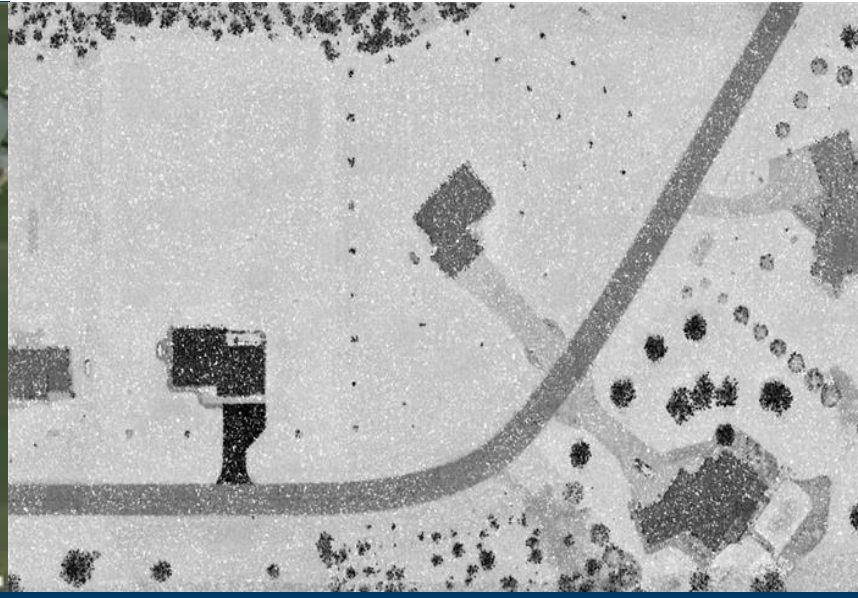




3DGeo Stakeholder Coordination: MN Lidar Plan

Call to Action: *Bringing New High-Density Lidar and Derived Products to Minnesota River East and West LABs & USGS 3DEP Grant Application Discussion*

Thursday, August 24, 2022, 10:00 – 11:30

MINNESOTA GEOSPATIAL ADVISORY COUNCIL

Gerry Sjerven	(MN Power)
Sean Vaughn	(MNIT DNR)
Colin Lee	(MnDOT)
Jennifer Corcoran	(DNR Forestry)
Alison Slaats	(MnGeo, CGIO)

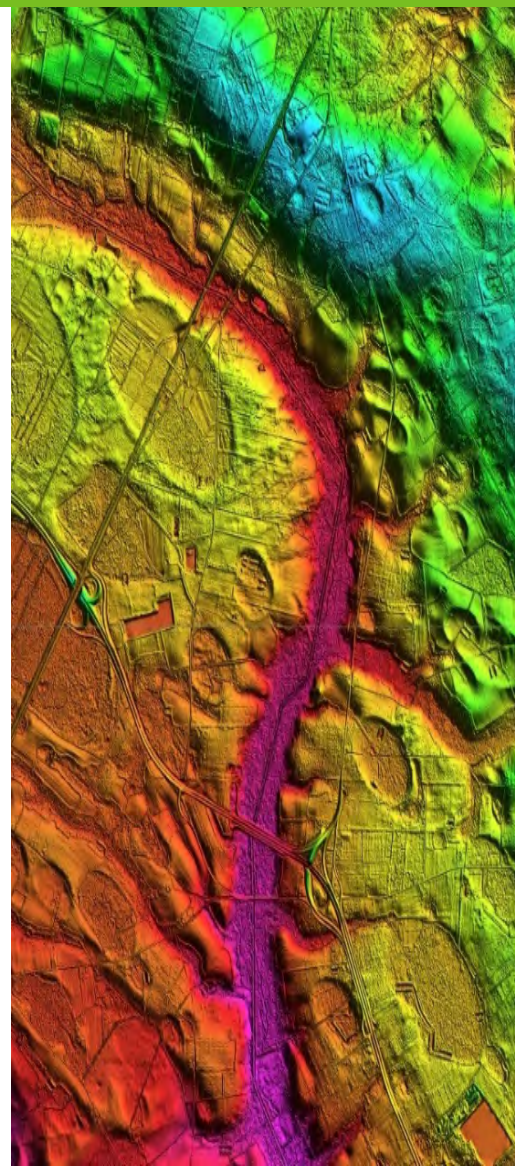
Welcome & Meeting Housekeeping

- Please **mute** your microphone if you're not speaking
- This meeting will be recorded.
  - The recording and presentation slides will be shared after the meeting
- Type in questions into the **chat window**, and we'll address them during the Q&A section

Welcome!

Thank you for joining us today

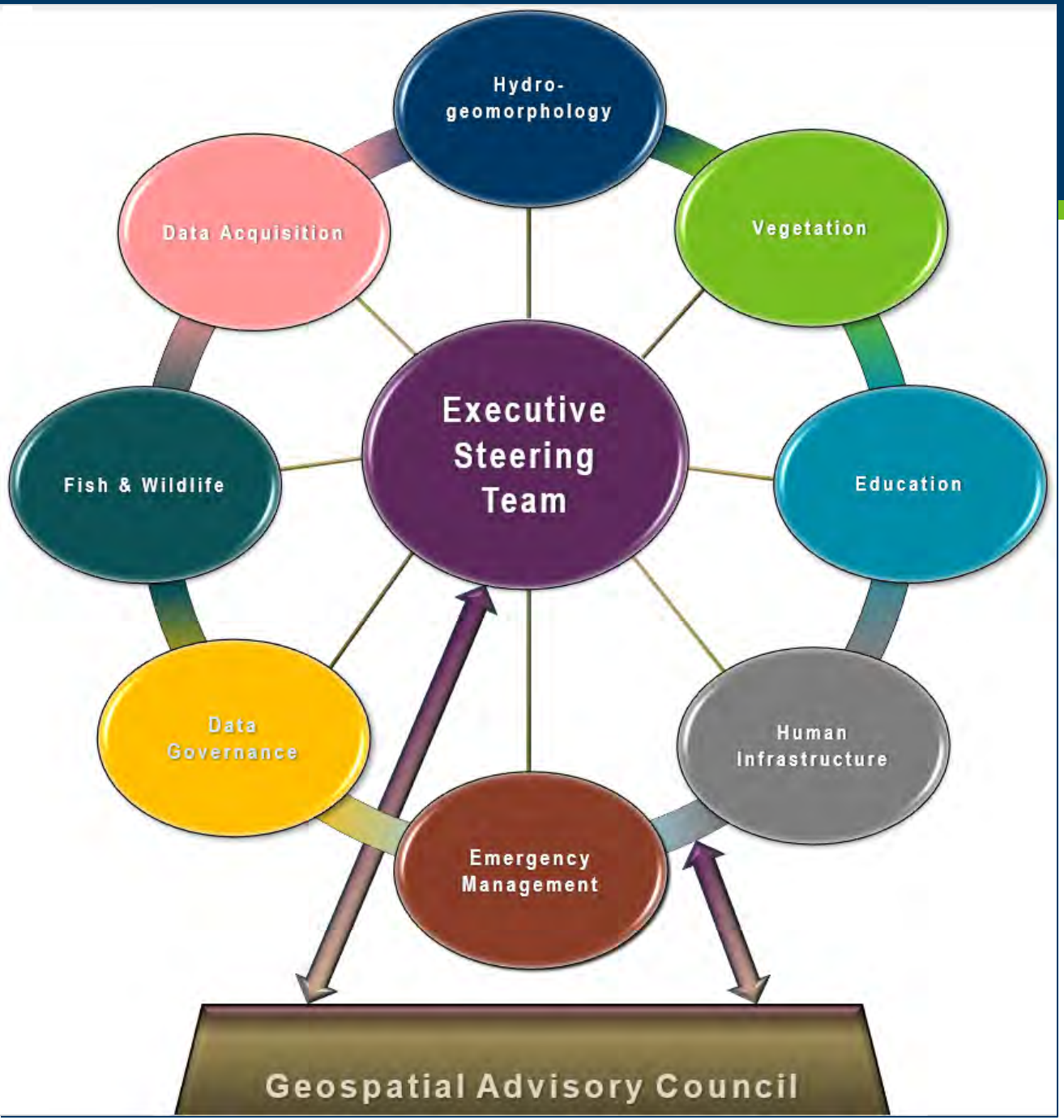
- We are excited to meet with you today to discuss lidar acquisition planning efforts in the Minnesota River Watershed Lidar Acquisition Blocks (LAB)
  - MN River West LAB
  - MN River East LAB
- Past 3DGeo Outreach in these LABs
  1. Tuesday, August 25, 2020 – Southern MN
  2. Wednesday, October 7, 2020 – Southern MN
  3. Tuesday, May 25, 2021 - 2:00 – 3:30 – Southern MN
  4. Tuesday June 15th, 2021 - 10:00 – 10:30 - Steven's County
  5. Friday, July 15, 2022, 11:15 – 12:15 – MN River East LAB - GBERBA



Topics for today

- Introduce the Minnesota **Lidar Plan** and **3D Geomatics Committee**
- Introduce the USGS 3D Elevation Program (**3DEP**) = funding opportunity
- Share Update on **status** of 3DGeo lidar acquisitions
- Provide **Awareness** – New Lidar Data is Coming to much of Minnesota
- A **Call to Action** - identify local champions and funding partners in the MN River - East and West LABs
- Provide time for **questions and discussion**

Coordinating Minnesota's Lidar Acquisition



Geospatial Advisory Council (GAC)
3D Geomatics Committee

Geospatial Advisory Council

- The Minnesota *Geospatial Advisory Council (GAC)* is the **coordinating body** for the Minnesota geospatial community.
- **Cross-section of organizations** that include counties, cities, universities, business, nonprofit organizations, federal and state agencies, tribal government, and other stakeholder groups.

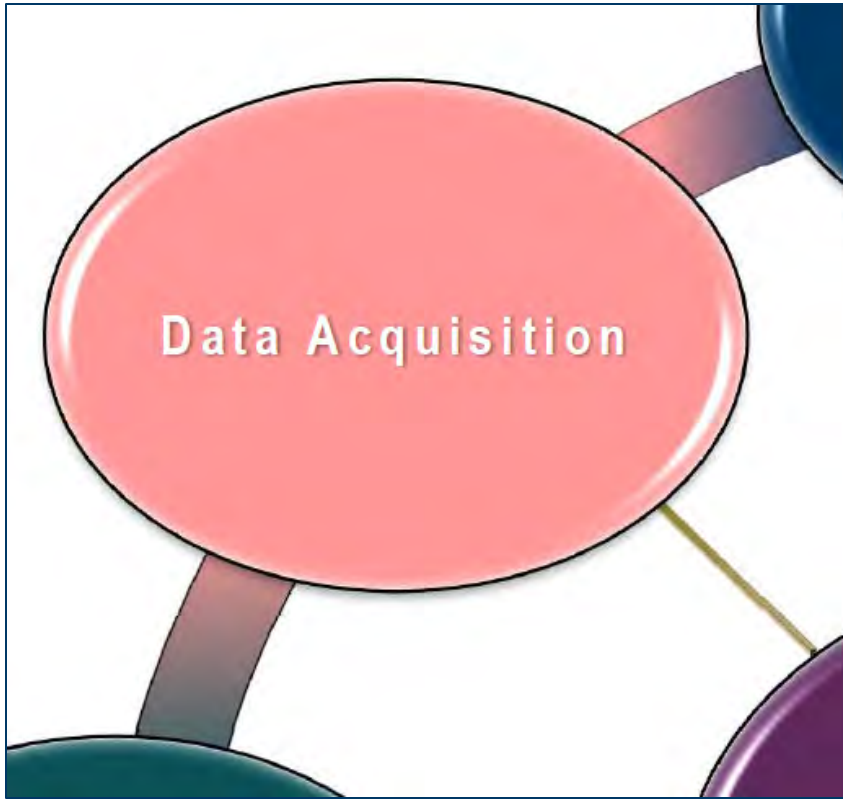
3D Geomatics Committee

- The ***3D Geomatics Committee*** (3DGeo) is a committee under GAC that works to identify and promote the need for planning, funding, acquisition, and management of three-dimensional geomatic data and derived products.

3DGeo - Data Acquisition Workgroup

Mission:

- The Data Acquisition Workgroup promotes procurement of foundational 3D data for Minnesota.

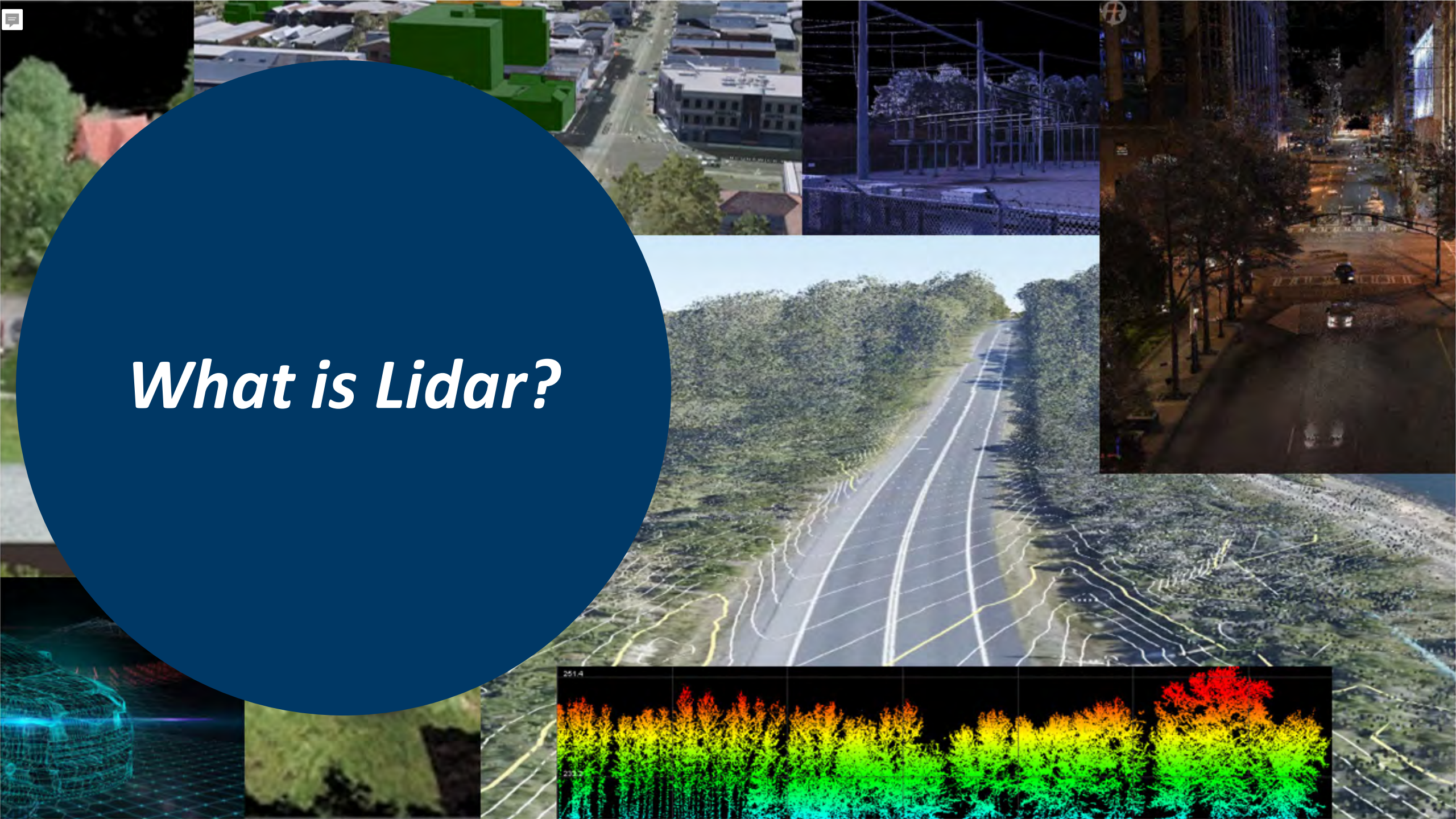


Co-Chairs

- Sean Vaughn, Alison Slaats, and Gerry Sjerven

Lidar Acquisition Subgroup:

- Alison Slaats (MnGeo), Sean Vaughn (MNIT DNR), Gerry Sjerven (MN Power), Dan Ross (NSGIC), Jennifer Corcoran (DNR), Colin Lee (MnDOT), Matt Baltes (NRCS), Joel Nelson (U of MN), Joe Sapletal (Dakota Co), Mark Reineke (Widseth), and Brandon Krumwiede (NOAA), Clint Little (DNR), Terry Zien (USACOE), Jeff Weiss (DNR).


What is Lidar?

What is lidar?

Lidar stands for light detection and ranging

- It is a **mapping technology** that uses a **pulsed laser** to measure the time it takes for emitted light to travel from a sensor to the ground or other objects and back.
- Some sensors can **pulse** laser beams towards earth's surface **millions** of times per second
- Millions of returns (**points**) are captured, resulting in a "**point cloud**" of three-dimensional measurements (x,y,z).

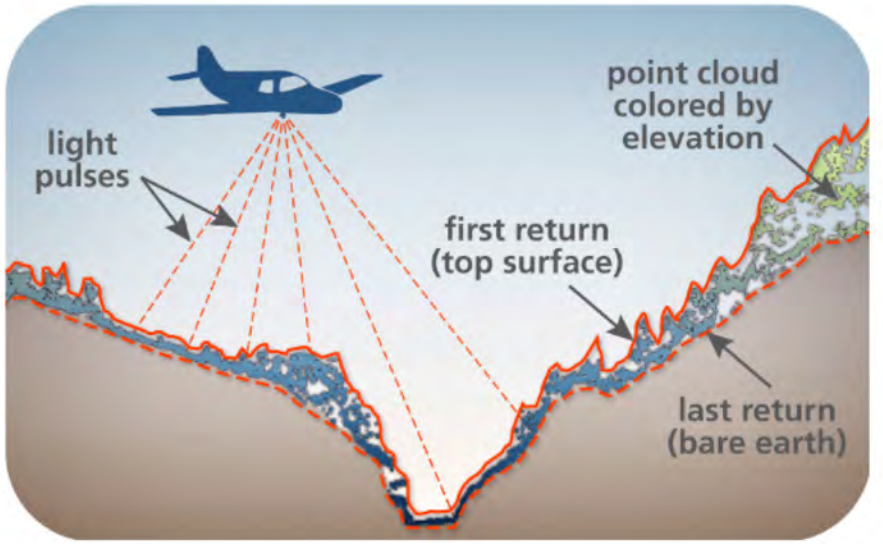
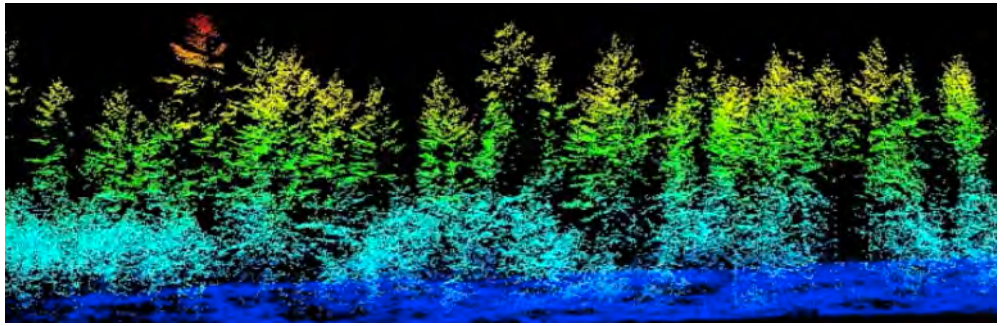


Image from the Washington Geological Survey



What is Lidar?

To Some Users Lidar Is:

- A 3D Point Cloud

To Some:

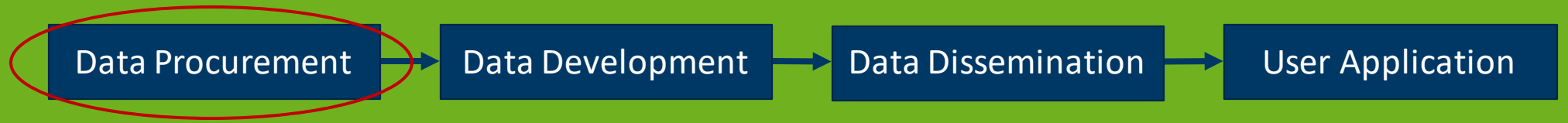
- Contours
- Digital Elevation Model (DEM)

Note: The two most downloaded authoritative lidar-derived products from MnTOPO are the 2-ft Contours and the DEM.

To Some:

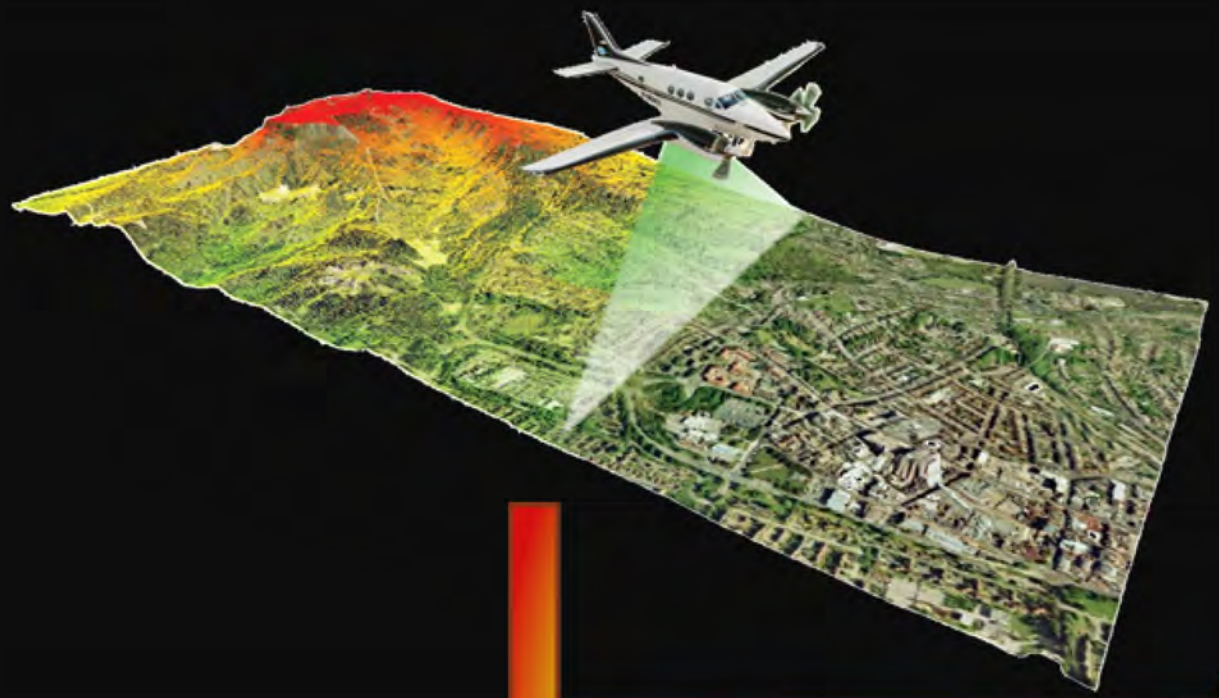
- Human/built infrastructure: Buildings
- Vegetation: Forests and Trees
- Intensity, Digital Surface Model (DSM)
- Hydro-modified DEM & Hydrography
- And many other products

Regardless what lidar is to you and your business needs, “lidar” begins with **collection of the lidar data** as part of a data procurement project, within a 3D Geomatics lidar acquisition block (LAB).



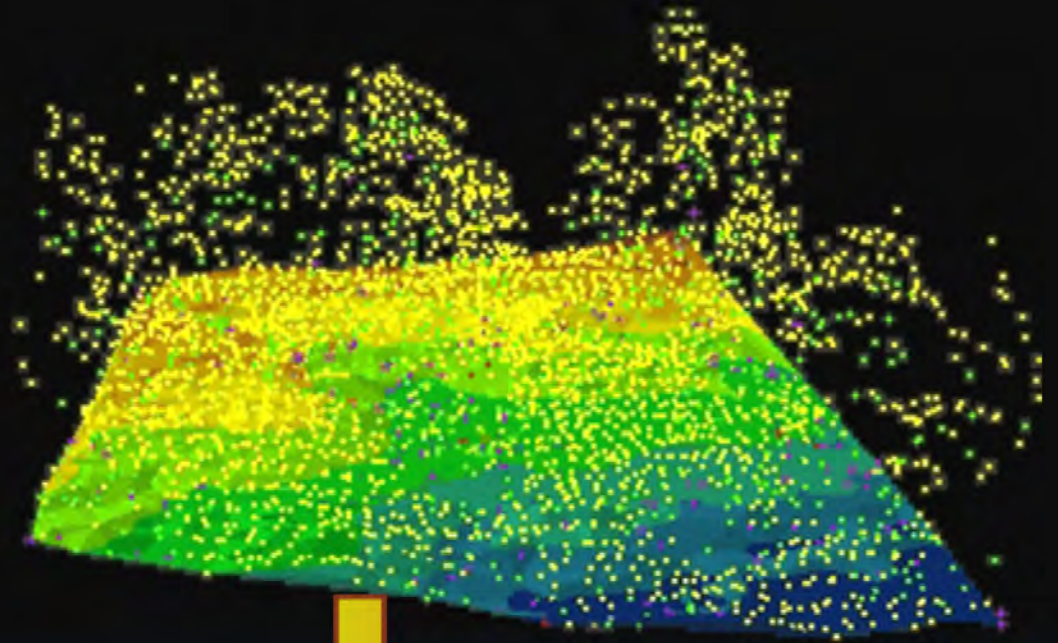
Lidar Acquisition → Point Cloud

Lidar Acquisition



Lidar Point Cloud

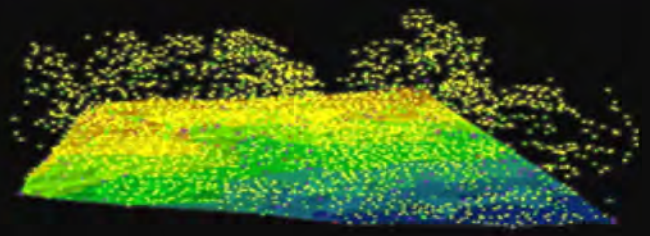
3D Rendition of Natural and Built Environments



Lidar Classification

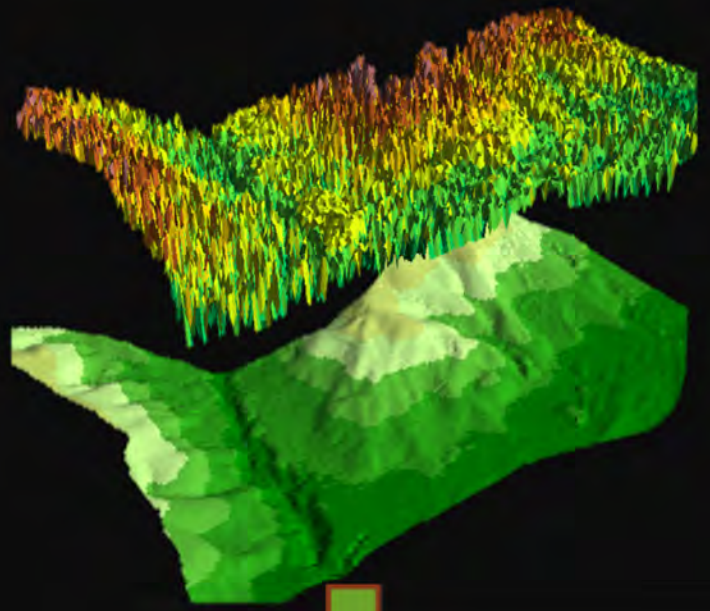
Painting the Lidar Point Cloud Elevation Values

Lidar Acquisition → Point Cloud → Classification → DEM

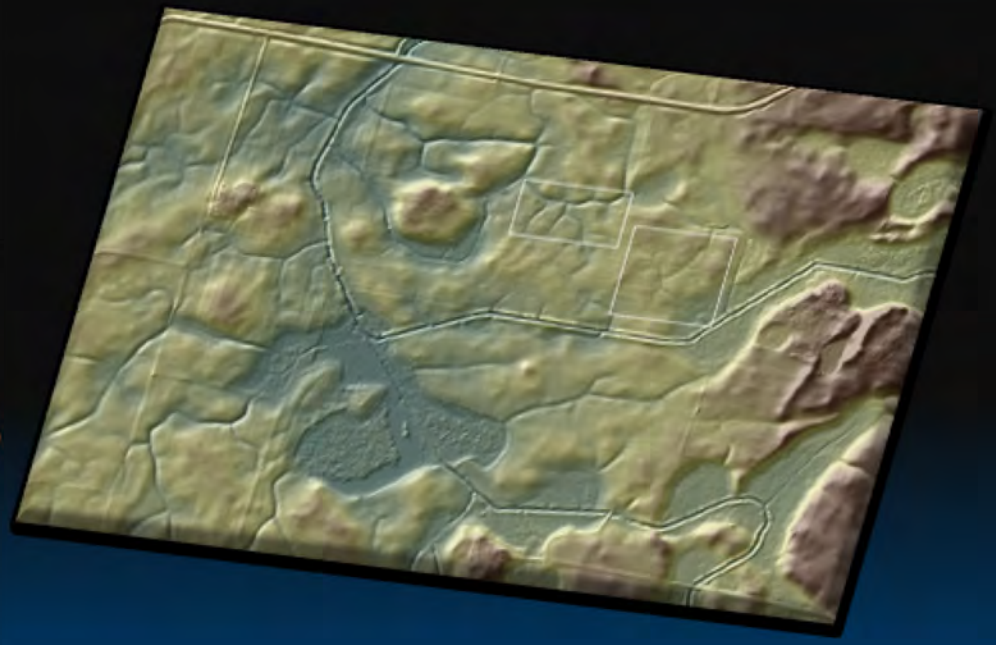


Lidar 3D Point Cloud

- Point Cloud Classification – Feature Identification and Separation of Data for Sector Application

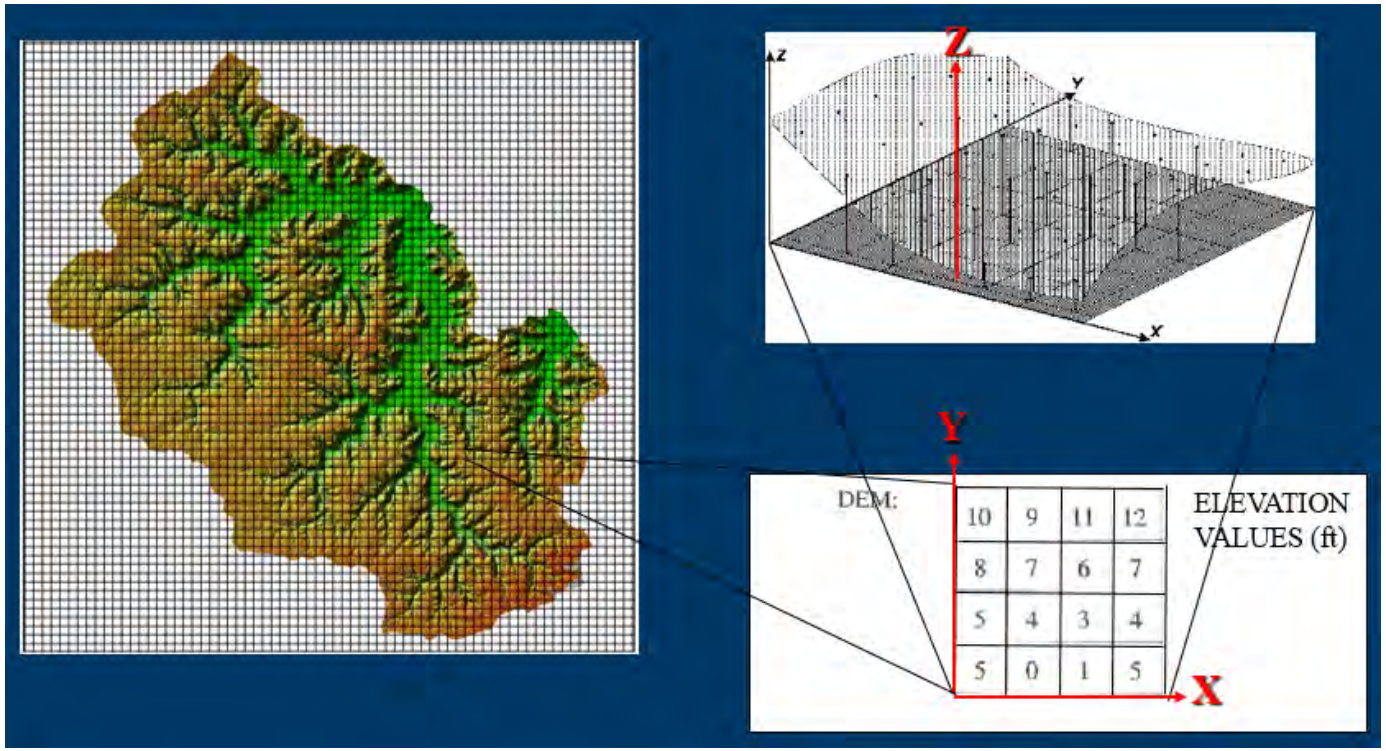


LiDAR-derived 3D Digital Elevation Model (DEM)



What is a DEM?

- **DEM** stands for digital elevation model
- A **digital representation** of the land surface.
- The DEM is a **derived product**
  - Represented as a gridded tessellation of the landscape built from Lidar-derived points with **elevation values** (Z).

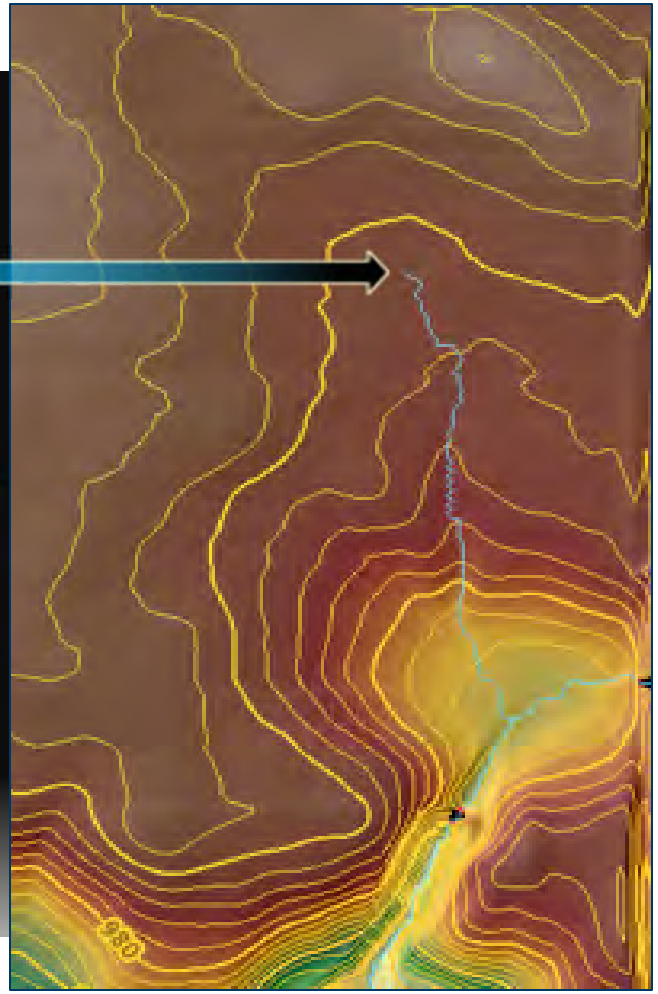


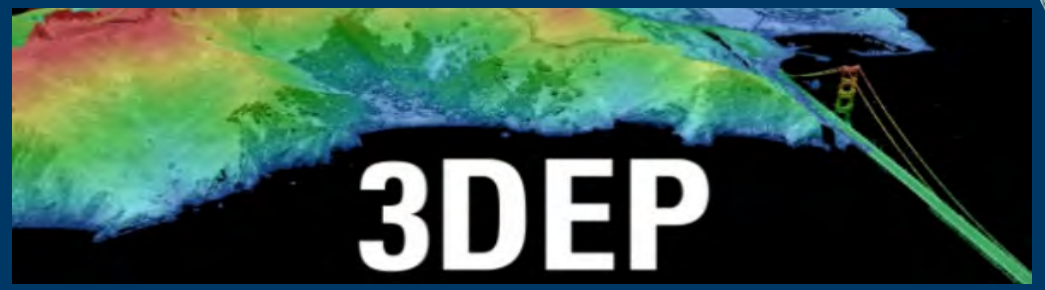
HD Lidar – Derived Products - Hydrography Example

WATER CONVEYANCE LANDFORMS

- Features of hydrologic Significance.
  - Nickpoint
  - Fluvial Processes
  - Soil Degradation
- Where does the watercourse begin ?
  - Where concentrated flow begins. LiDAR captures these landform.

We Model this with DEMs





(Federal Coordination and Grant)

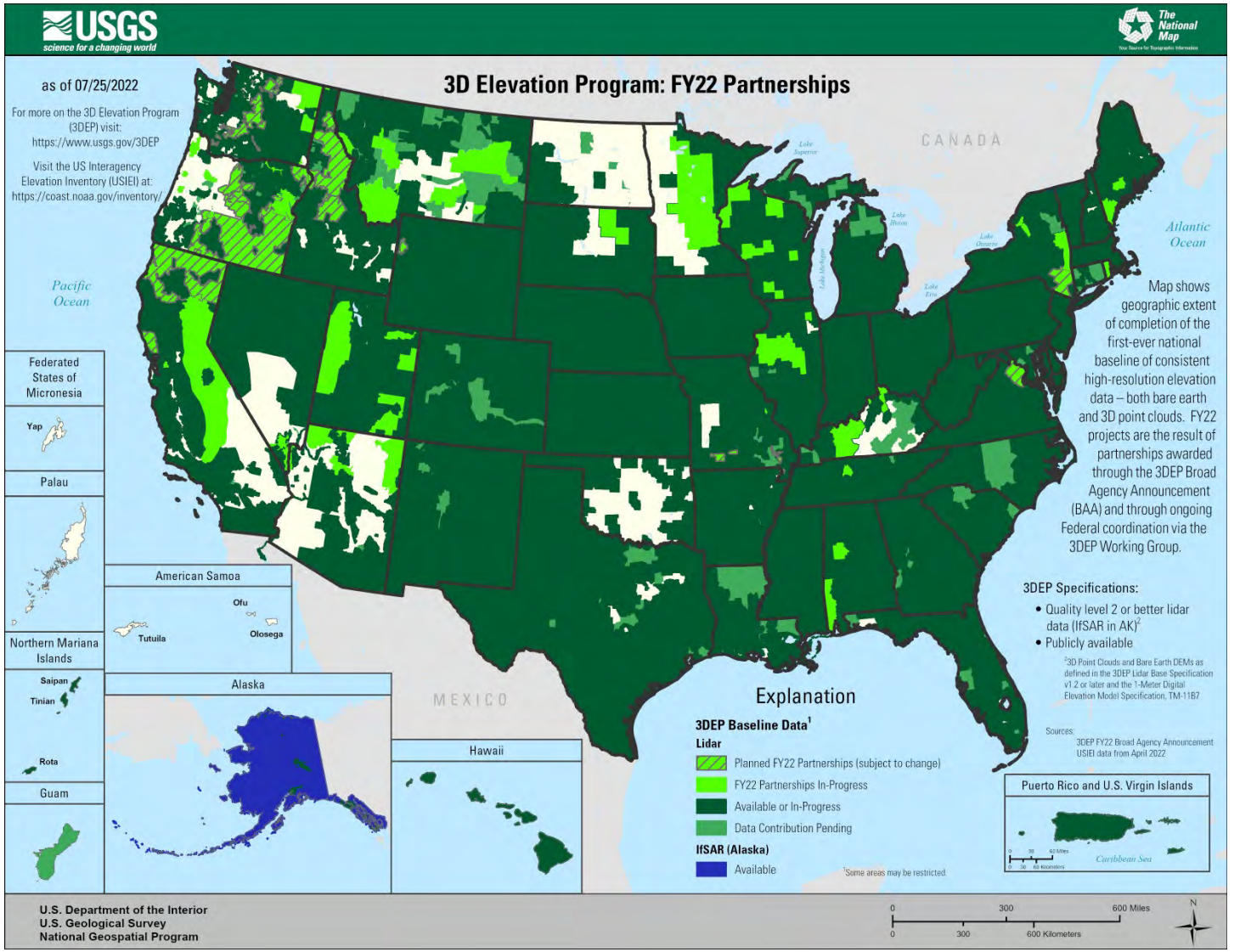
USGS 3D Elevation Program (3DEP)

3D Elevation Program (3DEP)

- **Systematically** guiding the collection of 3D elevation data in the form lidar data for the United States, and the U.S. territories

Broad Agency Announcement (BAA)

- **Due: October 1 (estimated)**
- **Grant coordinating** mechanism 3DEP
- Guides **partnerships** between the USGS and other Federal agencies with other public and private entities seeking high-quality 3D lidar elevation data acquisition



USGS 3D Elevation Program (3DEP) - IGCE

Independent Government Cost Estimate (IGCE)

Due: September

- Formal federal **contracting process**
- **Not unique** to this lidar acquisition project or 3DEP
- 3DEP BAA process uses **Attachment C** to solicit a PRELIMINARY Independent Government Cost Estimate.
- Provides an estimate of project costs sufficient for project planning and partnership development.
    - A full and final IGCE will be completed after award

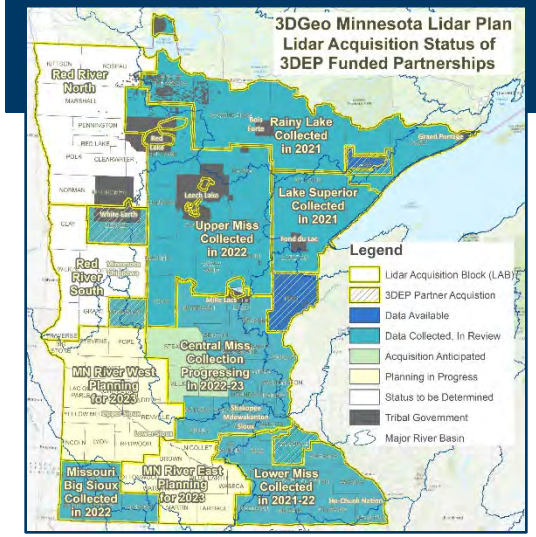
3D Geomatics: Funding, Agreements, and Acquisition

Contributions to Minnesota Lidar

($millions)

- Minnesota Partners: $ 6.05
- USGS 3DEP: $ 11.60
- Other Federal: $ 0.45

Total: $**18.09**M



Minnesota Funding Partners

- **48** Funding Partners
- **51,405** Square Miles of New Lidar
- **$118*** Cost/mi^2 For MN Partners

* Estimated cost per square mile paid by 48 unique Minnesota funding partners working collaboratively for consistent lidar data acquisition. $**118 Value**: 1.) is not specific to a 3DGeo Lidar Acquisition Block, 2.) is based on current total Minnesota partner contributions of $6,053,761.44, 3.) does not include federal contributions.

Minnesota Lidar Plan

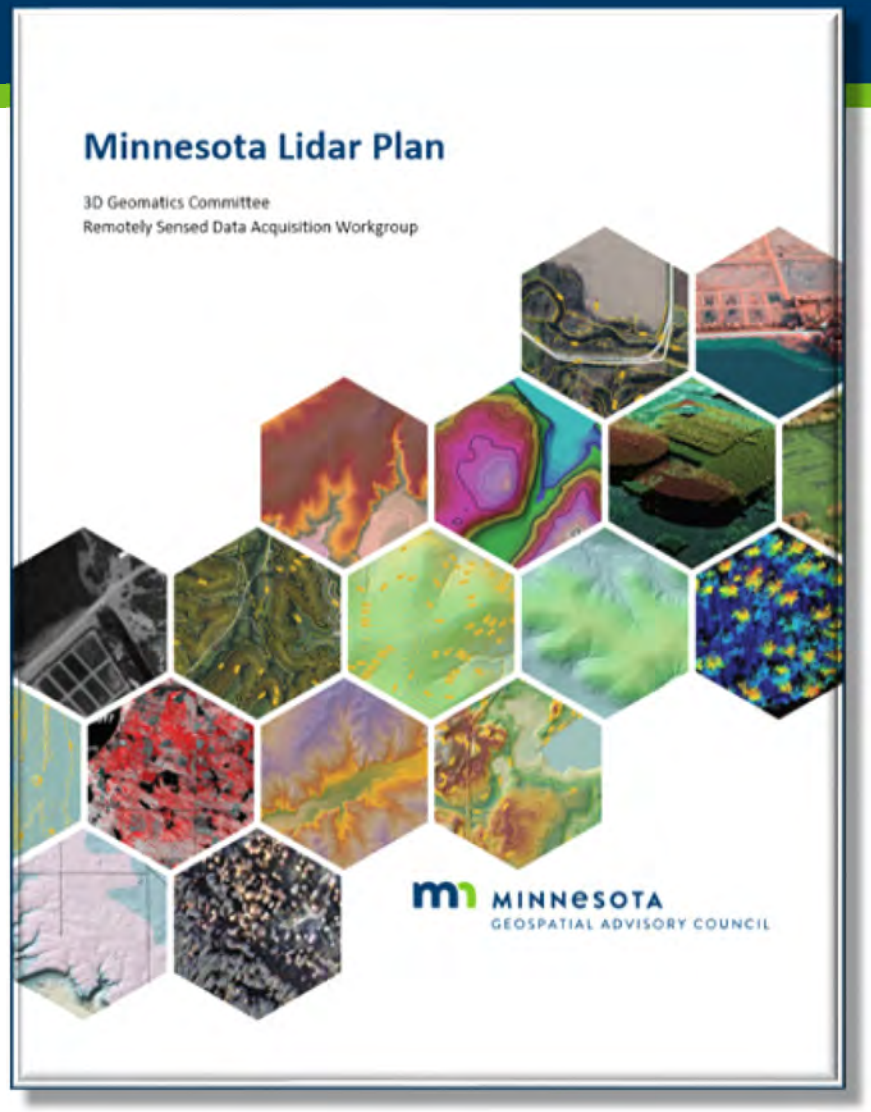
Minnesota Lidar Plan - Our Plan – Your Plan – One Plan

The Minnesota Lidar Plan

- **One** plan for Minnesota
- **Committee** led plan, not a state agency plan
- **Collaboration** of the geospatial community
- **Coordination** of lidar acquisition in Minnesota leverages federal match dollars

3DEP grant success is built on a guiding plan that pulls the community together to **foster collaboration** and coordinate funding to achieve the common goal of high density lidar acquisition across Minnesota

Minnesota Lidar Plan and StoryMap



https://www.mngeo.state.mn.us/committee/3dgeo/acquisition/Minnesota_State_Lidar_Plan.pdf

http://bit.ly/MnLidarPlanStoryMap

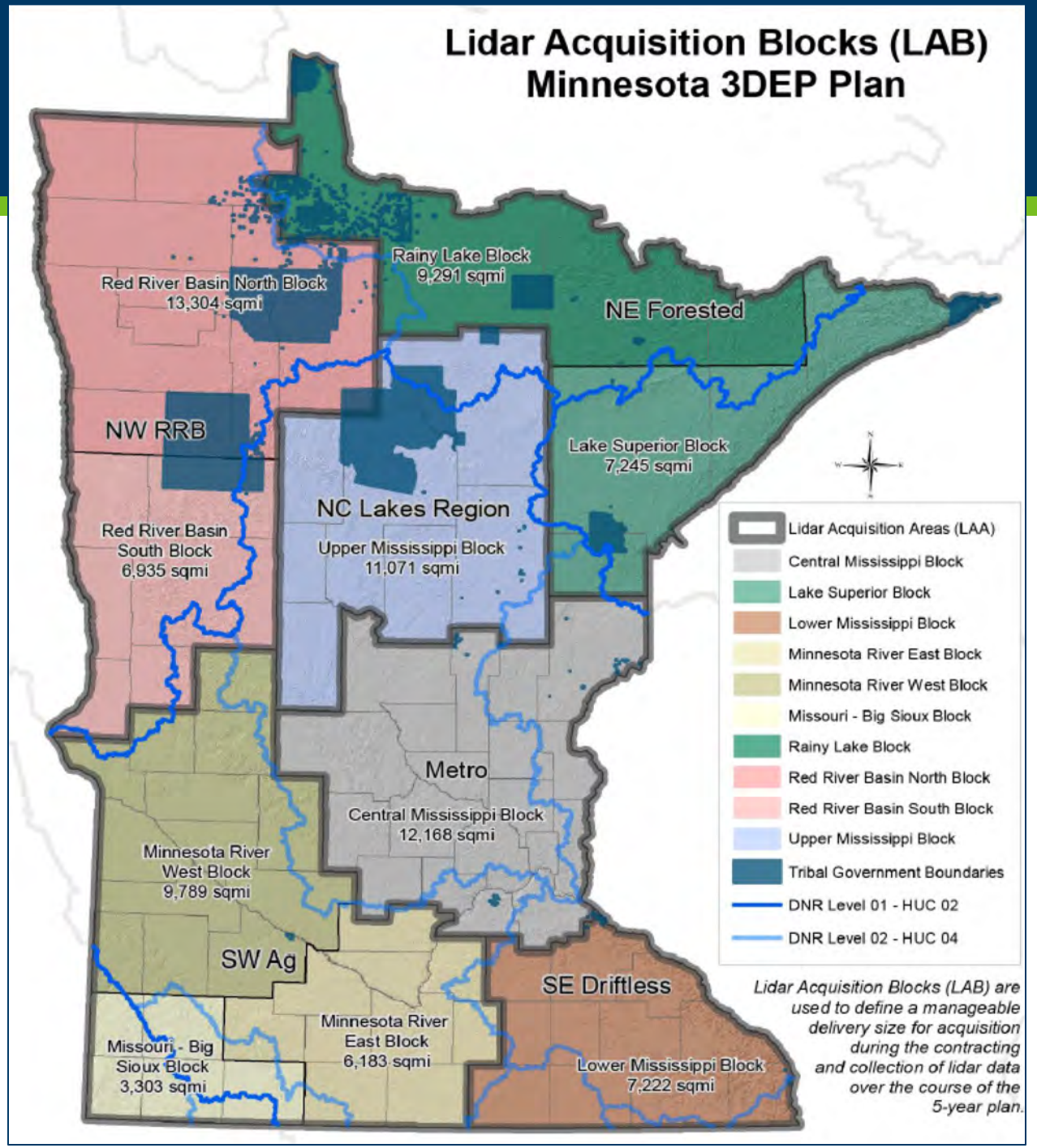
Lidar Planning – Background

- Lidar acquisitions are coordinated by the GAC's **3DGeo Committee**
- Minnesota's Lidar Plan divides up the state into **lidar acquisition areas** (LAA) based on political (county) and watershed boundaries
- **Grant funds** are available from USGS for lidar acquisition because there is a local-to-national scale need for a seamless nationwide DEM elevation layer
- 3DGeo is working to establish lidar acquisition **funding partnerships** with local, federal, and state stakeholders
  - Leveraging **USGS federal funding opportunity**
- **Economies of scale** are achieved when partners collaborate across landscapes
  - The bigger the collection footprint, the lower the cost

MN Lidar Status Map

- **Spring 2022 Acquisition – 6 Projects**
  - Poor Spring Weather Conditions
    - Wet – Standing water, flooding
    - Partial 2021 data acquisition in SE
  - As many as 13 fixed-wing aircraft were collecting

- **2022 Acquisition Funding Partners**
  - SE, SW funded – 14 funding partners
    - Partial 2021 data acquisition in SE
  - Upper Mississippi and Central Mississippi funded – 35 funding partners
  - Becker County/Otter Tail
  - Douglas County




What is:
High-density
Lidar

Lidar Quality Levels - Costs

	Quality Level (QL)	Average Cost per mi²*
Not Currently Supported by 3DEP →	**QL-0**	**N/A**
3DGeo QL1:30 →	**QL-1:30**	**$505.38**
3DGeo Statewide Recommendation →	**QL-1**	**$325.71**
USGS Base Specification →	**QL-2**	**N/A**
Current (2008 – 2012) Statewide Lidar →	***QL-3***	**N/A**

**Please note the following, regarding the above cost estimates:*

- *Estimates were obtained in 2021.*
- *These average estimates are based on a series of USGS 3DEP Independent Government Cost Estimate (**IGCE**) quotes. Actual cost estimates are subject to change based on a proposed area of interest.*
- *The 3DGeo Committee advocates for QL1 lidar and will assist partners to explore acquiring upgrades and additional derived products in their area of interest (e.g., QL-1:30). An upgrade to point density or additional derived products will increase costs and will be the responsibility of the requesting partner(s).*
- *QL3 no longer meets USGS Base Specification.*

HD Lidar – Derived Products

Lidar Quality Levels Define Deliverable Specifications

- Minimum **DEM** Cell Size
- Minimum **Contour** Interval

3DGeo Committee Minimum →

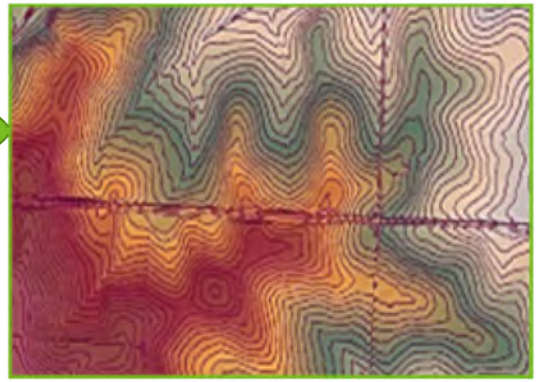
USGS Base Specification Minimum →

Current Minnesota Data Holdings →

LiDAR BASE SPECIFICATION (LBS)	LBS Table 6 Minimum DEM Cell Size		
Quality Level (QL)	**Minimum Cell Size** [m]	**Minimum Cell Size** [ft]	**Supported Contour Interval Accuracy** [ft]
QL-0	0.5	1.0	0.5
QL-1	0.5	1.0	1.0
QL-2	1.0	2.0	1.0
QL-3	2.0	5.0	2.0

16X

2X



A High-density Pulse = High Density of Points = Highly Detailed Derived Products

QL1 = 16 grid cells per one QL3 cell
QL1 = 2 additional contour lines for every one 2-foot contour

3DEP Program – Lidar Data

3DEP Standard Deliverables

- **Point Cloud** (classified to minimum level – meets most needs; data hosted online)
- Digital Elevation Model (**DEM**/Bare-Earth Surface Raster)
- Lidar Swath Polygon
- **Hydro**-breaklines
- Metadata & Reports

3DEP Program – Lidar Data and Derived Products

Possible Added Deliverables

- **Possible deliverables not funded by 3DEP, but can be part of the 3DEP contract as additional products and services with the 3DEP contract vendor at an additional cost**
  - Higher density Point Cloud
    - 3DGeo advocates for QL1, **partners may upgrade areas to QL1:30 (30 points/m^2)**
  - Improved hydrographic products
    - ✓ Advanced **hydro-modified DEM** (Conditioned DEM), and/or hydro-flattening
  - Bare Earth point cloud
  - Additional Point Classification
    - ✓ High vegetation and **buildings**
  - **Intensity** imagery, GeoTIFF

State Agency Lidar Derived Products

Foundational Derived Products

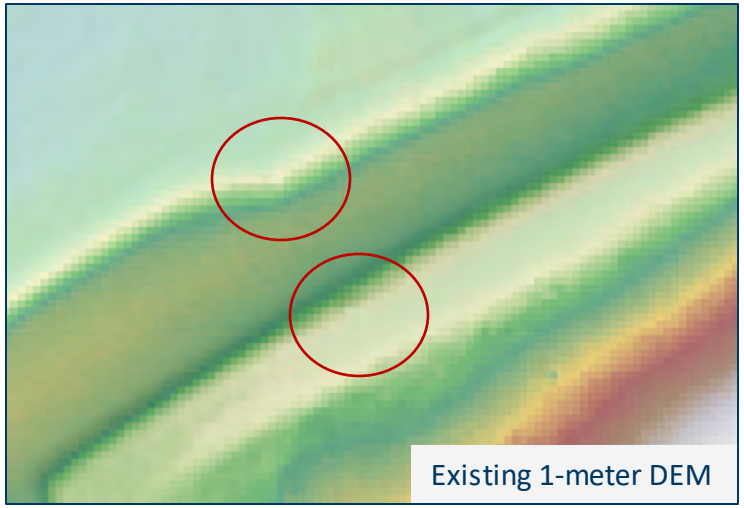
- **Publicly available data served as authoritative products from state agency distribution portals**
  - 1-ft **Contour** Dataset
  - **Hillshaded** DEM
  - **Canopy Height** Model (CHM)
  - Other products to come?

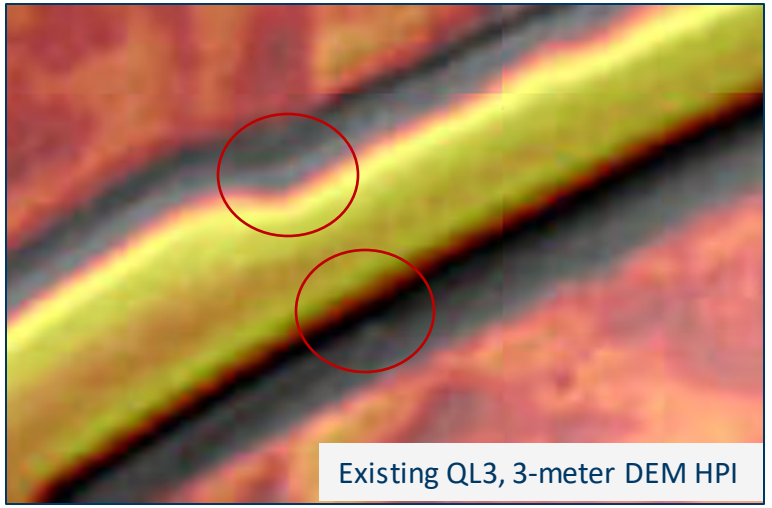
Next

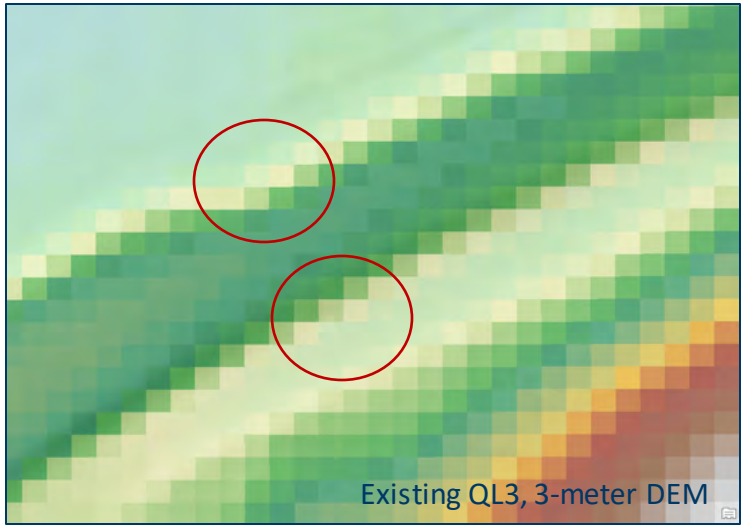
Sean Vaughn – Hydrography…

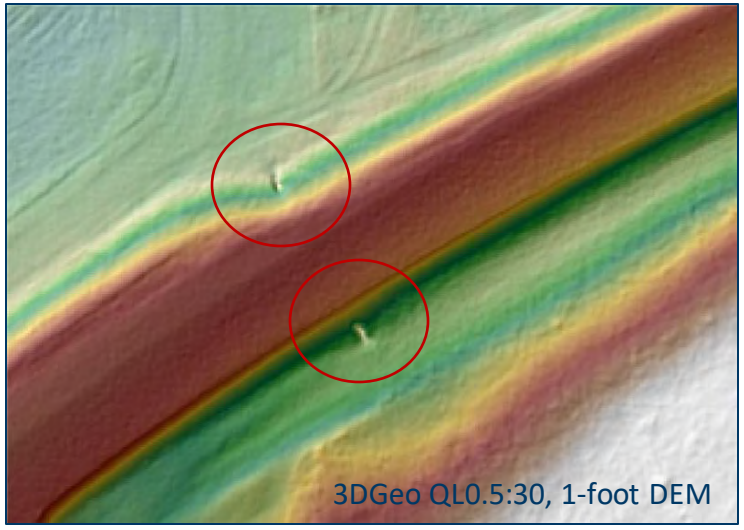
HD Lidar Examples: Hydrography & Infrastructure

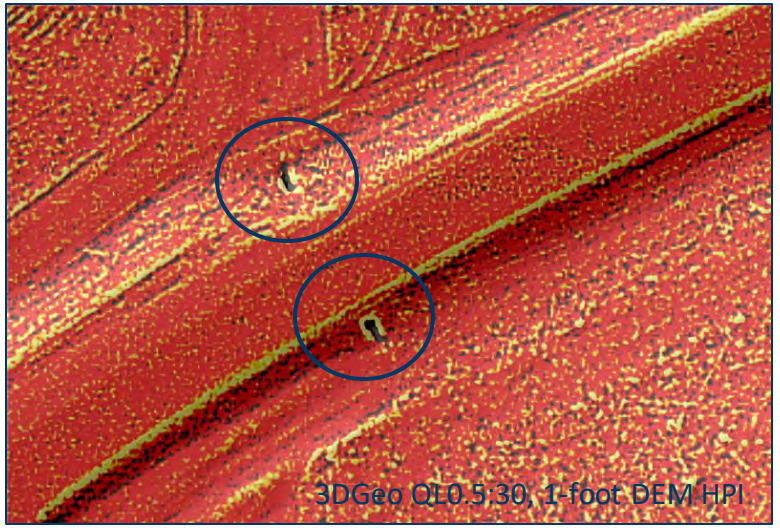
Culvert Capture High Density Lidar 3DGeo (≥30pts/m^2)



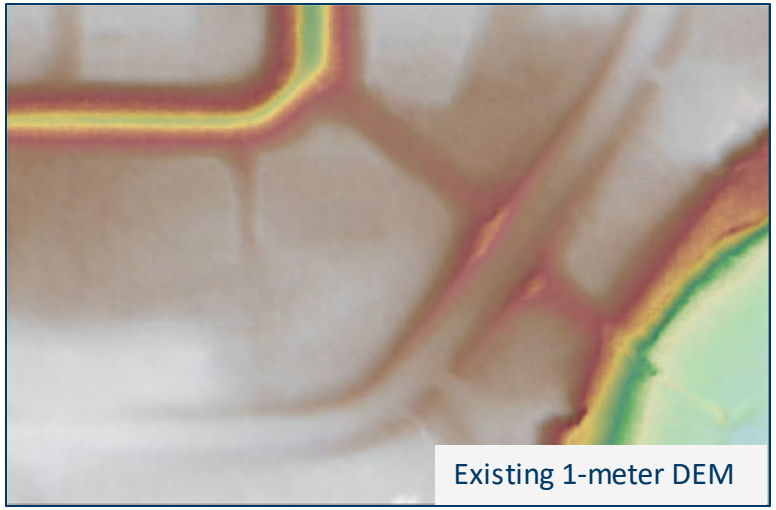


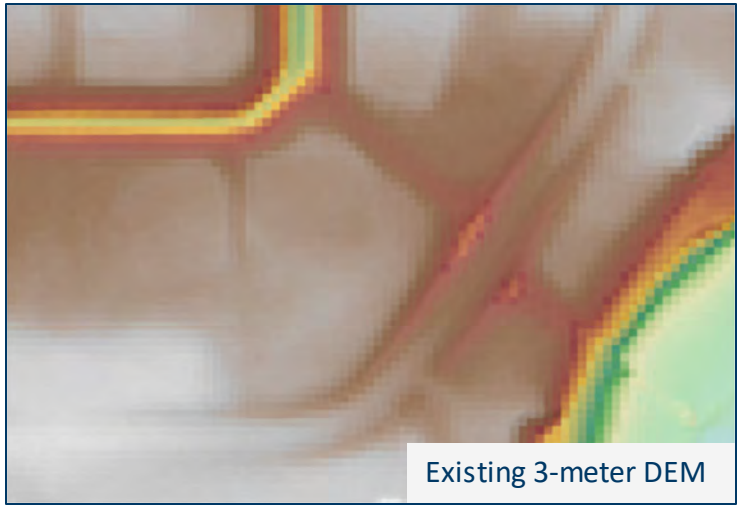


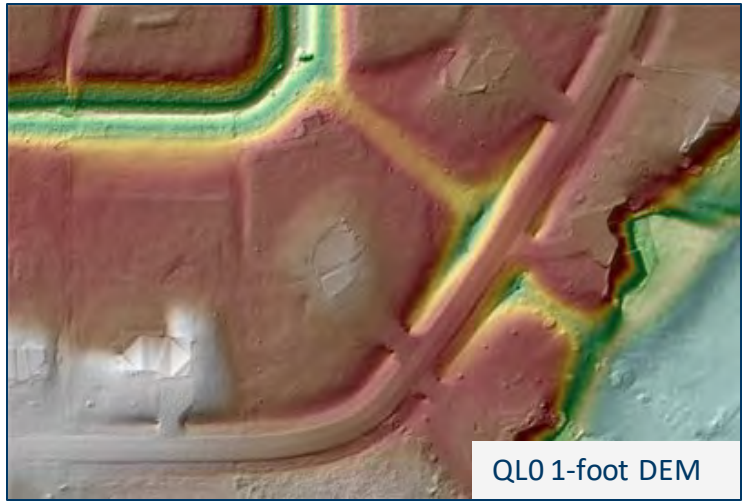


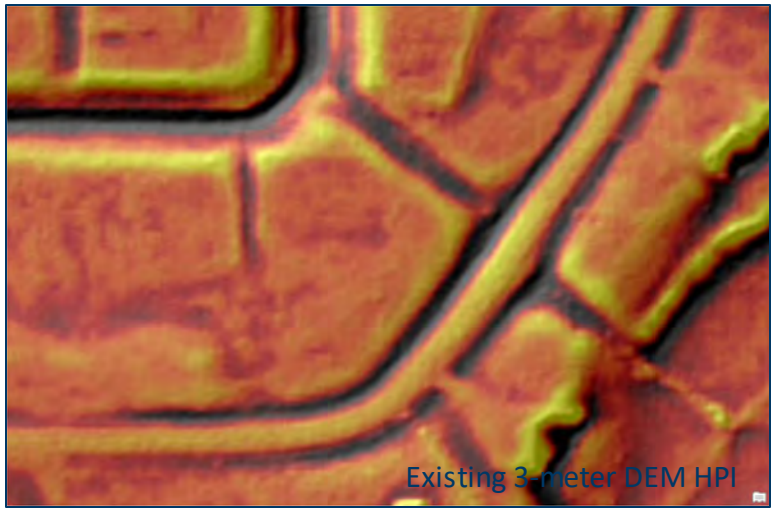


Early Results – Culvert Capture High Density (≥30pts/m^2)



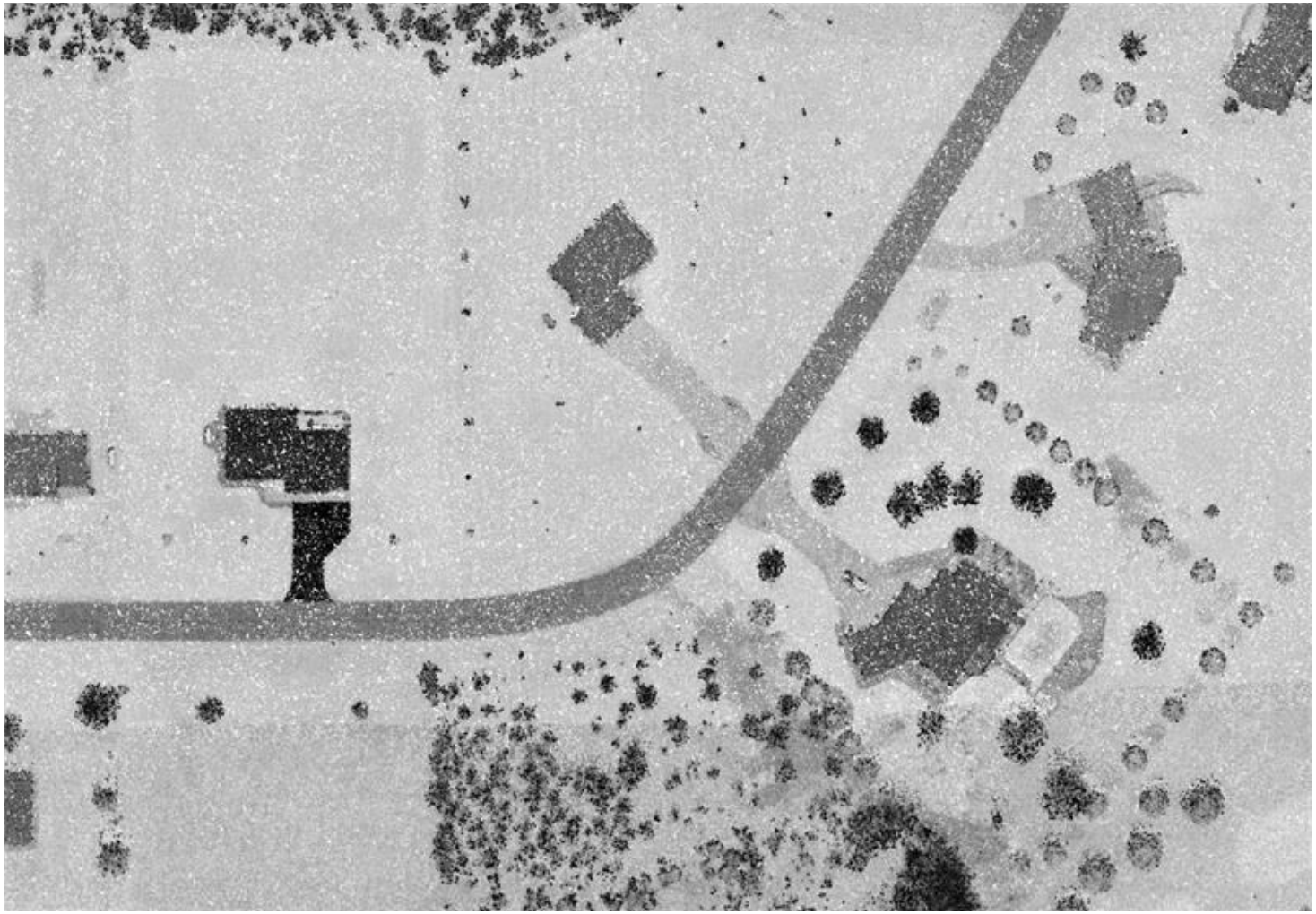






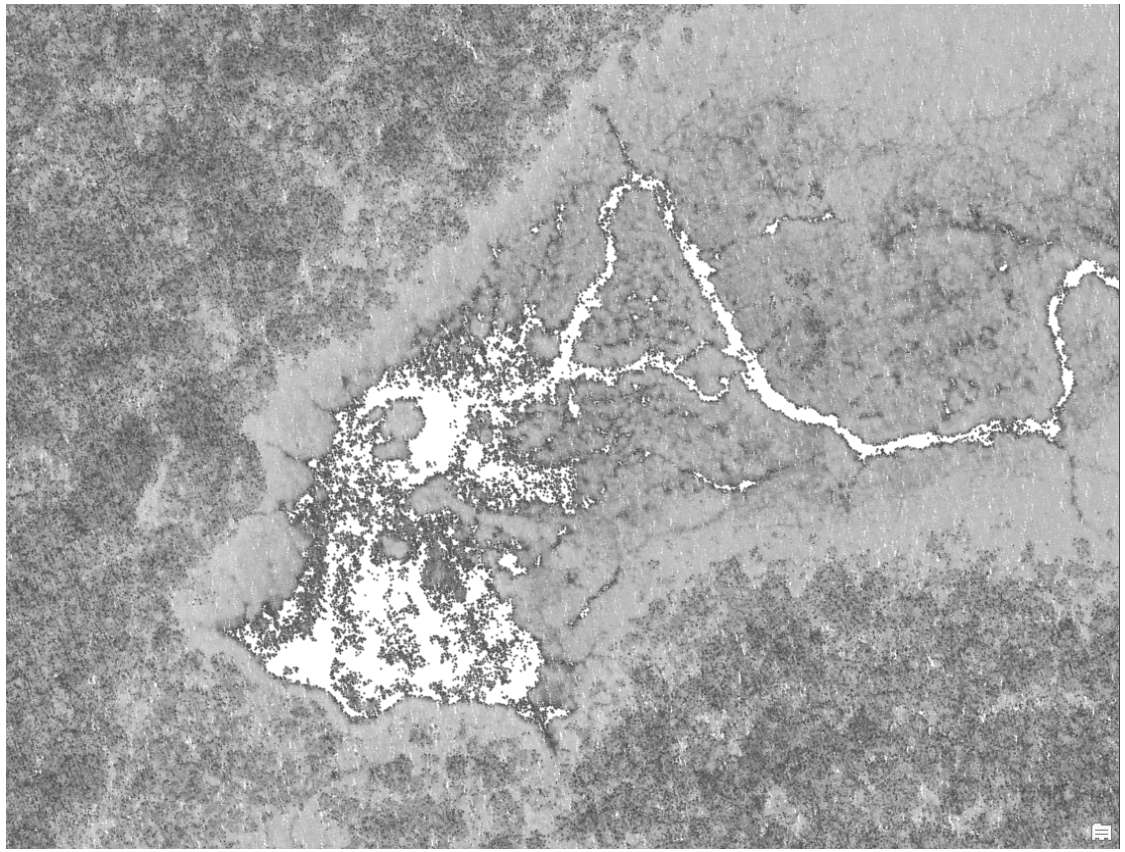
HD Lidar Examples – Lidar Intensity

High Density (≥30pts/m^2)



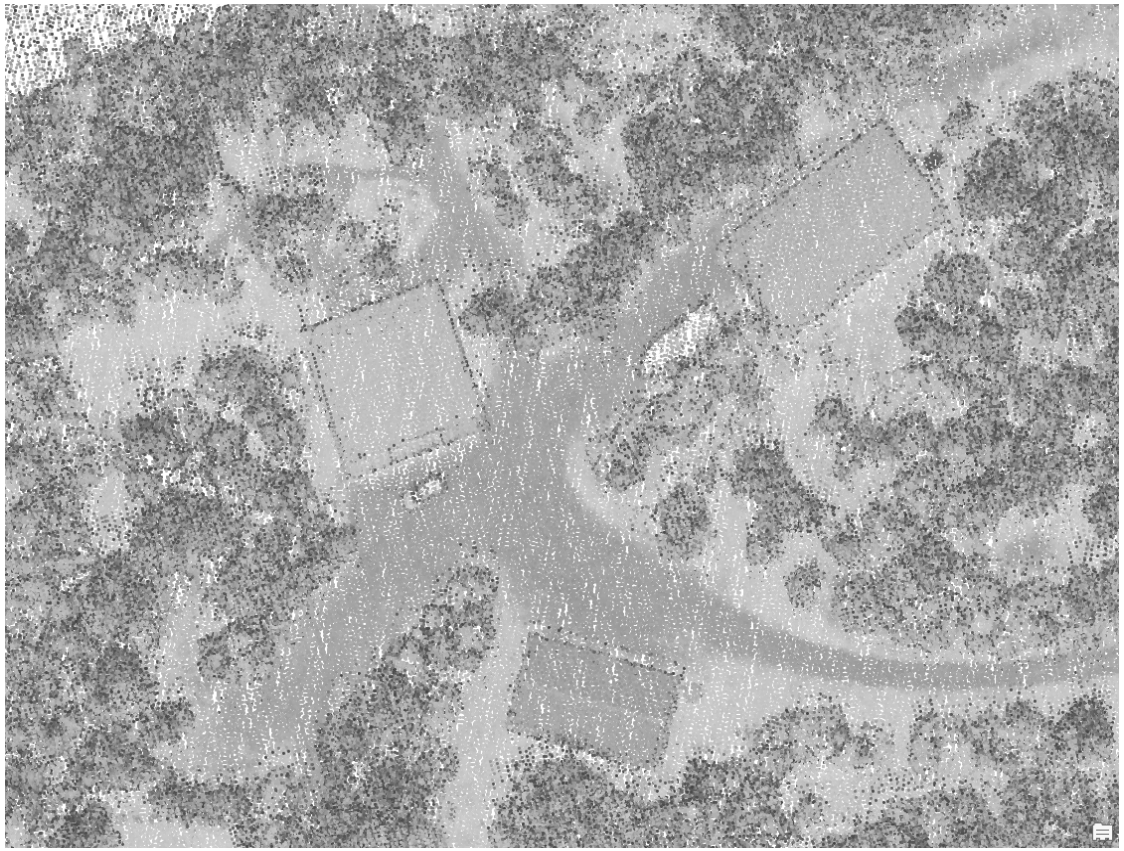
HD Lidar Examples - Lidar Intensity

NE Forested LAA, **QL1 Lidar Intensity** - **Hydrography Capture**



HD Lidar Examples - Lidar Intensity

NE Forested LAA, **QL1 Lidar Intensity** - **Infrastructure Capture**



3DGeo Field Visit – Preparing for Data Validation

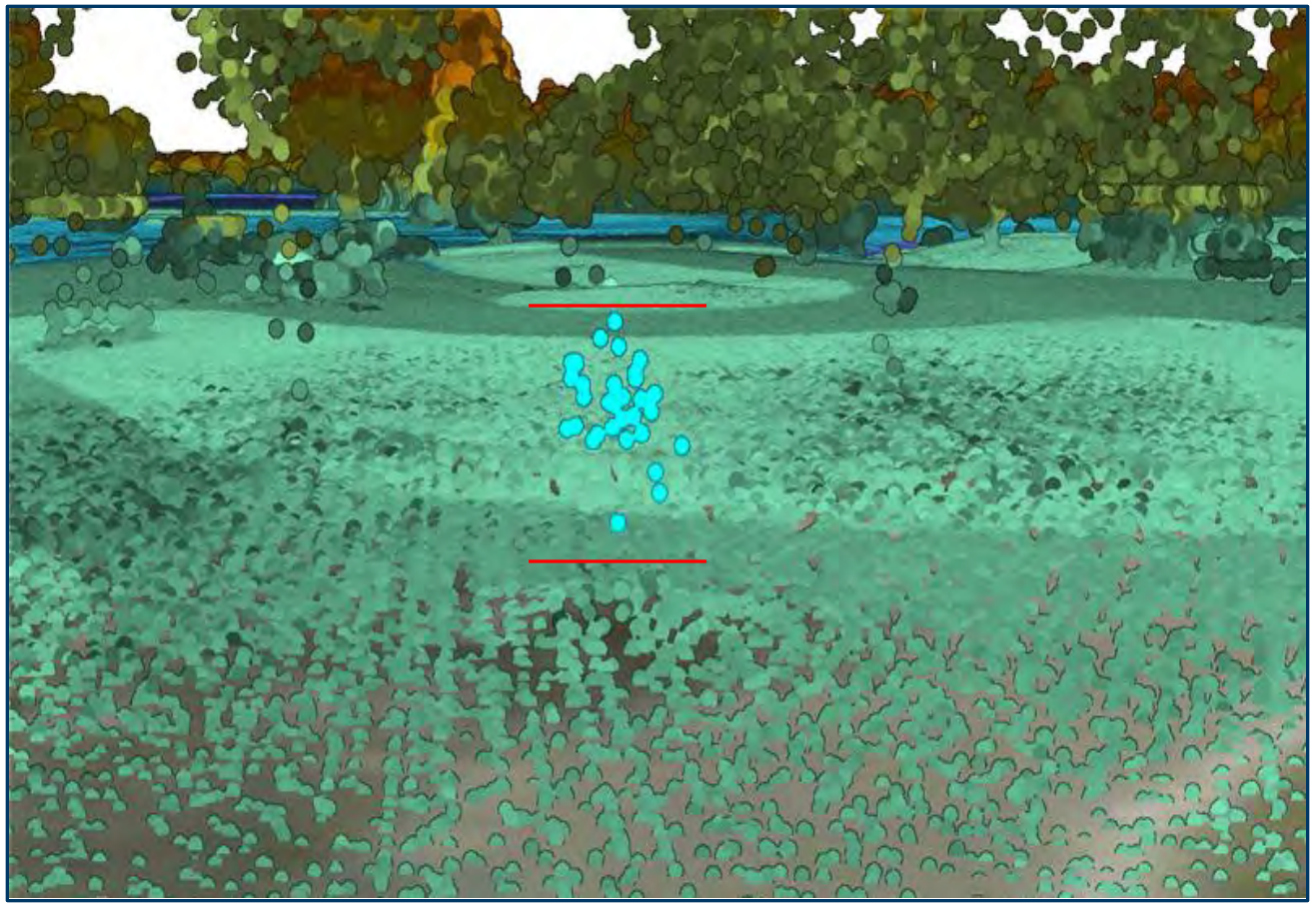
Lake Byllesby Regional Park | Dakota County, Cannon Falls, MN | High Density ≥30-point/m^2 Lidar Point Cloud

Bush in center of asphalt trail intersection surrounded by trees

Joel Nelson (3DGeo, U of MN) measures bush captured by HD Lidar

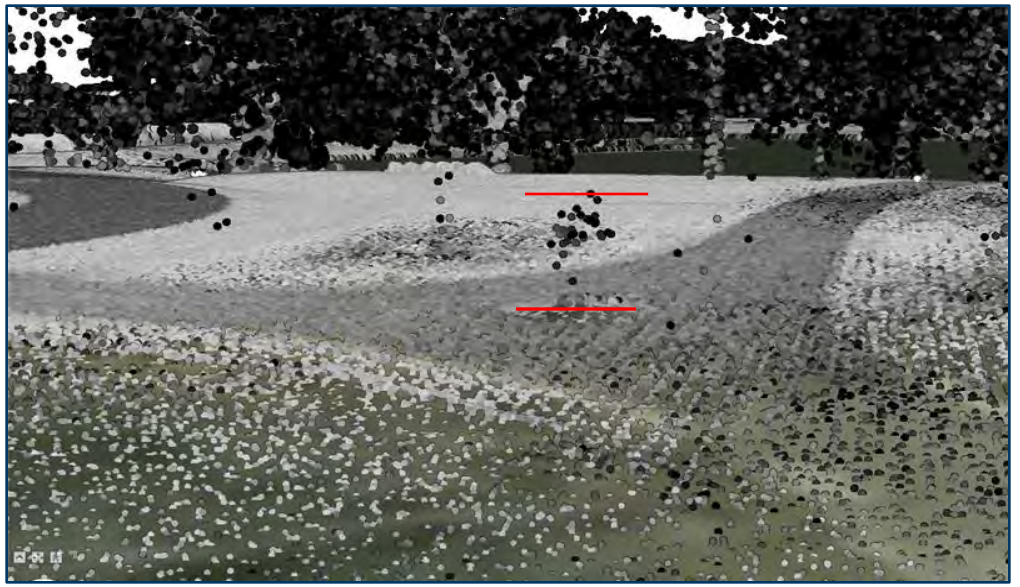
3DGeo Field Visit – Preparing for Data Validation

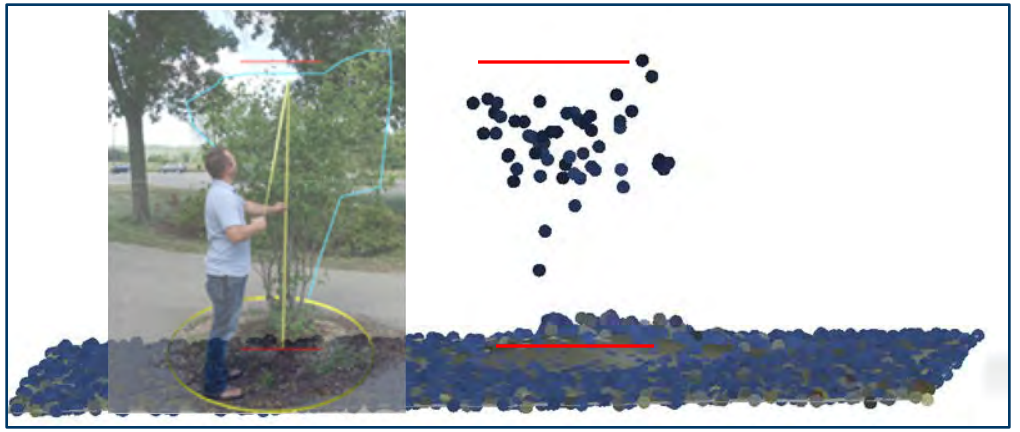
Lake Byllesby Regional Park | Dakota County, Cannon Falls, MN | High Density ≥30-point/m^2 Lidar Point Cloud



Bush as represented in high-definition point cloud

Bush and surrounding features captured by lidar intensity

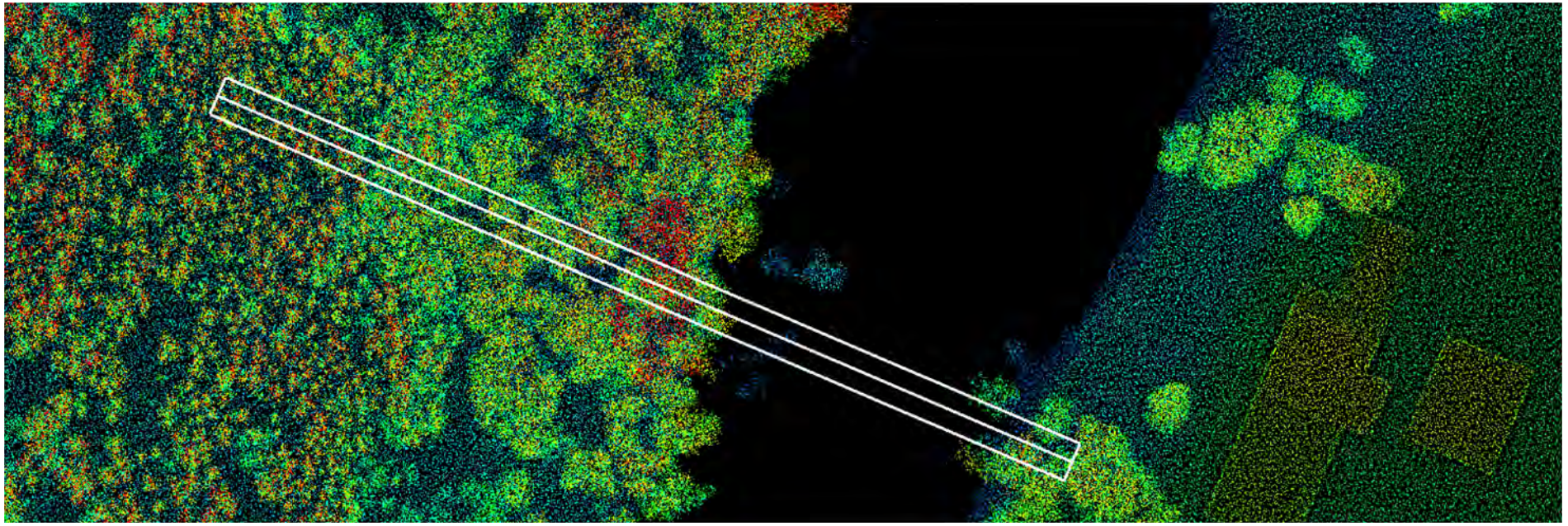


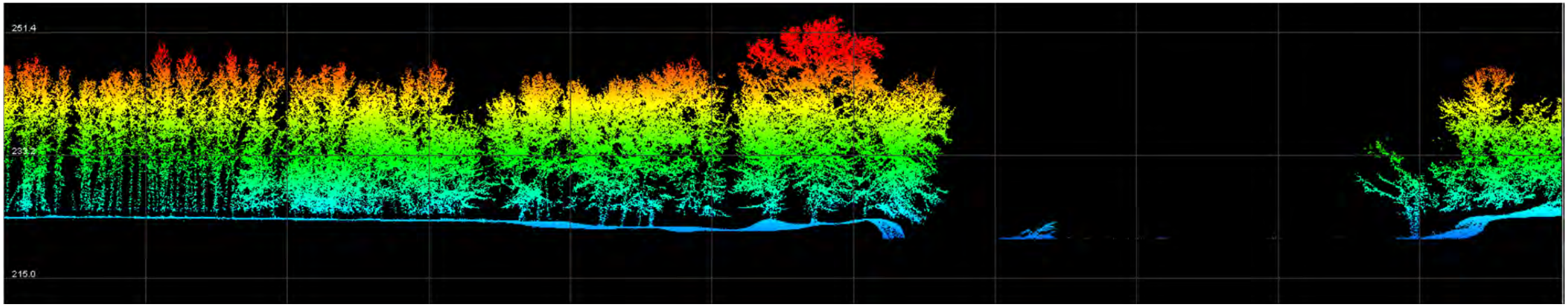


Bush Point Cloud

HD Lidar Examples: Hydrography & Infrastructure

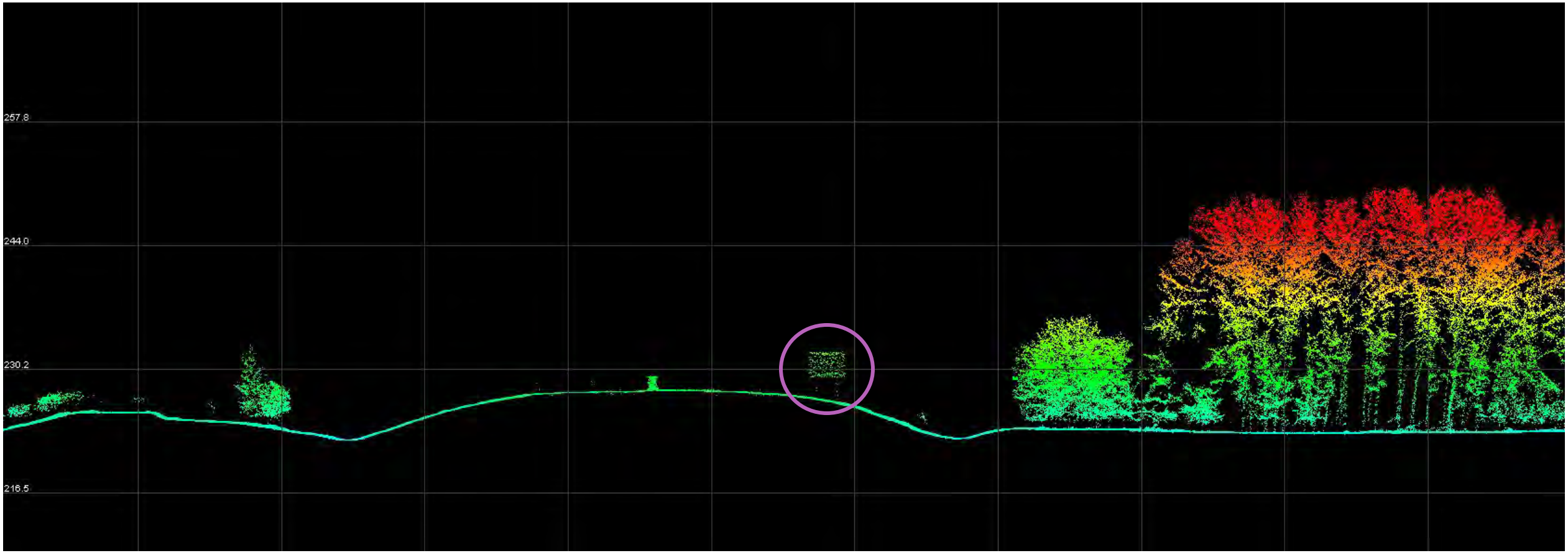
Feature Extraction | High Density Lidar ≥30-point/m^2 | Le Sueur County Lidar Data Collection 2021





HD Lidar Examples: Hydrography & Infrastructure

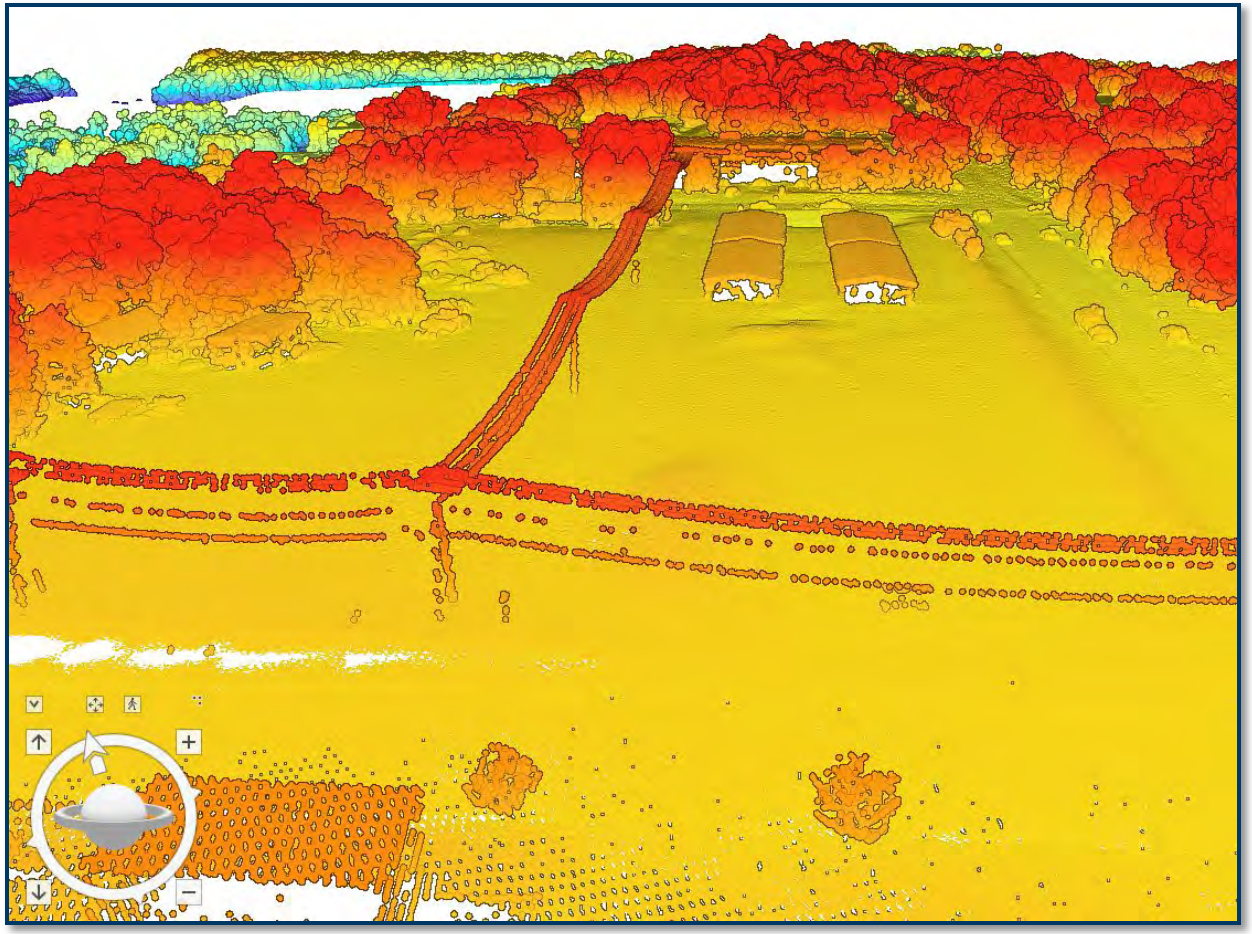
Feature Extraction | High Density Lidar ≥30-point/m^2 | Le Sueur County Lidar Data Collection 2021



HD Lidar Examples: Hydrography & Infrastructure

Infrastructure | High Density Lidar ≥30-point/m^2 | Le Sueur County Lidar Data Collection 2021

Lidar Point Cloud Intensity Classification



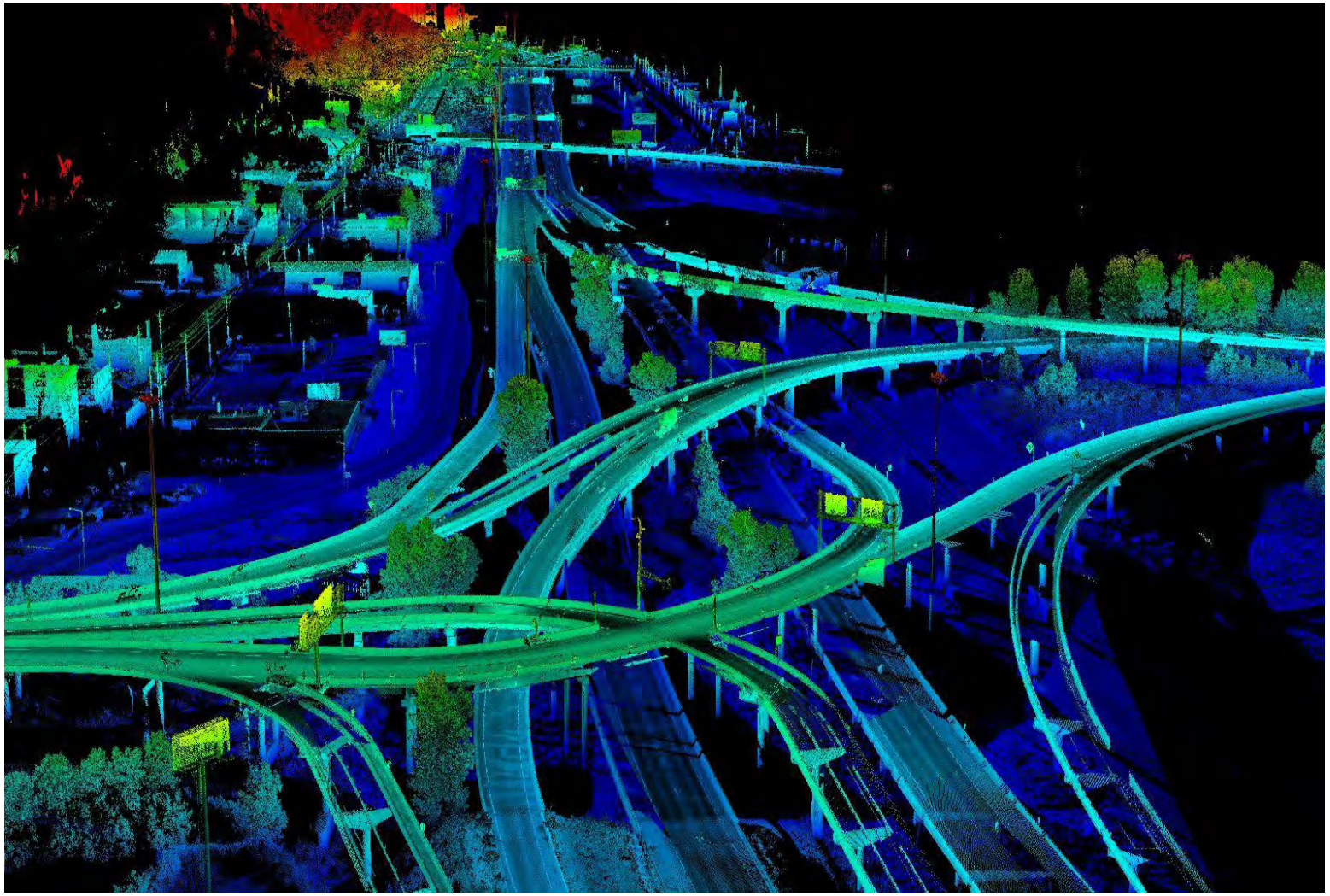
Lidar Point Cloud Elevation Classification

Next

Colin Lee – Infrastructure …

HD Lidar Examples: **Infrastructure**

- Transportation
  - 3d Design
  - Traffic operations
  - Signing and striping
  - Highway safety
  - Maintenance
  - Asset management
- Energy
  - Traditional
  - Renewable/Alternative
- Cultural/Historical Resources

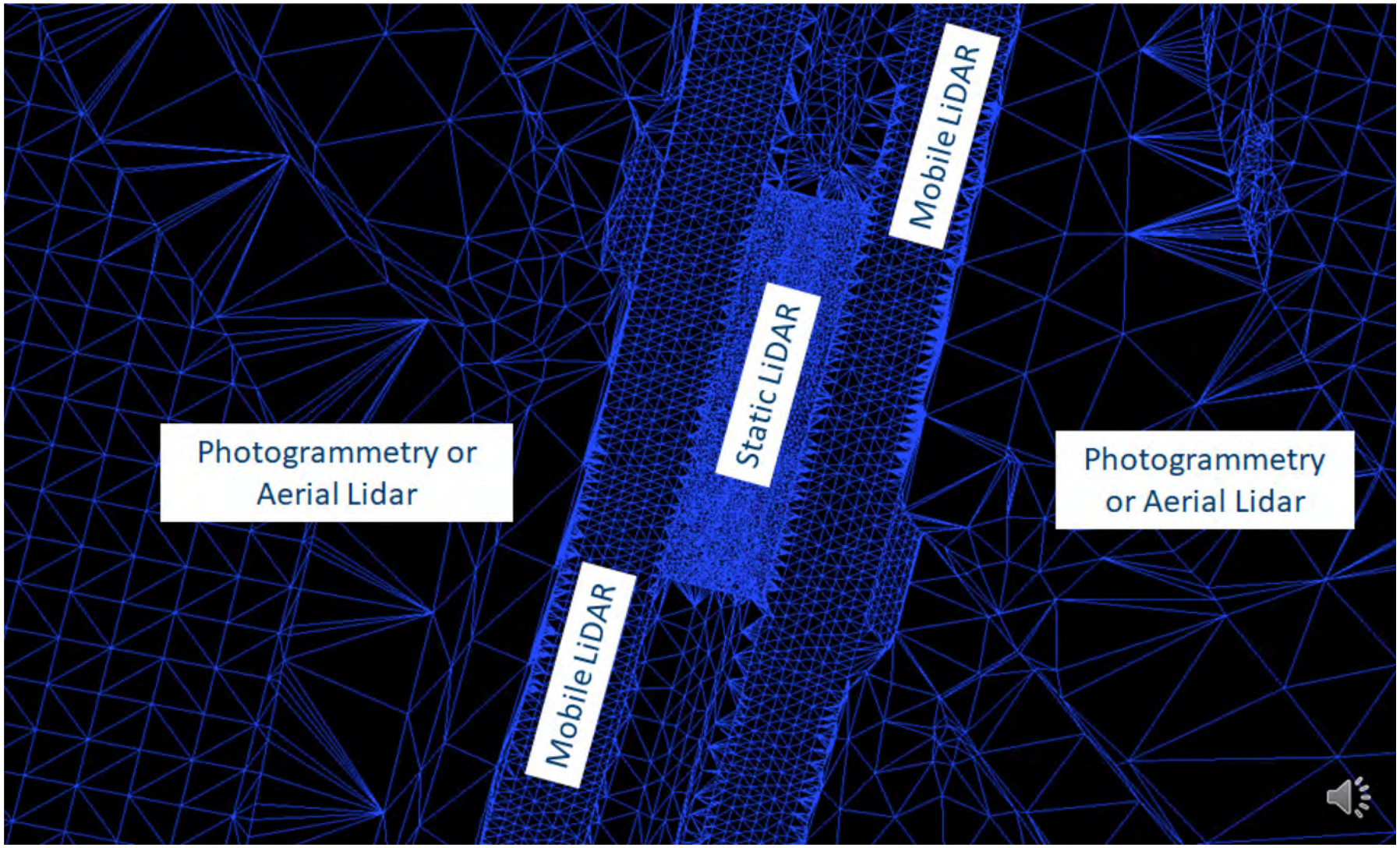


The I-35/Highway 53 interchange in Duluth, MN (known locally as the "Can of Worms")

HD Lidar Examples: **Infrastructure**

Supporting Corridor Mapping

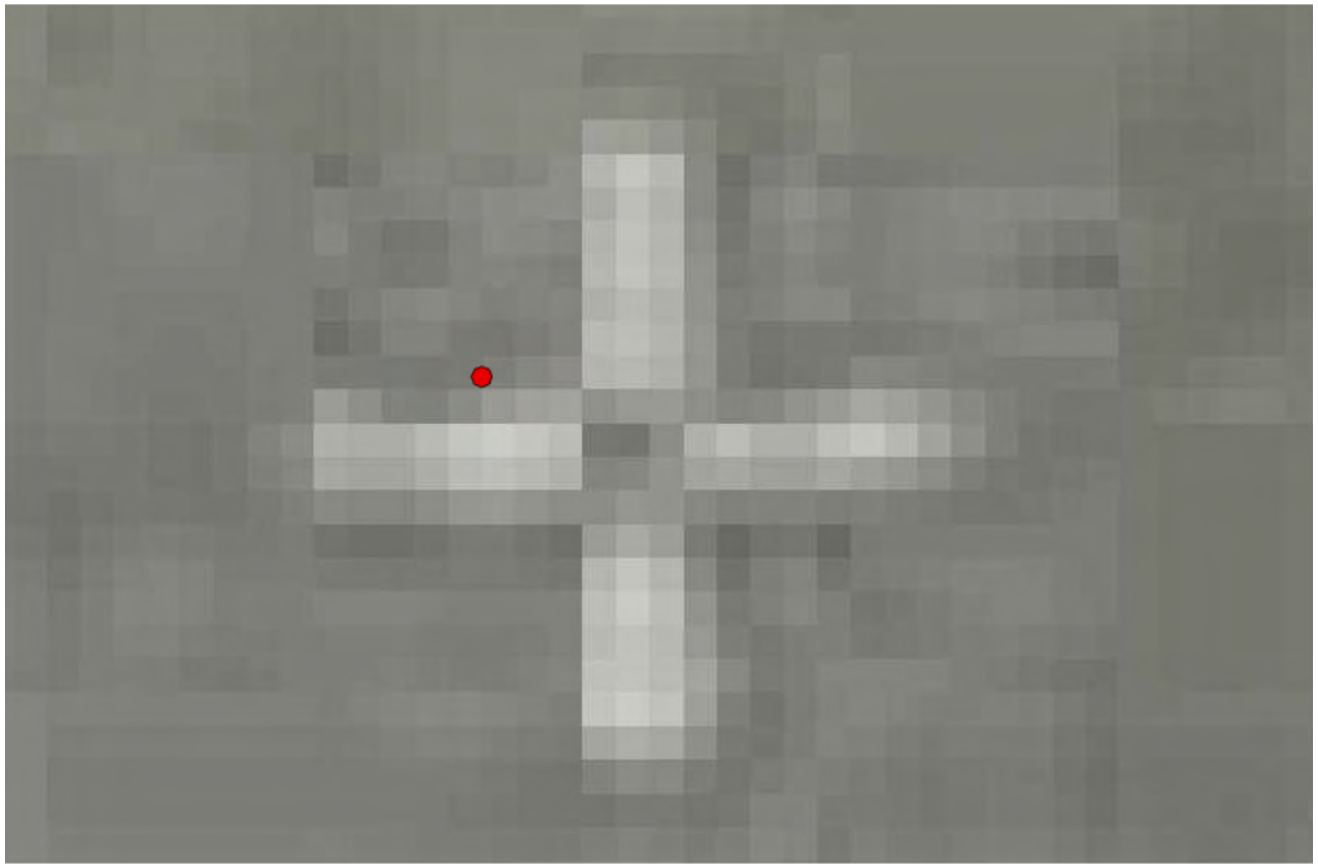
- New HD lidar can replace existing mapping methods
- Existing lidar no longer reliably supports many engineering products



HD Lidar Examples: **Infrastructure**

Supporting Orthomosaic Creation

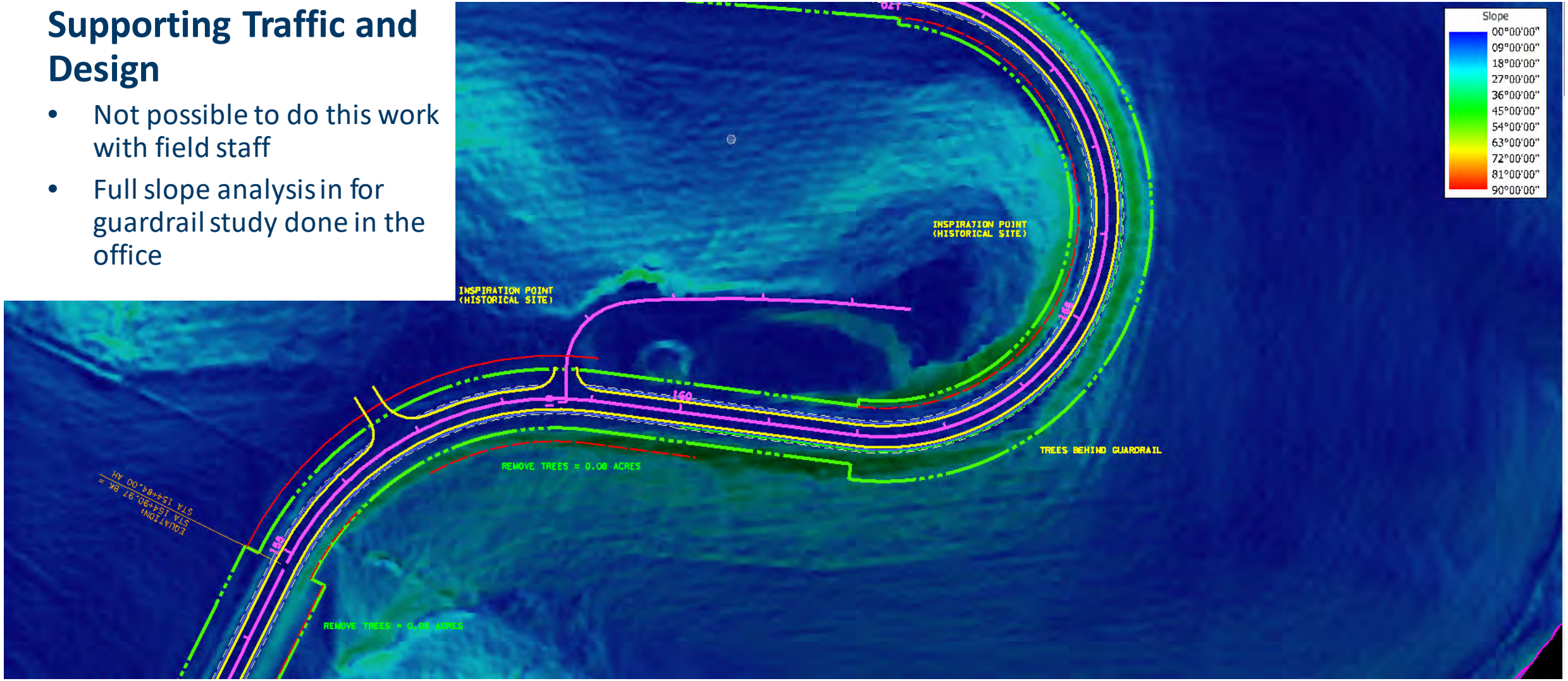
- New HD lidar can replace existing mapping methods
- Existing lidar no longer reliably supports the creation of high resolution orthophotos



HD Lidar Examples: **Infrastructure**

Supporting Traffic and Design

- Not possible to do this work with field staff
- Full slope analysis in for guardrail study done in the office



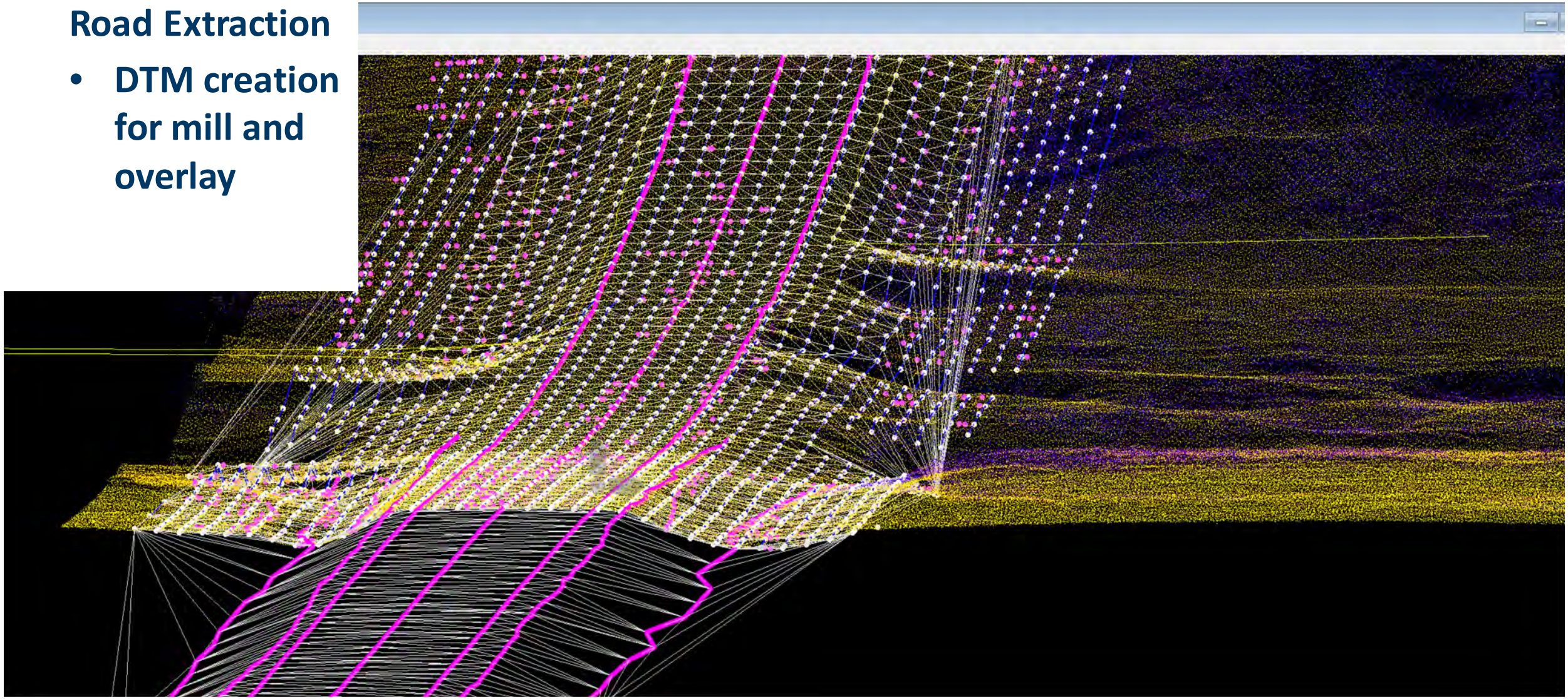
HD Lidar Examples: **Infrastructure**

Highway/Rail Grade Crossing Inspection

HD Lidar Examples: **Infrastructure**

Road Extraction

- **DTM creation for mill and overlay**



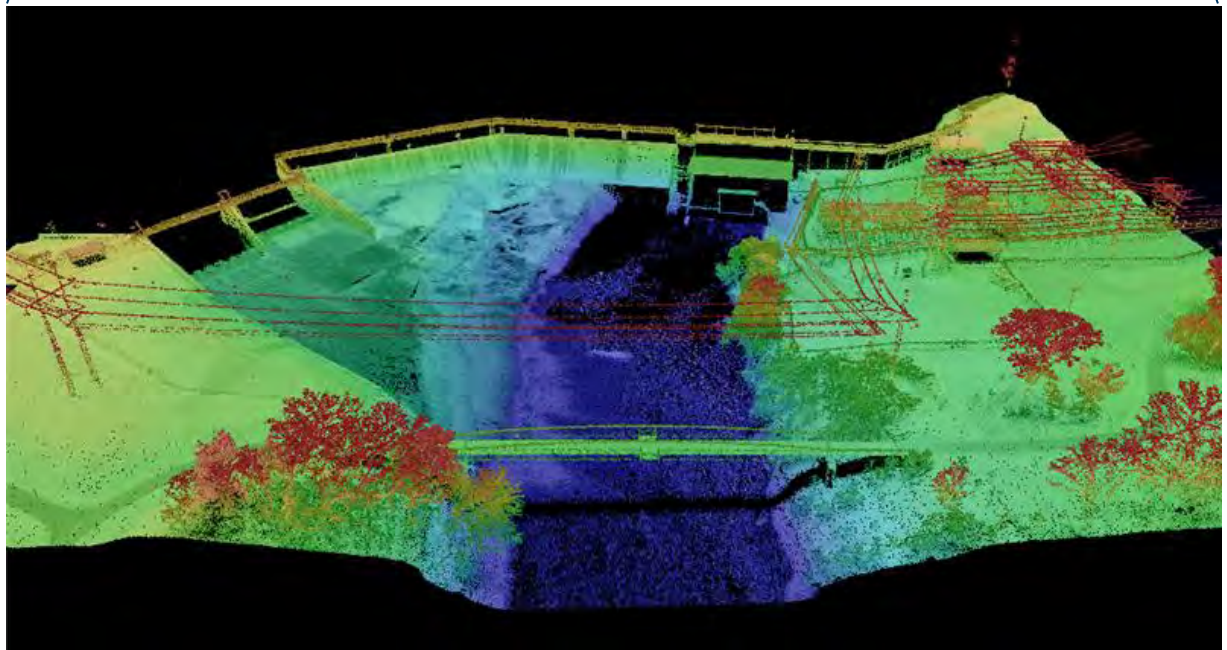
HD Lidar Examples: **Infrastructure**

MnDOT Vertical Accuracy Analysis

High-Density 30+pt/m^2 Quality level-0 Lidar Point Cloud

- Reviewed by Colin Lee and District 6 surveyors
- 90% of the lidar points evaluated have elevation values within **0.033 (ft)** to **0.066 (ft)** of actual, onsite, vertical survey results.
  - Test points represent open, hard, smooth surfaces
  - **1.0** (cm) to **2.0** (cm) of onsite, vertical survey results.
- These values are better than the minimum lidar base specification of ≤ 0.03 m (≤ 3.0 cm / 1.181 in) for QLO.

Lake Byllesby Dam & Reservoir Dakota County (QL0 Lidar Point Cloud)

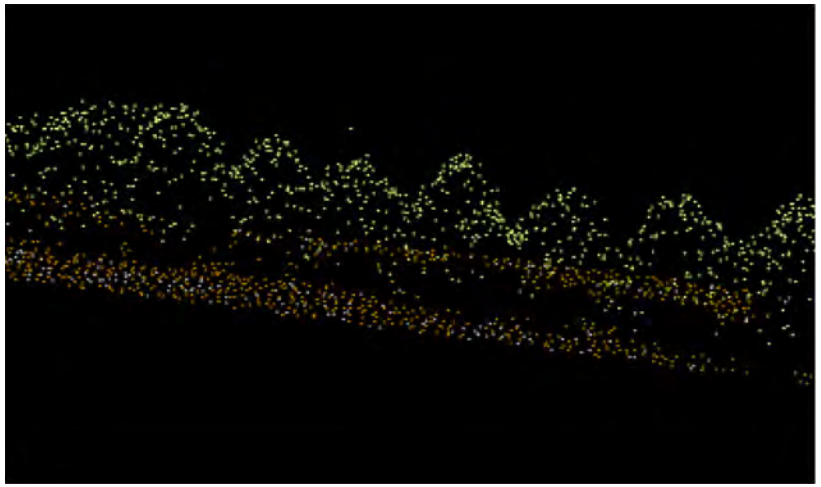


Next

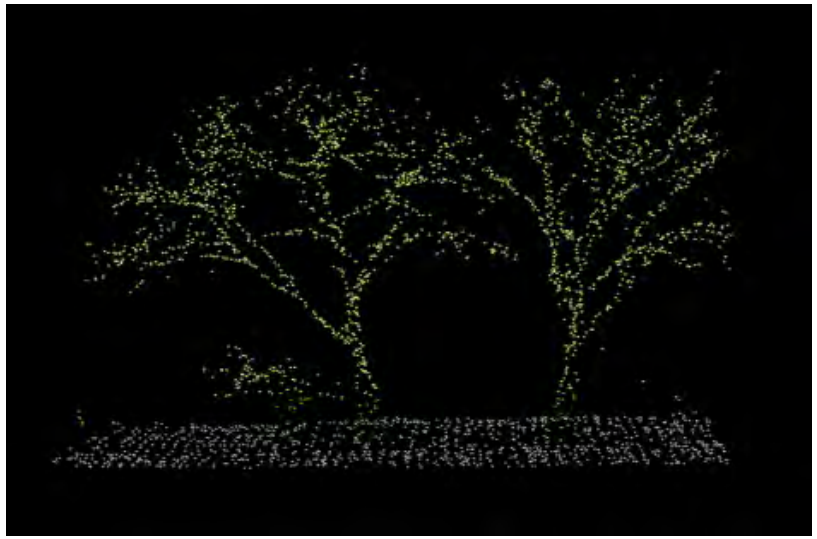
Jennifer Corcoran – Forestry…

HD Lidar Examples: **Vegetation Mapping**

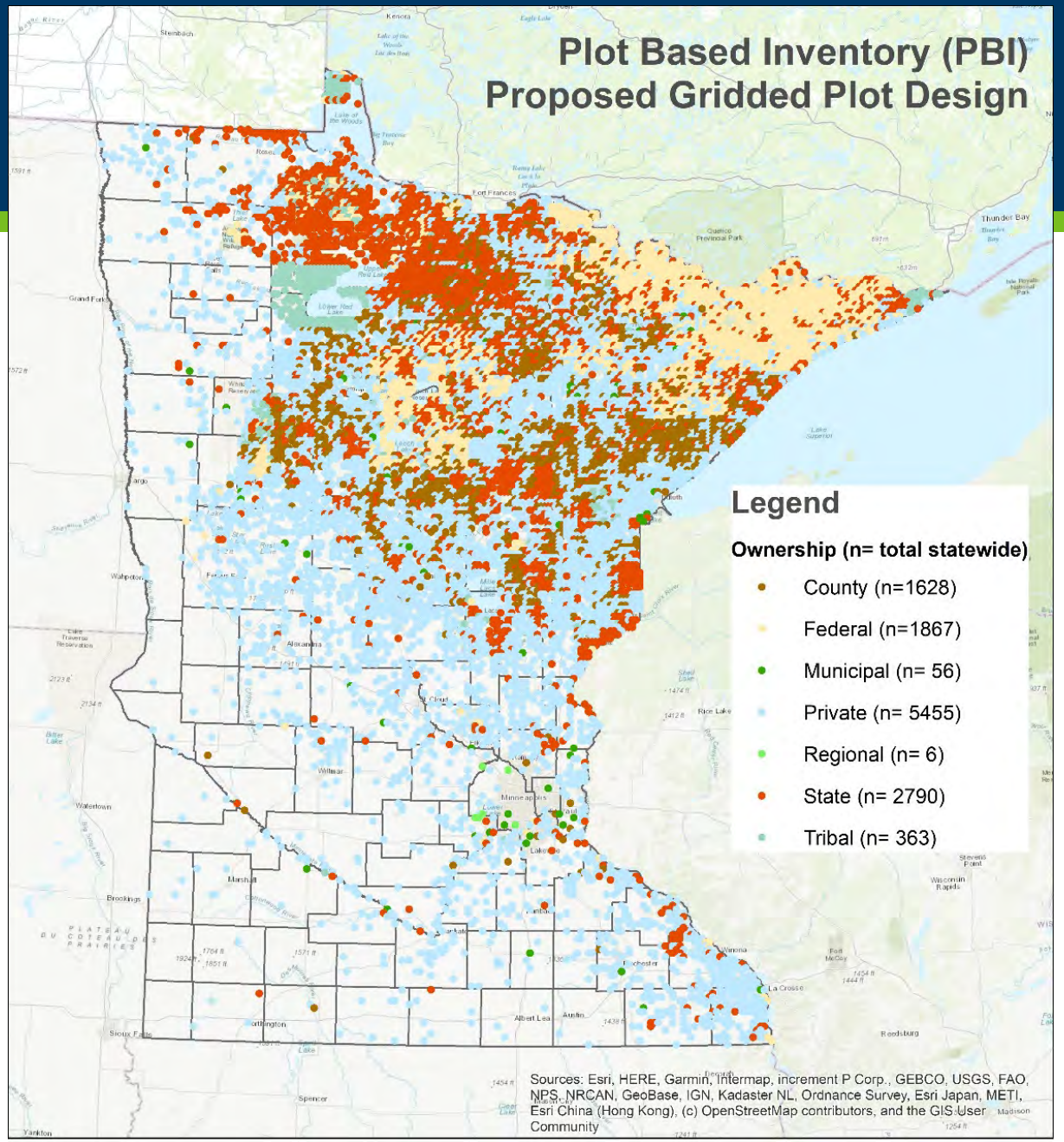
Low Density (QL3, 1ppm)



High Density (QL1, 8+ppm)

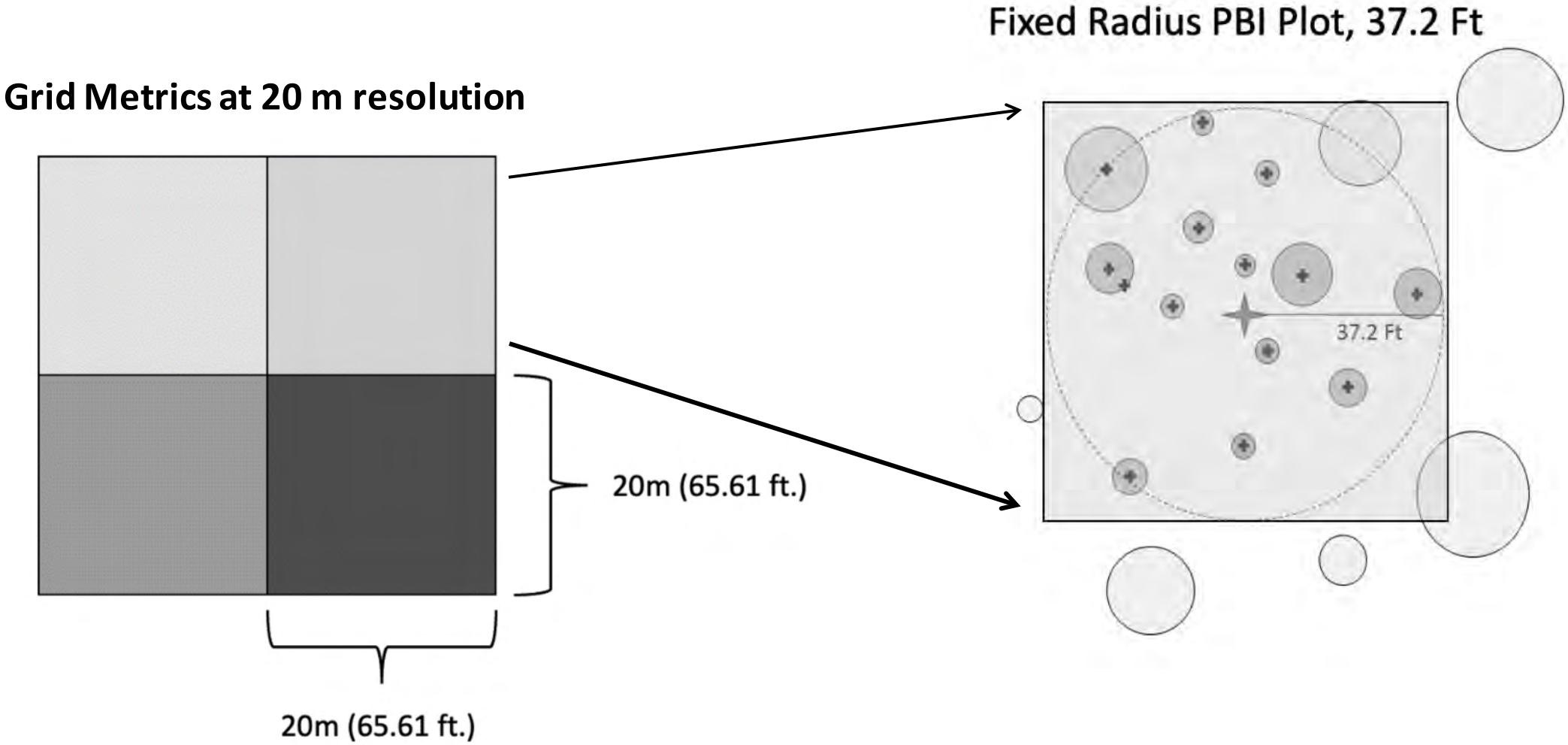


Proposed PBI Statewide



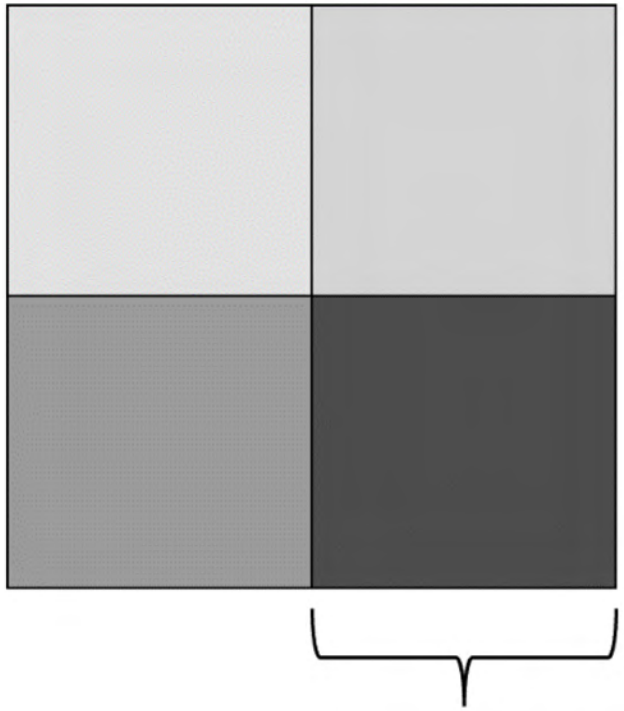
- PBI field work began in fall of 2020
- Each PBI Plot represents approximately 1500 acres
  - Business as usual = 1 week of work
- At present, 41% of DNR plots are complete
- Cost per Plot = ~$300-$500
  - That's only $0.17-$0.29 per acre!
- In 2022, partners will participate in the collection of 250 Federal plots and nearly 300 County plots in four counties
- In 2023, about 380 Federal plots and 390 County plots will be collected in four additional counties
- By the end of 2023, almost all DNR plots will be completed (more than 2900 plots)

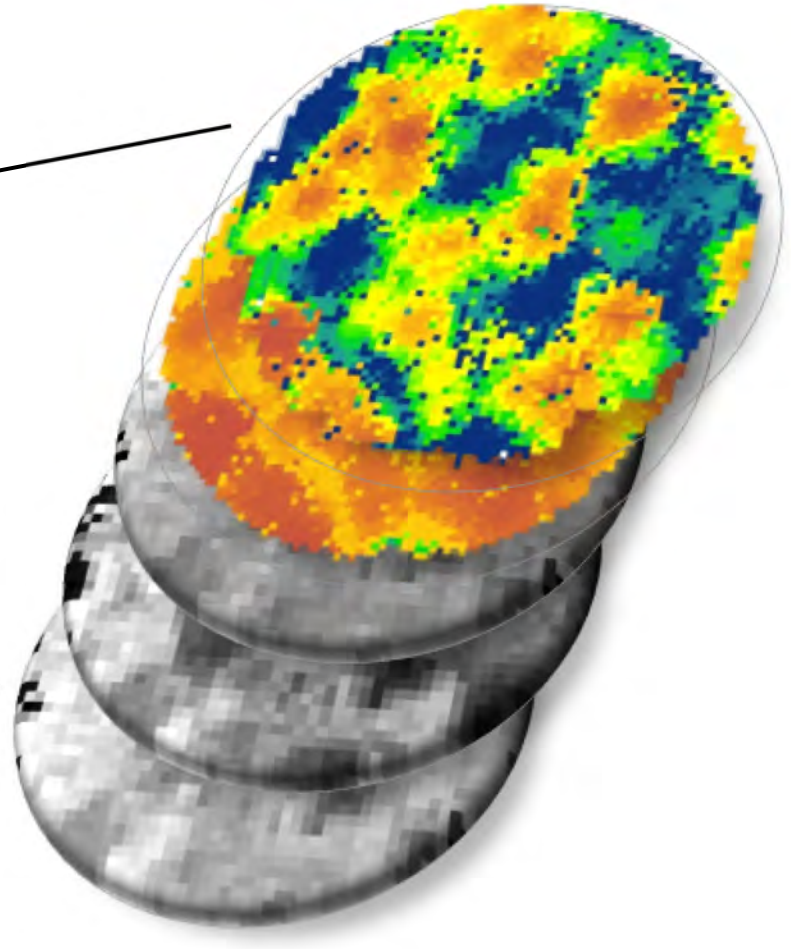
What is PBI – Grid Metrics



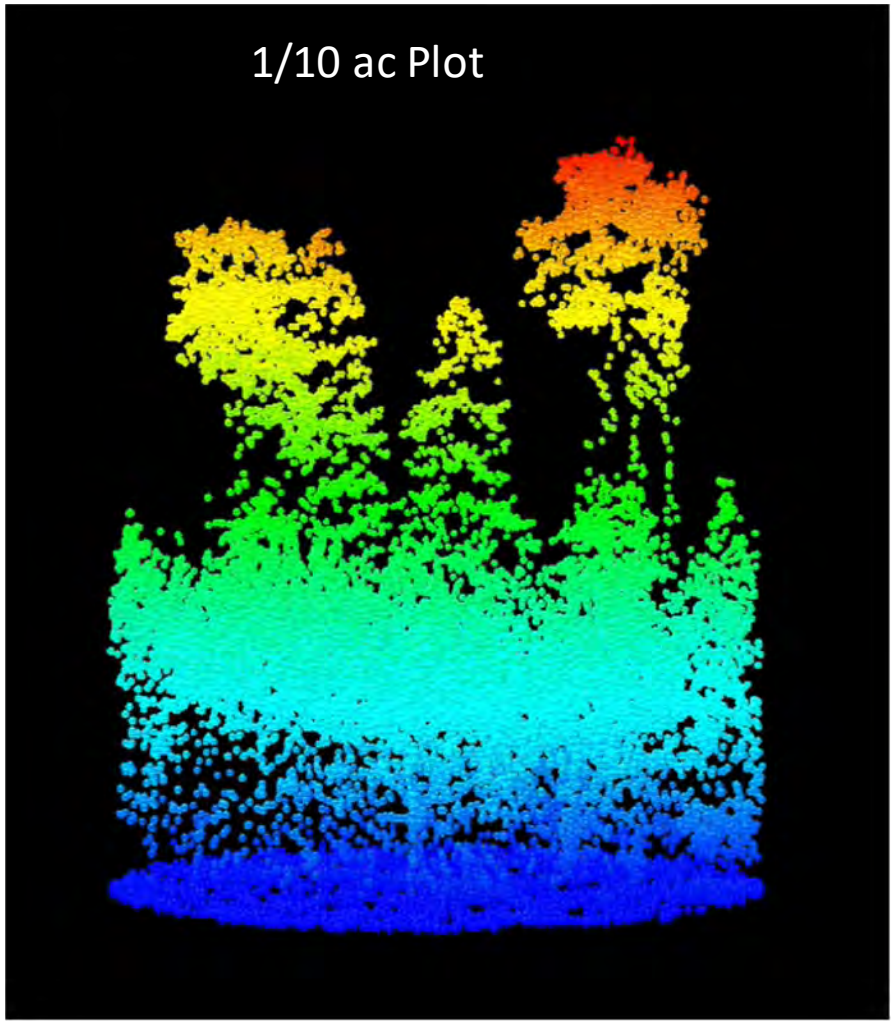
What is PBI – Grid Metrics

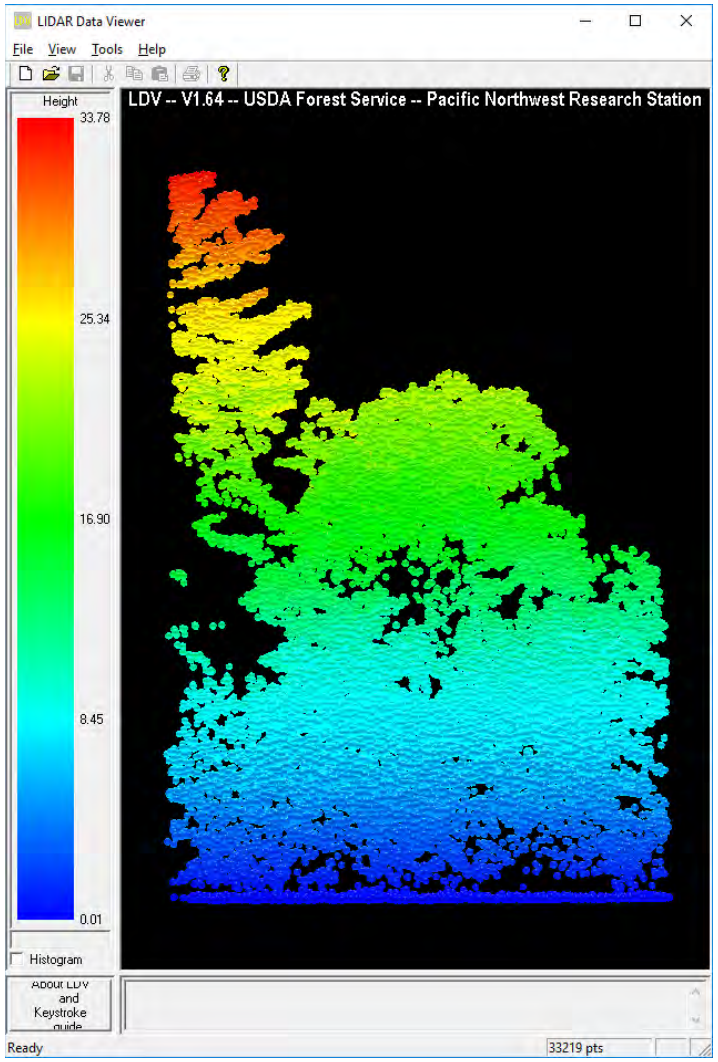
Grid Metrics at 20 m resolution





Co-located PBI Plots with Lidar Point Cloud

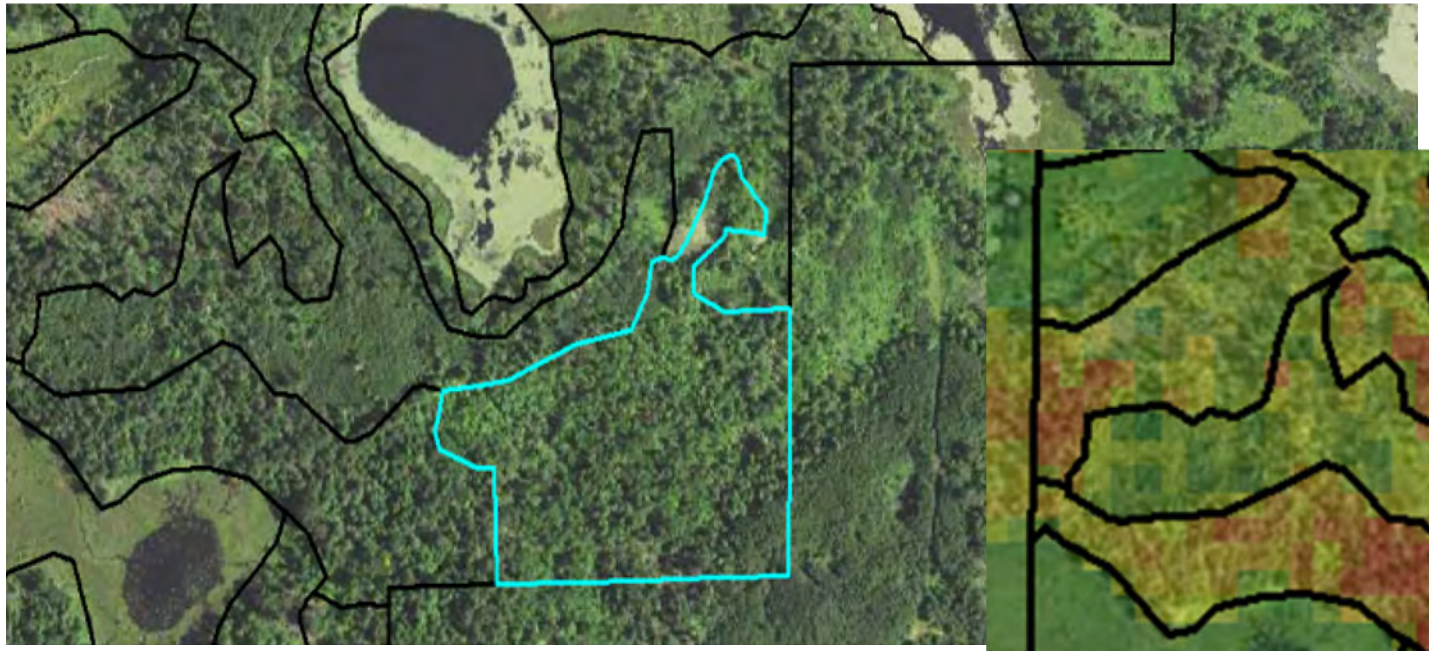


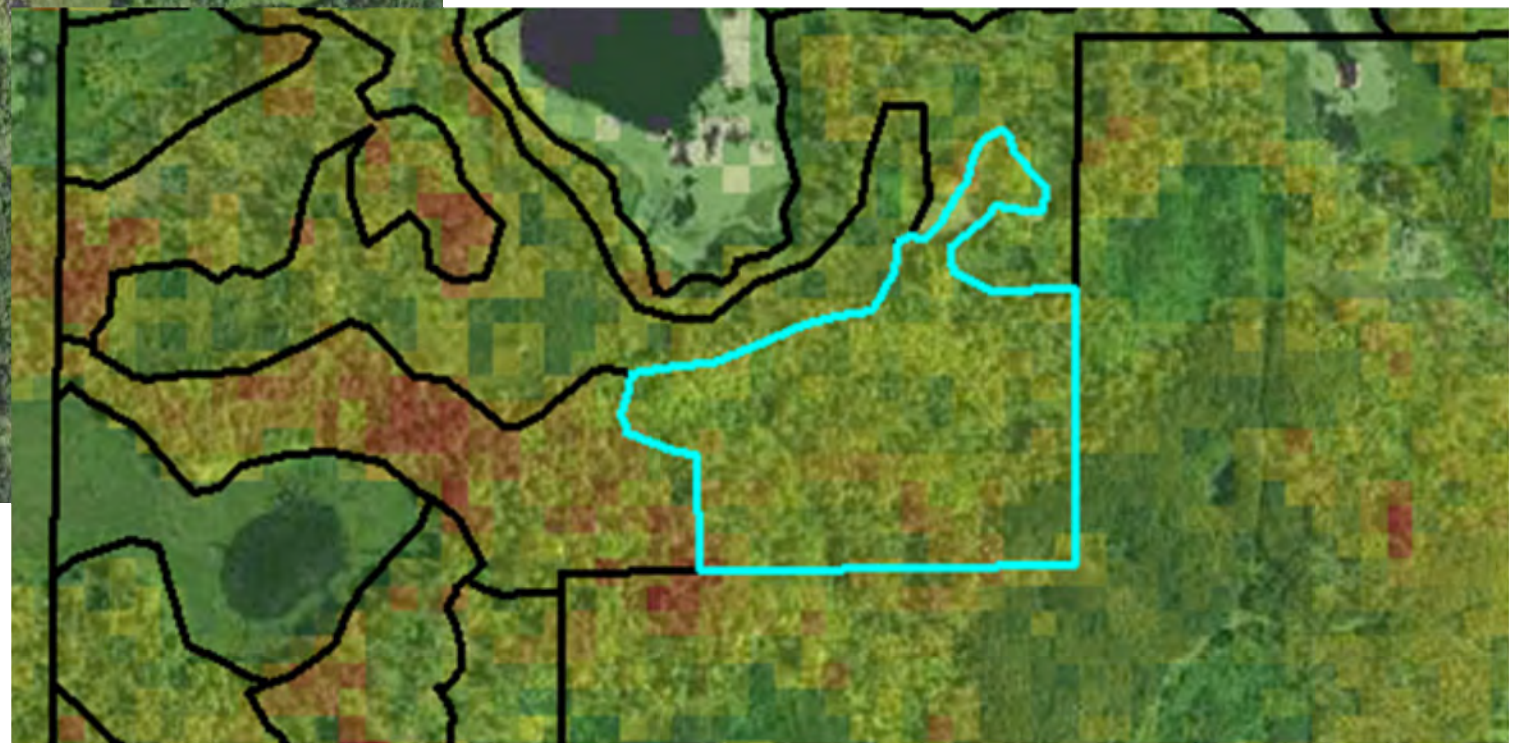


ElevMax	33.78 m
ElevP99	31.92 m
ElevP95	26.09 m
ElevMean	13.27 m
ElevMode	20.44 m
ElevSQRT	15.19 m
ElevCURT	16.74 m
Cover	89.70 %

Forestry - The End Goal

FID	Shape *	STAND_KEY	MN_CTYPE	SURVEY_YR	STAND_AGE	Field1	STAND_KE_1	Grid_Cell_	AGB_Lbs	BAWHT_Max	BA_Wt_weig	QMD_Inches	BA_SqFT_Pe	Site_Index	TPA	Volume_CuF	Age_2019	Volume_Cor	Stand_Acre
2908	Polygon	5374	1	1992	99	255	5374	164	91711.17	85.33	56.97	11.3	93.36	56.86	152	2230.88	126	28.24	16





Forestry Inventory - putting elements together

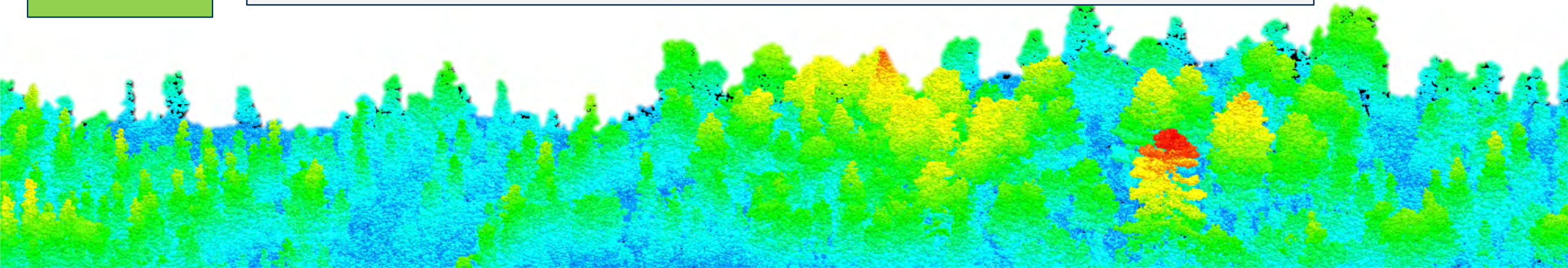
Lidar and PBI is Foundational Data for DNR

Data Procurement → Data Development → Data Dissemination → User Application

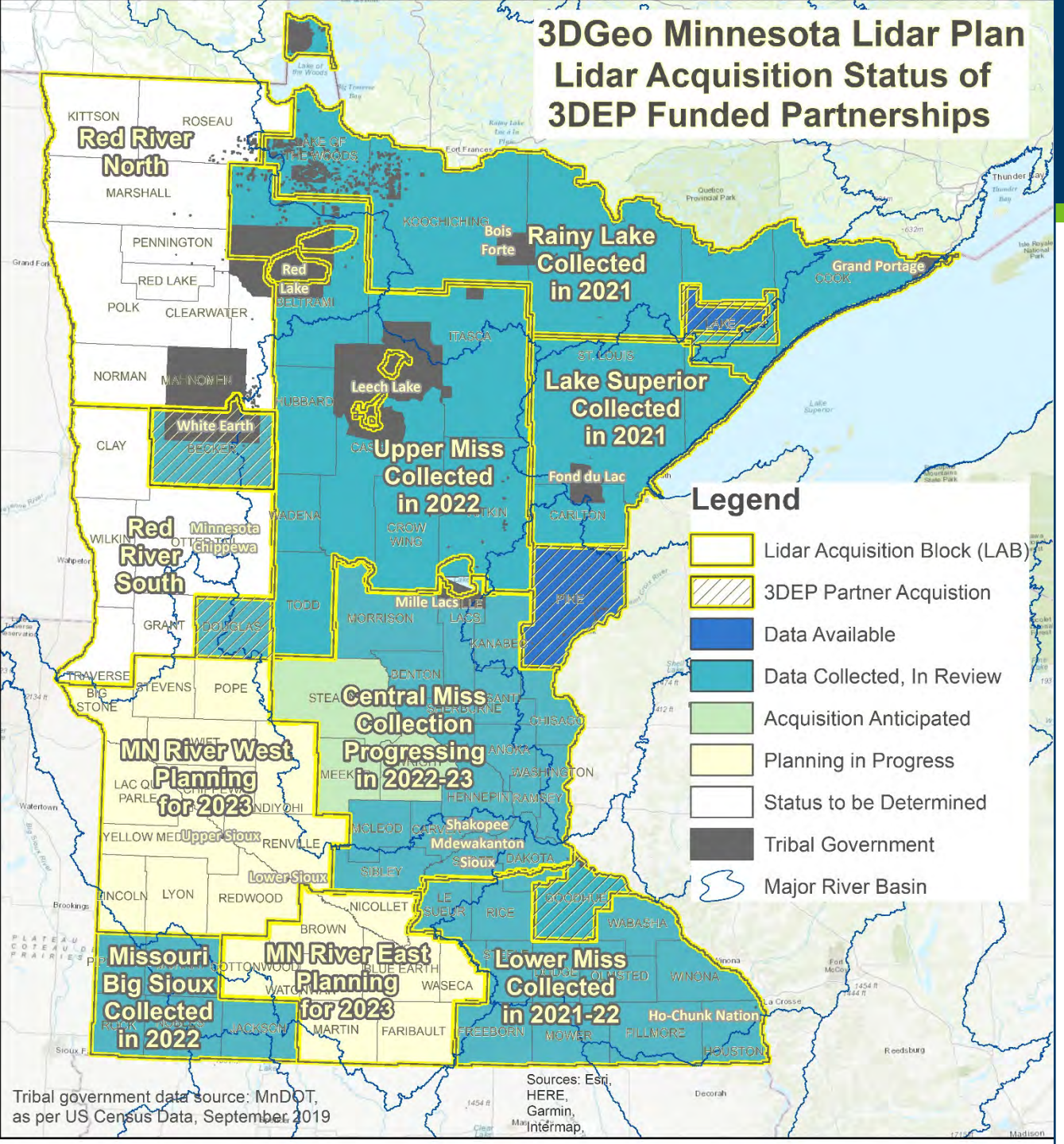
Lidar Point Cloud

PBI Data Collected

Relationships Modeled → **Grid Layers** → **Inventory Metrics** → **Stand Level Inventory** → **4Trees (FIM)/ Web Services**




Completed
& Planned
Lidar
Collections

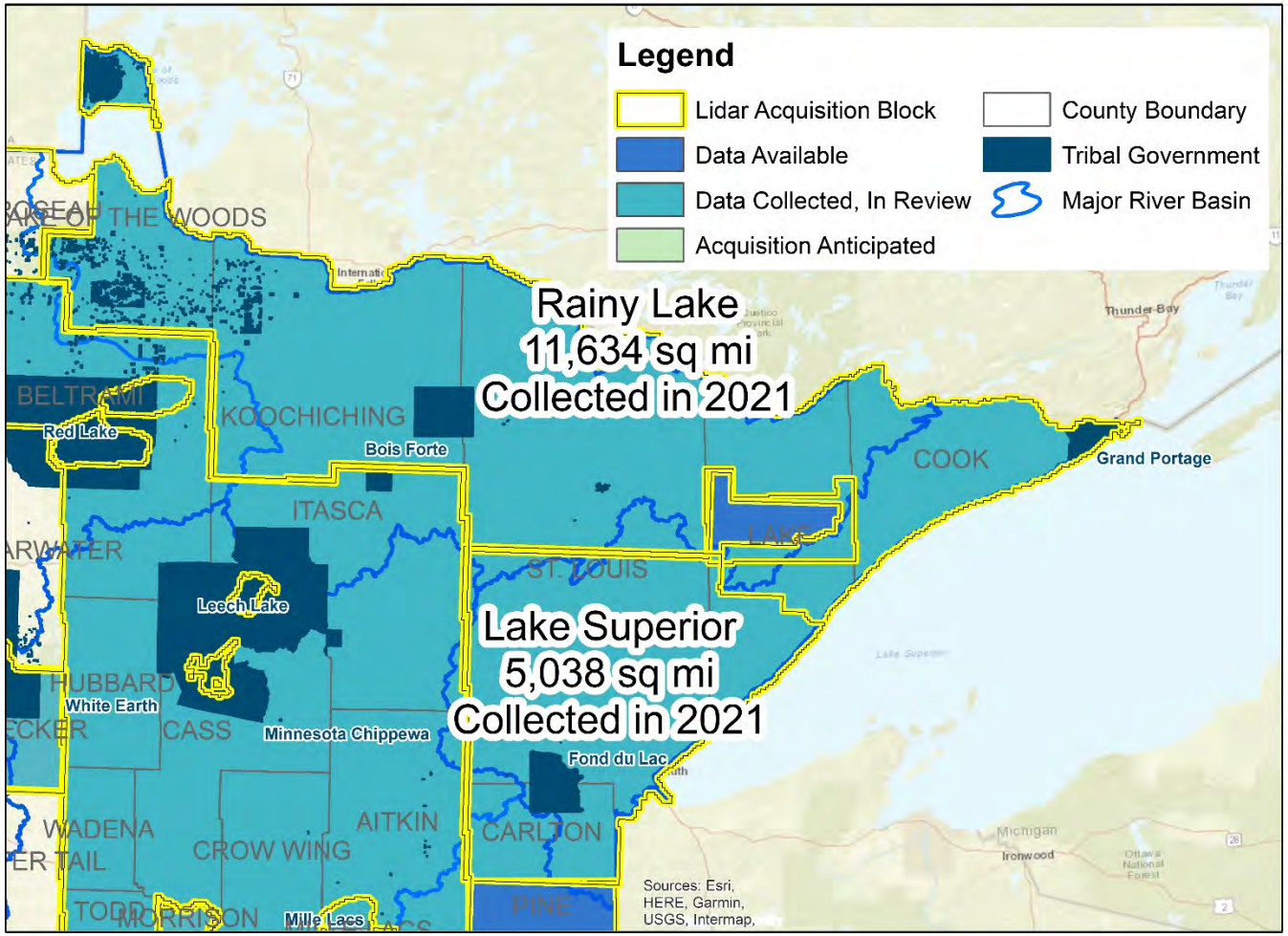


Lidar Acquisition Areas and Blocks of Interest

- Lake County area collected in fall 2018, data publicly available
- Pine County collected in spring 2019, data publicly available
- Goodhue County collected in spring 2020, data in review
- Rainy Lake and Lake Superior collected in spring 2021, data delivery fall 2022
- Missouri/Big Sioux, Becker and Douglas Counties, and Upper Mississippi collections completed spring 2022, data delivery expected in fall 2023
- Central Mississippi partially collected in spring 2022, remaining to be collected spring 2023
- Red River Watershed Management Board, with supporting Counties and Watershed Districts collected lidar in fall 2021 within the Red River Watershed

3DGeo Outreach: COLLECTED in 2021

Northeast – Rainy Lake & Lake Superior Blocks



Tribal boundaries data source: MnDOT, as per US Census Data September 2019

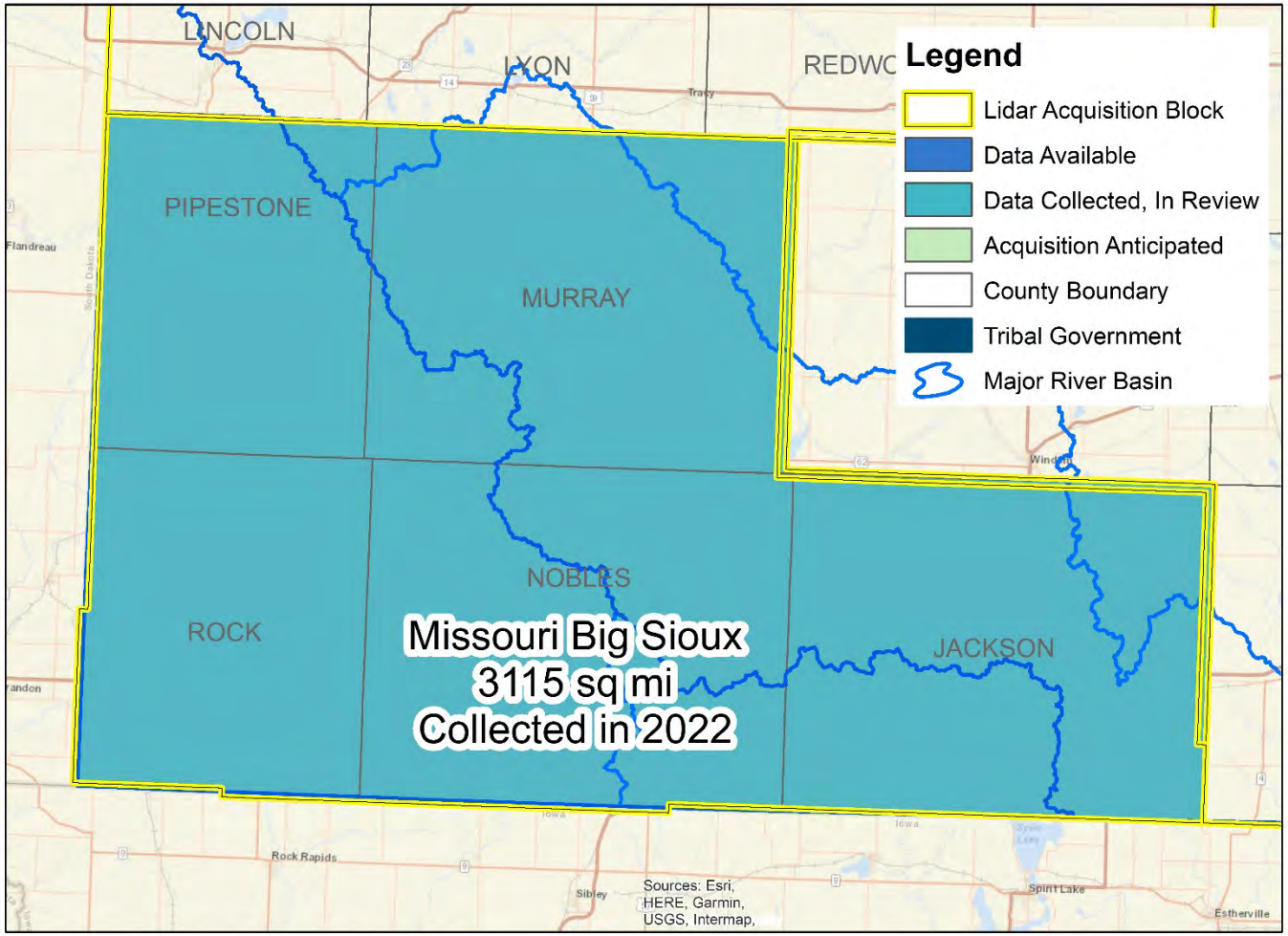
0 15 30 60 Miles

Map Date: Aug 24, 2022

17 state/local partners raised $1,768,561 total, leveraging a $3,803,513 match from 3DEP!

3DGeo Outreach: COLLECTED in 2022

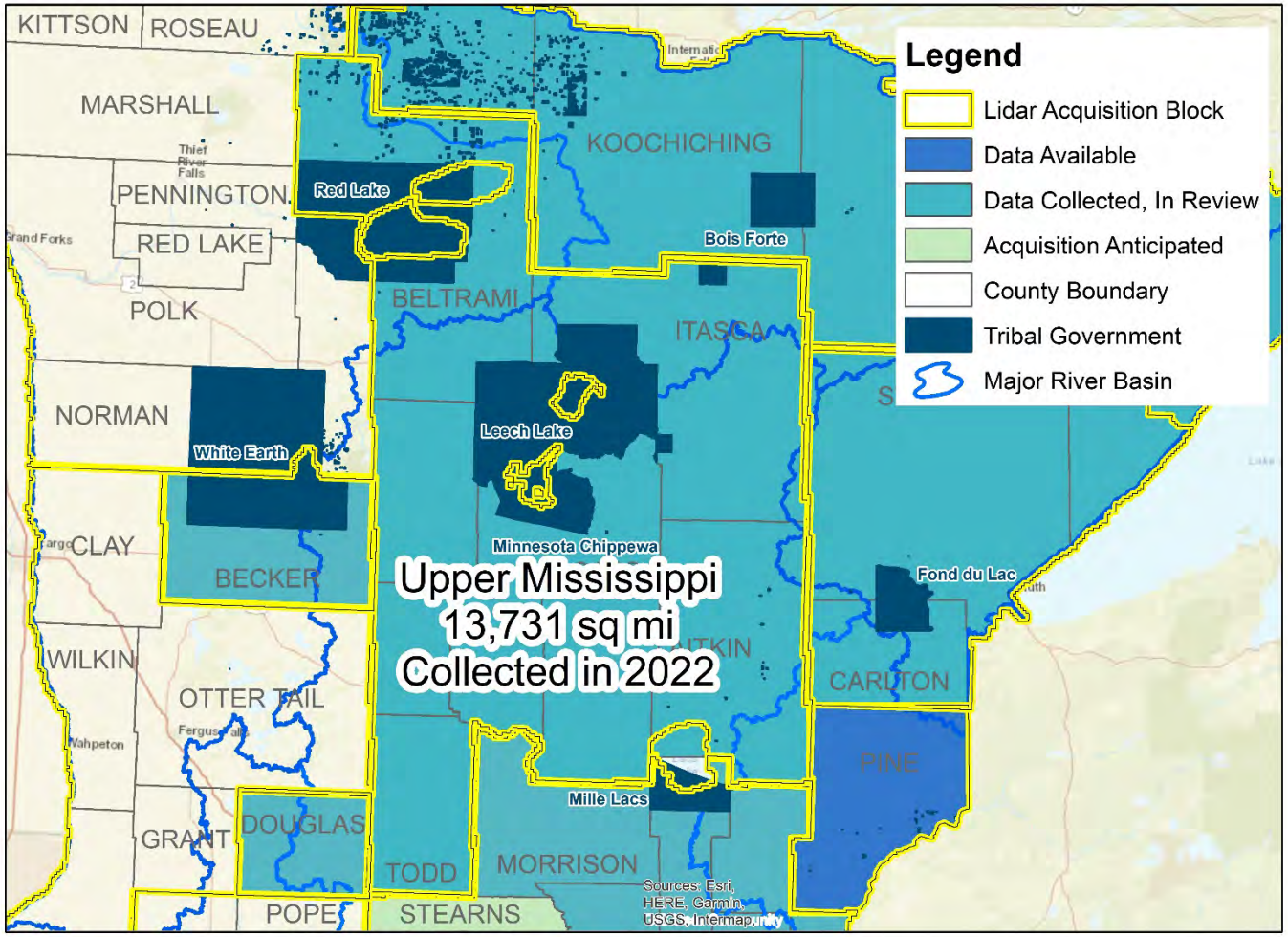
Southwest – Missouri River Big Sioux Block



8 state/local partners raised $355,626 total, leveraging a $657,342 match from 3DEP!

3DGeo Outreach: COLLECTED in 2022

Upper Mississippi River Block



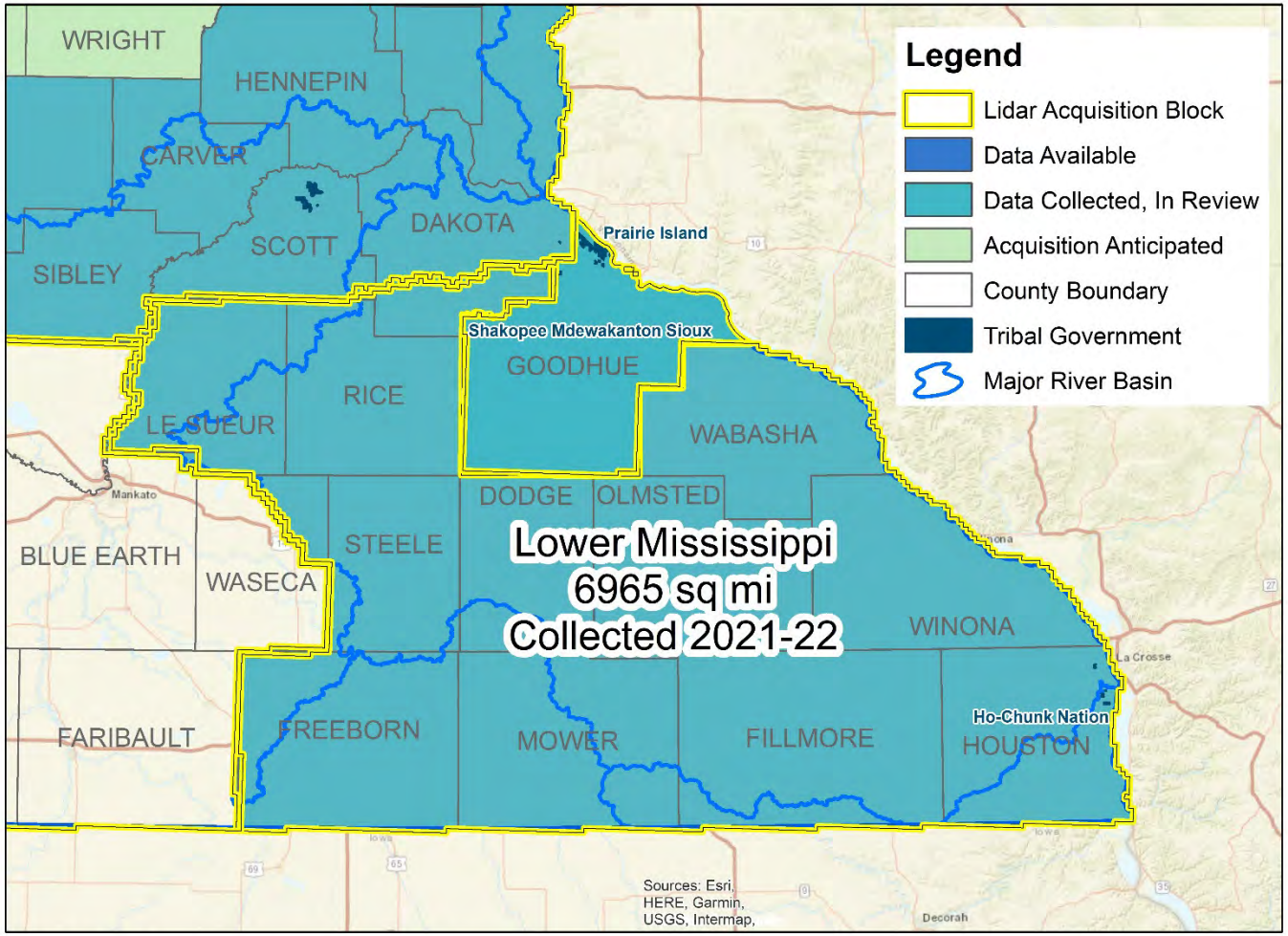
Tribal boundaries data source: MnDOT, as per US Census Data September 2019

0 15 30 60 Miles

Map Date: Aug 24, 2022

15 state/local partners raised $1,236,736 total, leveraging a $3,214,168 match from 3DEP!

3DGeo Outreach: COLLECTED in 2021 & 2022
Southeast – Driftless Block



Tribal boundaries data source: MnDOT, as per US Census Data September 2019

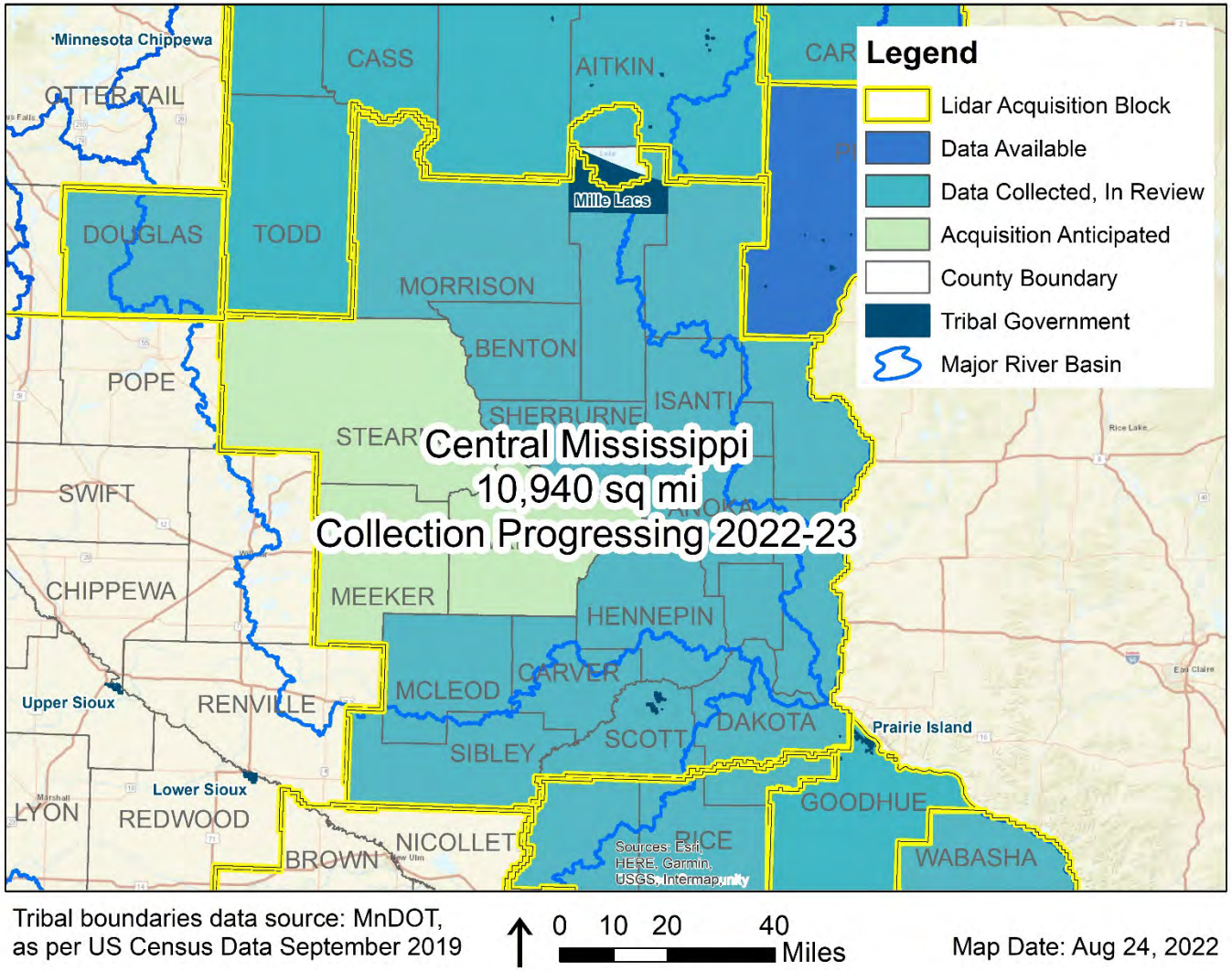
0 10 20 40 Miles

Map Date: Aug 24, 2022

6 state/local partners raised $1,025,193 total, leveraging a $1,427,488 match from 3DEP!

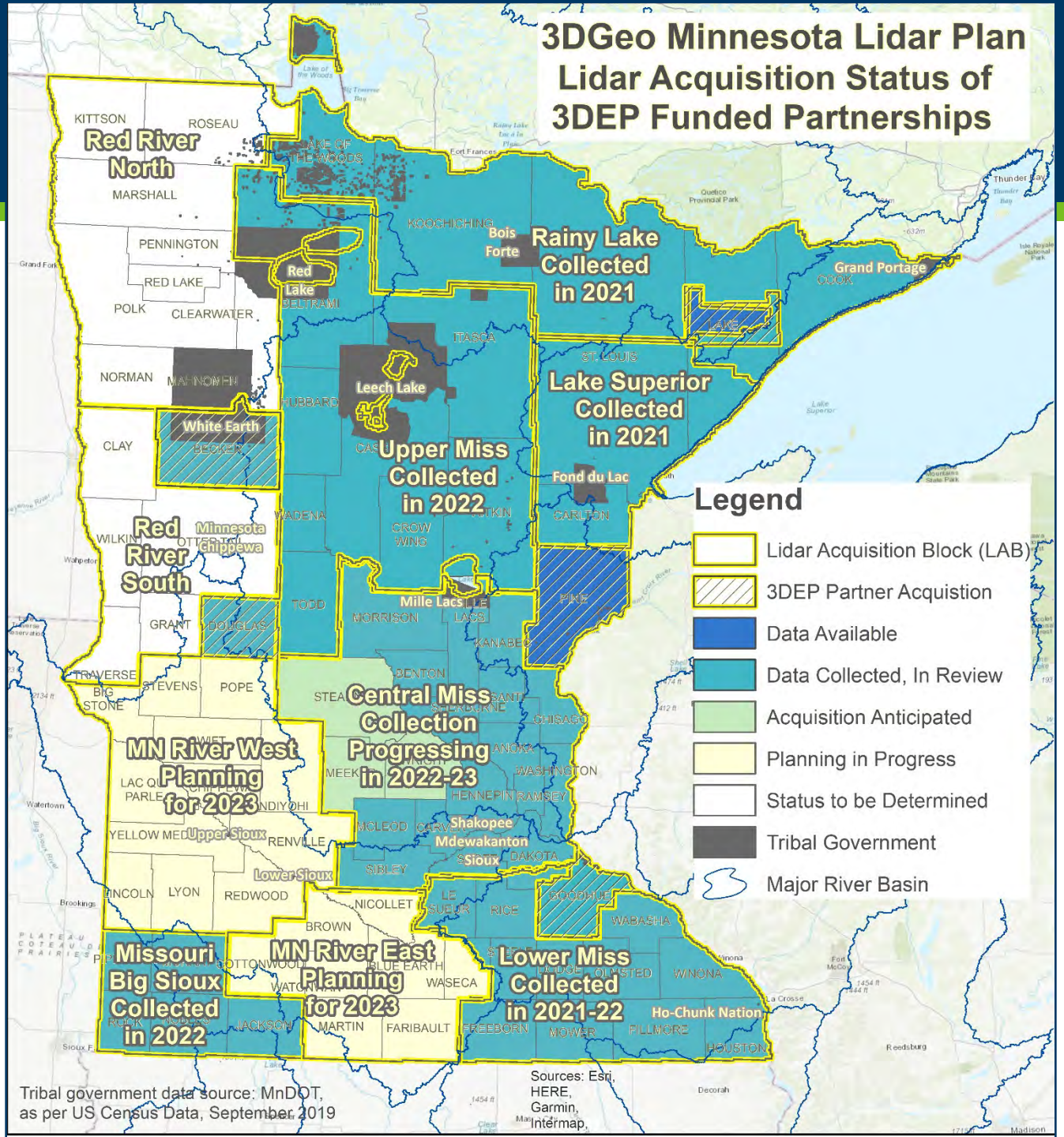
3DGeo Outreach: COLLECTED/ANTICIPATED in 2022 and 2023

Central Mississippi River Block



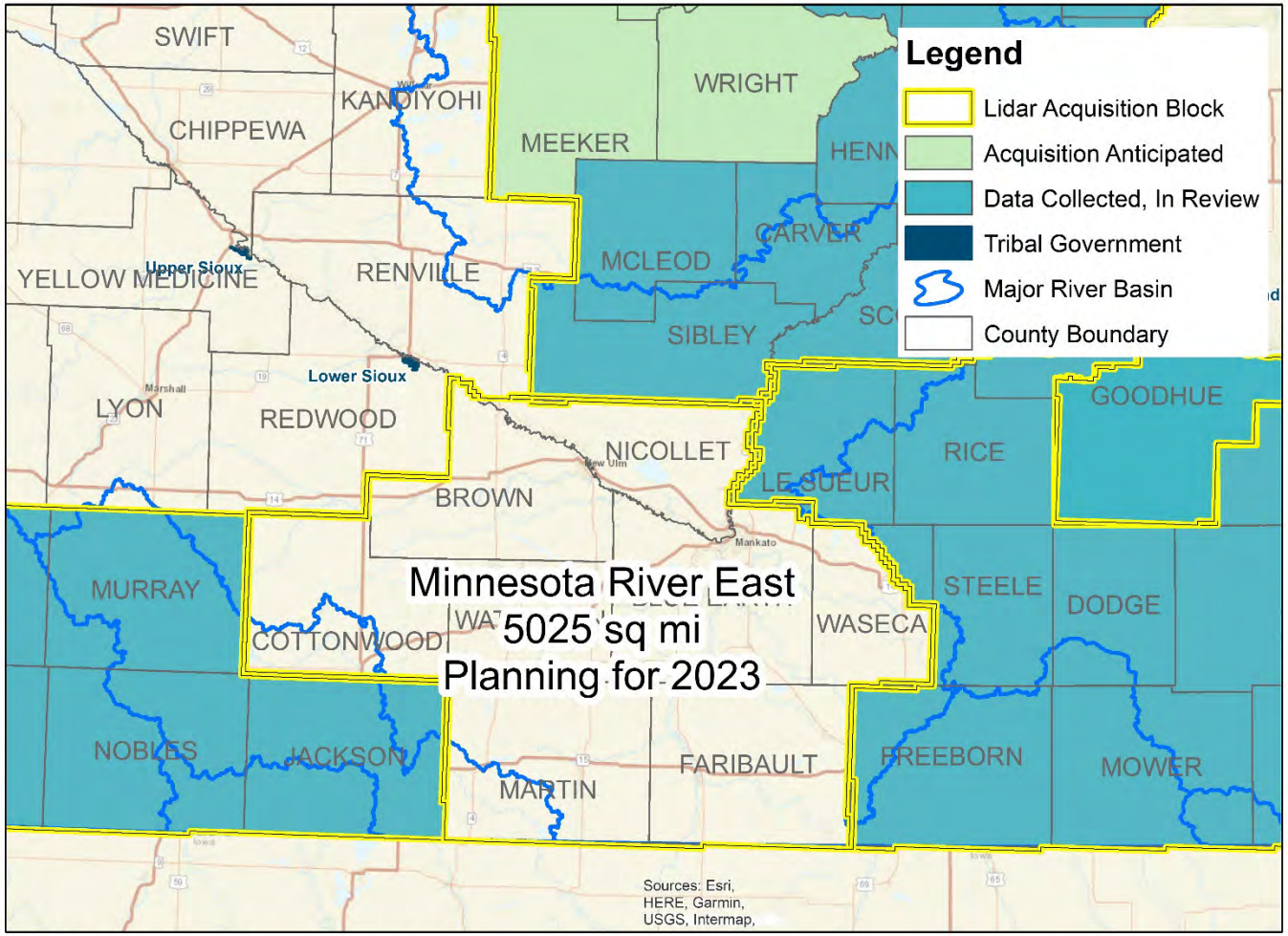
20 state/local partners raised $1,667,645 total, leveraging a $2,198,864 match from 3DEP!

Lidar Acquisition Areas and Blocks of Interest



3DGeo Outreach: PLANNING for 2023

Minnesota River - East Block



Tribal boundaries data source: MnDOT, as per US Census Data September 2019

0 10 20 40 Miles

Map Date: Aug 24, 2022

3DGeo stakeholder **outreach** began in the MN River East and West Blocks when conducting initial outreach in Southern MN in 2019

Estimated USGS 3DEP Contribution		Total Partner Contributions Needed	
%	$	%	$
40%	$653,250	60%	$979,875

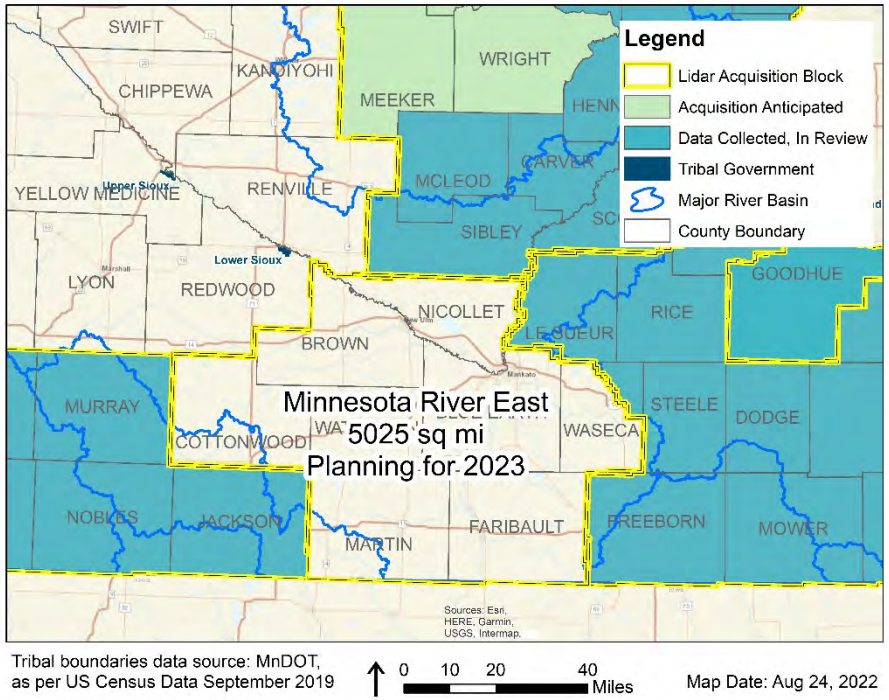
5025 square miles Estimated at **$325** per sq mi total = **$1,633,125** TOTAL

Average per County Partner Goal: **$61,242.19**

Minnesota River - East Block

- TOTAL Funds Needed: $1,633,125
- Estimated using $325 per square mile for QL1
- 8 Counties* - 5,025 square miles (range 433 – 765 mi^2)

Contributors	%	*Average Per County*	$
USGS	**40**		**$653,250**
Partners	**60**		**$979,875**
LAB Counties	*~ 30***	*$61,242*	*$489,938*
All Others	*~ 30***		*$489,938*
Grand TOTAL	**100**		**$1,633,125**

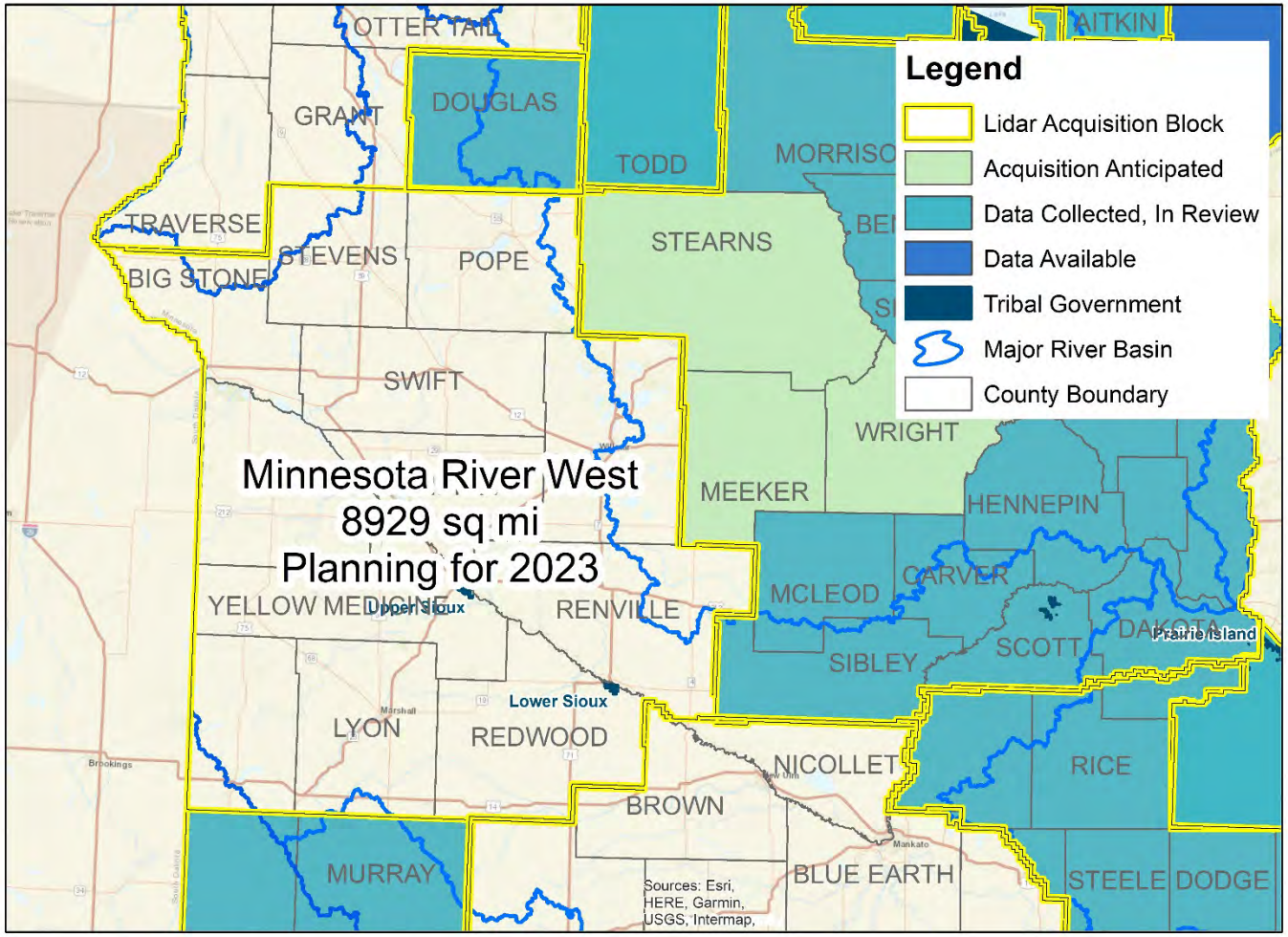


*Brown, Blue Earth, Cottonwood, Faribault, Martin, Nicollet, Waseca, Watonwan

**This is an estimate, up to 30% of the TOTAL, and dependent on the Lidar Acquisition Block

3DGeo Outreach: PLANNING for 2023

Minnesota River - West Block



Tribal boundaries data source: MnDOT, as per US Census Data September 2019

Map Date: Aug 24, 2022

3DGeo stakeholder **outreach** began in the MN River East and West Blocks when conducting initial outreach in Southern MN in 2019

Estimated USGS 3DEP Contribution		Total Partner Contributions Needed	
%	$	%	$
40%	$1,160,770	60%	$1,741,155

8,929 square miles Estimated at **$325** per sq mi total = **$2,901,925** TOTAL

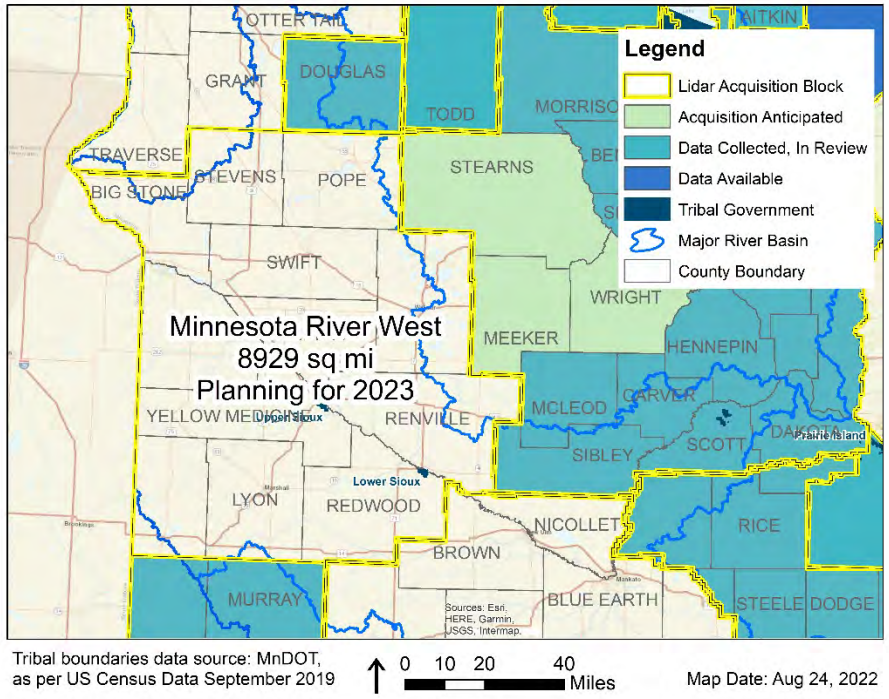
Average per County Partner Goal: **$72,548.13**

3DGeo Outreach: PLANNING for 2023

Minnesota River – West Block

- TOTAL Funds Needed: $2,901,925
- Estimated using $325 per square mile for QL1
- 12 Counties* - 8,929 square miles (range 529 – 764 mi^2)

Contributors	%	*Average Per County*	$
USGS	**40**		**$1,160,770**
Partners	**60**		**$1,741,155**
LAB Counties	*~ 30***	*$72,548*	*$870,578*
All Others	*~ 30***		*$870,578*
Grand TOTAL	**100**		**$2,901,925**



*Big Stone, Chippewa, Kandiyohi, Lac Qui Parle, Lincoln, Lyon, Pope, Redwood, Renville, Stevens, Swift, Yellow Medicine

**This is an estimate, up to 30% of the TOTAL, and dependent on the Lidar Acquisition Block

3D Geomatics: Fiscal Agent

MNIT Services is the Fiscal Agent

- MnGeo is establishing funding agreements with all local funding partners
- MnGeo establishes individual funding agreements with USGS 3DEP for each of the 3DGeo lidar acquisition blocks

Next steps to be a Financial Partner

- Let the 3DGeo know you're interested in partnering (email: **lidar@state.mn.us** with amount)
- Complete an "Attachment D" document to validate you are a proposed funding partner (this can be marked as pending or guaranteed because we know partners may need to have official approval from their Boards, etc.)
- MnGeo submits all Attachment Ds with the BAA funding application
- If the BAA funding is approved, MNIT will create a Joint Powers Agreements (JPA) between MNIT and your organization. These documents should be executed 90 days before lidar acquisition (December - February)
- MNIT will invoice partner in late spring (April)

Next

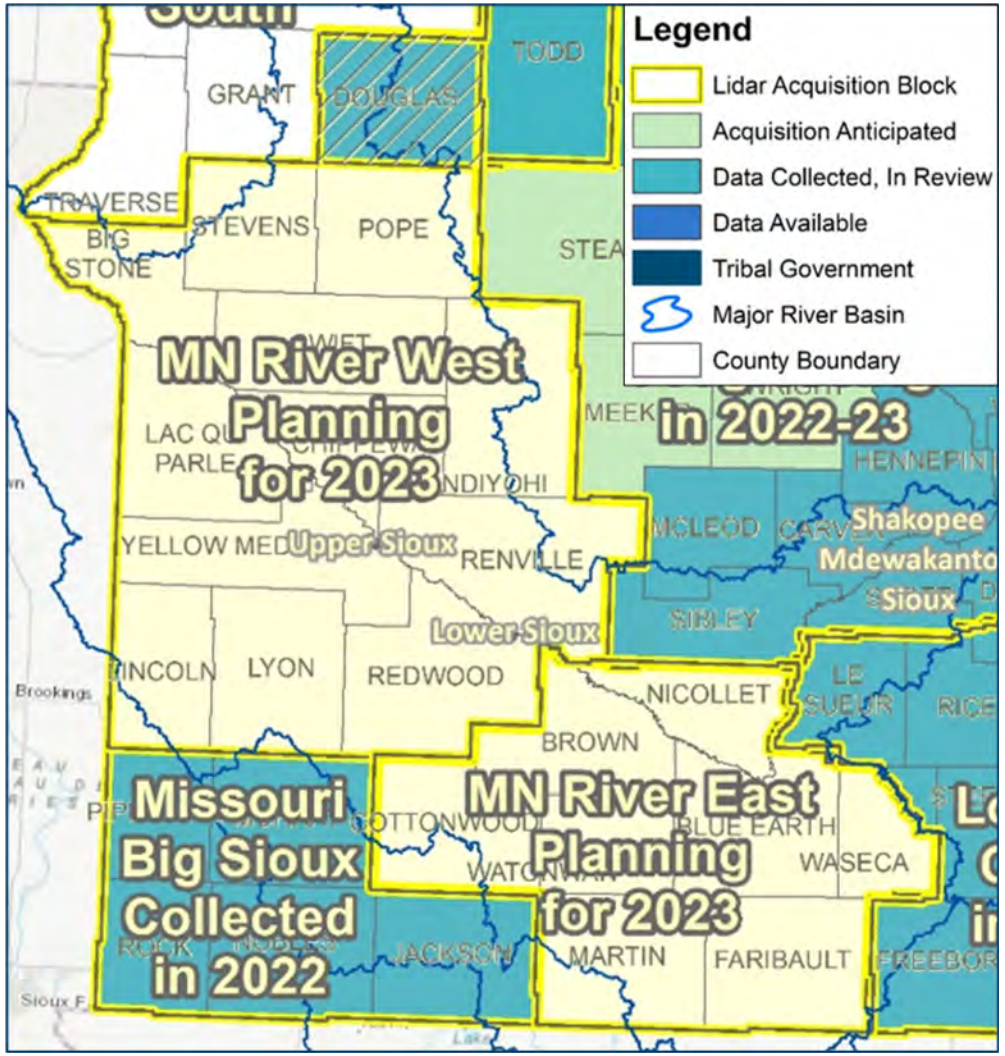
Wrap Up and Next Steps…

How:
You can Help

Call to action: Next steps – MN River East & West LAB

Call To Action

- 3DGeo seeks to identify local **champions** and **funding partners** across MN River - East and West LABs for a *Spring 2023* lidar acquisition project
  - 2023 - Lidar Collection
  - Data Delivery Late 2024
- Without stakeholder support and funding partnerships established by **September 2022**, 3DGeo will be forced to **withhold** its planned LAB grant submission(s) until September **2023**.
  - 2024 – Lidar Data Collection
  - Data Delivery late 2025

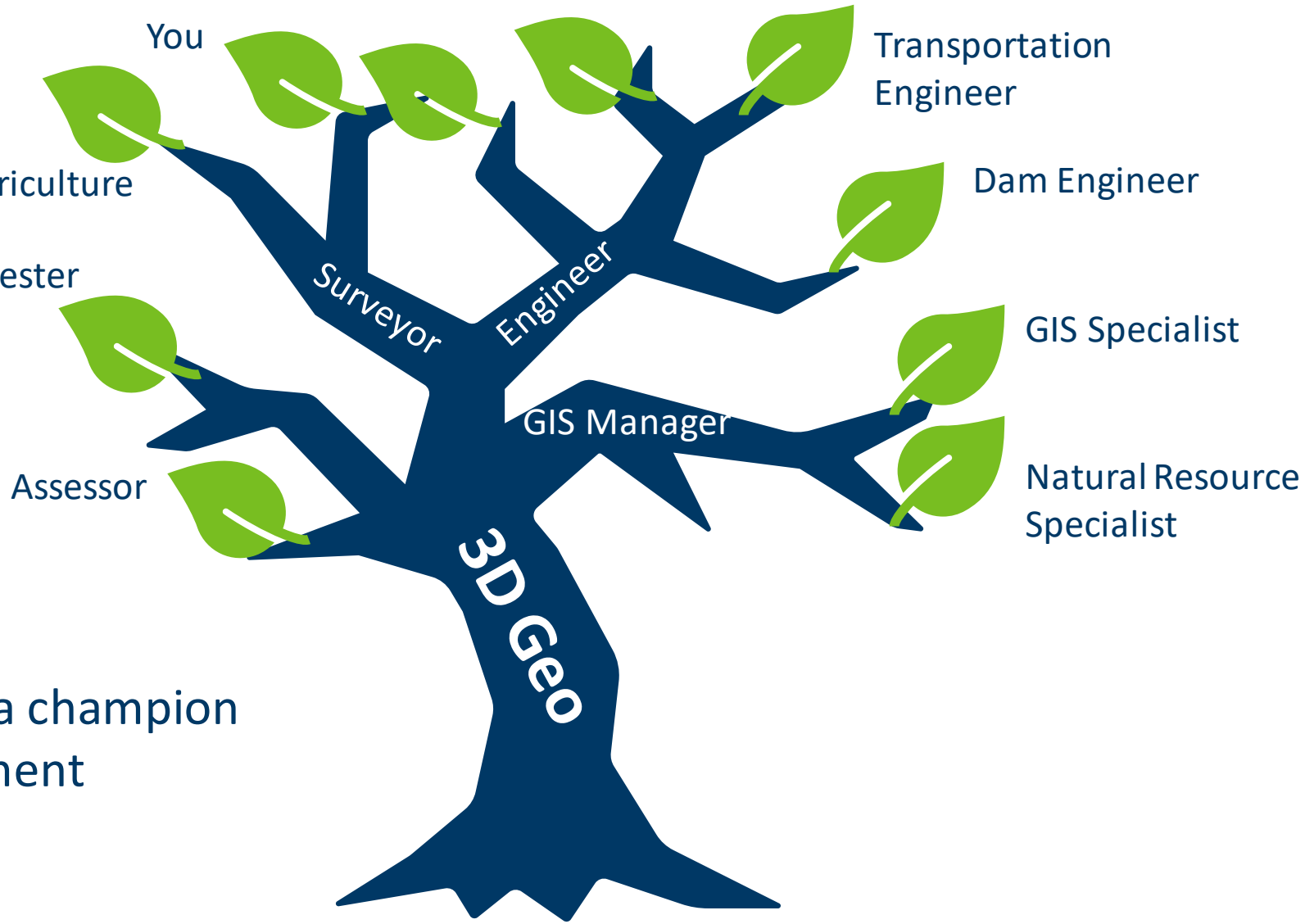


Call to action: Next steps → Individual Role

You don't have to have money or be a decision maker to be a stakeholder . . .

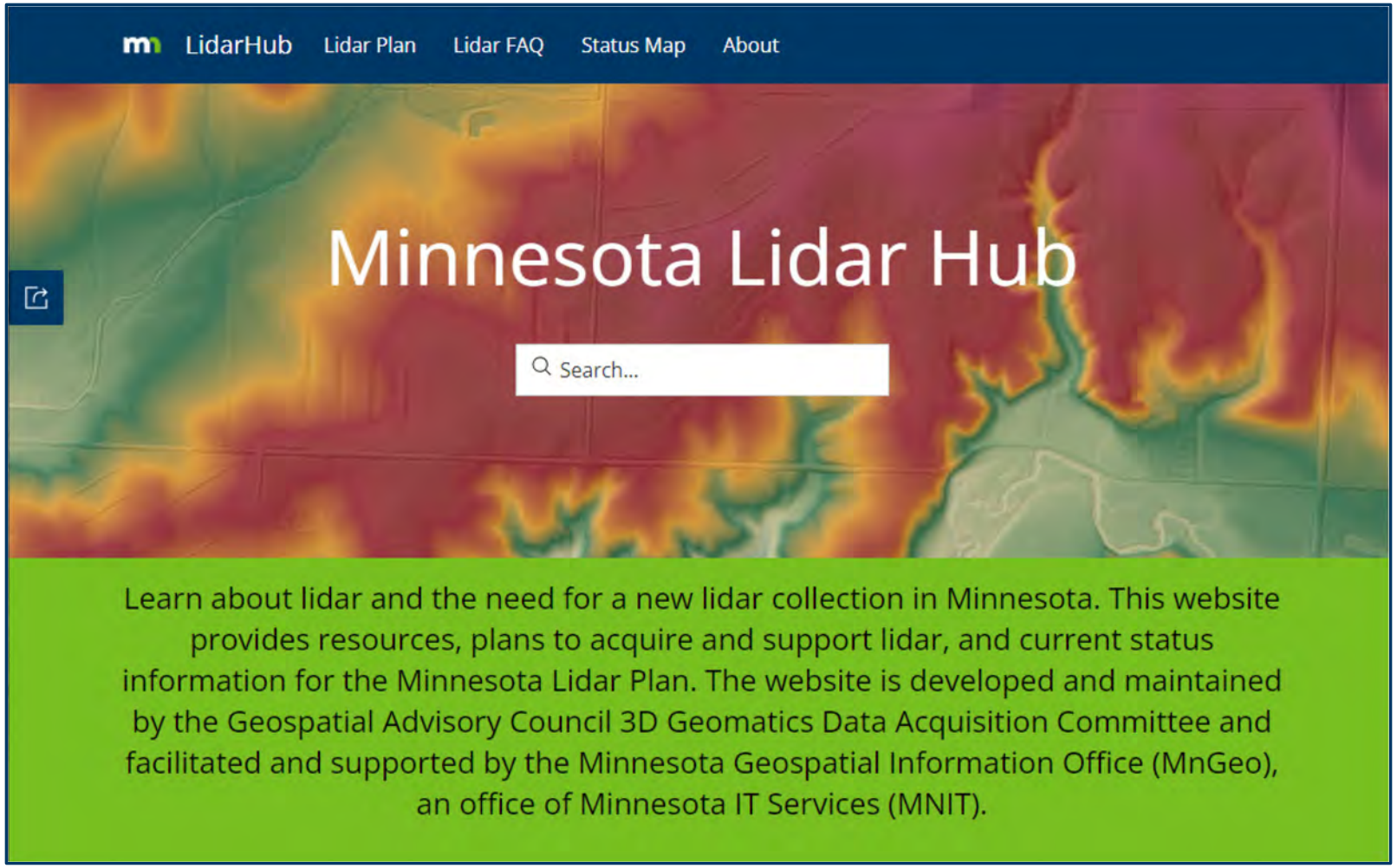
You can be a voice of support . . .

A collaborator!



Action Item: Please serve as a champion within your place of employment

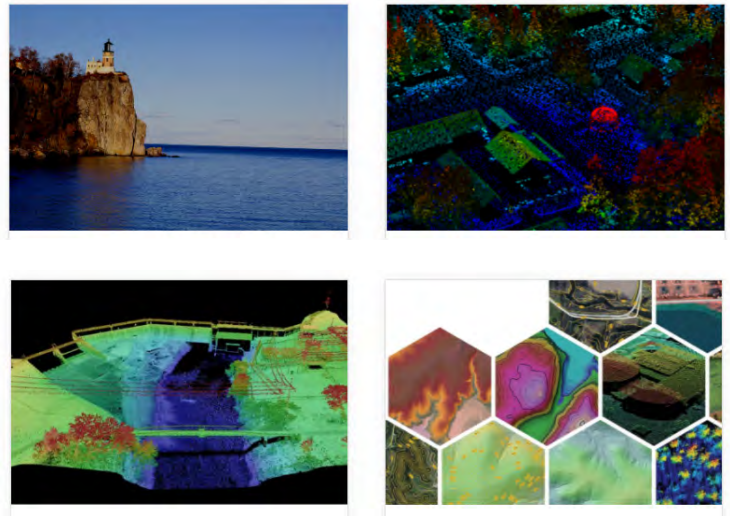
Next steps – Individual Role → Review Minnesota Lidar Hub



https://lidarhub-minnesota.hub.arcgis.com/

Lidar Hub

- Serves as our lidar **information portal**
- Visit often for **updates**



Call to action: Next steps – Individual Role → Obtain 3DGeo Outreach & Education Materials

USGS science for a changing world

The 3D Elevation Program—Summary for Minnesota

Introduction

Elevation data are essential to a broad range of applications, including forest resources management, wildlife and habitat management, national security, recreation, and many others. For the State of Minnesota, elevation data are critical for agriculture and precision farming, natural resources conservation, flood risk management, infrastructure and construction management, water supply and quality, coastal zone management, and other business uses. Today, high-quality light detection and ranging (lidar) data are the sources for creating elevation models and other elevation datasets. Federal, State, and local agencies work in partnership to (1) replace data, on a national basis, that are (on average) 30 years old and of lower quality and (2) provide coverage where publicly accessible data do not exist. A joint goal of State and Federal partners is to acquire consistent, statewide coverage to support existing and emerging applications enabled by lidar data. The new 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b), managed by the U.S. Geological Survey (USGS), responds to the growing need for high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features.

3D Elevation Program Benefits for Minnesota

The top 10 Minnesota business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in table 1. National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) survey respondents in the State of Minnesota estimated that the national 3DEP initiative would result in at least $13 million in new benefits annually to the State. The cost for such a program in Minnesota is approximately $28 million, resulting in a payback period of 2.1 years and a benefit-to-cost ratio of 3.9 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Minnesota are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Minnesota could benefit from access to statewide high-resolution elevation data.

The NEEA evaluated multiple data-collection programs to determine the optimal data quality and data replacement cycle relative to cost to meet the stated needs. For Minnesota, approximately 76 percent of the total benefits are realized in agriculture and precision farming and natural resources conservation uses alone, as shown in table 1. The status of publicly available lidar data in Minnesota is shown in figure 1. By enhancing coordination between the 3DEP and the various government and private organizations in Minnesota, it may be possible to meet a higher percentage of the needs.

Figure 1. Map of Minnesota showing the areal extent and quality levels of planned and existing publicly available light detection and ranging (lidar) data in November 2012. No lidar data that meet 3DEP requirements for quality level 2 or better are publicly available for Minnesota. See table 2 for quality levels.

3DEP in Minnesota by the Numbers

Expected annual benefits	$13.64 million
Estimated total cost	$28.15 million
Payback	2.1 years
Quality level 1 buy-up estimate	$17.91 million

3D Elevation Program

3DEP is a national program managed by the USGS to acquire high-resolution elevation data. The initiative is backed by a comprehensive assessment of requirements (Dewberry, 2011) and is in the early stages of implementation. 3DEP will improve data accuracy and provide more current data than is available in the National Elevation Dataset (NED). The goal of this high-priority cooperative program is to be operational by January 2015 and to have complete coverage of the United States by 2022, depending on funding and partnerships. The new program has the potential to generate $13 billion/year in new benefits through improved government services, reductions in crop and homeowner losses resulting from floods, more efficient routing of vehicles, and a host of other government, corporate, and citizen activities (Dewberry, 2011).

Benefits of a Funded National Program

- Economy of scale—Acquisition of data covering larger areas reduces costs by 25 percent.
- A systematic plan—Acquisition of data at a higher quality level reduces the cost of "buying up" to the highest levels needed by State and local governments.
- Higher quality data and national coverage—Ensure consistency for applications that span State and watershed boundaries and meet more needs, which results in increased benefits to citizens.
- Increase in Federal agency contributions—Reduces State and local partner contributions.
- Acquisition assistance—Provided through readily available contracts and published acquisition specifications.

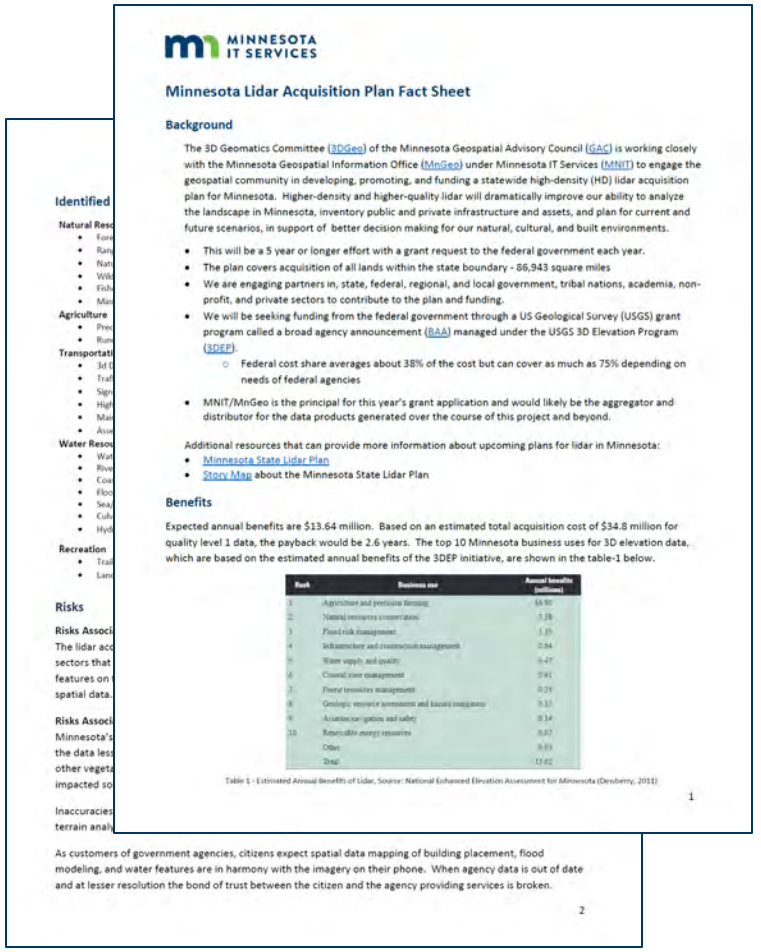
U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2013–3051
September 2013

U.S. Geological Survey
2280 Woodale Drive
Mounds View, MN 55112
Email: rwencl@usgs.gov

http://nationalmap.gov/3DEP/

By William J. Carswell, Jr.



MINNESOTA IT SERVICES

Minnesota Lidar Acquisition Plan Fact Sheet

Background

The 3D Geomatics Committee (3DGeo) of the Minnesota Geospatial Advisory Council (GAC) is working closely with the Minnesota Geospatial Information Office (MnGeo) under Minnesota IT Services (MNIT) to engage the geospatial community in developing, promoting, and funding a statewide high-density (HD) lidar acquisition plan for Minnesota. Higher-density and higher-quality lidar will dramatically improve our ability to analyze the landscape in Minnesota, inventory public and private infrastructure and assets, and plan for current and future scenarios, in support of better decision making for our natural, cultural, and built environments.

- This will be a 5 year or longer effort with a grant request to the federal government each year.
- The plan covers acquisition of all lands within the state boundary - 86,943 square miles
- We are engaging partners in, state, federal, regional, and local government, tribal nations, academia, non-profit, and private sectors to contribute to the plan and funding.
- We will be seeking funding from the federal government through a US Geological Survey (USGS) grant program called a broad agency announcement (BAA) managed under the USGS 3D Elevation Program (3DEP).
  - Federal cost share averages about 38% of the cost but can cover as much as 75% depending on needs of federal agencies
- MNIT/MnGeo is the principal for this year's grant application and would likely be the aggregator and distributor for the data products generated over the course of this project and beyond.

Additional resources that can provide more information about upcoming plans for lidar in Minnesota:

- Minnesota State Lidar Plan
- Story Map about the Minnesota State Lidar Plan

Benefits

Expected annual benefits are $13.64 million. Based on an estimated total acquisition cost of $34.8 million for quality level 1 data, the payback would be 2.6 years. The top 10 Minnesota business uses for 3D elevation data, which are based on the estimated annual benefits of the 3DEP initiative, are shown in the table-1 below.

Rank	Business use	Annual benefits (millions)
1	Agriculture and precision farming	$8.90
2	Natural resources conservation	3.38
3	Flood risk management	1.10
4	Infrastructure and construction management	0.84
5	Water supply and quality	0.47
6	Coastal zone management	0.41
7	Forest resources management	0.19
8	Geologic resource assessment and hazard mitigation	0.15
9	Aviation navigation and safety	0.14
10	Renewable energy resources	0.07
	Other	0.03
	Total	13.62

Table 1 - Estimated Annual Benefits of Lidar, Source: National Enhanced Elevation Assessment for Minnesota (Dewberry, 2011)

1

Risks

As customers of government agencies, citizens expect spatial data mapping of building placement, flood modeling, and water features are in harmony with the imagery on their phone. When agency data is out of date and at lesser resolution the bond of trust between the citizen and the agency providing services is broken.

2

MINNESOTA

Minnesota State Lidar Plan – Announcement

Overview

The Minnesota 3D Geomatics Committee and the State Geospatial Information Office, MnGeo, have developed a draft Lidar Plan for the State of Minnesota that will help guide the acquisition of new statewide lidar data over the next five years.

The State Lidar Plan seeks to outline collection timelines, standards, end user needs, products, and storage/dissemination methods.

Call to Action

Please contact us for more on the State Lidar Plan.

- Identify and share requirements and business use cases
- Provide your desired areas of interest and product needs
- Let us know if you can help provide matching funds
- Check out the draft State Lidar Plan and StoryMap on the web

Get involved: Contact https://www.mngeo.state.

Need for Lida

Lidar data prov making for ass to save costs i infrastructure, forestry. Lidar a multitude of

Funding Oppo

The USGS 3D E data and creat Nationwide. This program has been successful in our region, but our current lidar data does not meet the new specifications.

Every fall, the USGS has a call for proposals to apply for grant funding to match local partnerships. To receive federal funding, we must provide a non-federal funding match. We are currently reaching out to high quality lid be part of the

The quality lev and partner re point cloud, di others depend More informat and in the draf

State Lidar Plan

MINNESOTA

The Minnesota 3D Geomatics Committee and the State Geospatial Information Office, MnGeo, have developed a 5-year draft plan to help guide the acquisition of new statewide lidar data.

Deliverables proposed include a lidar point cloud, digital elevation model, canopy height model, and more depending on stakeholder needs and funding.

www.mngeo.state.mn.us/committee/3dgeo/

Get Involved!

- Let us know if you can help
- Share requirements and business use cases
- Provide areas of interest and product needs

MINNESOTA

The Draft Minnesota State Lidar Plan

An introduction to lidar, how it is used in Minnesota, and the Minnesota State Lidar Plan.

http://bit.ly/MnLidarPlanStoryMap

Call to action: Next steps – Individual Role →

- Partners are NEEDED to help fund lidar 2023 spring lidar acquisition in the MN River West & East LABs!!
- Check out the Lidar Plan & StoryMap
- Stay in touch
  - Email us: lidar@state.mn.us
  - Get on GovDelivery list: www.mngeo.state.mn.us/newsletter.html
  - Join a 3DGeo Workgroup!

Call to action

3DGeo Next Steps

Establish Funding Partners
- August -

IGCE
(Cost Estimate)
- September -

BAA
(Grant Submission)
- October 1 -

FINALIZE FINANCIAL AGREEMENTS
- February -

Conduct Outreach

Provide Final Cost Estimate to Funding Partners

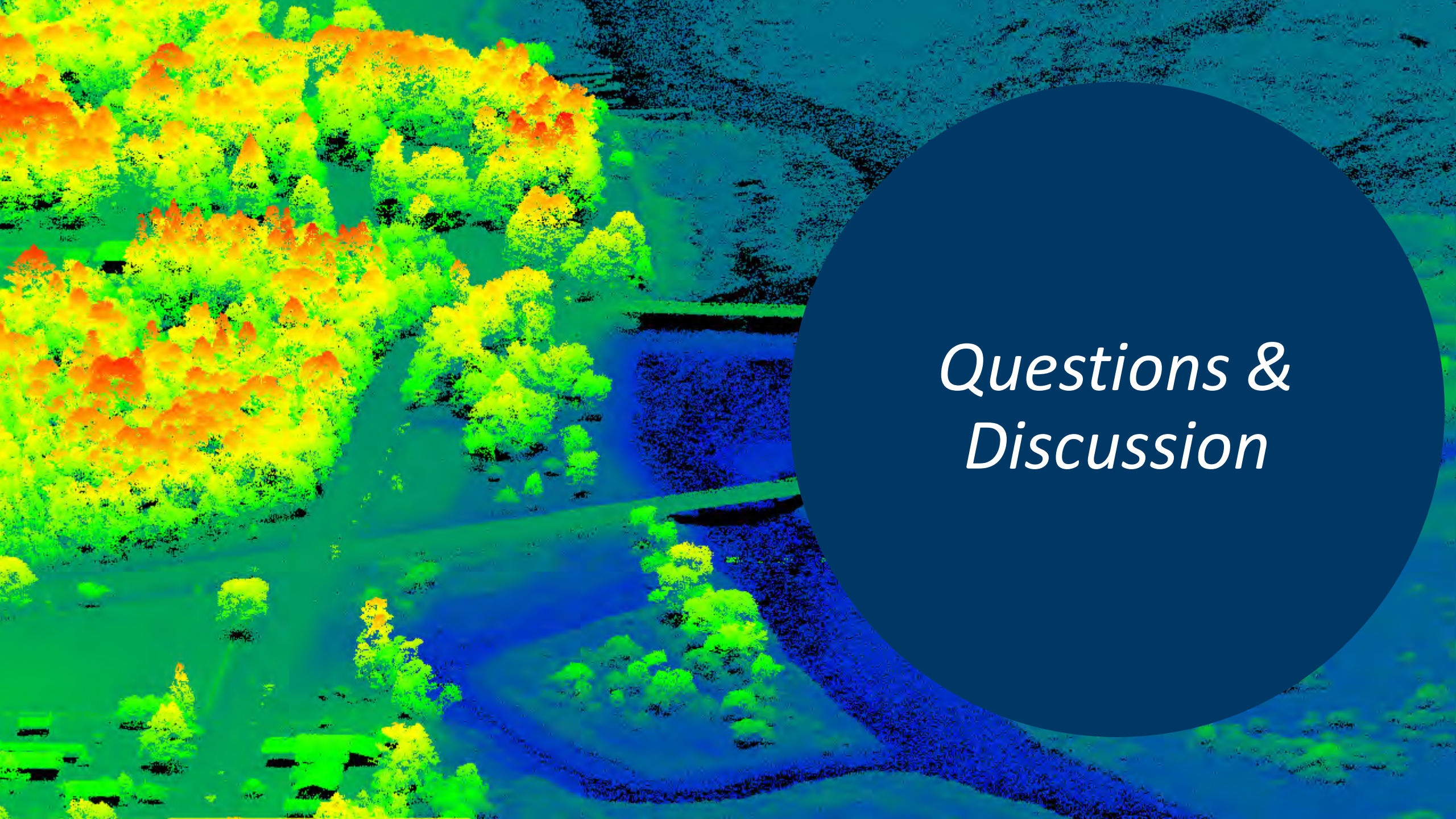
Partner Commitment (Attachment D)

Task Order and USGS/Vendor Contract - goal 90 days prior to collection

Call to action

Your Next Steps

- Learn more – Review Hub site
- Share Information with Your Organization – tree/hub/material
- Serve as a Champion – Build momentum of support in your organization
- Help Identify Funding Partners
- Let 3DGeo Know You Would Like to be a Financial Partner


Questions &
Discussion

MINNESOTA GEOSPATIAL ADVISORY COUNCIL

Thank You!

From: 3D Geomatics Data Acquisition

Today's 3DGeo Presenters

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Gerry Sjerven (MN Power)

Colin Lee (MnDOT)

Jennifer Corcoran (DNR Forestry)

Alison Slaats (MNIT MnGeo, CGIO)