



USGS 3DEP & Water Policy

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3DEP Coalition – www.3dep4america.com

April 3, 2019

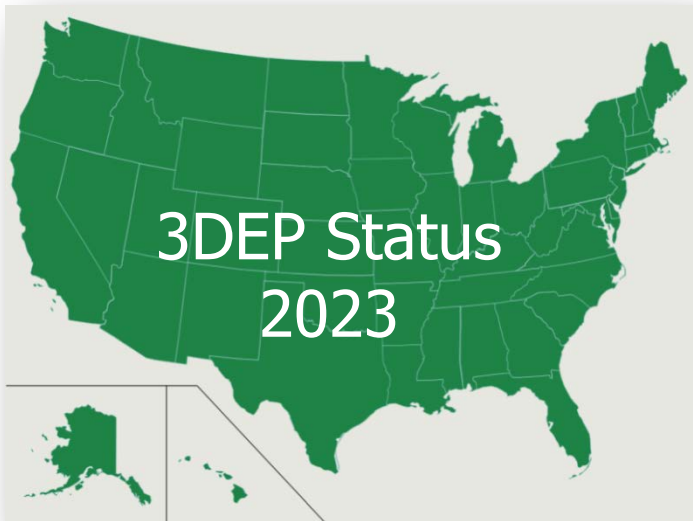
USGS 3DEP & Water Policy

- + U.S. Geological Survey (USGS)
3D Elevation Program (3DEP)
- + Improvement of Mapping,
Addresses, Geography,
Elevations and Structures
(IMAGES) Act



3D Elevation Program (3DEP) Goals

- Complete acquisition of nationwide lidar (IfSAR in AK) in 8 years
- Address Federal, state and other mission-critical requirements
- Realize ROI 5:1 and potential to generate \$13 billion/year
- Leverage the capability and capacity of private mapping firms
- Achieve a 25% cost efficiency gain
- Completely refresh national data holdings



Rank	Business Use	Annual Benefits	
		Conservative	Potential
1	Flood Risk Management	\$295M	\$502M
2	Infrastructure and Construction Management	\$206M	\$942M
3	Natural Resources Conservation	\$159M	\$335M
4	Agriculture and Precision Farming	\$122M	\$2,011M
5	Water Supply and Quality	\$85M	\$156M
6	Wildfire Management, Planning and Response	\$76M	\$159M
7	Geologic Resource Assessment and Hazard Mitigation	\$52M	\$1,067M
8	Forest Resources Management	\$44M	\$62M
9	River and Stream Resource Management	\$38M	\$87M
10	Aviation Navigation and Safety	\$35M	\$56M
:			
20	Land Navigation and Safety	\$0.2M	\$7,125M
Total for all Business Uses (1 – 27)		\$1.2B	\$13B

+ 3D Elevation Program (3DEP)

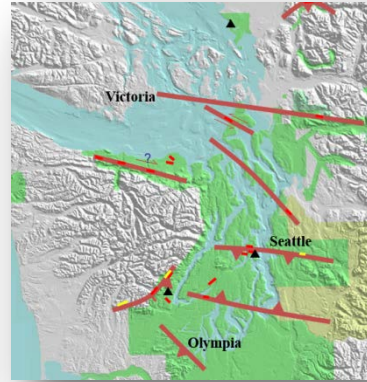
Applications



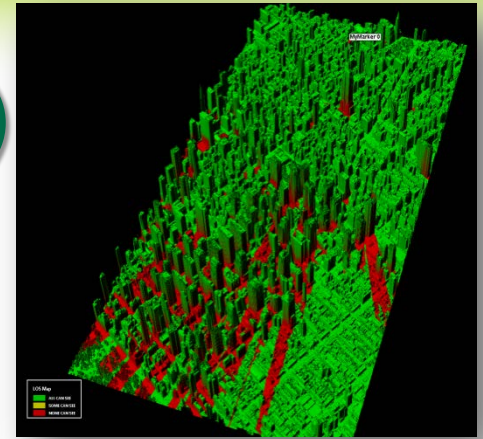
Flood Risk Management



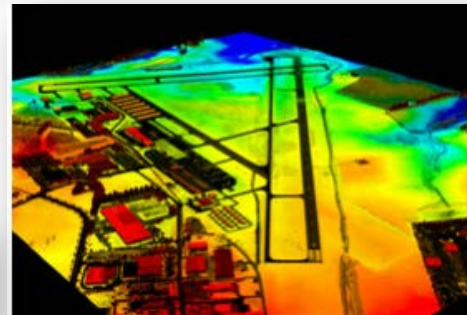
Critical Minerals



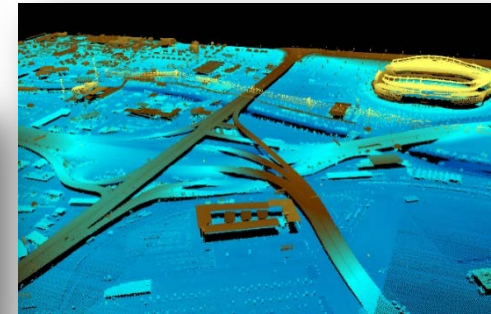
Seismic Hazards



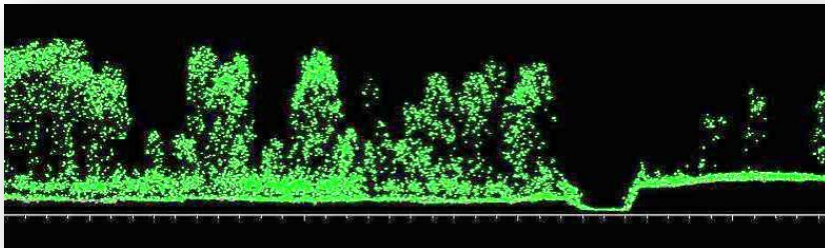
Broadband



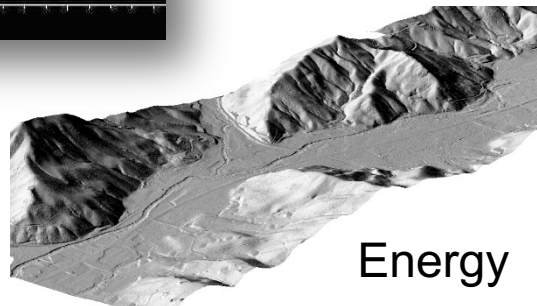
Aviation Safety



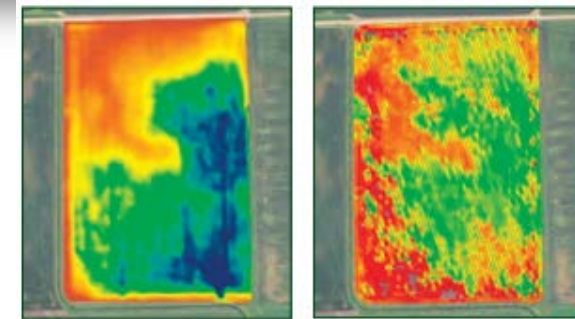
Infrastructure



Forestry



Energy



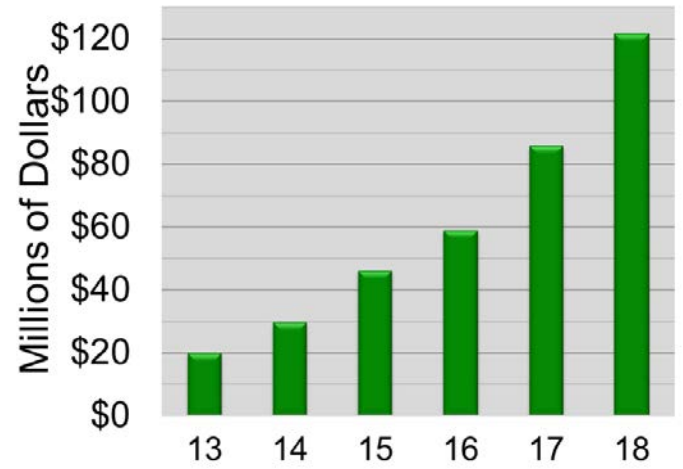
Precision Agriculture



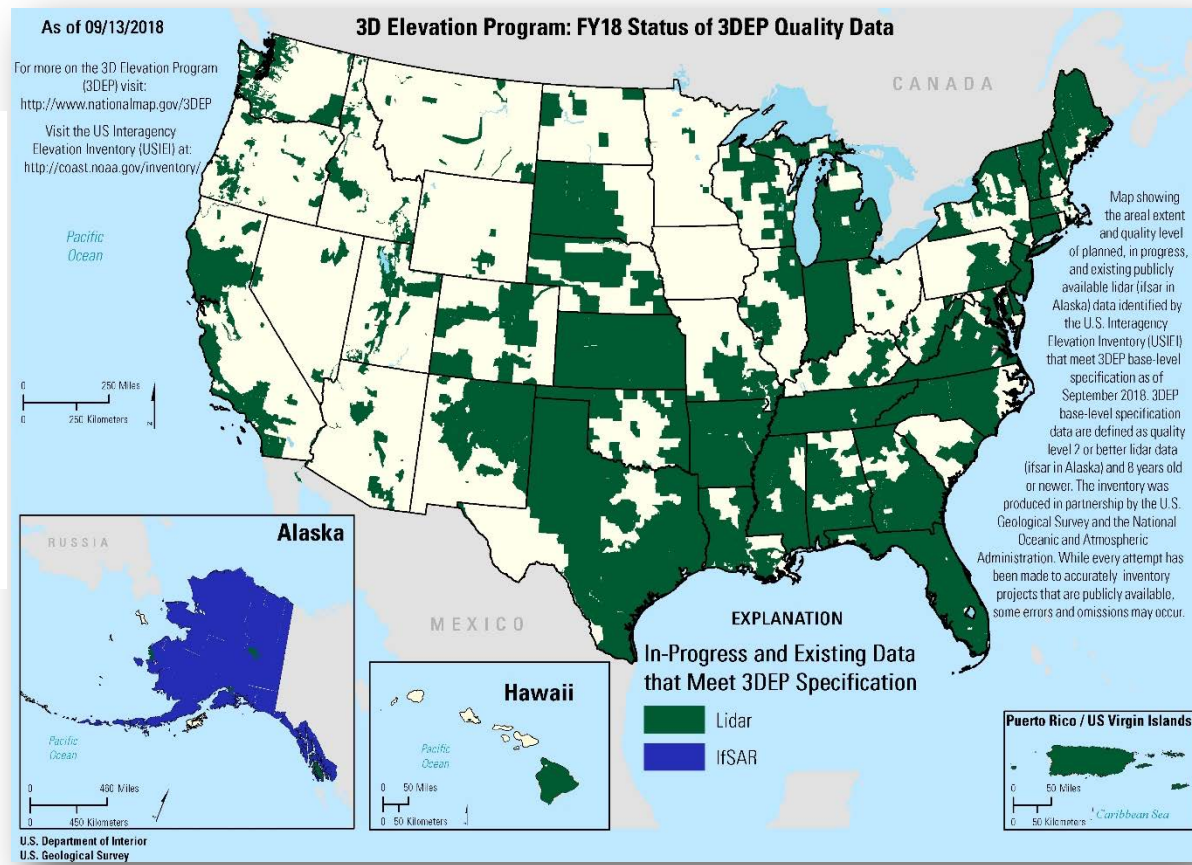
3DEP Status Including FY18 Partnerships

Data are available or in progress for 53% of the Nation

*includes lidar and AK IfSAR



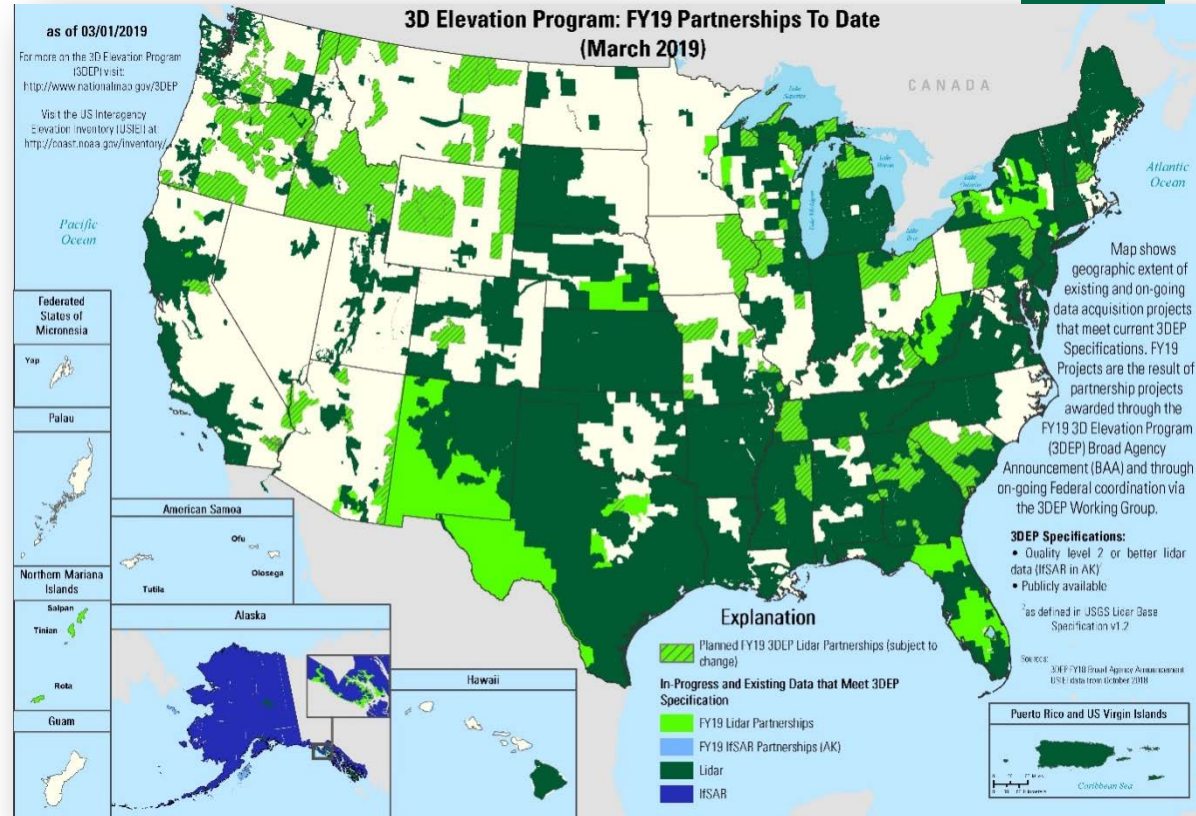
Data acquisition investments by all partners, by fiscal year



3DEP FY19 Partnerships

Broad Agency Announcement (BAA) and Federal Partnerships To Date

- FY19 BAA
 - Received 35 proposals in 23 states for a total value of \$36.3M
 - Applicants offering \$25.5M and requesting \$10.8M from 3DEP
 - As of 03/01/19 accepted 28 proposals; others may be awarded as funding becomes available
- 3DEP BAA will be amended early March, to request lidar partnerships for Earth MRI priority areas

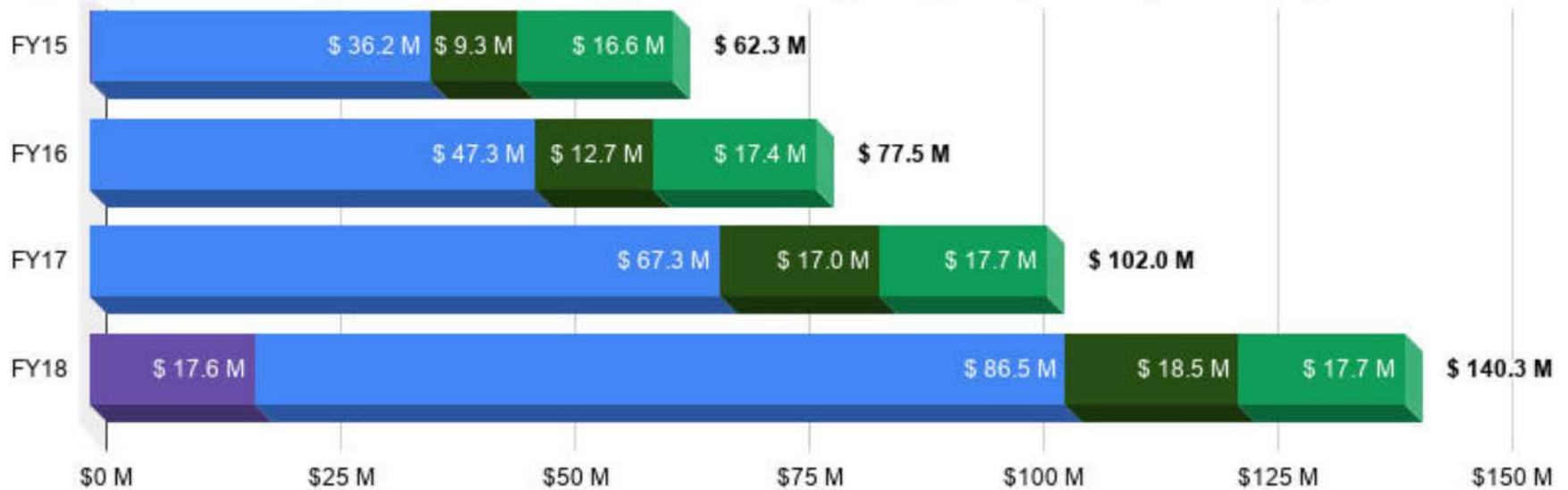


+ 3DEP Expenditures

Fiscal Year 2015-2018

Data Acquisition Funded by Supplemental Appropriations Partners

Funded by USGS NGP Data Acquisition Program management, data processing and delivery





FY19 Enacted and FY20 President's Budget

Core Science Systems	2018 Actual	2019 CR	2020 Request	Change
National Land Imaging Program (<i>new structure</i>).....	[101,065]	[101,065]	88,955	+88,955
Science Synthesis, Analysis, and Research Program.....	24,051	24,051	25,987	+1,936
National Cooperative Geological Mapping Program.....	24,397	24,397	24,397	0
National Geospatial Program.....	67,854	67,854	67,854	0
Subtotal, Core Science Systems	116,302	116,302	207,193	+90,891

	2018 Enacted	2019 President's Budget Request	2019 CR	2019 Omnibus	2020 President's Budget
3DEP	\$36.2M	\$24.6M	\$36.2M	\$37.7M	\$36.2M

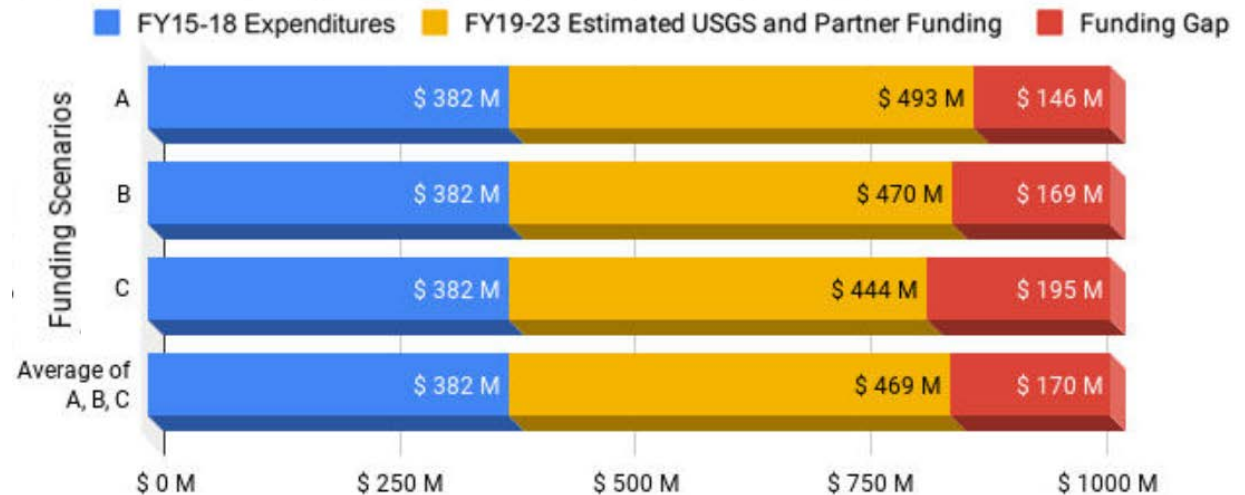
March 14th - USGS Stakeholder Listening Session, 10:00 am

March 18th - USGS detailed budget justification released

3DEP Goal to Complete Acquisition by 2023

Funding Gap

- Partnership scenarios - USGS:Partner funding – all assume 1:1 partnering on Federal lands
 - A: 1:4
 - B: 1:2
 - C: 1:1
 - Average of A, B and C



- Partner funding has been harder to raise for the western U.S. due to smaller tax bases and the presence of large areas of Federal lands; while partnering ratios of 1:4 or more are common in other areas of the US, the ratio will likely be lower in the western US – A is least likely scenario
- The total estimated cost for all scenarios is approximately \$1.021B. The [3D Elevation Program Initiative— A Call for Action](#) published in 2014 estimated total program costs at \$146M annually for 8 years, for a total of \$1.168B. Today's estimated cost of \$1.021B is \$147M less largely due to decreasing cost of acquisition since 2014
- **This projection is based on FY19 enacted – not FY20 PB released March 11 – so loss of \$1.5M in FY20 is NOT reflected – this will be updated on the website as soon as possible**



3DEP By the Numbers

Now maintained online

<https://www.usgs.gov/core-science-systems/ngp/3dep/3dep-numbers>



3D Elevation Program

- HOME
- WHAT IS 3DEP**
- About 3DEP Products & Services
- 3DEP Data Acquisition Status Maps
- 3DEP Product Availability Maps
- 3DEP By the Numbers**
- 3DEP Call for Action
- Alaska Mapping
- GOVERNANCE
- COLLABORATION AND PARTNERSHIPS
- PROGRAM BENEFITS
- STANDARDS AND SPECIFICATIONS
- DATA AND TOOLS
- PUBLICATIONS
- NEWS
- MULTIMEDIA
- CONNECT

3DEP By The Numbers

Key progress measures towards the 3D Elevation Program (3DEP) goal to complete data acquisition by 2023

When 3DEP was initially envisioned in the 2014 USGS Call for Action publication, a nationwide lidar program seemed an impossible dream due to the estimated cost at \$1B and the unprecedented data management challenge that would result. However, rapidly growing data demand, industry efficiency and cost improvements, and documented annual program benefits estimated to potentially reach \$13B, convinced the USGS to undertake the audacious goal of nationwide data coverage in 8 years. The first full year of 3DEP production began in 2016 with the target to complete data acquisition in 2023. Partnerships and funding have been growing every year, and FY18 was a banner year for data acquisition. Today, over 50 percent of the Nation has available or in progress elevation data that meet 3DEP specifications for high accuracy and resolution. This milestone is truly a community achievement, including the partners that fund acquisition, the vibrant lidar industry and private sector mapping firms that collect the data, and a growing and innovative user base.



The bar chart to the left shows growing investment in 3DEP data acquisition.

Total 3DEP investments in Lidar and IFSAR data acquisition by fiscal year (FY), from FY 2015 to FY 2018 in the United States and U.S. territories. Funding sources include Federal, state, and local agencies, Tribes, and other partner organizations. (FY15 funding levels: \$35.5 million in Federal funds, \$10.6 million in non-Federal funds; FY16: \$43.3 million in Federal funds, \$16 million in non-Federal funds; FY17: \$73 million in Federal funds, \$13.1 million in non-Federal funds; FY18: \$107.6 million in Federal funds, \$33.4 million in non-Federal funds.)

Click the graph for a larger version.

Bar graph showing 3D Elevation Program data acquisition federal and non-federal investments for fiscal years 2015 - 2018.

(Credit: Allyson Jason, USGS, Public domain.)

3D Elevation Program Fiscal Year 2015-2018 Expenditures



Bar graph showing 3D Elevation program fiscal year 2015-2018 expenditures

(Credit: Allyson Jason, USGS, Public domain.)

3DEP Expenditures include:

- Partner (Federal and non-Federal partners not including USGS) data acquisition investments shown in blue
- USGS National Geospatial Program (NGP) data acquisition investments shown in dark green, investments from other USGS programs that are not from the NGP 3DEP budget are included as partner funding, shown in blue
- Program management and data processing and delivery costs shown in light green, and
- Supplemental appropriation funds for hurricane and wildfire disasters shown in purple

Total Estimated Program Cost and Funding Gap to Complete Nationwide 3DEP Data Acquisition by 2023

To estimate the total program cost, FY15-18 expenditures (summarized from the bar chart above) are added to estimated costs for completing nationwide 3DEP. Cost estimates for completing coverage include the following considerations:

- Cost estimates vary geographically based on percent canopy cover and slope, with higher costs in areas with steep terrain and/or dense vegetation
- Higher costs are assumed for data acquisition on U.S. territories and islands.

Total Estimated Program Cost and Funding Gap to Complete Nationwide 3DEP Data Acquisition by 2023



Bar graph showing total estimated program cost and funding gap to complete nationwide 3D Elevation Program data acquisition by 2023

(Credit: Allyson Jason, USGS, Public domain.)

To estimate the funding gap for completing nationwide 3DEP data coverage by 2023, three different partnership scenarios and an average of the three scenarios were considered and are reflected in the bar graph. Each scenario is based on a different assumption of the ratio of USGS dollars to dollars from all other funding partners. For Federal lands, the land managing agencies are the only potential partners to co-fund data acquisition with the USGS, so a partnering ratio of 1:1 is used for Federal lands in every scenario (for every \$1 of USGS funding, \$1 is invested by the land managing agency partners). Explanation of each scenario shown in the bar graph:

- Funding scenario A:** The top row of the chart assumes that for every \$1 of USGS funding, \$4 are invested by partners except on Federal lands where we assume a \$1-\$1 partnership ratio. Note that Partner funding has been harder to raise for the western U.S. compared to the rest of the Nation due to smaller tax bases and the presence of large areas of Federal lands. While partnering ratios of 1:4 or more are common in other areas of the US, the ratio will likely be lower in the western US. This is the least probable scenario.
- Funding scenario B:** The second row of the chart assumes that for every \$1 of USGS funding, \$2 are invested by partners, except on Federal lands where we assume a \$1-\$1 partnership ratio.
- Funding scenario C:** The third row of the chart assumes that for every \$1 of USGS funding, \$1 is invested by partners on both Federal and non-Federal lands.
- Average of A, B and C: The last row of the chart is an average of the three scenarios.

The funding gap is the amount needed in addition to the estimated USGS and partner funding for each scenario to complete national coverage of 3DEP-quality data by 2023. For example, in the average of all 3 models (shown on the last row), \$170 M is needed to complete data acquisition by 2023 in addition to the \$469 M estimated USGS and partner funding level.

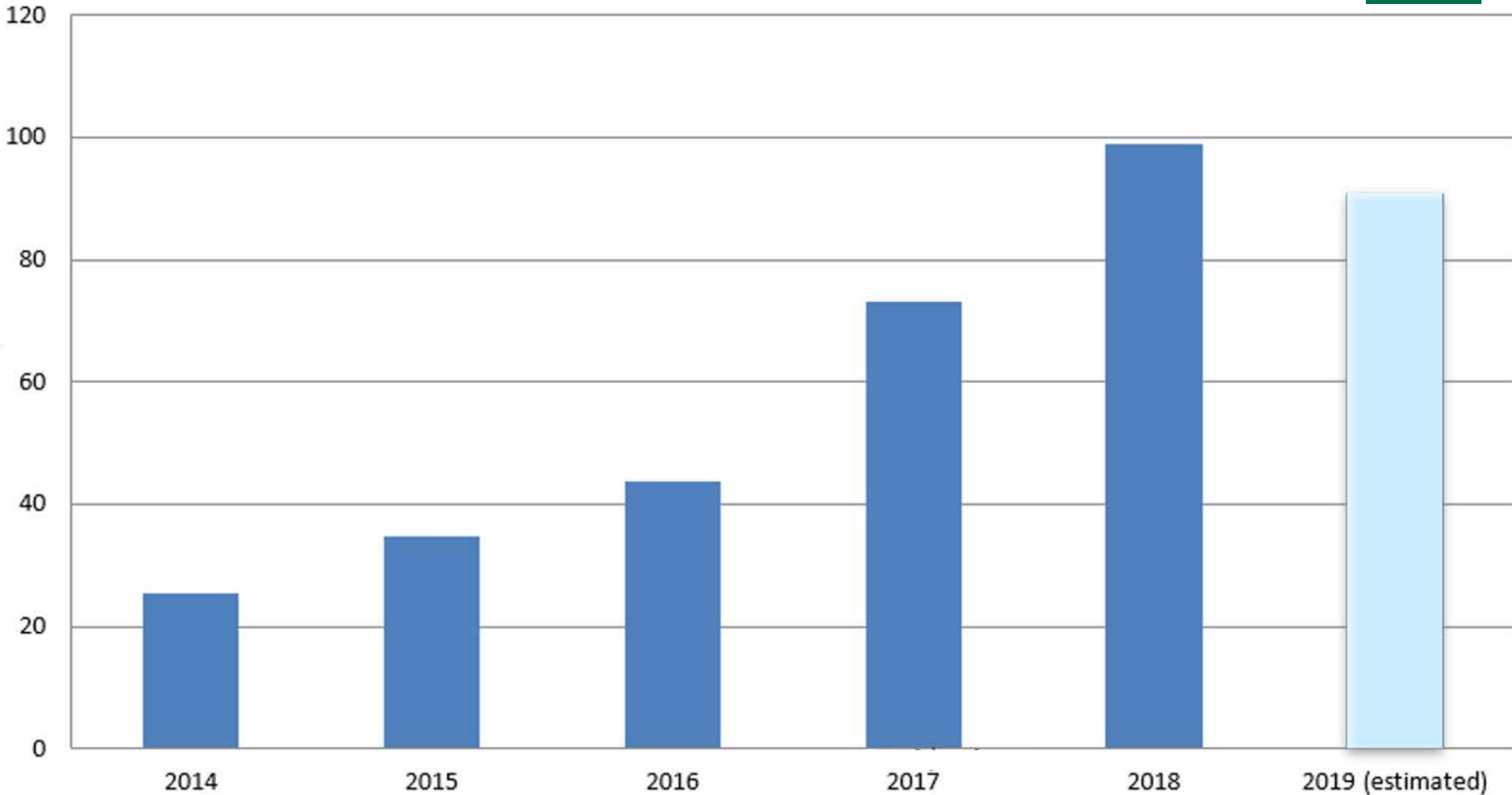
The total estimated cost for all scenarios is approximately \$1.021B. The 3D Elevation Program Initiative—A Call for Action published in 2014 estimated total program costs at \$146M annually for 8 years, for a total of \$1.168B. Today's reduced estimated cost of \$1.036B is largely due to decreasing cost of acquisition since 2014.

These estimates are based on many assumptions and are not intended to allocate cost shares to any particular organization or to individual government sectors. The actual funding model and sources of funds are expected to change based on actual investments in data acquisition across all partners.



Funding through the GPSC

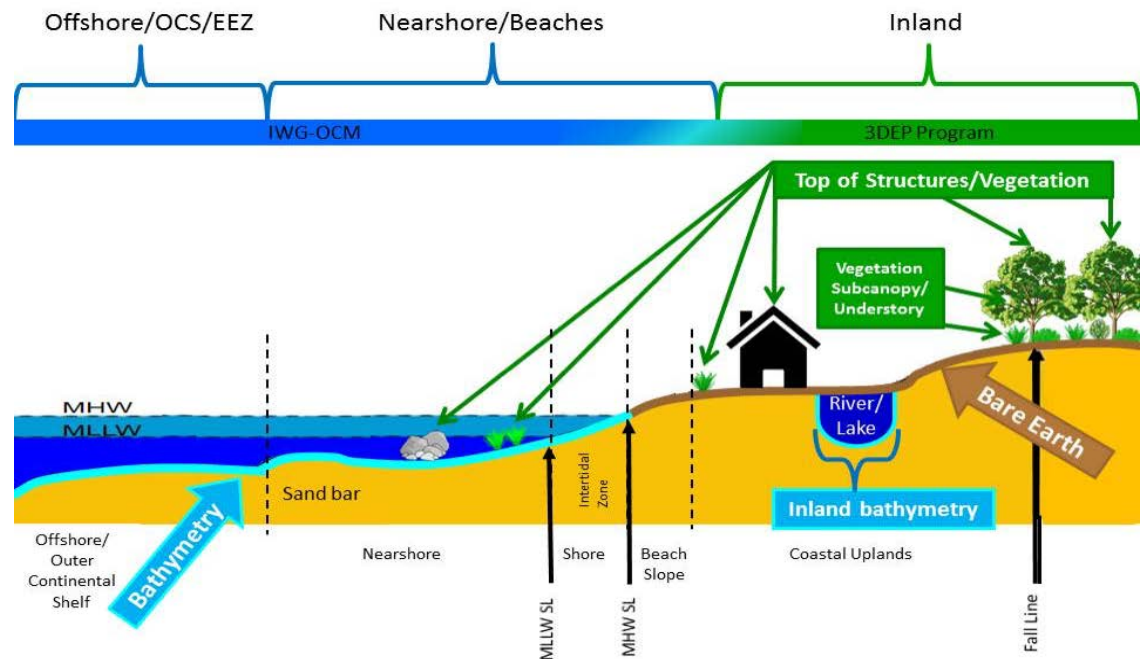
FY18 Total Value and FY19 Estimate



+ 3DEP Future Acquisition

3D Nation Elevation Requirements and Benefits Study

- Understand inland, nearshore and offshore bathymetric data requirements and benefits
- Understand how requirements and benefits dovetail in the nearshore coastal zone
- Plan for the next round of 3DEP after completion of nationwide coverage
- Gather technology-agnostic user information to be able to assess new technologies against requirements and identify the tradeoffs between different approaches
- Improve our understanding of needs to guide development of the next generation of 3DEP products and services



+

Study Phases and Timeline



Study Preparation (7 months)

Study Design

Questionnaire Development

OMB Approval

9/2017 – 3/2018

Initial Data Collection (8 months)

Identify Fed POCs/
State Champions

Questionnaire Open

Summary Reports
for Validation Phase

1/2018 – 9/2018

Data Validation (8 months)

Conduct
Validation Meetings

Validate Results
(Reports &
Geodatabase)

9/2018 – 5/2019

Aggregate/ Report (6 months)

Aggregate Benefits
by Business Use

Final Report &
Geodatabase

6/2019 – 11/2019

Analysis/ Development (7 months)

Develop Program
Scenarios

Analyze Benefit/Cost
and ROI

Determine Program
Direction

12/2019 – 6/2020



2017

2018

2019

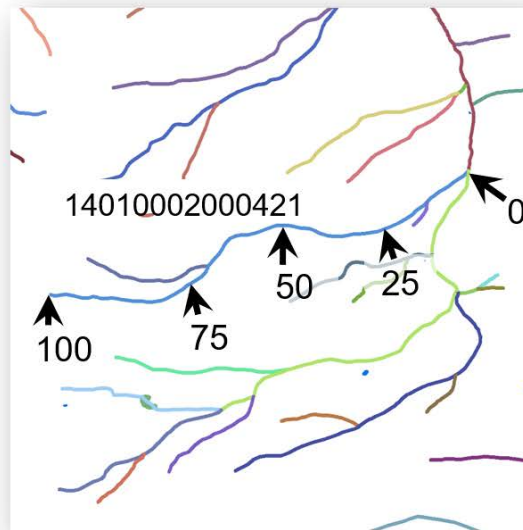




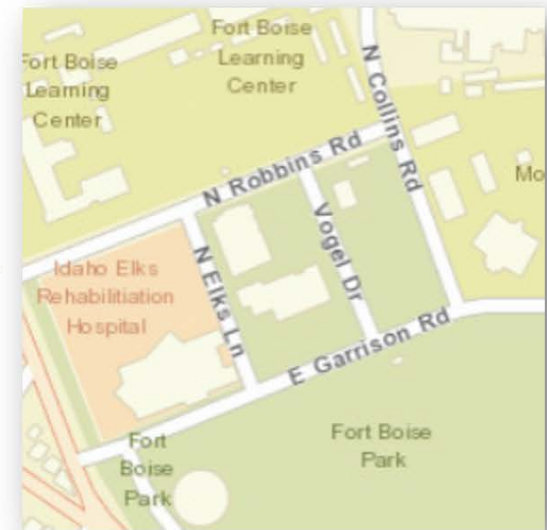
National Hydrography and Watershed Boundaries Datasets

Framework for indexing water related observations

NHD reach code and measure



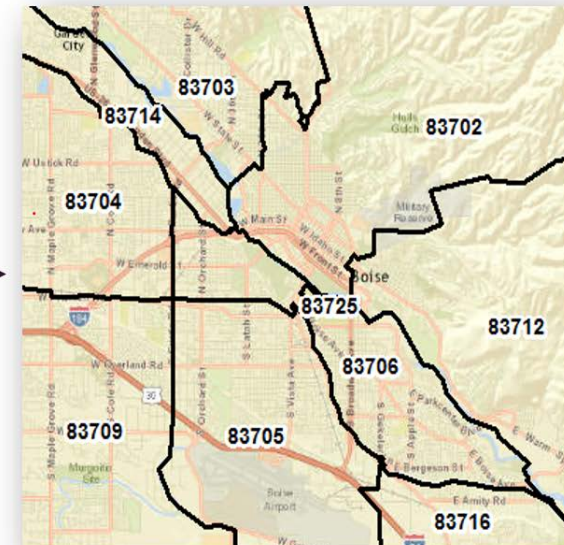
Street address



HU Codes



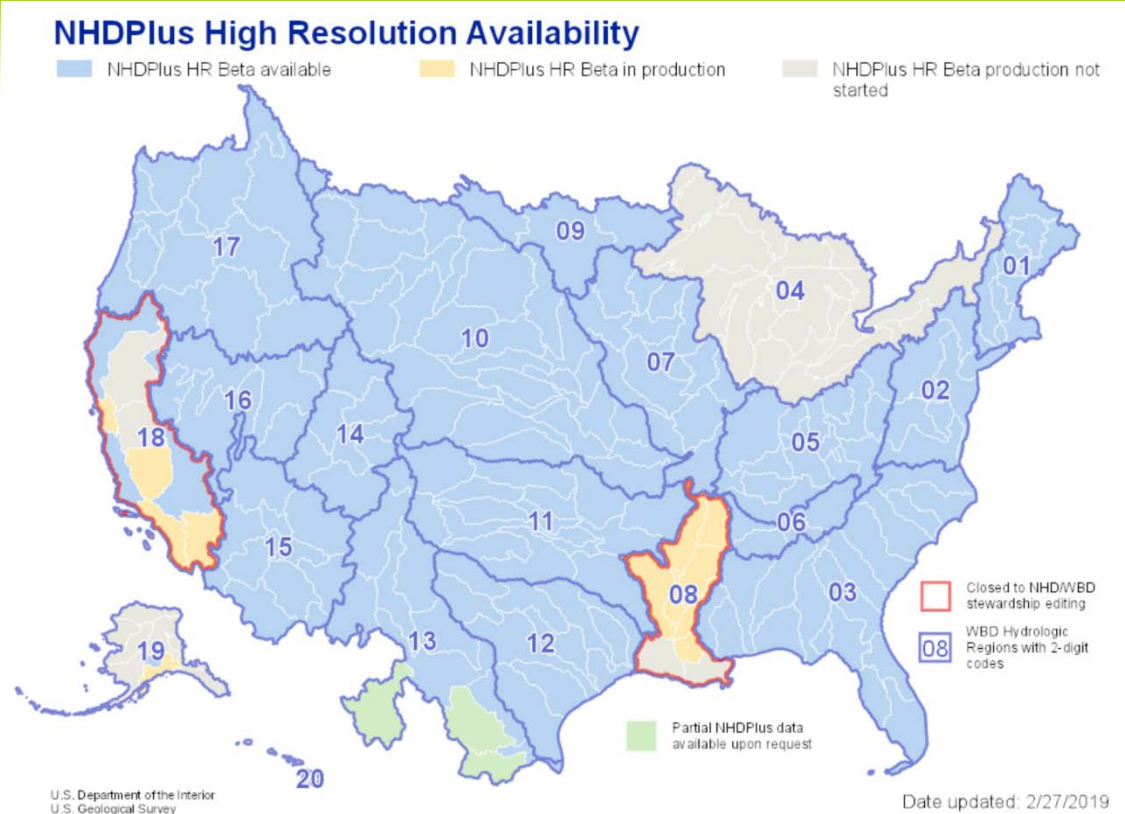
Zip Codes





NHDPlus HR

- A first step in addressing needs documented in the Hydrography Requirements and Benefits Study
- Integrate NHD, WBD and elevation
- Provide functionality of NHDPlus with detail and accuracy of local resolution NHD
- NHDPlus HR Beta planned to be completed in 2020 for CONUS, followed by AK, HI, and territories in later years
- Users feedback will be used to update and improve the data



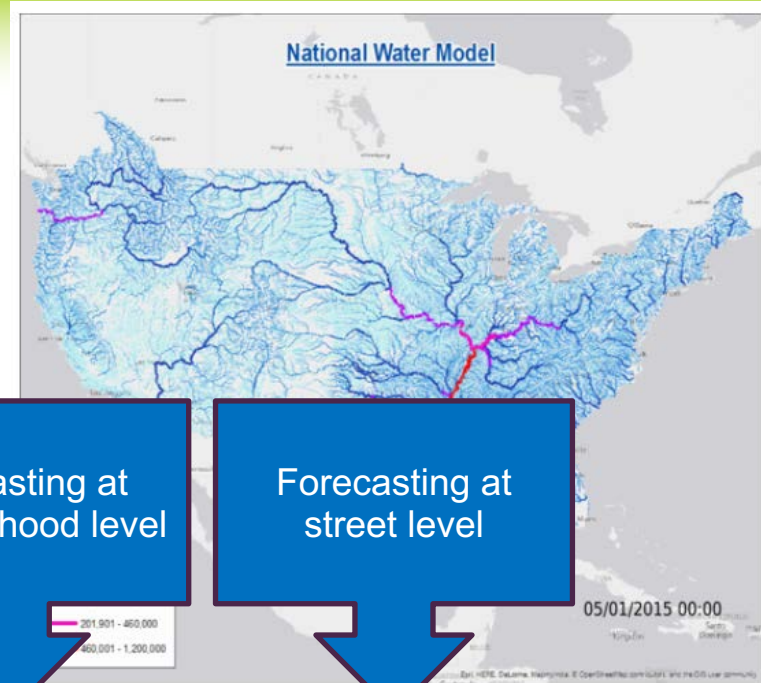
	IN USE TODAY: NHDPlus Medium Resolution	IN PROGRESS: NHDPlus High Resolution
Hydrography source	1:100,000-scale NHD	1:24,000-scale or better NHD
Elevation source	30 meter	10 meter
Number of features nationwide	2.7 million	26 million

+

Future

Hydrography derived from lidar

HRBS indicates that the best way to meet most medium to long-term requirements is through fully integrating hydrography and elevation data by deriving hydrographic data from 3DEP data



Forecasting at neighborhood level

Forecasting at street level

Simulates conditions for 2.7 million stream reaches, representing *the biggest improvement in flood forecasting ever*

	IN USE TODAY: NHDPlus Medium Resolution	IN PROGRESS: NHDPlus High Resolution	FUTURE: Hydrography Derived from Lidar
Elevation source	30 meter	10 meter	1 meter
Hydrography source	1:100,000-scale NHD	1:24,000-scale or better NHD	1:5,000-scale or better derived from lidar
Number of features nationally	2.7 million	26 million	200-300 million

6 STRATEGIES

A Vision for the Future Generations of USGS Hydrography and Elevation

1

COMPLETE NATIONWIDE BASELINE DATA

- Unifies observations and measurements onto one multiscale hydrography framework
- Realizes the benefits and ROI of nationwide lidar

3DEP & NHDPlus HR



2

ESTABLISH THE NATIONAL HYDROGRAPHY INFRASTRUCTURE

Implement the NHI as the authoritative, universal source for sharing and discovering water information

INTEGRATE HYDROGRAPHY AND ELEVATION

Derive hydrography with Z-values from lidar to move from the neighborhood to the street-level in accuracy of features

3

3DEP & 3D NHD

4

INTEGRATE MAN-MADE SYSTEMS AND GROUNDWATER

Integrate connection points to man-made hydrologic systems and groundwater to allow better accounting of the hydrologic cycle



5

INTEGRATE INLAND BATHYMETRY

- Extend elevation surface under water bodies
- Replace estimated flow volume with volume calculated from the mapped surface

National Terrain Model

4D National Terrain Model

REPEAT COVERAGE

6

- Enable monitoring and change detection
- Analytical capabilities increase exponentially with the availability of multiple data vintages

Enables 3D topographic maps and links with 3D geologic models to visualize data in new and unimagined ways



Supports the National Water Model, National Water Census, drought, water availability and use



Supports the 3D Nation vision of elevation data from the depths of the oceans to the peaks of the mountains



Realizes the benefits and ROI of the 3D Nation Study





Opportunities for collaboration

Build on current success of 3DEP

- Completion of nationwide 3DEP – western U.S.
- Next generation of 3DEP
 - New repeat cycles, quality levels and geographic needs from the 3D Nation Study
 - Inland bathymetry – building towards an operational, national program approach
- Program building for Hydrography
 - Preparing input data and developing NHDPlus HR for Alaska
 - Deriving hydrography from lidar – developing a specification and national approach
 - Approaches for integrating manmade systems and groundwater

3DEP

The U.S. Geological Survey's 3D Elevation Program (3DEP)

- Enhanced elevation data could have the potential to generate \$13 billion in annual benefits
- Benefit-to-cost ratio of 4.7 to 1
- \$146 million is the optimal annual funding for 3DEP as originally requested by USGS

3DEP

3DEP will satisfy the growing demand for consistent, high-quality topographic data and a wide range of other three-dimensional representations of the Nation's natural and constructed features.

The USGS has identified more than 600 applications that would benefit from enhanced elevation data.

3DEP

Data procured from 3DEP can be applied to flood risk management; infrastructure; landslides and other hazards; water resources; aviation safety; telecommunications; homeland security; emergency response; precision agriculture; energy; pipeline safety; and other areas.

3DEP will promote economic growth, facilitate responsible environmental protection and resource development and management, assist with infrastructure improvement, and generally enhance the quality of life of all Americans.

3DEP

- John Palatiello, of the 3DEP Coalition, testified on 3DEP before the House Appropriations Committee in February



3DEP

- A House letter was delivered last week to the House Appropriations Committee requesting \$146 Million for USGS 3DEP, cosigned by 38 Members of Congress ... is your Member of Congress one of these?
- A Senate letter is being organized with the same request of Senate Appropriators - will your Senators be among those on the letter?
- ICWP was one of 40 organizations making the same request of Congressional Appropriators for FY 2020

3DEP

Rep. Suzan DelBene (D-WA), lead author of the recent House letter to Congressional Appropriators, & JB



3DEP

**Tim Petty, Assistant Secretary for Water and Science,
U.S. Department of Interior (DOI) & JB**



3DEP

**JB & U.S. Geological Survey (USGS) Director
Jim Reilly, recipient of 2018 3DEP Coalition letter of
which ICWP cosigned**



3DEP

JB speaking last week at a Congressional Briefing co-hosted by the House Committee on Small Business



3DEP

- In Summary:

Thank you to Sue Lowry & ICWP
for playing a key part in the
3DEP Coalition!

IMAGES Act

Improvement of Mapping, Addresses, Geography, Elevations and Structures (IMAGES) Act

Maximizing the surveying profession's expertise in elevation data collection and additional data helpful in improving the NFIP Risk Map Program

IMAGES Act

The statutory authority for the National Flood Insurance Program (NFIP) of the Federal Emergency Management Agency (FEMA) will expire on May 31, 2019

Flood maps identify areas at greatest risk of flooding and provide the foundation for NFIP. Accurate geospatial information is essential to all aspects of flood insurance risk assessment and emergency management (preparedness, prevention, protection, detection, response, recovery)

IMAGES Act

In the 116th Congress, Representatives Vicente Gonzalez (D-TX) and Alex Mooney (R-WV) will reintroduce legislation known as the Improvement of Mapping, Addresses, Geography, Elevations and Structures (IMAGES) Act to accomplish these vital reforms. This legislation will be an updated version of H.R. 4905 in the 115th Congress.

IMAGES Act

**Rep. Vicente Gonzalez (D-TX), lead sponsor
of the House IMAGES Act, 116th Congress**



IMAGES Act

- Lidar data collection and coordination between FEMA's NFIP and USGS 3DEP
- National Structure Inventory
- USGS National Streamflow Information

Note the recent ICWP coalition letters with NSPS backing

- National, geo-enabled, web access to maps

IMAGES Act

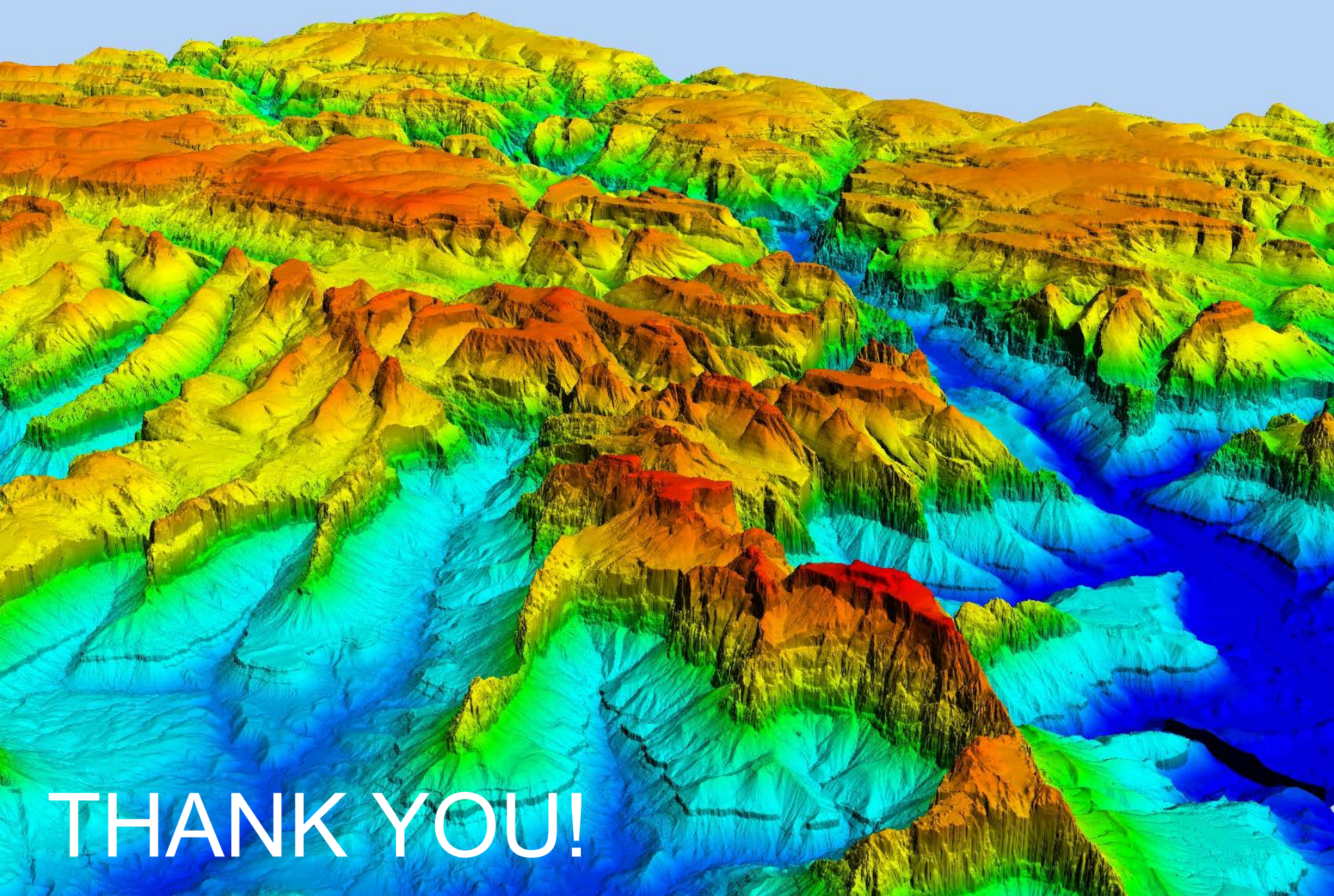
IMAGES Act -- 5 organizations are on board as endorsers/supporters:

- **American Public Works Association (APWA);**
- **American Society of Civil Engineers (ASCE);**
- **Interstate Council on Water Policy (ICWP);**
- **National Society of Professional Surveyors (NSPS); and**
- **Reinsurance Association of America (RAA).**

IMAGES Act

- In Summary:

Thank you to Sue Lowry & ICWP
for playing a key part
supporting the IMAGES Act!



THANK YOU!

Zion National Park,
UT
3D Elevation Program (3DEP)

Questions

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