

The following was presented at DMT'12  
(May 20-23, 2012).

The contents are provisional and will be  
superseded by a paper in the  
DMT'12 Proceedings.

See also earlier Proceedings (1997-2011)

<http://ngmdb.usgs.gov/info/dmt/>

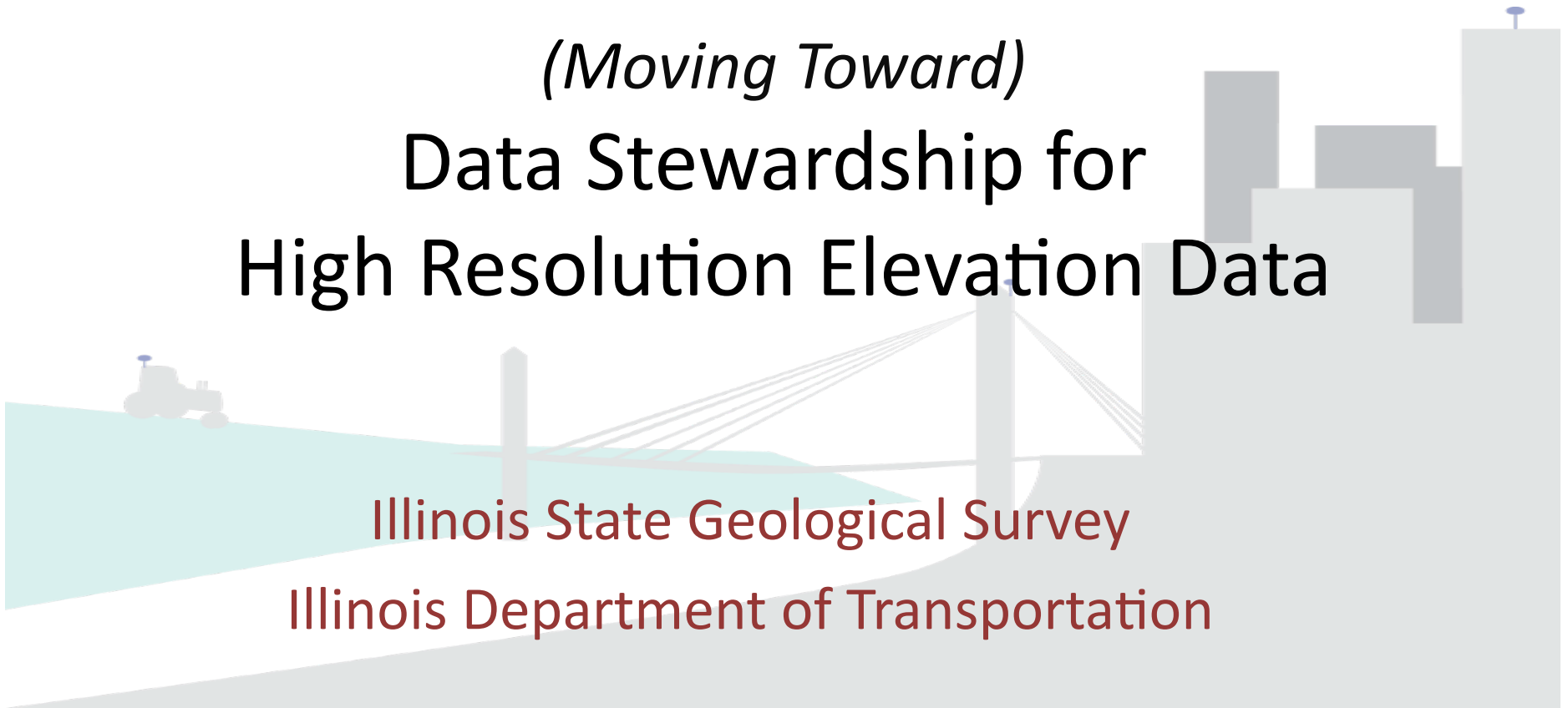
# Illinois Height Modernization Program

*(Moving Toward)*

## Data Stewardship for High Resolution Elevation Data

Illinois State Geological Survey

Illinois Department of Transportation

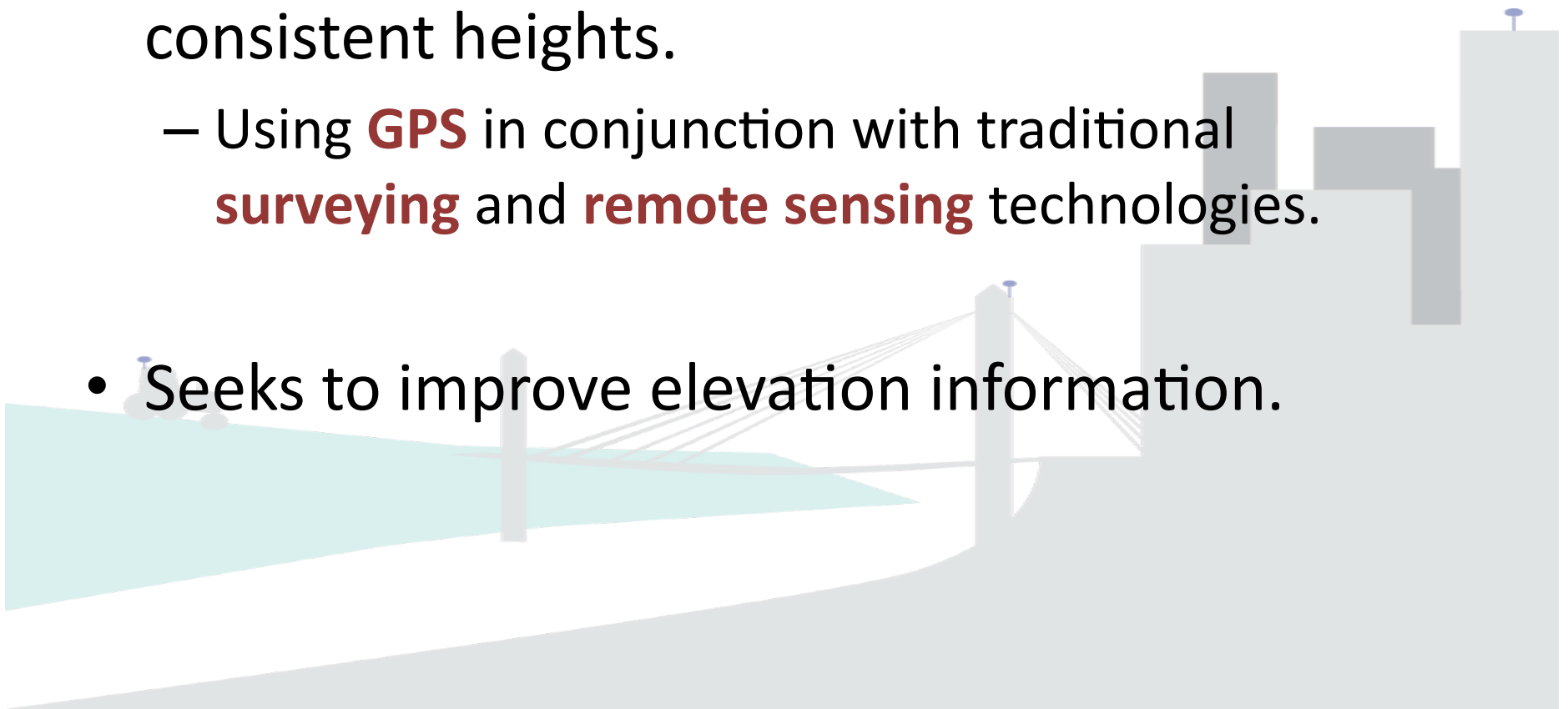


# Data Curation

- Actions performed to maintain and utilize data and research results for current and future generations.
  - Sustain current state of knowledge for a research area.
- *Joint Information Systems Committee (JISC) Circular 6/03.*  
<http://www.dcc.ac.uk/docs/6-03Circular.pdf>

# National Height Modernization Program

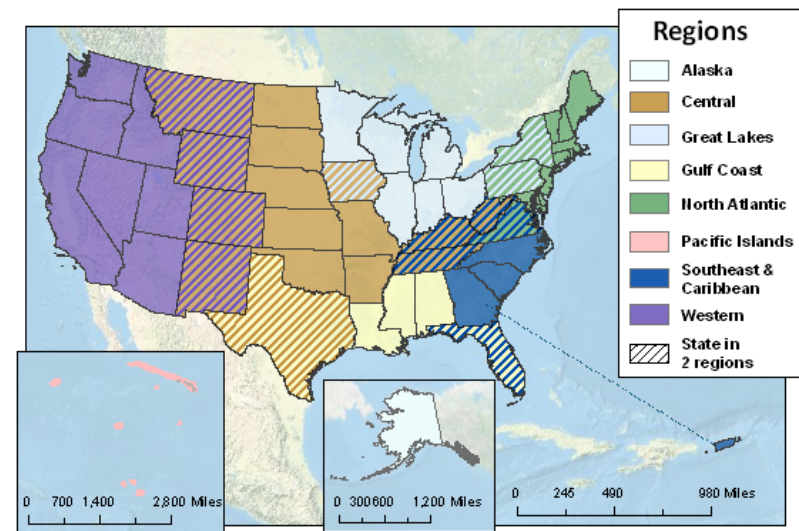
- The National Height Modernization Program enables access to accurate, reliable, and consistent heights.
  - Using **GPS** in conjunction with traditional **surveying** and **remote sensing** technologies.
- Seeks to improve elevation information.





# National Height Modernization Program

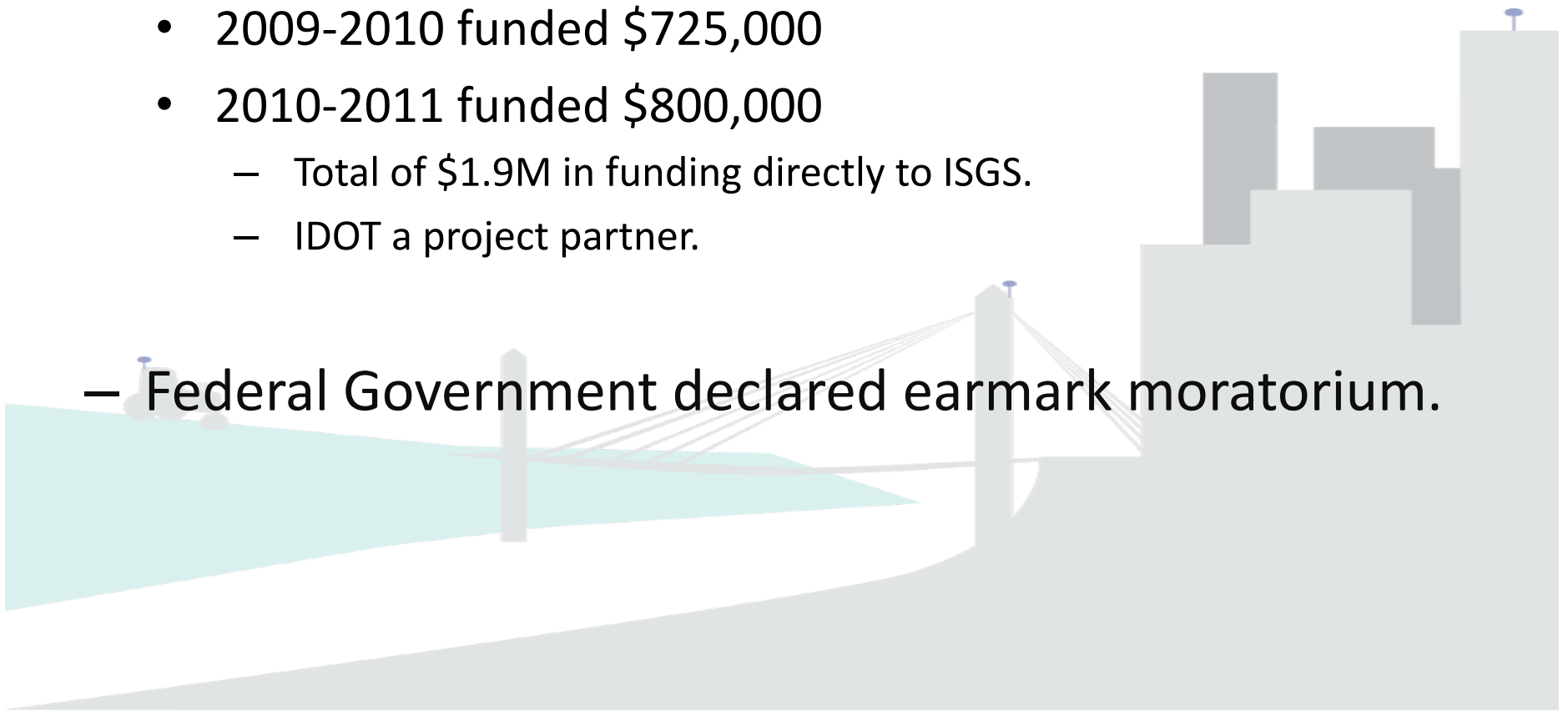
- National Geodetic Survey (NGS), NOAA
  - Regional collaboration.
  - Great Lakes region holds meetings Spring and Fall.
  - Commonly led by DOTs
- Common efforts include:
  - Continuously Operating Reference Station (CORS)
    - Real-Time Network (RTN)
  - Geodetic Leveling to set new survey monuments
  - LiDAR and derivative elevation data



# Illinois Height Modernization

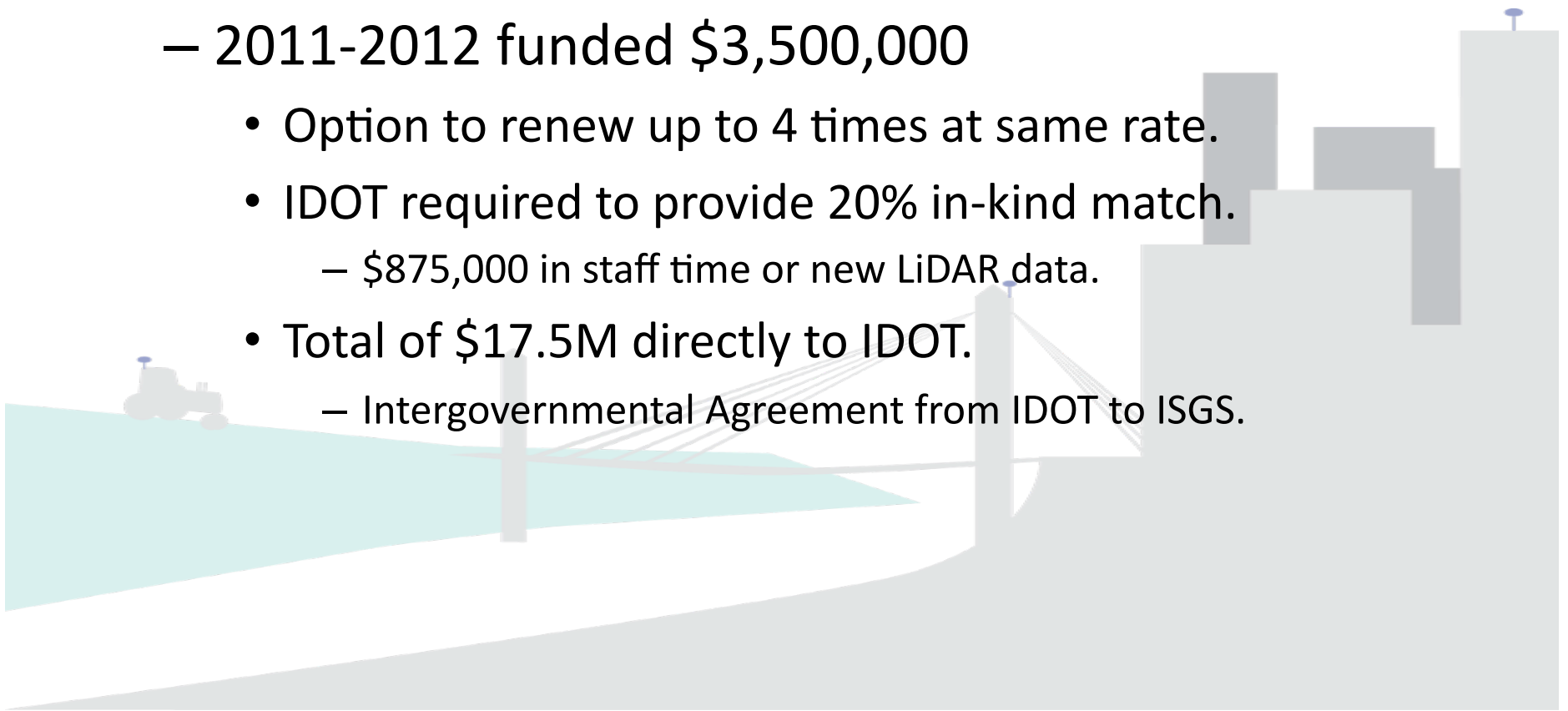
- Years 1-3: funded by federal appropriations.
  - 2008-2009 funded \$300,000
  - 2009-2010 funded \$725,000
  - 2010-2011 funded \$800,000
    - Total of \$1.9M in funding directly to ISGS.
    - IDOT a project partner.

– Federal Government declared earmark moratorium.



# Illinois Height Modernization

- Year 4: Federal Highway Administration, State Planning and Research (SPR) Program.
  - 2011-2012 funded \$3,500,000
    - Option to renew up to 4 times at same rate.
    - IDOT required to provide 20% in-kind match.
      - \$875,000 in staff time or new LiDAR data.
    - Total of \$17.5M directly to IDOT.
      - Intergovernmental Agreement from IDOT to ISGS.

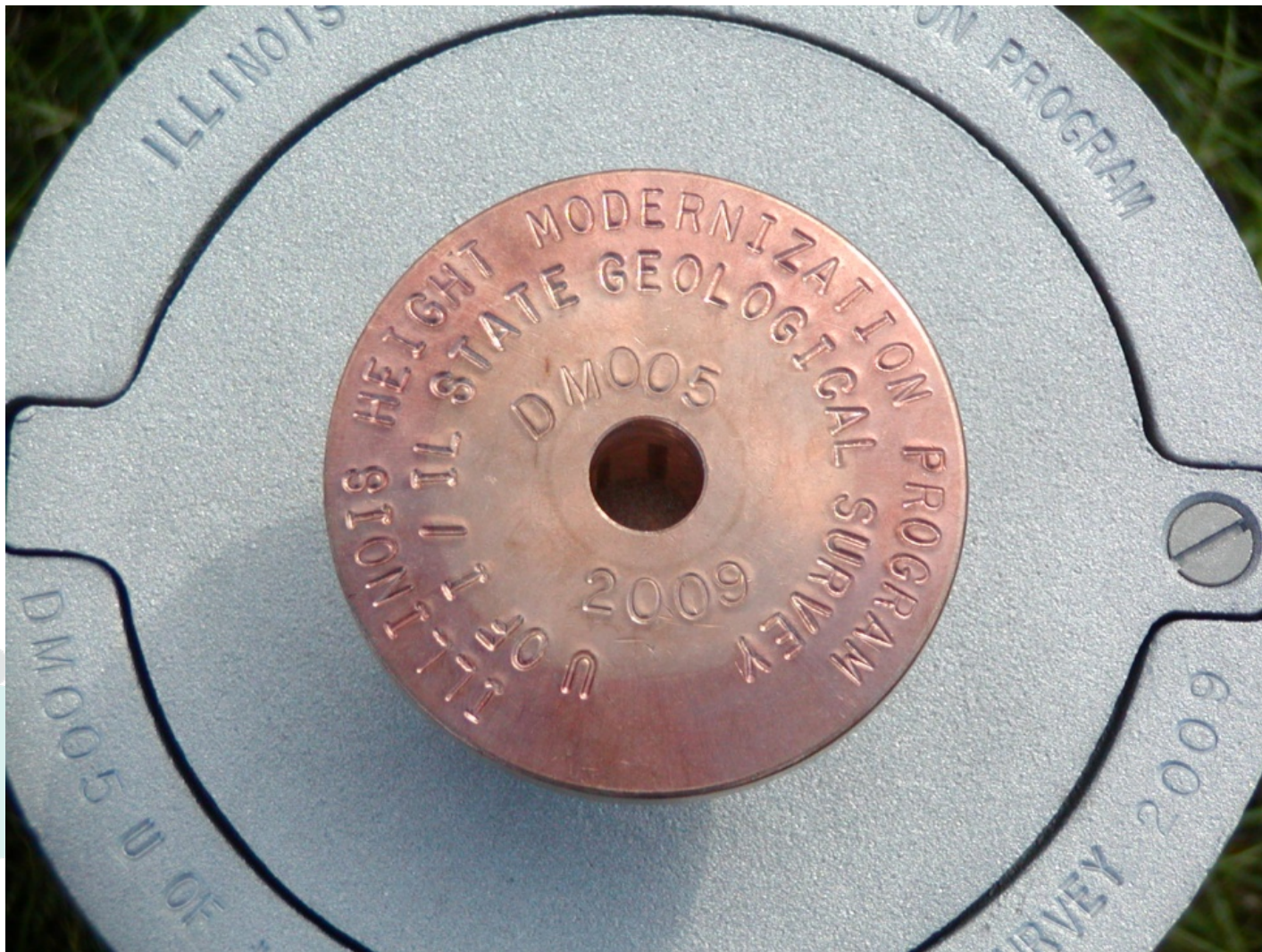


# ILHMP: Geodetic Leveling





# ILHMP: Geodetic Leveling



# ILHMP: Geodetic Leveling





DATASHEETS - Mozilla Firefox

File Edit View History Bookmarks Tools Accessibility Help

http://www.ngs.noaa.gov/cgi-bin/ds\_mark.prl?PidBox=DM5640

McAfee SiteAdvisor

Reports Navigation Text Equivalents Scripting Style Validators Tools Keyboard Options

The Illinois Natural Resources ... DATASHEETS

## The NGS Data Sheet

See file [dsdata.txt](#) for more information about the datasheet.

```

DATABASE = NGSIDB , PROGRAM = datasheet95, VERSION = 7.87.4.2
1 National Geodetic Survey, Retrieval Date = NOVEMBER 10, 2011
DM5640 *****
DM5640 DESIGNATION - MB006
DM5640 PID - DMS640
DM5640 STATE/COUNTY- IL/MCHENRY
DM5640 USGS QUAD - HARVARD (1975)
DM5640
DM5640 *CURRENT SURVEY CONTROL
DM5640
DM5640* NAD 83(1986)- 42 26 50.01 (N) 088 36 18.31 (W) HD_HOLD1
DM5640* NAVD 88 - 292.172 (meters) 958.57 (feet) ADJUSTED
DM5640
DM5640 GEOID HEIGHT- -33.87 (meters) GEOID09
DM5640 DYNAMIC HT - 292.075 (meters) 958.25 (feet) COMP
DM5640 MODELED GRAV- 980,282.4 (mgal) NAVD 88
DM5640
DM5640 VERT ORDER - SECOND CLASS I
DM5640
DM5640.The horizontal coordinates were established by differentially corrected
DM5640.hand held GPS obs and have an estimated accuracy of +/- 3 meters.
DM5640
DM5640.The orthometric height was determined by differential leveling and
DM5640.adjusted in April 2011.
DM5640
DM5640.The geoid height was determined by GEOID09.
DM5640
DM5640.The dynamic height is computed by dividing the NAVD 88
DM5640.geopotential number by the normal gravity value computed on the
DM5640.Geodetic Reference System of 1980 (GRS 80) ellipsoid at 45
DM5640.degrees latitude (g = 980.6199 gals.).
DM5640
DM5640.The modeled gravity was interpolated from observed gravity values.
DM5640
DM5640; North East Units Estimated Accuracy
DM5640;SFC IL E - 641,813.8 277,644.0 MI (+/- 3 meters HHI GPS)
DM5640
DM5640 SUPERSEDED SURVEY CONTROL
DM5640
DM5640.No superseded survey control is available for this station.
DM5640
DM5640 U.S. NATIONAL GRID SPATIAL ADDRESS: 16TGN609300601 (NAD 83)
DM5640 MARKER: F = FLANGE-ENCASED ROD
DM5640_SETTING: 59 = STAINLESS STEEL ROD IN SLEEVE (10 FT.+)
DM5640_STAMPING: MB006
DM5640_MARK LOGO: ILGEO
DM5640_PROJECTION: FLUSH
DM5640_MAGNETIC: I = MARKER IS A STEEL ROD
DM5640_STABILITY: B = PROBABLY HOLD POSITION/ELEVATION WELL
DM5640_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DM5640+SATELLITE: SATELLITE OBSERVATIONS - June 24, 2010

```

```






DM5640_SATELLITE: THE SITE LOCATION WAS REPORTED AS SUITABLE FOR
DM5640+SATELLITE: SATELLITE OBSERVATIONS - June 24, 2010
DM5640_ROD/PIPE-DEPTH: 4.8 meters
DM5640_SLEEVE-DEPTH : 0.9 meters
DM5640
DM5640 HISTORY - Date Condition Report By
DM5640 HISTORY - 20100624 MONUMENTED TROTT
DM5640
DM5640 STATION DESCRIPTION
DM5640
DM5640'DESCRIBED BY TROTTER AND ASSOCIATES 2010 (JMM)
DM5640'STATION IS LOCATED APPROXIMATELY 1.8 MI (2.9 KM) NORTH OF HARVARD.
DM5640'
DM5640'TO REACH FROM THE INTERSECTION OF IL RIGHT 173 (DIGGINS ST) AND US 14
DM5640'(DIVISION ST), PROCEED NORTH ON US 14 FOR 1.8 MI (2.9 KM) TO THE
DM5640'STATION ON THE LEFT.
DM5640'
DM5640'IT IS 38.2 FT (11.6 M) WEST OF CENTER LINE OF US 14, 0.2 MI (0.3 KM)
DM5640'NORTH OF CROWLEY ROAD, 92.0 FT (28.0 M) WEST OF POWER POLE, 173.0 FT
DM5640'(52.7 M) NORTHWEST OF POWER POLE AND 329.0 FT (100.3 M) NORTH OF
DM5640'AGGREGATE FIELD ENTRANCE.
DM5640'
DM5640'NOTE-A ROD WITH A FLOATING BRASS DISK IN PVC SLEEVE WITH LOGO CODE
DM5640'ILLINOIS HEIGHT MODERNIZATION U OF I/ISGS.
DM5640
*** retrieval complete.
Elapsed Time = 00:00:01

```

Done

# Level Line Status for Illinois

February 2012

-  Year 1 - 2009
-  Year 2 - 2010
-  Year 3 - 2011
-  Year 4 - 2012
-  IDOT Districts

**Additional information:**  
Sheena Beaverson  
217-244-9306  
sbeavers@illinois.edu



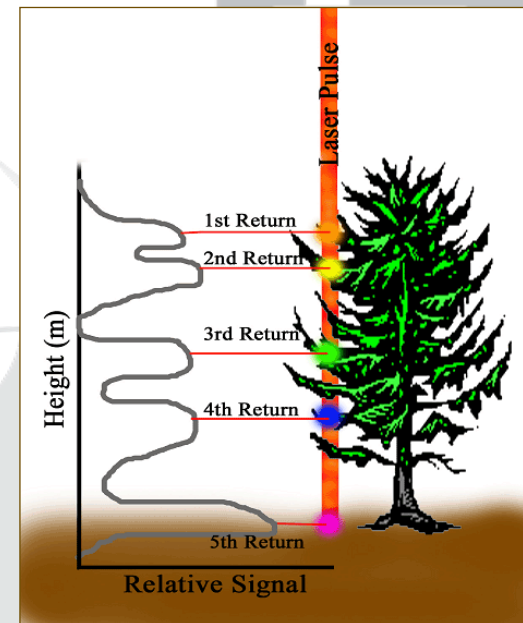
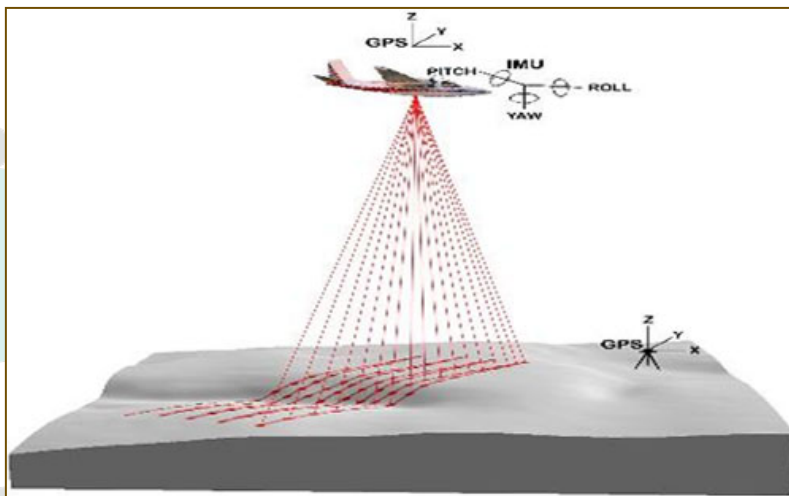
For access to Level Line data please visit the  
**Illinois Height Modernization Program**

[www.igs.illinois.edu/nsdihome/webdocs/ilhmp/](http://www.igs.illinois.edu/nsdihome/webdocs/ilhmp/)  
or search for "ILHMP" on Google

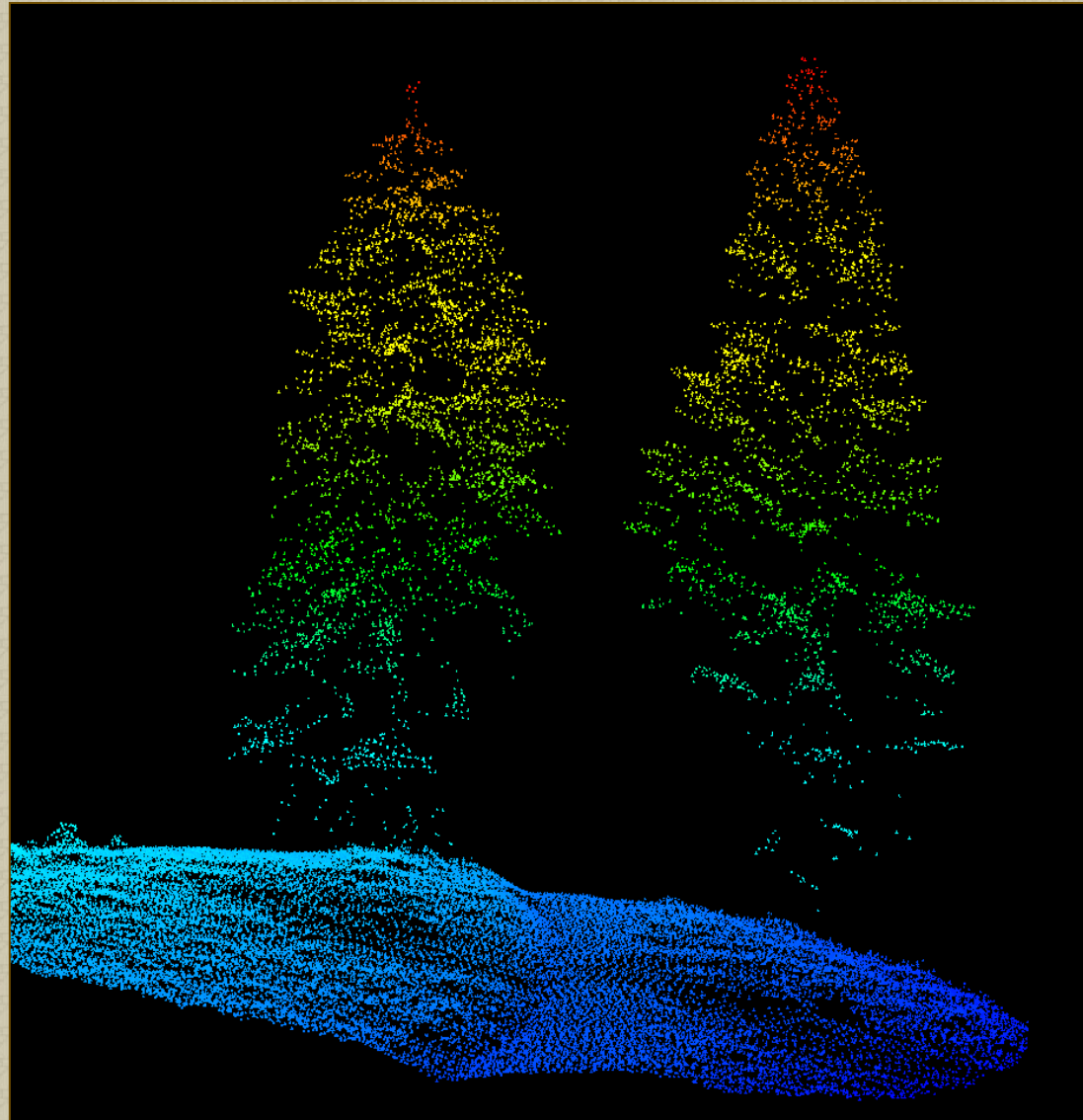


# Light Detection and Ranging

- Light Detection and Ranging (LiDAR) data
  - Reflected light pulses are detected by instruments that record location information in 3 dimensions.
  - A single pulse of light can be reflected back to the instruments multiple times.

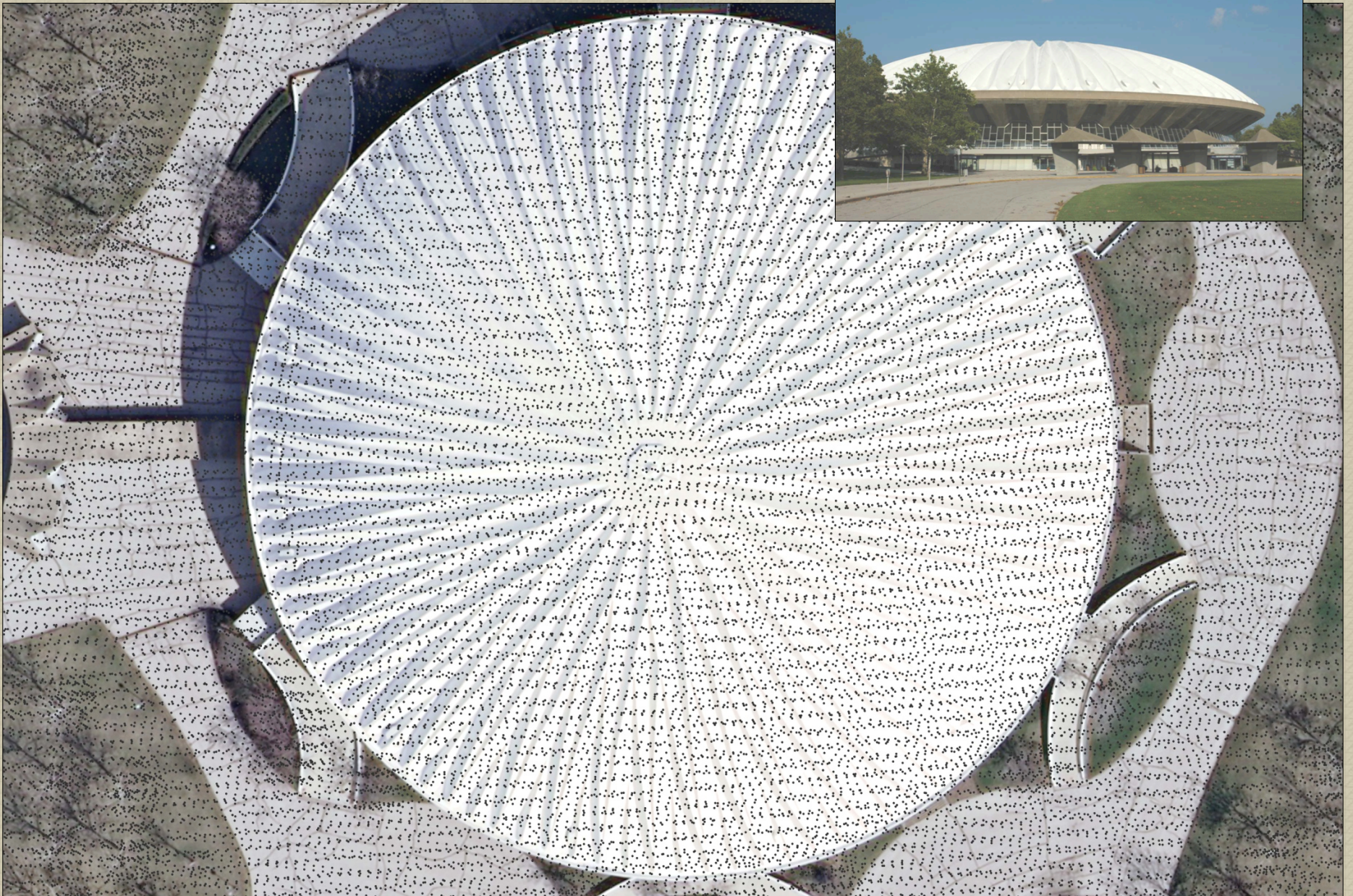
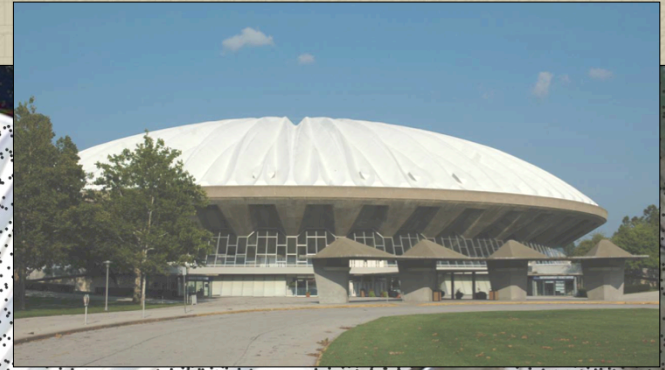


## LiDAR All Returns Point Cloud





# Lidar First Returns Point Cloud (3½' grc)



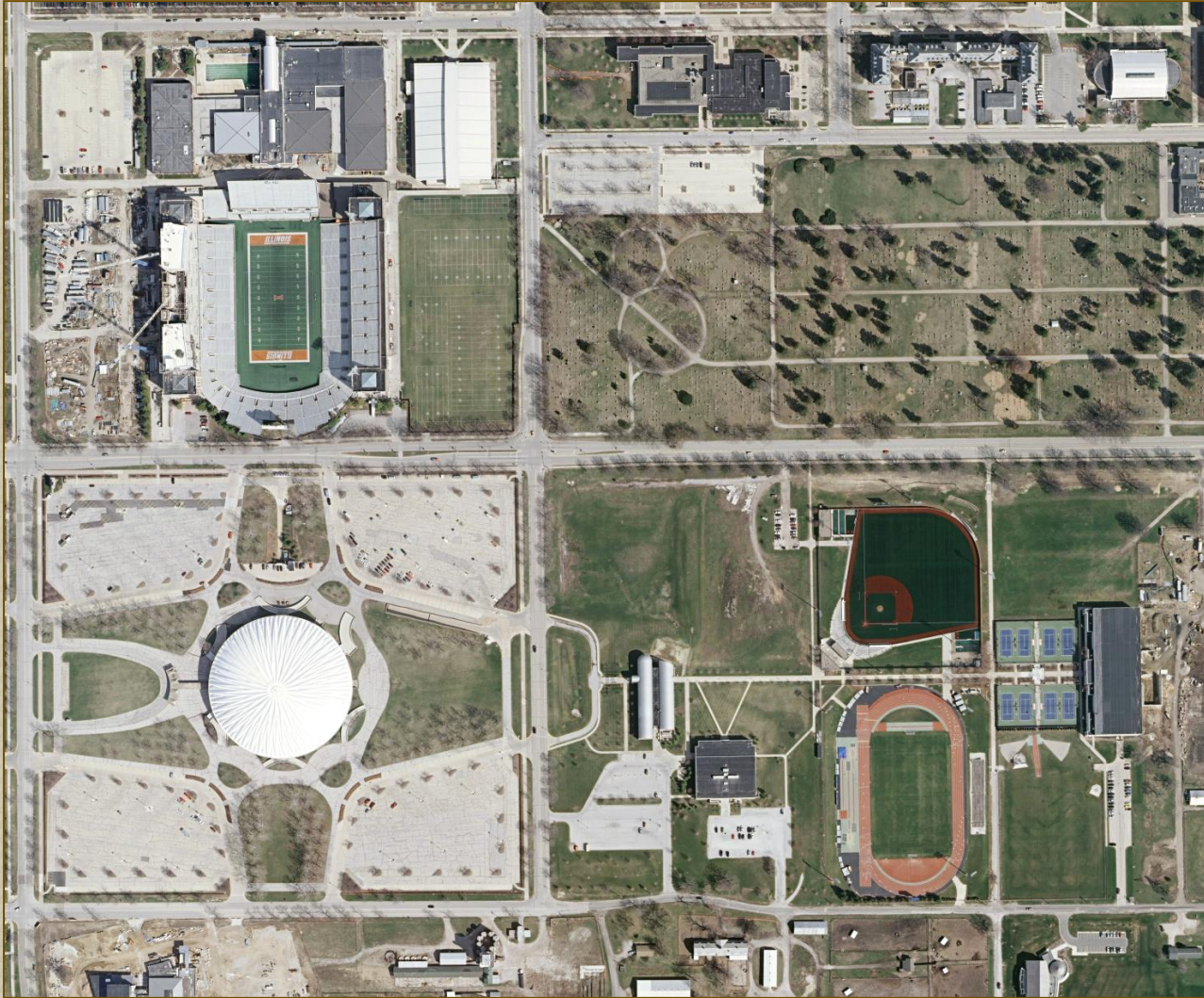


**Lidar Last Returns Filtered to Bare Earth Point Cloud (3½' grc)**



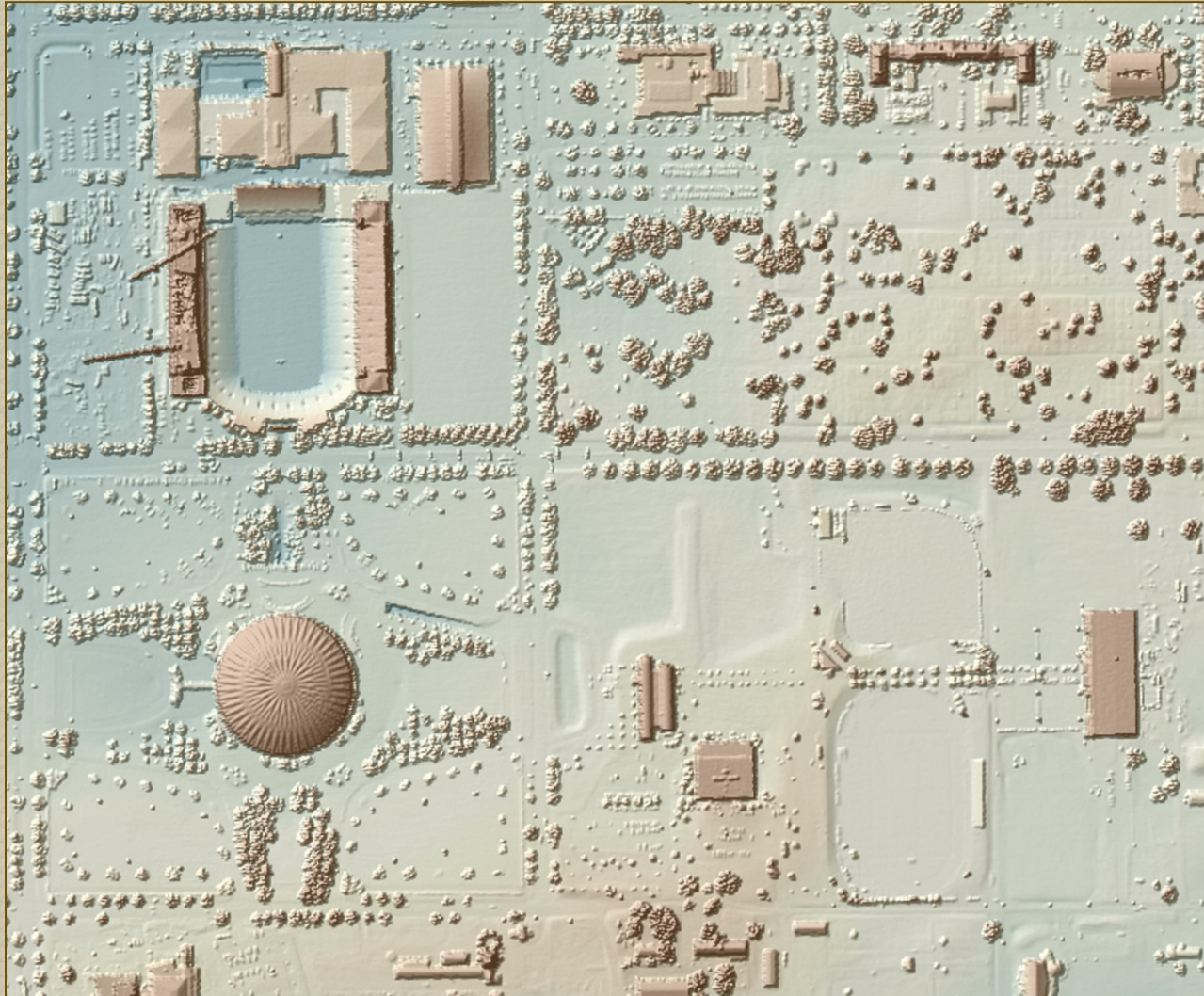


# 2008 Color Digital Orthophotography



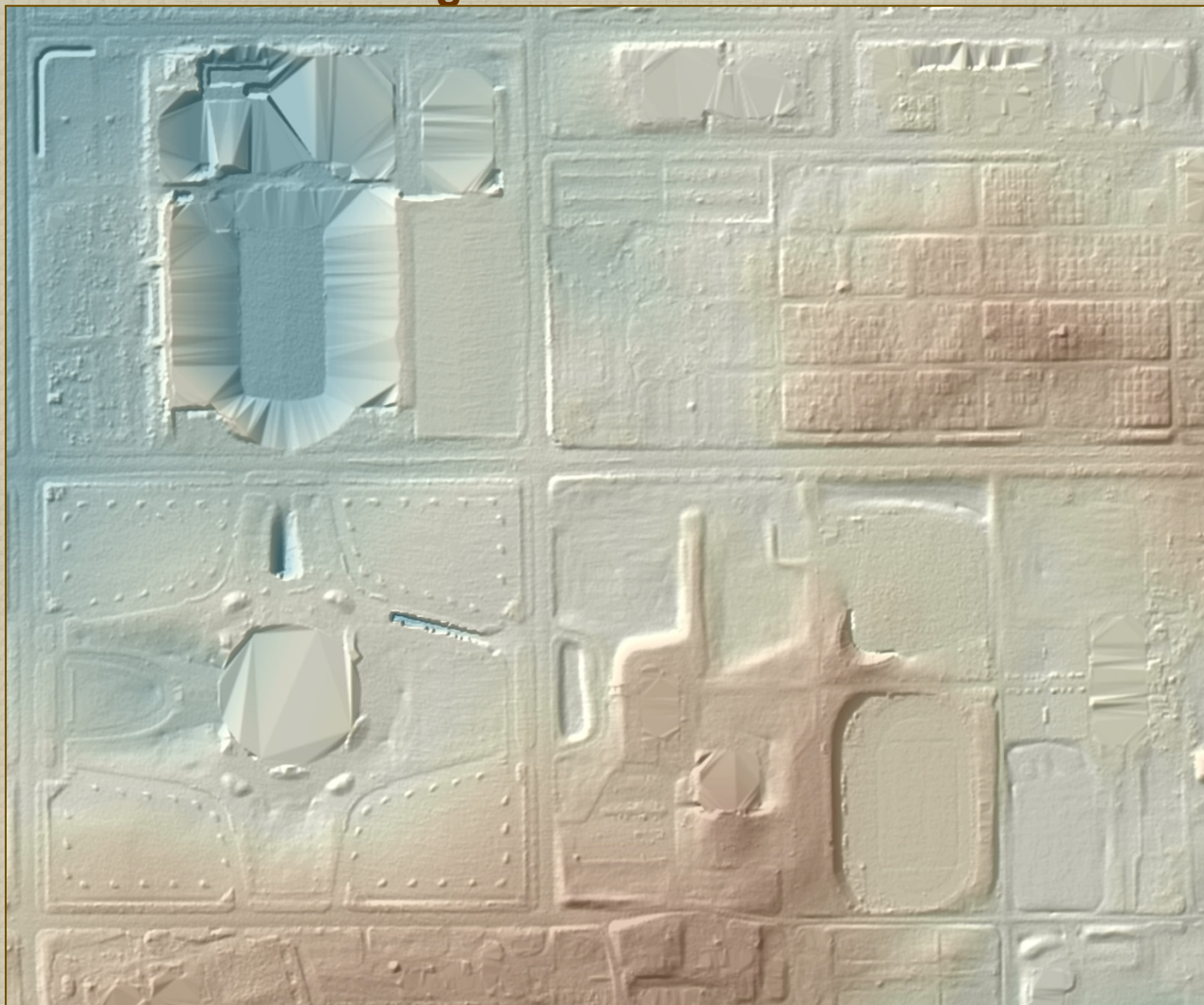


## 2008 Lidar First Returns Point Cloud Digital Surface Model





**2008 Lidar Last Returns Filtered to Bare Earth Point  
Cloud  
Digital Surface Model**



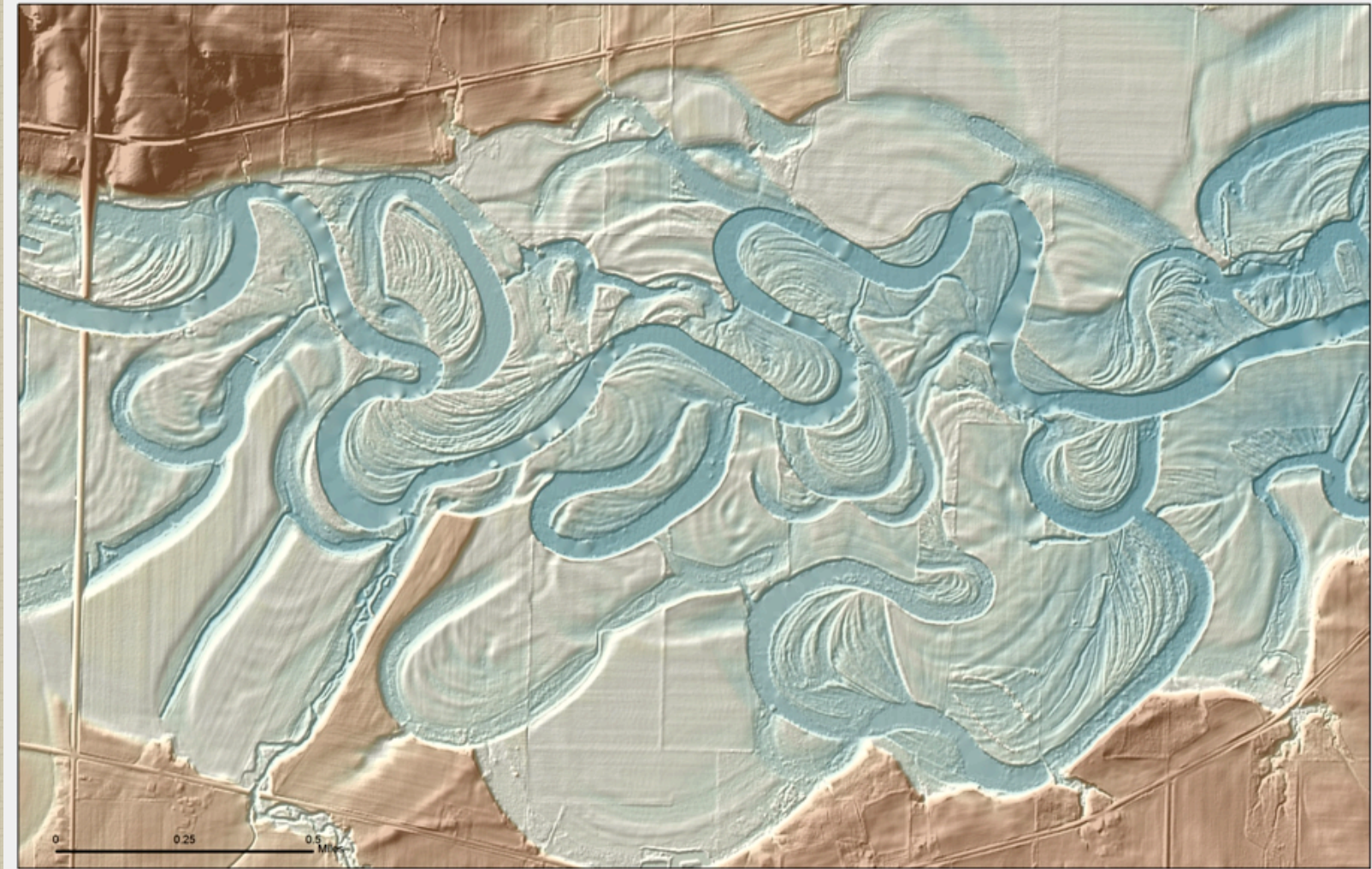


# USGS Elevation Data compared to Lidar Enhanced Elevation Data





USGS 30 Meter DEM  
Pecatonica River, Winnebago County IL

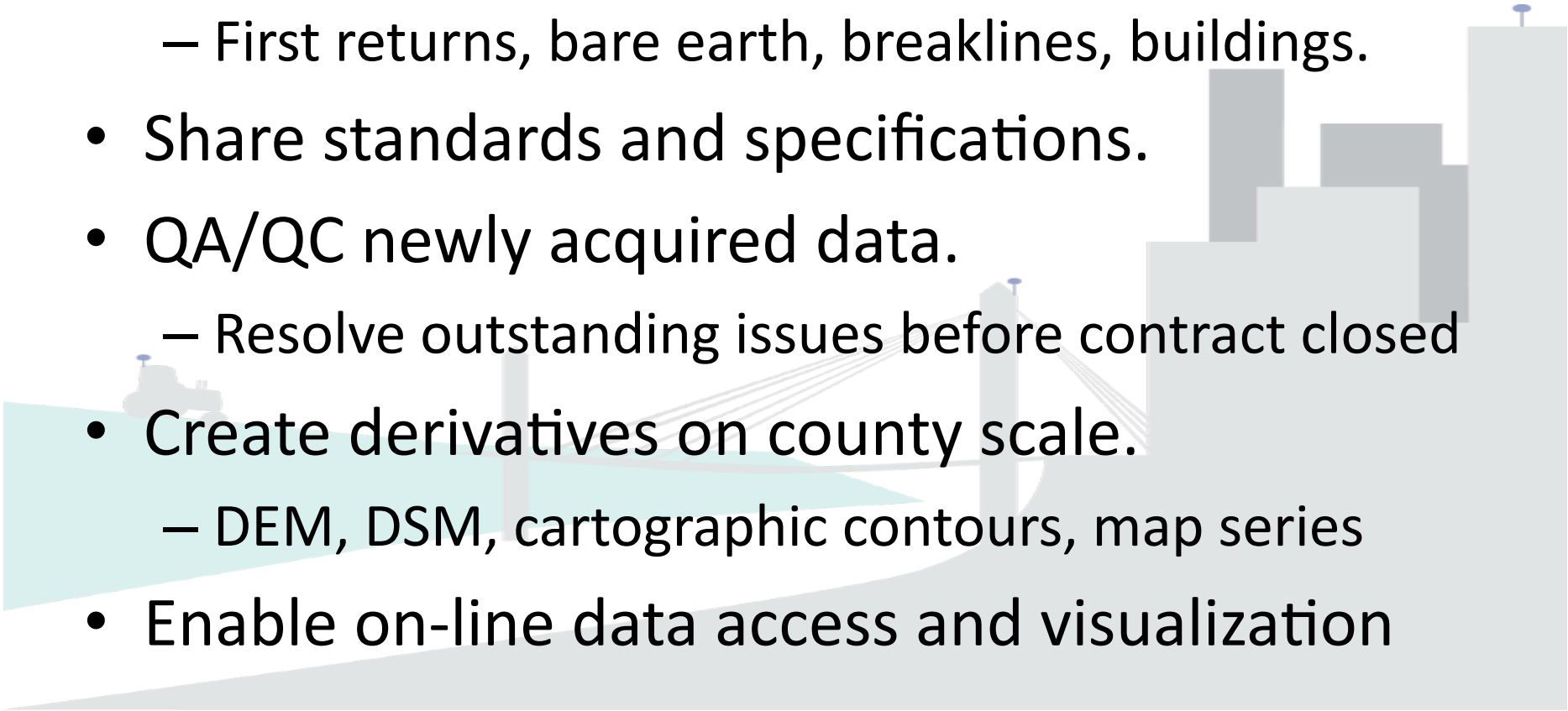


# Preservation of Digital Data

- What does “Preserve Data” mean?
  - Sustainable funding for costs.
  - Policies and standards.
  - Assessing data integrity.
  - Establish and maintain access.
  - Risk assessment and disaster planning.

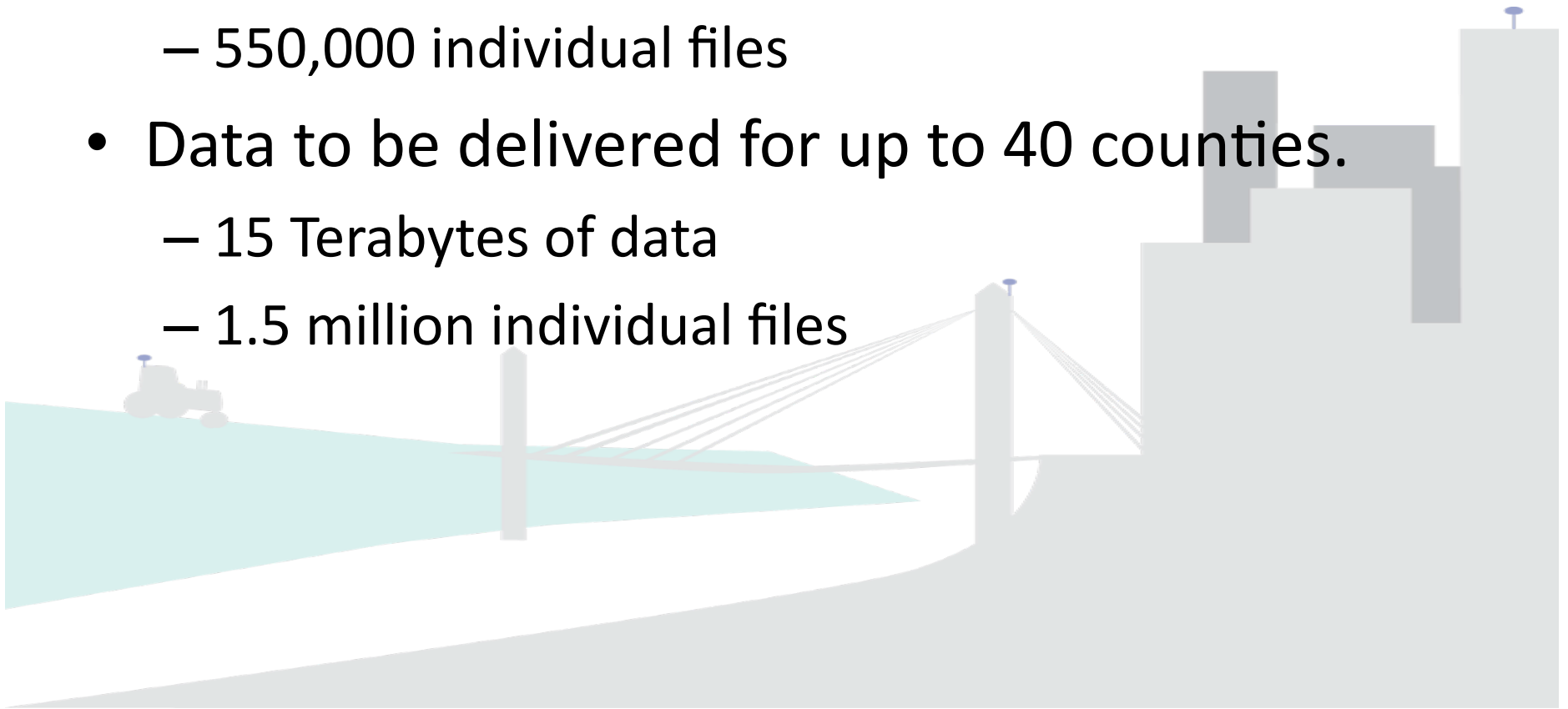


# ILHMP LiDAR: Project Goals

- Acquire, or establish data sharing agreements for, LiDAR and derivative elevation data.
    - First returns, bare earth, breaklines, buildings.
  - Share standards and specifications.
  - QA/QC newly acquired data.
    - Resolve outstanding issues before contract closed
  - Create derivatives on county scale.
    - DEM, DSM, cartographic contours, map series
  - Enable on-line data access and visualization
- 

# ILHMP LiDAR Data

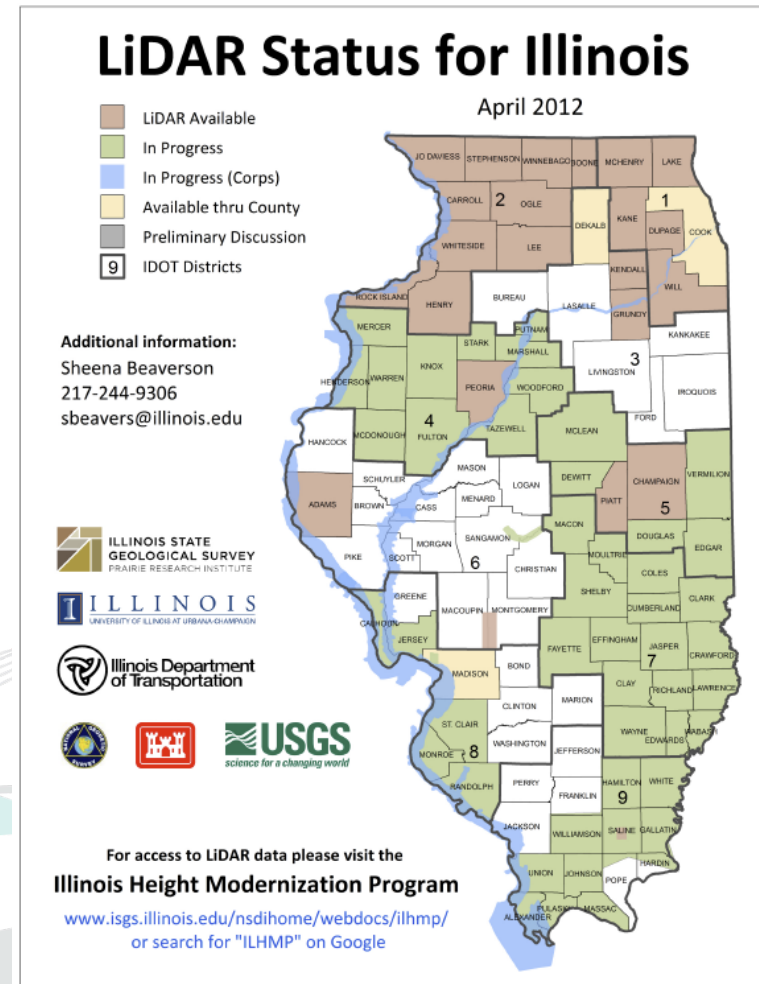
- Data for 22+ counties
  - 5 Terabytes of data
  - 550,000 individual files
- Data to be delivered for up to 40 counties.
  - 15 Terabytes of data
  - 1.5 million individual files





# ILHMP LiDAR Data

- LiDAR exist for brown, yellow counties.
- LiDAR contracted for green counties and river corridors.

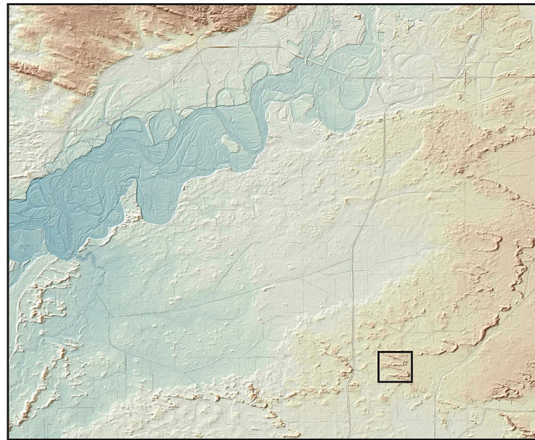


# Illinois Height Modernization Program

## LiDAR Data Applications

### Morphology of Dune Complexes

Xiaodong Miao and Donald E. Luman

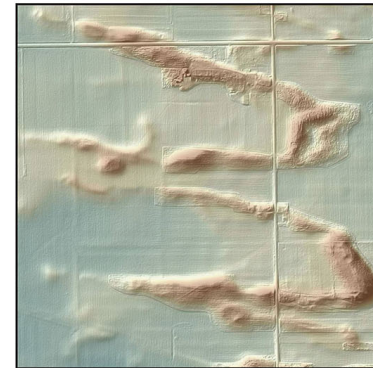


1) 2009 LiDAR elevation image of central Whiteside County.

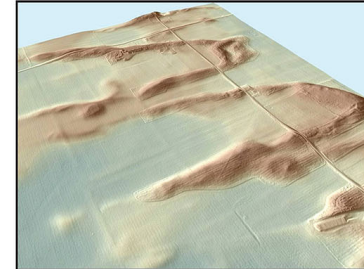
#### Whiteside County, Illinois

Sand dunes are a particularly prominent landform feature within the Green River Lowland of Whiteside County. Formed by wind action, most dunes have parabolic, compound parabolic, transverse, or dome forms, and are stabilized by vegetation cover under the current climate regime. Dune orientation and internal cross-bedding structure consistently indicate that winds from the northwest and west were responsible for dune construction, similar to the current prevailing wind direction in this region. Optically stimulated luminescence ages (OSL or optical ages) indicate that major dune construction in the Green River Lowland occurred around 17,000 to 18,000 years ago. Dune sand is highly valued by industry, mostly for use in foundries for making high-quality metal castings.

Figure 1 is a color relief image produced from 2009 LiDAR elevation data showing a portion of the dune complex extending twenty miles along the Green River. Dune height in the region ranges from a few feet to nearly forty feet. Figures 2-3 are



2) Close-up of two prominent parabolic dunes.



3) Perspective view of the two dunes.

close-up images of two large parabolic dunes, both of which have a horizontal extent of  $\frac{3}{4}$  mile. The dune situated on the lower half of the image has a maximum height of thirty-five feet above the surrounding ground surface. The exceptional horizontal resolution ( $\sim 3$  ft.) and vertical resolution ( $\sim 1$  ft.) of LiDAR elevation data makes it ideal for examining the morphology of these dunes, which have heretofore not been mapped in this detail.

#### For Additional Information:

[www.isgs.uiuc.edu/maps-data-pub/county-maps/bureau-co.shtml](http://www.isgs.uiuc.edu/maps-data-pub/county-maps/bureau-co.shtml)

# Height Modernization

- ESRI International User Conference
  - National Geodetic Survey and Multi-State Map Gallery Display. Monday July 23, 2012.

