HOW ARE YOU MAKING THE MOST OF YOUR IMAGERY AND LIDAR?

A GUIDE TO THE POWER OF DERIVATIVE PRODUCTS

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Welcome and Introduction

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WHAT WE'LL COVER

The fundamentals of imagery and lidar
Key derivative products
Real-world examples and applications
How agencies are using these tools to improve planning, assessment, and response

Why this Matters?

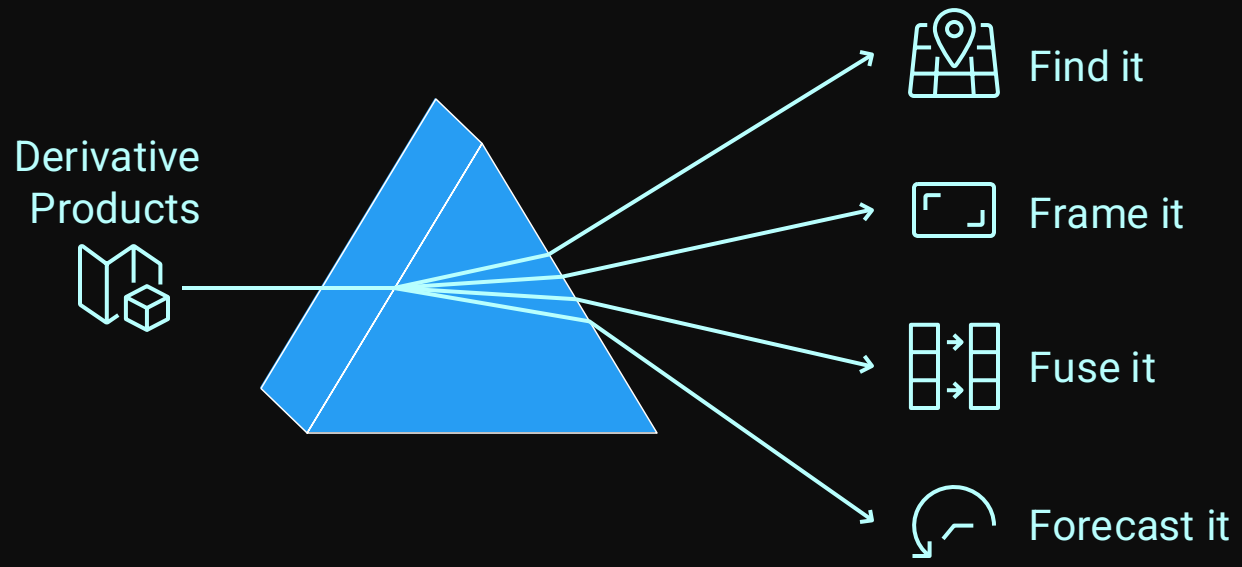
AGENCIES ACROSS THE COUNTRY FACE INCREASING PRESSURE TO:

- Improve planning and decision-making
- Manage assets more efficiently
- Respond quickly to environmental and infrastructure challenges
- Reduce costs while increasing accuracy

Imagery, lidar, and derivative products provide the current, reliable, and actionable data needed to meet these demands.

DERIVATIVE GEOSPATIAL PRODUCTS ALLOW YOU TO:

- Find it – Discover spatial data
- Frame it – Quantify and add context
- Fuse it – Integrate and analyze
- Forecast it – Anticipate outcomes



Why Use Imagery and Lidar Together?

When combined, imagery and lidar create a powerful, comprehensive dataset.

BENEFITS:

- It’s all about the Voxels!
- Visual detail + structural accuracy
- Improved classification and feature extraction
- Better modeling and analysis
- More reliable decision-making
- This combination enables the derivative products we’ll explore next

DERIVATIVE PRODUCTS

Derivative Products

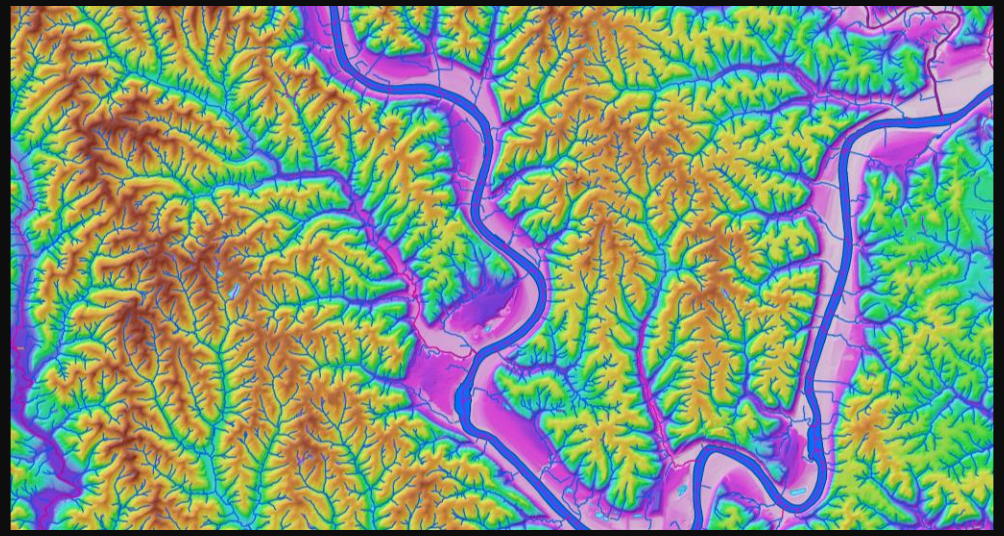
BUILDING OUTLINES

Advanced in-house tools and the latest orthoimagery and lidar data accurately map individual building footprints. A semi-automated process enables faster and more affordable results than traditional manual methods. Data is extracted from high-resolution imagery or classified lidar. The process begins with identifying sample areas representing diverse land cover and terrain, followed by custom classification algorithms and thorough statistical and visual reviews to drive accuracy.

EDGE OF PAVEMENT

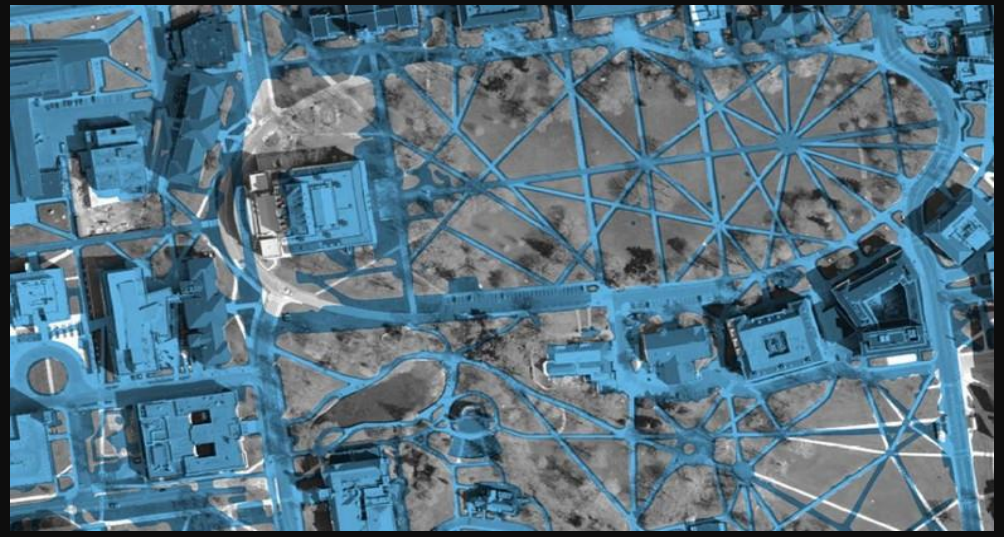
Detailed edge-of-pavement GIS layers help estimate repaving costs across jurisdictions. High-resolution imagery processed in an AI/ML environment enhances areas where imagery alone is unclear — resulting in more automated, accurate, and consistent pavement delineation.

Derivative Products



ELEVATION-DERIVED HYDROGRAPHY

The dynamic nature of water shapes our ever-changing physical landscape and shortens the shelf life of accurate geographic data and analytic products. EDH uses lidar data, human-built features, and detailed landscape classifications to create true-to-life representations of water flow patterns. Woolpert's dedicated EDH team supports the U.S. Geological Survey 3D Hydrography program, incorporating small and ephemeral streams to develop hydrography data up to four times denser than existing surface water data.



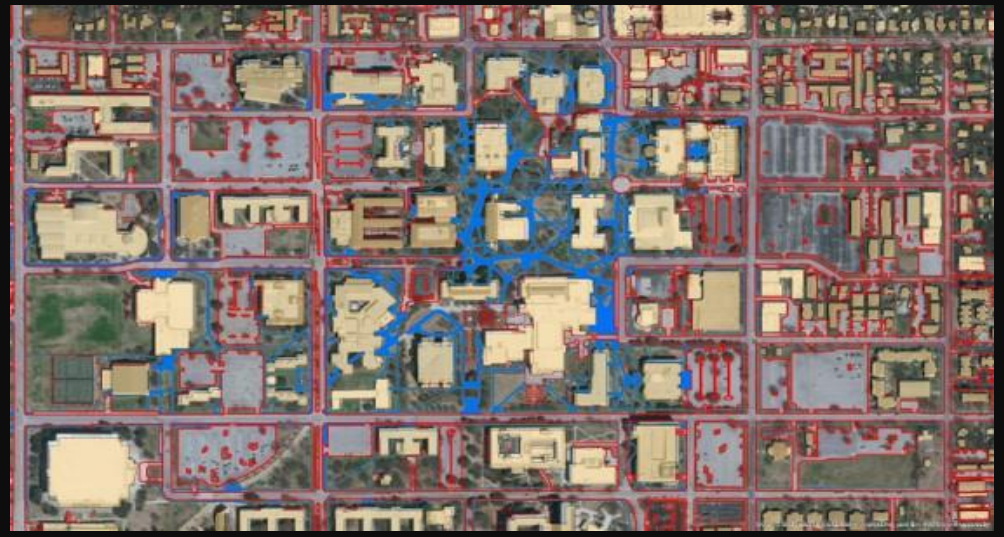
IMPERVIOUS SURFACE MAPPING

Impervious areas — such as roads, rooftops, and parking lots — are identified and quantified using high-resolution multispectral imagery and ancillary datasets. Advanced AI and machine learning models detect features based on elevation, shape, texture, and spectral signatures. This enables precise mapping for stormwater billing, watershed analysis, flood modeling, and EPA compliance, with fast, scalable, and highly accurate results.

Derivative Products

LAND COVER/LAND USE MAPPING

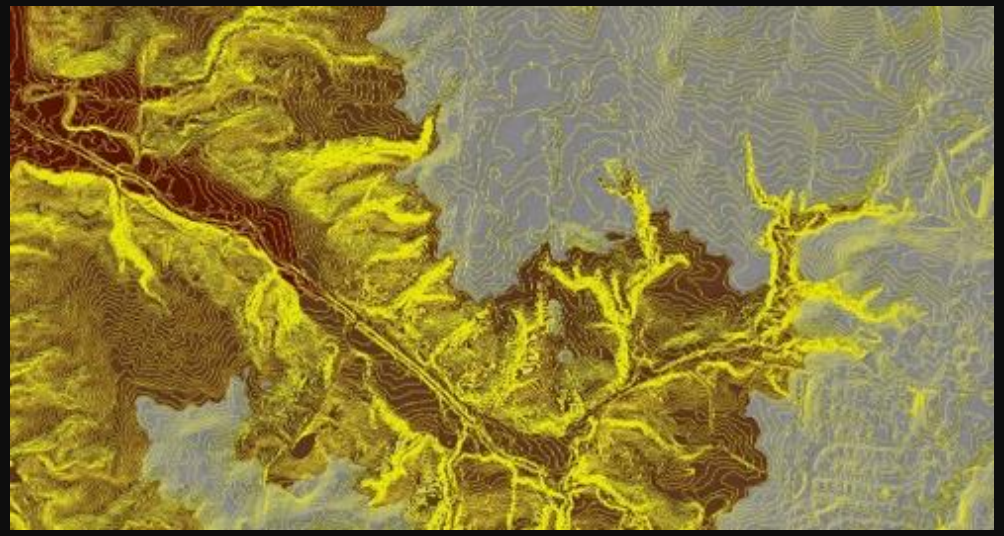
Automated, repeatable workflows generate reliable, cost-effective datasets across diverse landscapes. Lidar elevation data, high-resolution imagery, and ancillary datasets are combined to train machine learning algorithms that accurately classify land cover types. Proprietary pattern recognition and scene reconstruction techniques support change detection, resource management, and planning.



PLANIMETRIC FEATURES

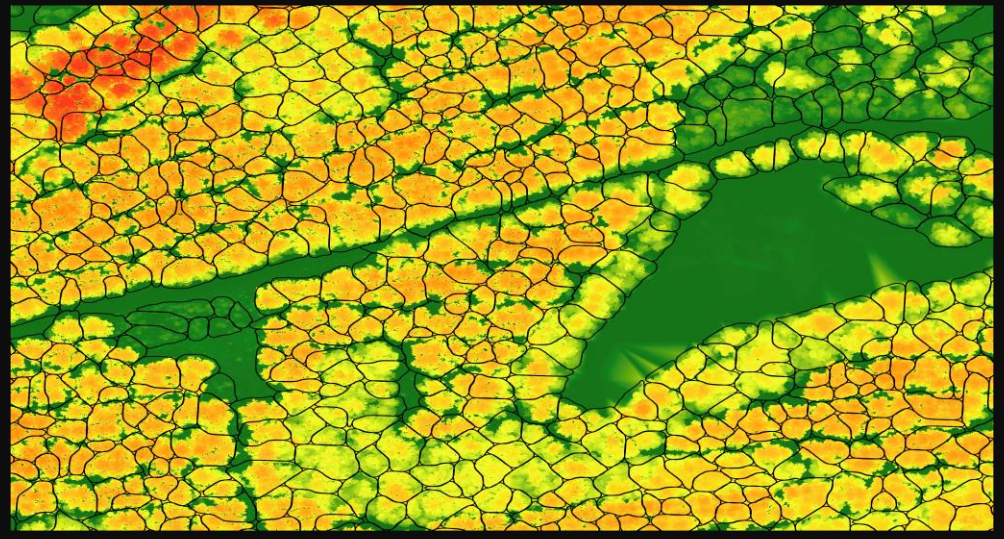
Detailed planimetric features are extracted from high-resolution orthoimagery and lidar using advanced remote sensing and photogrammetry. Semi-automated workflows — built on both commercial and proprietary software — support accuracy and efficiency with integrated quality control. Mapped features include buildings, driveways, roads, sidewalks, swimming pools, patios, unpaved roads, vegetation groups, and waterbodies.

Derivative Products



CONTOURS

In-house tools and routines are used to generate contours at any interval requested. They can be generated from lidar-derived surfaces or point clouds with varying levels of break line detail depending on project specific use and requirements. Automated quality control checks verify continuity and accuracy.



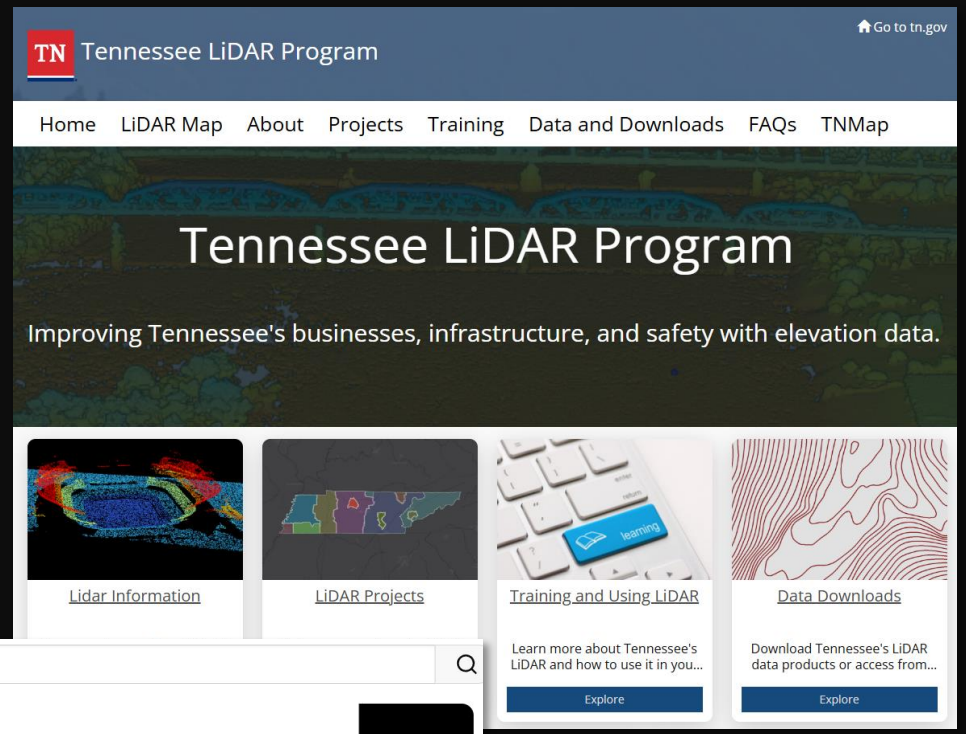
VEGETATION CLASSIFICATION

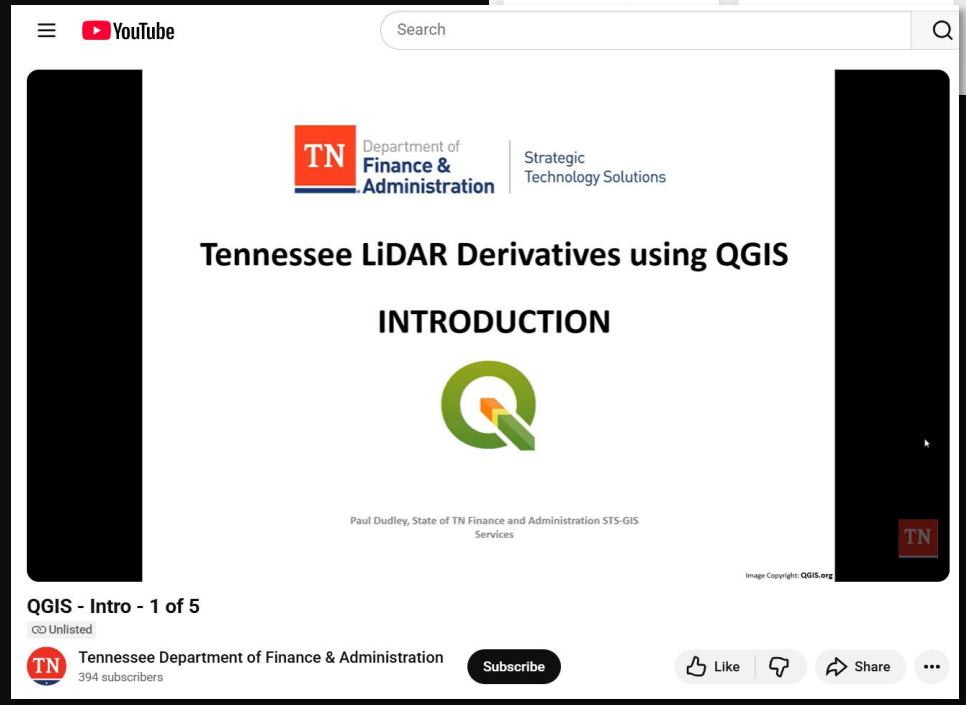
After identifying building features, we classify vegetation into height-based categories. Using supervised machine learning and ground truth validation, we achieve over 95% accuracy. This supports wildfire risk detection — including invasive species and deadfall — and enables consistent year-over-year monitoring.

EXAMPLES AND CASE STUDIES

Tennessee – Lidar Program

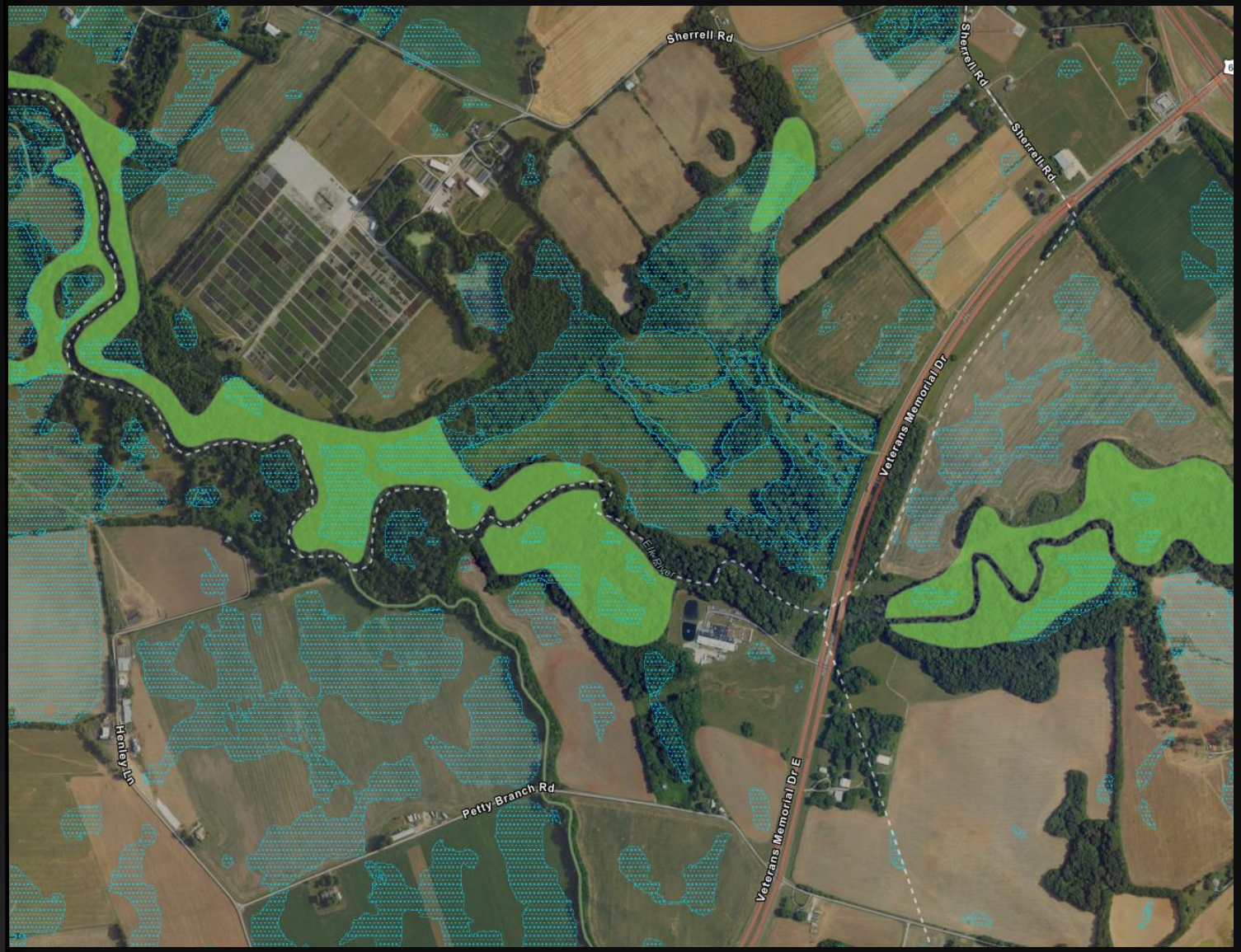
- Program evolution
  - 2015
  - USGS 3DEP
- Use cases
- Hub and training program
  - *Find it*





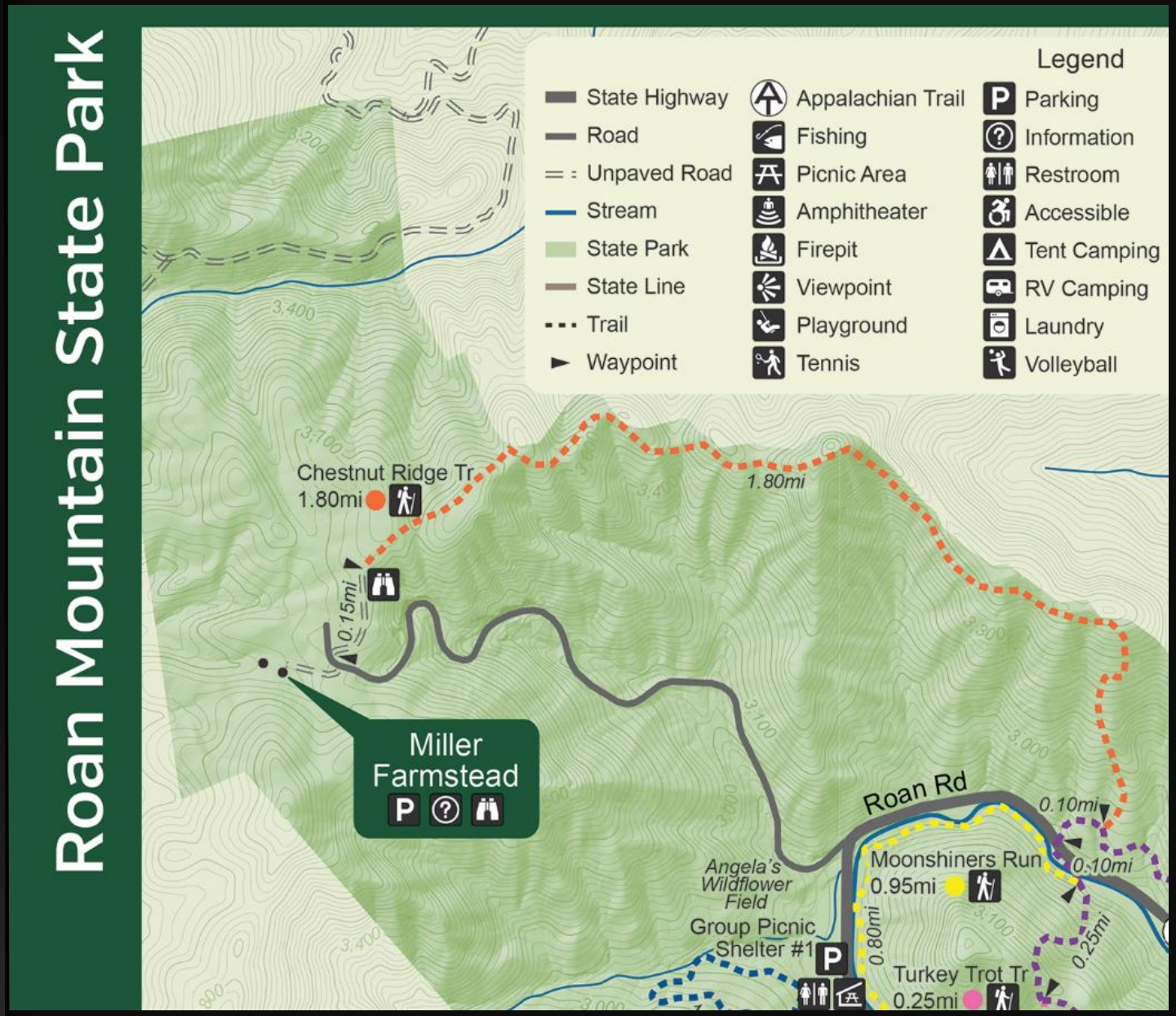
Tennessee – Key Derivatives

- Elevation models
  - TN Dept. Of Environment and Conservation - Wetlands Screening Tool



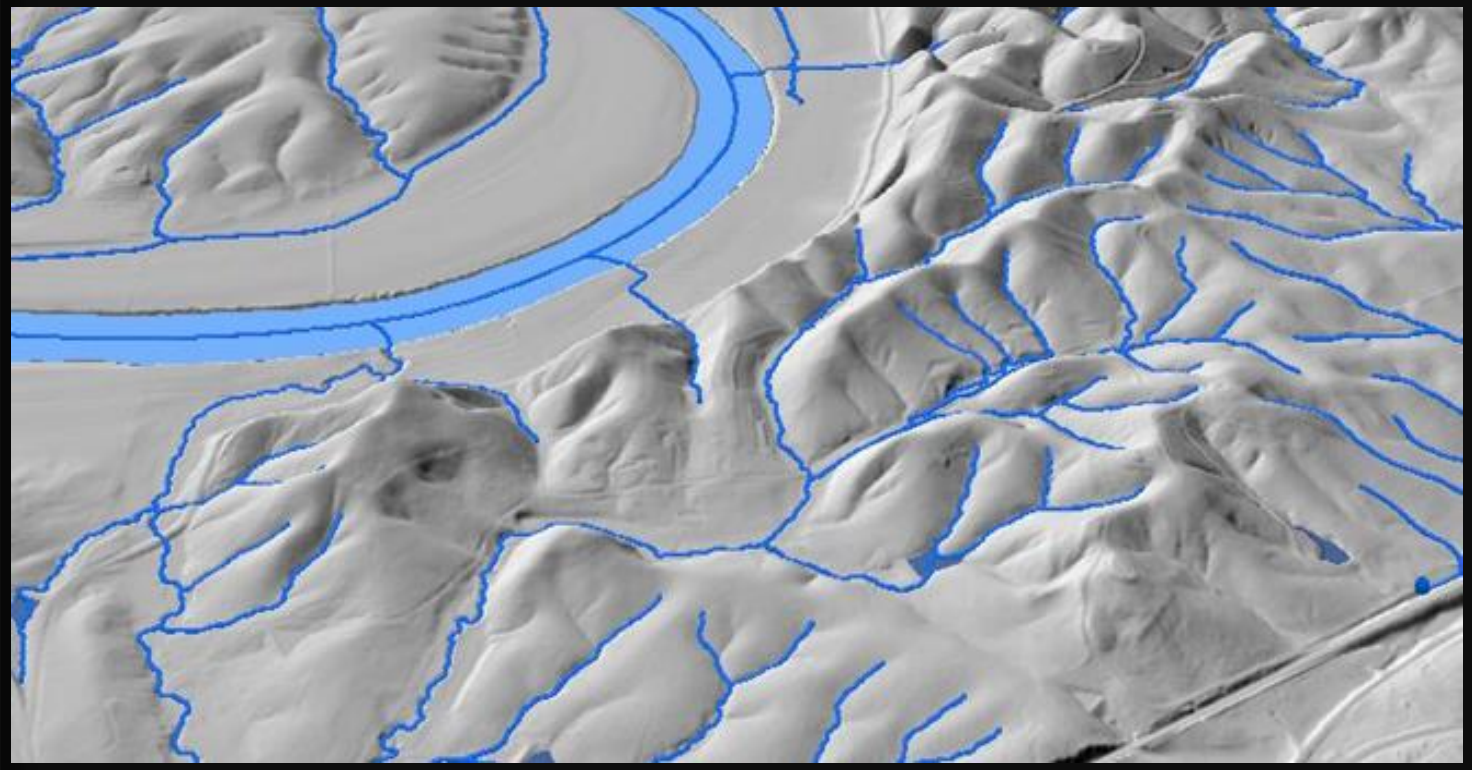
Tennessee – Key Derivatives

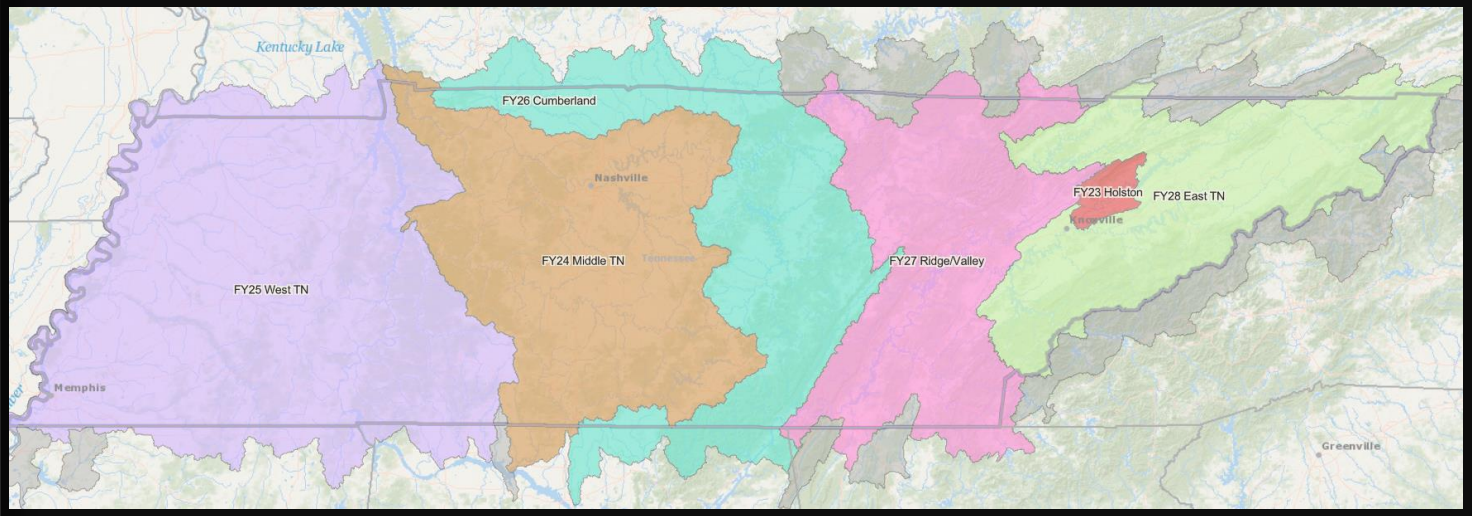
- Contours
  - TN state parks
  - Engineers/surveyors
- Building outlines
  - State-owned buildings
  - Local governments



Tennessee – Key Derivatives

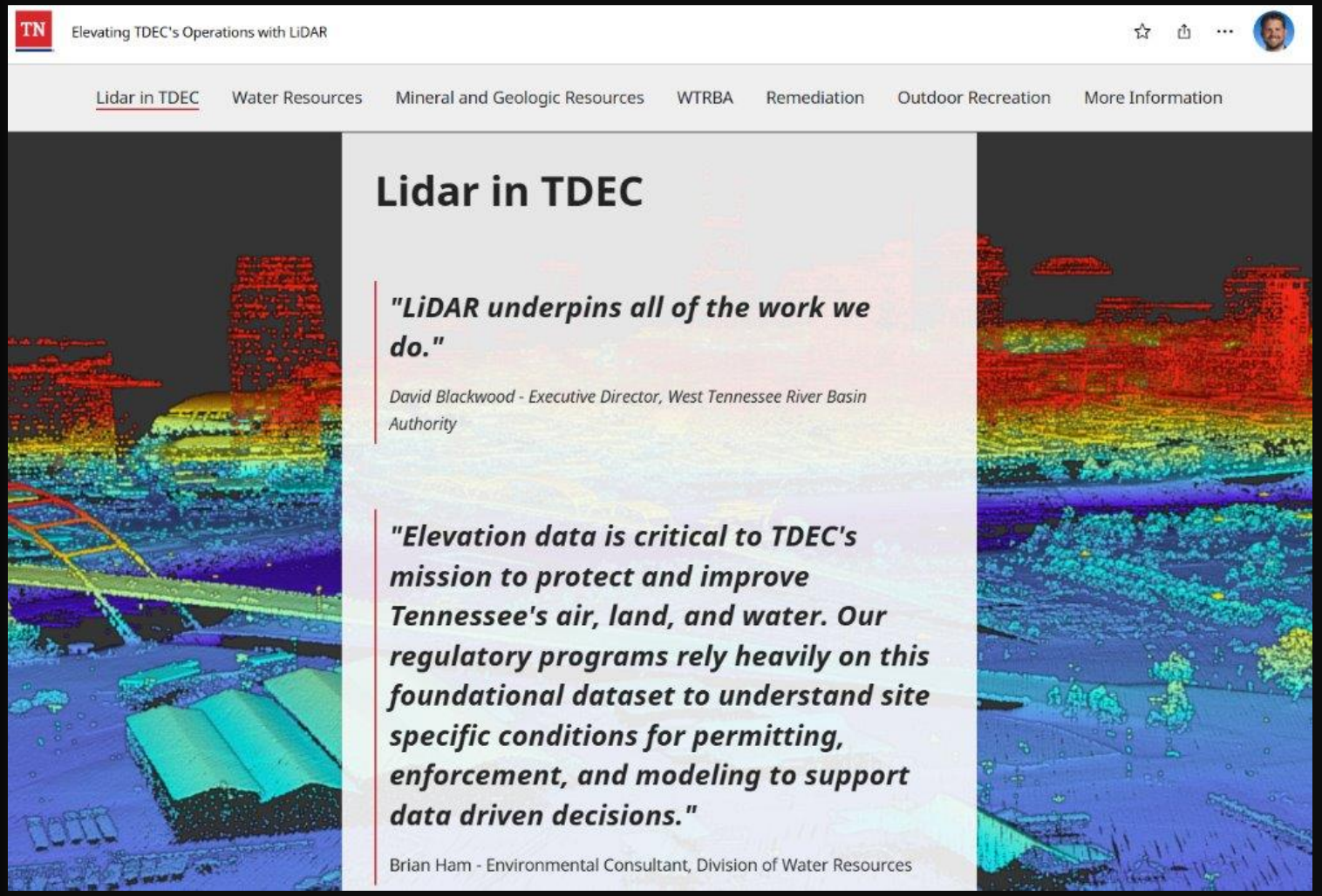
- Elevation Derived Hydrography - 3D Hydrography Program (3DHP)
  - Dept. of Environment and Conservation
    - Safe Dams Program
    - Stormwater
    - Source water protection
    - Rare species studies
  - Dept. of Transportation
    - Hydraulic design
    - Flood analysis





Tennessee – The Value

- Derivatives are now integral to business operations
  - *Fund it*



Case Study – Ohio Statewide Imagery Program (OSIP)

Background: Partnership between state and local agencies since 2006.

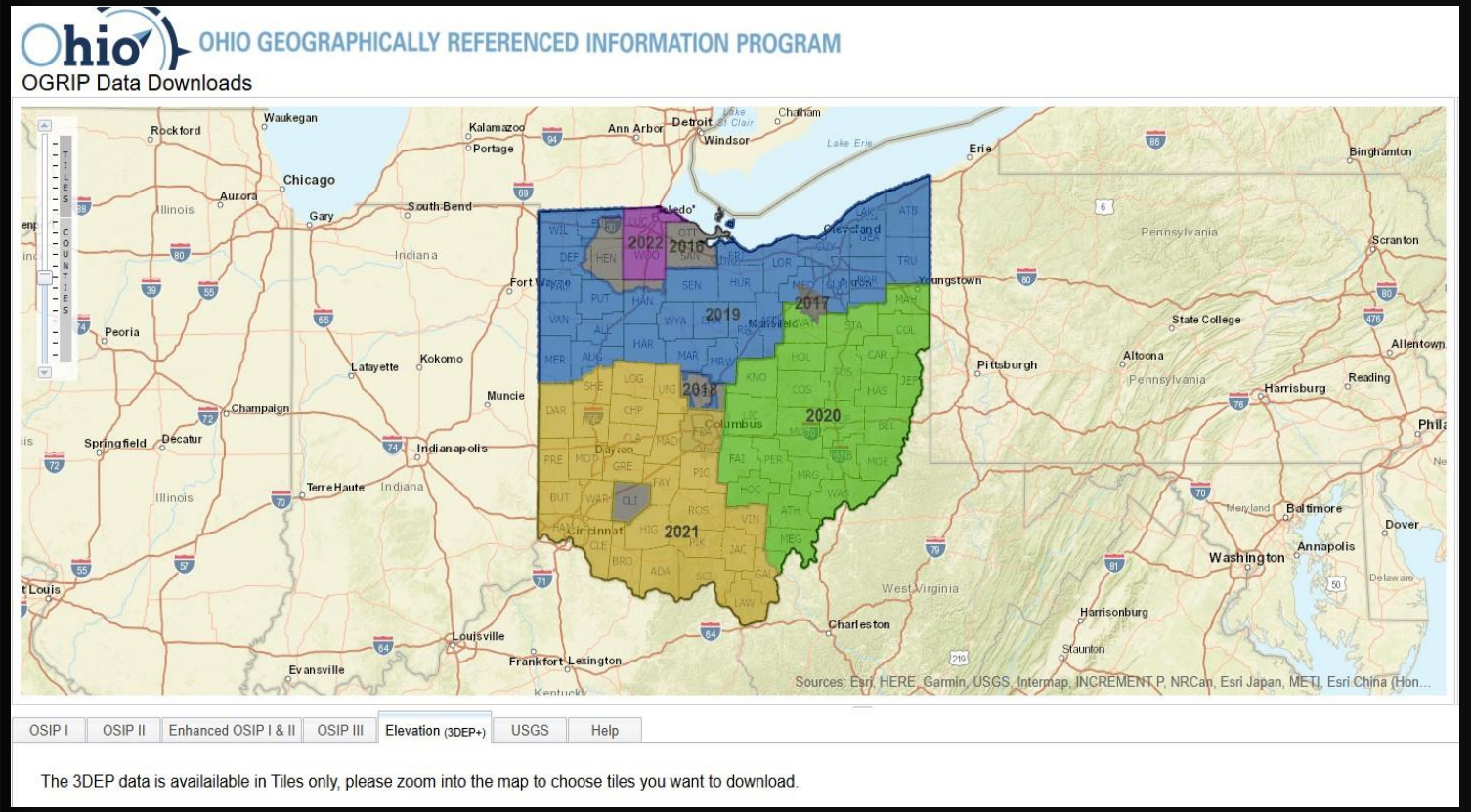
How it works: Regular statewide orthoimagery and topographic lidar; counties can “buy up” for higher resolution imagery and derivative products.

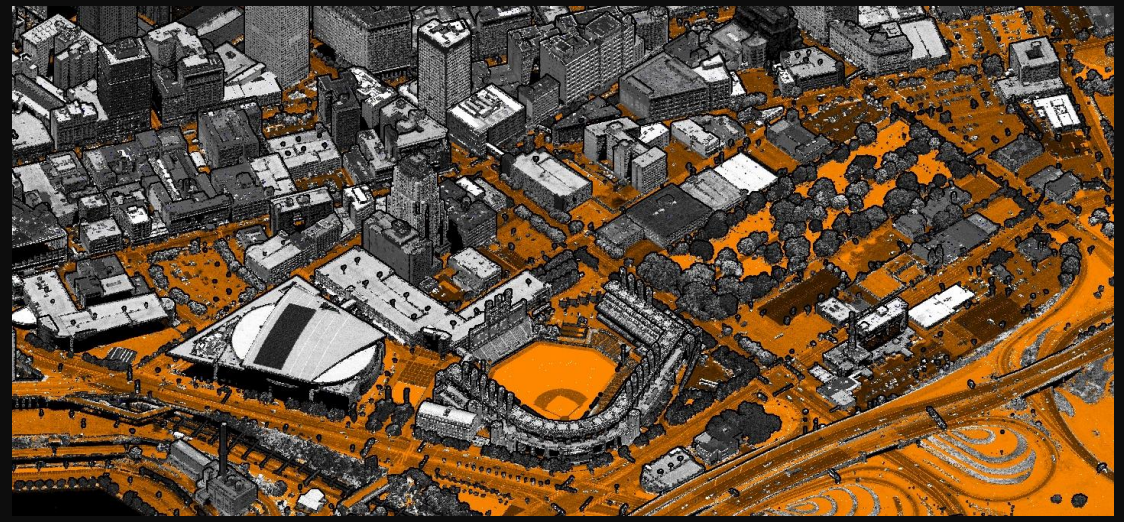
Benefits:

- Fully administered by the state with local input and guidance.
- Seamless, up-to-date base maps for all 88 counties.
- Data accessible at no cost to government and the public.
- Allows other state and local entities to use contract for related projects.

Ohio – Lidar Program

- Program evolution
  - USGS 3DEP QL1
  - 8ppsm statewide with ~12 counties upgrading to 20-30ppsm
  - 2019-2021

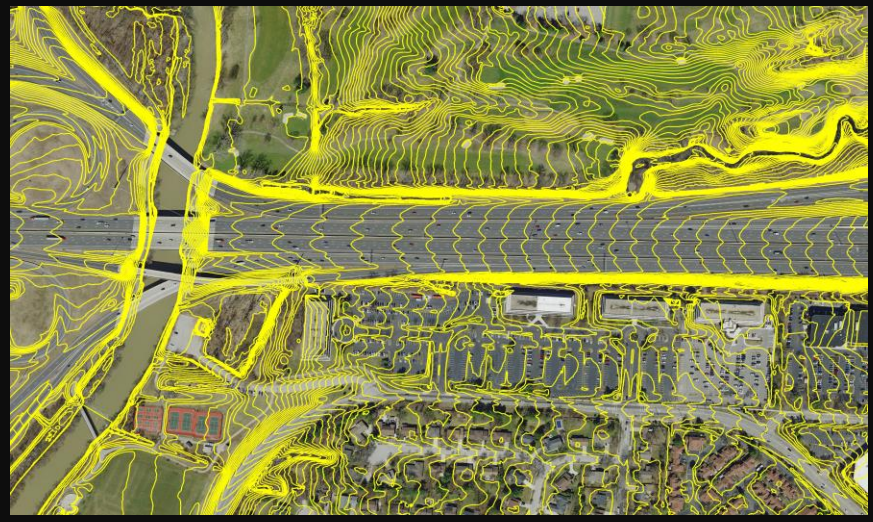




Ohio – 3DHP Program

Program evolution

- USGS 3DHP
- Work performed for the Ohio Department of Administrative Services (supported by ODOT, OEPA, ODNR, County Engineers Association of Ohio, County Commissioners Association of Ohio, The Nature Conservancy, and the Ohio Scenic Rivers Association)
- Upgraded to define flowlines at a 6-acre catchment size (due to need for additional granularity)
- Realizing a 3x-4x increase in the flowline miles as compared to the existing USGS NHD
- 2-foot contours (preliminary engineering and planning)
- 2025-2027

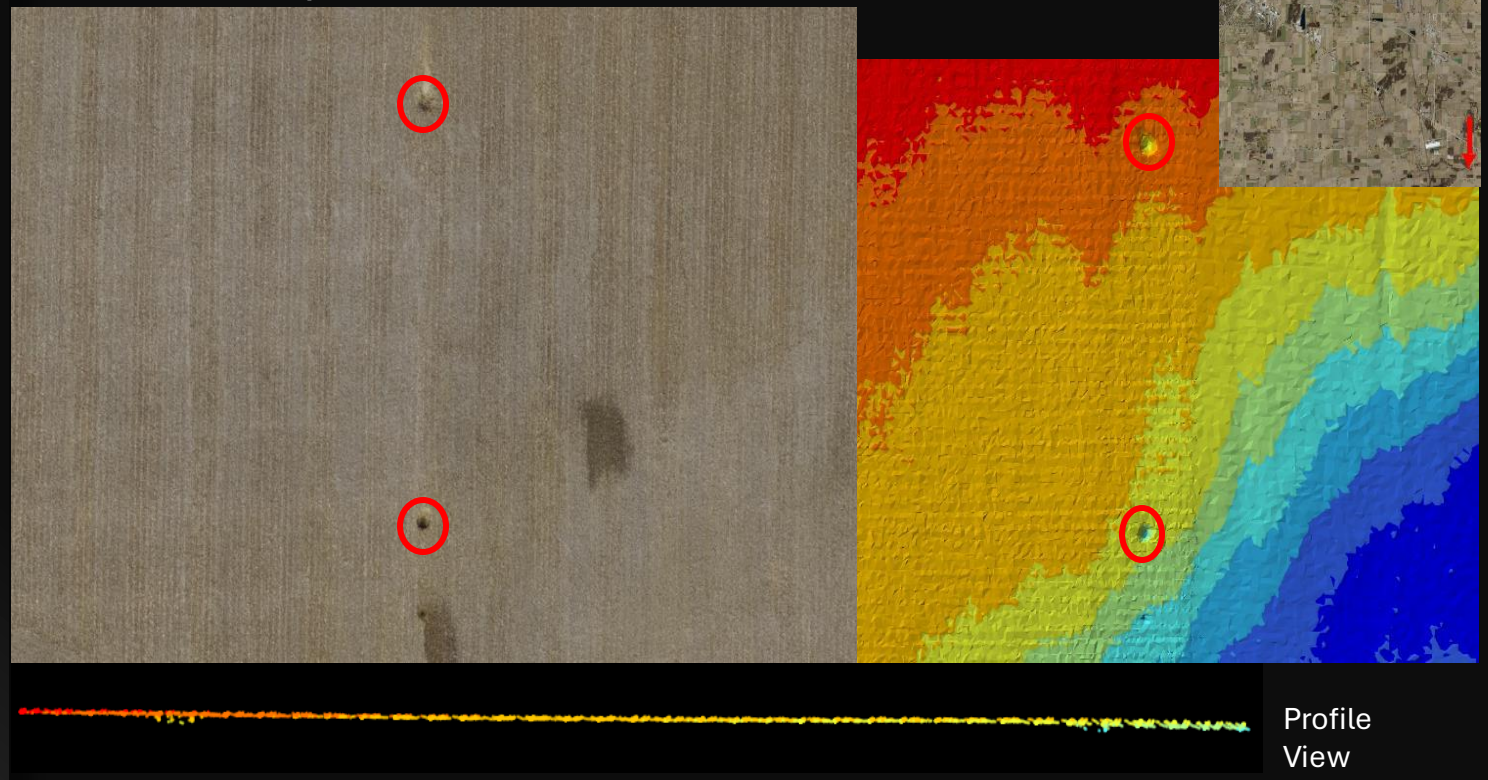


Ohio – Orphan Wells

Program Evolution

- USGS 3DEP QL1
- Work performed for the Ohio Department of Natural Resources
- Define potential orphan well sites across the state
- QL1 or 8ppsm lidar was chosen to identify undocumented vertical oil and gas wells

Possible Orphan Well

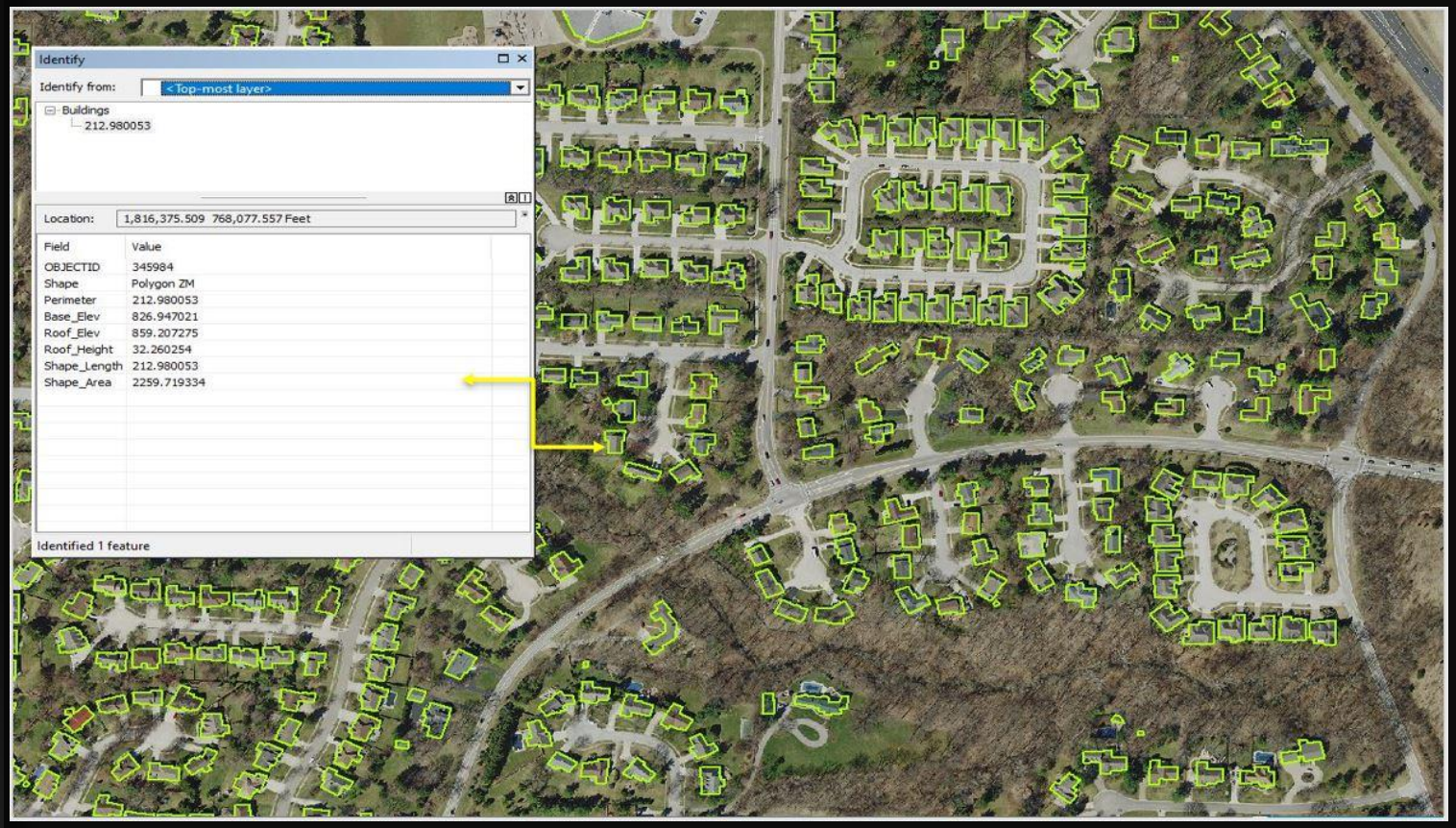


Profile View

Ohio - Planimetrics

Program Evolution

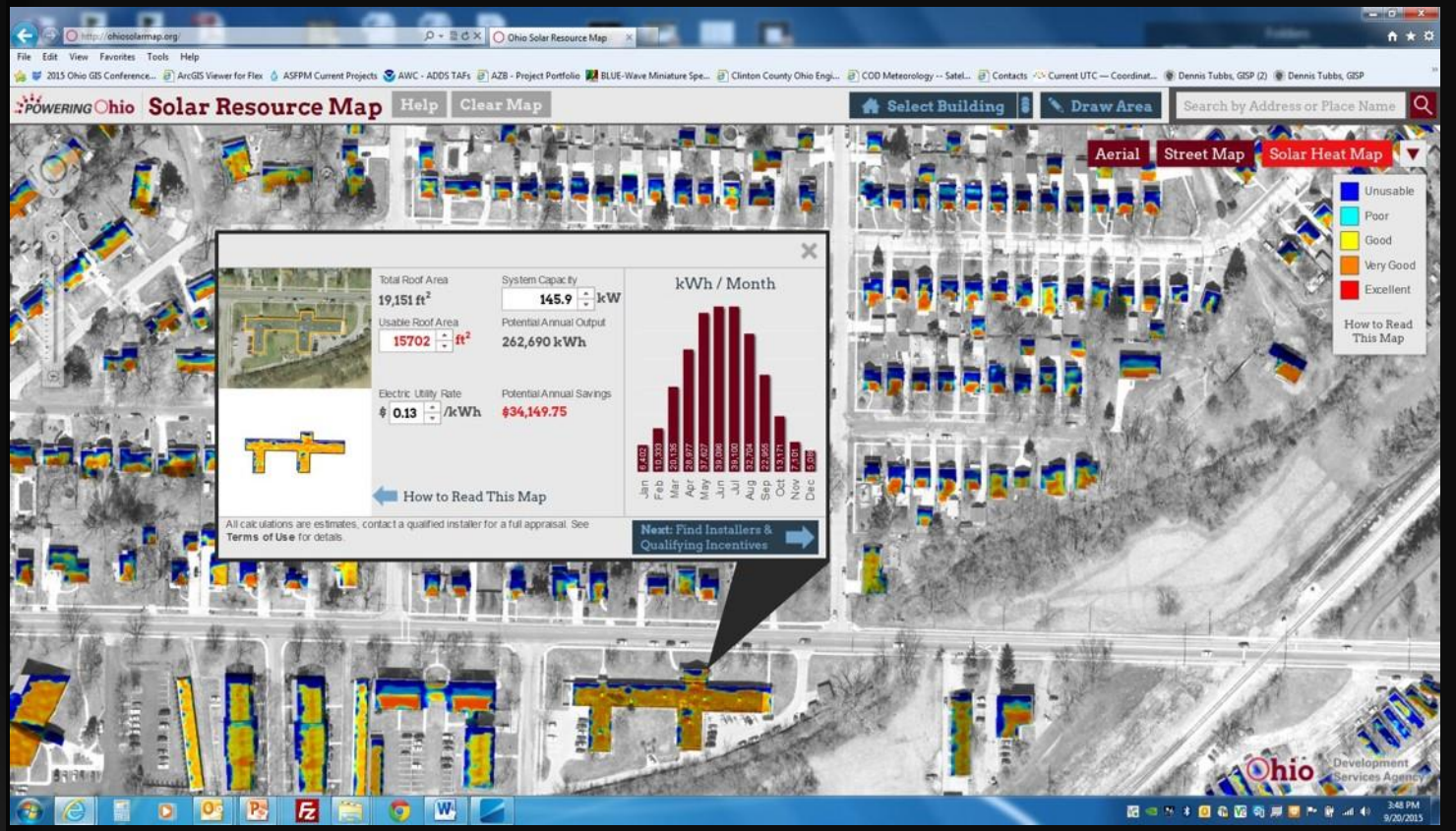
- USGS 3DEP
- Work performed for numerous counties throughout the state
- Define building structures100 square feet and larger for property assessment
- In addition to defining the area of each structure, lidar was used to provide top and bottom elevations, which support potential flood inundation modeling and Next Generation 911 as outlined in the updated NENA Standard



Ohio – Solar Mapping

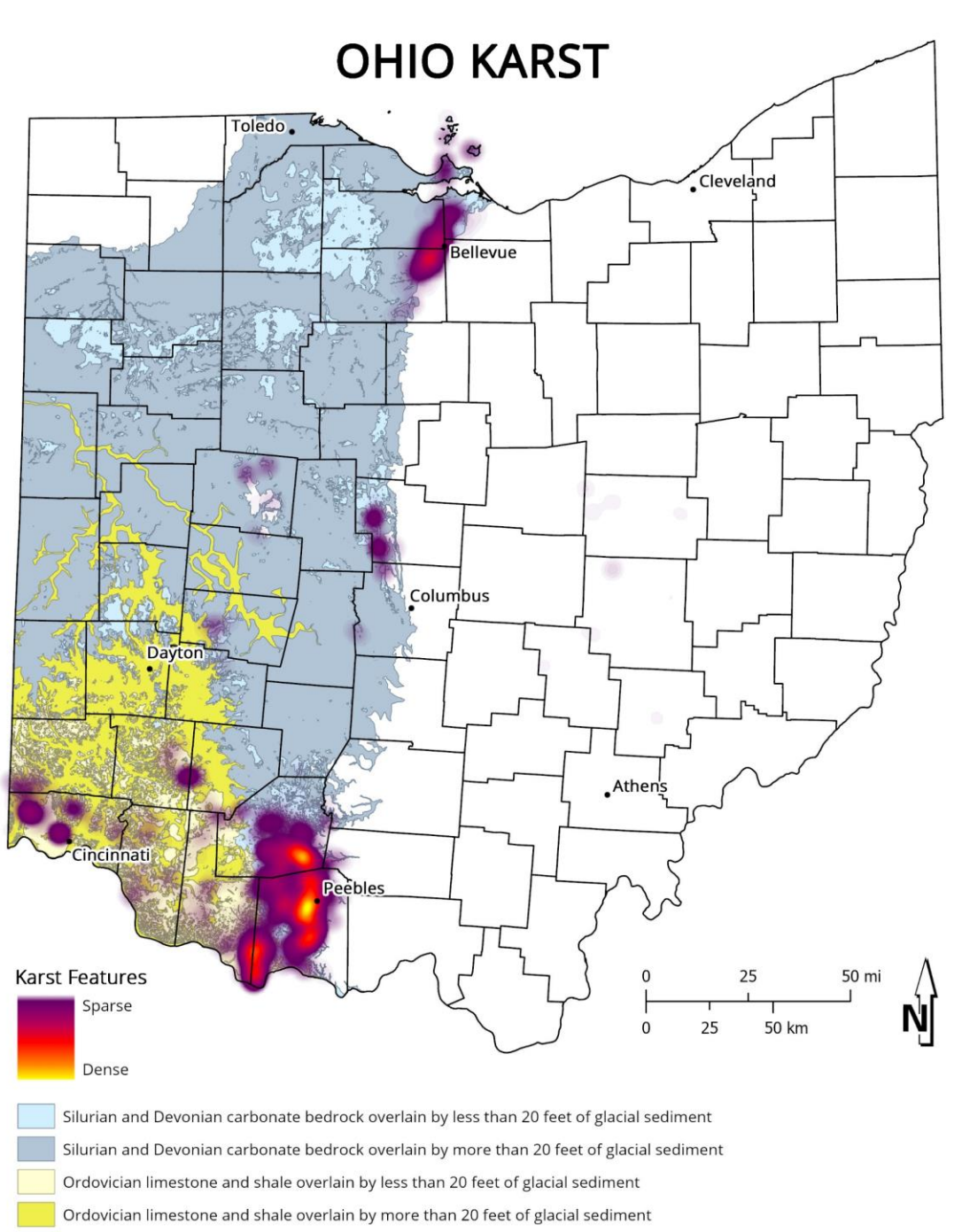
Program evolution

- USGS 3DEP
- Define solar potential
- Work performed for the Ohio Department of Development
- Lidar utilized to determine the slope/aspect of each structure's roof in relation to the solar radiation calculated over 365 days



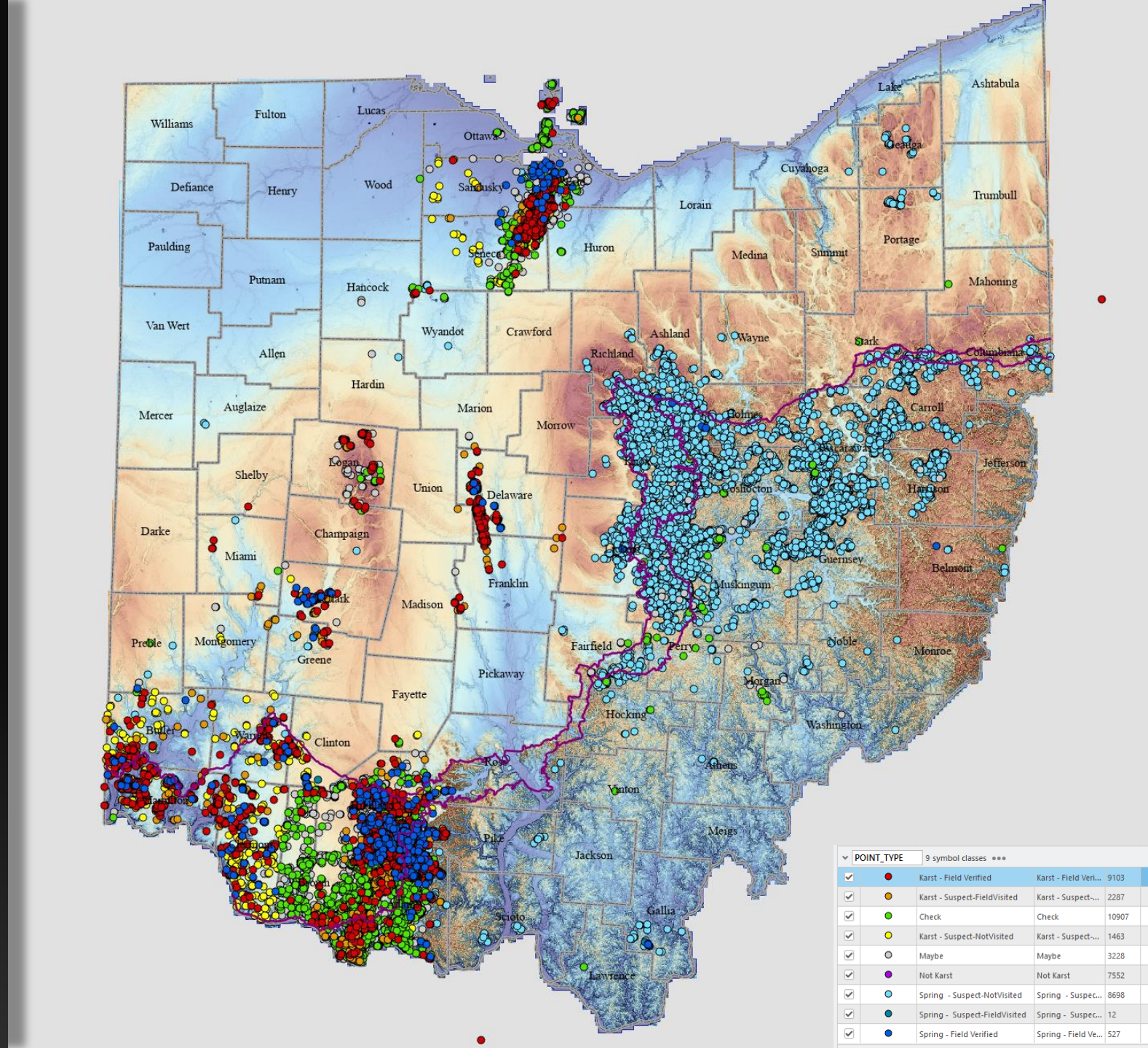
Ohio - Karst

- 9,103 confirmed sinkholes
- 526 confirmed springs
- ~18k potential/unconfirmed points



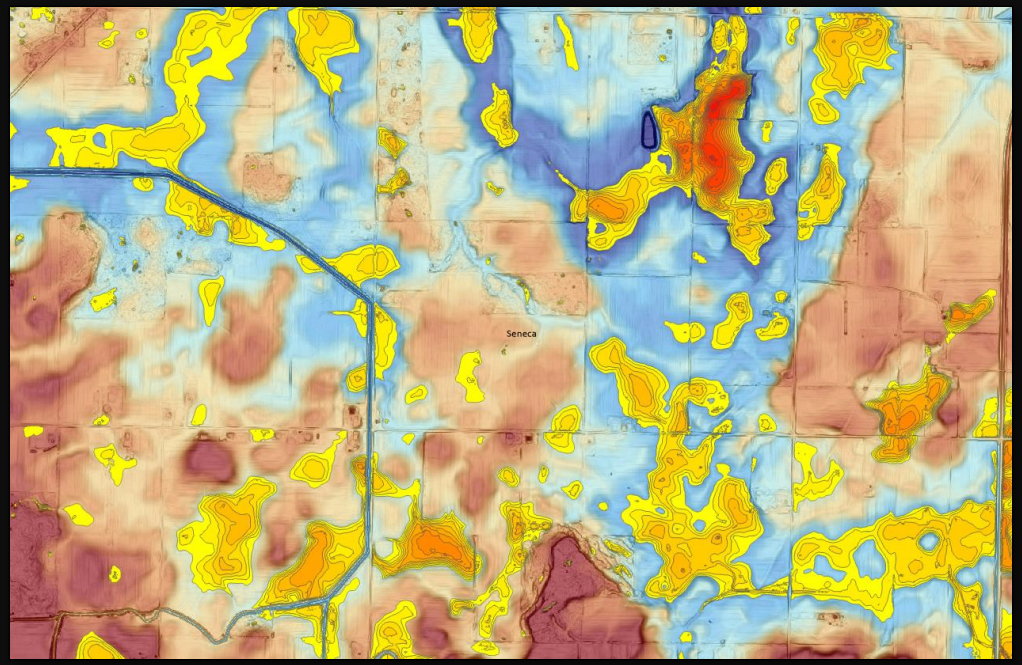
Ohio - Karst

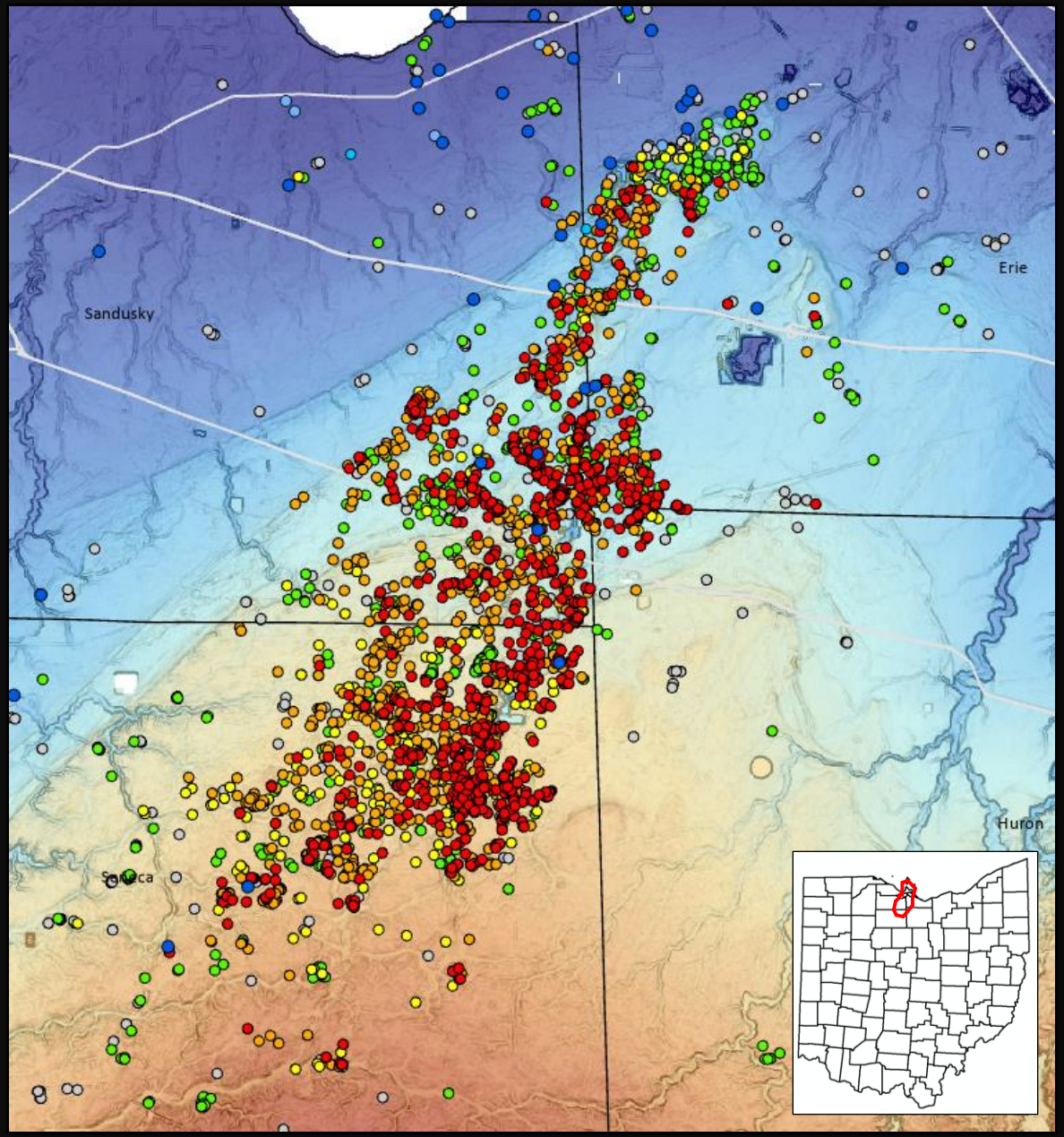
- Statewide karst and springs
  - Glacial boundary
  - Non-carbonate springs
  - 8k so far



Ohio - Karst

- Bellevue-Castalia Karst Plain
  - Largest sinks by area
  - Irregular shape





Summary

When combined, imagery and lidar create a powerful, comprehensive dataset.

Benefits:

- Visual detail + structural accuracy
- Improved classification and feature extraction
- Better modeling and analysis
- More reliable decision-making


Thank you!
Any questions?