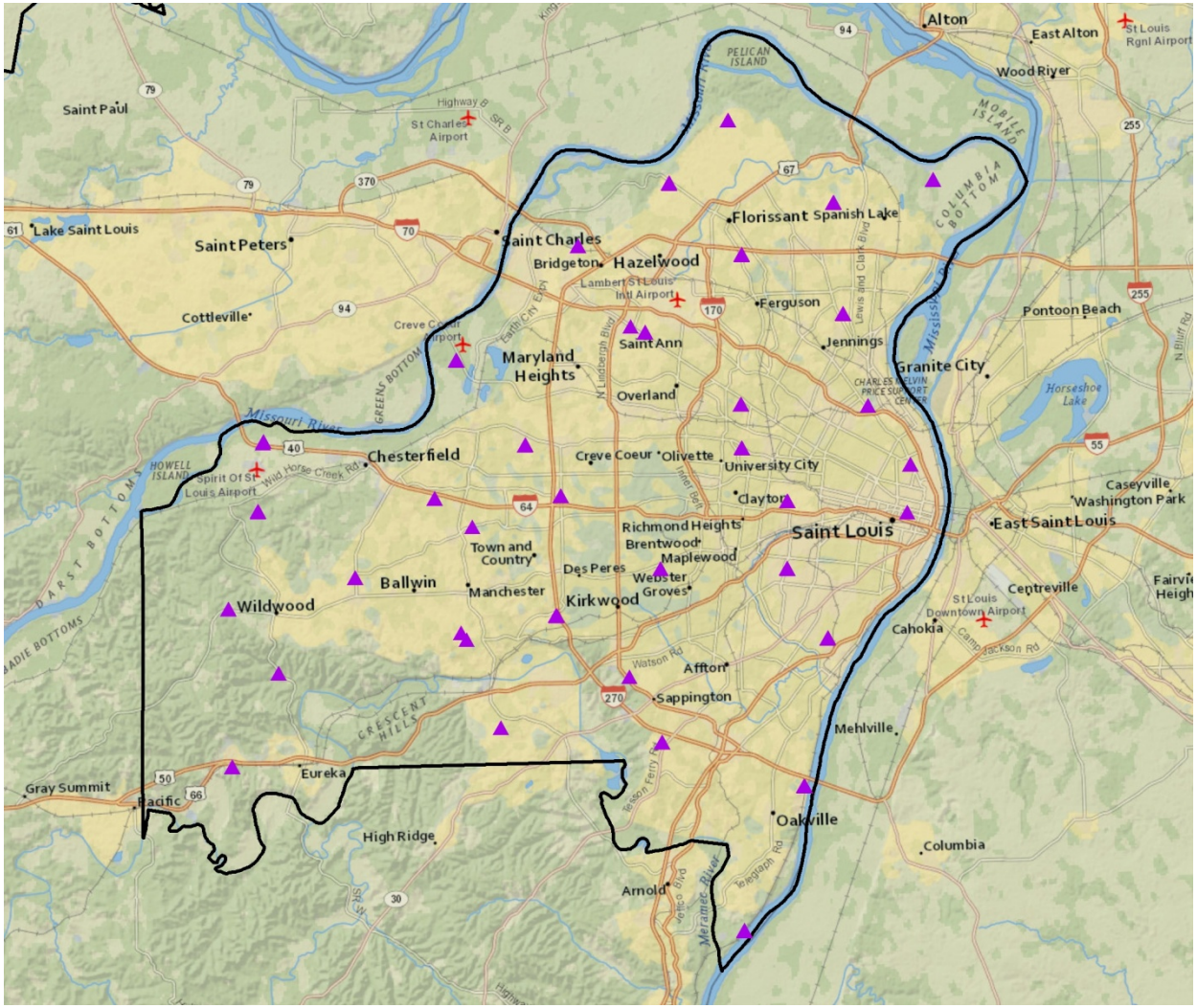
Survey Control St. Louis



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Accuracy Results

- **Average FVA per delivery area = 11.3 cm (12.5 cm RMSEz spec.)**
- **Average CVA per delivery area = 22.6 cm (36.3 cm 95th % spec.)**

St. Louis County Results

Stat	Hard Surface	Grass	Trees	Overall
Count	36	33	33	102
Average	-0.021	-0.067	-0.045	-0.044
RMSEz	0.071	0.090	0.094	0.085
95th Percentile	0.139	0.177	0.185	0.167

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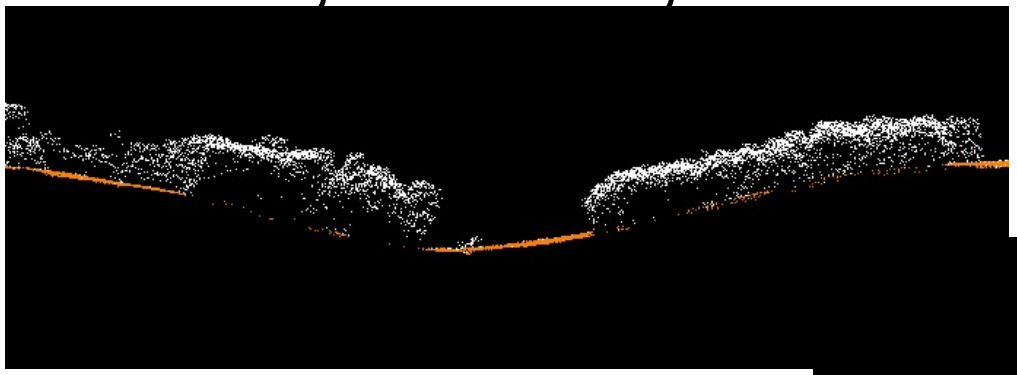
LiDAR Data Post Processing

- All 6,500 sq. miles being post processed at Surdex
- Automated and manual filtering techniques are being used for creation of the bare-earth surface
- 95% removal of artifacts, outliers, voids, errors, noise, anomalies, manmade features & vegetation



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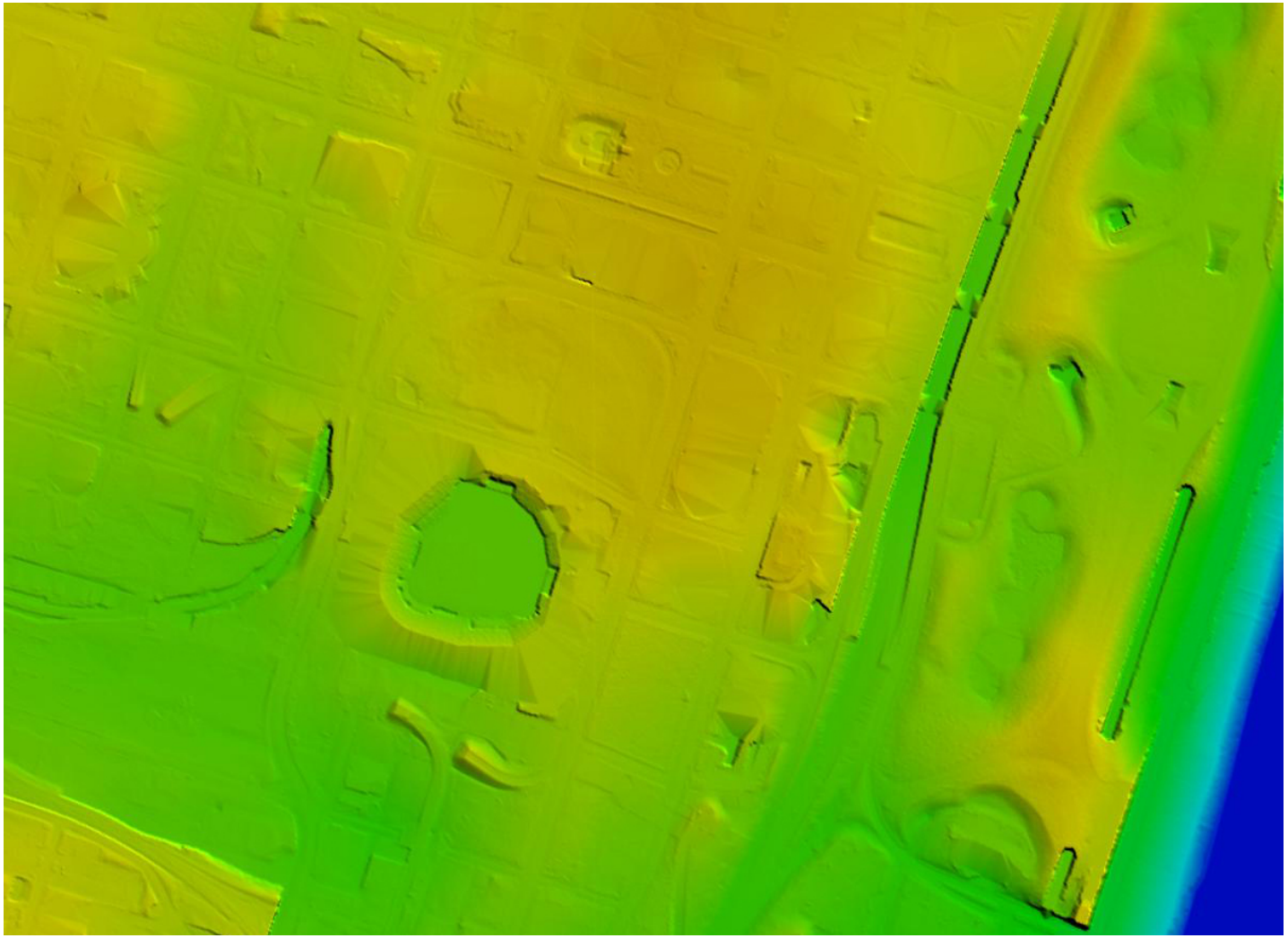
LiDAR Bare-Earth Data



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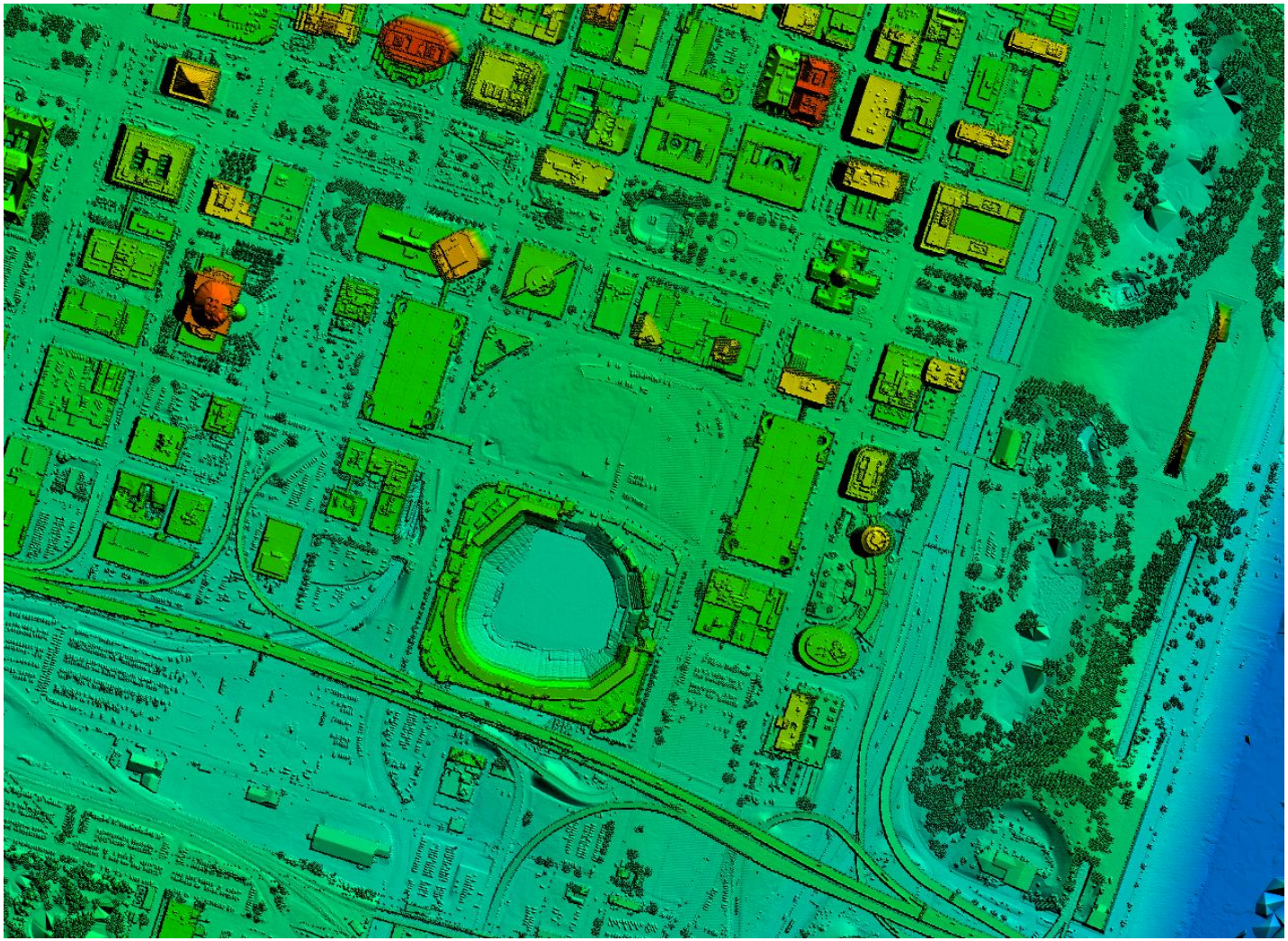
LiDAR First Return Data



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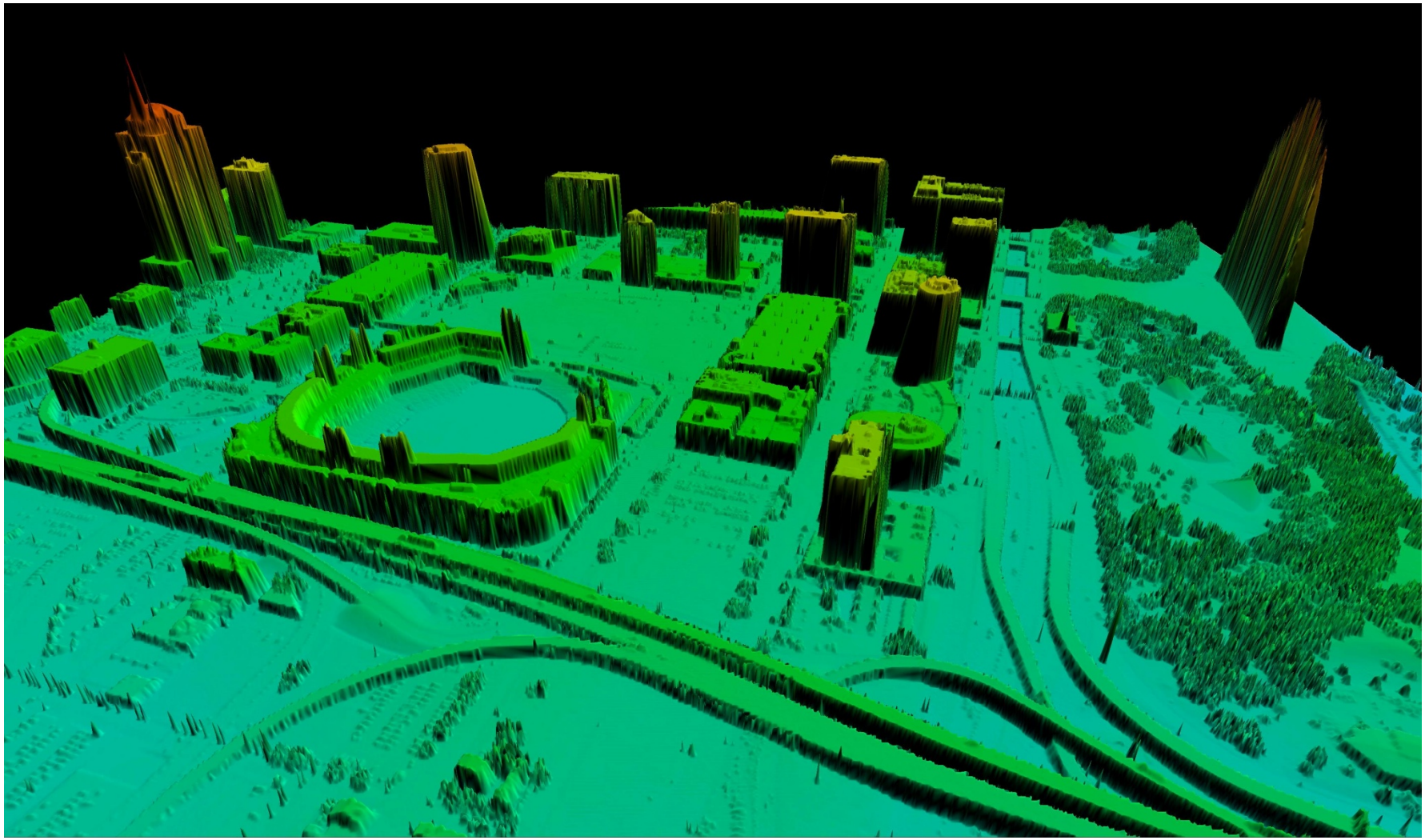
LiDAR First Return Data 3D



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LiDAR Intensity Data

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Hydro Enforced Breaklines

- Hydro-enforcement flattens the elevations of all ponds/lakes and also keeps streams/rivers flowing downhill
- 2+ acre ponds & ~100’+ rivers are being collected
- Collection is done in ArcMap using the bare-earth shaded relief and draped to the LAS data

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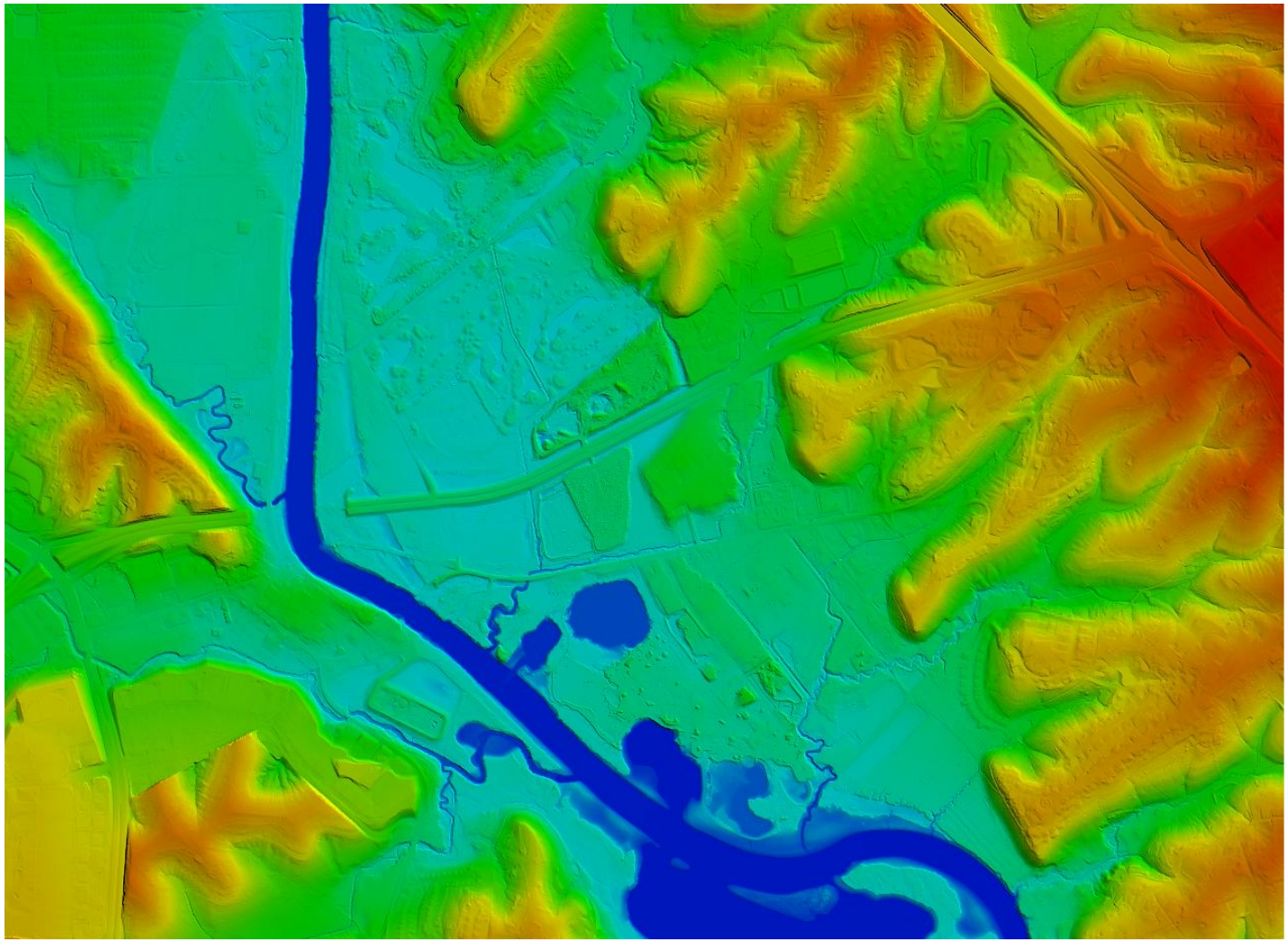
Bare-Earth Data



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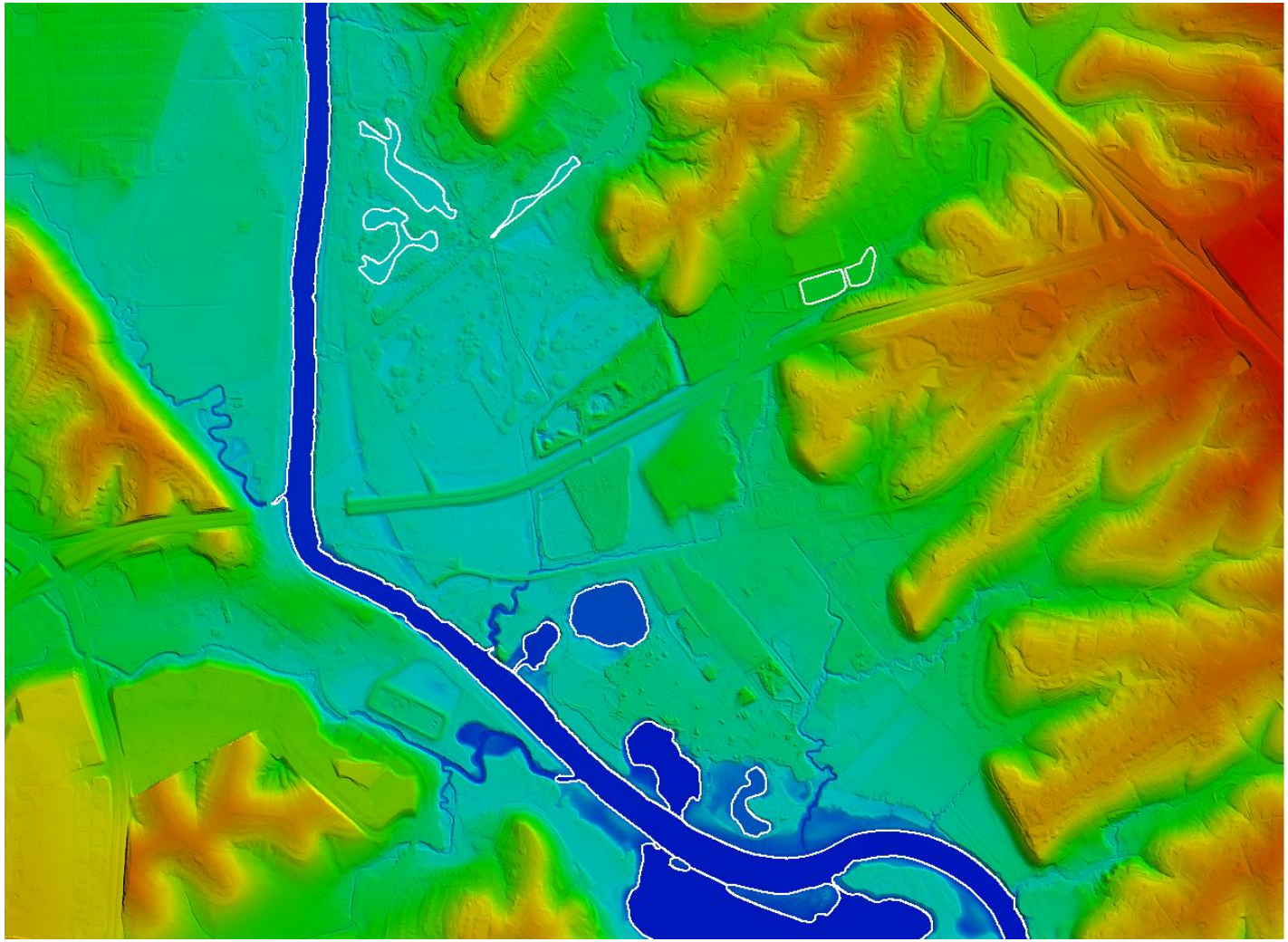
Bare-Earth Data with Hydro



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Project Deliverables

- All data delivered in UTM NAD83 Zone 15 meters & MO-SPCS NAD83 US feet, NAVD88
- Classified LAS tiles (classes 1, 2, 7, 9, 10 & 11)
- ESRI Grid Bare-Earth tiles
- Hydro Breaklines in 3D Shapefile format
- FGDC Metadata in XML format

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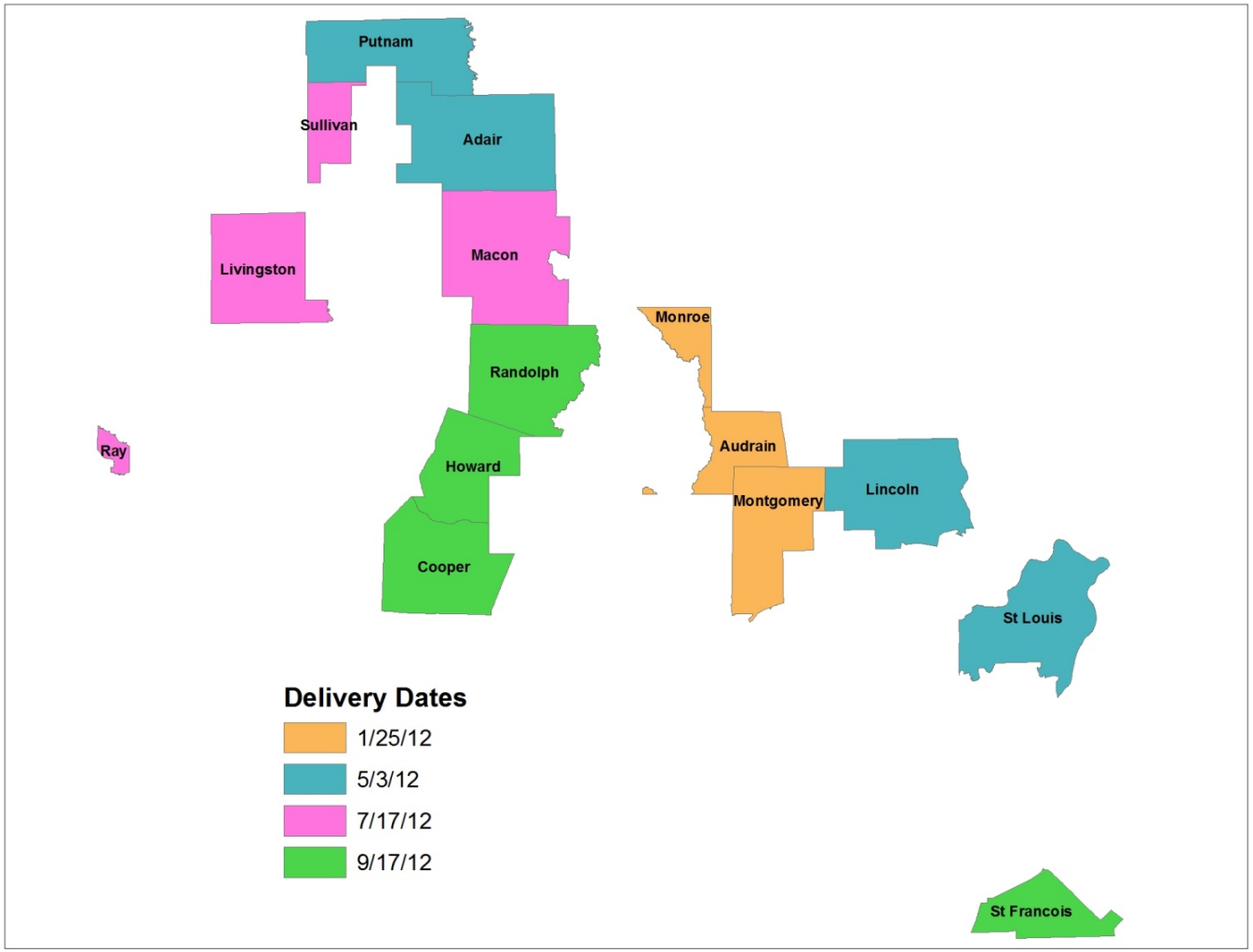
Project Delivery Status



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Data Availability

- **Data availability through MSDIS, http://www.msdis.missouri.edu/data/lidar/index.html**
- **Liz Cook, Elizabeth.Cook@mo.usda.gov**

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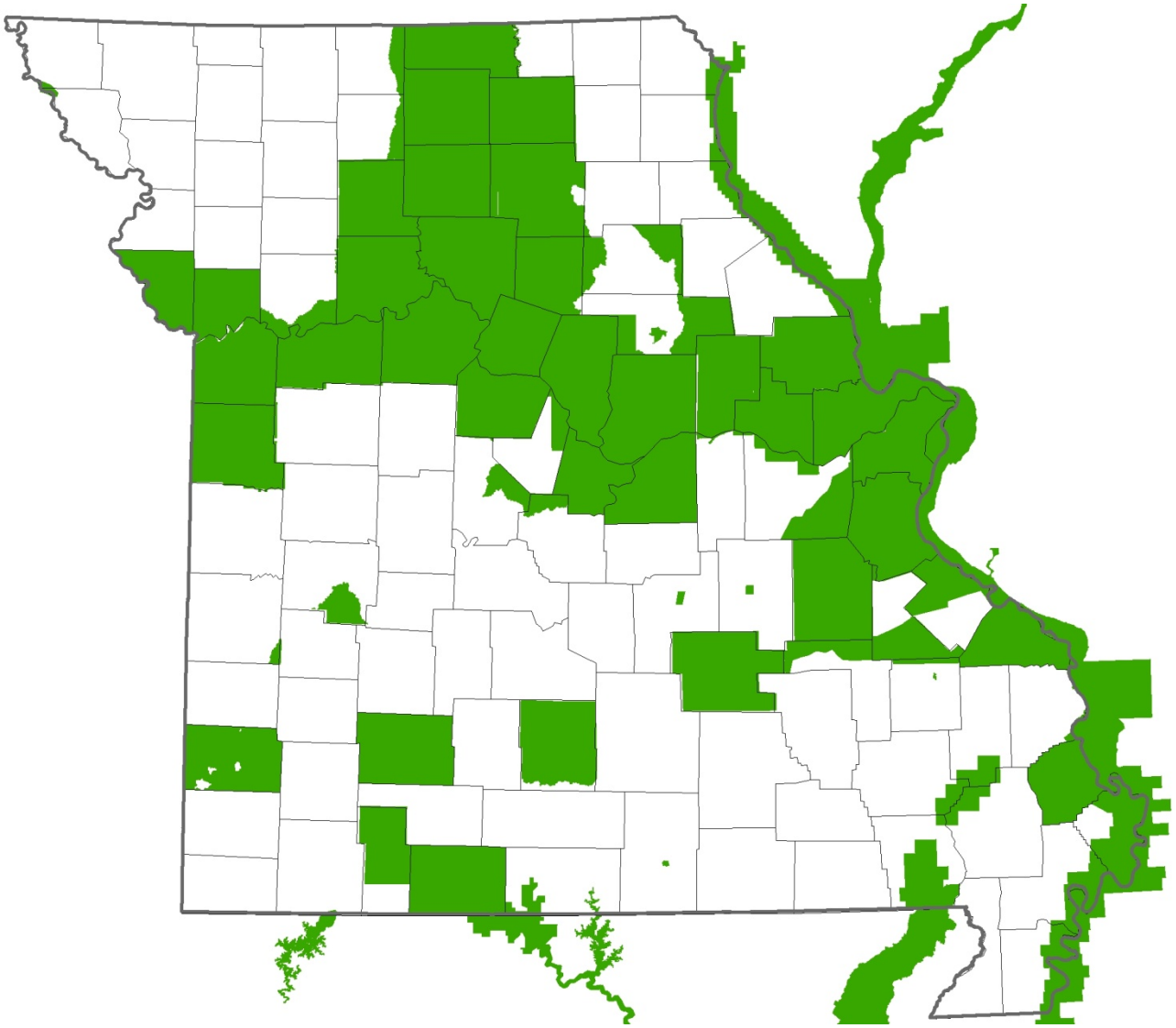
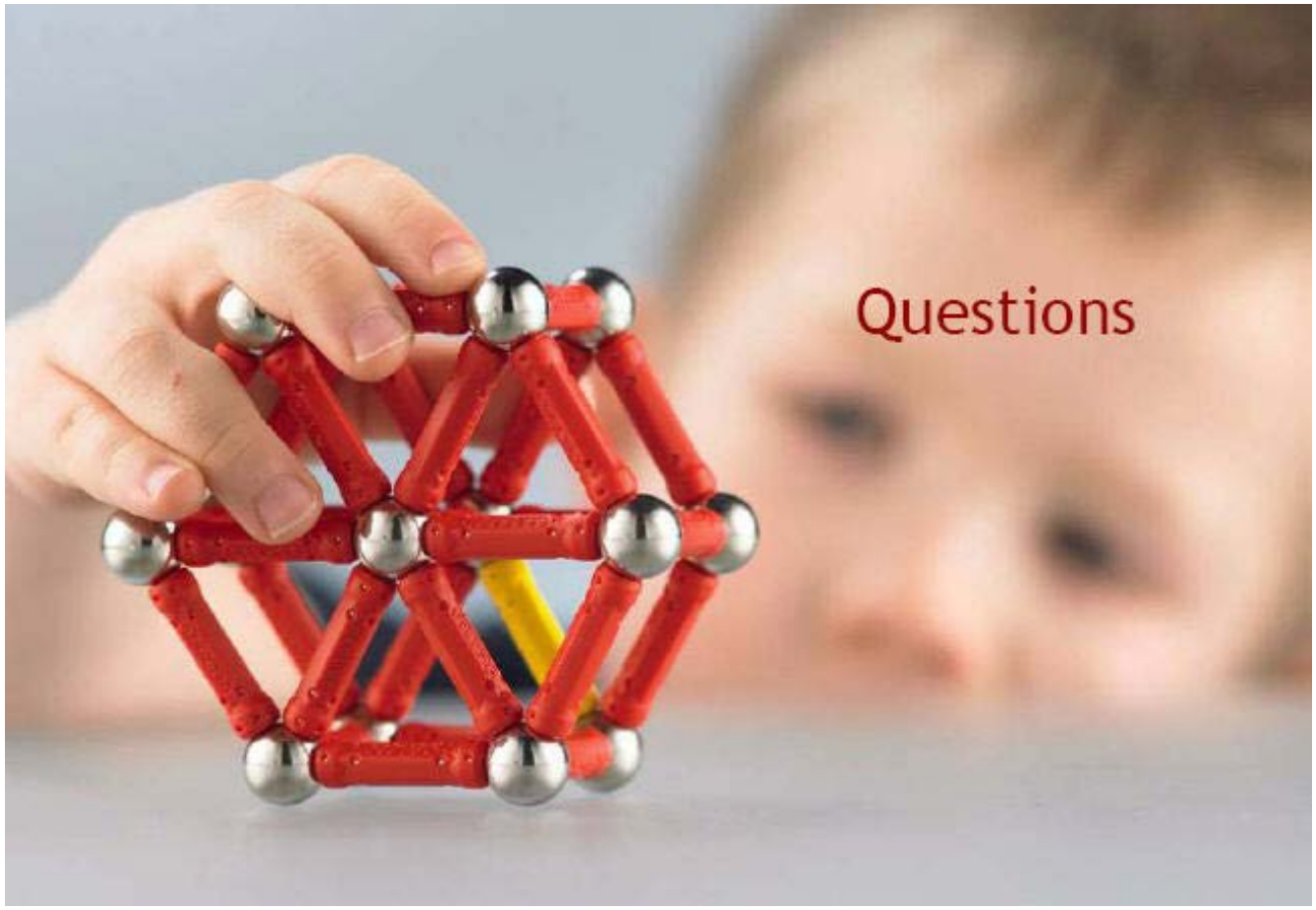
USGS LiDAR Data Coverage




Questions