

## 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*

Friday September 16, 2022, 10:00 – 11:30

# Welcome & Meeting Housekeeping

- This meeting will be recorded.
  - The recording and presentation slides will be shared after the meeting

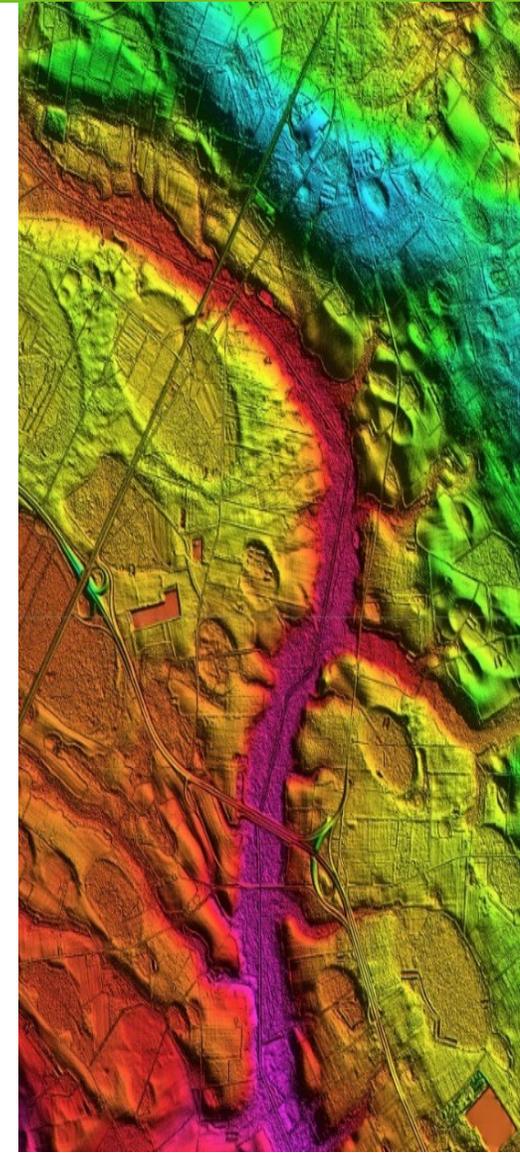


# Welcome!

## Thank you for joining us today

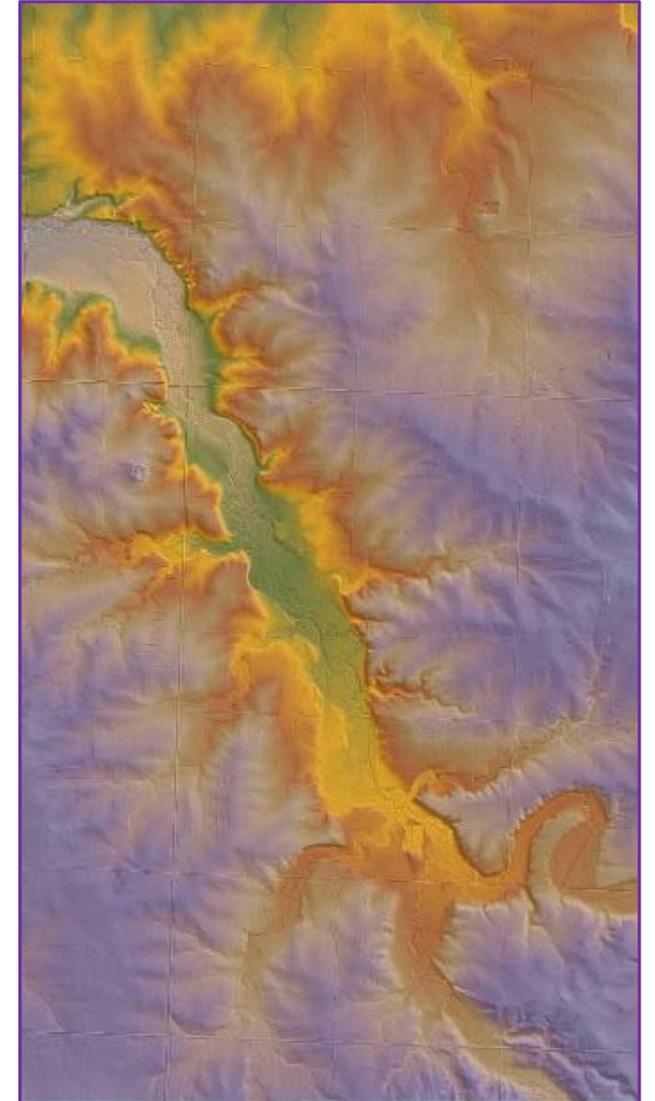
- Past 3DGeo Outreach in the MN River Watershed LABs
  1. Tuesday, August 25, **2020**, Southern MN
  2. Wednesday, October 7, **2020**, Southern MN
  3. Tuesday, May 25, **2021**, Southern MN
  4. Tuesday, June 15, **2021**, Steven's County
  5. Friday, July 15, **2022**, MN River East LAB – GBERBA
  6. Thursday, August 25, **2022**, MN River East & West LAB

**Who has not attended one of our 3DGeo Outreach Meetings?**



# Topics for today

- Briefly Re-introduce:
  - The Minnesota **Lidar Plan** and **3D Geomatics Committee**
  - The USGS 3D Elevation Program (**3DEP**)
  - Review our lidar acquisition **status map**
  - Provide **Awareness** – New Lidar Data is Coming to much of Minnesota
- Answer Your **Questions** and have a Discussion
- **Work collaboratively** to ensure we don't miss this funding opportunity





# 3DGeo - Data Acquisition Workgroup

## Mission:

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

## Co-Chairs

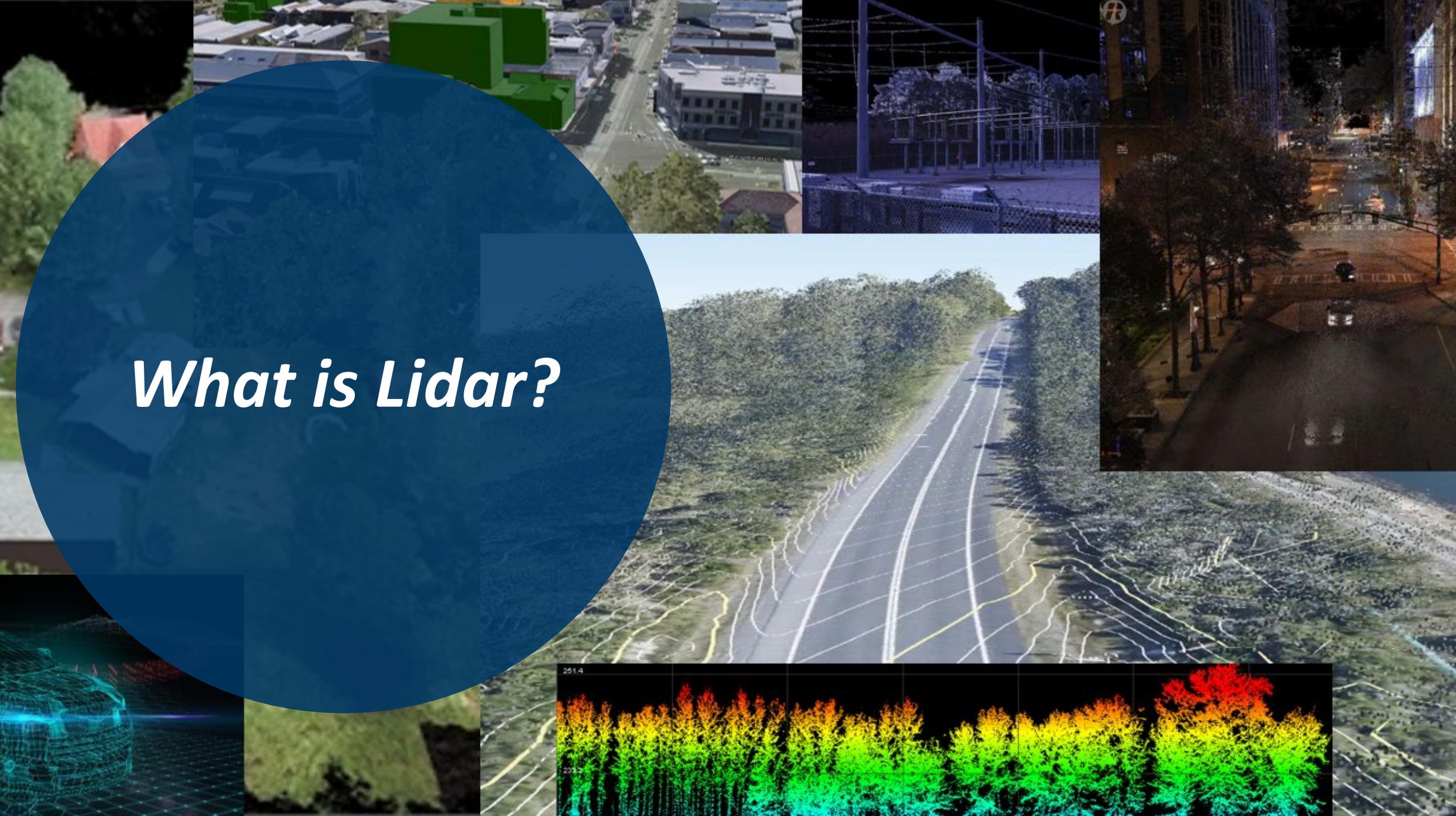
- Sean Vaughn, Alison Slaats, and Gerry Sjerven

## 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).



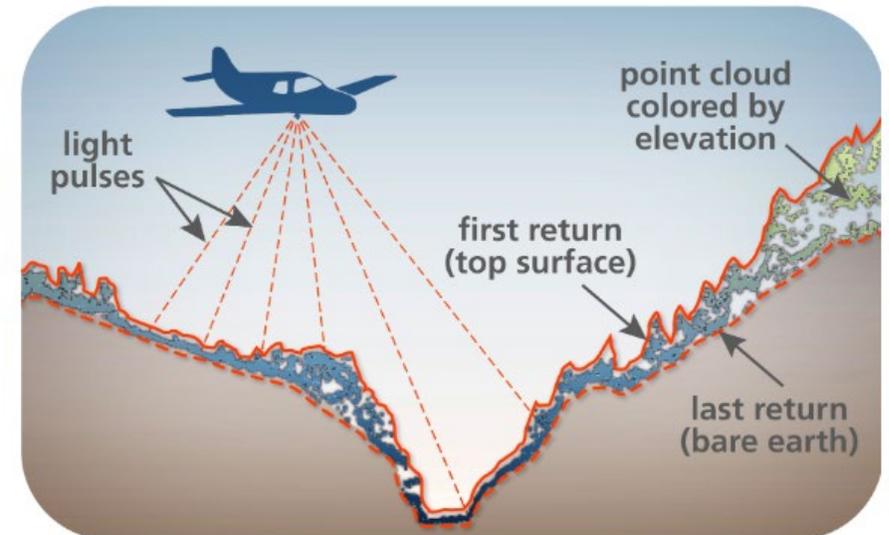
# *What is Lidar?*



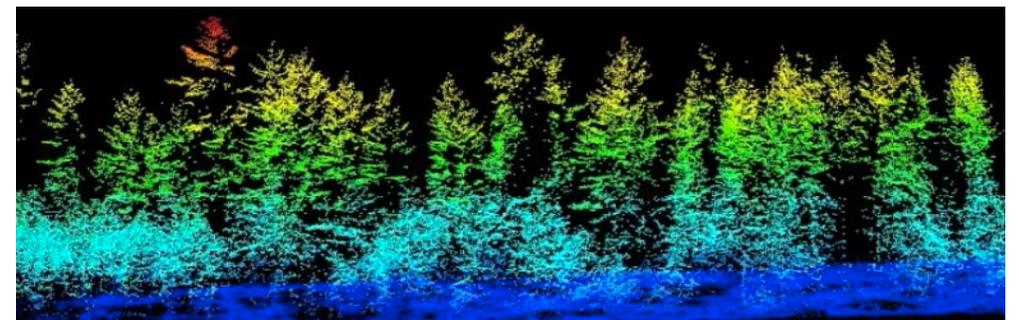
# What is lidar ?

## 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).

Data Procurement

Data Development

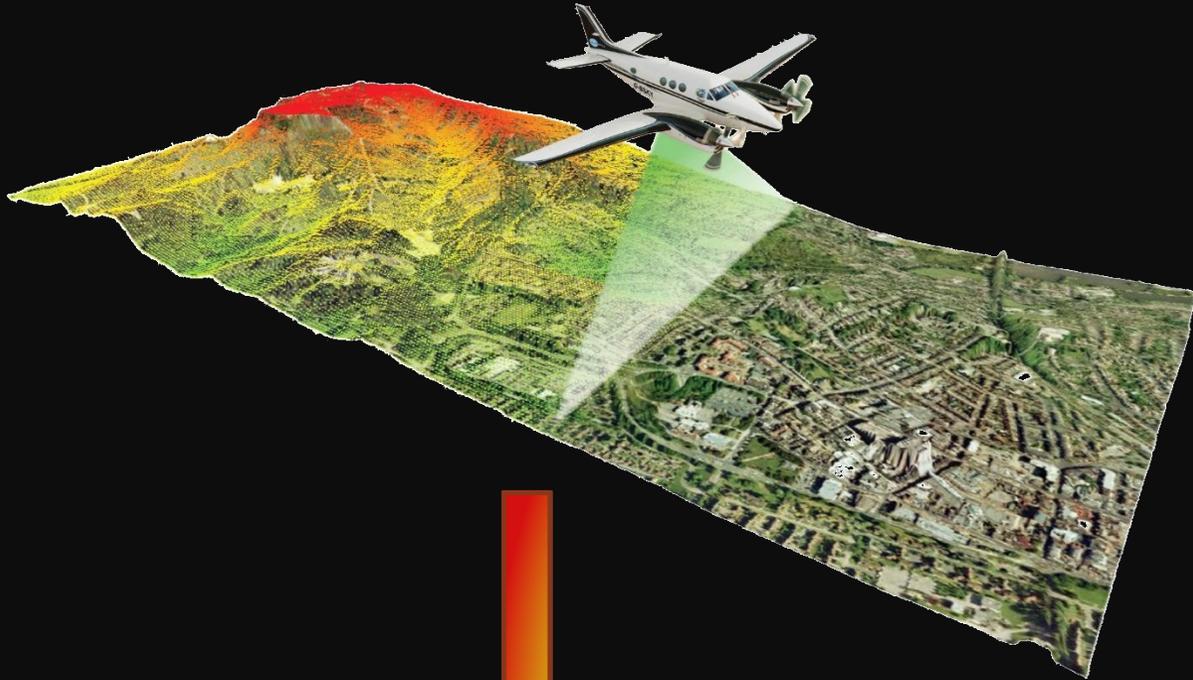
Data Dissemination

User Application



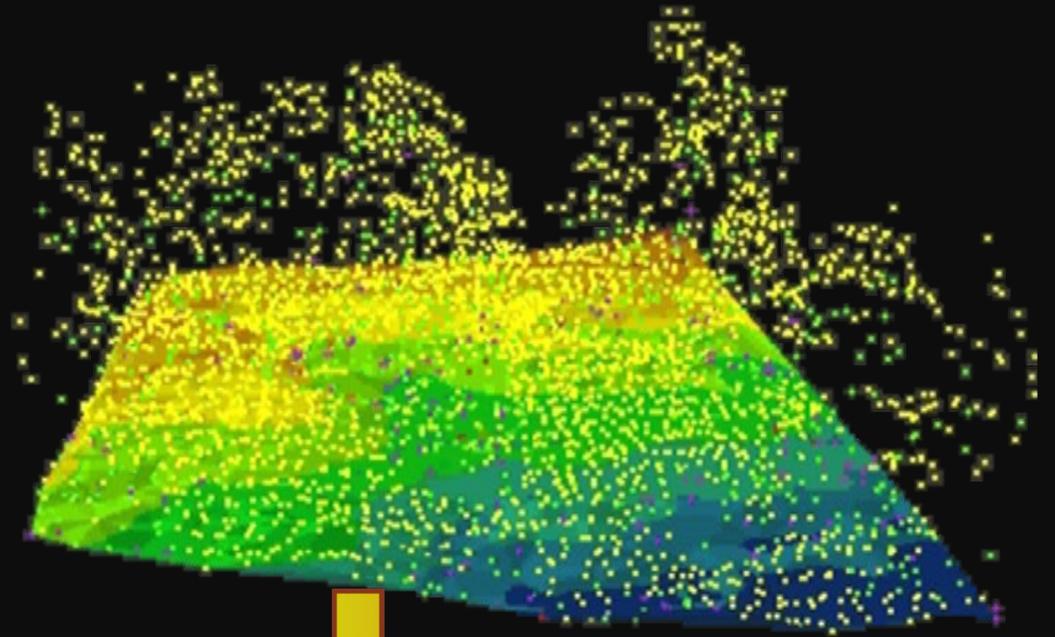
# Lidar Acquisition → Point Cloud

Lidar Acquisition



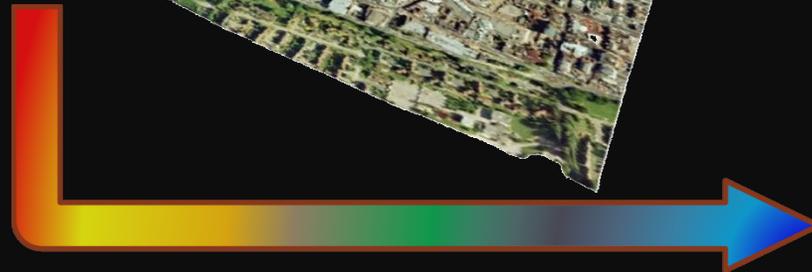
Lidar Point Cloud

3D Rendition of Natural  
and Built Environments



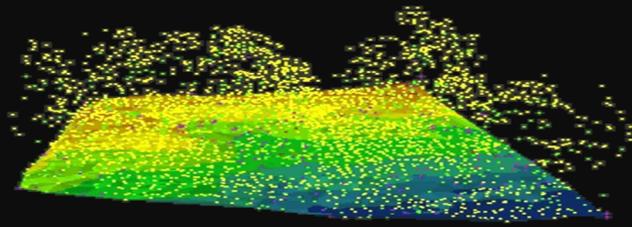
Lidar Classification

Painting the Lidar Point Cloud  
Elevation Values

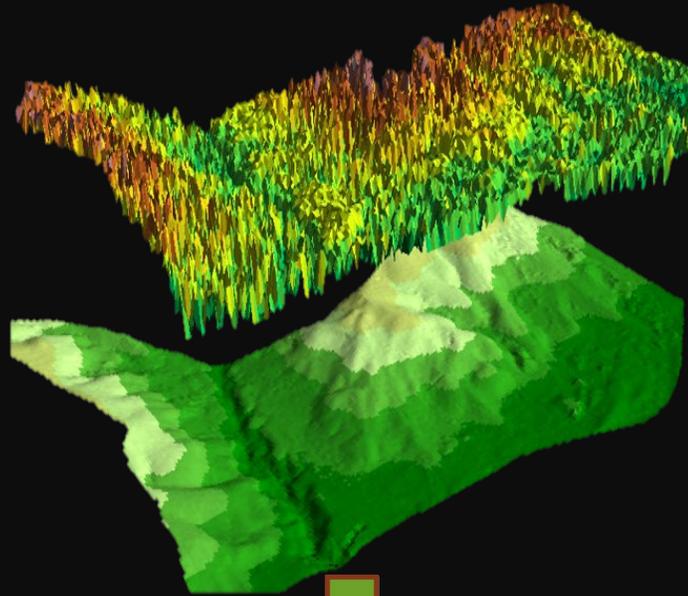


Lidar Acquisition → Point Cloud → Classification → DEM

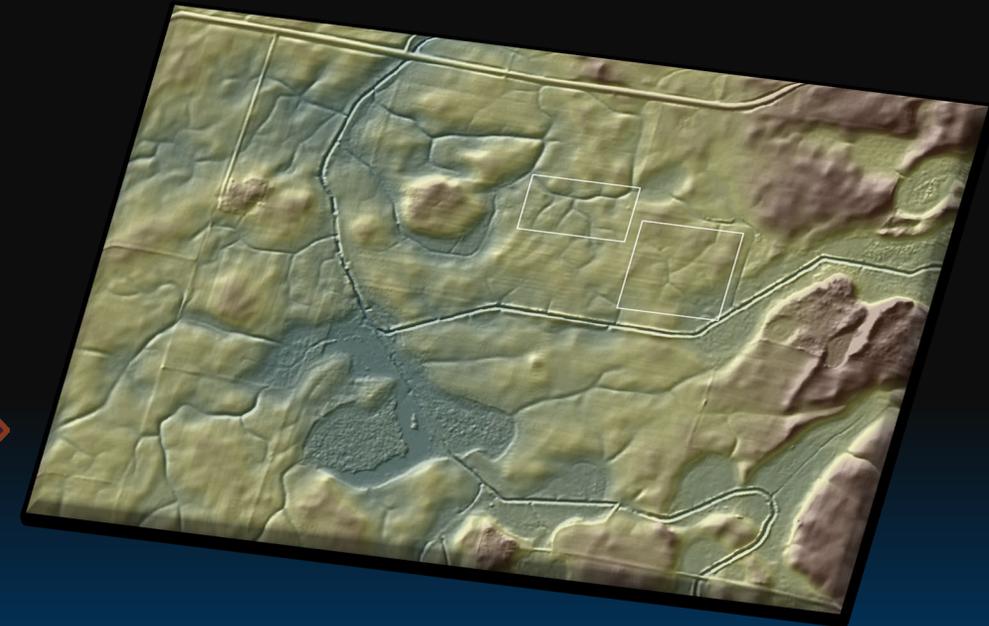
Point Cloud Classification – Feature Identification and Separation of Data for Sector Application



Lidar 3D Point Cloud

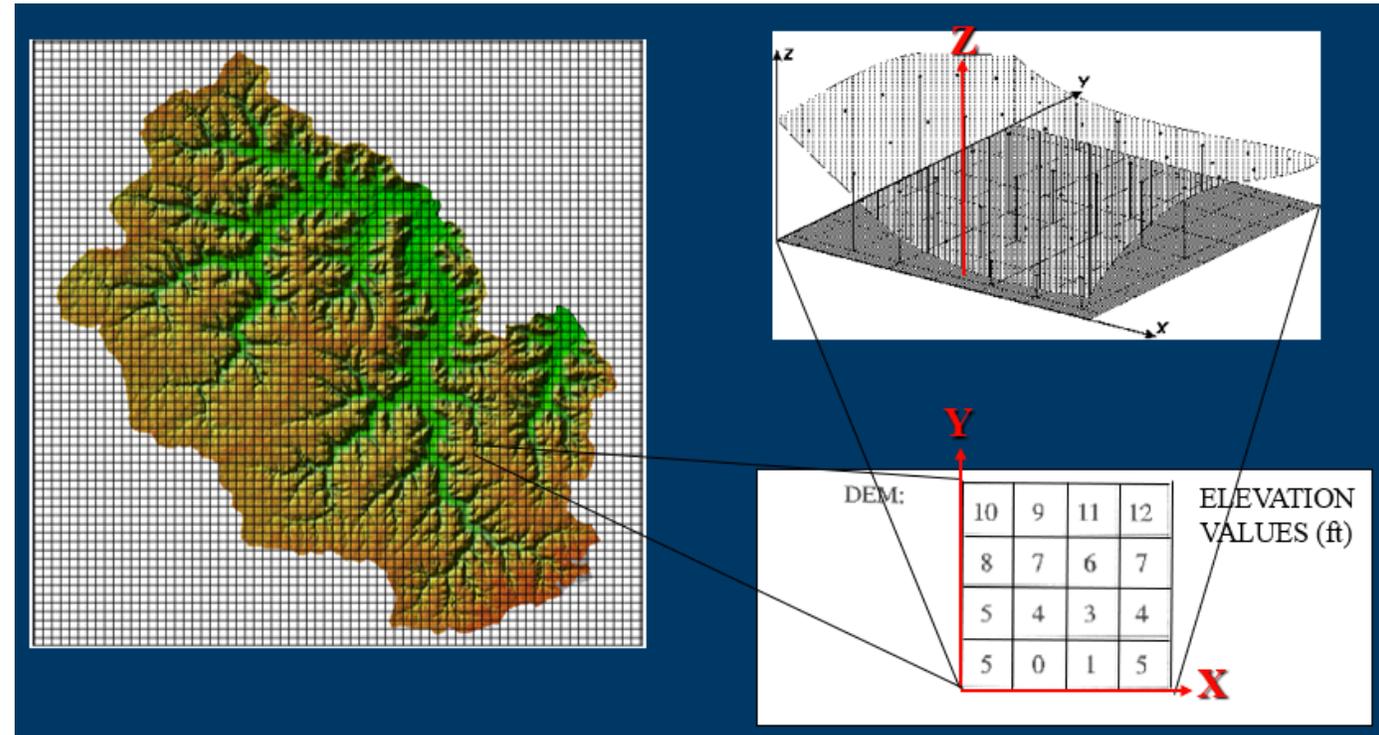


LiDAR-derived 3D Digital Elevation Model (DEM)



# 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)**.

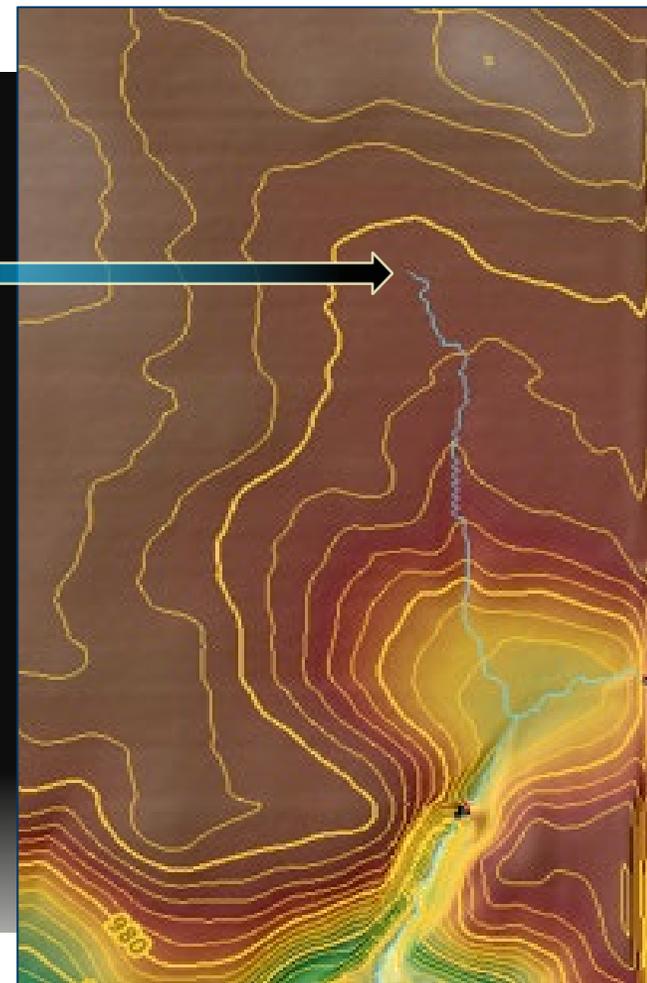


## WATER CONVEYANCE LANDFORMS



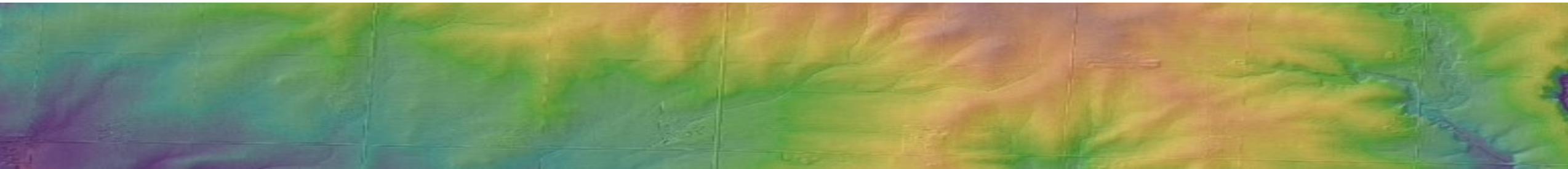
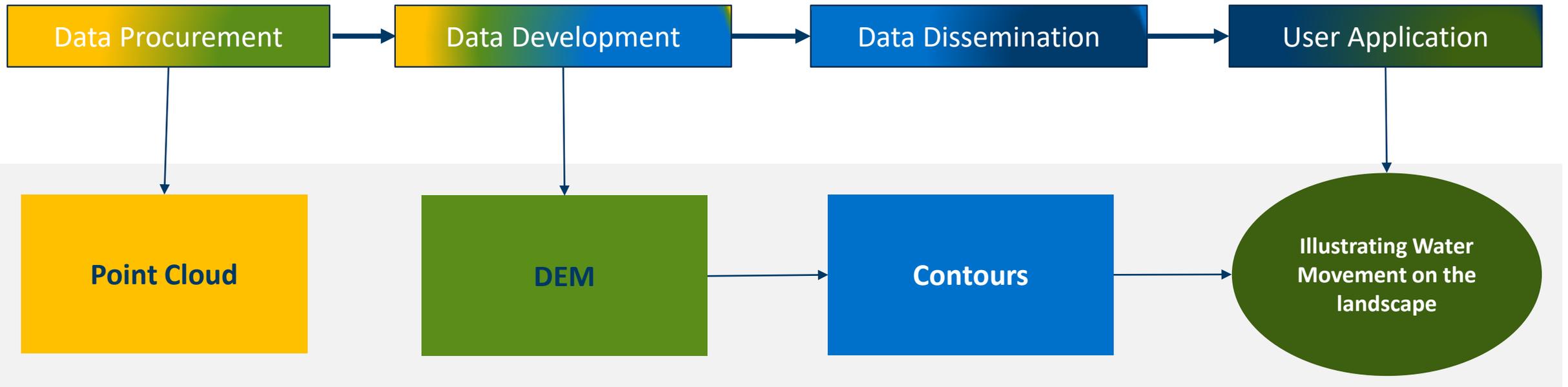
- Features of hydrologic Significance.
  - Nickpoint
  - Fluvial Processes
  - Soil Degradation
- Where does the watercourse begin ?
  - Where concentrated flow begins. LiDAR captures these landform.

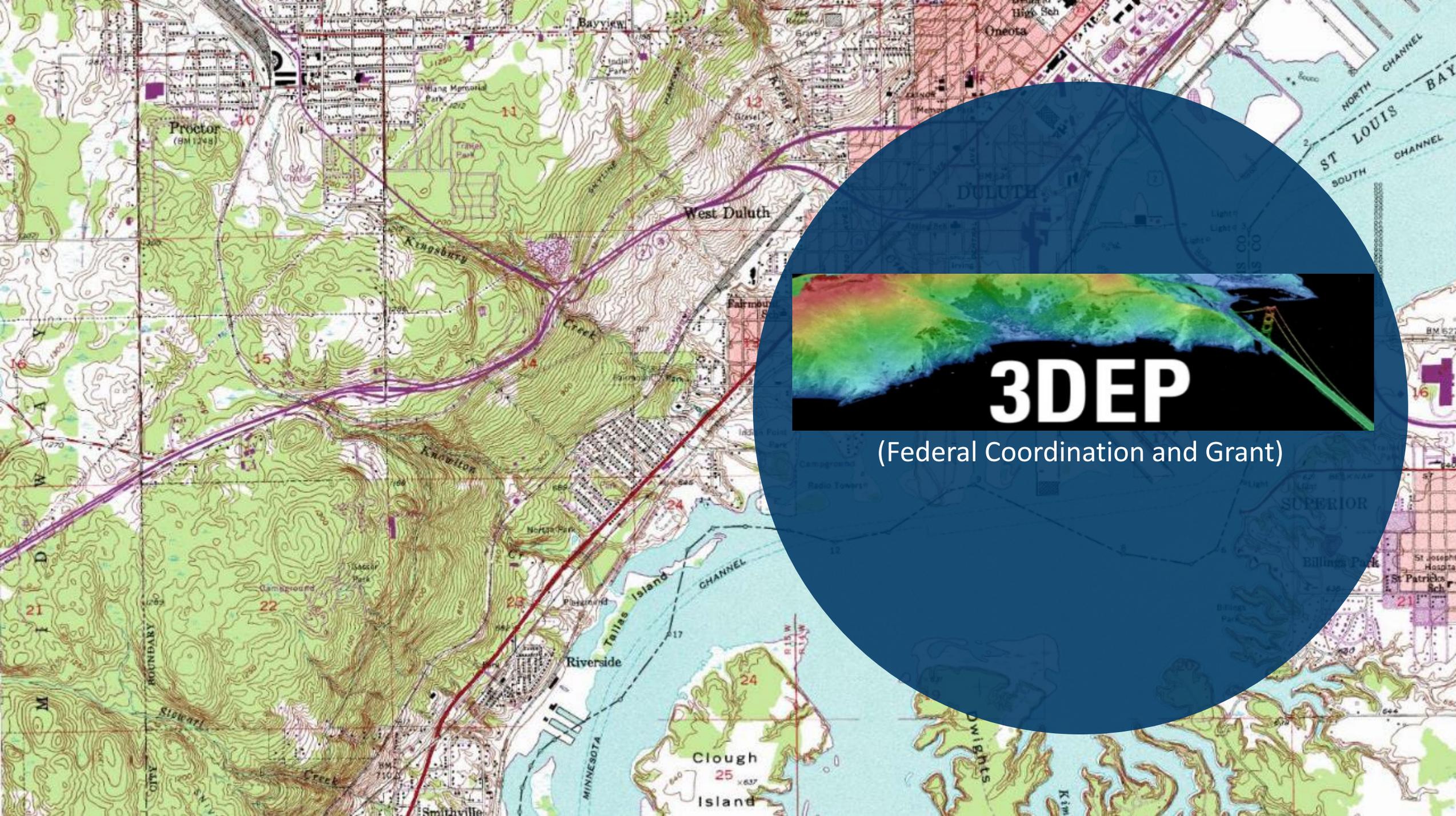
We Model this with DEMs



# What is Lidar ?

## A Simplified Workflow Representing Lidar Data





# 3DEP

(Federal Coordination and Grant)

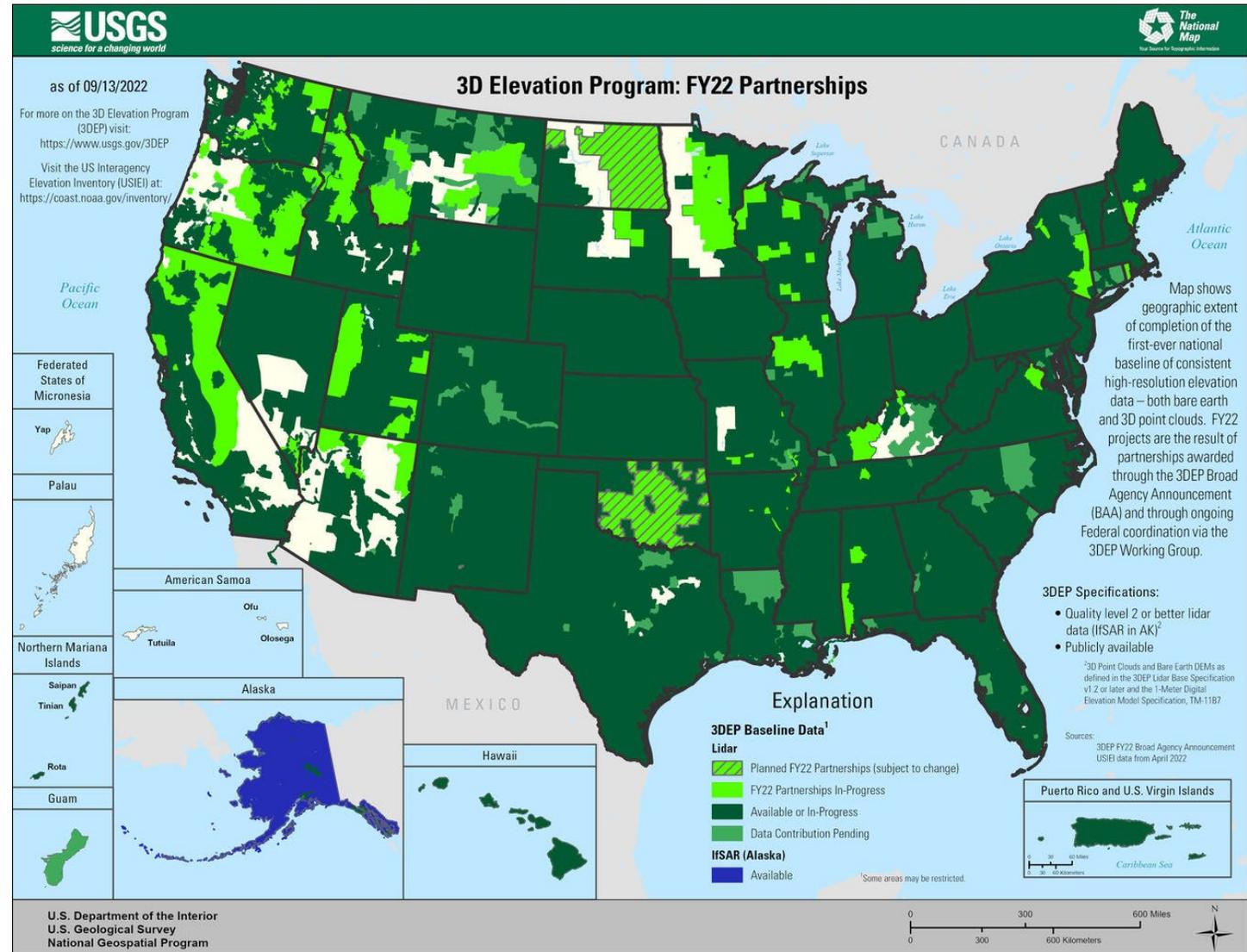
# USGS 3D Elevation Program (3DEP)

## 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** (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: **\$18.09M**



## Minnesota Funding Partners

- **47** Funding Partners
- **51,405** Square Miles of New Lidar
- **\$118\*** Cost/mi<sup>2</sup> 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 - 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

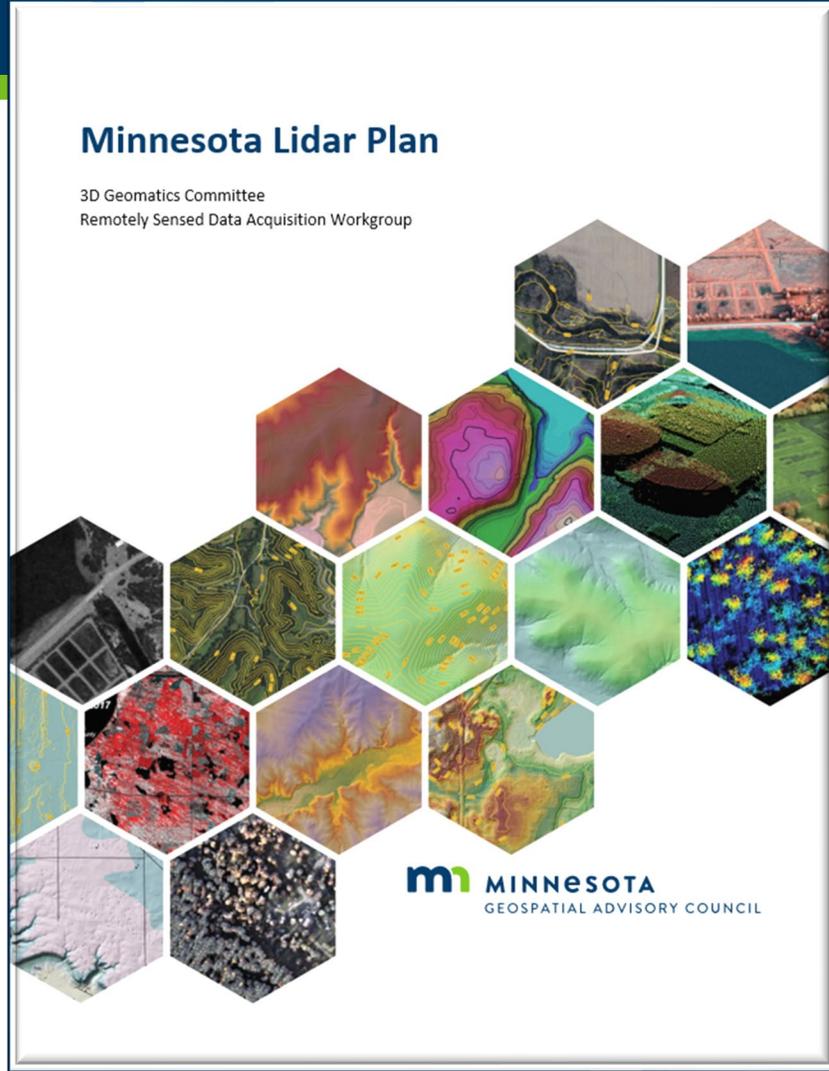


**OUR PLAN**

Cities | Counties | DNR | FEMA | MnDOT | MnGeo | MNIT  
NOAA | NRCS | SWCD | Tribal Nations | Universities  
USFS | USGS | Utilities | Watersheds | Other Partners

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



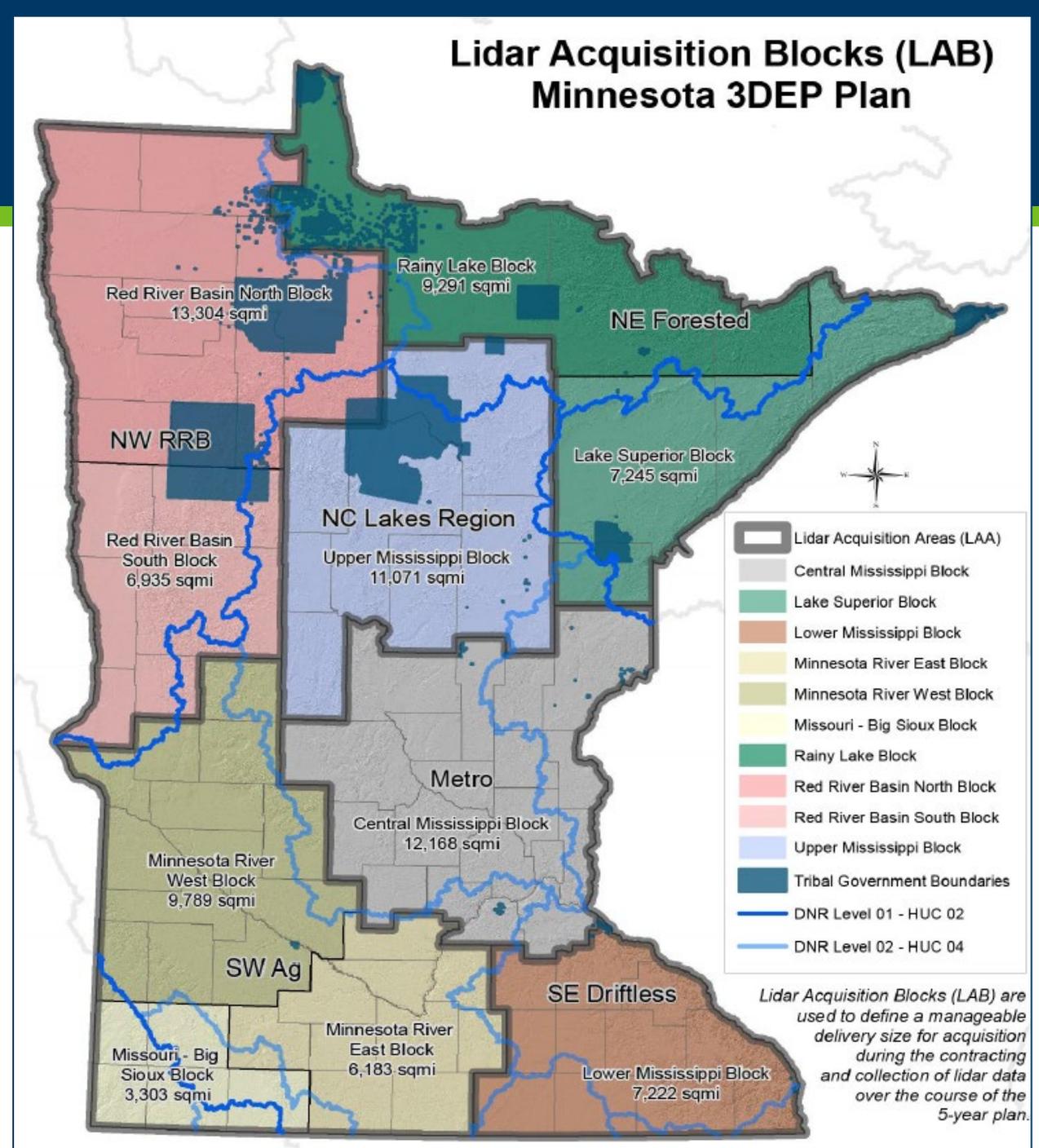
[https://www.mngeo.state.mn.us/committee/3dgeo/acquisition/Minnesota\\_State\\_Lidar\\_Plan.pdf](https://www.mngeo.state.mn.us/committee/3dgeo/acquisition/Minnesota_State_Lidar_Plan.pdf)



# MN Lidar LAAs

## Watersheds and Counties

- Large areas of acquisition to obtain economies of scale



# Lidar Quality Levels - Costs

	Quality Level (QL)	Average Cost per mi <sup>2</sup> *
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		Supported Contour Interval Accuracy [ft]
	Minimum Cell Size [m]	Minimum Cell Size [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



**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

16X

2X

## 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<sup>2</sup>)**
- 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

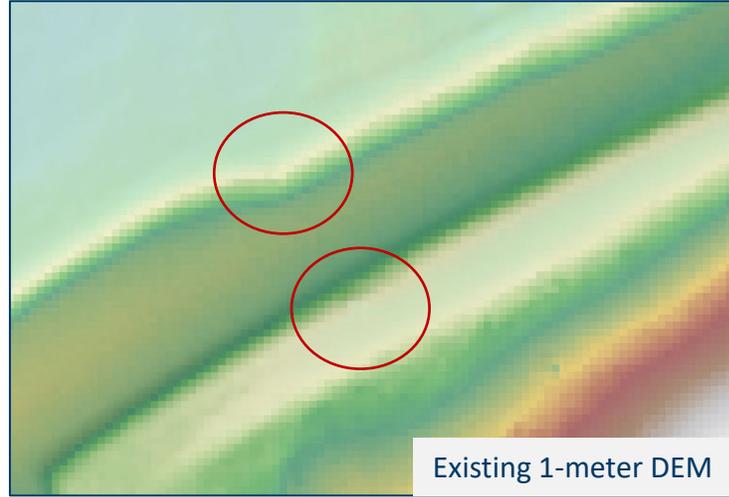
- Publicly available data served as authoritative products from state agency distribution portals
  - 1-ft **Contour** Dataset
  - **Hillshaded** DEM
  - **Canopy Height** Model (CHM)
  - Other products to come?

Next

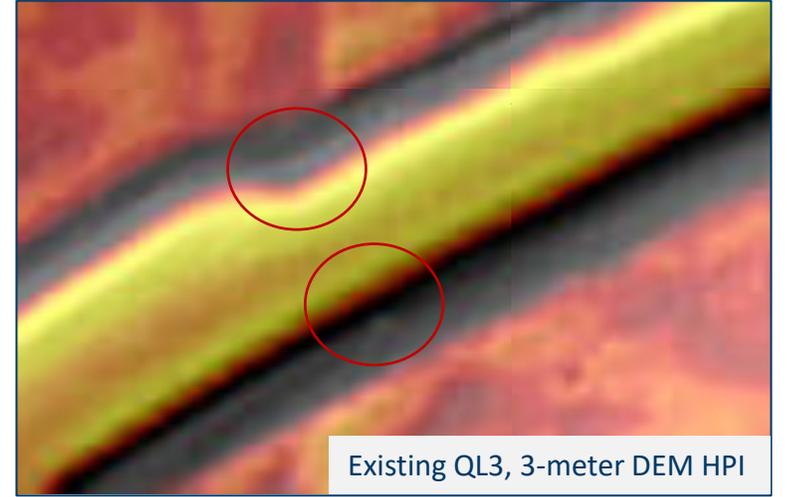
**Examples of High-density Lidar...**

# HD Lidar Examples: Hydrography & Infrastructure

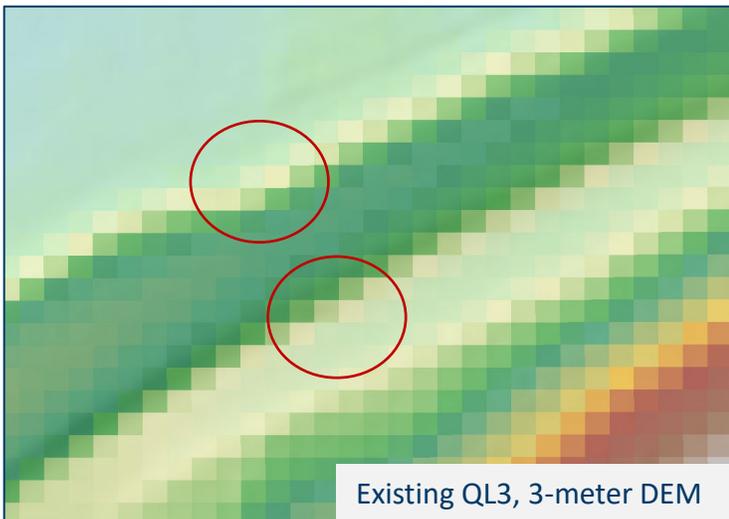
Culvert Capture High Density Lidar 3DGeo ( $\geq 30\text{pts}/\text{m}^2$ )



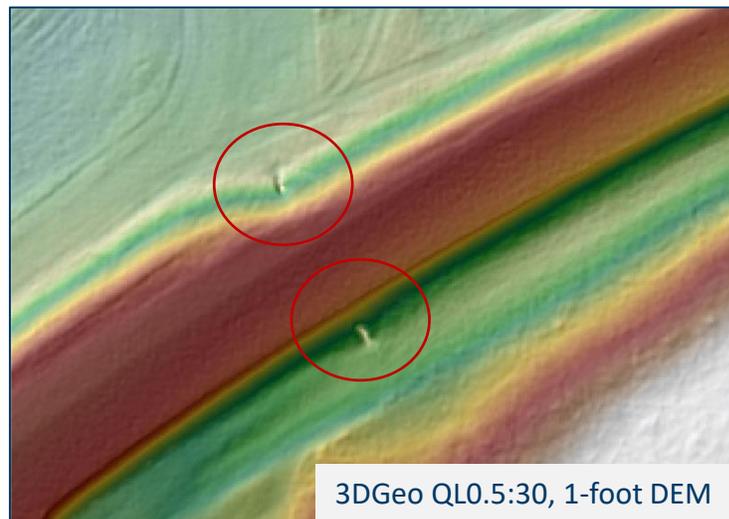
Existing 1-meter DEM



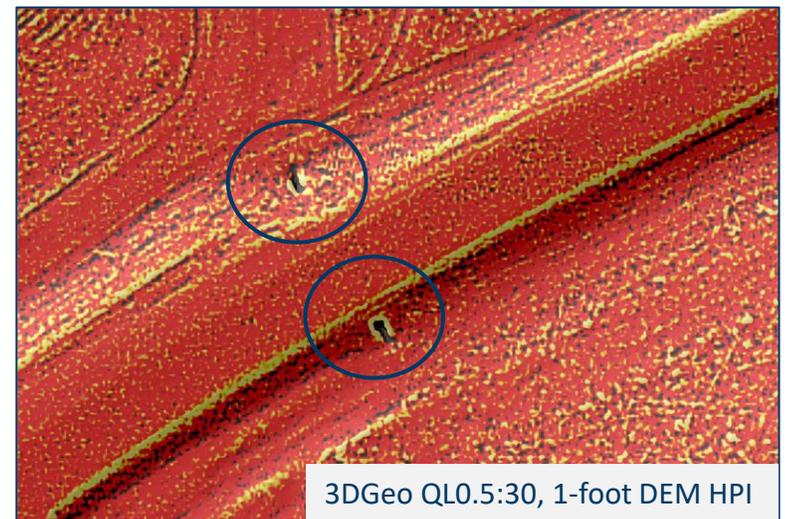
Existing QL3, 3-meter DEM HPI



Existing QL3, 3-meter DEM

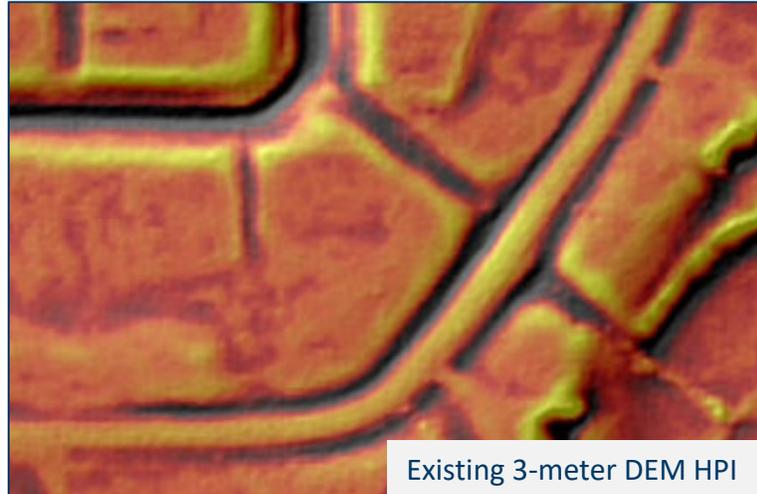
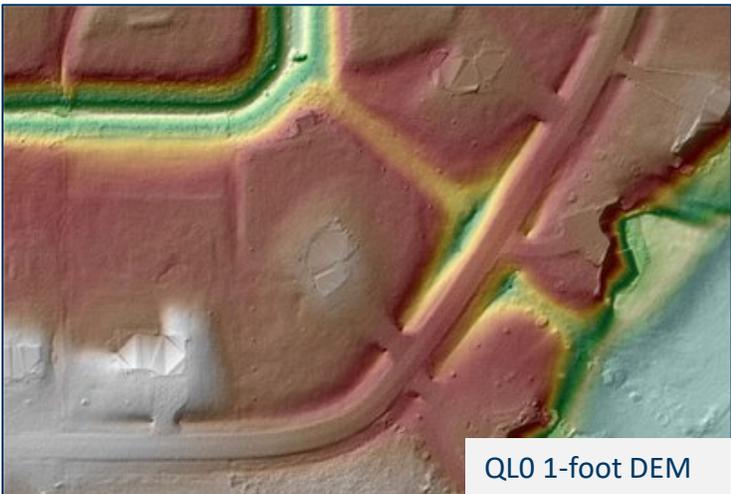
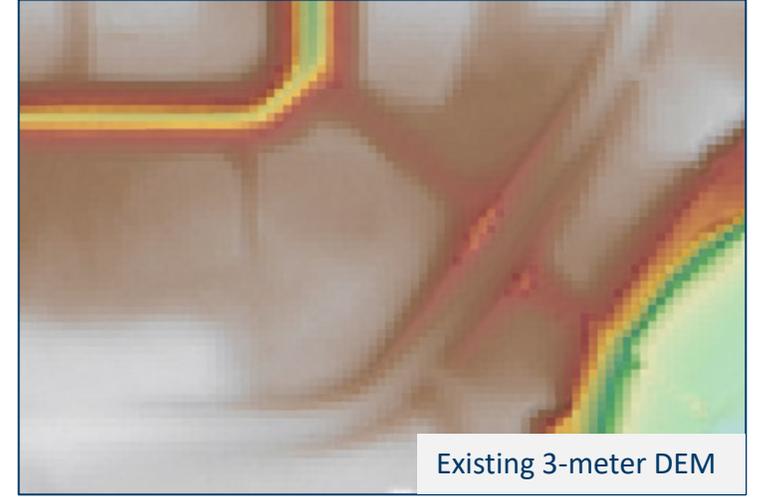
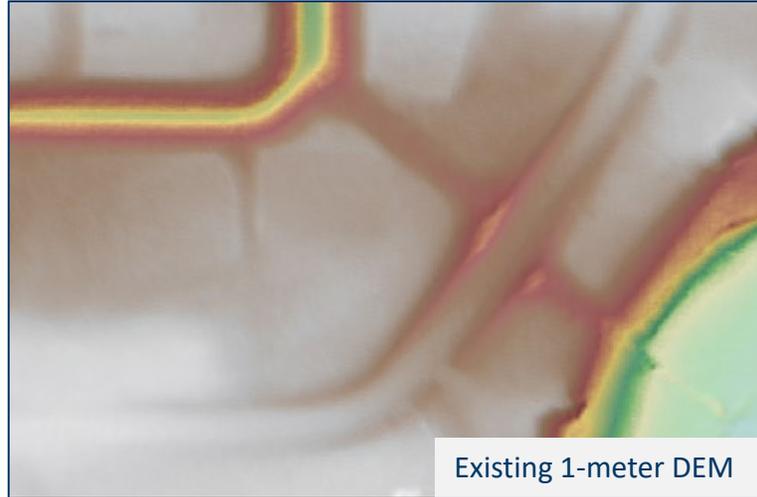


3DGeo QL0.5:30, 1-foot DEM



3DGeo QL0.5:30, 1-foot DEM HPI

# Early Results – Culvert Capture High Density ( $\geq 30\text{pts}/\text{m}^2$ )



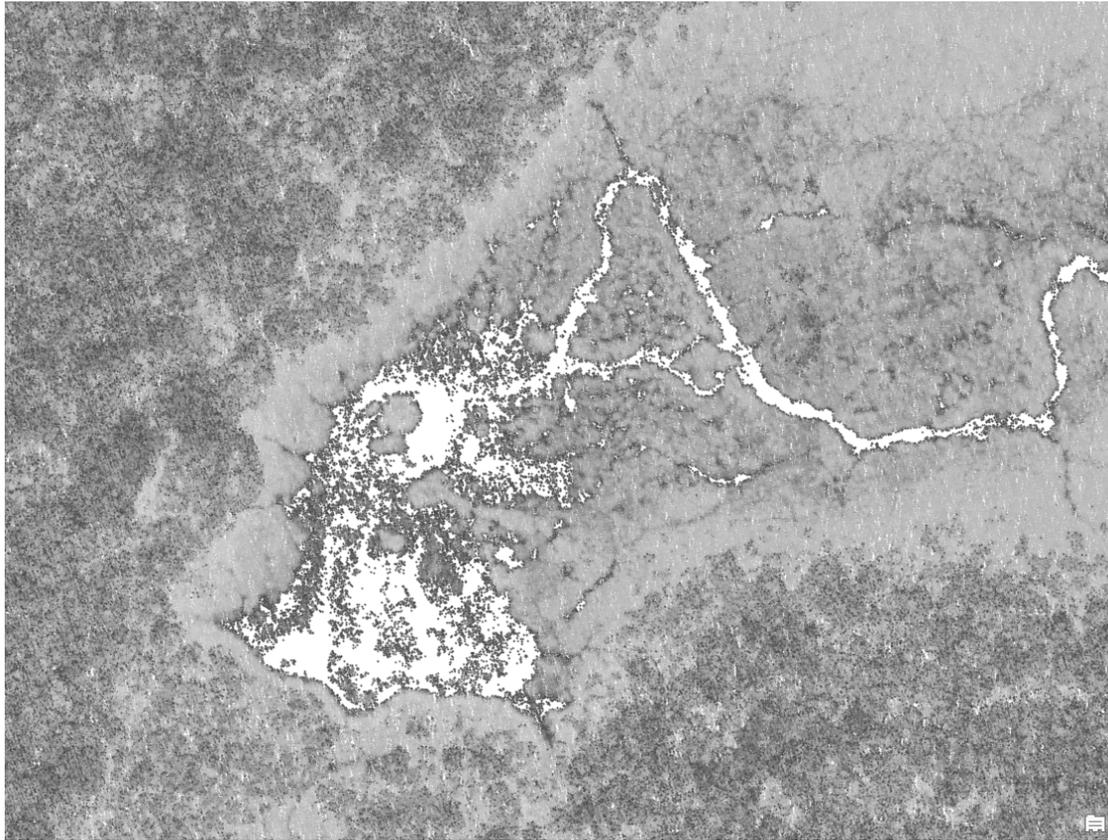
# HD Lidar Examples – Lidar Intensity

High Density ( $\geq 30\text{pts/m}^2$ )



# HD Lidar Examples - Lidar Intensity

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



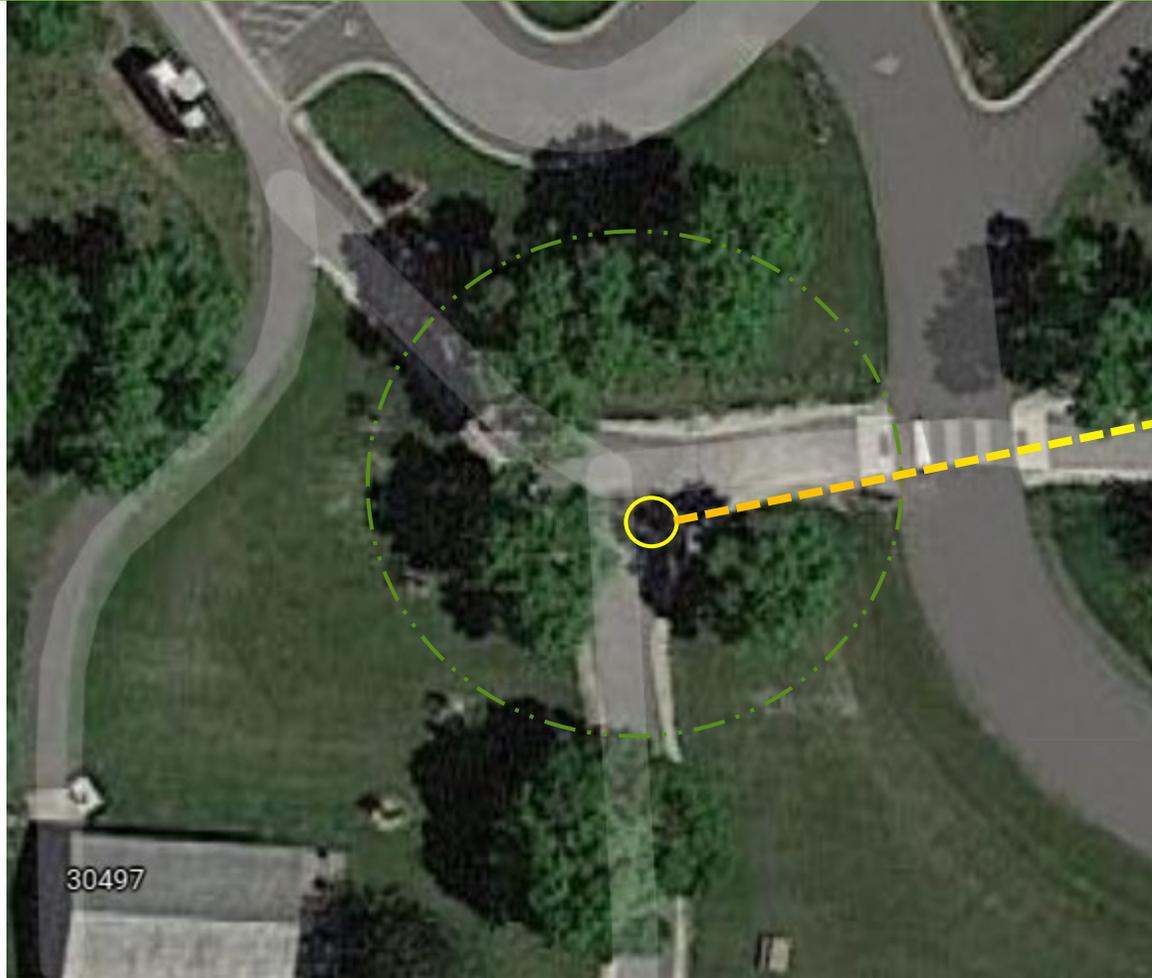
# HD Lidar Examples - Lidar Intensity

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  $\geq 30$ -point/m<sup>2</sup> Lidar Point Cloud



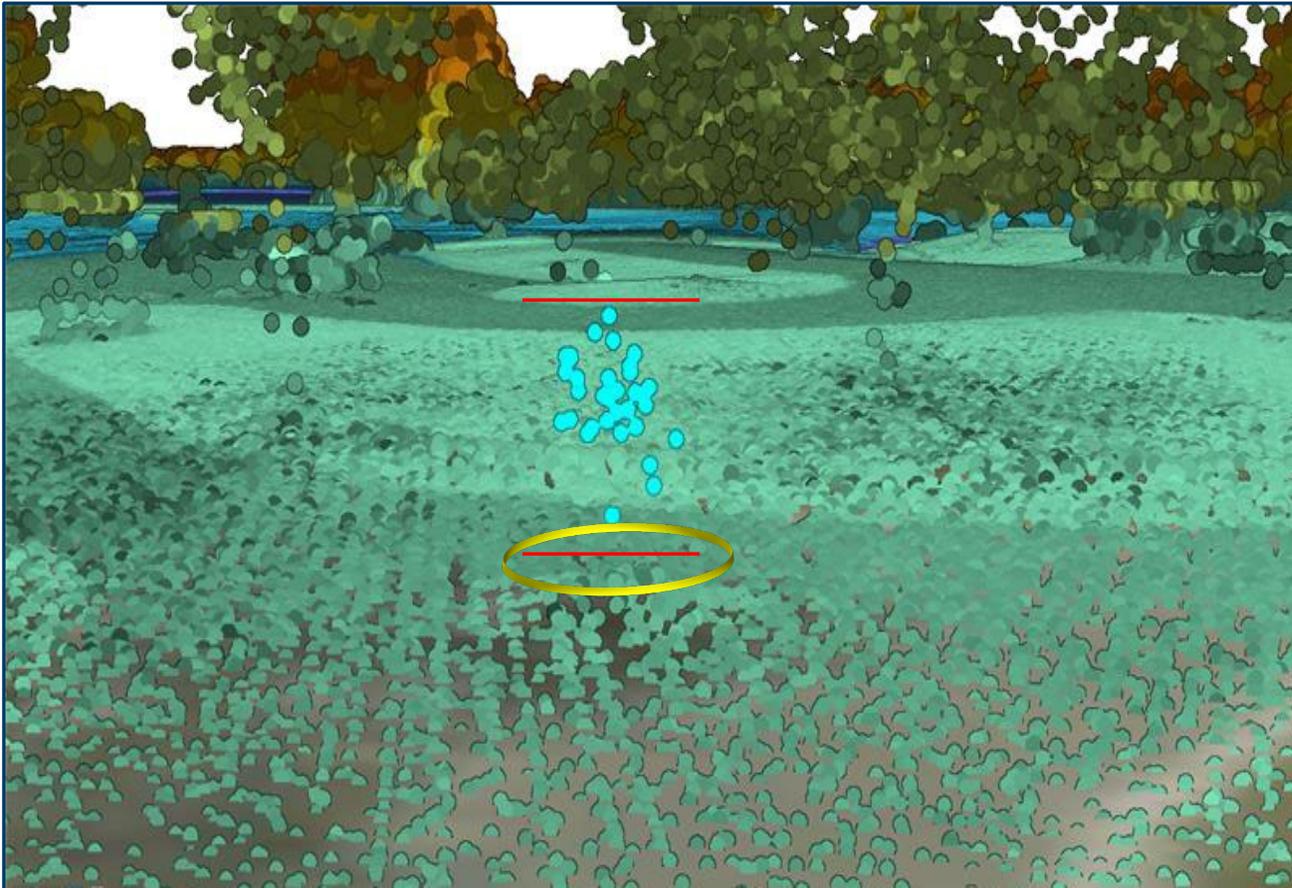
Bush in center of asphalt trail intersection surrounded by trees



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

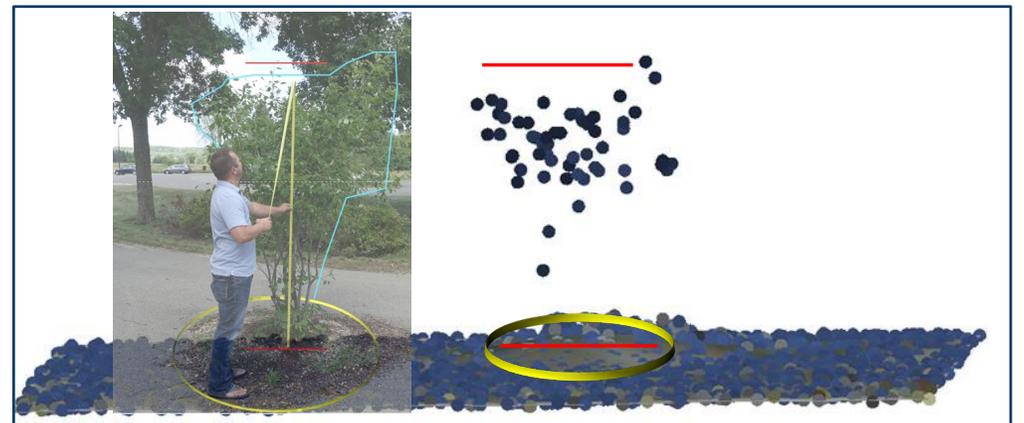
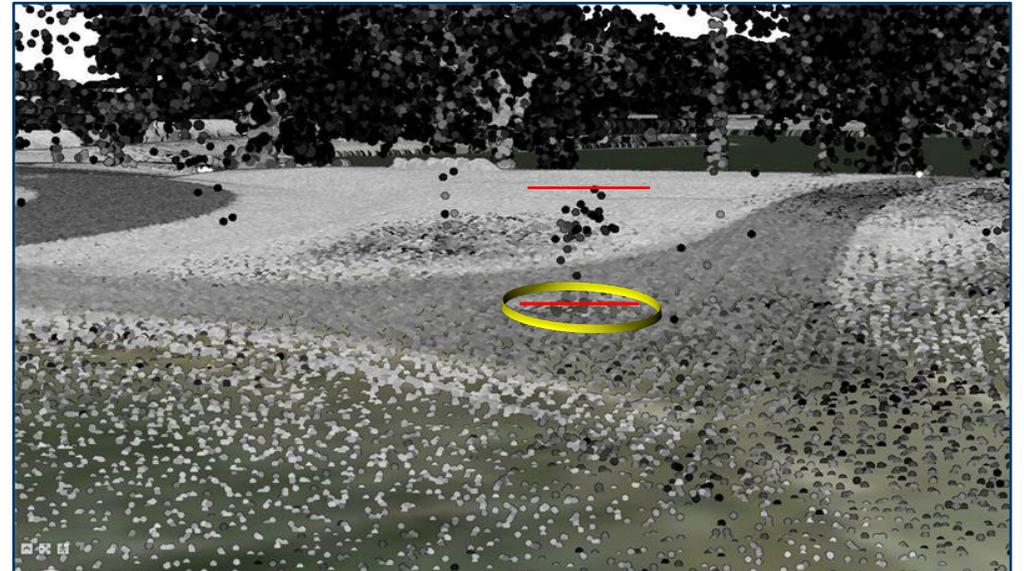
# 3DGeo Field Visit: Preparing for Data Validation

Lake Byllesby Regional Park | Dakota County, Cannon Falls, MN | High Density  $\geq 30$ -point/m<sup>2</sup> Lidar Point Cloud



Bush as represented in high-definition point cloud

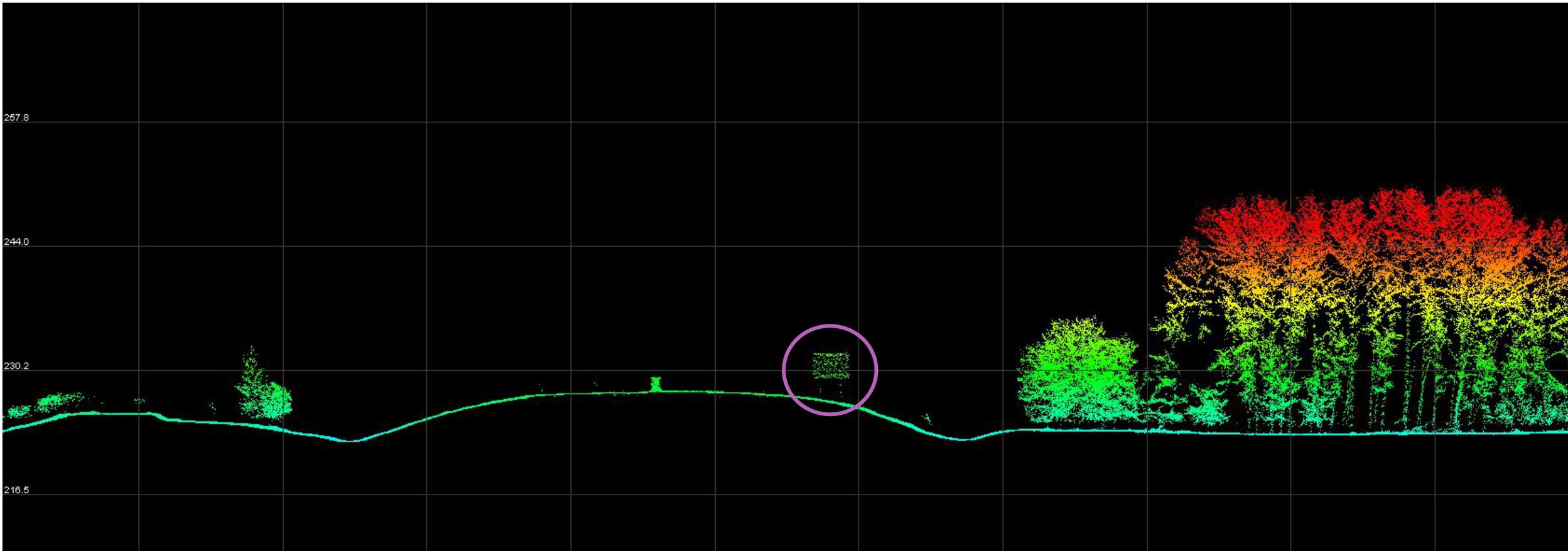
Bush and surrounding features captured by lidar intensity



Bush Point Cloud

# HD Lidar Examples: Hydrography & Infrastructure

Feature Extraction | High Density Lidar  $\geq 30$ -point/m<sup>2</sup> | Le Sueur County Lidar Data Collection 2021

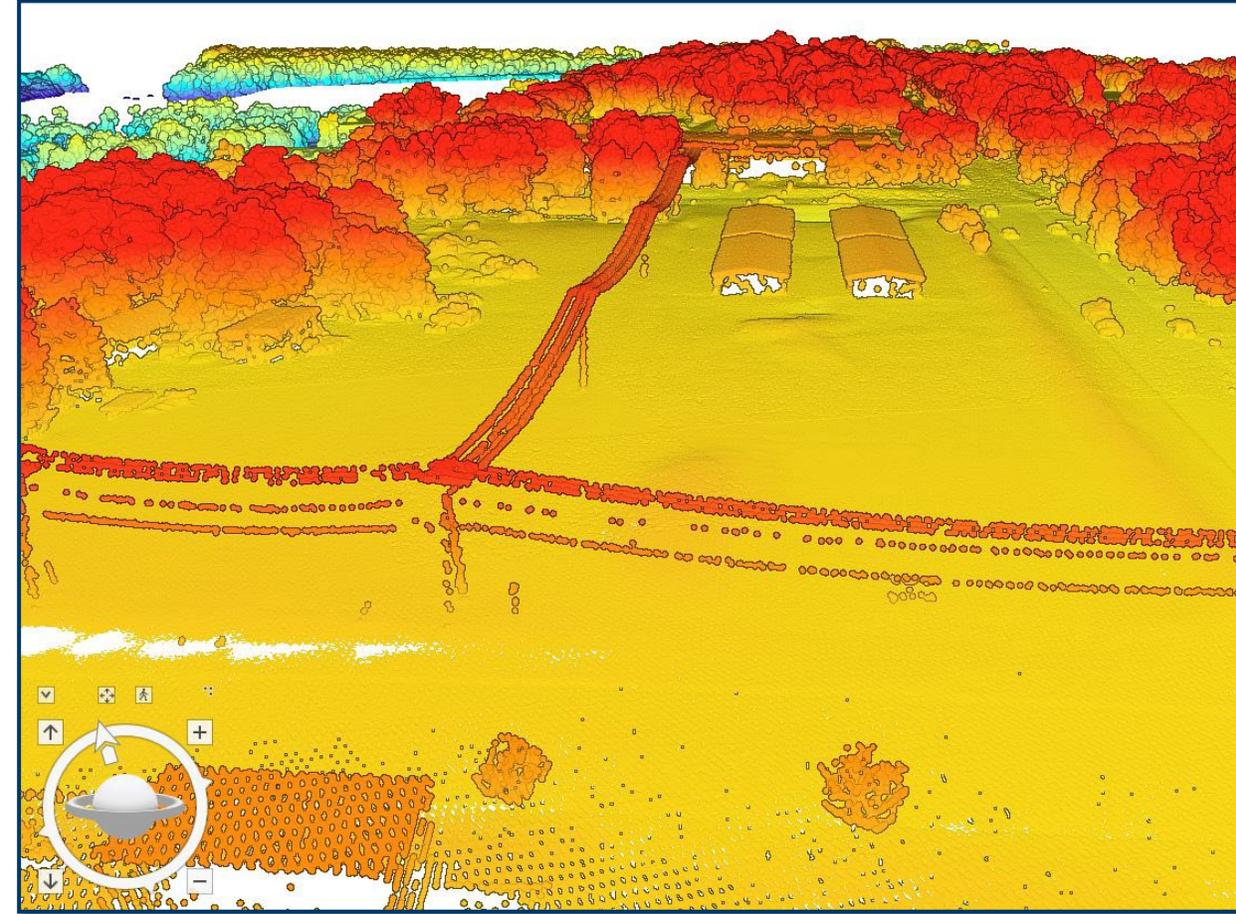


# HD Lidar Examples: Hydrography & Infrastructure

Infrastructure | High Density Lidar  $\geq 30$ -point/m<sup>2</sup> | Le Sueur County Lidar Data Collection 2021



Lidar Point Cloud Intensity Classification

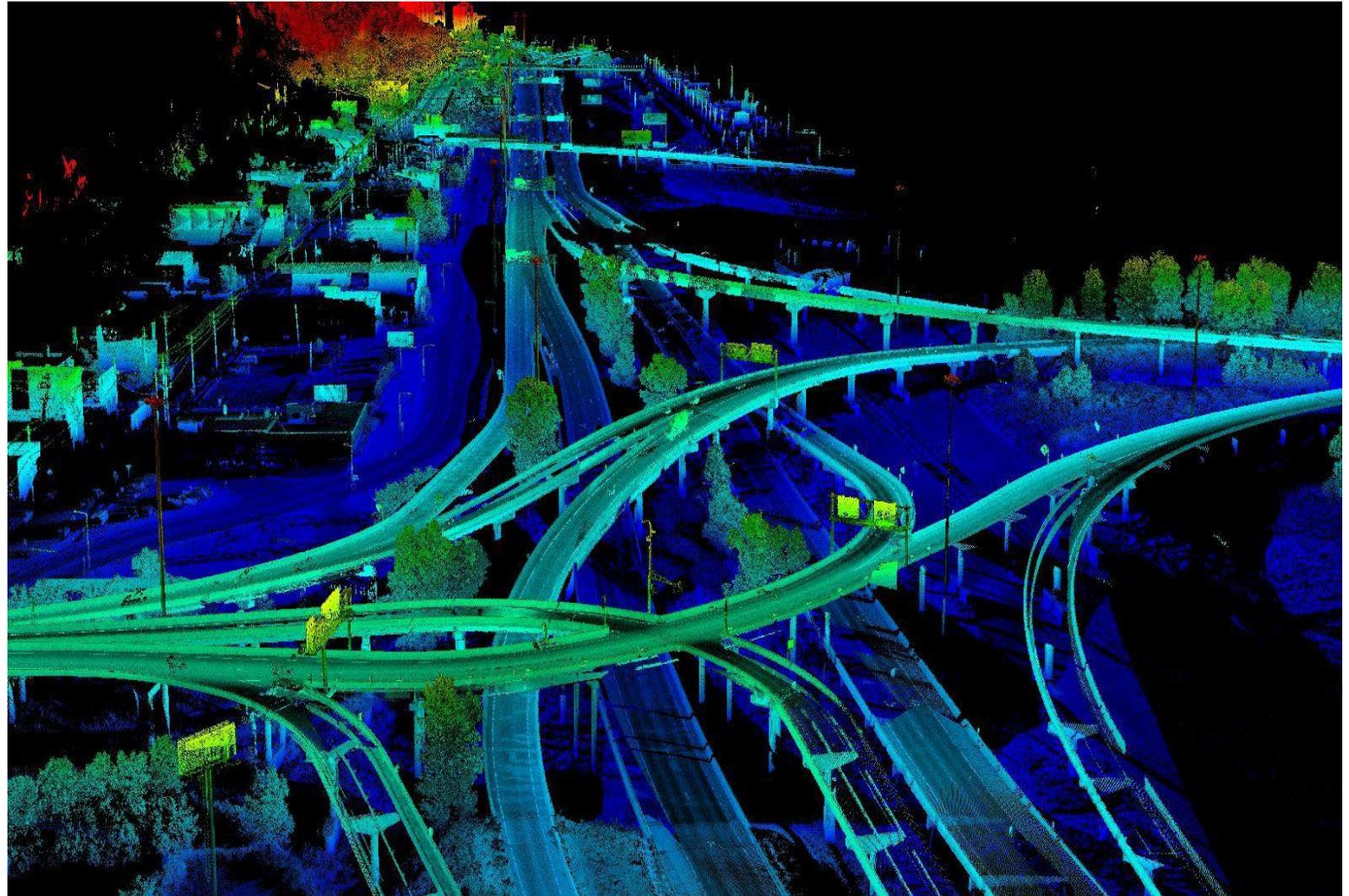


Lidar Point Cloud Elevation Classification

**Jennifer – More Examples of High-definition Lidar...**

# HD Lidar Examples: Infrastructure

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

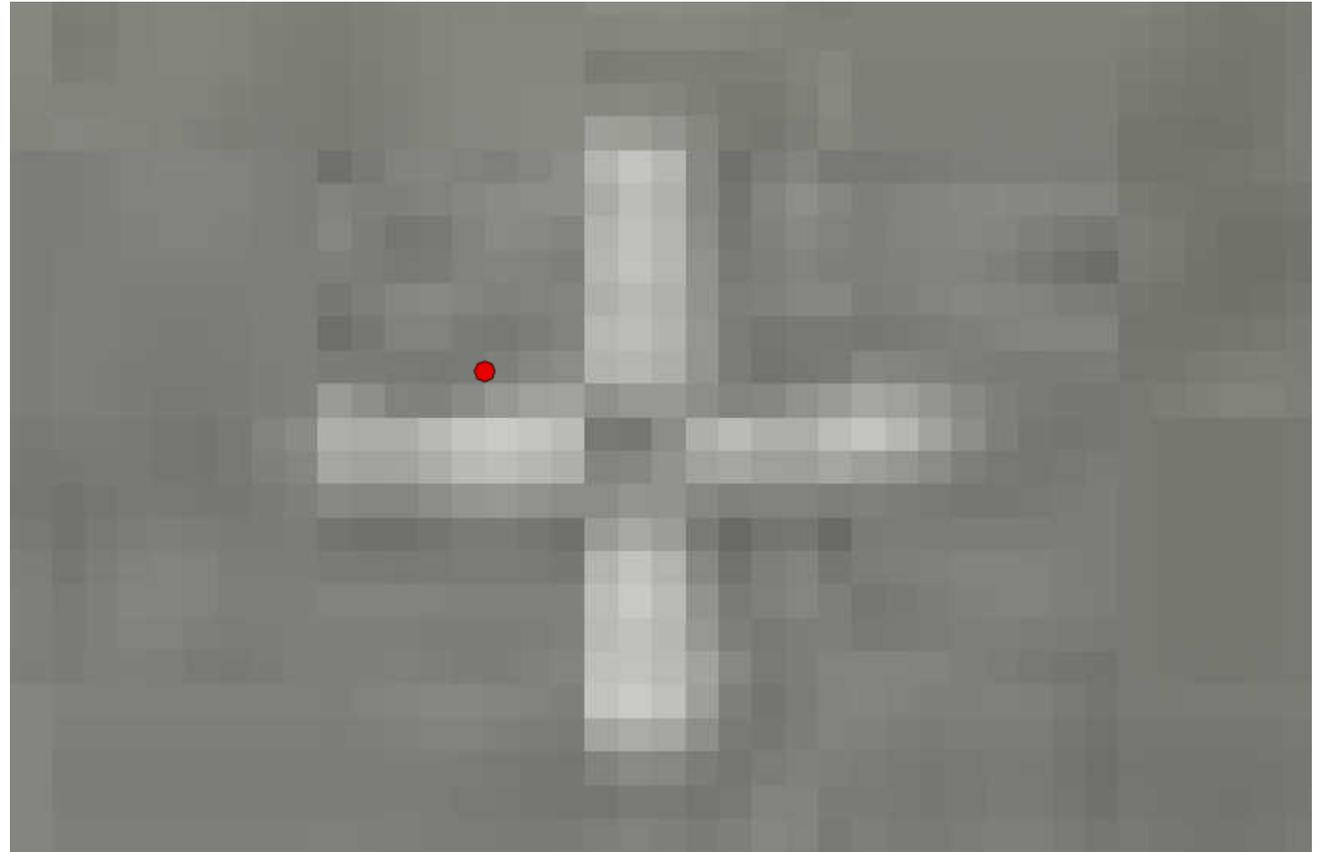


The I-35/Highway 53 interchange in Duluth, MN (known locally as the "Can of Worms")

# HD Lidar Examples: Infrastructure

## Supporting 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

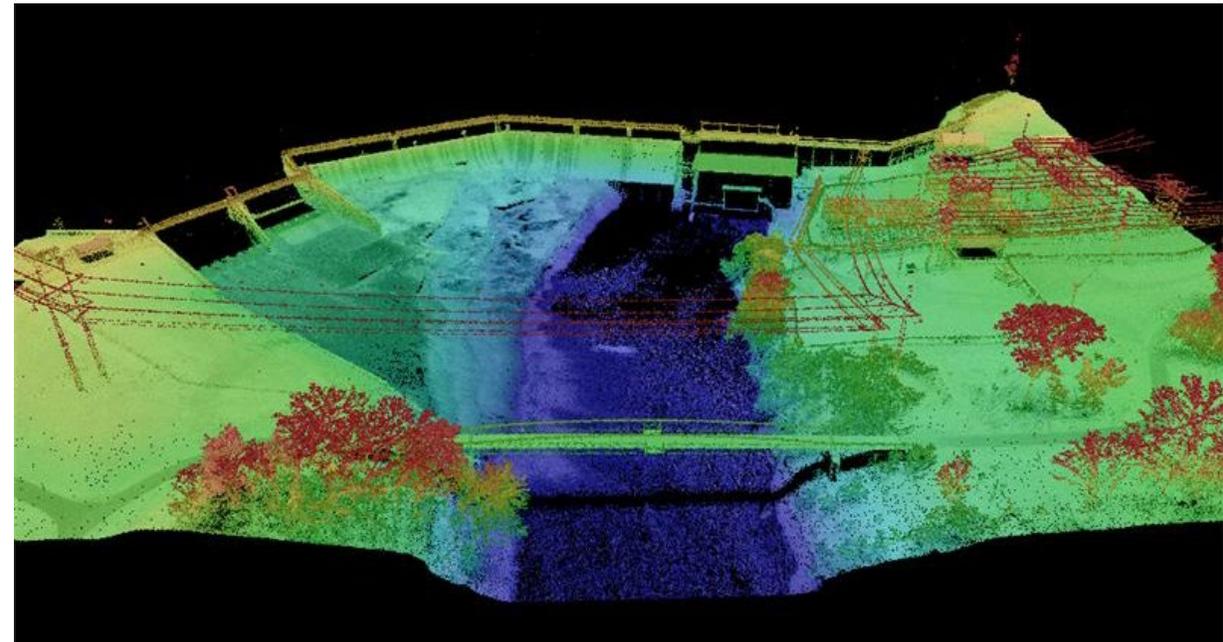
## MnDOT Vertical Accuracy Analysis

### High-Density 30+pt/m<sup>2</sup> 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  $\leq 0.03$  m ( $\leq 3.0$  cm / 1.181 in) for QLO.



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

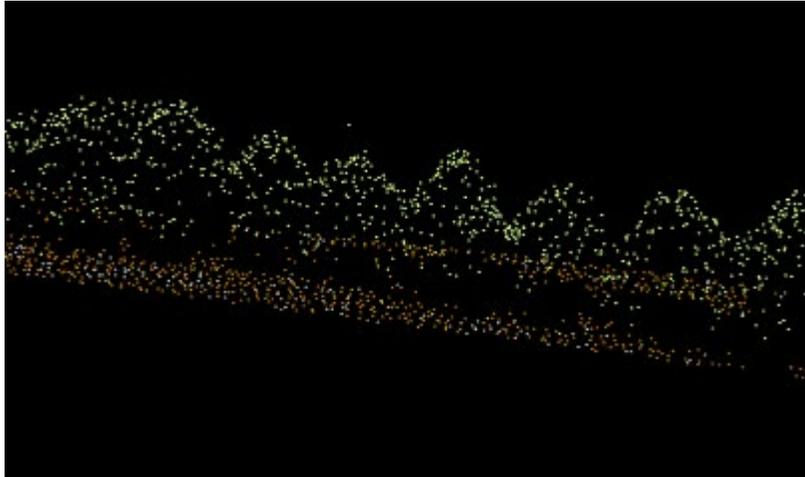


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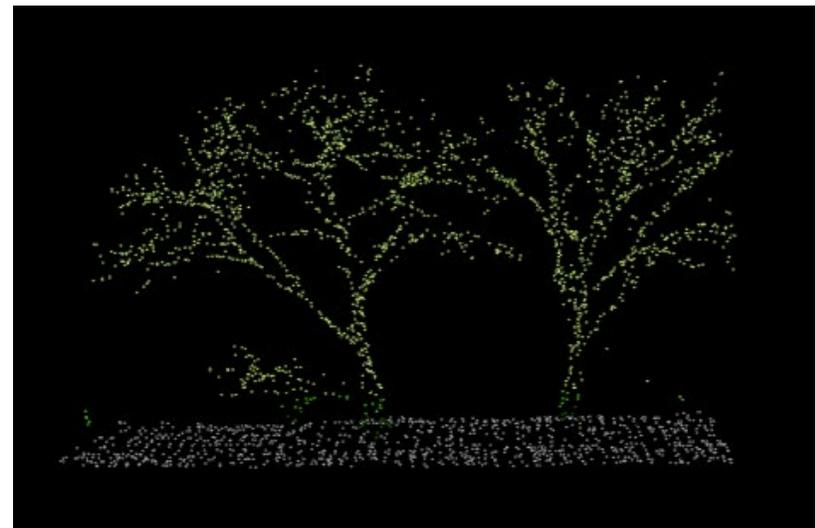
**Forestry...**

# HD Lidar Examples: Vegetation Mapping

Low Density (QL3, 1ppm)

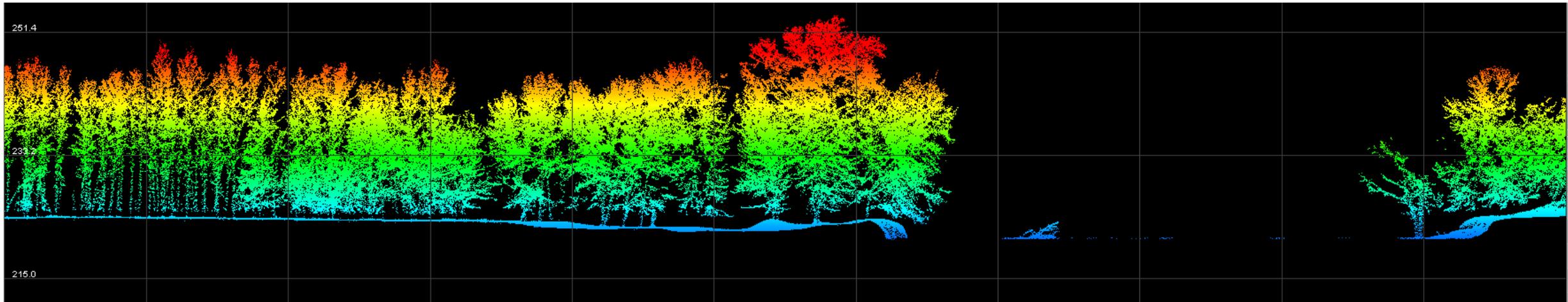
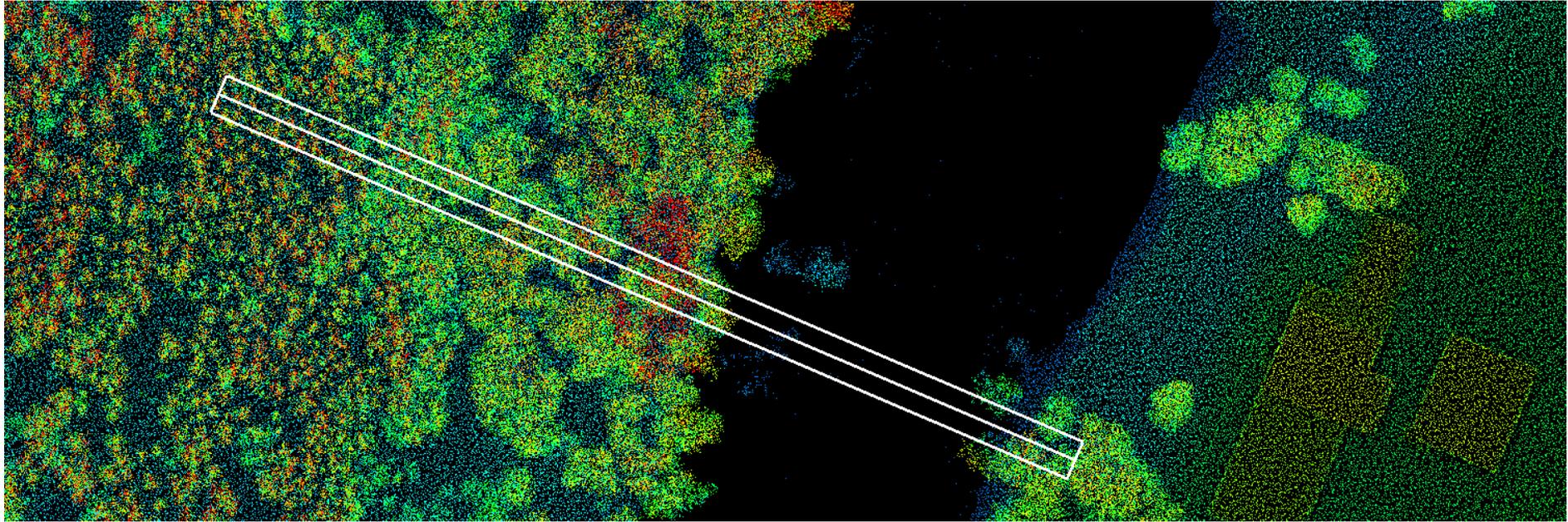


High Density (QL1, 8+ppm)

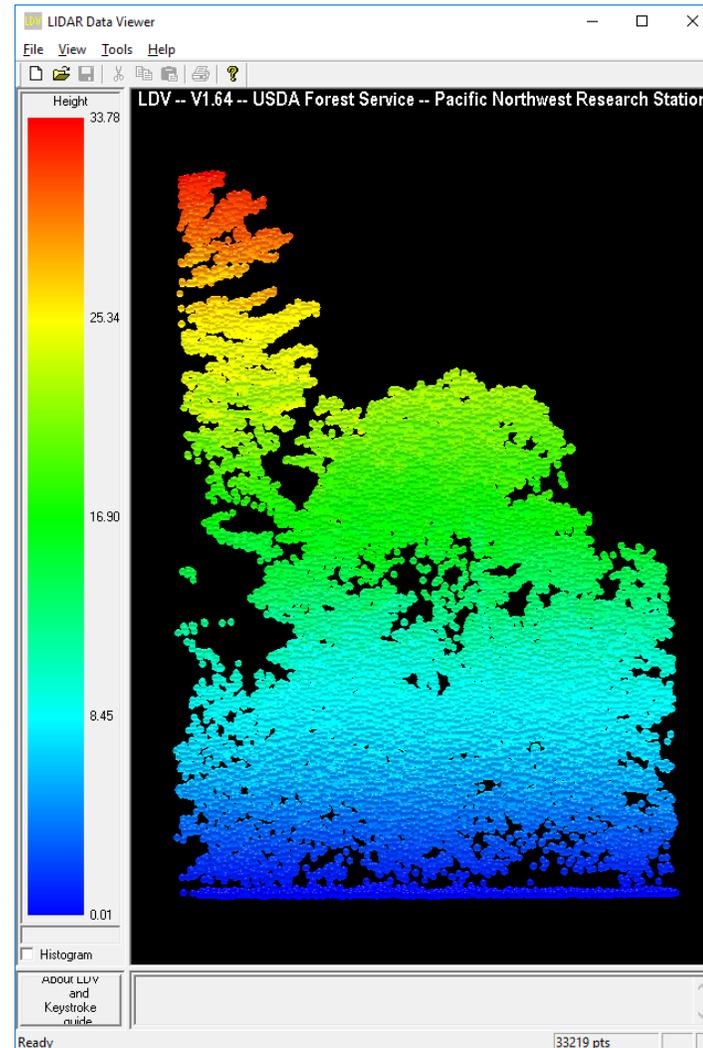


# HD Lidar Examples: Hydrography & Infrastructure

Feature Extraction | High Density Lidar  $\geq 30$ -point/m<sup>2</sup> | Le Sueur County Lidar Data Collection 2021



# Co-located PBI Plots with Lidar Point Cloud



Elevation	Meters
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 %

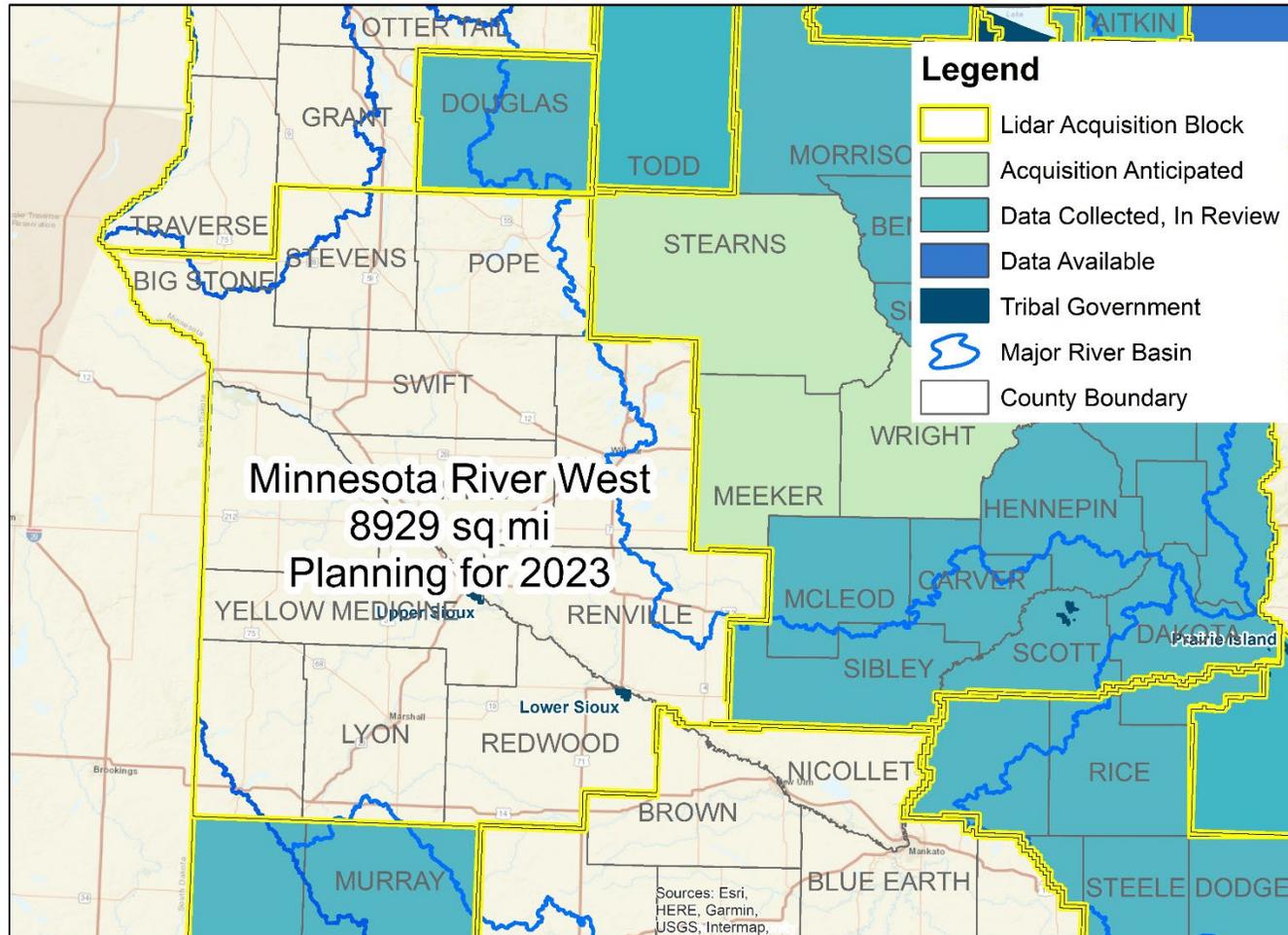
An aerial photograph of a large, irregularly shaped lake with numerous forested islands and peninsulas. The surrounding land is covered in dense green forest. The sky is blue with large, white, fluffy clouds. A large, dark blue circular graphic is overlaid on the right side of the image, containing white text.

# Completed & Planned Lidar Collections



# 3DGeo Outreach: PLANNING for 2023

## Minnesota River - West Block



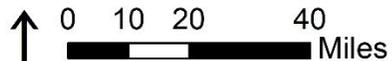
**3DGeo stakeholder outreach** began in the MN River East and West Blocks when conducting initial outreach in Southern MN in 2019.

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 = **\$2,901,925** TOTAL.

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

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

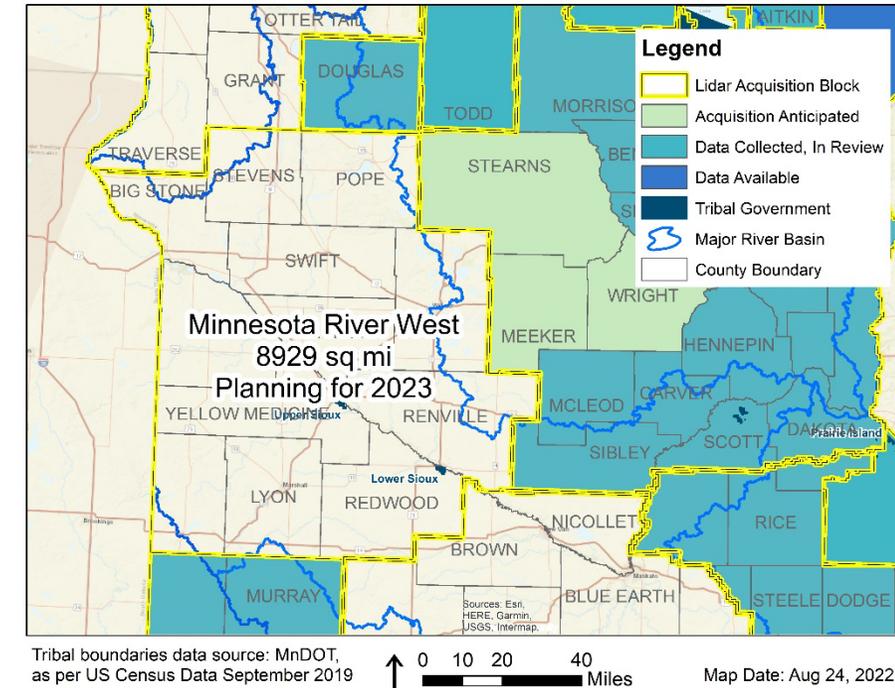


Map Date: Aug 24, 2022

# 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<sup>2</sup>)
- Average per county is \$97.50 per square mile

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



\*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

Next

**Future – 3D Environment Immersion...**

# HD Lidar Examples: 3D Scene Immersion

## Highway/Rail Grade Crossing Inspection



# HD Lidar Examples: **3D Scene Immersion**

## Future – 3D Visualization and Analysis



**Upgrade to Higher Density – 30 Points/m<sup>2</sup>...**

## 8 Points per Square Meter → 30 Points per Square Meter

3DGeo - Lidar Acquisition Specifications for USGS 3DEP Submissions for Broad Agency Announcemnt (BAA), Statement of Work (SOW), and Task Orders

Lidar Quality Levels Adopted from 3DEP Lidar Base Specification (LBS)	Description	LBS Table-2: Aggregate Nominal Pulse Spacing (ANPS) [m]	LBS Table-2: Aggregate Nominal Pulse Density (ANPD) [pulse/m <sup>2</sup> ]	LBS Table-4: Absolute Vertical Accuracy RMSEz (Non-vegetated) [m] <i>Alternative Units</i> ([cm] / [in] / [ft])	ASPRS Checkpoint Vertical Survey Requirement 3-times More Accurate than Non-vegetated RMSEz (3xRMSEz) [m] <i>Alternative Units</i> ([cm] / [in] / [ft])	LBS Table-6: DEM Cell Size [m]	Supported Contour Interval Accuracy [ft]	Delivered Point Density [point/m <sup>2</sup> ]	Central Miss - Metro LAB Cost Estimate Based on 2021 IGCE (2021-09-24) [mile <sup>2</sup> ]	QL Upgrade Cost (Central Miss LAB) Addition to Funding Partner's Initial Commitment (Based on 2021-09-24 IGCE) [mile <sup>2</sup> ]
QL1	• ASPRS Accuracy Compliant QL1	≤ 0.35	≥ 8.0	≤ 0.100 m ≤ <b>10.0</b> cm ≤ 3.937 in ≤ 0.328 ft	≤ 0.033 m ≤ <b>3.333</b> cm ≤ 1.312 in ≤ 0.109 ft	0.5 m	1.0 ft	≥ <b>30.0</b>	\$505.38	<b>\$179.67</b>
QL1	• ASPRS Accuracy Compliant QL1	≤ 0.35	≥ 8.0	≤ 0.100 m ≤ <b>10.0</b> cm ≤ 3.937 in ≤ 0.328 ft	≤ 0.033 m ≤ <b>3.333</b> cm ≤ 1.312 in ≤ 0.109 ft	0.5 m	1.0 ft	≥ 8.0	<b>\$325.71</b>	<b>\$0.00</b>

## 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

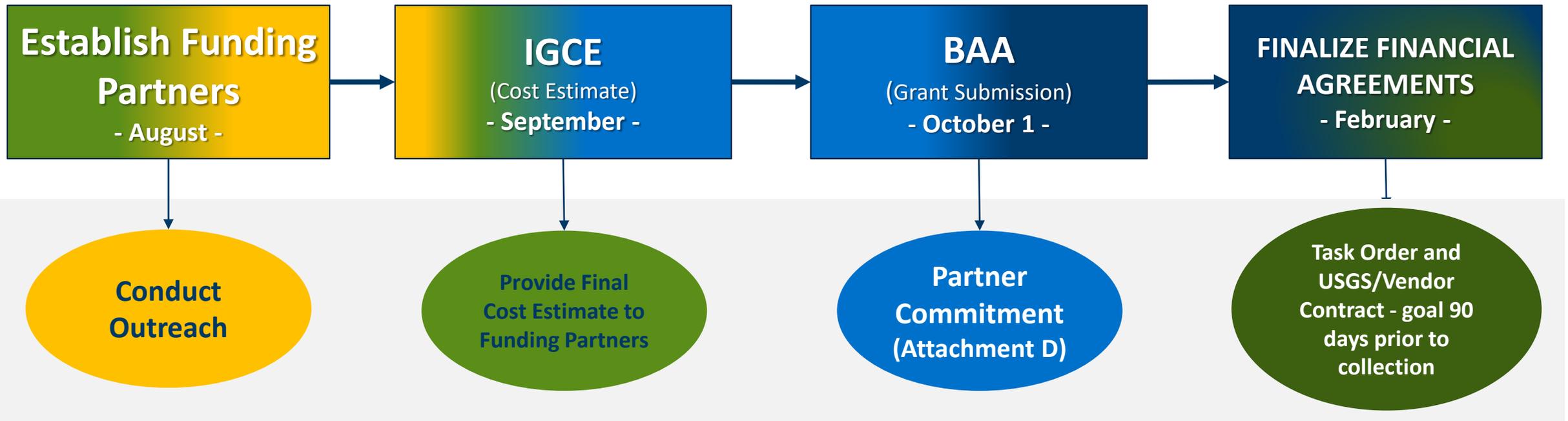


## Next steps to be a Financial Partner

- Let the 3DGeo know you're interested in partnering (email: [lidar@state.mn.us](mailto: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)



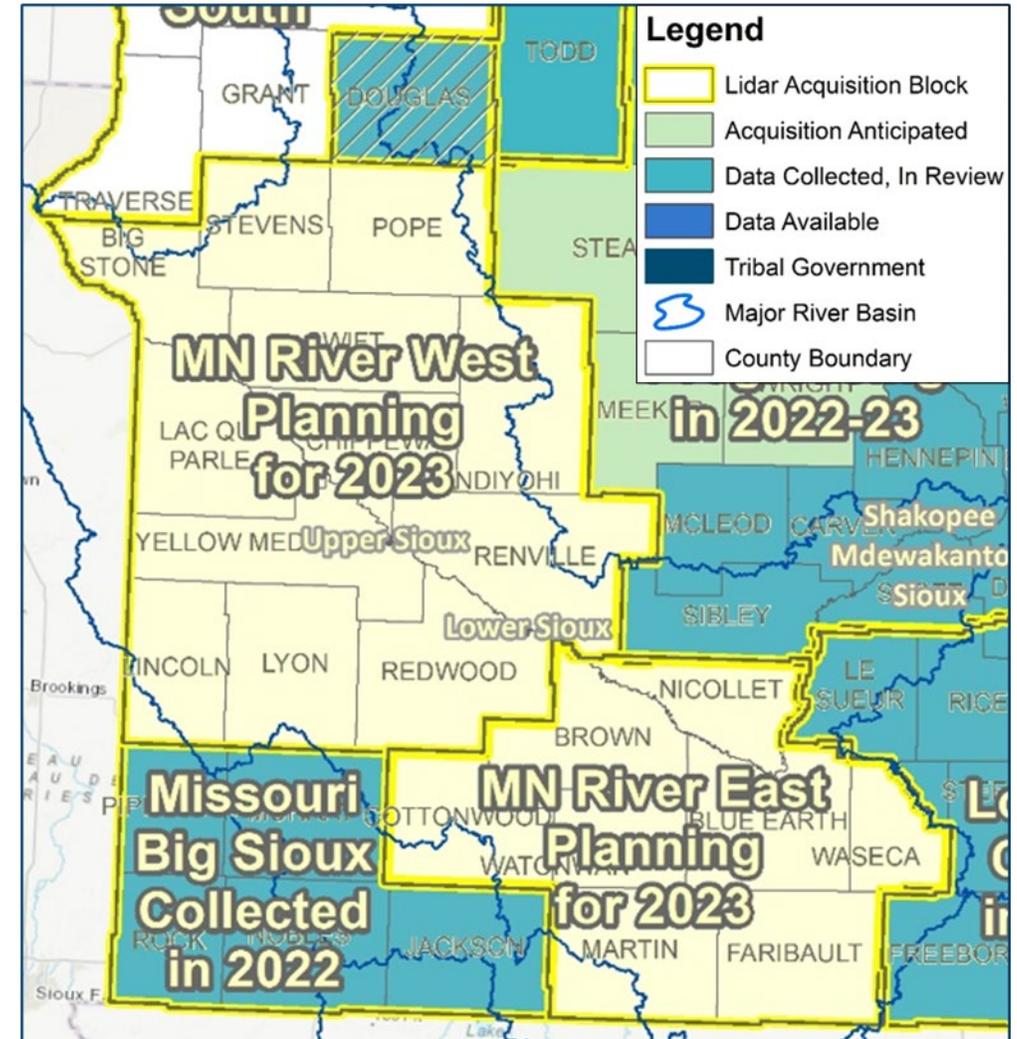
## 3DGeo Next Steps



# 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



# Stakeholder Questions Following August 25 Meeting

**For the MN River West Block, the goal is roughly \$73k from each county. Is the goal the same amount from each county, even though counties are different sizes?**

- *Yes.*
- *This amount is our GOAL per county to collect lidar across the whole Block.*
- *The MN Lidar Plan has a goal of statewide collection of high density lidar and 3DEP has a Nationwide goal.*
- *3DEP is a major contributor, but it won't happen without partnerships.*
- *This goal represents an even 30% split between all counties within the Block, with the expectation of raising another 30% from state and other local partners, and 40% from 3DEP.*

**What happens if a county decides not to participate and there is not 100% participation in the Block?**

- *A funding opportunity will be missed. Without sufficient local partnerships within the LAB, 3DGeo may not be able to apply for the 3DEP funding during this round and we would need to delay a year.*
- *Costs are driven by economies of scale. A single county or smaller area of lidar acquisition will be more expensive.*

# Stakeholder Questions Following August 25 Meeting

## **Are we obligated to the Attachment D that we sign?**

- *The Attachment D form is not a contract.*
- *Commitments can be marked as pending and become confirmed later.*
- *Funding agreements with partners happen between MNIT (MnGeo) and the county or other local government.*
- *The goal for a contractual agreement between the local governments and MNIT is within 90 days of lidar acquisition. This ensures the contractual agreements between MNIT and USGS are in place before the Task Order is finalized with the and USGS and the vendor, and all is complete before the spring collection season.*

## **If data is collected in spring 2023, when is data delivery expected?**

- *The vendor will be obligated to submit data to the USGS to review around one year after data collection.*
- *The USGS preforms quality control and vertical accuracy checks, sometimes warranting edits from the vendor.*
- *Partners may receive a copy of the entire Block from the vendor after the USGS establishes provisional acceptance of the data, or after the USGS completes all final vertical accuracy reports.*
- *The public will be able to access the data through The National Map after the USGS uploads the data, after all final checks and reports are completed.*

A top-down view of a group of people's hands stacked in a circle, symbolizing unity and support. The hands are of various skin tones and are wearing different colored sleeves (beige, plaid, yellow, blue, light blue). One person has a gold watch and a black beaded bracelet. The background is a wooden floor. A large, semi-transparent blue circle is overlaid on the right side of the image, containing the text.

*How:*  
You can Help

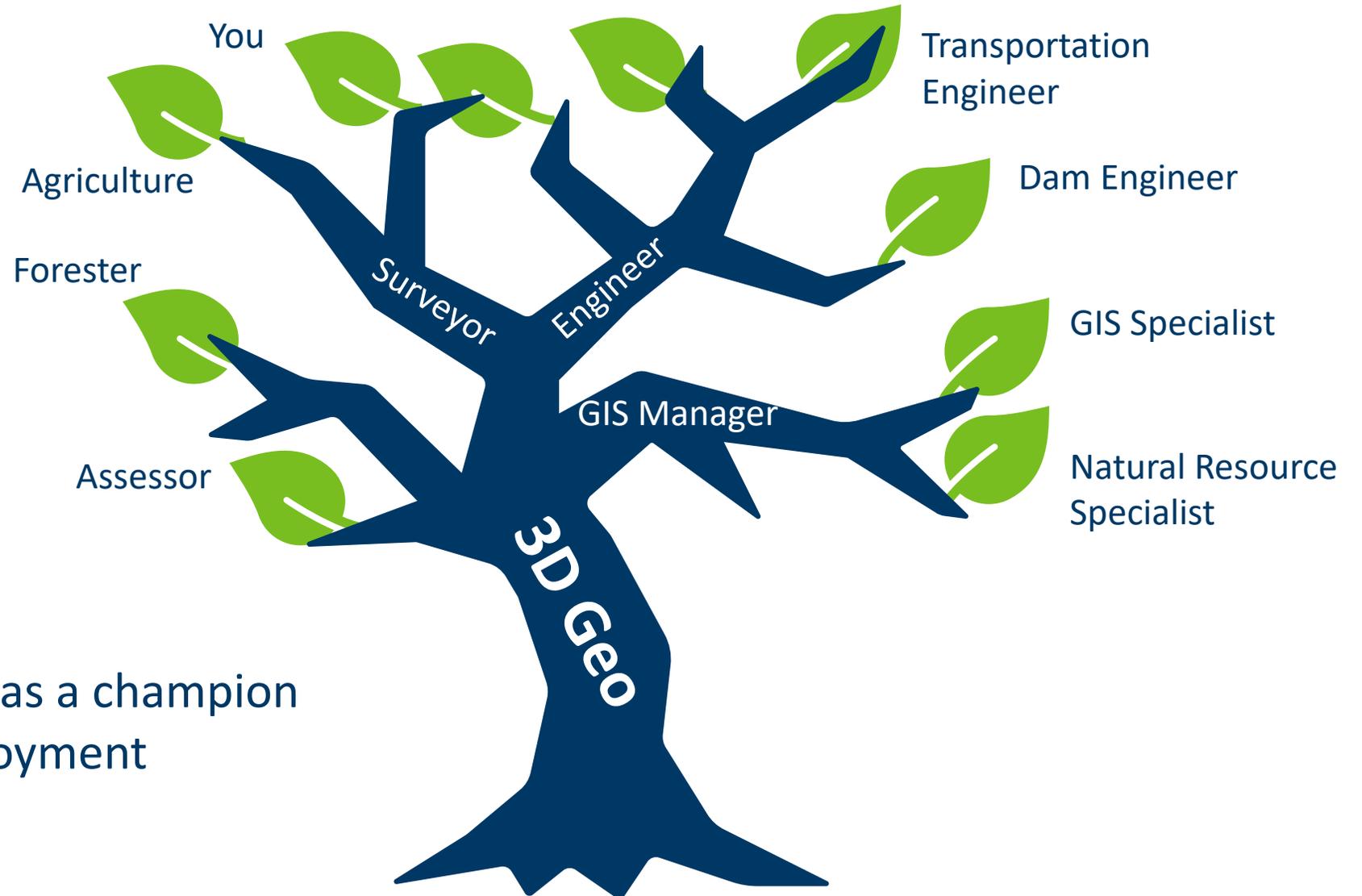
# Call to action: Next steps → Individual Role

**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!

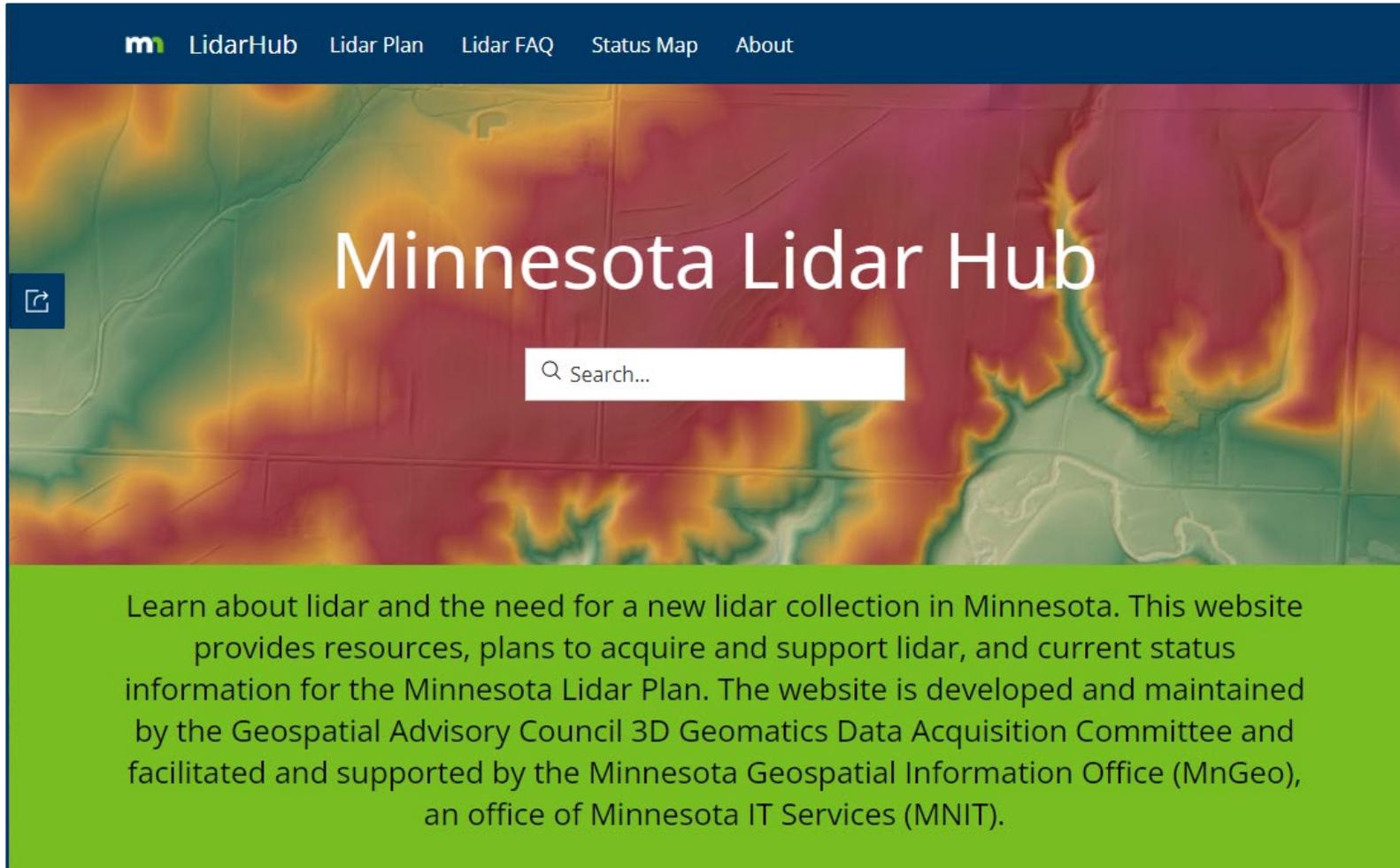
**Action Item:** Please serve as a champion within your place of employment



## Next Steps

- 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

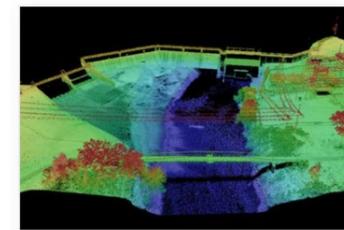
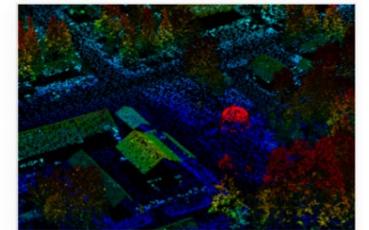
# Next steps – Individual Role → Review Minnesota Lidar Hub



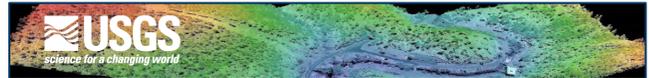
<https://lidarhub-minnesota.hub.arcgis.com/>

## Lidar Hub

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



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



## 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.



**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.

### 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. 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.

Fact Sheet 2013-2015 September 2013



## 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	56.90
2	Natural resources conservation	3.38
3	Flood risk management	1.10
4	Infrastructure and construction management	0.64
5	Water supply and quality	0.47
6	Coastal zone management	0.41
7	Forest resources management	0.33
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)

### Identified

- Natural Res**
  - Fish
  - Wet
  - Nat
  - Wild
  - Fish
  - Wild
- Agriculture**
  - Prec
  - Run
  - Bos
- Transportat**
  - 3D
  - Traf
  - Sign
  - High
  - Mai
- Water Resou**
  - Wat
  - Riv
  - Coa
  - Flo
  - Sea
  - Cuk
  - Hyd
- Recreation**
  - Tra
  - Lan

### Risks

- Risks Associ**  
The lidar ac sectors that features on spatial data.
- Risks Associ**  
Minnesota's the data less other veget impacted so
- Inaccuracies**  
terrain anal

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.

## 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.

### Need for Lidar

Lidar data providing for ass making for ass to save costs in infrastructure, forestry. Lidar a multitude of

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.mn.us/committee/3dgeo/>

### State Lidar Plan

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/](http://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

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 lidar be part of the

The quality level and partner re point cloud, di others depend More informat and in the drat

**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>

Several org Minnesota have a variety of reed with particular activities. The high low 3DEP ness needs in M water quality by runoff into stre of sediment and lakes and rivers tion terrain data effectively impl conservation pr watershed del efforts to preser and improve wa These practices public that will resources cons



Table 1. C 3DEP data (Dewberry)

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

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

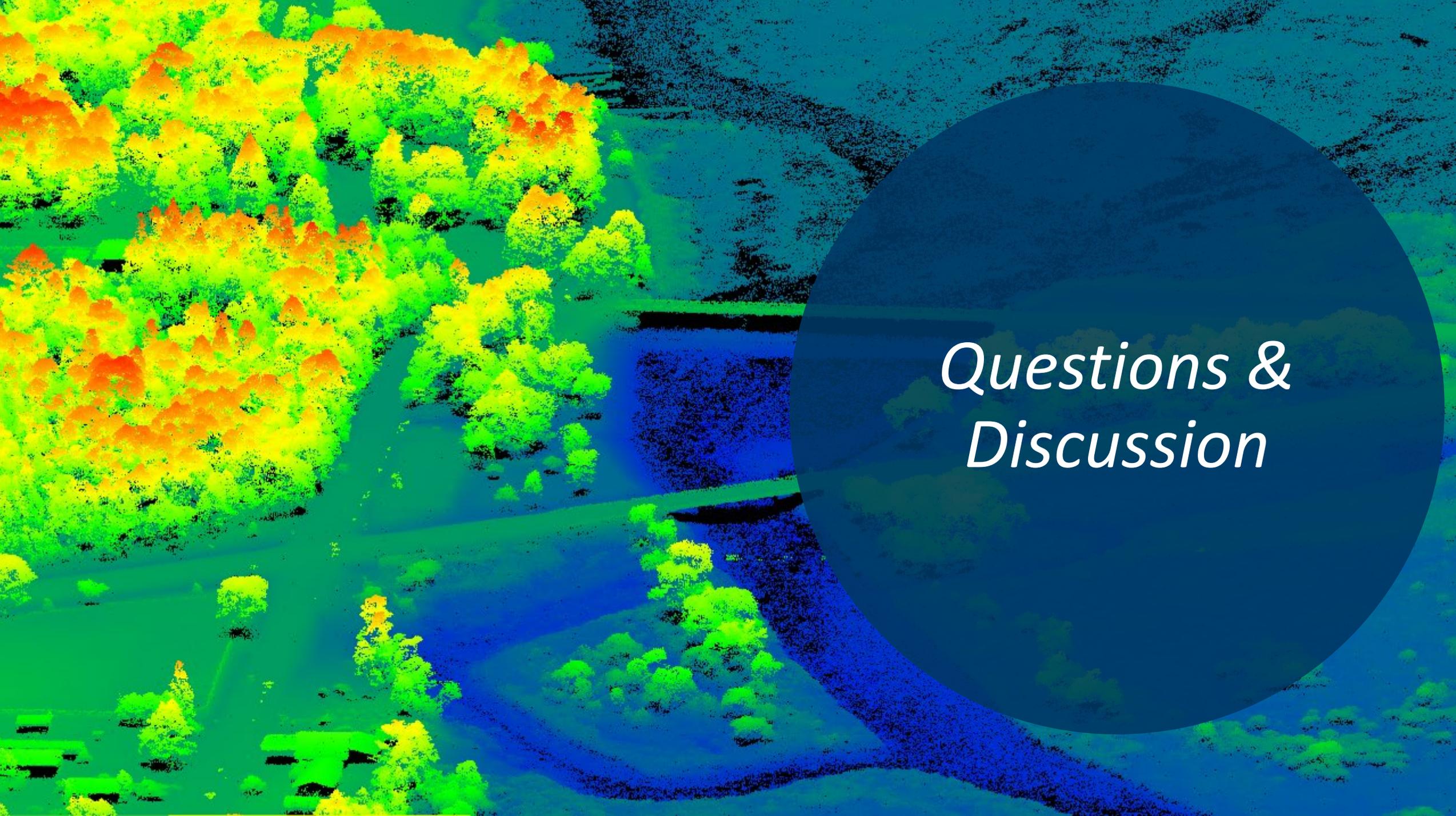
<http://nationalmap.gov/3DEP/>

By William J. Carwell, Jr.

## 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](mailto:lidar@state.mn.us)
  - Get on GovDelivery list: [www.mngeo.state.mn.us/newsletter.html](http://www.mngeo.state.mn.us/newsletter.html)
  - Join a 3DGeo Workgroup!





*Questions &  
Discussion*

# Thank You!

From: 3D Geomatics Data Acquisition

**Sean  
Vaughn**  
(MNIT DNR)

**Jennifer  
Corcoran**  
(DNR Forestry)