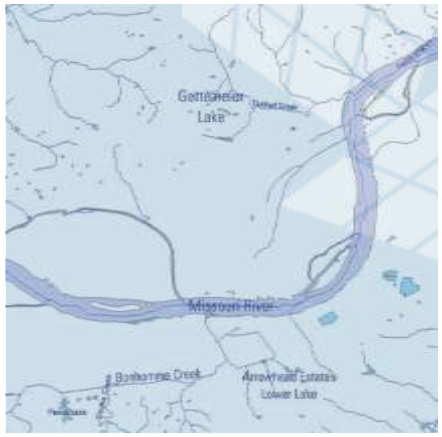
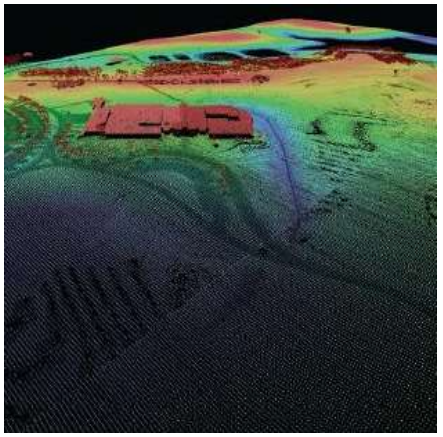
USGS Update On:

- National Map
- US Topo
- Historical Topo Maps
- NHD and WBD
- 3DEP ...





Charley Hickman
U.S. Geological Survey
National Geospatial Program

Michigan IMAGIN Annual Conference
June 5, 2017 – Traverse City

Handout with links

USGS National Map Links – Handout at Michigan IMAGIN – 6/5/17

USGS > https://www.usgs.gov/
USGS Michigan Water Science Center > https://mi.water.usgs.gov/

* **The National Map > http://nationalmap.gov**
* National Map videos > https://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html

National Geospatial Program >
https://www.usgs.gov/science/mission-areas/core-science-systems/national-geospatial-program
National Map FAQ's > https://www2.usgs.gov/faq/categories/9854

US Topo > https://nationalmap.gov/ustopo/
For 2017 Michigan has 1,290 new US Topo maps
Historical Topographic Map Collection > https://nationalmap.gov/historical/

FAQ - How do I find and download US Topo and HTMC maps?
https://www2.usgs.gov/faq/categories/9797/3571
See short videos at > http://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html
Lesson 4c - Downloading Maps with National Map Download Client
Lesson 9a - Accessing US Topo through USGS Store
Lesson 9b - Accessing USGS Historical Maps Through TopoView
Lesson 6b - Using USGS The National Map Data on Mobile Devices

US Topo Style Template (to create ESRI ArcGIS v10x map document (mxd) and geoda
files) > https://viewer.nationalmap.gov/tools/topotemplate/

National Map Hydrography > https://nhd.usgs.gov
National Hydrography Dataset (NHD)
Watershed Boundary Dataset (WBD) > https://nhd.usgs.gov/wbd.html
NHDPlus High Resolution (NHDPlus HR) > https://nhd.usgs.gov/NHDPlus_HR.html

NHD monthly newsletter > https://nhd.usgs.gov/newsletter_list.html
USGS Hydrography Seminar Series > https://nhd.usgs.gov/HydrographySeminarSeries.html

Hydrography Requirements and Benefits Study > https://nationalmap.gov/HRBS.html
> http://www.dewberry.com/services/geospatial/national-hydrography-requirements-and-benefits-study
Michigan section pages C-621 to C-648

Michigan Drain Commissioners (MACDC) plan for NHD >
http://www.michigan.gov/documents/cgi/MACDC_Business_Plan_Final_Draft_v4r_470878_7.pdf
> http://www.michigan.gov/cgi/0,4548,7-158-52927_53037_12699---,00.html

Introducing the NHDPlus High Resolution: A new framework for water-related information >
https://www.usgs.gov/news/introducing-nhdplus-high-resolution-a-new-framework-water-related-information
> https://www.usgs.gov/news/technical-announcements
National Hydrography Dataset / Watershed Boundary Dataset Map Service Improvement >
https://www.usgs.gov/news/national-hydrography-dataset-watershed-boundary-dataset-map-service-improve

National Map Corps – Volunteered Geographic Information (VGI)
> https://nationalmap.gov/TheNationalMapCorps

3D Elevation Program: Summary for Michigan - USGS Fact Sheet 2014-3107
> http://pubs.usgs.gov/fs/2014/3107/pdf/fs2014-3107.pdf
Other state 3DEP fact sheets > https://nationalmap.gov/3DEP/3dep_statefactsheets.html

2016 Michigan QL2 status from DTMB >
https://content.govdelivery.com/attachments/MIDEPTTMB/2016/08/24/file_attachments/608001/MI_LiDAR_QL2_Status_20160815.pdf

2017 lidar partnership awards
> https://www.usgs.gov/news/2017-lidar-partnership-awards-announced
Wayne County Michigan Lidar – 3DEP 2017
> https://nationalmap.gov/3DEP/3dep_fy17projectlist.html#Michigan
USDA NRCS Michigan 2016 3DEP lidar for 30 counties
> https://nationalmap.gov/3DEP/3dep_fy16projectlist.html#Michigan

3DEP fact sheets and publications > https://nationalmap.gov/3DEP/3dep_pubs.html
3DEP and America's Infrastructure > https://pubs.usgs.gov/fs/2016/3093/fs20163093.pdf

3DEP - Precision Agriculture and Other Farm Practices
> https://pubs.usgs.gov/fs/2016/3088/fs20163088.pdf
3DEP – Landslide Recognition, Hazard Assessment, and Mitigation Support
> https://pubs.usgs.gov/fs/2016/3094/fs20163094.pdf

Lidar Base Specifications: Techniques and Methods 11–B4
> https://pubs.usgs.gov/tm/11b4/ > https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf

Lidar Topography and Hydrographic Integration: Fundamentals and Application Issues
> https://nhd.usgs.gov/documents/Hydrography_Seminar_8_Heidemann.pdf

Seasketch – lidar wish list areas of interest > http://seasket.ch/hwpR3E-MxO
> http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4/layers
Six-minute video "Using SeaSketch to View 3DEP Lidar Areas of Interest (Lesson 11d)"
> https://www.usgs.gov/media/videos/using-seasketch-view-3dep-lidar-areas-interest-lesson-11d
> https://www.youtube.com/watch?v=H-Q-YyZuZvo
From NM video set > https://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html

US Interagency Elevation Inventory > https://www.csc.noaa.gov/inventory/

National Enhanced Elevation Assessment (NEEA) pages 386-388 for Michigan section
> https://nationalmap.gov/3DEP/3dep_neea.html
> http://www.dewberry.com/services/geospatial/national-enhanced-elevation-assessment

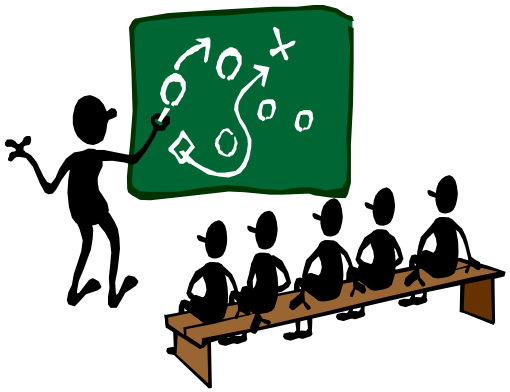
Draft 3D Nation Study Questionnaire
3D Nation Requirements and Benefits Elevation Data Study Questionnaire (NEEA II) >
https://iocm.noaa.gov/iwg/docs/3D-Nation-Questionnaire-DRAFT-clean-FRN-02-23-17.pdf
> https://iocm.noaa.gov/iwg/ > https://iocm.noaa.gov/

National Map technical support help desk > tnm_help@usgs.gov
USGS customer support > ask@usgs.gov > 1-888-ASK-USGS (1-888-275-8747) > http://ask.usgs.gov

Charles Hickman - Geographer / National Map Liaison to Michigan and Ohio
U.S. Geological Survey / 6460 Busch Blvd. Suite 100 **(new address)**
Columbus, Ohio 43229 / Phone: (614) 430-7768 / E-mail: chickman@usgs.gov

Outline

- National Map
- US Topo
- Historical Topographic Map Collection
- National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD)
- More National Map
- 3D Elevation Program (3DEP)



- Note 4:15 PM for Ele-Hydro with Andrew Brenner

Dept. of Interior

Fish, Wildlife & Parks

- National Park Service (NPS)
- U.S. Fish and Wildlife Service (FWS)

Indian Affairs

- Bureau of Indian Affairs (BIA)
- Bureau of Indian Education

Insular Areas

- Office of Insular Affairs

Land & Minerals Management

- Bureau of Land Management (BLM)
- Bureau of Ocean Energy Management
- Bureau of Safety and Environmental Enforcement
- Office of Surface Mining, Reclamation & Enforcement

Water and Science

- Bureau of Reclamation (BOR)
- **U.S. Geological Survey (USGS)**

About the USGS

Seven Mission Areas

1. Climate and Land Use Change
2. **Core Science Systems**
3. Ecosystems
4. Energy and Minerals
5. Environmental Health
6. Natural Hazards
7. Water

The USGS through these mission areas provides impartial and unbiased information on the:

- Health of our ecosystems and environment
- Natural hazards that threaten the Nation
- Natural resources the country relies on
- Impacts of climate and land-use change

- Mission areas were determined to address the large multi-disciplinary challenges that face our society today
- Recognizes that today's issues are more complex and interwoven than our historic perception recognized

U.S. Geological Survey in Michigan

- Lansing, Grayling, Escanaba

  Michigan-Ohio Water Science Center

- Ann Arbor

  Great Lakes Science Center

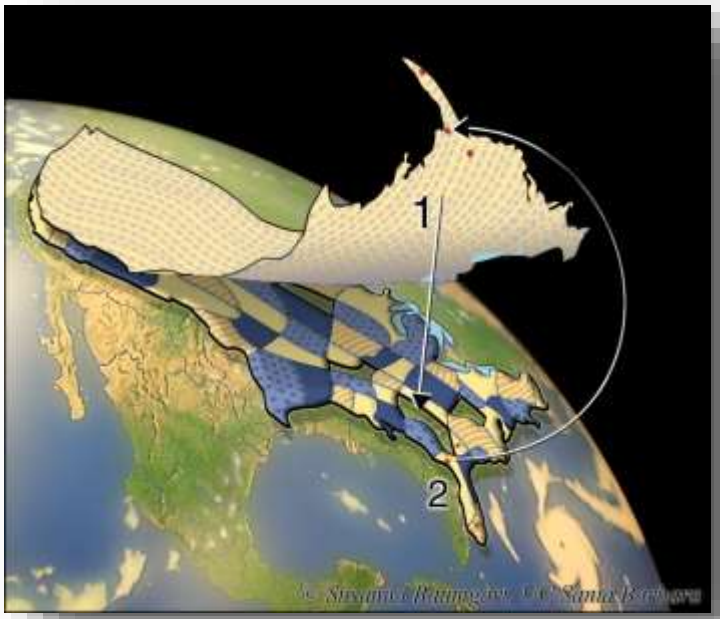
USGS science for a changing world

The National Map
Your Source for Topographic Information

The National Map
Your Source for Topographic Information

Overview

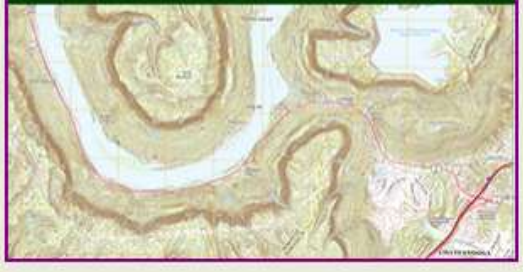
- One of the cornerstones of the **National Geospatial Program**
- Developed and maintained through partnerships
  - Collaborative effort among the USGS, Federal, State, and local partners to improve and deliver topographic information for the Nation
  - Nationwide repository of integrated data from these sources
- **The National Map** provides 3DEP, NHD, WBD and other topographic information via web visualization, services, and downloadable data



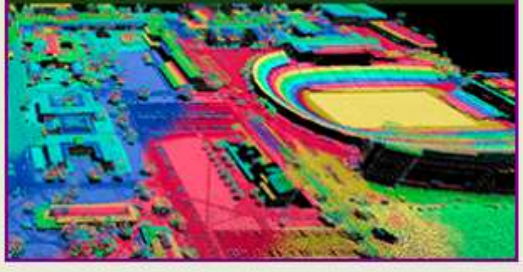
The National Map

Your Source for Topographic Information

US Topo



3D Elevation Program



National Hydrography Data Set

Historical Topographic

Maps	Elevation	Hydrography
Geographic Names	Transportation	Structures
Boundaries	Orthoimagery	Land Cover

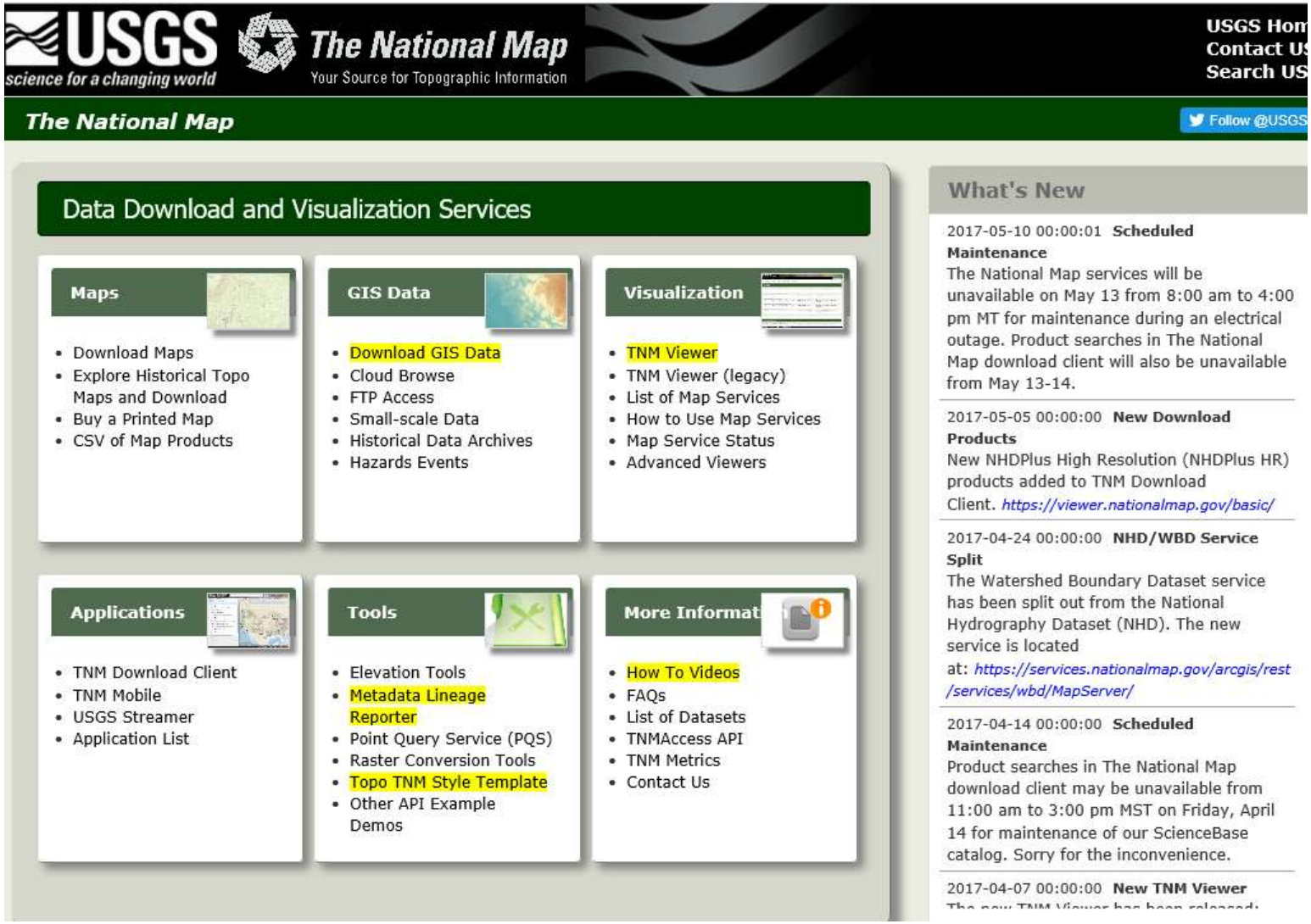
Find Data + View & Download

TNM Partnership & User Engagement

The National Map Corps

U.S. Board on Geographic Names

The National Map https://nationalmap.gov/



The National Map https://nationalmap.gov/

Topo Map Vector Data

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** **Spatial Reference:** 102100 (3857)
Refresh Cycle: Continuous **Min Scale:** 0 **Max Scale:** 0

Elevation Index - 3DEP

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2015-09-04 **Spatial Reference:** 4326 (4326)
Refresh Cycle: Monthly **Min Scale:** 0 **Max Scale:** 0

Theme Overlays

Watershed Boundary Dataset

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2017-04-24 **Spatial Reference:** 102100 (3857)
Refresh Cycle: Quarterly **Min Scale:** 0 **Max Scale:** 0

Transportation

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2017-04-06 **Spatial Reference:** 4326 (4326)
Refresh Cycle: Quarterly **Min Scale:** 0 **Max Scale:** 0

Structures

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2017-04-06 **Spatial Reference:** 4326 (4326)
Refresh Cycle: Quarterly **Min Scale:** 18,489,298 **Max Scale:** 0

Reference Polygons

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2017-04-06 **Spatial Reference:** 4326 (4326)
Refresh Cycle: Quarterly **Min Scale:** 0 **Max Scale:** 0

National Land Cover Database (NLCD)

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2015-01-12 **Spatial Reference:** 102100 (3857)
Refresh Cycle: As Needed **Min Scale:** 0 **Max Scale:** 0

National Hydrography Dataset

REST WMS ArcGIS.com ArcMap Legend Thumbnail **Published Date:** 2017-04-06 **Spatial Reference:** 4326 (4326)
Refresh Cycle: Quarterly **Min Scale:** 110,000,000 **Max Scale:** 0

The National Map https://nationalmap.gov/

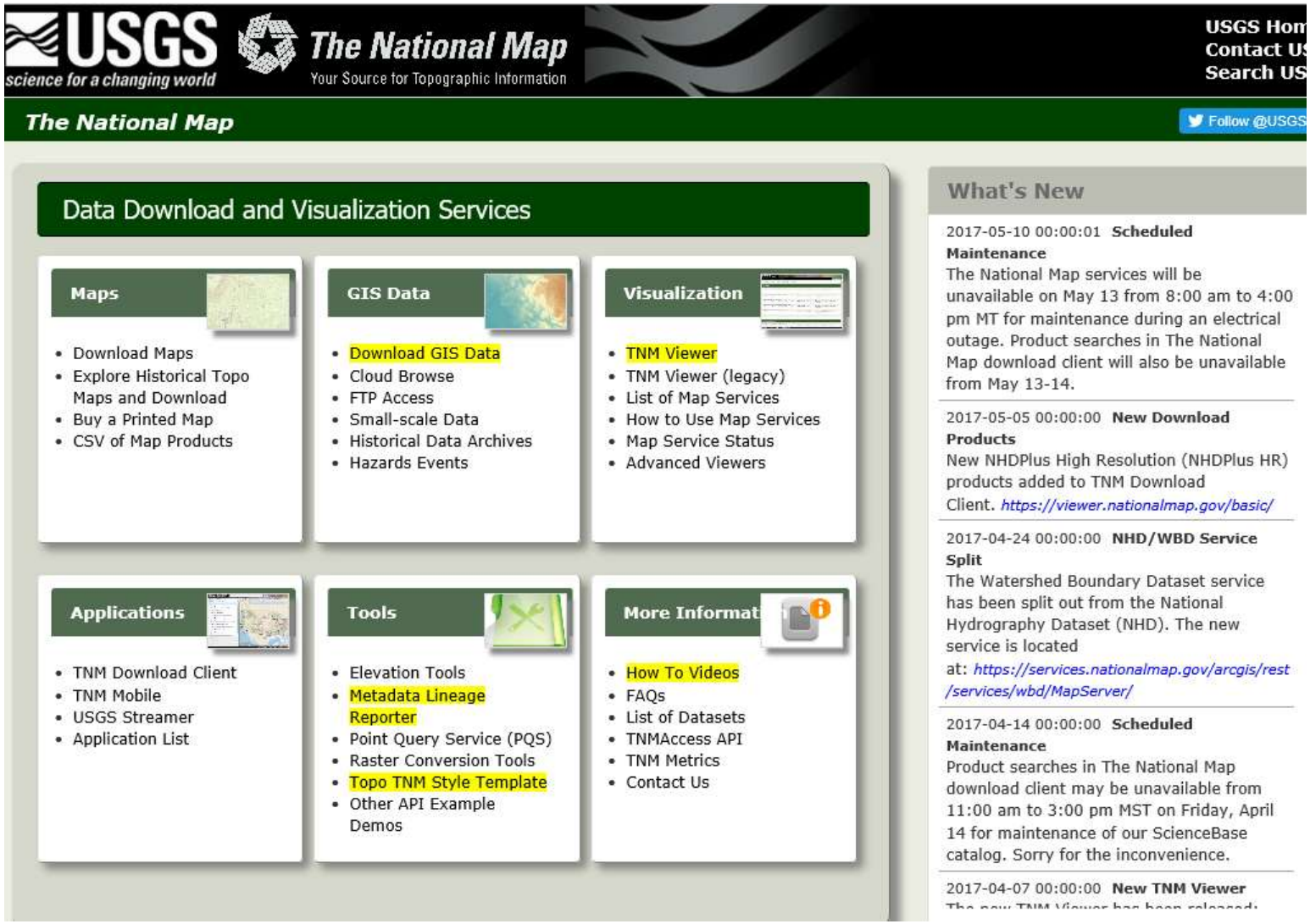
APRIL 20, 2017

National Hydrography Dataset / Watershed Boundary Dataset Map Service Improvement

As part of an ongoing effort to improve the suite of hydrography web-based map services, the USGS will separate the services for the National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD).

Attribution: National Geospatial Program

The National Map https://nationalmap.gov/



Lesson 1 - Introduction

- Contains an overview of the course, including how to operate the lesson player, what software is required and how to obtain help with the course.

Lesson 2 - The Eight Layers of The National Map (TNM)

- General discussion of each of the eight-data layers of TNM. This includes: Major features and attributes, Maintenance activities, and Links to more detailed information.
- The eight data layers include: Boundaries, Elevation, Geographic Names, Hydrography, Land Cover, Orthoimagery, Structures, and Transportation.
- Discussion about the information that is available for each layer.
- Discussion on how the information is managed for each layer.
- Discuss about the steps necessary to better utilize TNM.
- Lesson ends with a demonstration of each of the eight data layers.
- This lesson runs for 36 minutes.

Lesson 3a - The National Map Viewer - Introduction

- Upon completion of this lesson, you will have the skills to: view TNM data (along with mashed up data layers), navigate TNM overlays and cached background maps, and view metadata for TNM layers.
- This lesson runs for 8 minutes.

Lesson 3b - The National Map Viewer - Map Tools

- Upon completion of this lesson, you will have the skills to: use map tools to identify features, perform queries, get coordinates and acquire measurements and spot elevations.
- This lesson runs for 6 minutes.

Lesson 4a - Using The National Map Download Client

- This lesson provides a brief introduction to using The National Map Client, including the basic features of the user interface.
- This lesson runs for 6.5 minutes.

Lesson 4b - Downloading Data with The National Map Download Client

- This lesson discusses the process of using The National Map Download Client to download data.
- This lesson runs for 7 minutes.

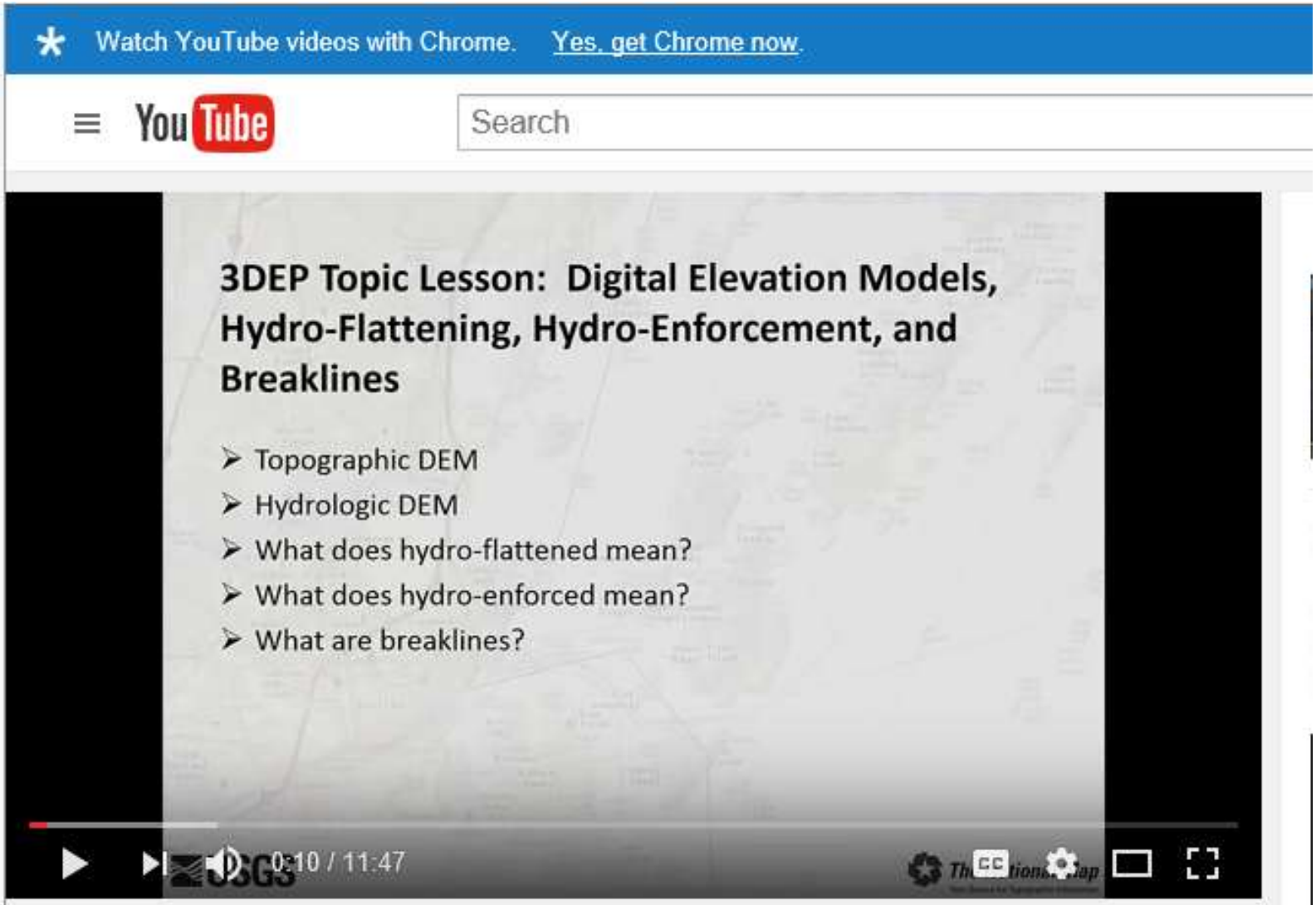
Lesson 4c - Downloading Maps with The National Map Download Client

- This lesson discusses the process of using The National Map Download Client to download maps.
- This lesson runs for 6 minutes.

Lesson 4d - Using The National Map Download Manager

- This lesson will introduce and demonstrate how to use The National Map Download Manager.
- This lesson runs for 6 minutes.

National Map Short Videos



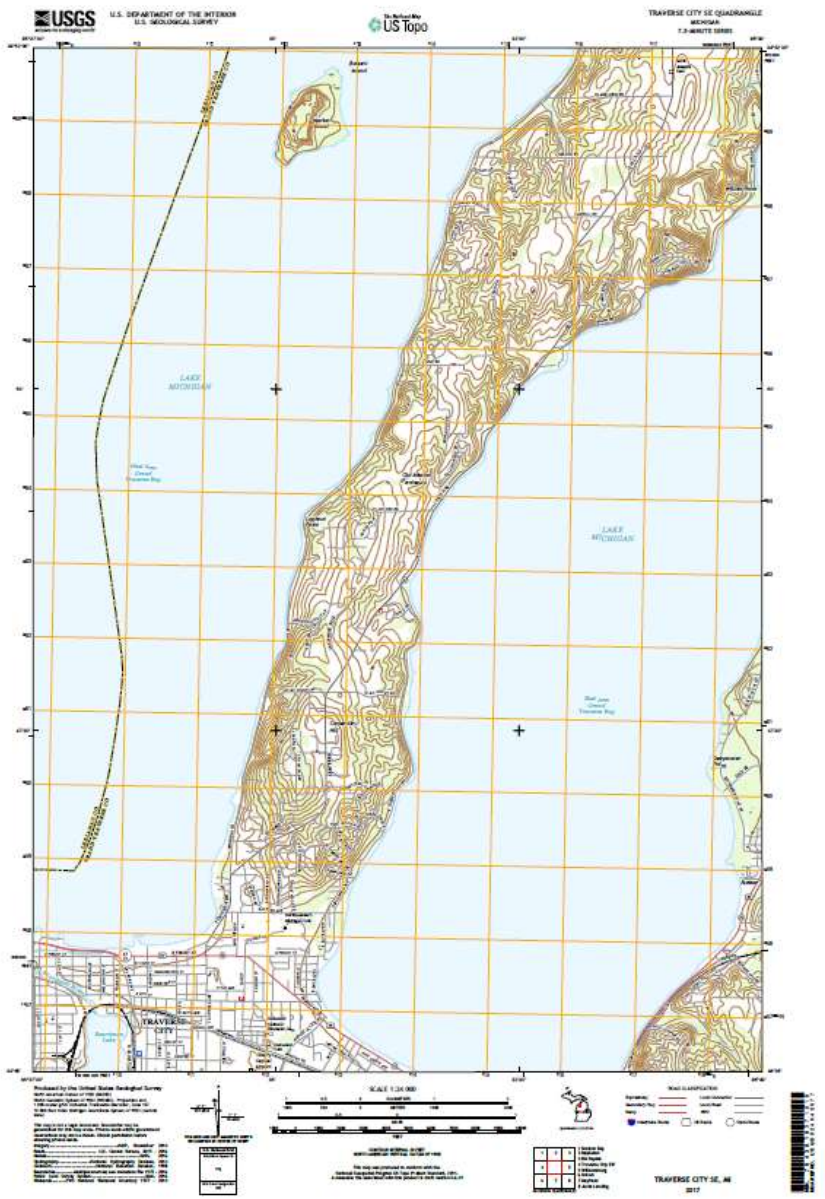
Outline

- National Map
- >>> US Topo <<<
- Historical Topographic Map Collection
- National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD)
- More National Map
- 3D Elevation Program (3DEP)

- Note 4:15 PM for Ele-Hydro with Andrew Brenner

US Topo – 1,290 New Michigan Quads

- Replaces traditional 1:24,000-scale topographic maps
- Modeled on standard 7.5-minute quads
- Layered PDF



US Topo https://nationalmap.gov/ustopo

USGS science for a changing world | The National Map US Topo | USGS Home | Contact USGS | Search USGS

The National Map

The National Map Home >> US Topo

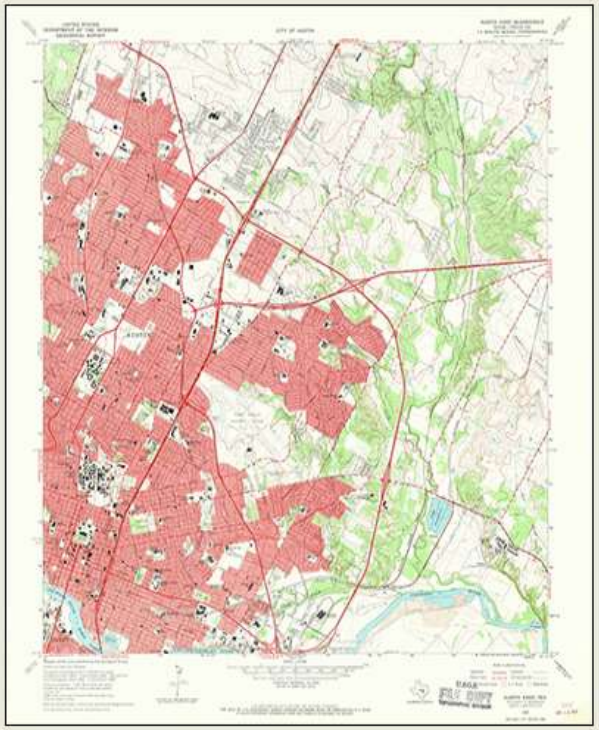
- About US Topo Maps
- Download Maps
- Frequently Asked Questions
- User's Guide-Quickstart (1 MB PDF)
- Fact Sheet
- US Topo News
- Contact Us

US Topo: Maps for America

Building on the success of 133 years of USGS topographic mapping, the US Topo series is a new generation of maps of the American landscape. US Topo topographic maps are produced by the National Geospatial Program of the U.S. Geological Survey (USGS). The project was launched in late 2009, and the term "US Topo" refers specifically to quadrangle topographic maps published in 2009 and later. These maps are modeled on the familiar 7.5-minute quadrangle maps of the period 1947-1992, but are mass-produced from national GIS databases on a repeating cycle. US Topo maps repackage geographic information system (GIS) data in traditional map form; this benefits non-specialist map users, as well as applications that need traditional maps.

US Topo maps can be downloaded free of charge from several USGS websites. Prior to May 2017 , the maps have been published in Portable Document Format (PDF) with geospatial extensions (GeoPDF®), patented by TerraGo Technologies. After May 2017 the maps will begin to be published in an ISO 32000 compliant geospatial PDF using a modernized production system. All maps can be viewed and printed with Adobe Reader or comparable PDF viewing software. Limited GIS functionality, such as displaying ground coordinates, is available with all maps, and the layered construction of the PDF files allows users to turn data layers on and off.

The maps include layers not present on most traditional topographic maps, such as aerial photo and shaded relief images. Many additional feature classes have been added



EAST AUSTIN, TX 1966
7.5 MINUTE SERIES QUADRANGLE (1:24,000–SCALE)
HISTORICAL TOPOGRAPHIC MAP

click on map to view larger image
download map (GeoPDF 16 MB)

◀ ⏸ 1 2 3 4 5 6 7 8 9 10 11 12 ▶

How do I find and download US Topo and HTMC maps?

US Topo maps and the maps of the Historical Topographic Map Collection (HTMC) can be downloaded free of charge, in PDF format, from these applications:

- *The National Map* Download Client is our primary application for finding and downloading maps and other data products of the USGS National Geospatial Program. This is our newest and most general search and download interface for maps and digital geospatal base data.

- A text query application. CSV-format information here allows advanced users to write custom download scripts. This application serves US Topo and HTMC topographic quadrangle maps only.

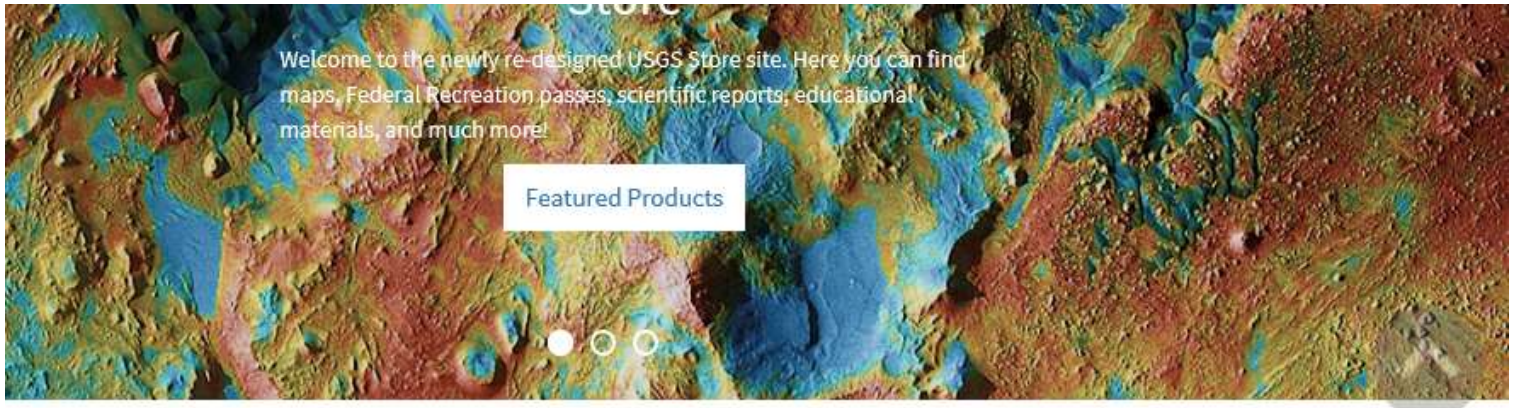
- TopoView provides the best visual overview of the HTMC, but does not serve current US Topo maps or other geospatial data. It serves GeoTIFF, JPG, and KMZ versions of the HTMC maps, in addition to the product standard GeoPDF. Bulk delivery is not yet available for these additional formats.

- The USGS Store website has several search and download features. The Store also sells printed maps, and USGS maps and publications that are not included in either the US Topo or HTMC series.

For tutorial information on download and product use, see the US Topo and Historical Topographic Map Users Guide.

Bulk deliveries and scripted downloads are also possible.

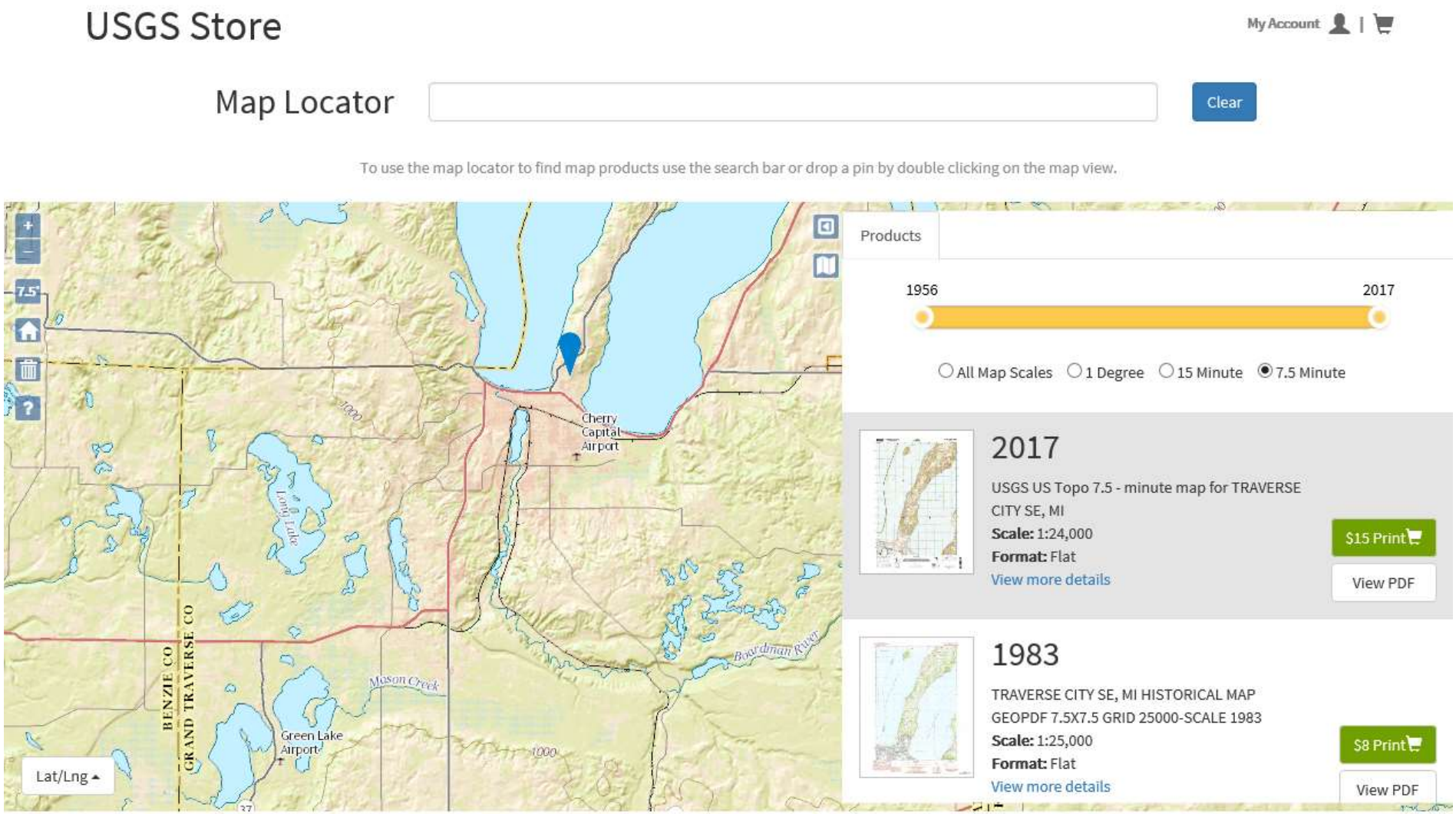
USGS Store https://store.usgs.gov



USGS science for a changing world

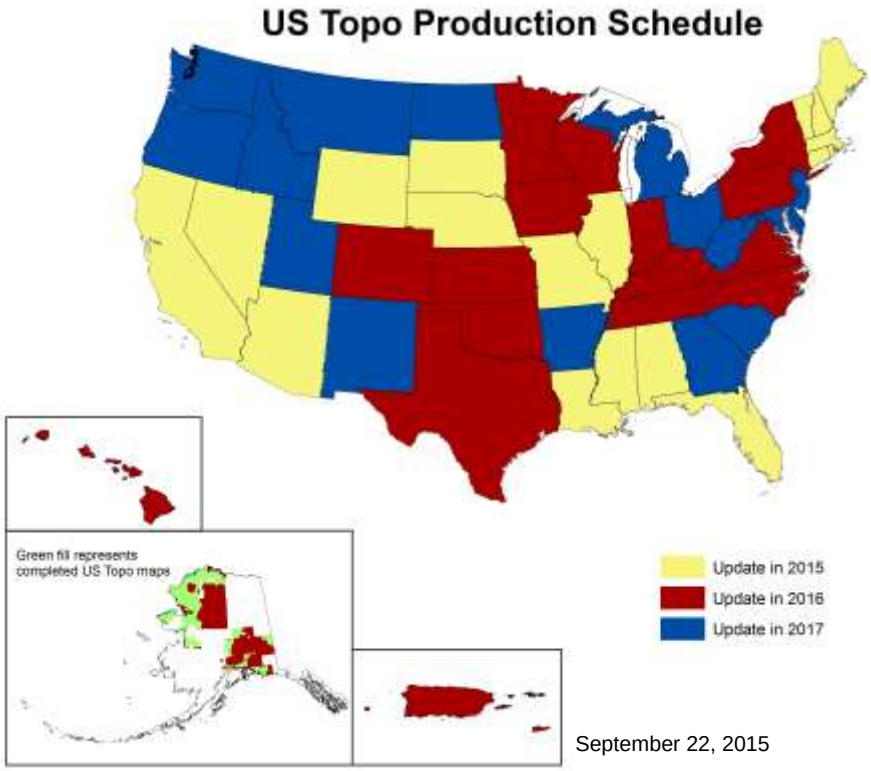
The National Map
Your Source for Topographic Information

USGS Store https://store.usgs.gov



US Topo Program *(cont.)*

- Continuously maintained
- 3-year production cycle
- Producing over 11,000 new, higher-resolution (1:25,000-scale) digital maps for Alaska
- Maps are published in PDF with geospatial extensions (GeoPDF®)
- Geospatial PDF coming soon
- US Topo maps can be downloaded free of charge from several USGS interfaces
- See: https://nationalmap.gov/ustopo/index.html



US Topo Program *(cont.)*

- Orthoimage base
- Core feature layers
- Recent US Topo maps also include the PLSS and the US National Grid
- Key data layers:
  - orthoimagery
  - transportation
  - geographic names
  - topographic contours
  - boundaries
  - hydrography
  - structures
  - woodlands

Recreational Points of Interest
Landform polygons
Great Smoky Mountain NP
Updated road network
Fish & Wildlife Service Wetlands
National Scenic Trails
IMBA Trails
Correctional Facilities
Police Stations
State Capitals
Boundaries
Selected Trails - Fish & Wildlife Service
Shaded Relief
Post Offices
Military Boundaries, Cemeteries
Hospitals, Schools
Fire Stations
Railroads, Public Land Survey System
Woodland
Runways
State/County/Forest Service Boundaries
Hydrography
Elevation contours
Names
Roads
Aerial Imagery

USGS science for a changing world
The National Map Your Source for Topographic Information

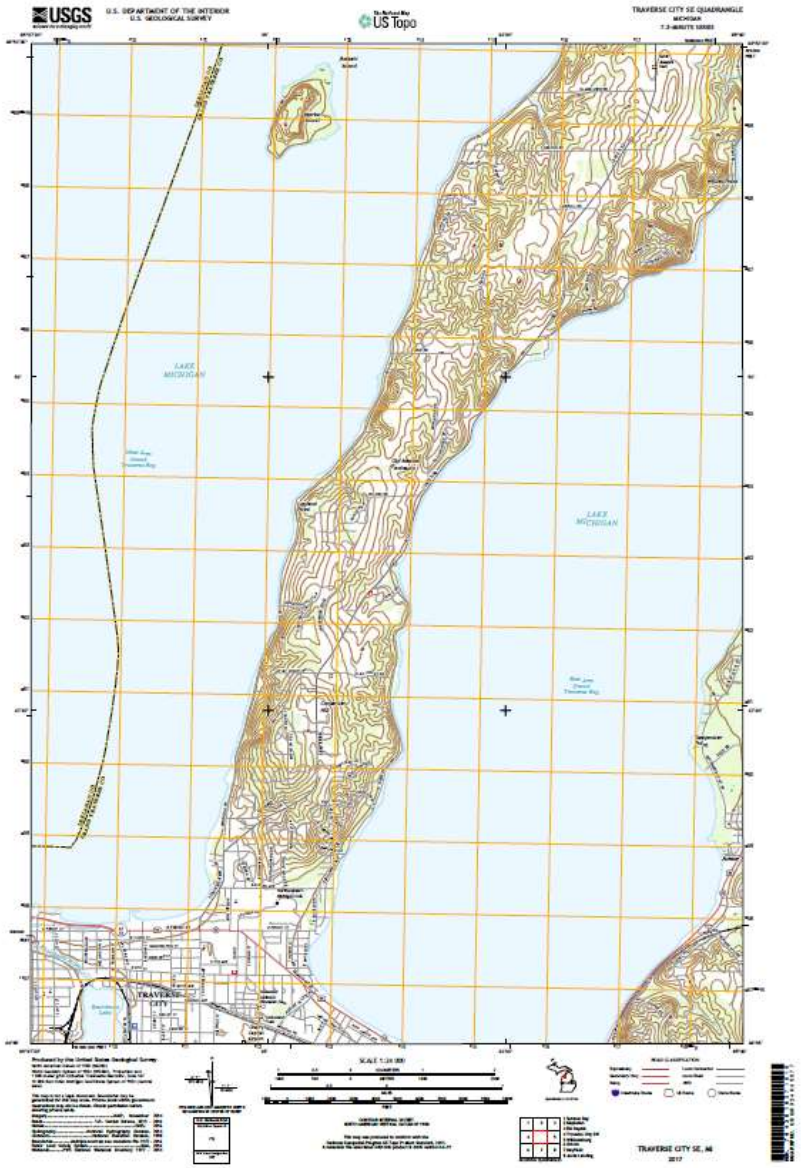
MI_Traverse_City_SE_20170504_TM_geo.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

Home Tools Document 1 / 1

Layers

- Map Collar
  - Map Elements
- Map Frame
  - Projection and Grids
  - Geographic Names
  - Structures
  - Transportation
    - Road Names and Shields
    - Road Features
    - Trails
    - Railroads
    - Airports
  - PLSS
  - Wetlands
  - Hydrography
  - Terrain
    - Contours
    - Shaded Relief
  - Woodland
  - Boundaries
    - Jurisdictional Boundar
    - Federal Administered
- Images
  - Orthoimage
- Barcode



MI_Traverse_City_SE_20170504_TM_geo.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

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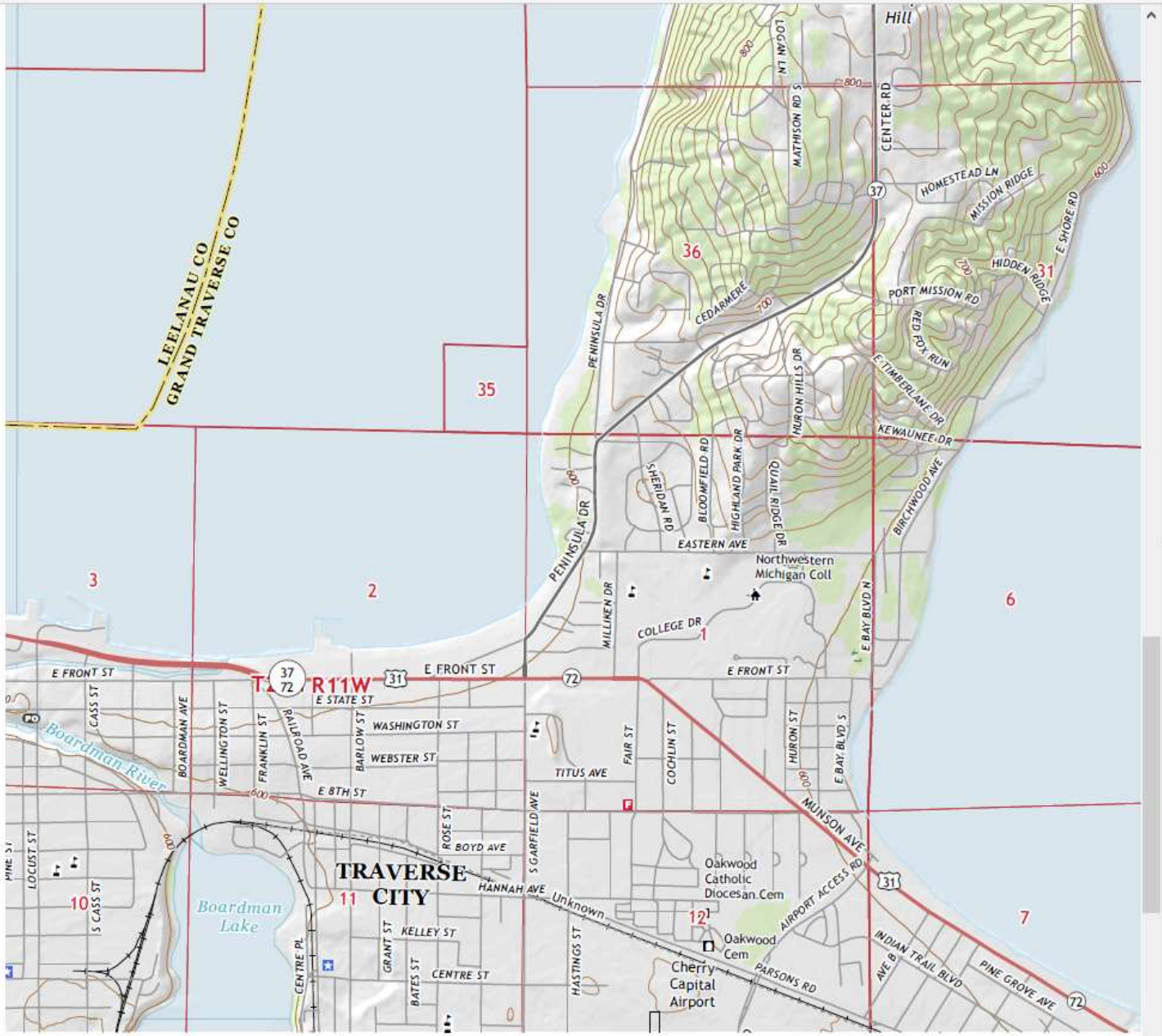

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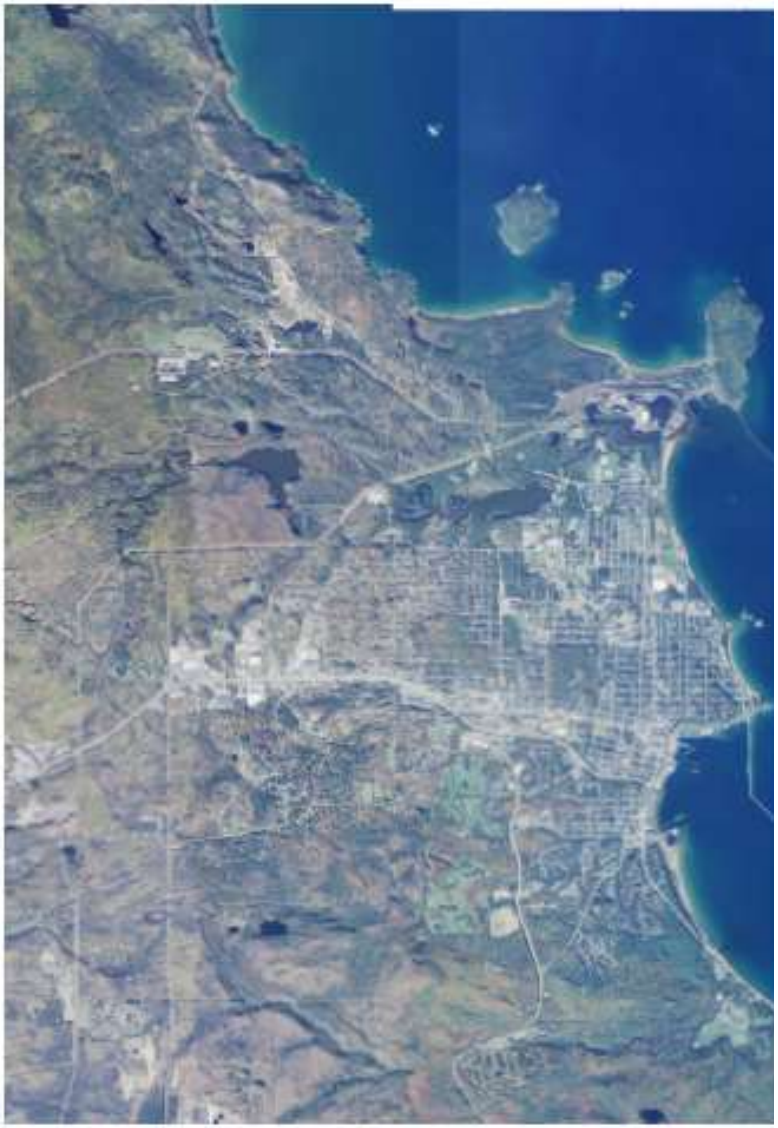

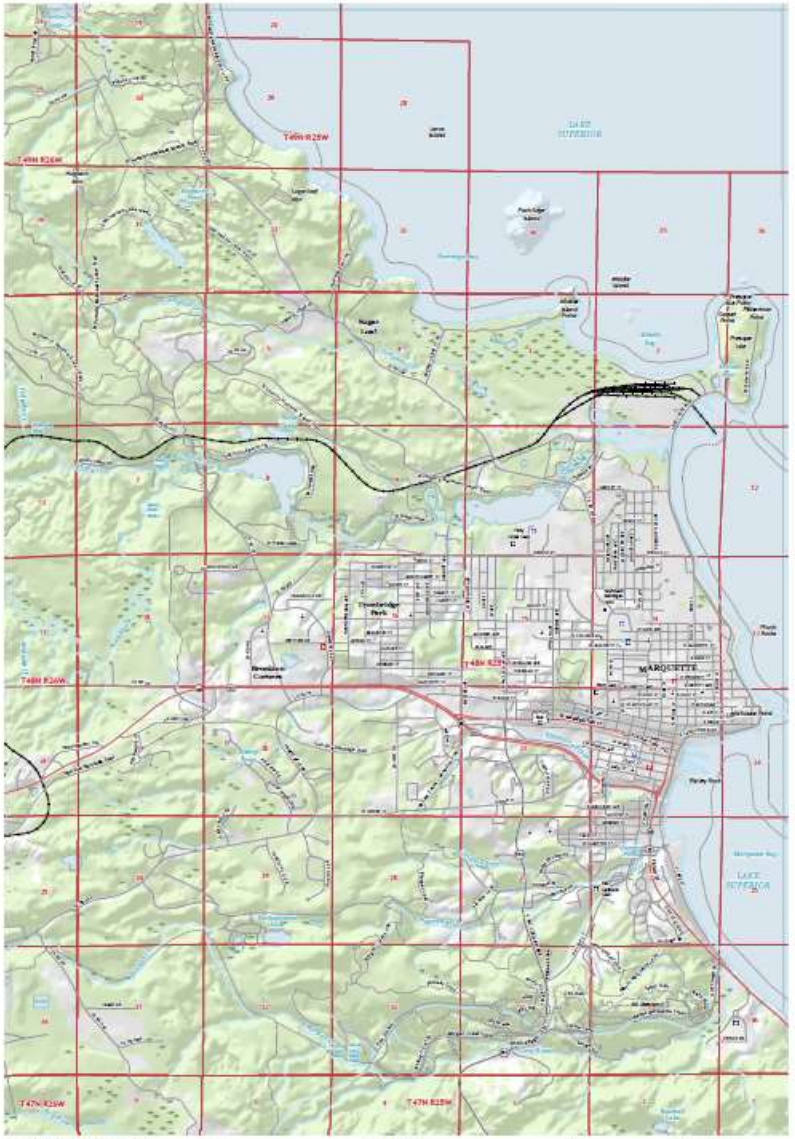
MARQUETTE

MI_Marquette_20170504_TM_geo.pdf - Adobe Acrobat Reader DC

File Edit View Window Help

Home Tools Document 1 / 1

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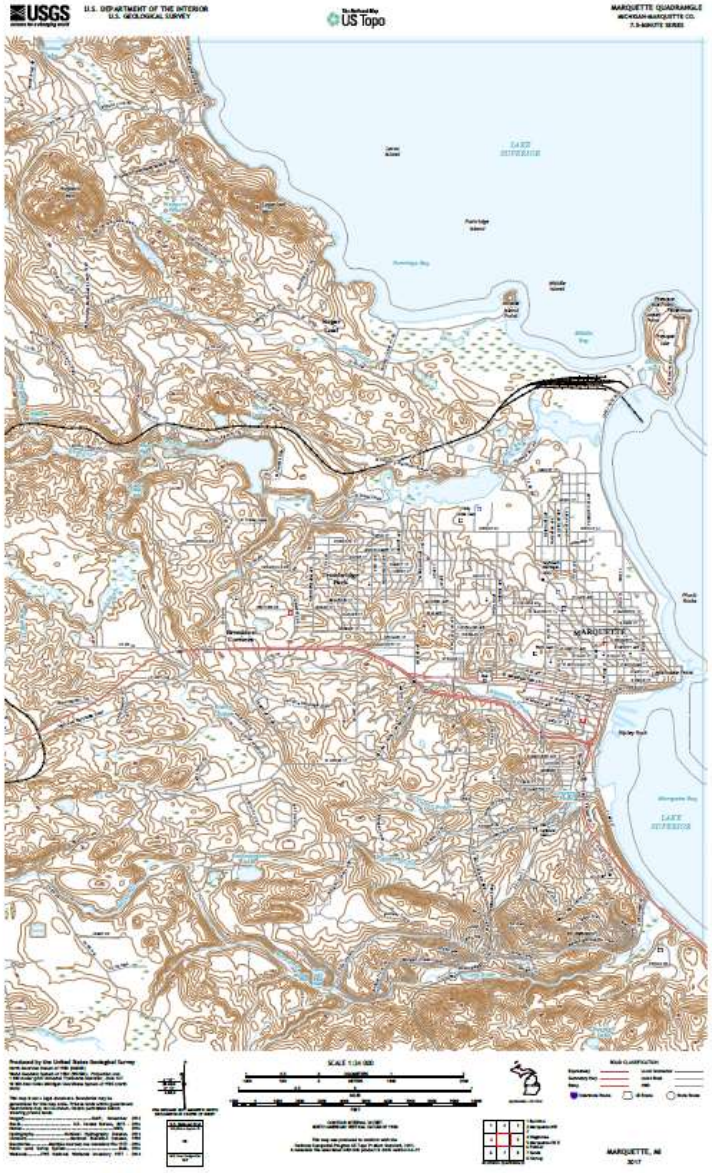
  - Images
  - Barcode



Topo TNM Style Template

The National Map | Topo TNM Style Templa

Secure | https://viewer.nationalmap.gov/tools/topotemplate/

USGS science for a changing world | The National Map

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Topo TNM Style Template

A NEW GIS-READY TOPOGRAPHIC MAP STYLE TEMPLATE!

The Topo TNM Style Template can be readily used with the Topo Combined Vector Product (recently renamed "Topo Map Vector Data products") and other data available for download from *The National Map* (TNM). The template and TNM data are intended to be used together to quickly provide the GIS user with a fully customizable map in the style of US Topo maps using the most current TNM data.

The Topo TNM Style Template is provided by the U.S. Geological Survey (USGS) National Geospatial Technical Operations Center (NGTOC). It has been developed according to the 24,000-scale, 7.5-minute layout and cartographic design of published US Topo Maps and is intended for use in any geographic location where data is available for download from TNM. The template is provided as an Esri-specific solution (ArcGIS v10.0 map document (mxd)) for the benefit of USGS earth scientists and other scientific professionals who have a requirement for symbolized and annotated topographic base map layers to support advance Geographic Information System (GIS) analysis and mapping. Symbolized map layers, links to Web Map Services, labeling rules, grids, standard map layout, and marginalia information are included in the template. Ancillary data for tailoring the template is provided along with the template in an Esri file geodatabase (v10.x). The USGS recognizes that this solution only meets the needs of end users dependent upon Esri products. Research continues into alternative formats.

This template may be used with any TNM datasource available for download and can easily be extended with any data layers according to end user needs. For best results in symbolization and labeling, it is recommended to be used with Topo Map Vector Data products. These products are currently under production and many are now available for download from TNM Downloader.

The Topo Map Vector Data products are one specific type of staged product intended for a variety of GIS and cartographic applications, including use with the Topo TNM Style Template. These products are staged at a 7.5-minute footprint that corresponds with a single US Topo Map extent. They will contain four feature datasets that include feature classes from all TNM Vector data themes, including Elevation Contours, Government Units (Boundaries), Woodland Tint polygons, Structures, Transportation, Hydrography, TNM Derived Names, and 7.5-minute map cells.

The following items are available for download:

1. Zip file containing the template, tailoring data contained in a file geodatabase, and tailoring instructions in PDF
2. Frequently Asked Questions document in PDF
3. Topo TNM Style Template Metadata, FAQ, Text, and XML

The USGS values your comments. Email can be sent to tnm_help@usgs.gov or contact us through the methods listed here.

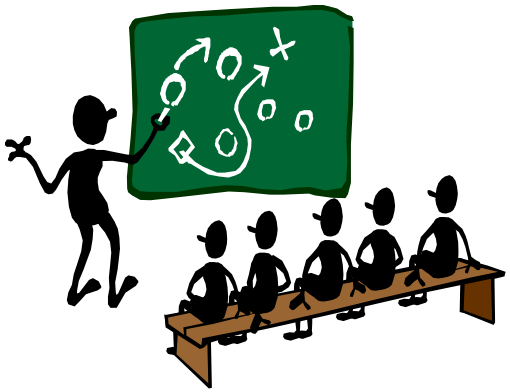
Accessibility | FOIA | Privacy | Policies and Notices

U.S. Department of the Interior | U.S. Geological Survey
URL: https://viewer.nationalmap.gov/tools/topotemplate/ Page Last Modified: 24-Oct-16
Page Contact Information: The National Map

USA.gov

Outline

- National Map
- US Topo
- >>> Historical Topographic Map Collection <<<
- National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD)
- More National Map
- 3D Elevation Program (3DEP)



Historic Topographic Map Collection (HTMC)

- Historical Topographic Map Collection (HTMC)
- Started 2011
- High-resolution scans of more than 178,000 historical topo maps
- Between 1884 and 2006
- GeoPDF® versions can be downloaded free of charge
- Website: http://nationalmap.gov/historical

1907 Marquette

HTMC - Marquette 1954

science for a changing world Map

The National Map: Historical Topographi

The National Map Home >> Historical Topographic Map Collection

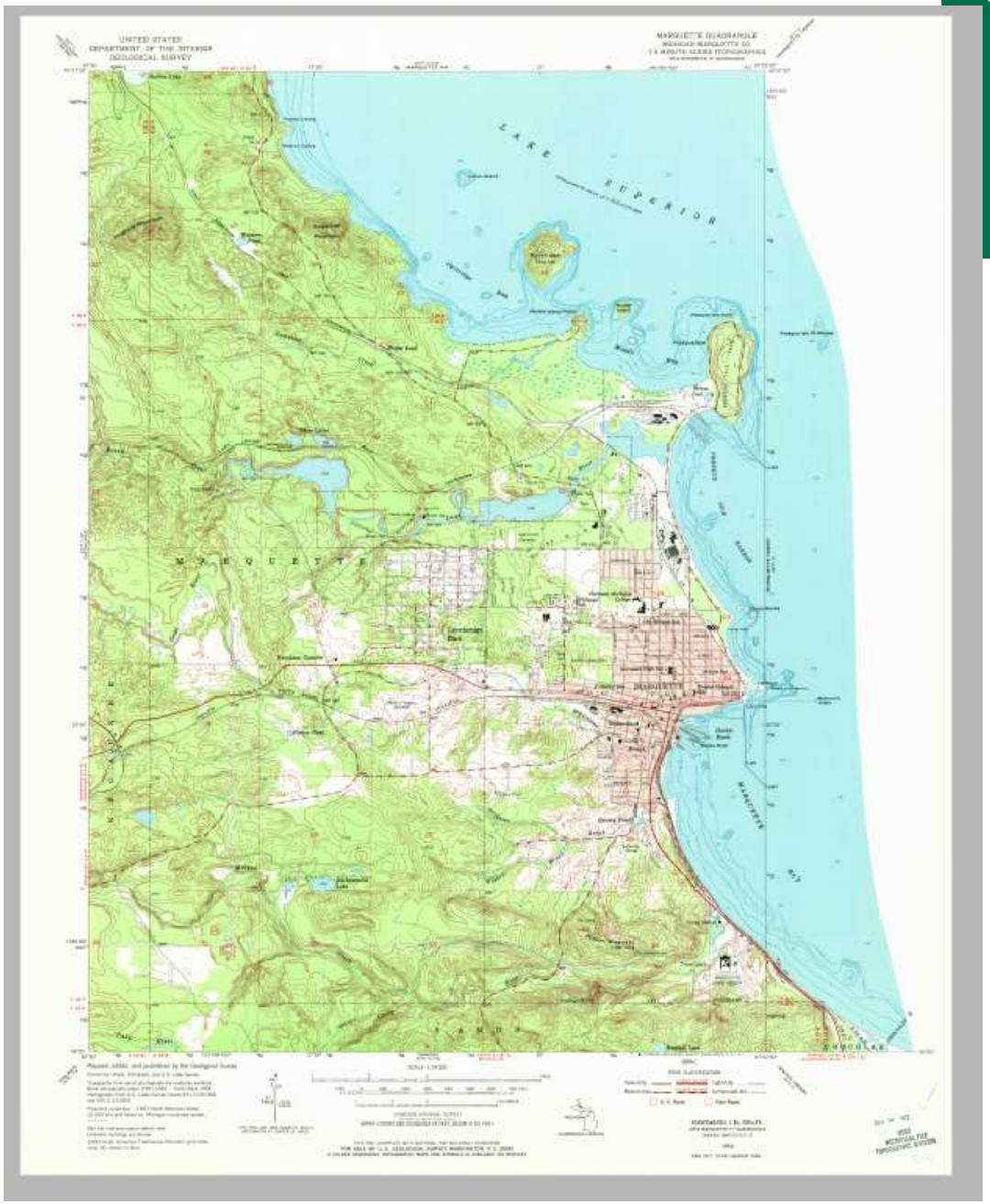
- Map Collection Home
- Download Instructions
- User's Guide
- Frequently Asked Questions
- Fact Sheet
- Standards
- Multimedia
- Contact Us

Historical Topographic Maps - Preserving the Past

In 2009, USGS began the release of a new generation of topographic maps (US Topo) in electronic form, and in 2011, complemented them with the release of high-resolution scans of more than 178,000 historical topographic maps of the United States. The topographic map remains an indispensable tool for everyday use in government, science, industry, land management planning, and recreation.

Historic maps are snapshots of the nation's physical and cultural features at a particular time. Maps of the same area can show how an area looked before development and provide a detailed view of changes over time. Historical maps are often useful to scientists, historians, environmentalists, genealogists and others re

The goal of The National M
2011, is to provide a digita



USGS science for a changing world

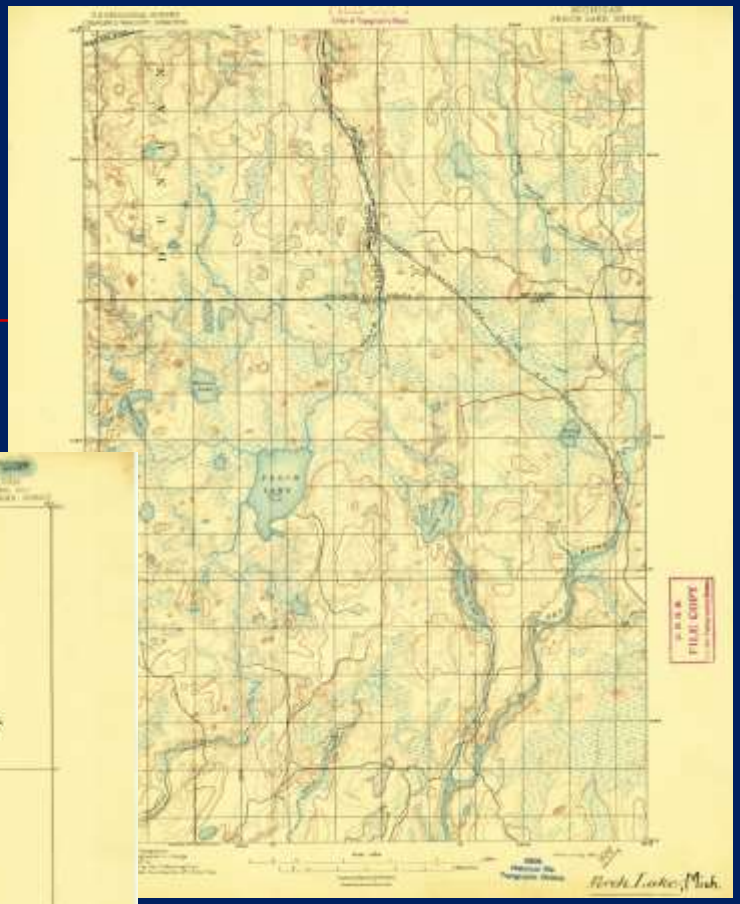
The National Map
Your Source for Topographic Information

Michigan's Oldest Maps

Published 1895 1:62,500

Ned Lake

Passage Island



Perch Lake

USGS

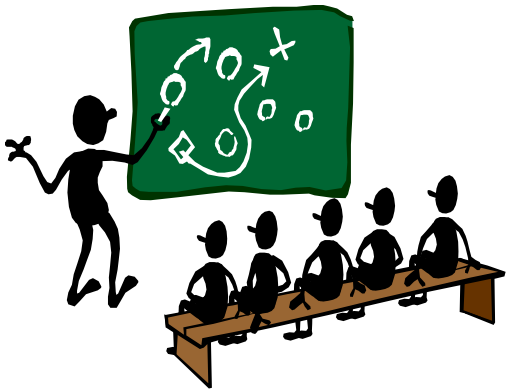
Topoview & Historical Map Archive

Entire Historical Topographic Map Collection is now available in GeoTIFF format !!!

- Historical topos have been available in GeoPDF format through TNM viewer & USGS Store
- National Geologic Map Data Base (NGMDB) has added additional file formats of the historical topos: GeoTIFF, JPEG, & KMZ
  - GeoTIFF files are a compressed, 300 dpi TIFF image format, with embedded georeferencing information so that the map can be used directly in GIS
- http://ngmdb.usgs.gov/maps/TopoView/
- Demo on YouTube: https://www.youtube.com/watch?v=kOpe3WXsZrQ

Outline

- National Map
- US Topo
- Historical Topographic Map Collection
- >>> National Hydrography Dataset (NHD), Watershed Boundary Dataset (WBD), NHDPlus HR <<<
- More National Map
- 3D Elevation Program (3DEP)

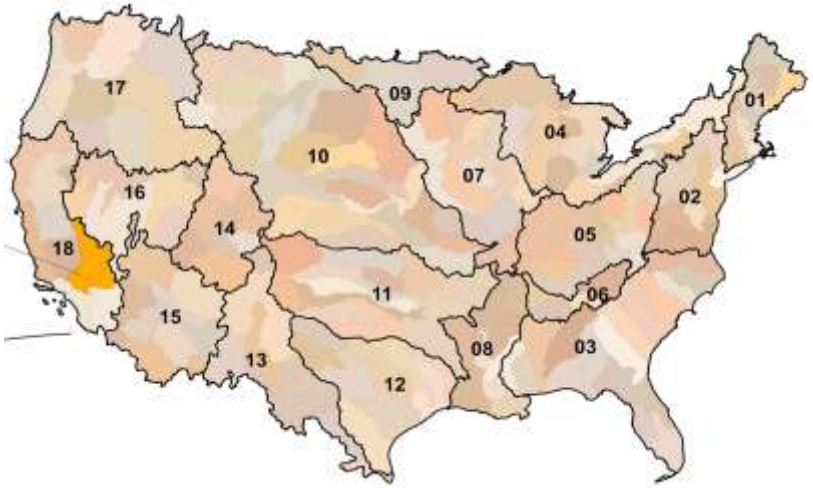


- Note 4:15 PM for Ele-Hydro with Andrew Brenner

Foundational Hydrography Datasets

Surface water layers of *The National Map*

National Hydrography Dataset (NHD)



Watershed Boundary Dataset (WBD)

Hydrography https://nhd.usgs.gov

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- Get Data Products and Map Services
- User Resources
- Tools
- Stewardship
- Applications
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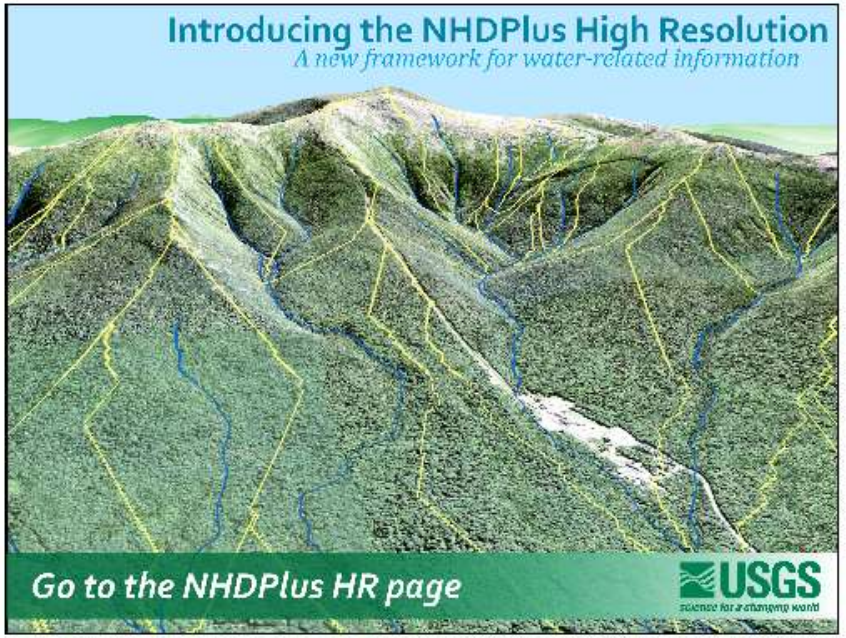
Hydrography

NHDPlus High Resolution
National Hydrography Dataset
Watershed Boundary Dataset



The National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD) are digital geospatial datasets that map the surface water of the United States and are a part of The National Map. The NHD represents the nation's drainage networks and related features, including rivers, streams, canals, lakes, ponds, glaciers, coastlines, dams, and streamgages. The NHD High Resolution, at 1:24,000 scale or better, is the most up-to-date and detailed hydrography dataset for the nation (please visit the NHD Medium Resolution page for information about accessing the legacy 1:100,000 scale dataset). The WBD represents drainage areas of the country in eight nested levels.

Together, the NHD and WBD, along with data from the 3D Elevation Program (3DEP), are processed to create the NHDPlus High Resolution (NHDPlus HR), a networked geospatial

USGS science for a changing world

NHD (Hydrography) Monthly Newsletter

USGS science for a changing world

National Hydrography Dataset

NHD Home « NHD News « Newletter List

NHD Newsletters

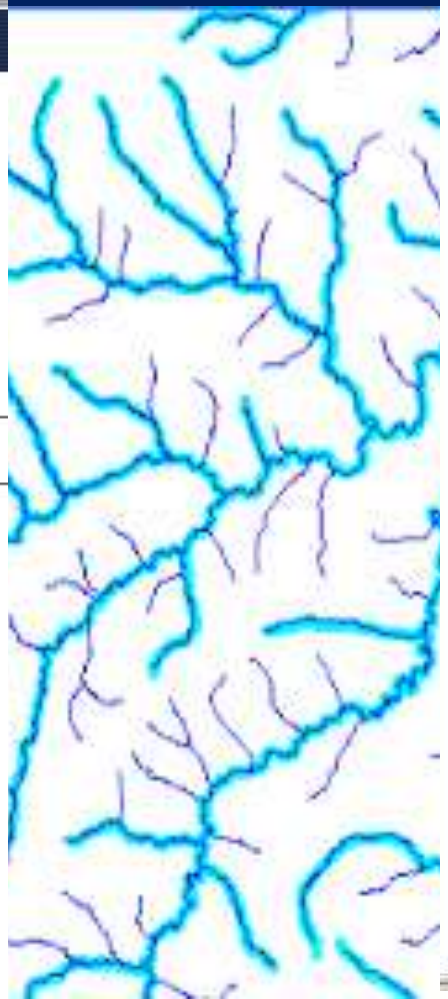
Archived NHD Newsletters

2010 | **2009** | **2008** | **2007**

2010

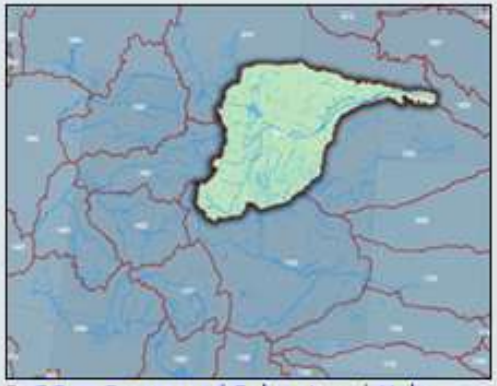
December 2010

- LiDAR and the NHD
- NHD Management Team Meeting
- Projects for NHD and WBD
- USGS Reorganizes to Better Address Science Strategy
- WBD Integration Status
- NHD Photo of the Month
- November Hydrography Quiz / New December Quiz
- Upcoming NHD Training



There are three ways to access the data:

1. GO to the NHD Viewer | Help



2. GO to Pre-staged Subregions | Help

3. GO to NHD Extracts by State | Help

Need Help Downloading NHD Data?
See Instructions.

https://nhd.usgs.gov/HydrographySeminarSeries.html

Seminar 9, Session 1 – Tuesday May 23, 2017 - 1:00 PM Eastern - One Hour

NHDPlus High Resolution (NHDPlus HR) Seminar, Session 1

Abstract – The USGS has just released the first NHDPlus High Resolution (NHDPlus HR) datasets in Beta version for seven hydrologic regions covering a quarter of the conterminous U.S. NHDPlus HR extends the rich attribution and functionality present in the NHDPlus Version 2 to the spatial accuracy and detail present in the high resolution National Hydrography Dataset and 1/3 arc-second 3D Elevation Program data. For more information, please see the NHDPlus High Resolution page.

Topics will include:

- Overview: What is NHDPlus HR, what does Beta mean, what you can do with it, and how it improves upon the NHDPlus Version 2
- Data availability: Production and release plans
- How to download: TNM Download viewer, FTP and Cloud folders
- What comes after Beta: The NHDPlus HR Refresh concept, Beta QC and Markup tool overview
- Learn about the VisibilityFilter Attribute: The ability to represent the data at different scales, currently populated for testing in Regions 01 and 06

Seminar 8 - Thursday May 19, 2016 - 2:00 PM Eastern - One Hour

Lidar Topography and Hydrographic Integration Fundamentals and Application Issues
Karl Heidemann, Senior Lidar Scientist, USGS EROS Data Center Science and Applications Branch

Abstract - Light Detection and Ranging (lidar) has become the dominant technology for topographic mapping. The significant improvements in spatial resolution, vertical accuracy, and most dramatically, relative accuracy of lidar data has enormous impact on the hydrology/hydrography community, making it possible to map features from lidar data that previously required costly field surveys.

This seminar will present a brief overview of lidar technology and terminology to establish a common understanding of these topics. Particular emphasis will be placed on those topics and concepts that relate to the reintegration of hydrography (namely the NHD) and the new generation of lidar-derived topographic data.

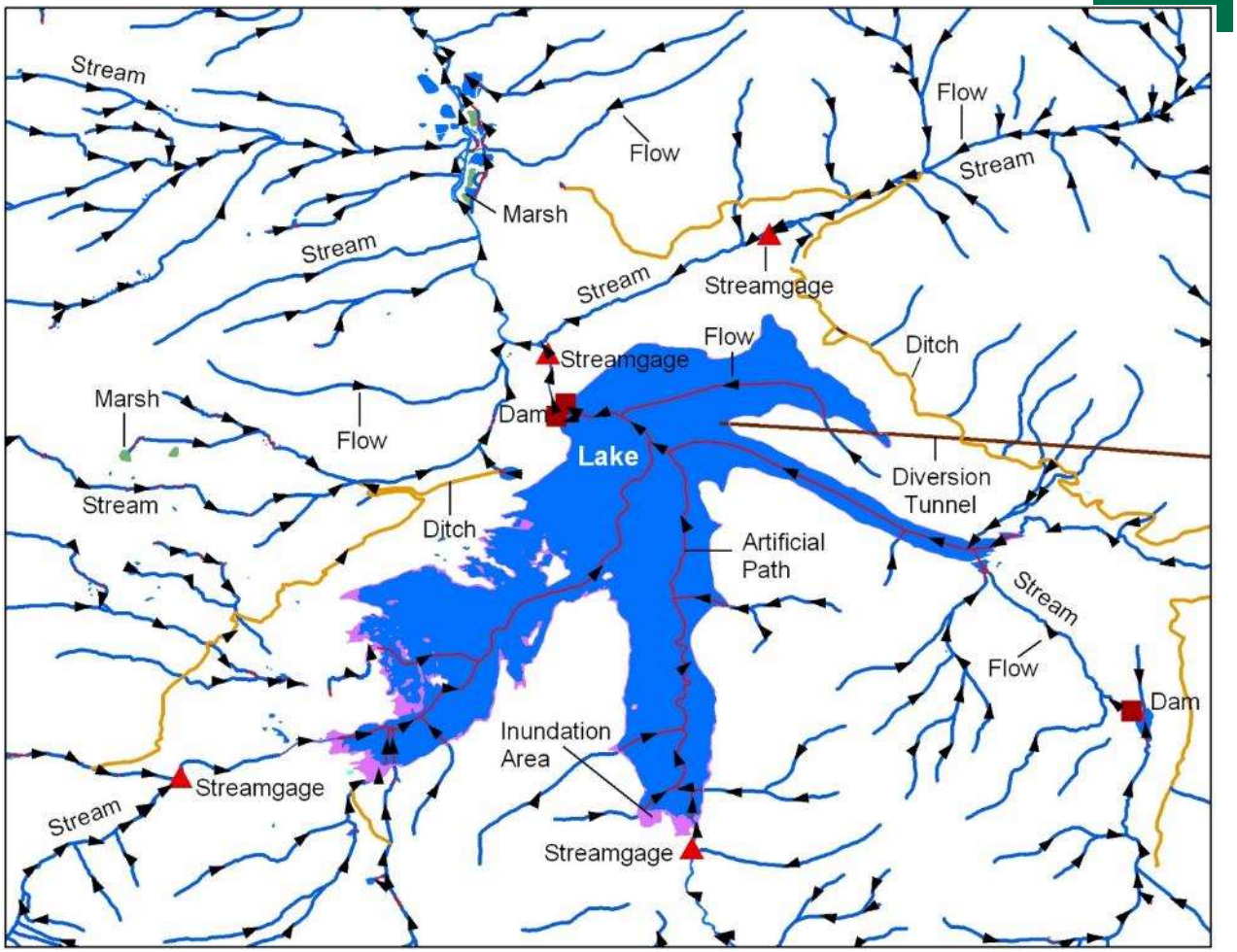
What is the National Hydrography Dataset?

Surface water features found on topographic maps

National drainage network of rivers and streams, plus other hydro info

Currently maintain 24k – Local Res Version (63k – 24k in AK)

Shapefile and GDB downloads plus services



Watershed Boundary Dataset (WBD)

Overview

- WBD is a **seamless baseline drainage area** dataset for the Nation
- Boundaries are **defined by hydrographic and topographic criteria** with no regard for administrative boundaries
- Delineated in a **nested multi-level, hierarchical drainage system**
- Each level assigned a **progressive 2-digit Hydrologic Unit Code (HUC)** which describes where the unit is in the country and the 'level' of the unit
- **Jointly managed** by the USGS National Geospatial Program (NGP) and Water Mission Area (WMA) and the US Dept. of Agriculture Natural Resources Conservation Service (NRCS) as part of the integrated hydrologic information system

WBD *(cont.)*

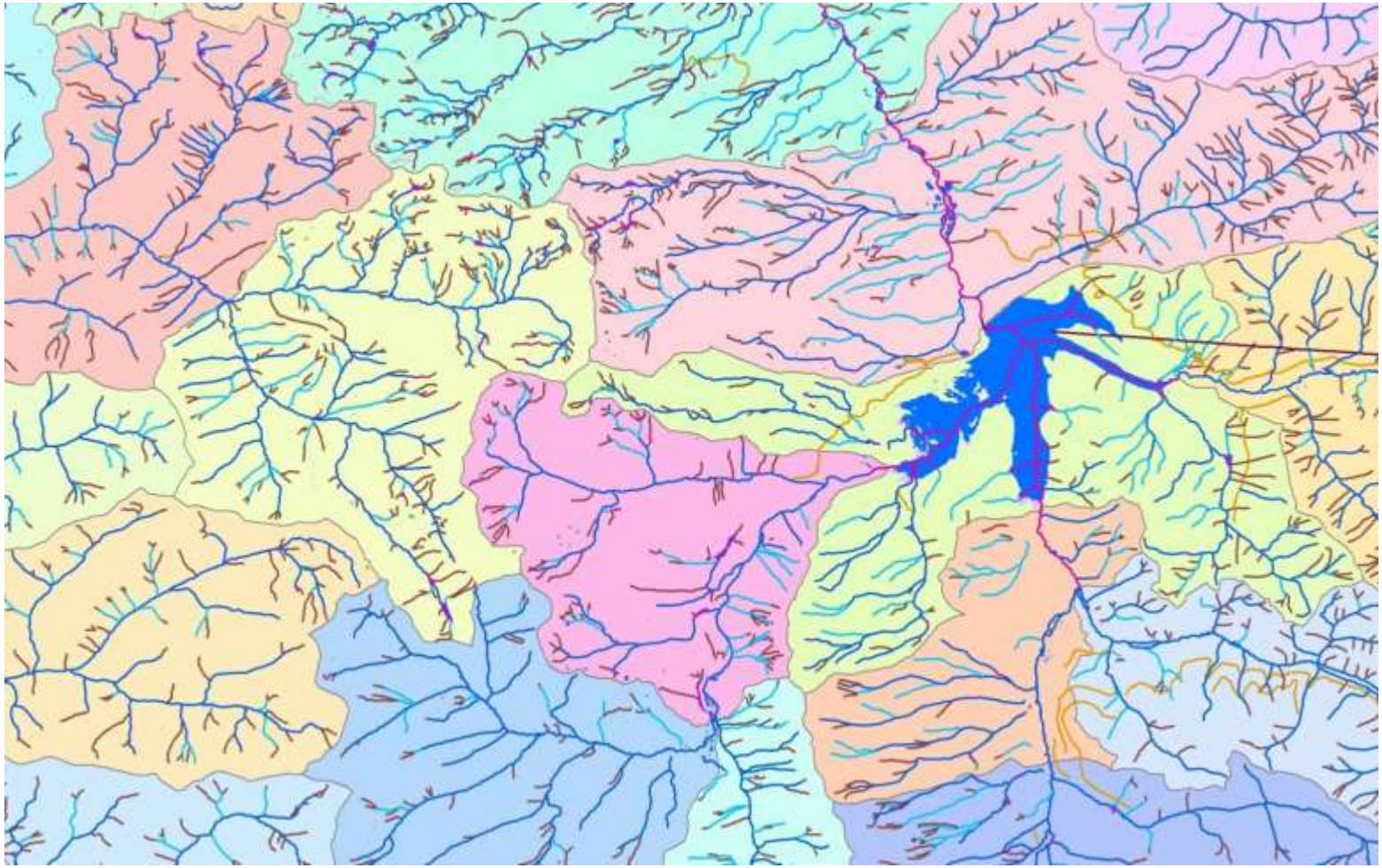
Watershed Definitions

The WBD represents drainage basins at eight scales

Name	Level	Digit	Number of HUCs
Region	1	2	21
Subregion	2	4	222
Basin	3	6	352
Subbasin	4	8	2,149
Watershed	5	10	22,000
Subwatershed	6	12	160,000

WBD

NHD Network Integrated with Hydrologic Units



The National Map https://nationalmap.gov/

APRIL 20, 2017

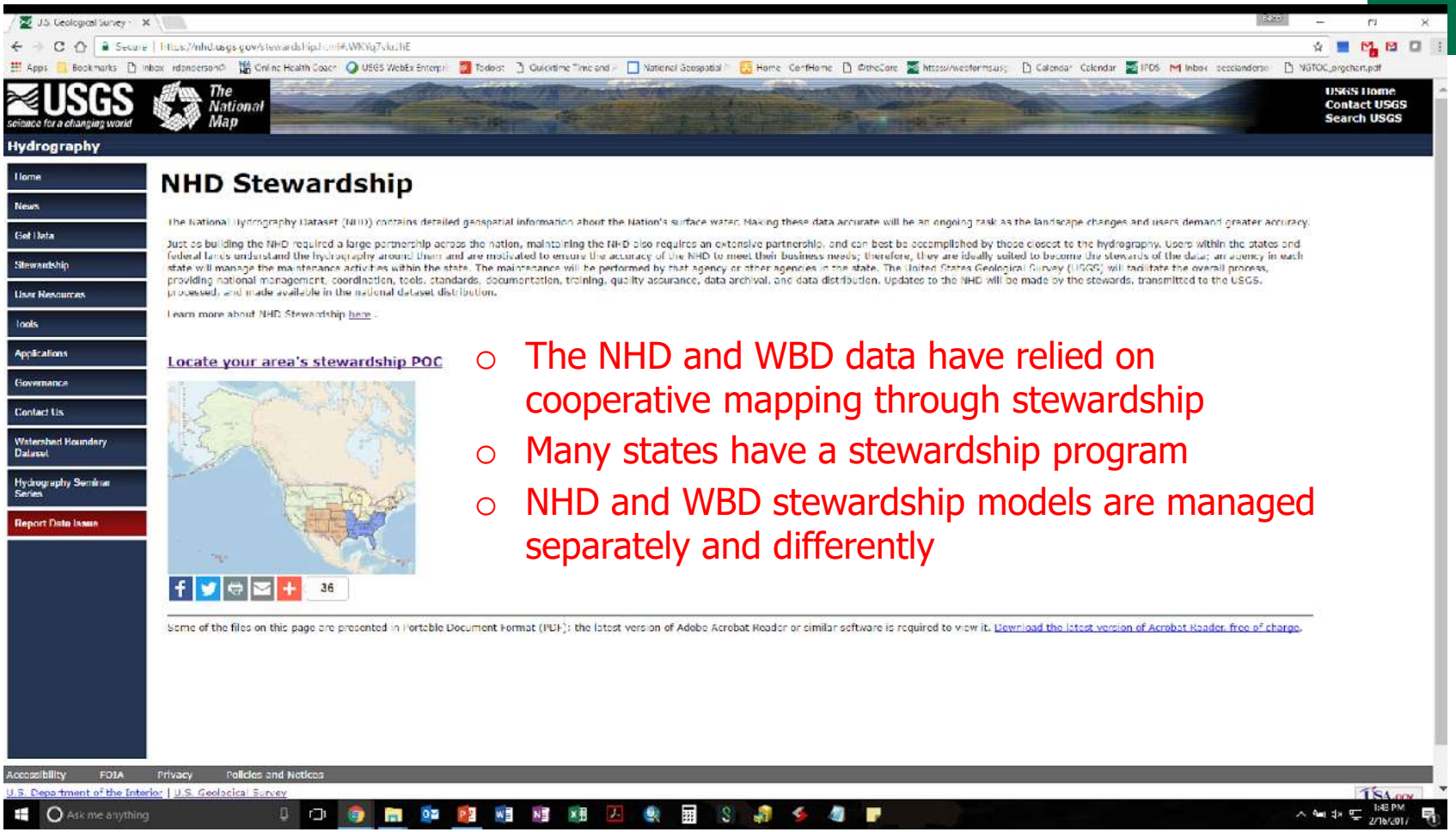
National Hydrography Dataset / Watershed Boundary Dataset Map Service Improvement

As part of an ongoing effort to improve the suite of hydrography web-based map services, the USGS will separate the services for the National Hydrography Dataset (NHD) and Watershed Boundary Dataset (WBD).

Attribution: National Geospatial Program

Stewardship

NHD and WBD

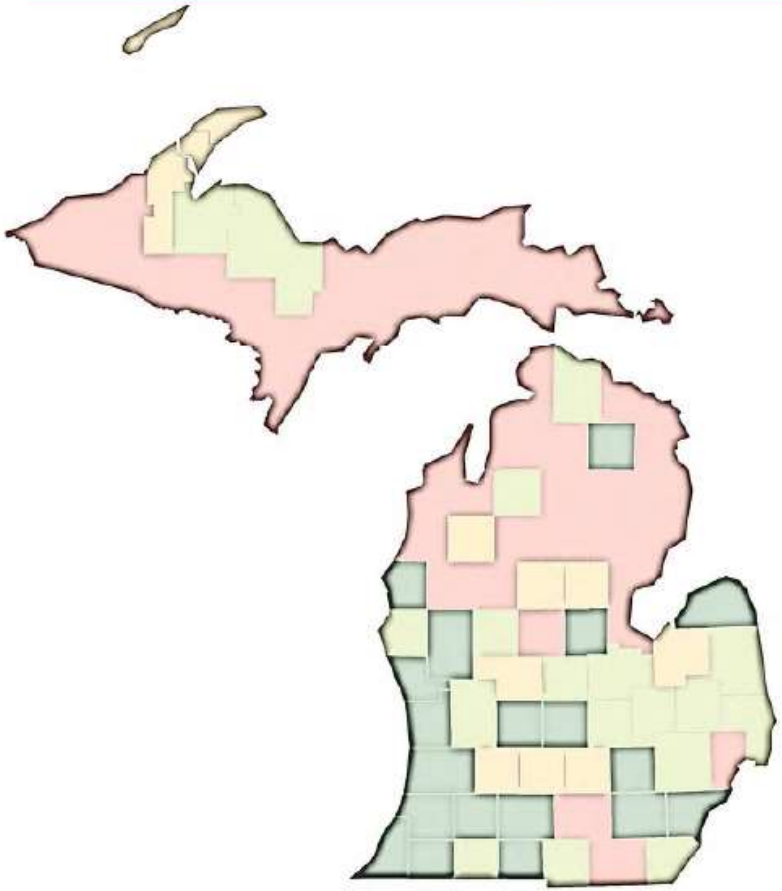


- The NHD and WBD data have relied on cooperative mapping through stewardship
- Many states have a stewardship program
- NHD and WBD stewardship models are managed separately and differently

Michigan Drain Commissioners (MACDC) plan for NHD

Michigan Association of County Drain Commissioners (MACDC)

Business Plan for NHD Implementation



USGS science for a changing world

The National Map
Your Source for Topographic Information

Hydrography Requirements and Benefits Study - HRBS

- Documented 420 Mission Critical Activities
- 23 Federal Agencies, 50 States, 8 Tribal governments and 3 national associations
- https://nationalmap.gov/HRBS.html
- **Michigan section pages C-621 to C-648**
- Current Annual Benefits - $538M
- Future Potential Annual Benefits - $602M
- Benefits likely significantly under-reported - 35% of respondents were unable to provide a dollar value for future benefits
- Program recommendation during FY17

USGS science for a changing world

The National Map
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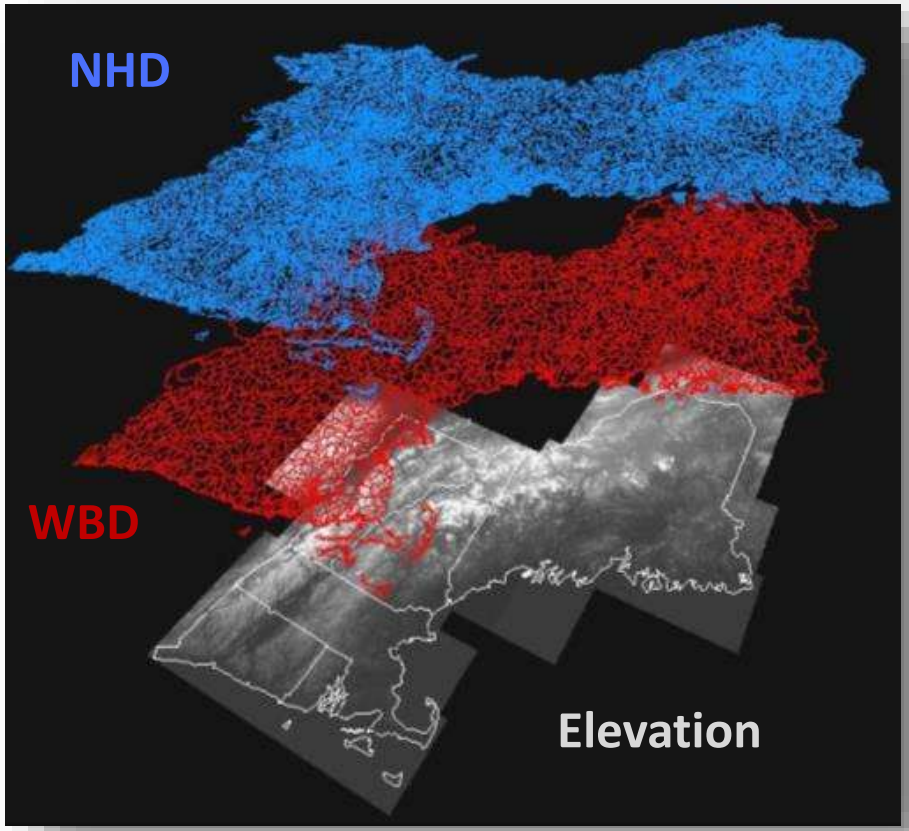
National Hydrography Dataset Plus - NHDPlus

Medium Resolution created for CONUS

High Resolution in work for CONUS and AK



Catchments for each unique NHDPlus stream segment (flowline) shown.

Incorporates

- Hydrography
- Boundaries
- Elevation

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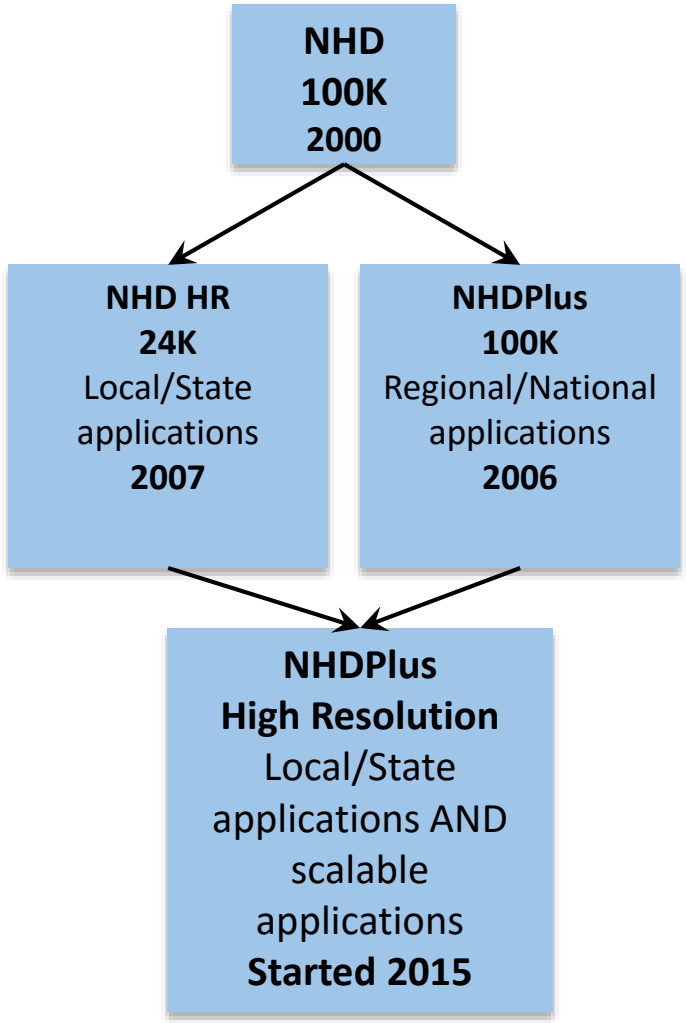
NHDPlusHR

Taking NHDPlus v2 (MedRes) to a new level

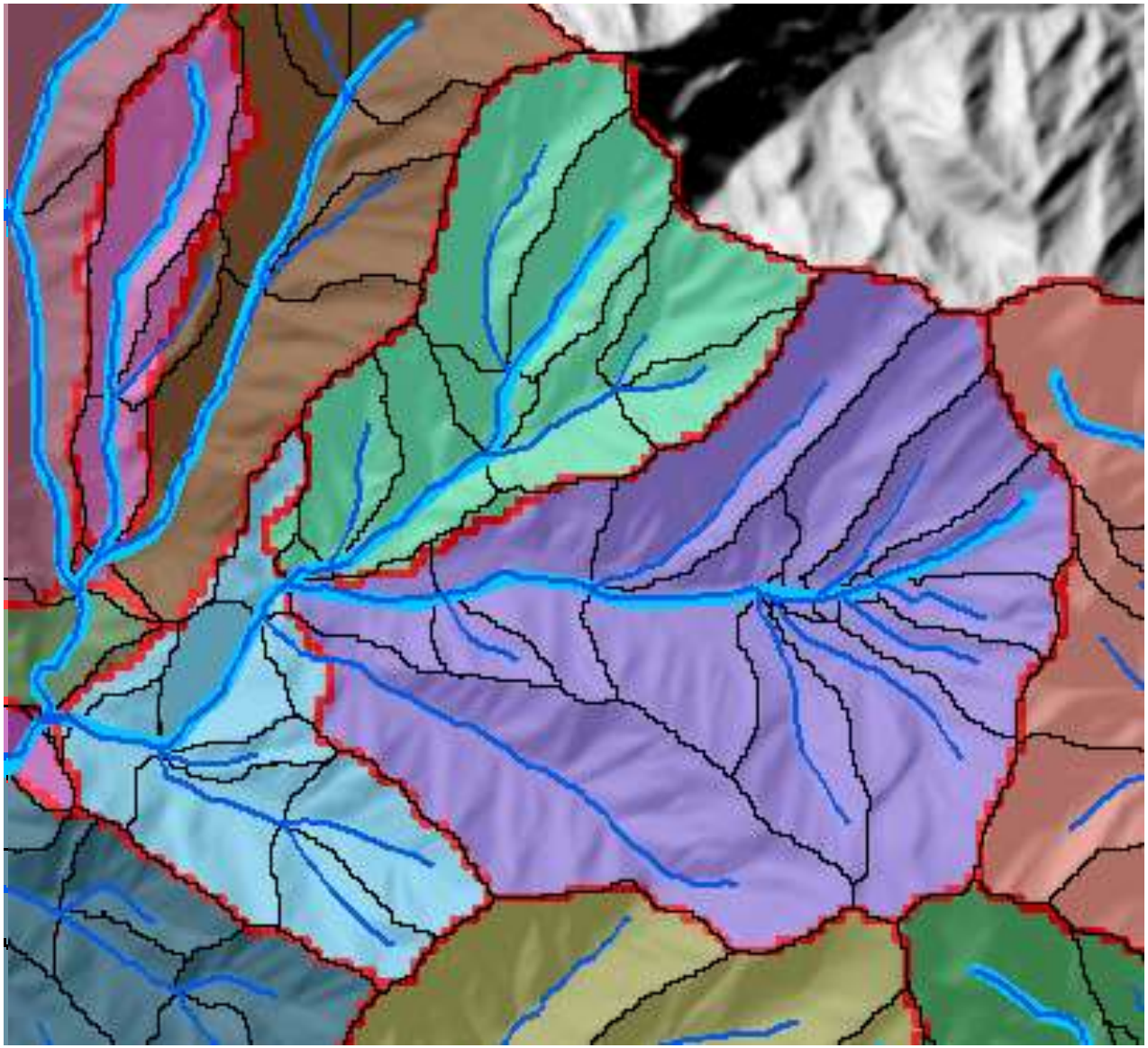
The best of 24K+ data and NHDPlus

Addresses the need for a single hydrographic frame of reference

Link data to one network and generalize to many different scales



NHDPlus HR Adds Local Detail



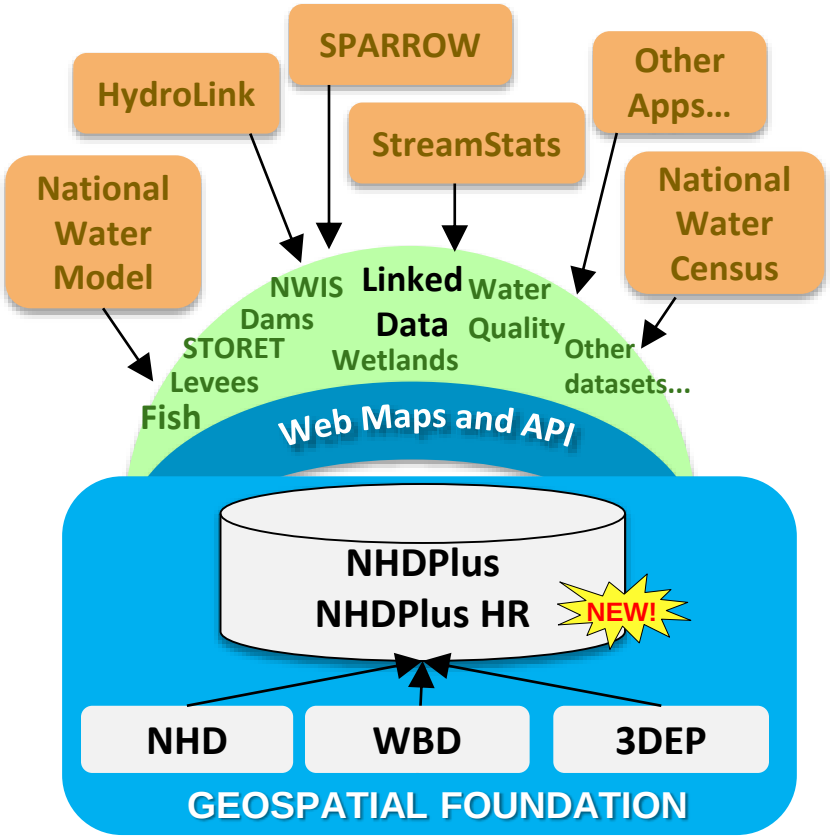
USGS science for a changing world

The National Map
Your Source for Topographic Information

NHDPlus is the foundation for navigating the Nation's Water Information

NHDPlus, with related web maps and API, creates a geospatial foundation for:

- Linking any type of **data** to the water network
- Providing the framework for **systems** like the National Water Model
- Navigating the stream network to discover related data for a growing range of **applications**



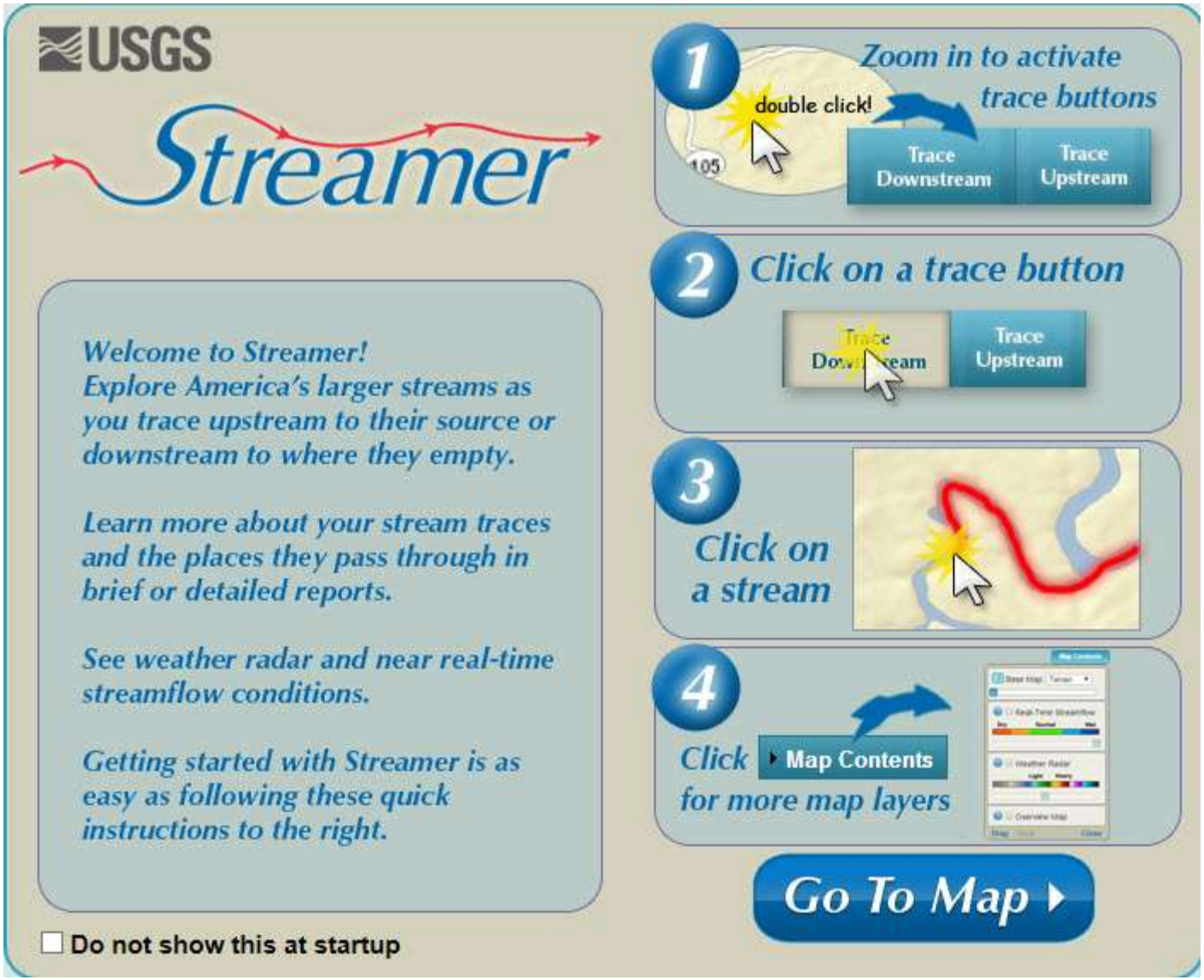
EXAMPLE: THE WATER QUALITY PORTAL

Water Quality Portal data were mapped to NHDPlus to provide data discovery and navigation capabilities -users can now find more than 200 million data records about the health of water in the US collected by over 400 state, federal, tribal, and local agencies along 2.7 million stream segments represented in NHDPlus

EXAMPLE: GOLD KING MINE

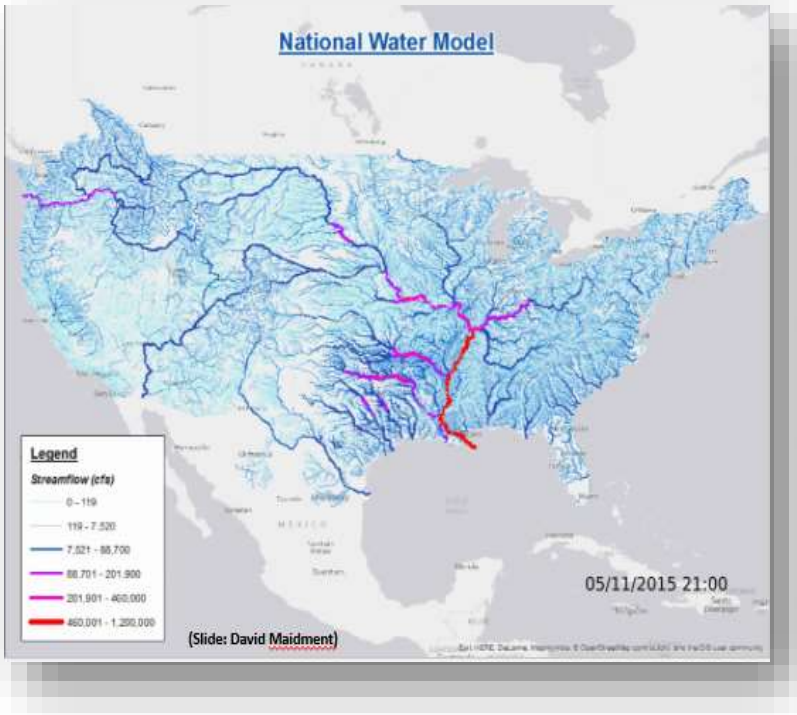
In August, 2015, waste spilled from the Gold King Mine and contaminated the Animas River with toxic heavy metals. The Governor of Colorado declared a disaster zone and the USGS was requested to provide all existing water quality records for the river. Because the Water Quality Portal is now linked to NHDPlus, what once took a group of experts several days of dedicated effort to assemble from multiple databases can be done today in less than two minutes via a simple map-based query (http://www.waterqualitydata.us/)

USGS is producing NHDPlus HR to greatly increase the detail and accuracy of the stream network


USGS
Streamer
Welcome to Streamer!
Explore America's larger streams as you trace upstream to their source or downstream to where they empty.
Learn more about your stream traces and the places they pass through in brief or detailed reports.
See weather radar and near real-time streamflow conditions.
Getting started with Streamer is as easy as following these quick instructions to the right.
1
Zoom in to activate trace buttons
double click!
Trace Downstream
Trace Upstream
2
Click on a trace button
Trace Upstream
3
Click on a stream
4
Click
Map Contents
for more map layers
Go To Map
Do not show this at startup

Foundational Hydrography Datasets

Future



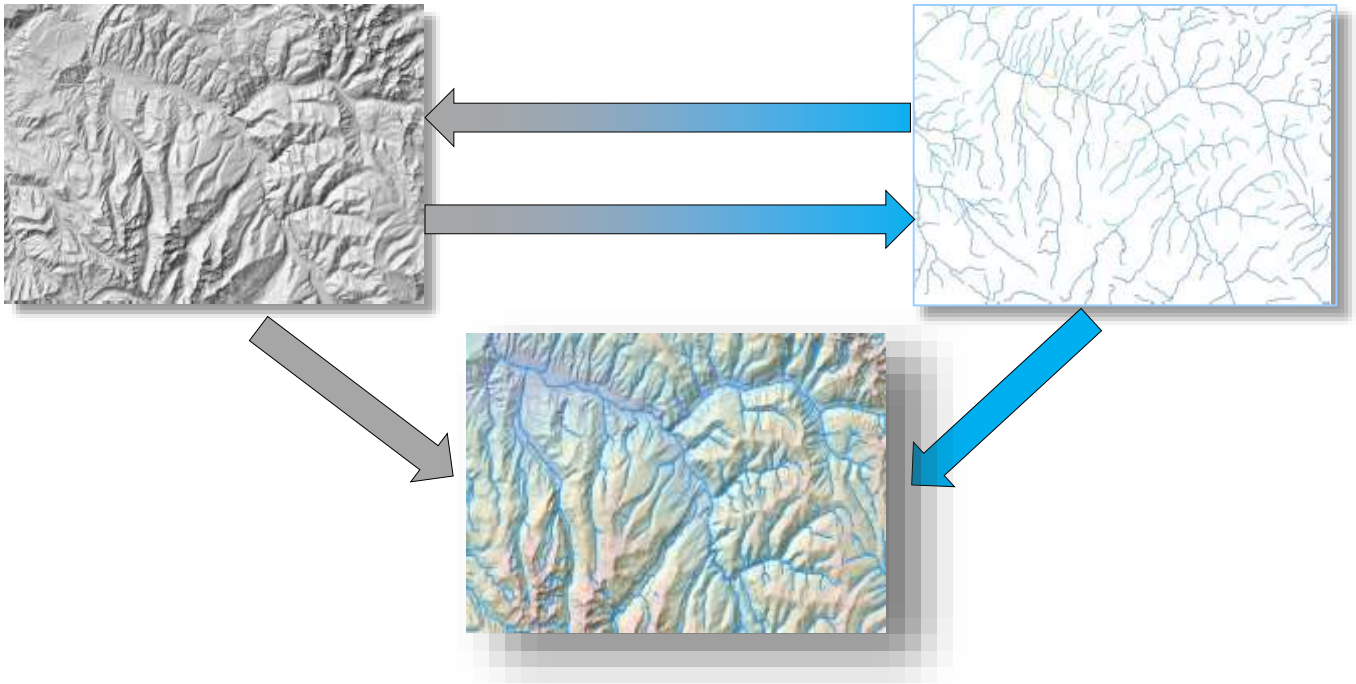
	IN USE TODAY: Medium Resolution NHDPlus	IN PROGRESS: High Resolution NHDPlus	FUTURE: Hydrography Derived from Lidar
Number of features nationally	3 million	34.5 million	300 million
Elevation source	30 meter	10 meter	1 meter
Hydrography source	1:100,000-scale NHD	1:24,000-scale or better (local) resolution NHD	1:5,000-scale or better derived from lidar
Watershed boundaries source	Composite WBD snapshot of 2010-2012	Updated WBD	Catchments derived from lidar

- Early analysis of the Hydrography and Benefits Study indicates that the most medium to long-term requirements will be met best by deriving hydrographic data from 3DEP data so that the elevation and hydrography are fully integrated
- Pilot projects underway to determine approaches and associated costs

Future: Ele-Hydro

Hydrography derived from 3DEP Lidar

- Integration of lidar and hydrography data
- Alignment of elevation and hydrography such that streams flow in channels
- Final data product can be accessed in one dataset



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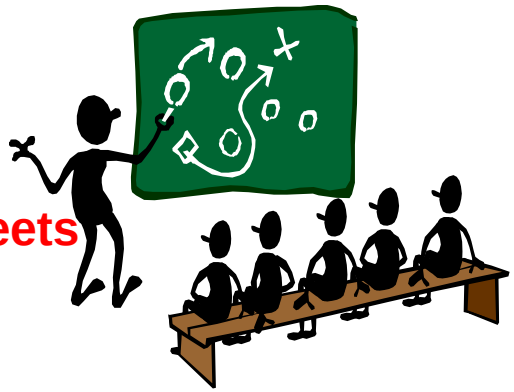
- >>> More National Map <<<

Names, BGN, Structures, VGI, Boundaries, Roads, Streets



- 3D Elevation Program (3DEP)

- **U.S. Board on Geographic Names – BGN**
- **Geographic Names Information System - GNIS**

THE PLAIN DEALER

Name that creek yourself and get feds to back you

Friday, December 02, 2005

Wonder if that creek behind your house has a name? You can check the topographic map for your neighborhood. They are probably available at the nearest library or town hall.

If it doesn't have a name, or you think the one on the map is inappropriate, you can come up with a moniker and ask the U.S. Board of Geographic Names to make it official.

The board says any American has the right to propose a new name or a change. It has one hard and fast rule: No names of living people. And it might help your cause to get some backing from the county commissioners, township, village or city.

An application is available through the Internet at:

geonames.usgs.gov, where you can reach the board's Web site.

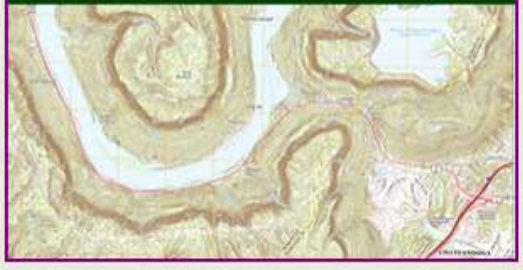
If you don't have Internet access, here's the address:

U.S. Board on Geographic Names, U.S. Geological Survey, 12201 Sunrise Valley Drive, MS523, Reston, Va.

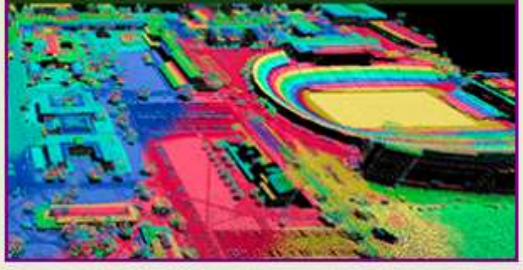
The National Map

Your Source for Topographic Information

US Topo



3D Elevation Program



National Hydrography Data Set

Historical Topographic

Find Data + View & Download

Maps	Elevation	Hydrography
Geographic Names	Transportation	Structures
Boundaries	Orthoimagery	Land Cover

TNM Partnership & User Engagement

The National Map Corps

U.S. Board on Geographic Names

10 STRUCTURES

- School
- College/University
- Fire Station/EMS
- Law Enforcement
- Prison/Correctional Facility
- State Capital
- Hospital/Medical Center
- Ambulance Service
- Cemetery
- Post Office

http://navigator.er.usgs.gov/help/vgistructures_userguide.html

USGS
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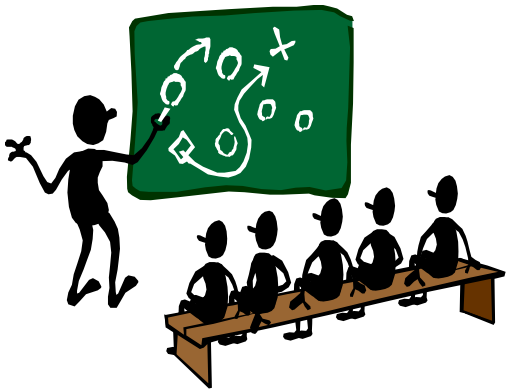

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3D Elevation Program (3DEP)

3D Elevation Program (3DEP)

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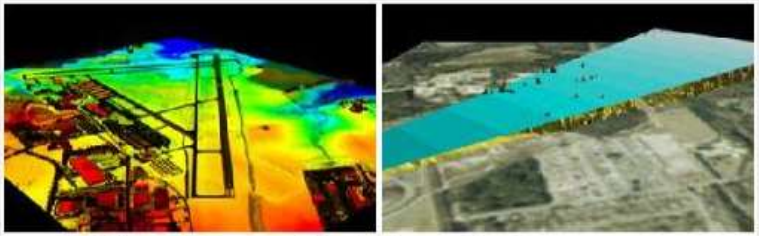
The National Map Home >> 3D Elevation Program (3DEP)

Introduction and Goals



LiDAR is used to detect potential obstacles that present hazards to air navigation.

Lidar is used to detect potential obstacles that present hazards to air navigation.

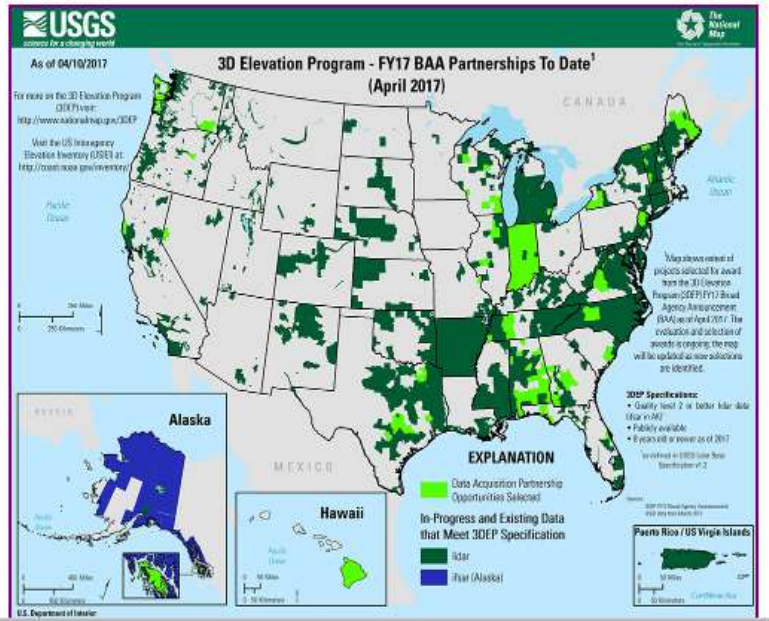
The 3D Elevation Program (3DEP) initiative is being developed to respond to growing needs for high-quality topographic data and for a wide range of other three-dimensional representations of the Nation's natural and constructed features. The primary goal of 3DEP is to systematically collect enhanced elevation data in the form of high-quality light detection and ranging (lidar) data over the conterminous United States, Hawaii, and the U.S. territories, with data acquired over an 8-year period. Interferometric synthetic aperture radar (IfSAR) data will be collected over Alaska, where cloud cover and remote locations preclude the use of lidar over much of the State. The 3DEP initiative is based on the results of the National Enhanced Elevation Assessment.

3DEP Data Acquisition Partnership Opportunities

FY17 USGS Broad Agency Announcement (BAA) for the 3D Elevation Program (3DEP)

Partnership Opportunities

The FY16/FY17 Broad Agency Announcement (BAA) for 3D Elevation Program (3DEP) was released on August 11, 2016. The BAA provides detailed information on how to partner with the USGS and other Federal agencies to acquire high-quality 3D Elevation data. Information and contacts are available at Fed Biz Opps (Search for Reference Number: G16PS00711) and Grants.gov (Funding Opportunity Number: G16AS00121). Applicants may contribute funds toward a USGS lidar data acquisition activity via the Geospatial Products and Services Contracts or they may request 3DEP funds toward a lidar data acquisition activity where the requesting partner is the acquiring authority. Federal agencies, state and local governments, tribes, academic institutions and the private sector are eligible to submit proposals. FY17 Project awards have been made. An award summary is available. The BAA remains open; however additional FY17 awards are based



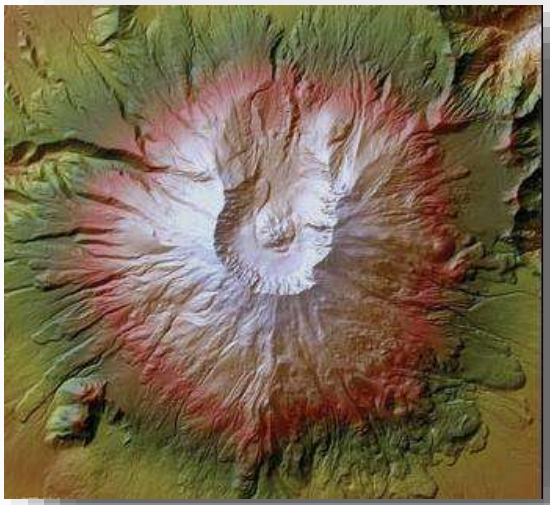
3D Elevation Program (3DEP)

Overview - USGS has a long history providing elevation data

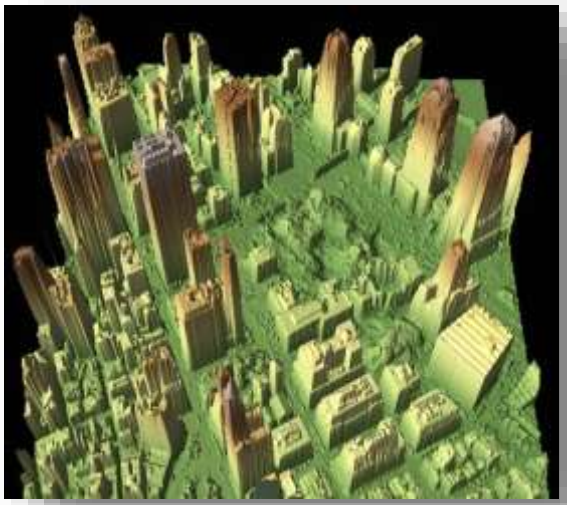
- First through contours on topographic maps
- Later by digital data in the National Elevation Dataset (NED)

Background

- 3DEP initiative - based on the results of the National Enhanced Elevation Assessment (NEEA)
- Lidar for the Nation with IfSAR over Alaska

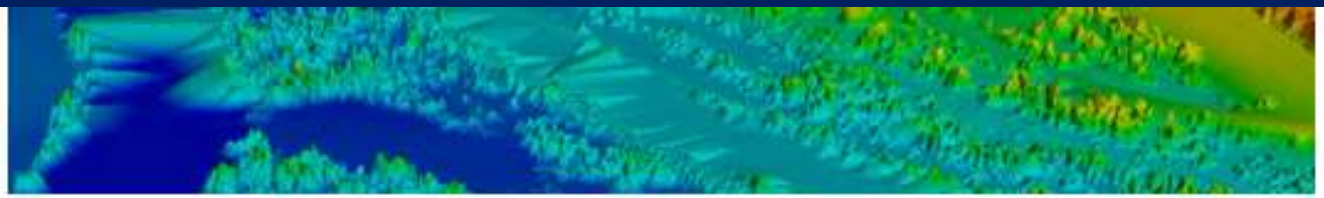


Lidar examples of natural (Mount St Helens, left) and constructed (urban area, right) features



NEEA – National Enhanced Elevation Assessment

Is a national effort needed? What should it look like?



Final Report of the National Enhanced Elevation Assessment

Revised March 29, 2012

The National Enhanced Elevation Assessment (NEEA) was performed to document national requirements for improved elevation data, estimate the benefits and costs of meeting these requirements, and evaluate multiple national enhanced program implementation scenarios. The study was sponsored by member agencies of the National Digital Elevation Program and was completed December 2011. Study participants included 34 federal agencies, 50 states, and selected local governments and tribes, as well as private and not-for-profit organizations. An analysis of the results showed that an improved national program has the potential to generate $1.2-billion to $13-billion in new benefits each year once fully operational. The report was developed by Dewberry under contract to the USGS. The findings build on similar results documented by the National Research Council, federal agencies, and numerous state reports. Questions regarding the report should be directed to Greg Snyder, USGS, at gsnyder@usgs.gov.

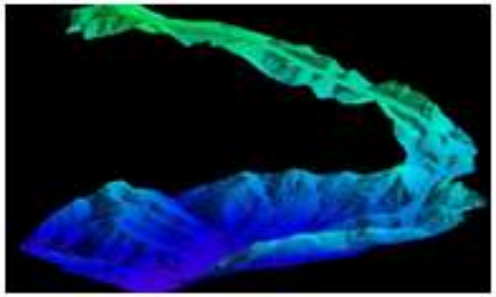
Downloads

- NEEA Final Report
- Appendix A: NED Release Notes
- Appendix B: Federal Agency Functional Activities
- Appendix C: State, Territory & Local Functional Activities
- Appendix D: Nongovernmental Functional Activities
- Appendix E: Business Use Requirements & Benefits
- Appendix F: Benefit Cost Analysis Process
- Appendix G: Technology Trends & Risk Considerations
- Appendix H: IT Infrastructure
- Appendix I: USGS LiDAR Guidelines & Base Specs
- Appendix J: Online Questionnaire

Report posted to www.dewberry.com at the request of the USGS.

+ Example Business Uses

Precision Farming



Land Navigation and Safety

Geologic Resources and Hazards Mitigation

Natural Resource Conservation

Infrastructure Management

Flood Risk Mitigation

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Michigan Input to NEEA

- **Sam Quon** (City of Lansing and Ingham County)
- **Mike Sobocinski** (Michigan State Police hazard mitigation)
- **Mike Toth** (MDOT lead on elevation)

- Flood map analysis and loss estimates for properties in flood prone areas
- Forest fire susceptibility and identification of structures in wildland interface areas
- Preliminary design and planning
- ID glacial deposits for metallic, non-metallic and aggregate evaluation (John Esch)

USGS

http://nationalmap.gov/3DEP/3dep_statefactsheets.html

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The 3D Elevation Program—Summary for Michigan

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 Michigan, elevation data are critical for agriculture and precision farming, natural resources conservation, flood risk management, water supply and quality, infrastructure and construction management, coastal zone management, and other business uses. Today, high-density light detection and ranging (lidar) data are the primary sources for deriving elevation models and other datasets. Federal, State, Tribal, and local agencies work in partnership to (1) replace data that are older 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 National Enhanced Elevation Assessment (NEEA; Dewberry, 2011) evaluated multiple elevation data acquisition options to determine the optimal data quality and data replacement cycle relative to cost to meet the identified requirements of the user community. The evaluation demonstrated that lidar acquisition at quality level 2 (table 1) for the conterminous United States and quality level 5 interferometric synthetic aperture radar (ifsar) data (table 1) for Alaska with a 6- to 10-year acquisition cycle provided the highest benefit/cost ratios. The 3D Elevation Program (3DEP) initiative (Snyder, 2012a,b) selected an 8-year acquisition cycle for the respective quality levels. 3DEP, managed by the U.S. Geological Survey (USGS), the Office of Management and Budget Circular A–16 lead agency for terrestrial elevation data, responds to the growing need for high-quality topographic data and a wide range of other 3D representations of the Nation's natural and constructed features. The Michigan Statewide Authoritative Imagery and Lidar (MiSAIL) program provides statewide lidar coordination with local, State, and national groups in support of 3DEP for Michigan.

3DEP in Michigan by the Numbers

Expected annual benefits	$10.19 million
Estimated total cost	$19.39 million
Payback	1.9 years
Quality level 1 buy-up estimate	$12.34 million

Figure 1. Map of Michigan showing publicly available lidar data. Information source is the United States Interagency Elevation Inventory, March 2015 (http://coast.noaa.gov/inventory/?redirect=301ocm#). The inventory is updated annually. Quality level 2 or better data meet 3DEP requirements. See table 1 for quality level information.

3D Elevation Program Benefits for Michigan

The top 10 Michigan business uses for 3D elevation data, which are based on the estimated annual conservative benefits of the 3DEP initiative, are shown in table 2. The NEEA survey respondents in the State of Michigan estimated that the national 3DEP initiative would result in at least $10.2 million in new benefits annually to the State. The cost for such a program in Michigan is approximately $19 million, resulting in a payback period of 1.9 years and a benefit/cost ratio of 4.2 to 1 over an 8-year period. Because monetary estimates were not provided for all reported benefits, the total benefits of the 3DEP to Michigan are likely much higher. On the basis of the NEEA survey results, all levels of government and many organizations in Michigan could benefit from access to statewide high-resolution elevation data.

For Michigan, approximately 72 percent of the identified business use requirements will be met in agriculture and precision farming, natural resources conservation, and flood risk management uses, as shown in table 2. The status of publicly available lidar data in Michigan is shown in figure 1. By enhancing coordination between 3DEP and various government and private organizations in Michigan, it may be possible to realize more than the cited conservative benefits and attain the higher potential benefits for many business uses.

The following examples highlight how 3DEP data can support business uses in Michigan: (1) Approximately 28 percent of the land area of Michigan is devoted to agricultural uses. Enhanced elevation data can provide a more accurate depiction of terrain and improve precision farming activities, which helps improve crop yields, prevent soil degradation, and reduce agricultural chemical runoff—factors that help farmers realize a larger return on their investments. (2) Enhanced elevation data could enable State, regional, and local governments to reduce field work for conservation projects such as grade stabilization, ponds, grassed waterways, terracing, and wetland delineation and restoration, which would yield a cost savings to the public. (3) Subtle features not evident on conventional USGS topographic maps (or aerial photography) often are readily apparent on lidar images (fig. 2). The availability of lidar data has fundamentally changed how geological mapping and geological resource evaluations are conducted.

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 have complete coverage of the United States by the end of 2022, depending on funding and partnerships. 3DEP can conservatively provide new benefits of $1.2 billion/year and 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). A shared, common elevation dataset would foster cooperation and improve decision-making among all levels of government and other stakeholders.

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.

References Cited

Dewberry, 2011, Final report of the National Enhanced Elevation Assessment (revised 2012): Fairfax, Va., Dewberry, 84 p. plus appendixes, http://www.dewberry.com/Consultants/GeospatialMapping/FinalReport-NationalEnhancedElevationAssessment.

Snyder, G.I., 2012a, National Enhanced Elevation Assessment at a glance: U.S. Geological Survey Fact Sheet 2012–3088, 2 p., http://pubs.usgs.gov/fs/2012/3088/.

Snyder, G.I., 2012b, The 3D Elevation Program—Summary of program direction: U.S. Geological Survey Fact Sheet 2012–3089, 2 p., http://pubs.usgs.gov/fs/2012/3089/.

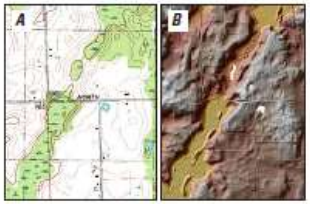

Figure 2. Enhanced elevation lidar data provide a more detailed view of the landscape and reveal subtle features that are not evident on a traditional USGS 7.5-minute topographic map (from 1980) of Northwest Albion, Michigan (*A*). Features such as the esker glacial deposits trending southwest to northeast on the lidar shaded relief map of the Northwest Albion area of Calhoun County (*B*) are often the source of economically important gravel deposits. Courtesy of Michigan Geological Survey.

Table 2. Conservative benefits estimates for the top 10 business uses of the proposed 3DEP data identified in the National Enhanced Elevation Assessment for Michigan (Dewberry, 2011).

Rank	Business use	Annual benefits (millions)
1	Agriculture and precision farming	$3.16
2	Natural resources conservation	2.93
3	Flood risk management	1.27
4	Water supply and quality	0.75
5	Infrastructure and construction management	0.72
6	Coastal zone management	0.69
7	Forest resources management	0.36
8	Aviation navigation and safety	0.13
9	Geologic resource assessment and hazard mitigation	0.11
10	Renewable energy resources	0.03
	Other	0.04
	Total	10.19

3D Elevation Program—Continued

The USGS and its partners will acquire quality level 2 or better (table 1) 3D lidar data over the conterminous United States, Hawaii, and the U.S. territories. Interferometric synthetic aperture radar (ifsar) data are being collected at quality level 5 (table 1) in Alaska. The data will be acquired over an 8-year period and will be made available to the public. By using this acquisition scenario, a number of high-quality elevation-data products can be created to serve a wide range of business uses in government and the private sector.

Table 1. Data quality levels and related accuracies for the 3D Elevation Program (3DEP) initiative as provided on page 6 in USGS Circular 1399 (http://dx.doi.org/10.3133/cir1399). These data quality parameters for the 3DEP initiative approximate those used in the National Enhanced Elevation Assessment (Dewberry, 2011).

[$RMSE_z$, root mean square error in the *z* (elevation) dimension; n/a, not applicable]

Quality level	Nominal pulse spacing (meters)	Vertical error as $RMSE_z$ (centimeters)
1	0.35	10
2	0.7	10
3	1.4	20
4	n/a	139
5	n/a	185

Next Steps for Implementing 3DEP

Accomplishing the 3DEP initiative's goal of national coverage in 8 years depends on the following factors:

- Increased partnerships among Federal, State, Tribal, and local governments.
- Partnerships that acquire elevation data to the program's specifications across larger project areas.
- Increased communication about and awareness of the program's benefits and goals.
- Support for the program from government and other stakeholders.

For Further Information:

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Email: 3DEP@usgs.gov

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The National Map Liaison
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Columbus, Ohio 43229
Email: chickman@usgs.gov

http://nationalmap.gov/3DEP/

By William J. Carswell, Jr.

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

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The 3D Elevation Program—Landslide Recognition, Hazard Assessment, and Mitigation Support

3D Elevation Information Underpins Our Understanding of Landslides

A core mission of the U.S. Geological Survey (USGS) is to provide information that leads to reduced loss of life and damage to property and infrastructure from landslides. Gathering this information relies on a detailed and accurate understanding of the landscape. The USGS Landslide Hazards Program (https://www.usgs.gov/science/mission-areas/natural-hazards/landslide-hazards) conducts landslide hazard assessments, pursues landslide investigations and forecasts, provides technical assistance to respond to landslide emergencies, and engages in outreach. All of these activities benefit from the availability of high-resolution, three-dimensional (3D) elevation information in the form of light detection and ranging (lidar) data and interferometric synthetic aperture radar (IfSAR) data.

Research on landslide processes addresses critical questions of where and when landslides are likely to occur as well as their size, speed, and effects (Schulz, 2005). This understanding informs the development of methods and tools for hazard assessment and situational awareness used to guide efforts to avoid or mitigate landslide impacts. Such research is essential for the USGS to provide improved information on landslide potential associated with severe storms, earthquakes, volcanic activity, coastal wave erosion, and wildfire burn areas. Decisionmakers in government and the private sector increasingly depend on information the USGS provides before, during, and following disasters so that communities can live, work, travel, and build safely. High-resolution 3D elevation data significantly aid in the refinement of assessments of where and when landslides will occur, improving information delivered to decisionmakers and the public (figs. 1 and 2). A nationwide program to provide a baseline of high-quality 3D elevation data is essential for supporting improved hazard assessments, response preparation, and effective response execution.

The 3D Elevation Program (3DEP) (Sugarbaker and others, 2014; see sidebar) is collecting 3D elevation data in response to a call for action to address landslide applications and a wide range of other urgent needs nationwide. 3DEP furnishes the programmatic infrastructure and provides data to users, reducing their costs and risks and allowing them to concentrate on their mission objectives. The programmatic infrastructure includes (1) data acquisition partnerships that leverage funding, (2) contracts with experienced private mapping firms, (3) technical expertise, standards, and specifications, and (4) most important, providing public access to high-quality 3D elevation data.

Figure 1. Oblique aerial view and smaller-scale lidar image (inset) of the Oso, Washington, landslide of March 22, 2014. Red arrows start at upper edge of scarp and show direction of material flow. Photograph taken on April 1, 2014, by Mark Reid (USGS). Lidar image derived from 3DEP data collected by the Washington Department of Transportation on March 24, 2014.

3D Elevation Program (3DEP)

The 3D Elevation Program (3DEP) is a national program managed by the USGS to acquire high-resolution elevation data (Sugarbaker and others, 2014). It produces point clouds, bare-earth digital elevation models (DEMs), and other products.

3DEP is backed by a comprehensive assessment of lidar, interferometric synthetic aperture radar (IfSAR), and related elevation data requirements (Dewberry, 2012) and is now an operational program. The goal of this high-priority cooperative program is to have complete coverage of quality level 2 lidar data for the conterminous United States, Hawaii, and the U.S. territories, and IfSAR data for Alaska, by the end of 2023.

Reduced Acquisition Costs and Risks

A funded national program will provide:

- *Economy of scale* by acquiring data for larger areas and reducing acquisition costs by 25 percent.
- *Predictable, efficient, and flexible Federal investments* that reduce costs for and allow better planning by Federal, State, Tribal, U.S. territorial, and local government partners, including the option of "buying up" to acquire higher quality data.
- *Consistent, high-quality, national coverage* that (1) provides data ready for applications that span project, jurisdictional, and watershed boundaries, (2) meets multiple needs, and (3) increases benefits to citizens.
- *Simpler data acquisition* that provides contracts, published data-acquisition specifications, and specialized quality assurance and information technology expertise. Partners reduce their risks and can concentrate on their business activities.

3DEP can conservatively provide new benefits of $690 million per year and has the potential to generate $13 billion per year in new benefits through applications that span the economy (Dewberry, 2012). The shared lidar, IfSAR, and derived elevation datasets would foster cooperation and improve decisionmaking among all levels of government and other stakeholders.

High-Quality Data

For the conterminous United States, Hawaii, and the U.S. territories, the USGS and its partners acquire quality level 2 or better lidar data. Quality level 2 data have a minimum nominal pulse spacing of 0.7 meters

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The 3D Elevation Program and America's Infrastructure

Infrastructure Connects Us All

Infrastructure—the physical framework of transportation, energy, communications, water supply, and other systems—and construction management—the overall planning, coordination, and control of a project from beginning to end—are critical to the Nation's prosperity. The American Society of Civil Engineers (2013) warns that, despite the importance of the Nation's infrastructure, it is in fair to poor condition and needs sizable and urgent investments to maintain and modernize it, and to ensure that it is sustainable and resilient.

Three-dimensional (3D) light detection and ranging (lidar) elevation data (fig. 1) provide valuable productivity, safety, and cost-saving benefits to infrastructure improvement projects and associated construction management (Dewberry, 2012). However, the acquisition of 3D elevation data primarily on a project-by-project basis can increase infrastructure project costs and risks, and distract management attention from project goals (Chang and others, 2012).

By providing data to users, the 3D Elevation Program (3DEP) of the U.S. Geological Survey (USGS) (Sugarbaker and others, 2014; see sidebar) reduces users' costs and risks and allows them to concentrate on their mission objectives. 3DEP includes (1) data acquisition partnerships that leverage funding, (2) contracts with experienced private mapping firms, (3) technical expertise, lidar data standards, and specifications, and (4) most important, public access to high-quality 3D elevation data.

The size and breadth of improvements for the Nation's infrastructure and construction management needs call for an efficient, systematic approach to acquiring foundational 3D elevation data. The 3DEP approach to national data coverage will yield large cost savings over individual project-by-project acquisitions and will ensure that data are accessible for other critical applications.

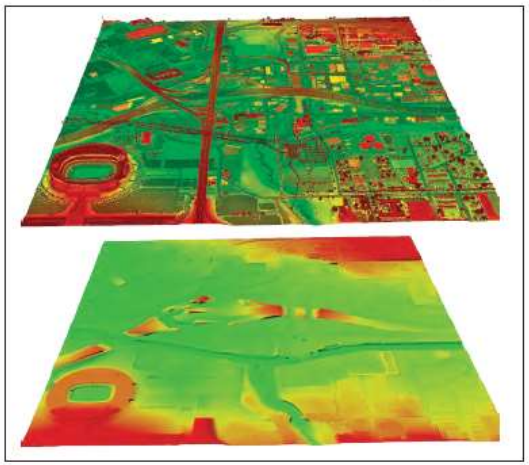

Figure 1. 3D elevation data for an area of Denver, Colorado, in the form of a lidar point cloud (top) and a derived bare-earth digital elevation model (bottom). These data along with other products provide valuable productivity, safety, and cost-saving benefits to infrastructure improvement projects. Image provided by Jason Stoker (USGS).

3D Elevation Program (3DEP)

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Fact Sheet 2016–3092
November 2016

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The 3D Elevation Program—Precision Agriculture and Other Farm Practices

Agricultural Productivity and High-Quality Terrain Information

A founding motto of the Natural

Knowledge of relevant terrain information—

3D Elevation Program (3DEP)

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High-Quality Data

For the conterminous United States, Hawaii, and the U.S. territories, the USGS and its partners acquire QL2 or better lidar data. The QL2 data have a minimum nominal pulse spacing of 0.7 meters and a vertical error

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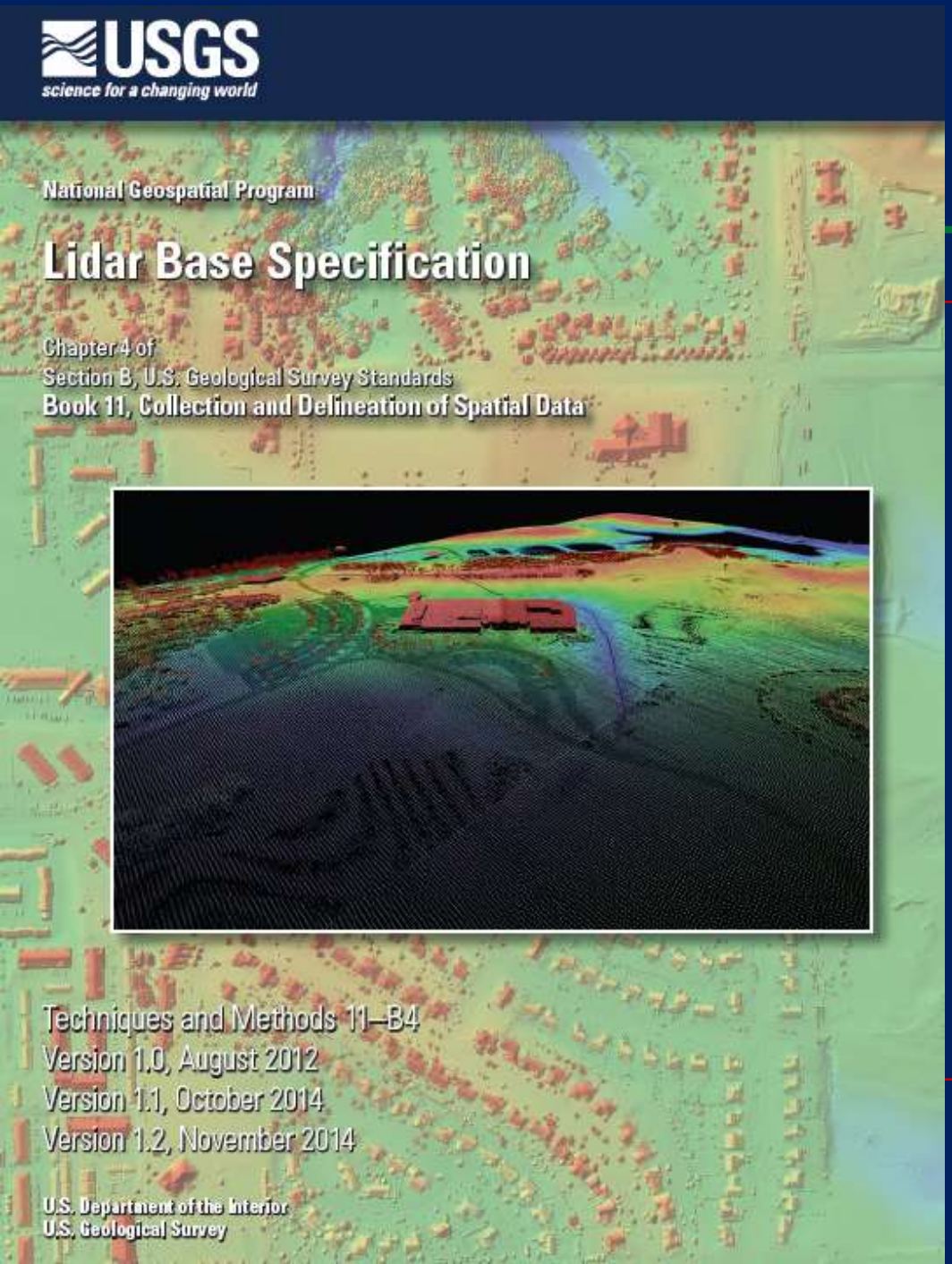

http://pubs.usgs.gov/tm/11b4/

http://nationalmap.gov/3DEP/3dep_prodstandards.html

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Lidar Base Spec
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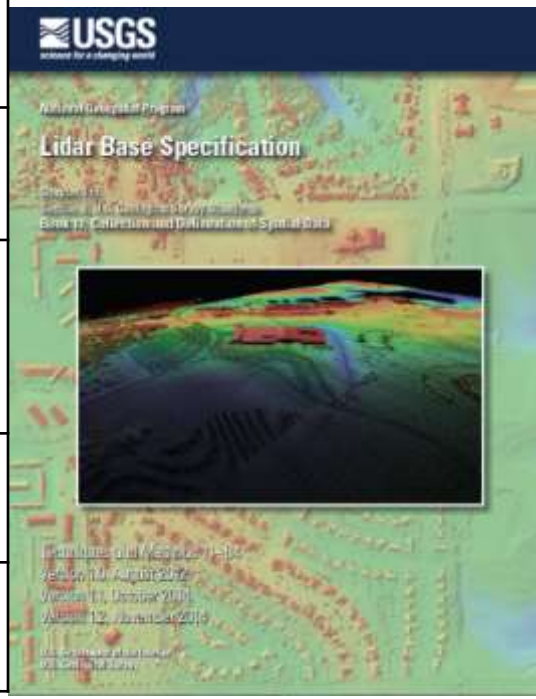
3DEP Quality Levels

Quality Level	Source	Vertical Accuracy RMSEz	Nominal Pulse Spacing (NPS)	Nominal Pulse Density (NPD)	DEM Post Spacing
QL1	Lidar	10 cm	0.35 m	8 points/sq meter	0.5 meter
QL2	Lidar	10 cm	0.7 m	2 points/sq meter	1 meter
QL3	Lidar	20 cm	1.4 m	0.5 points/sq meter	2 meter
QL4	Imagery	139 cm	N/A	N/A	5 meters
QL5	Ifsar	185 cm	N/A	N/A	5 meters



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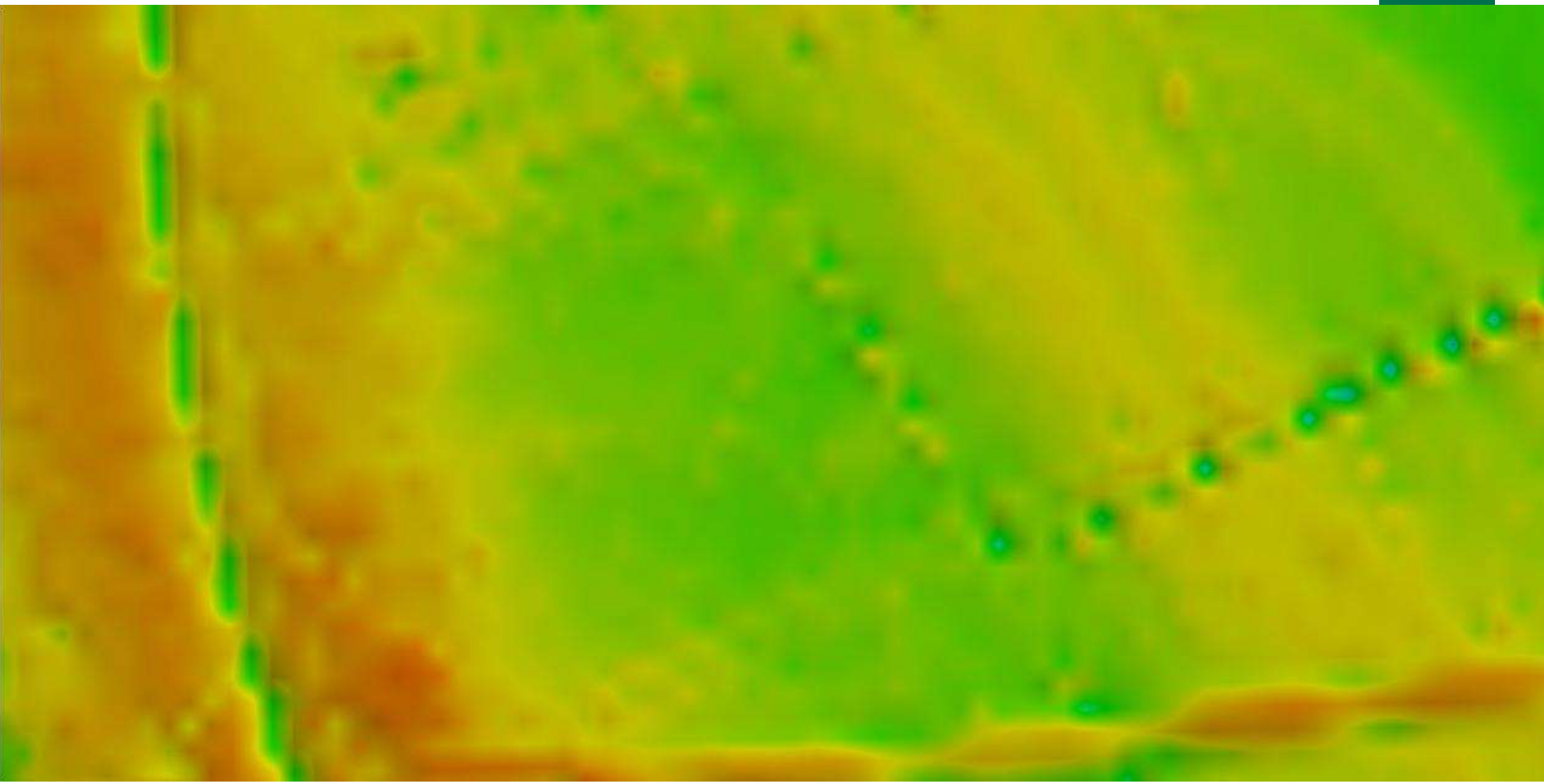
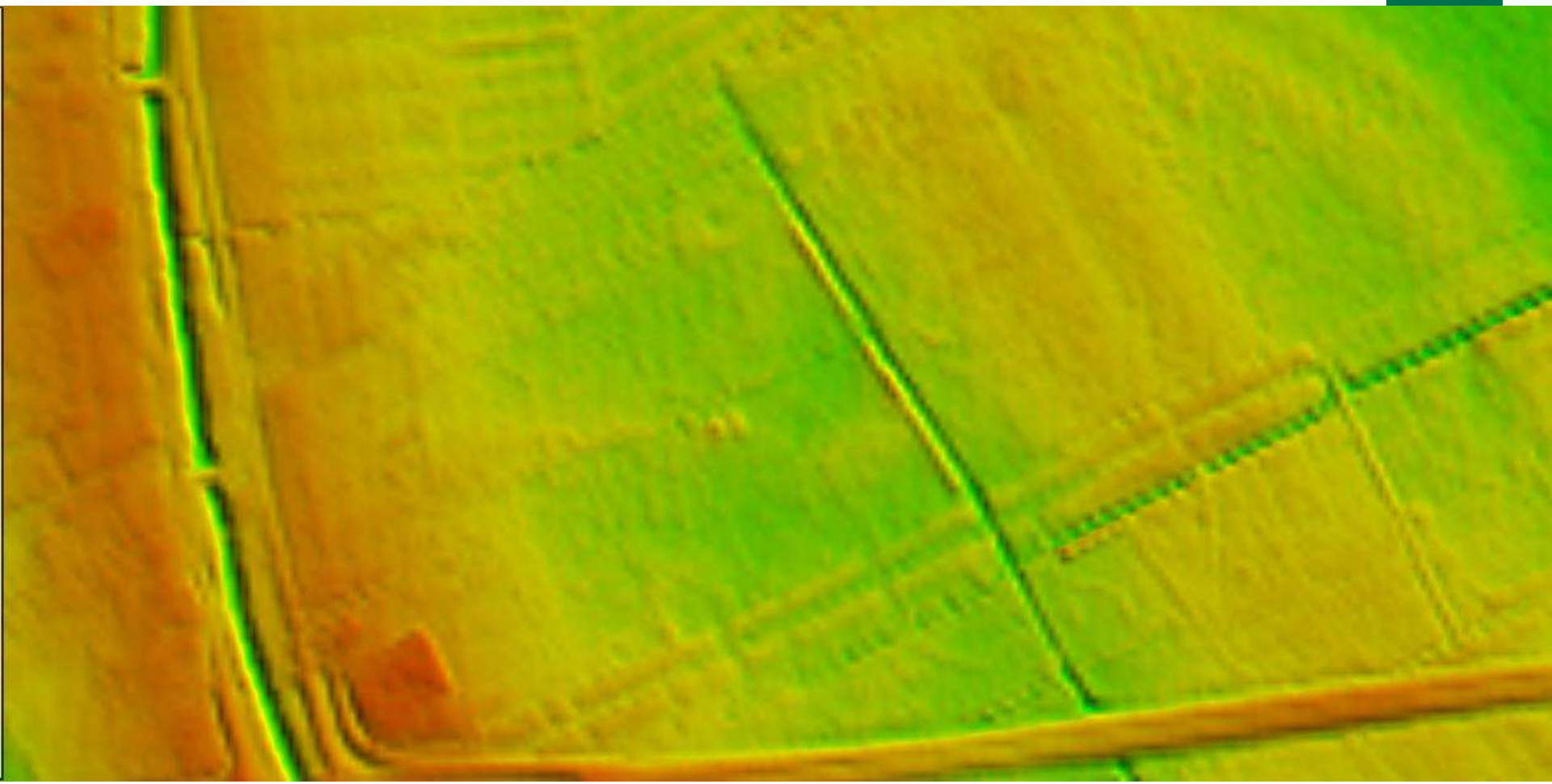
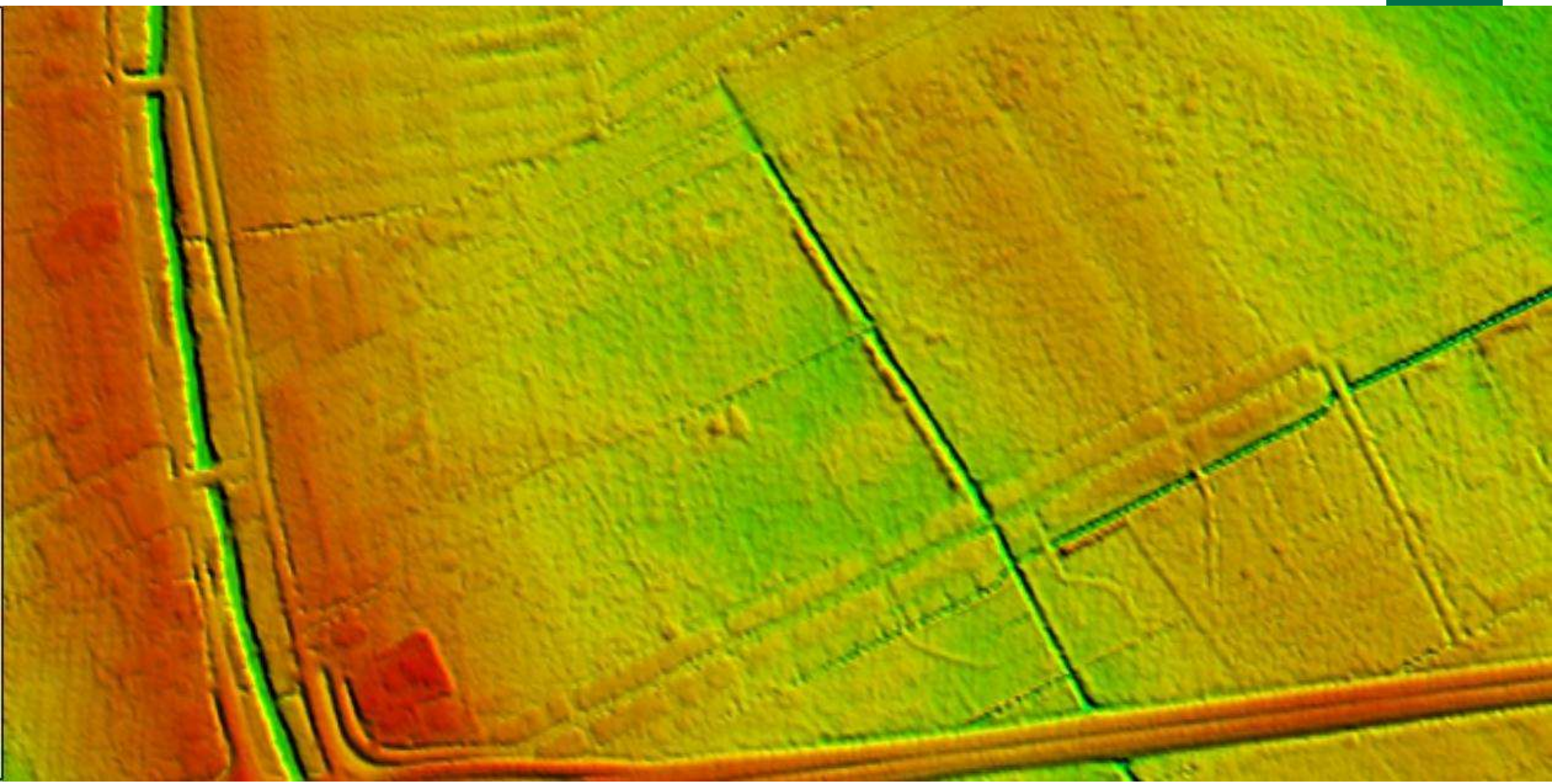


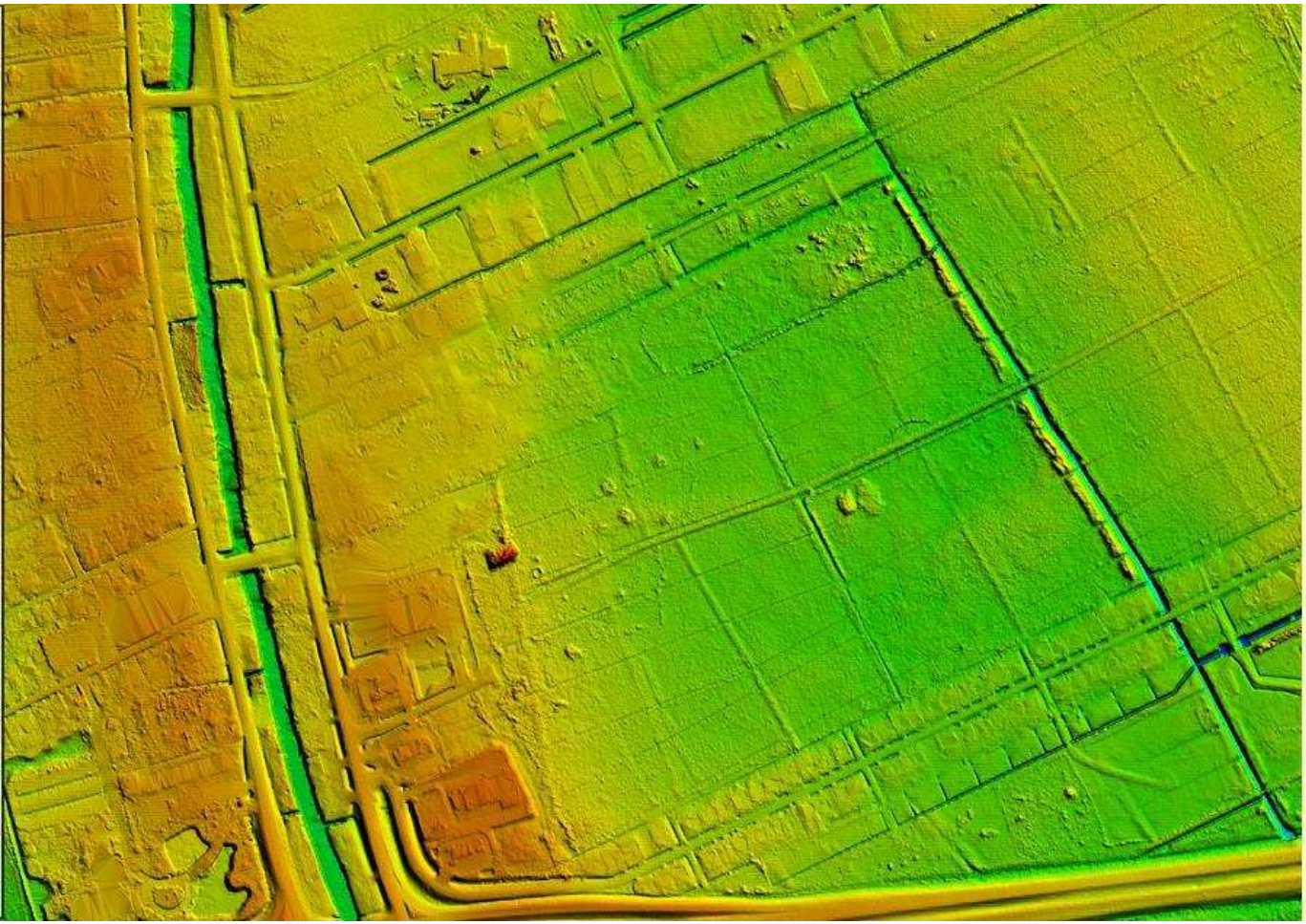
10 meter DEM



3 meter DEM



3DEP 1 meter DEM



3DEP Products

Layer
Seamless DEM
2 Arc Second (~ 60m resolution) (Seamless Alaska only)
1 Arc Second (~ 30m resolution) (Seamless 48 states, some Alaska, Canada, Mexico)
1/3 Arc Second (~ 10m resolution) (Seamless 48 states, Hawaii, US territories)
Project Based DEM
1/9 Arc Second (~ 3m resolution) (No longer collected but still distributed)
1 meter
5 meter (Alaska only)
Source Data
Source DEM - Original Product Resolution DEM (OPR)
Digital Surface Model (DSM) (Alaska only)
Orthorectified Radar Intensity Imagery (ORI) (Alaska only)
Lidar Point Cloud (Classified Las)

NEW 3DEP Products for *The National Map!*

USGS science for a changing world

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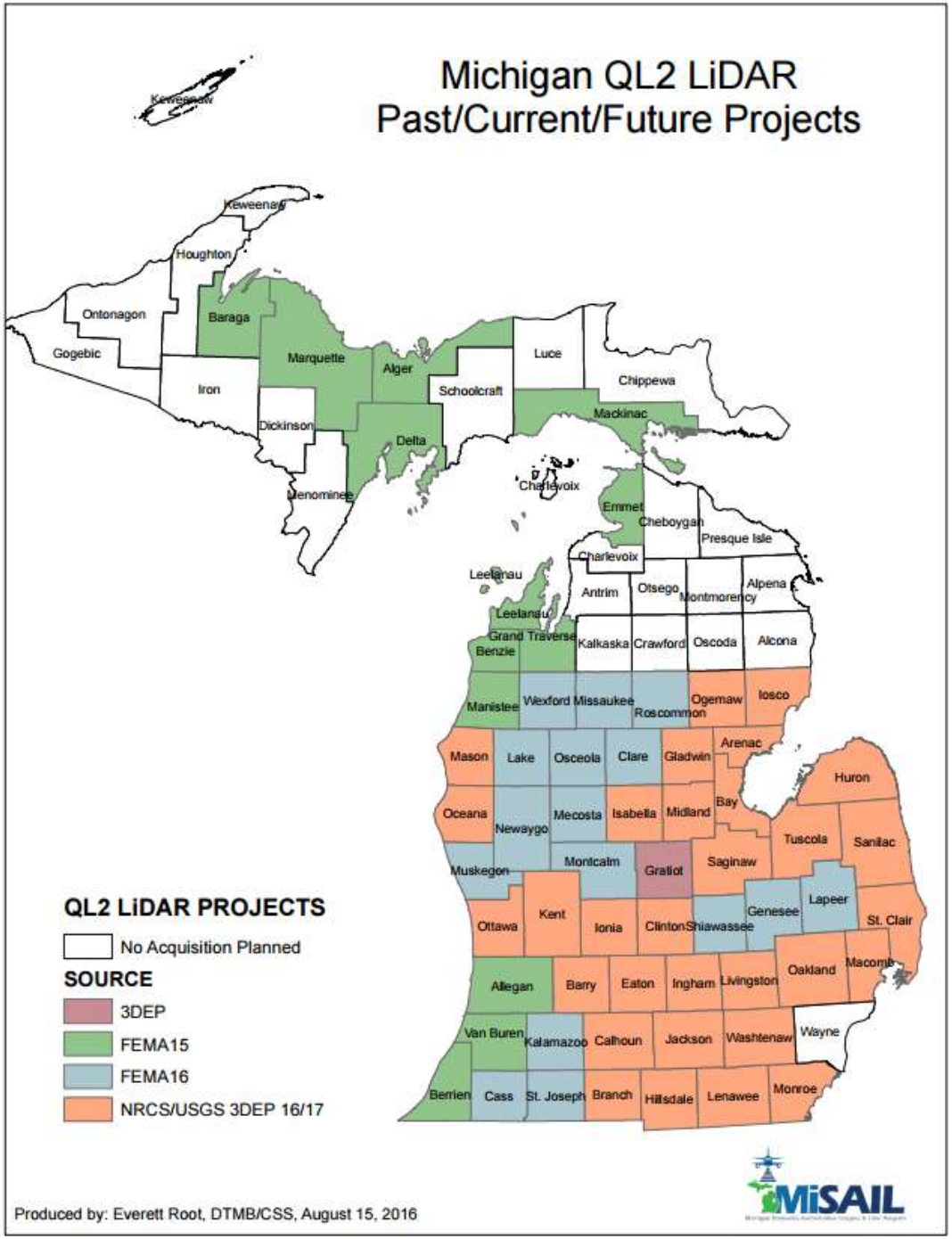
Michigan QL2 LiDAR
Past/Current/Future Projects
Keweenaw
Houghton
Ontonagon
Baraga
Gogebic
Marquette
Alger
Luce
Chippewa
Iron
Schoolcraft
Mackinac
Dickinson
Delta
Menominee
Charlevoix
Emmet
Cheboygan
Presque Isle
Leelanau
Antrim
Otsego
Montmorency
Alpena
Grand Traverse
Kalkaska
Crawford
Oscoda
Alcona
Benzie
Manistee
Wexford
Missaukee
Roscommon
Ogemaw
Iosco
Arenac
Mason
Lake
Osceola
Clare
Gladwin
Huron
Bay
Oceana
Newaygo
Mecosta
Isabella
Midland
Tuscola
Sanilac
Muskegon
Montcalm
Gratiot
Saginaw
Lapeer
Genesee
Ottawa
Kent
Ionia
Clinton
Shiawassee
St. Clair
Oakland
Macomb
Allegan
Barry
Eaton
Ingham
Livingston
Wayne
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw
Berrien
Cass
St. Joseph
Branch
Hillsdale
Lenawee
Monroe
QL2 LiDAR PROJECTS
No Acquisition Planned
SOURCE
3DEP
FEMA15
FEMA16
NRCS/USGS 3DEP 16/17
Produced by: Everett Root, DTMB/CSS, August 15, 2016
MiSAIL

https://viewer.nationalmap.gov/basic/?basemap=b1&category=ned,nedsrc&title=3DEP

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USGS The National Map

3DEP View *(V1.0)* How to Start Over Custom Views Share Link Contact Us

Datasets Products

Advanced Search Options Find Products

Data

- [ ] Elevation Products (3DEP)
- [x] Elevation Source Data (3DEP)

Product Search Filter

- [ ] All Subcategories
- [x] DEM Source (OPR)
  Hide Availability
- [ ] Ifsar Digital Surface Model (DSM)
  Show Availability
- [ ] Ifsar Orthorectified Radar Image (ORI)
  Show Availability
- [ ] Lidar Point Cloud (LPC)
  Show Availability

Description

Data Extent
Varies

File Format
ArcGrid

Show All Availability

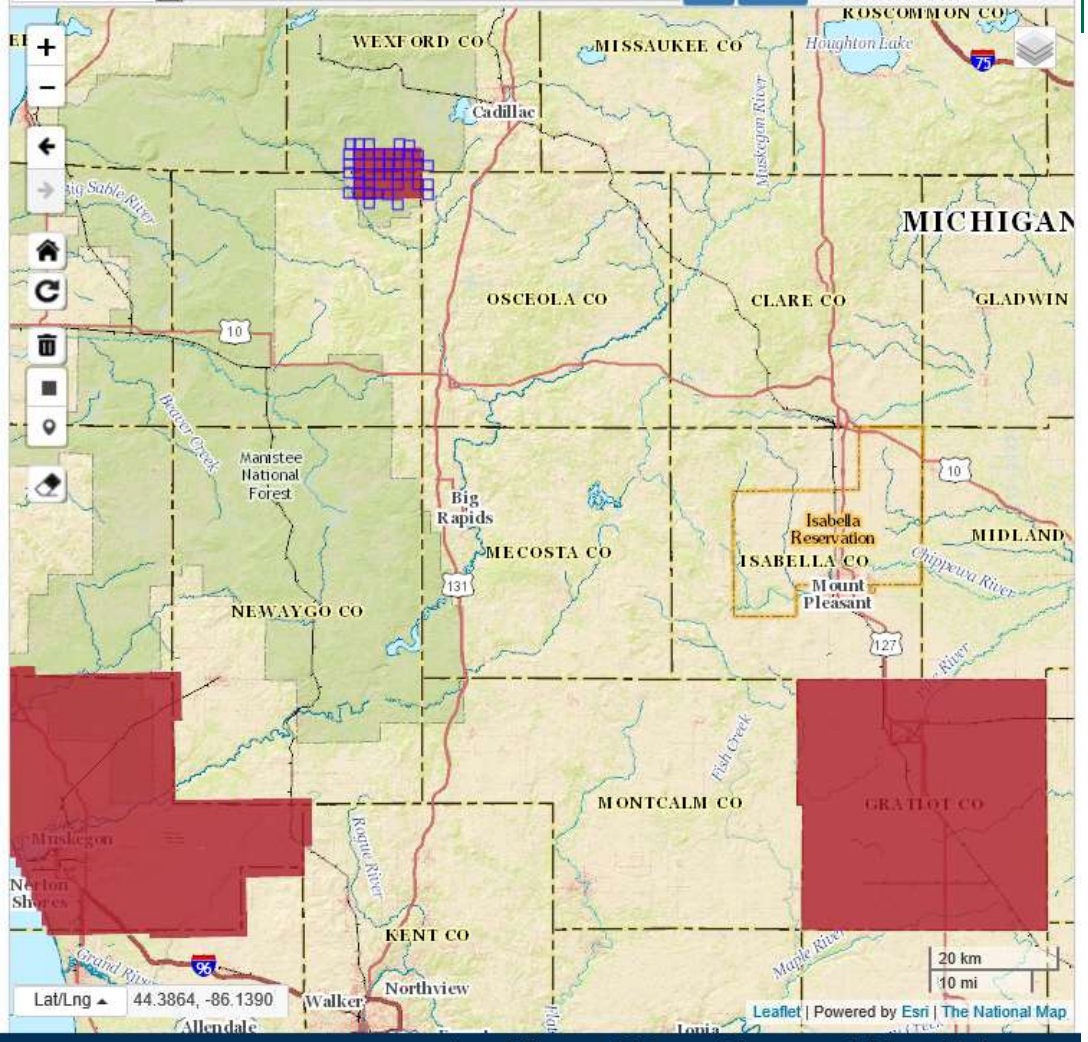
Availability legend

- DEM Source (OPR)
- Ifsar DSM (Alaska only)
- Ifsar ORI (Alaska only)
- LPC - 0.700001 - 50.000000
- LPC - 0.350001 - 0.700000
- LPC - 0.000001 - 0.350000
- LPC - 0.000000

[x] Use Map ( ) Box/Point (•) Current Extent ( ) Coordinates ( ) Located Point ( ) Polygon:

[ ] Map Indices ( ) 1 Degree ( ) 15 Minute ( ) 7.5 Minute ( ) All

Address/Place Search location. Go Clear



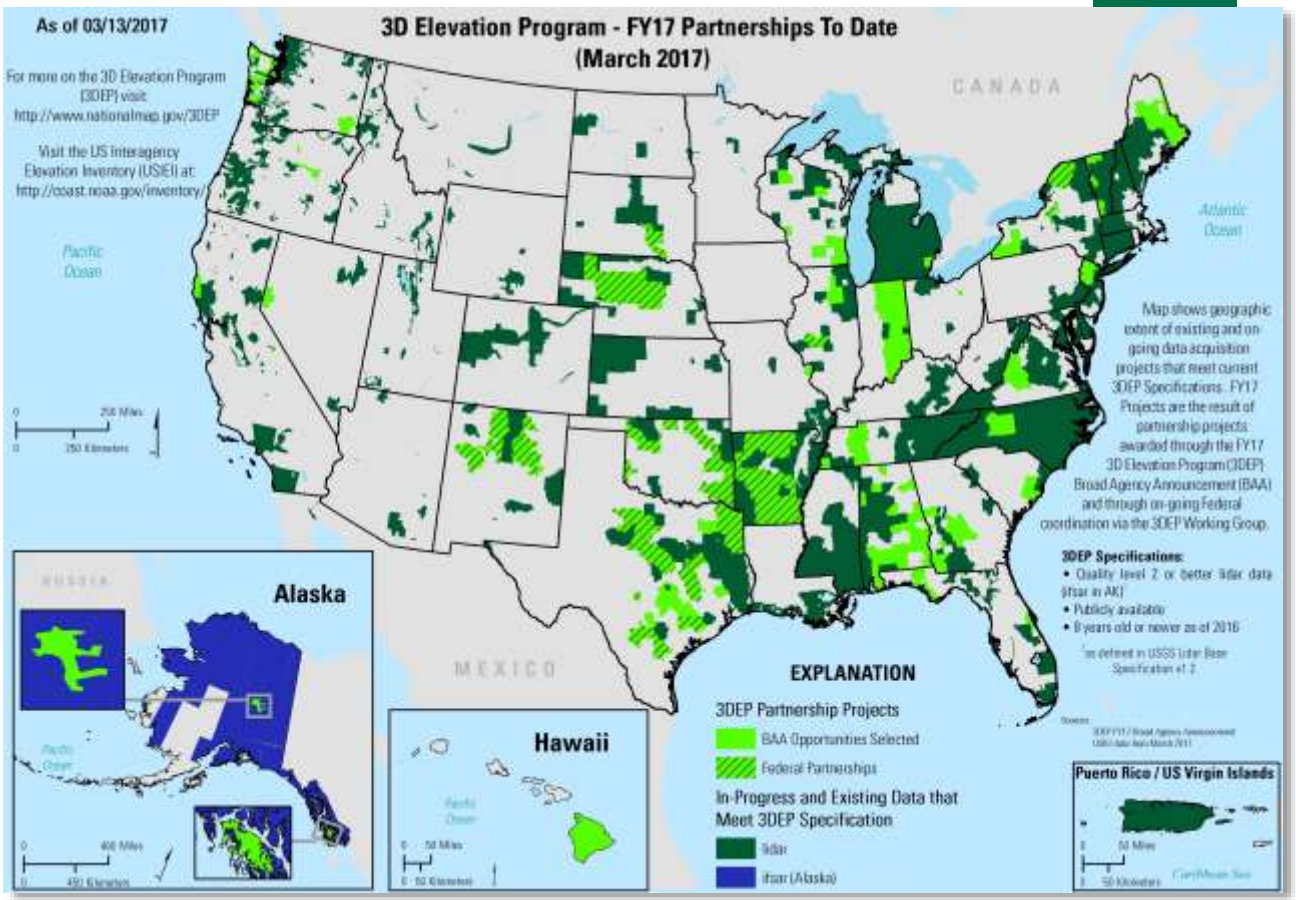
Accessibility FOIA Privacy Policies and Notices

Date received	State	PTS project and link	Square miles	Contract source	Completed date	Quality level
11/3/2015	WI	Lincoln Co	946	GPSC		QL2
11/5/2015	MI	MI_GratiotCo	574	GPSC		QL2
4/23/2015	WA	Elwha River LiDAR 2014 - MOD2	6	GPSC		QL2
10/8/2014	CA	CA_SonomaCo	1,600	partner		QL1
8/25/2015	AZ	AZ_Eastern Pima Co	2,203	partner		QL2
2/17/2016	VA	VA_Eastern-Shore_BAA	1,175	GPSC		QL2
2/13/2015	IL	IL Contributed ILDOT District 4 QL3 (FultonCo)	1,193	contributed		QL3
3/22/2016	WI	WI_Shawano_2015	909	GPSC		QL2
11/17/2015	MO-A	MO-AR 2014 Lidar (Crittenden-Cross)	1,073	partner		QL2
5/23/2016	IL	IL_Ford-Iroqouis-Livingston_2015	486	contributed		QL2
5/23/2016	IL	IL_BureauCO	869	contributed		QL2
2/10/2016	MI	MI_13County_2015_C16 (Allegan Co)	828	contributed		QL2
2/10/2016	MI	MI_13County_2015_C16 (Berrien Co)	571	contributed		QL2
2/10/2016	MI	MI_13County_2015_C16 (VanBurren Co)	611	contributed		QL2
9/12/2016	PA	PA_Allentown Ortho Acq-LiDAR_2016_D16	20	GPSC		QL1
8/2/2016	IL	IL_Pike-Scott_2015	1,100	GPSC		QL2
8/2/2016	FL	FL_SRWMD-LidarGaps-NorthCentralFL (BAA-FY15)_16	1,689	GPSC		QL2
5/1/2016	NH	NH_Connecticut-River_2015 (North-L6)	4,229	GPSC		QL2
4/1/2016	TN	TN 27 County QL2 Lidar (Cumberland Plateau) 16(Blk 1)	2,332	GPSC		QL2
5/3/2016	TN	TN 27 County QL2 Lidar (Cumberland Plateau) 16(Blk 2)	3,232	GPSC		QL2
6/1/2016	TN	TN 27 County QL2 Lidar (Cumberland Plateau) 16(Blk 3)	2,203	GPSC		QL2
7/5/2016	TN	TN 27 County QL2 Lidar (Cumberland Plateau) 16(Blk 4)	3,731	GPSC		QL2
2/18/2016	MI	MI_13County_2015_C16 (Emmet Co)	468	contributed		QL2
7/18/2016	AL	AL_BAA AL 3 County QL2 Lidar_16	2,910	GPSC		QL2
12/22/2015	ND	ND_North Dakota 2014 QL3 Lidar_15 (McKenzie Co)	3,013	partnership		QL3
8/24/2016	WY	WY_Casper-Natrona	354	contributed		QL2
8/11/2016	VA	VA_ChesapeakeBay	3,765	GPSC		QL2
4/15/2016	MI	MI_13County_2015_C16 (BenzieCo)	321	contributed		QL2
4/15/2016	MI	MI_13County_2015_C16 (LeeLanau_Co)	348	contributed		QL2

FY17 Broad Agency Announcement

Status (03/01/17)

- **Summary of proposals**
  - 41 proposals in 25 states
  - Total value of $36.2 M: offering $22.5M and seeking $13.7 M from 3DEP
  - ~155,000 sq. mi.
- **Awards to date**
  - 33 Projects in 25 States
  - Total Value $29M
    - Federal $17.2M:
      USGS $7.6M
      NRCS $6.7M
      FEMA $1M
      Other Feds $1.9
    - Non-Federal $11.8M
  - ~125,000 sq. mi.
- **Reaching new partners –** 20 new and 13 repeat partners
- **Additional Federal investments -** $25.7M and ~121,000 sq. mi



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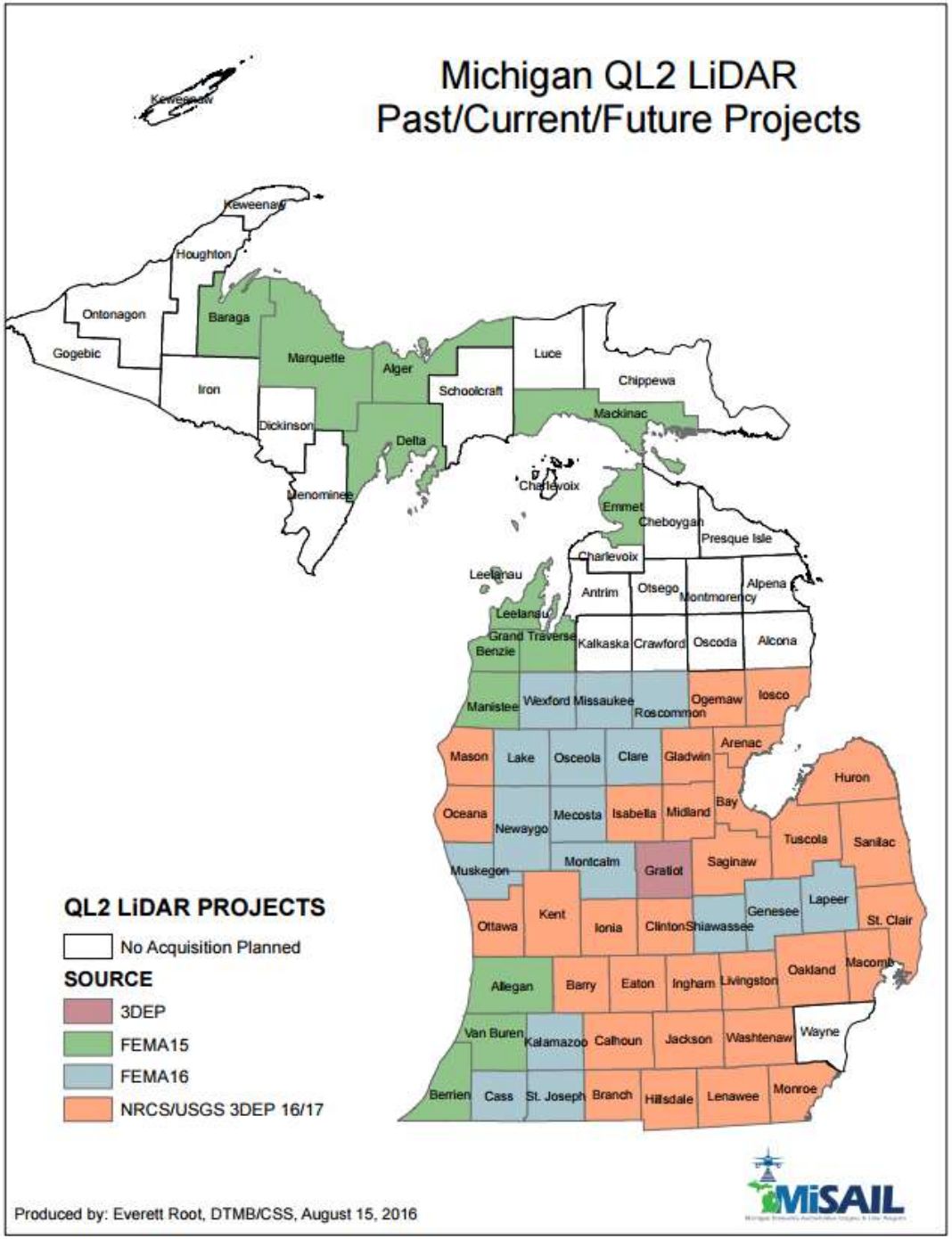
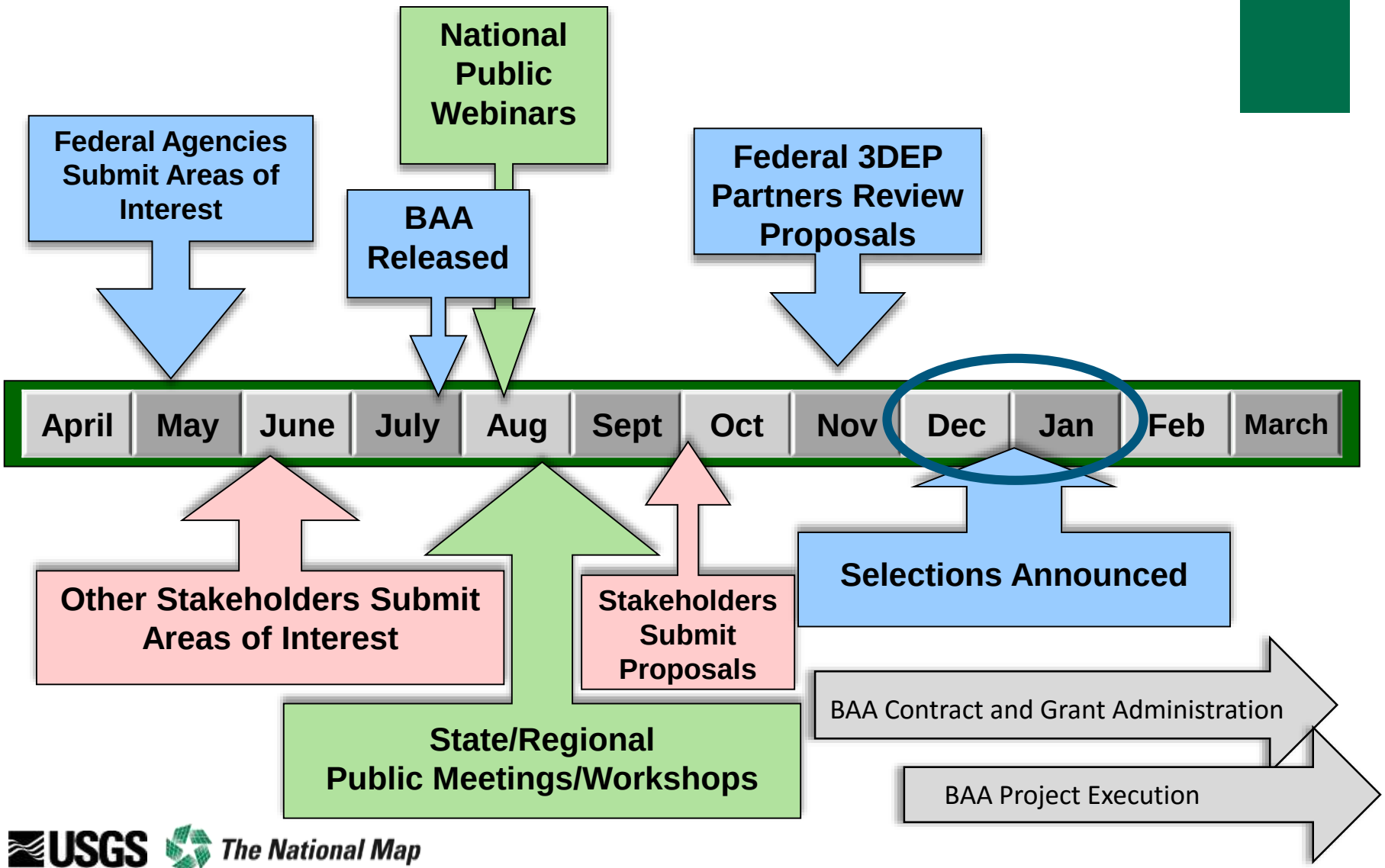
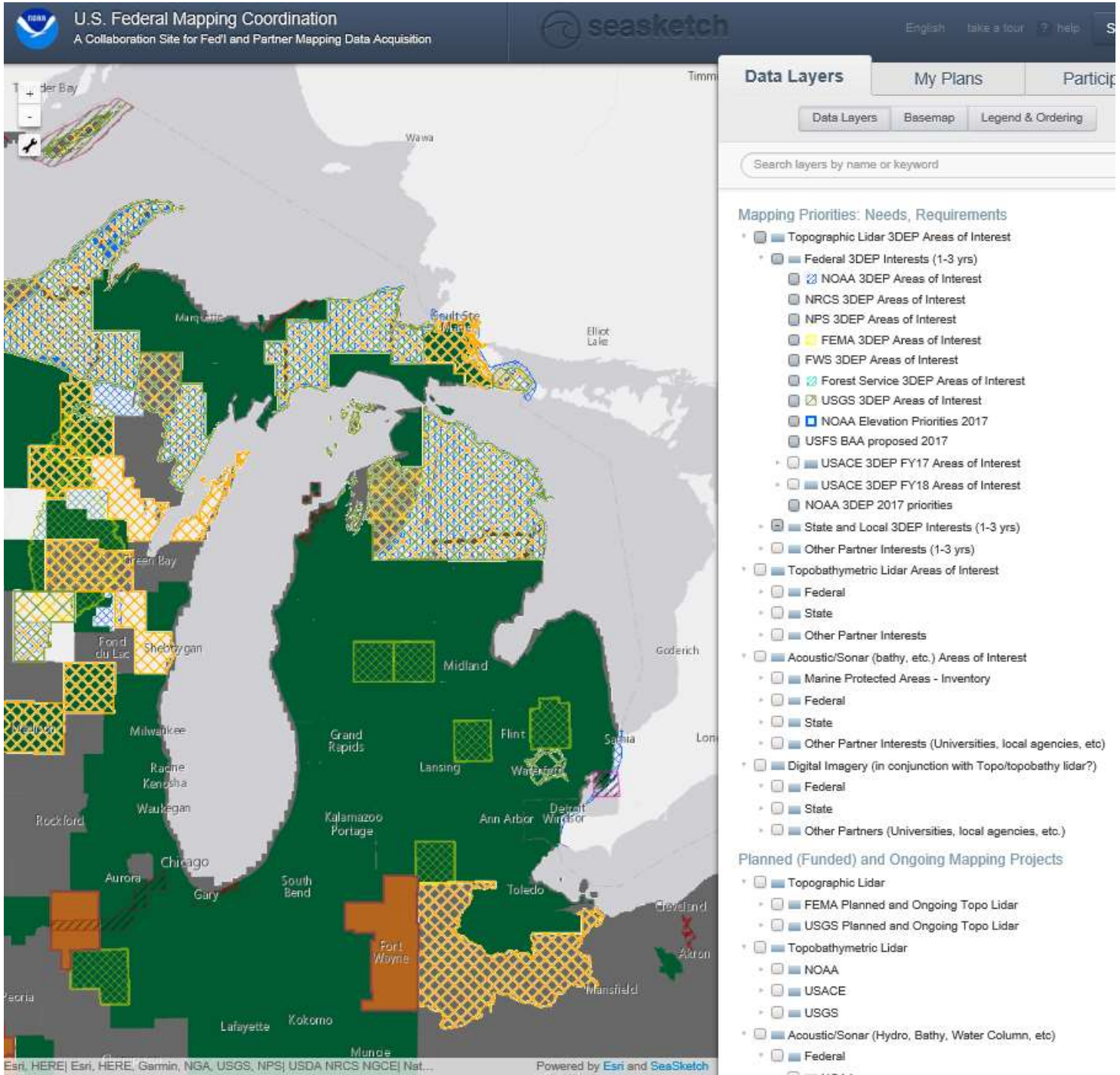

Michigan QL2 LiDAR
Past/Current/Future Projects
Keweenaw
Houghton
Ontonagon
Baraga
Gogebic
Marquette
Alger
Luce
Chippewa
Iron
Schoolcraft
Mackinac
Dickinson
Delta
Menominee
Charlevoix
Emmet
Cheboygan
Presque Isle
Leelanau
Antrim
Otsego
Montmorency
Alpena
Grand Traverse
Kalkaska
Crawford
Oscoda
Alcona
Benzie
Manistee
Wexford
Missaukee
Roscommon
Ogemaw
Iosco
Arenac
Mason
Lake
Osceola
Clare
Gladwin
Huron
Oceana
Newaygo
Mecosta
Isabella
Midland
Bay
Tuscola
Sanilac
Muskegon
Montcalm
Gratiot
Saginaw
Lapeer
Genesee
St. Clair
Ottawa
Kent
Ionia
Clinton
Shiawassee
Oakland
Macomb
Allegan
Barry
Eaton
Ingham
Livingston
Van Buren
Kalamazoo
Calhoun
Jackson
Washtenaw
Wayne
Berrien
Cass
St. Joseph
Branch
Hillsdale
Lenawee
Monroe
QL2 LiDAR PROJECTS
No Acquisition Planned
SOURCE
3DEP
FEMA15
FEMA16
NRCS/USGS 3DEP 16/17
Produced by: Everett Root, DTMB/CSS, August 15, 2016
MiSAIL

3DEP BAA Timeline (Funding Grants)




U.S. Federal Mapping Coordination
A Collaboration Site for Fed'l and Partner Mapping Data Acquisition
seasketch
English
take a tour
? help
Data Layers
My Plans
Data Layers
Basemap
Legend & Ordering
Search layers by name or keyword
Mapping Priorities: Needs, Requirements
Topographic Lidar 3DEP Areas of Interest
Federal 3DEP Interests (1-3 yrs)
NOAA 3DEP Areas of Interest
NRCS 3DEP Areas of Interest
NPS 3DEP Areas of Interest
FEMA 3DEP Areas of Interest
FWS 3DEP Areas of Interest
Forest Service 3DEP Areas of Interest
USGS 3DEP Areas of Interest
NOAA Elevation Priorities 2017
USFS BAA proposed 2017
USACE 3DEP FY17 Areas of Interest
USACE 3DEP FY18 Areas of Interest
NOAA 3DEP 2017 priorities
State and Local 3DEP Interests (1-3 yrs)
Other Partner Interests (1-3 yrs)
Topobathymetric Lidar Areas of Interest
Federal
State
Other Partner Interests
Acoustic/Sonar (bathy, etc.) Areas of Interest
Marine Protected Areas - Inventory
Federal
State
Other Partner Interests (Universities, local agencies, etc)
Digital Imagery (in conjunction with Topo/topobathy lidar?)
Federal
State
Other Partners (Universities, local agencies, etc.)
Planned (Funded) and Ongoing Mapping Projects
Topographic Lidar
FEMA Planned and Ongoing Topo Lidar
USGS Planned and Ongoing Topo Lidar
Topobathymetric Lidar
NOAA
USACE
USGS
Acoustic/Sonar (Hydro, Bathy, Water Column, etc)
Federal
Wawa
Elliot Lake
Midland
Goderich
Grand Rapids
Flint
Lansing
Waterford
Detroit
Windsor
Ann Arbor
Milwaukee
Racine
Kenosha
Waukegan
Rockford
Chicago
Aurora
Gary
South Bend
Kalamazoo
Portage
Toledo
Cleveland
Akron
Fort Wayne
Mansfield
Lafayette
Kokomo
Muncie
Peoria
Sheboygan
Fond du Lac
Green Bay
Esri, HERE| Esri, HERE, Garmin, NGA, USGS, NPS| USDA NRCS NGCE| Nat...
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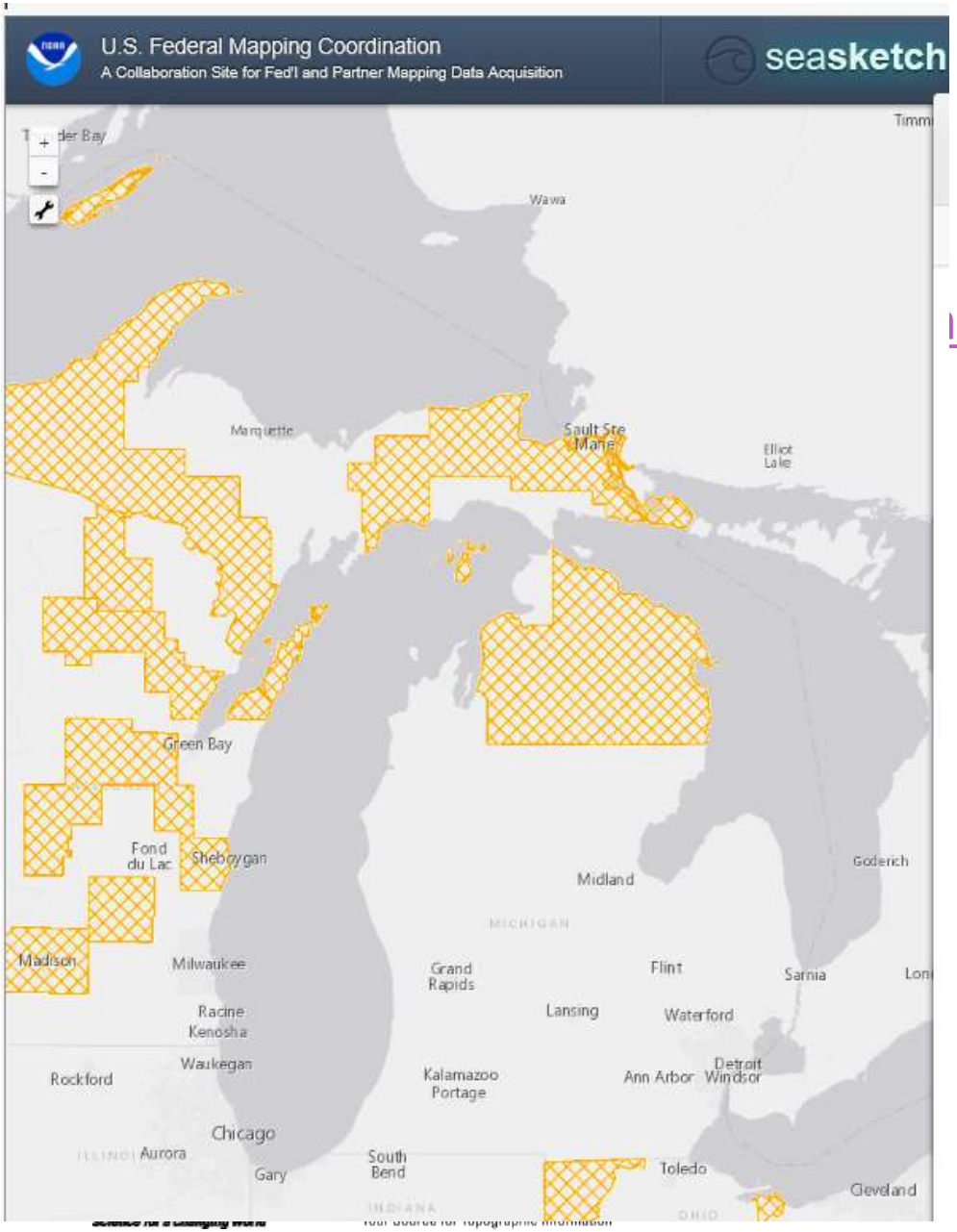
Seasketch


U.S. Federal Mapping Coordination
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Fond du Lac
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Racine
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Chicago
Aurora
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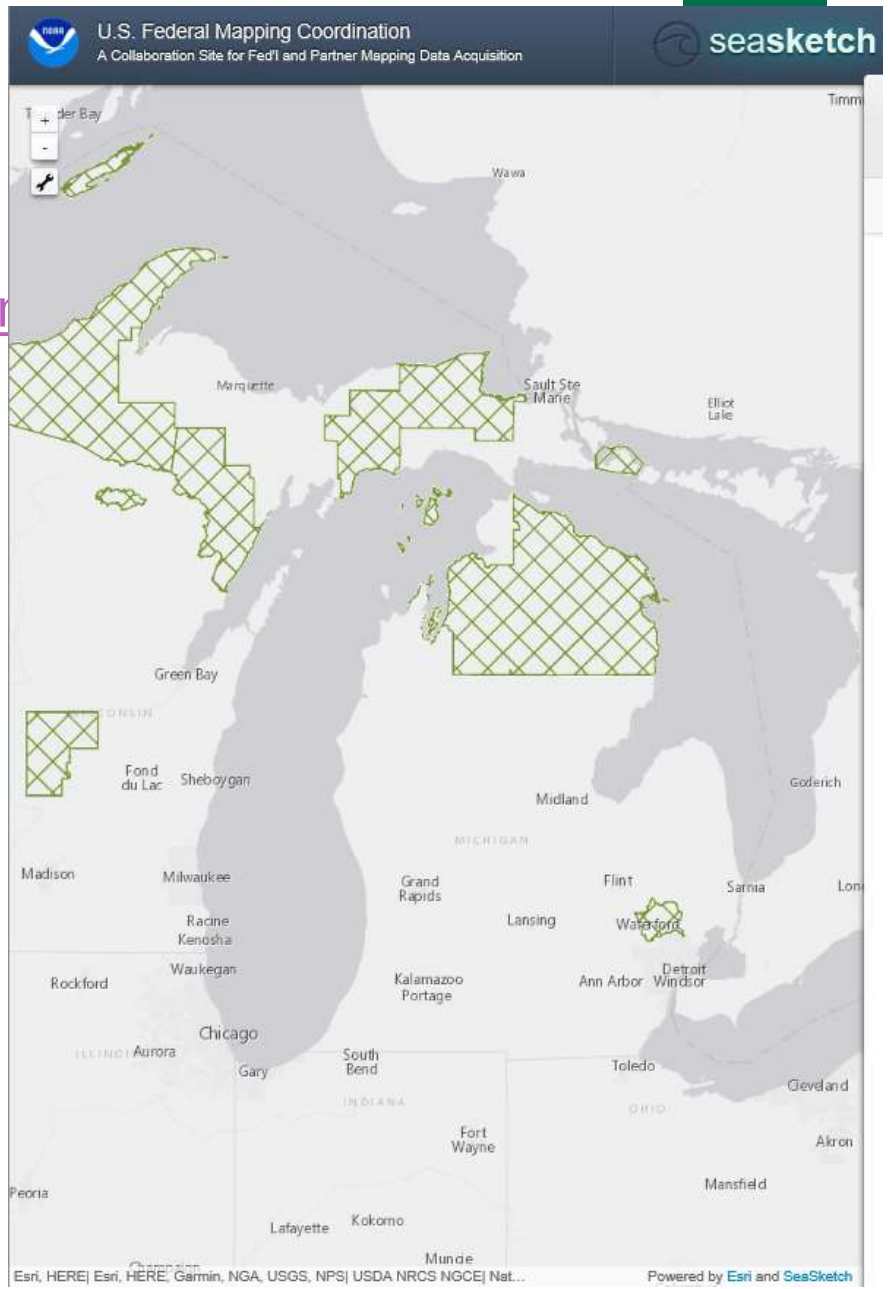
Cleveland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Aurora
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Cleveland
Fort Wayne
Akron
Mansfield
Peoria
Lafayette
Kokomo
Muncie
Esri, HERE| Esri, HERE, Garmin, NGA, USGS, NPS| USDA NRCS NGCE| Nat...
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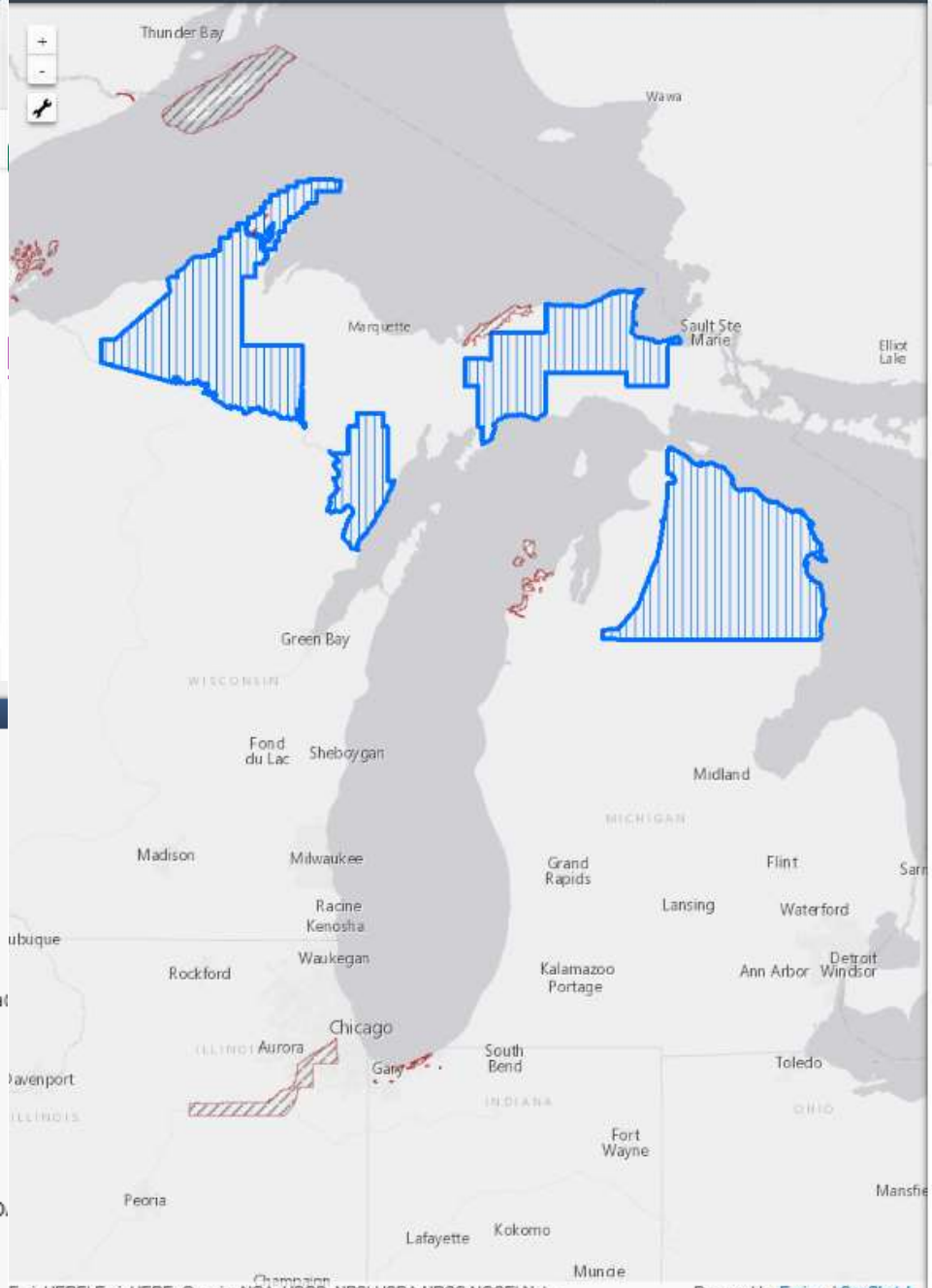
FS_Requirements_addl

OBJECTID	3
SHAPE	Polygon
Project_Name	Huron National Forest land in Crawford, Oscoda and Alcona Counties, Michigan
Data_Type	Lidar-Topo
CollectionYear	2018
ProjectStatus	3DEP Area of Interest
Restrictions	Unknown
State	MI
Point_Of_Contact	Trevor Hobbs/Terry Saarela, HMNF, 231-775-2421, tchobbs@fs.fed.us/tsaarela(
Metadata_Link	Null
Data Access	Null
Horizontal_Datum	Null
Horizontal_Accuracy	1 meter
Vertical_Accuracy	10 cm RMSE NVA
Vertical_Datum	Null
Notes	This would complete coverage at QL2 for the Huron-Manistee NF. Looks like NO. interest in this area as well.
Point_Spacing	< 0.71 m

U.S. Federal Mapping Coordination
A Collaboration Site for Fed'l and Partner Mapping Data Acquisition
seasketch



Esri, HERE| Esri, HERE, Garmin, NGA, USGS, NPS| USDA NRCS NGCE| Nat...
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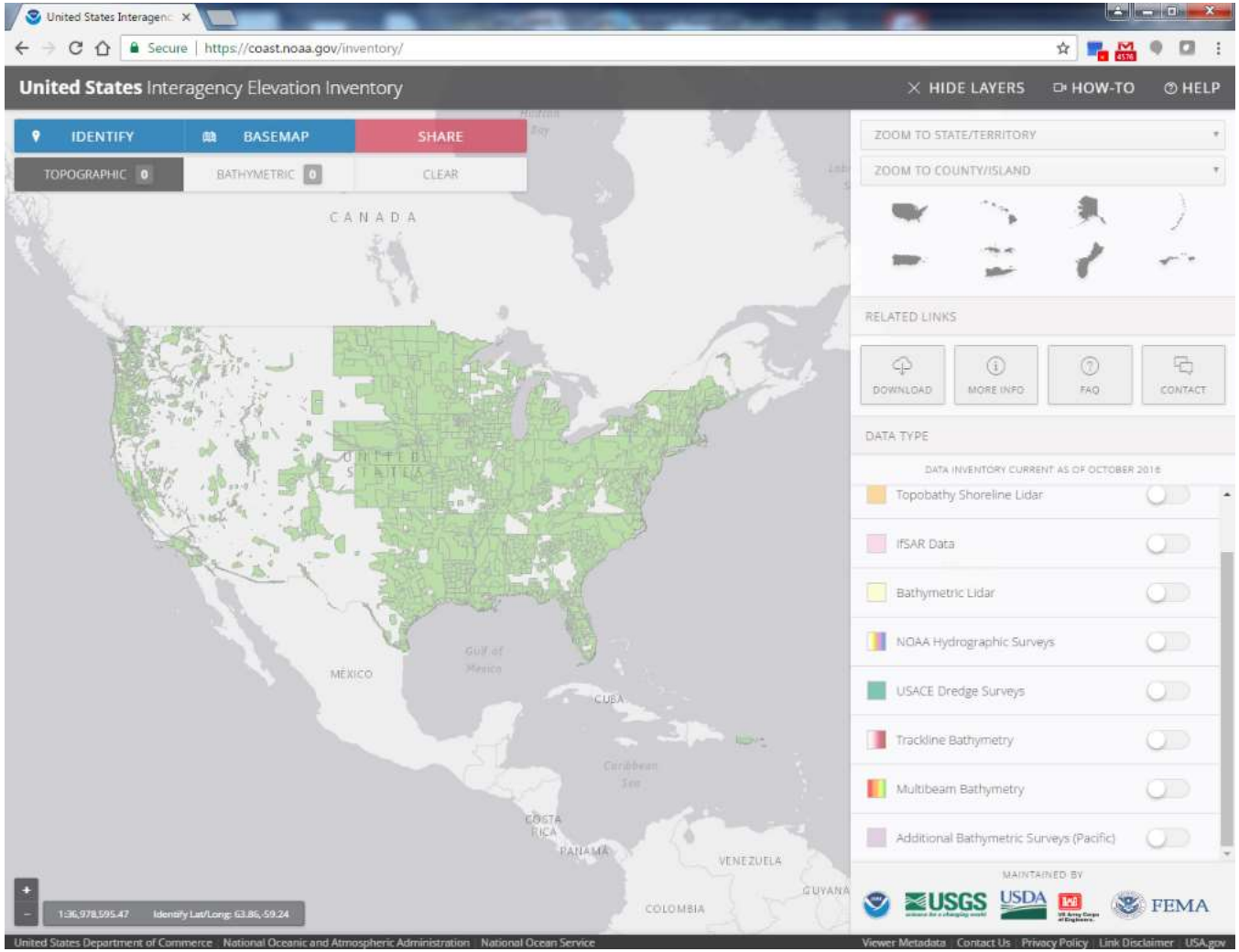
U.S. Interagency Elevation Inventory

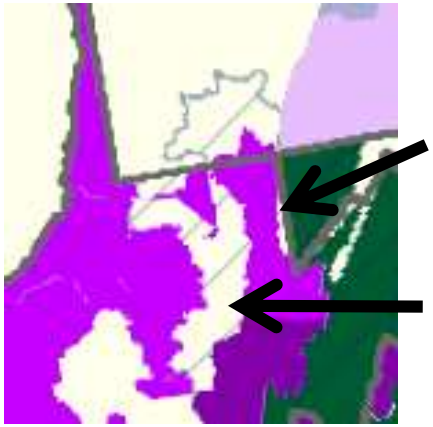
https://coast.noaa.gov/inventory/



3DEP Multi-Year Planning

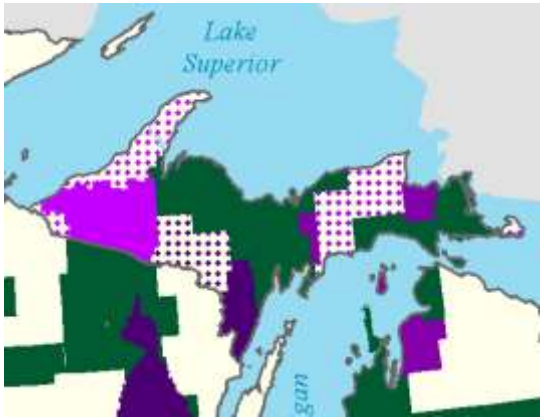
Next Steps – Transform individual agency plans and needs into a collaborative national acquisition plan

- Overall goal is to leverage interests and maximize acquisition coverage
- All projects need to be compared to existing data and each other to fill in gaps and create optimal collection strategy
  - Coordinate among Federal agencies
  - Coordinate with non-Federal partners through development of state plans and BAA projects
  - Use USGS 3DEP funding to help fill in



Design projects to avoid leaving coverage gaps

Revisit unfunded requirements with opportunity to leverage with a funded project



Use funded projects to guide larger, regional acquisitions – ex. complete all of Upper Peninsula, MI (i.e. expand to included dot-shaded area)

Funded Requirements Year
- 2017 Planned EOY Funds
- 2018
- 2019
- 2020
- Unknown
- Potential 3DEP Project Expansion
- No publicly available 3DEP lidar data

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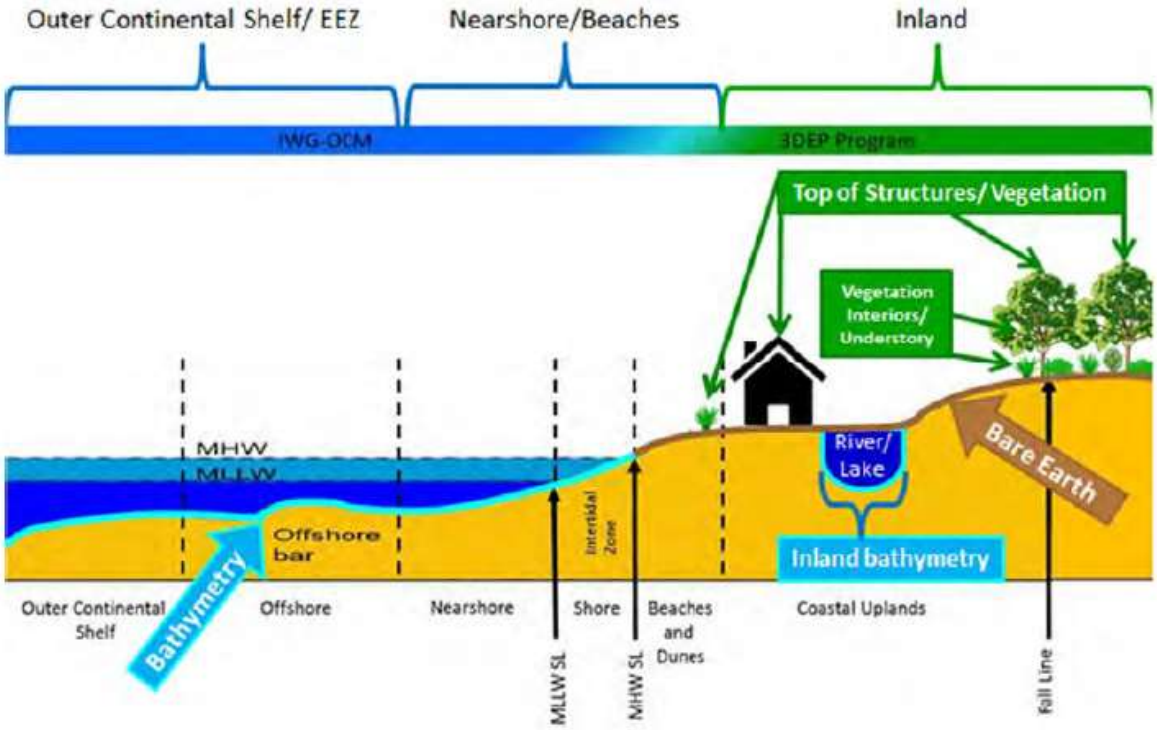
3D Nation Requirements and Benefits Study

(NEEA update with more coastal and inland topobathy)

Question 9. For your Mission Critical Activity, how would you characterize the area for which you need 3D data? Check all that apply.

- ☐ Inland, including inland waters
- ☐ Nearshore/Beaches
- ☐ Offshore/Outer Continental Shelf/EEZ



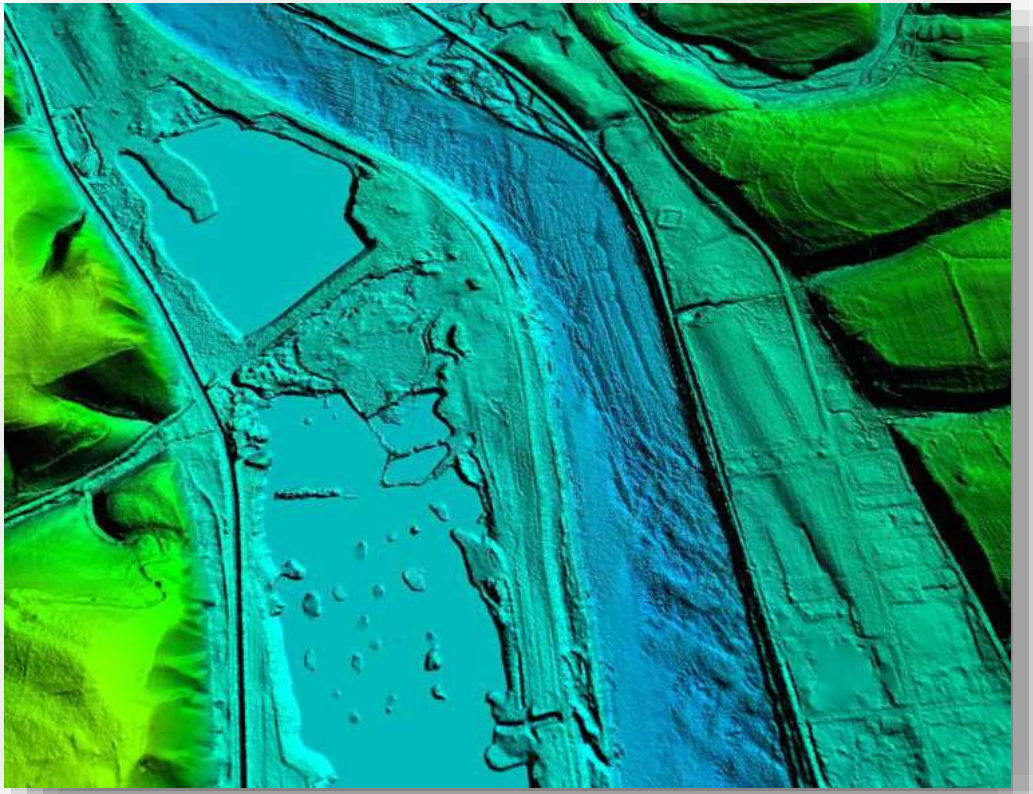
Question 10. For your Mission Critical Activity, what do you need/want to measure in 3D? Check all that apply.

- ☐ Bare earth ground

USGS science for a changing world

Emerging Technology

- Geiger mode and single photon lidar tests
  - Potential to increase quality and/or bring down costs
  - Pilots in NC, SD, and IL
- Inland bathymetry
  - Technology proven in coastal areas
  - Initial tests by EAARL-B in Delaware River were promising
  - Commercial sensors becoming available
  - Begin assessments of commercial capabilities in FY17



Frenchtown Subregion of the Delaware River, integrated EAARL-B and topographic lidar

Handout with links

USGS National Map Links – Handout at Michigan IMAGIN – 6/5/17

USGS > https://www.usgs.gov/
USGS Michigan Water Science Center > https://mi.water.usgs.gov/

* **The National Map > http://nationalmap.gov**
* National Map videos > https://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html

National Geospatial Program >
https://www.usgs.gov/science/mission-areas/core-science-systems/national-geospatial-program
National Map FAQ's > https://www2.usgs.gov/faq/categories/9854

US Topo > https://nationalmap.gov/ustopo/
For 2017 Michigan has 1,290 new US Topo maps
Historical Topographic Map Collection > https://nationalmap.gov/historical/

FAQ - How do I find and download US Topo and HTMC maps?
https://www2.usgs.gov/faq/categories/9797/3571
See short videos at > http://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html
Lesson 4c - Downloading Maps with National Map Download Client
Lesson 9a - Accessing US Topo through USGS Store
Lesson 9b - Accessing USGS Historical Maps Through TopoView
Lesson 6b - Using USGS The National Map Data on Mobile Devices

US Topo Style Template (to create ESRI ArcGIS v10x map document (mxd) and geod
files) > https://viewer.nationalmap.gov/tools/topotemplate/

National Map Hydrography > https://nhd.usgs.gov
National Hydrography Dataset (NHD)
Watershed Boundary Dataset (WBD) > https://nhd.usgs.gov/wbd.html
NHDPlus High Resolution (NHDPlus HR) > https://nhd.usgs.gov/NHDPlus_HR.html

NHD monthly newsletter > https://nhd.usgs.gov/newsletter_list.html
USGS Hydrography Seminar Series > https://nhd.usgs.gov/HydrographySeminarSeries.html

Hydrography Requirements and Benefits Study > https://nationalmap.gov/HRBS.html
> http://www.dewberry.com/services/geospatial/national-hydrography-requirements-and-benefits-study
Michigan section pages C-621 to C-648

Michigan Drain Commissioners (MACDC) plan for NHD >
http://www.michigan.gov/documents/cgi/MACDC_Business_Plan_Final_Draft_v4r_470878_7.pdf
> http://www.michigan.gov/cgi/0,4548,7-158-52927_53037_12699---,00.html

Introducing the NHDPlus High Resolution: A new framework for water-related information >
https://www.usgs.gov/news/introducing-nhdplus-high-resolution-a-new-framework-water-related-information
> https://www.usgs.gov/news/technical-announcements
National Hydrography Dataset / Watershed Boundary Dataset Map Service Improvement >
https://www.usgs.gov/news/national-hydrography-dataset-watershed-boundary-dataset-map-service-improvement

National Map Corps – Volunteered Geographic Information (VGI)
> https://nationalmap.gov/TheNationalMapCorps

3D Elevation Program: Summary for Michigan - USGS Fact Sheet 2014-3107
> http://pubs.usgs.gov/fs/2014/3107/pdf/fs2014-3107.pdf
Other state 3DEP fact sheets > https://nationalmap.gov/3DEP/3dep_statefactsheets.html

2016 Michigan QL2 status from DTMB >
https://content.govdelivery.com/attachments/MIDEPTTMB/2016/08/24/file_attachments/608001/MI_LiDAR_QL2_Status_20160815.pdf

2017 lidar partnership awards
> https://www.usgs.gov/news/2017-lidar-partnership-awards-announced
Wayne County Michigan Lidar – 3DEP 2017
> https://nationalmap.gov/3DEP/3dep_fy17projectlist.html#Michigan
USDA NRCS Michigan 2016 3DEP lidar for 30 counties
> https://nationalmap.gov/3DEP/3dep_fy16projectlist.html#Michigan

3DEP fact sheets and publications > https://nationalmap.gov/3DEP/3dep_pubs.html
3DEP and America's Infrastructure > https://pubs.usgs.gov/fs/2016/3093/fs20163093.pdf

3DEP - Precision Agriculture and Other Farm Practices
> https://pubs.usgs.gov/fs/2016/3088/fs20163088.pdf
3DEP – Landslide Recognition, Hazard Assessment, and Mitigation Support
> https://pubs.usgs.gov/fs/2016/3094/fs20163094.pdf

Lidar Base Specifications: Techniques and Methods 11–B4
> https://pubs.usgs.gov/tm/11b4/ > https://pubs.usgs.gov/tm/11b4/pdf/tm11-B4.pdf

Lidar Topography and Hydrographic Integration: Fundamentals and Application Issues
> https://nhd.usgs.gov/documents/Hydrography_Seminar_8_Heidemann.pdf

Seasketch – lidar wish list areas of interest > http://seasket.ch/hwpR3E-MxO
> http://www.seasketch.org/#projecthomepage/5272840f6ec5f42d210016e4/layers
Six-minute video "Using SeaSketch to View 3DEP Lidar Areas of Interest (Lesson 11d)"
> https://www.usgs.gov/media/videos/using-seasketch-view-3dep-lidar-areas-interest-lesson-11d
> https://www.youtube.com/watch?v=H-Q-YyZuZvo
From NM video set > https://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html

US Interagency Elevation Inventory > https://www.csc.noaa.gov/inventory/

National Enhanced Elevation Assessment (NEEA) pages 386-388 for Michigan section
> https://nationalmap.gov/3DEP/3dep_neea.html
> http://www.dewberry.com/services/geospatial/national-enhanced-elevation-assessment

Draft 3D Nation Study Questionnaire
3D Nation Requirements and Benefits Elevation Data Study Questionnaire (NEEA II) >
https://iocm.noaa.gov/iwg/docs/3D-Nation-Questionnaire-DRAFT-clean-FRN-02-23-17.pdf
> https://iocm.noaa.gov/iwg/ > https://iocm.noaa.gov/

National Map technical support help desk > tnm_help@usgs.gov
USGS customer support > ask@usgs.gov > 1-888-ASK-USGS (1-888-275-8747) > http://ask.usgs.gov

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Reminder 4:15 Ele-Hydro with Andrew

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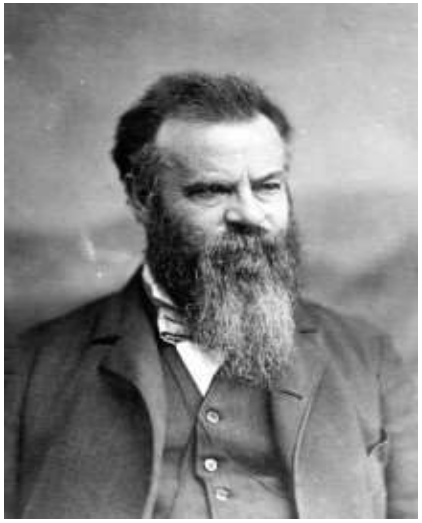
http://nationalmap.gov

National Map help > tnm_help@usgs.gov

- Ask USGS
- Email: ask@usgs.gov,
- Phone 1-888-ASK-USGS
- Web http://www.usgs.gov

US Topo Program

USGS Topographic mapping background



John Wesley Powell (1834-1902), 2nd USGS Director, establishes the topographic mapping program in 1884

"A Government cannot do any scientific work of more value to the people at large than by causing the construction of proper topographic maps of the country."

Henry Gannett (1846-1914)

Appointed by Powell to be the USGS Chief Geographer in 1882

Considered father of topographic mapping in the US

USGS National Map Links – Handout at Michigan IMAGIN – 6/5/17

USGS > https://www.usgs.gov/
USGS Michigan Water Science Center > https://mi.water.usgs.gov/

*** The National Map > http://nationalmap.gov**
***** National Map videos > https://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html

National Geospatial Program >
https://www.usgs.gov/science/mission-areas/core-science-systems/national-geospatial-program
National Map FAQ's > https://www2.usgs.gov/faq/categories/9854

US Topo > https://nationalmap.gov/ustopo/
For 2017 Michigan has 1,290 new US Topo maps
Historical Topographic Map Collection > https://nationalmap.gov/historical/

FAQ - How do I find and download US Topo and HTMC maps?
https://www2.usgs.gov/faq/categories/9797/3571
See short videos at > http://training.usgs.gov/TEL/TheNationalMap/TNM-TEL-Index.html
Lesson 4c - Downloading Maps with National Map Download Client
Lesson 9a - Accessing US Topo through USGS Store
Lesson 9b - Accessing USGS Historical Maps Through TopoView
Lesson 6b - Using USGS The National Map Data on Mobile Devices

US Topo Style Template (to create ESRI ArcGIS v10x map document (mxd) and geodatabase files) >
https://viewer.nationalmap.gov/tools/topotemplate/

National Map Hydrography > https://nhd.usgs.gov
National Hydrography Dataset (NHD)
Watershed Boundary Dataset (WBD) > https://nhd.usgs.gov/wbd.html
NHDPlus High Resolution (NHDPlus HR) > https://nhd.usgs.gov/NHDPlus_HR.html

NHD monthly newsletter > https://nhd.usgs.gov/newsletter_list.html
USGS Hydrography Seminar Series > https://nhd.usgs.gov/HydrographySeminarSeries.html

Hydrography Requirements and Benefits Study > https://nationalmap.gov/HRBS.html
> http://www.dewberry.com/services/geospatial/national-hydrography-requirements-and-benefits-study
Michigan section pages C-621 to C-648

Michigan Drain Commissioners (MACDC) plan for NHD >
http://www.michigan.gov/documents/cgi/MACDC_Business_Plan_Final_Draft_v4r_470878_7.pdf
> http://www.michigan.gov/cgi/0,4548,7-158-52927_53037_12699---,00.html

Introducing the NHDPlus High Resolution: A new framework for water-related information >
https://www.usgs.gov/news/introducing-nhdplus-high-resolution-a-new-framework-water-related-information
> https://www.usgs.gov/news/technical-announcements
National Hydrography Dataset / Watershed Boundary Dataset Map Service Improvement >
https://www.usgs.gov/news/national-hydrography-dataset-watershed-boundary-dataset-map-service-improvement

National Map Corps – Volunteered Geographic Information (VGI)
> https://nationalmap.gov/TheNationalMapCorps
Structures > https://nationalmap.gov/structures.html

Geographic names – BGN, GNIS > https://geonames.usgs.gov/
> https://nationalmap.gov/gnis.html

National Map Elevation / 3DElevation Program (3DEP) / Lidar
> https://nationalmap.gov/3dep/ > https://nationalmap.gov/elevation.html

3D Elevation Program: Summary for Michigan - USGS Fact Sheet 2014-3107
> http://pubs.usgs.gov/fs/2014/3107/pdf/fs2014-3107.pdf
Other state 3DEP fact sheets > https://nationalmap.gov/3DEP/3dep_statefactsheets.html

2016 Michigan QL2 status from DTMB >
https://content.govdelivery.com/attachments/MIDEPTTMB/2016/08/24/file_attachments/608001/MI_LiDAR_QL2_Status_20160815.pdf

2017 lidar partnership awards
> https://www.usgs.gov/news/2017-lidar-partnership-awards-announced
Wayne County Michigan Lidar – 3DEP 2017
> https://nationalmap.gov/3DEP/3dep_fy17projectlist.html#Michigan
USDA NRCS Michigan 2016 3DEP lidar for 30 counties
> https://nationalmap.gov/3DEP/3dep_fy16projectlist.html#Michigan

3DEP fact sheets and publications > https://nationalmap.gov/3DEP/3dep_pubs.html
3DEP and America's Infrastructure > https://pubs.usgs.gov/fs/2016/3093/fs20163093.pdf

3DEP - Precision Agriculture and Other Farm Practices
> https://pubs.usgs.gov/fs/2016/3088/fs20163088.pdf
3DEP – Landslide Recognition, Hazard Assessment, and Mitigation Support
> https://pubs.usgs.gov/fs/2016/3094/fs20163094.pdf

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