"National Elevation Data for National Flood Insurance Policy; NFIP & 3DEP Efforts"

John "JB" Byrd of John M. Palatiello & Associates, Inc.
Government Affairs Manager (MAPPS)
Lobbyist (NSPS)

November 3, 2015 before the

SMARTERSAFER.ORG - Americans for Smart Natural Catastrophe Policy

SmarterSafer.org is a national coalition that is made up of a diverse chorus of voices united in favor of environmentally-responsible, fiscally-sound approaches to natural catastrophe policy that promotes public safety.

About MAPPS and NSPS

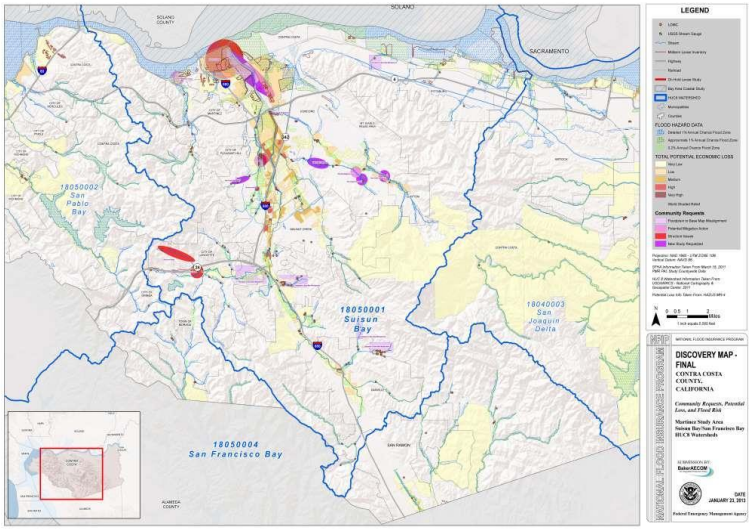
- MAPPS is the only national association of private sector firms in the surveying, spatial data and geographic information systems field in the United States.

- The National Society of Professional Surveyors (NSPS) is the national voice of land surveying professionals throughout the United States.

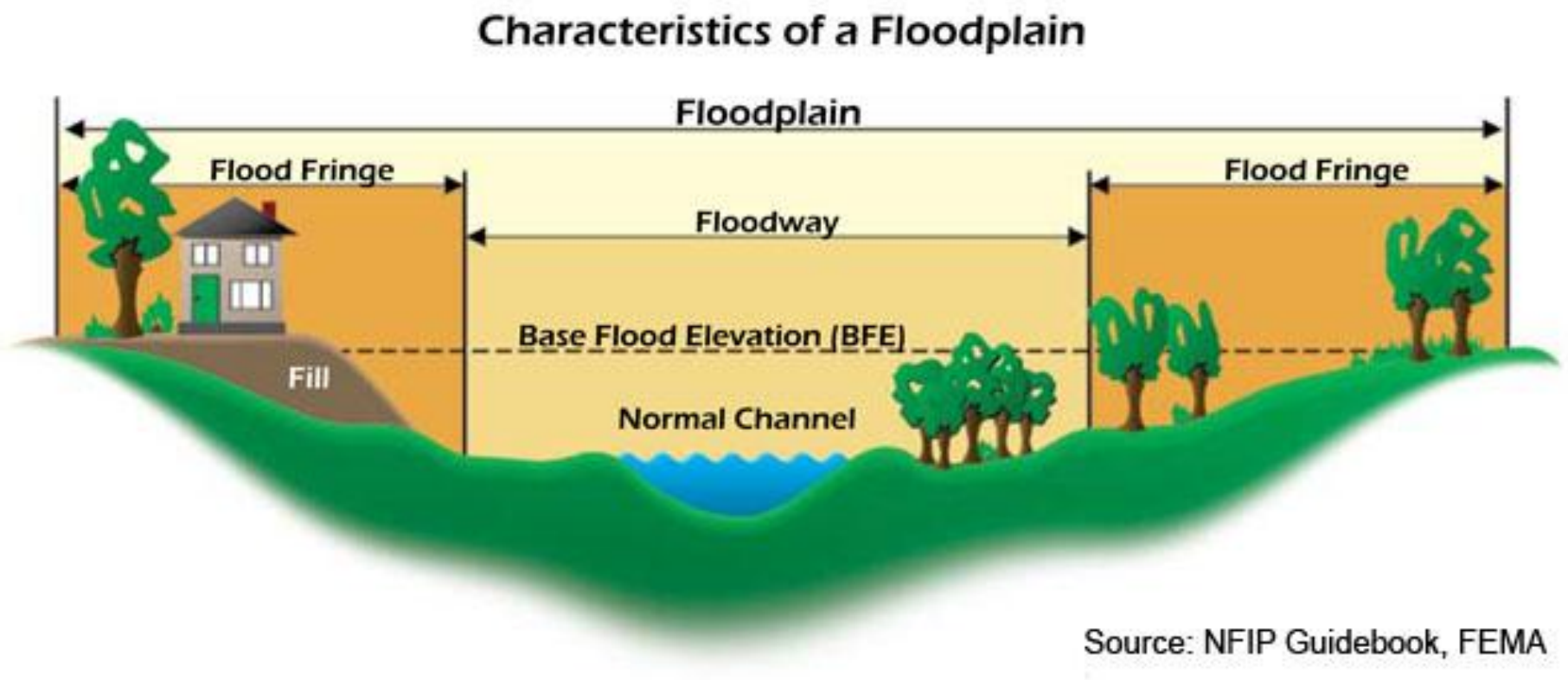
The NFIP and Flood Mapping

- The National Flood Insurance Program (NFIP) is a Federal program enabling property owners in participating communities to purchase flood insurance.
- FEMA's flood hazard mapping program, Risk Mapping, Assessment and Planning (MAP), FEMA **identifies flood hazards, assesses flood risks** and partners with states and communities to provide accurate flood hazard data.

+ Flood hazard mapping is an important part of the NFIP, as it is the basis of the NFIP regulations and flood insurance requirements.



Characteristics of a Floodplain



Surveying and mapping activities within NFIP

- Topography (LiDAR, ISFAR, etc)
- Aerial imagery (flown with topography data collect)
- Land use and land cover data
- Field run data collection and cross-sections (overbanks, below water data)
- Hydraulic structures data (bridge, culvert, and pipe data)
- Levee and dam data(levee crest elevations, levee closures, dam crest, emergency spillway and outlet structures)
- Building footprints (for risk analysis)
- Elevation certificate (flood insurance rating)

Surveying and mapping processes within NFIP

- Topographic data along with land use and land cover and hydraulic structures data is used for development of the watershed hydrology (stream discharge values) and hydraulics and compute the water surface elevations at each cross.
- Floodplain delineation on the Flood Insurance Rate Map (FIRM) is based on the elevations derived from the hydraulic models projected on to the topographic data.
- Elevation and topographic data are used in performing FEMA levee accreditations and Levee Analysis Mapping Process (LAMP) for levees that can not be accredited
- Surveys for elevation certificates for insurance rating and for Letter of Map Amendments (LOMAs)
- Risk analysis and assessments using building footprints and building specific information. This information can also be used in mitigation actions

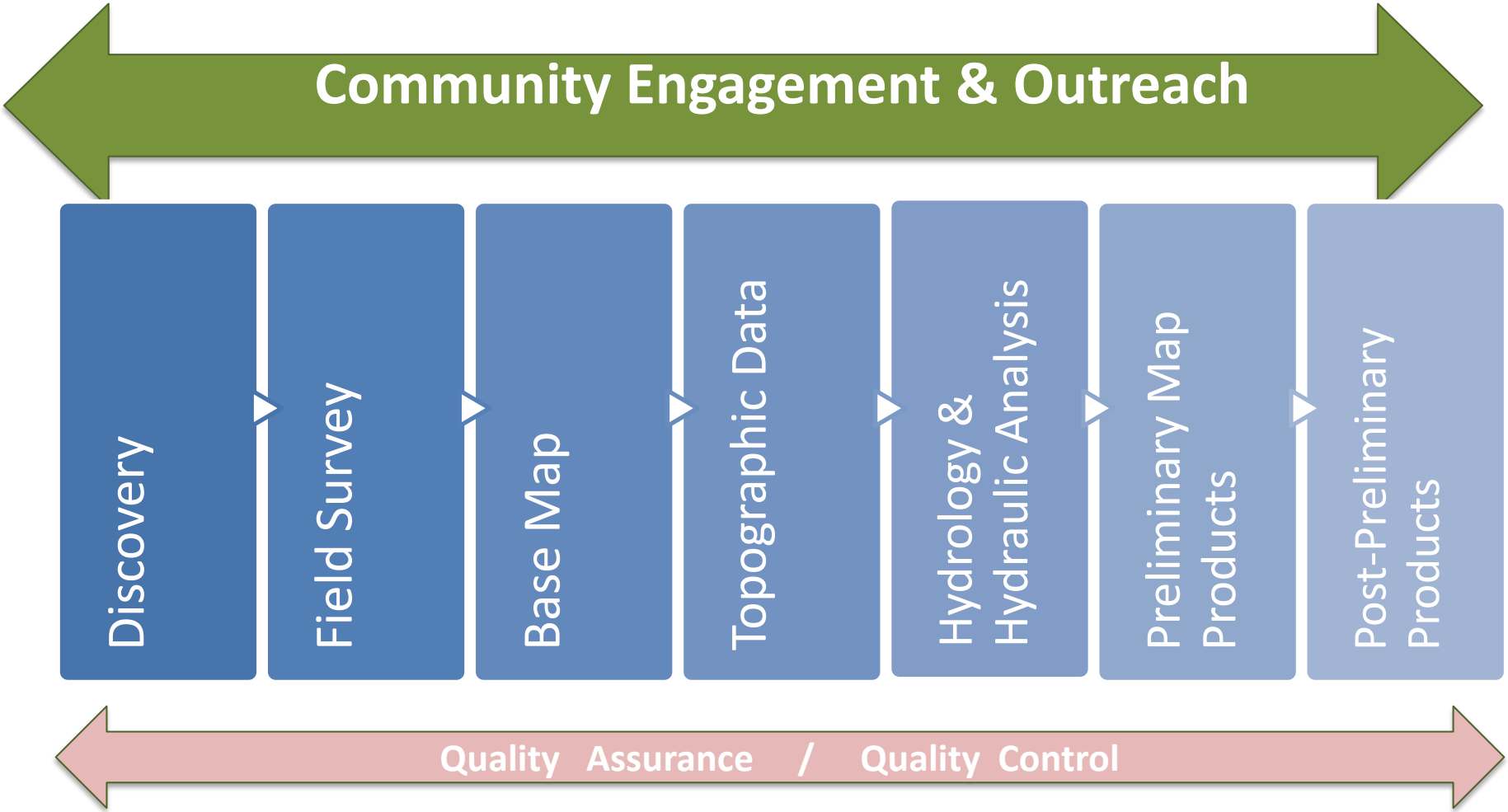
The Role of the Engineering Company

- Providing FEMA with program management, engineering, mapping, and related technical services, including the production of flexible and sustainable Risk MAP products to communities.

+ Benefit to FEMA and Communities
  - To push action and awareness through the FIRM production process for digital products.
  - Increase Communities resilience to hazards and communicate risk.

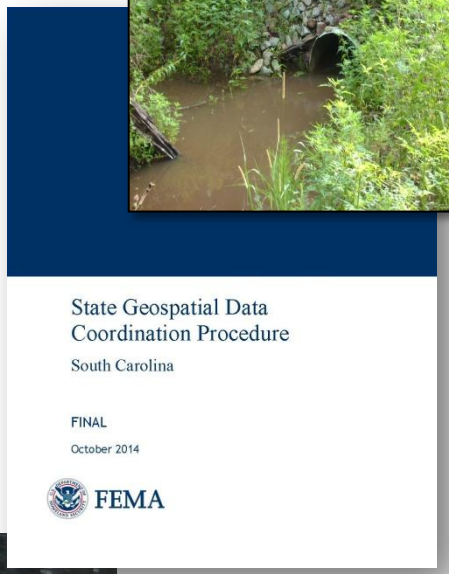
The Study Process

Overview of the FEMA Study Process



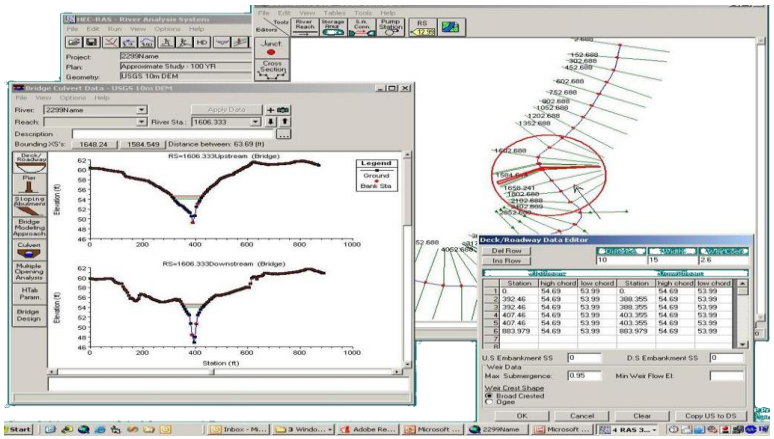
The Mapping Process

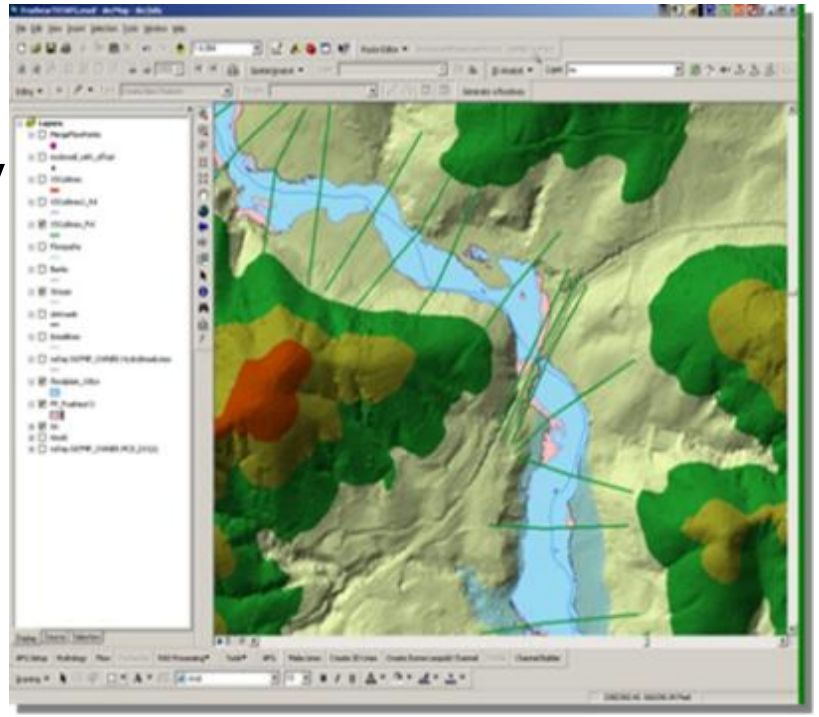
- **Field Survey**
  - Bathymetry
  - Bridges/Culverts/Hydraulic Structures
- **Acquire Base Map**
  - Leverage data early in process
- **Develop Topographic Data**
  - Aerial Photogrammetry
  - LiDAR (Mobile, Terrestrial, Aerial)



The Mapping Process

- Develop Hydrologic & Hydraulic Data
  - Stream gage analysis, rainfall/runoff modeling, regression equations
  - 1-D and 2-D hydraulic modeling
- Mapping
  - Produce regulatory & non-regulatory products
  - Ensure compliance with FEMA's latest mapping standards

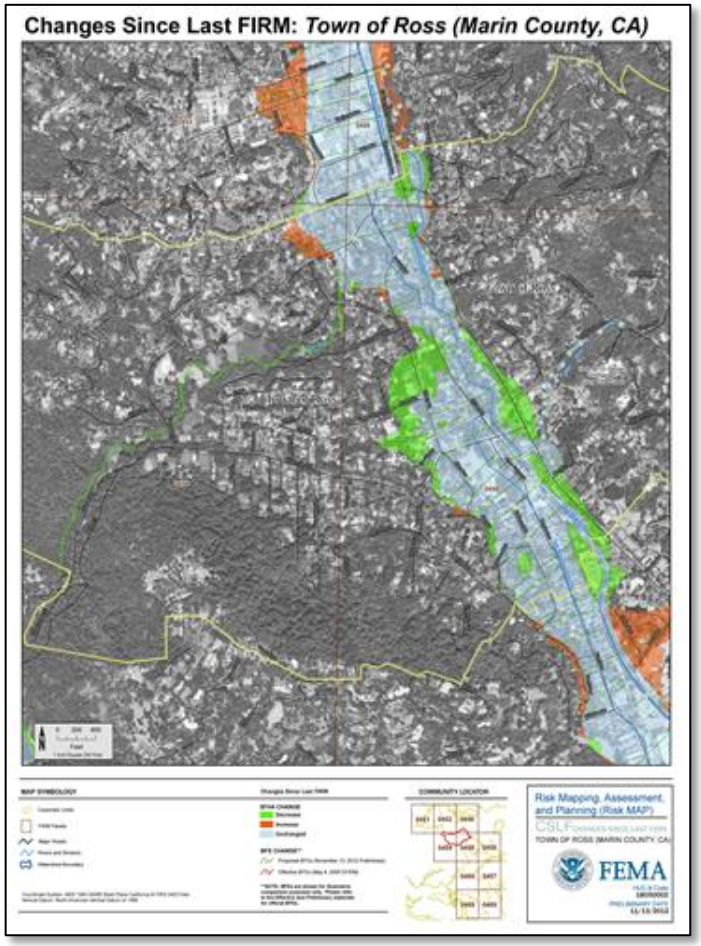




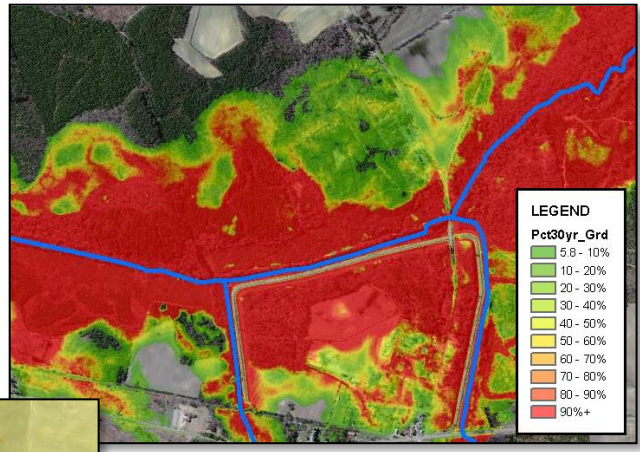
+ Risk MAP Products Help Communicate Risk

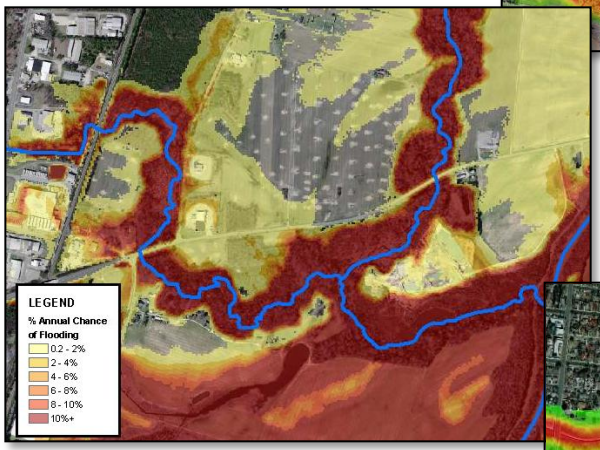
Public Outreach Process

Changes Since Last FIRM (CSLF)



Percent Chance of Flooding over a 30-Year Period Grid →



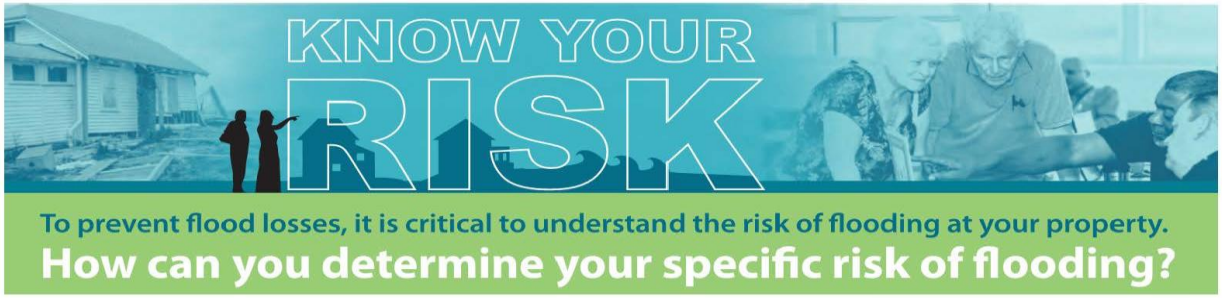


← Percent Annual Chance Flooding Grid

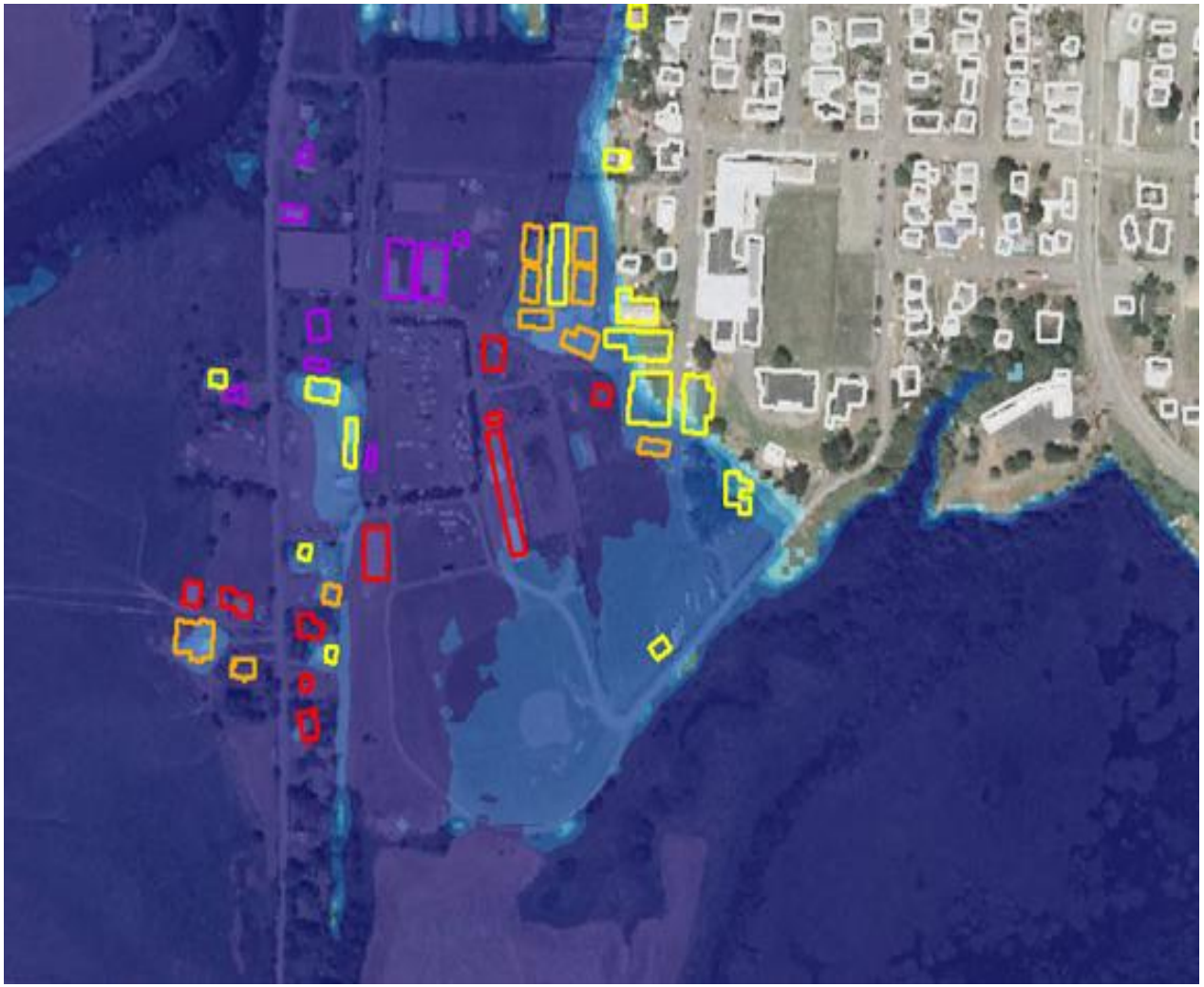
Flood Velocity Grid →

Development of Educational, Outreach and Training Programs

Delivering the ***right message*** at the ***right time*** the ***right way***.

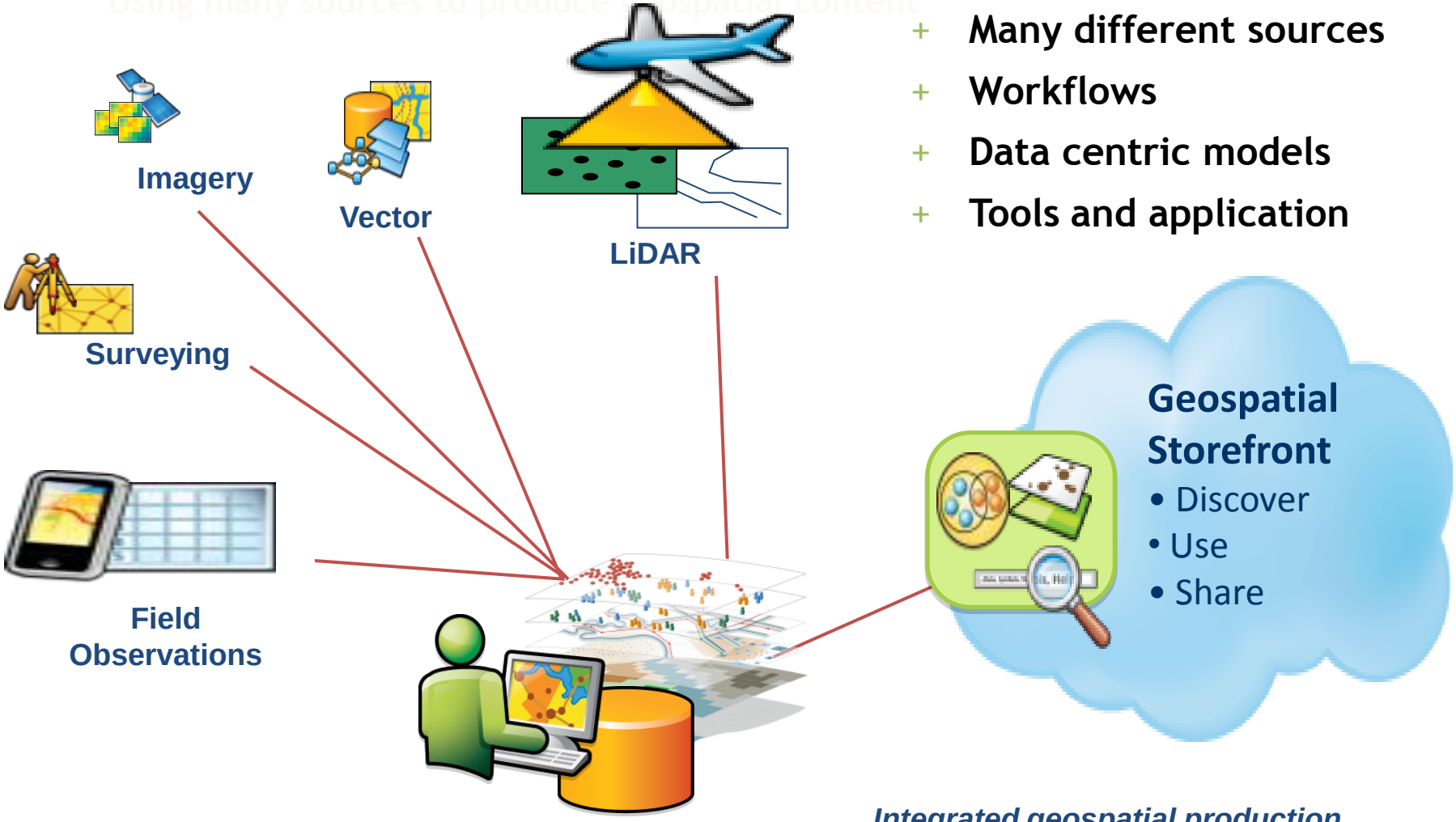


Floodplain depth grids with structure data



Pre- and Post-Disaster Imagery

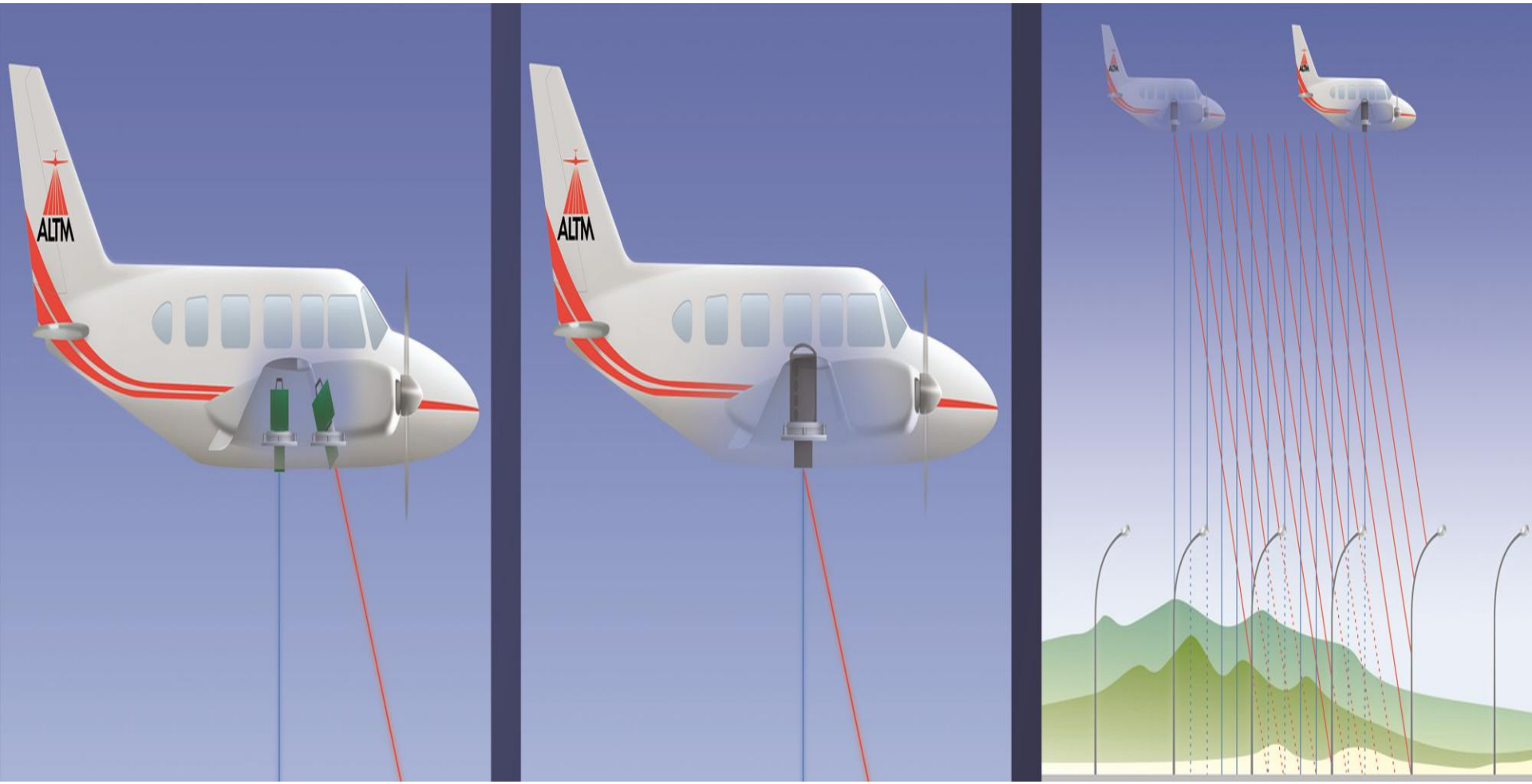
Geospatial Platforms



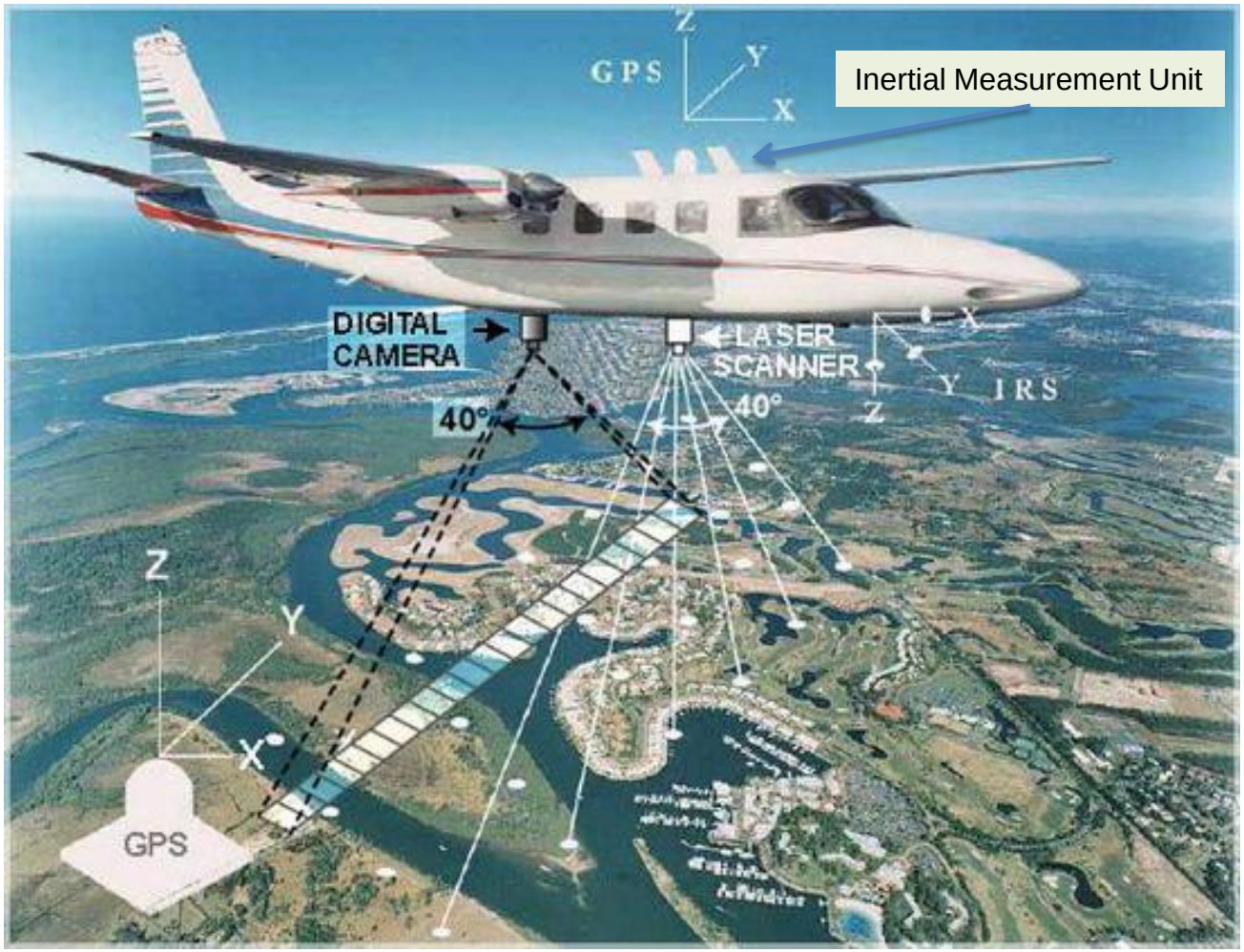
+ Many different sources
+ Workflows
+ Data centric models
+ Tools and application

. . . Integrated geospatial production

LiDAR!
(Light Detection and Ranging)

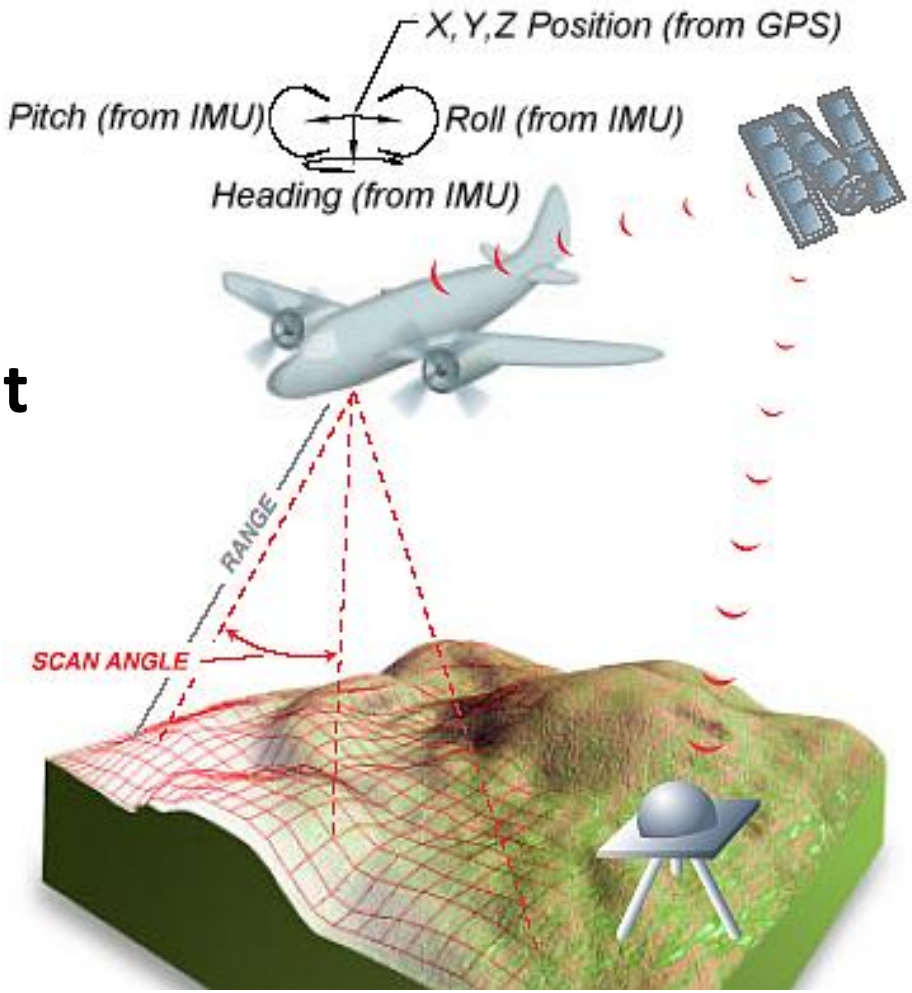


Light Detection and Ranging (LiDAR)

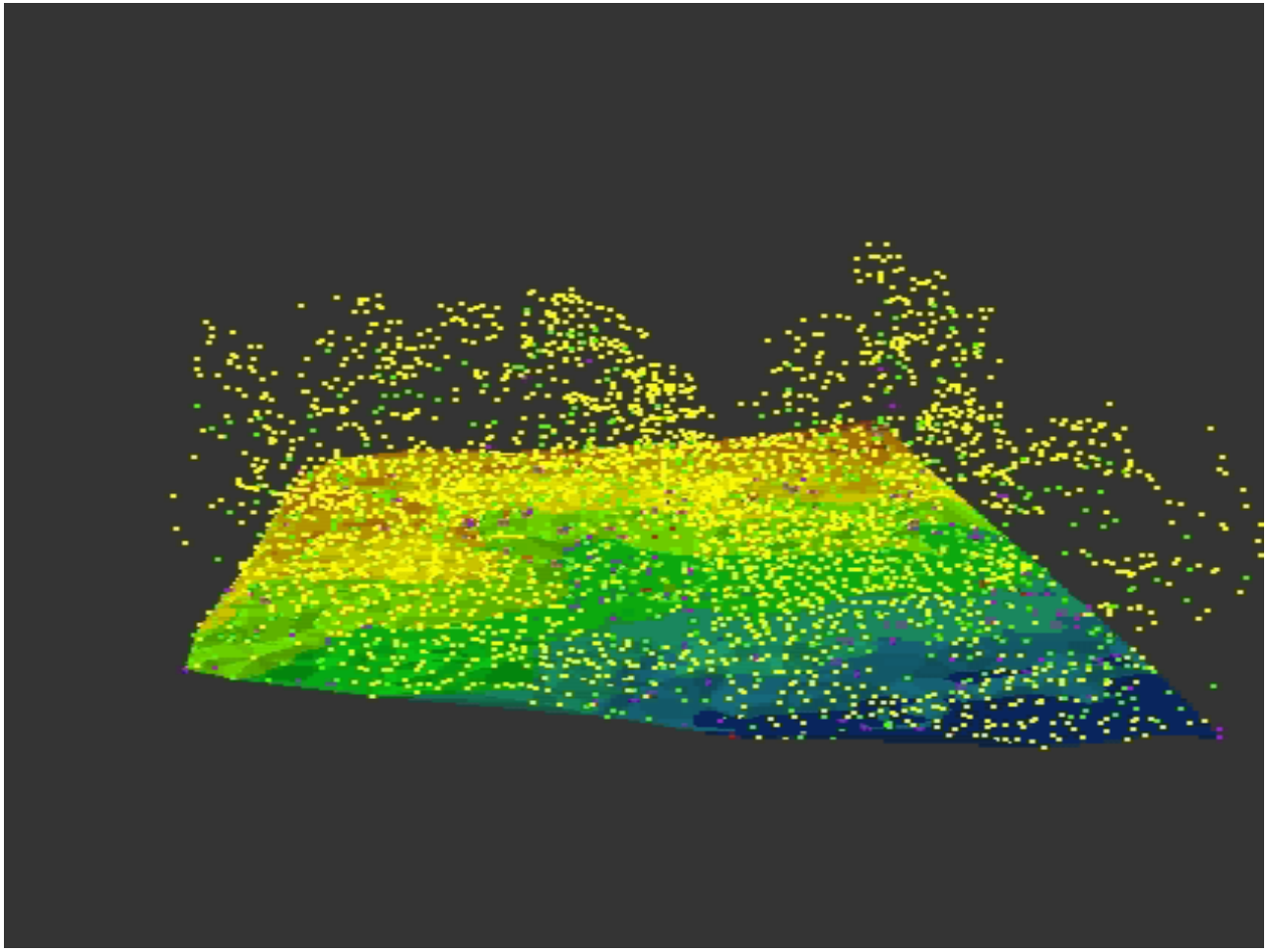


Three Major Components of a LiDAR System

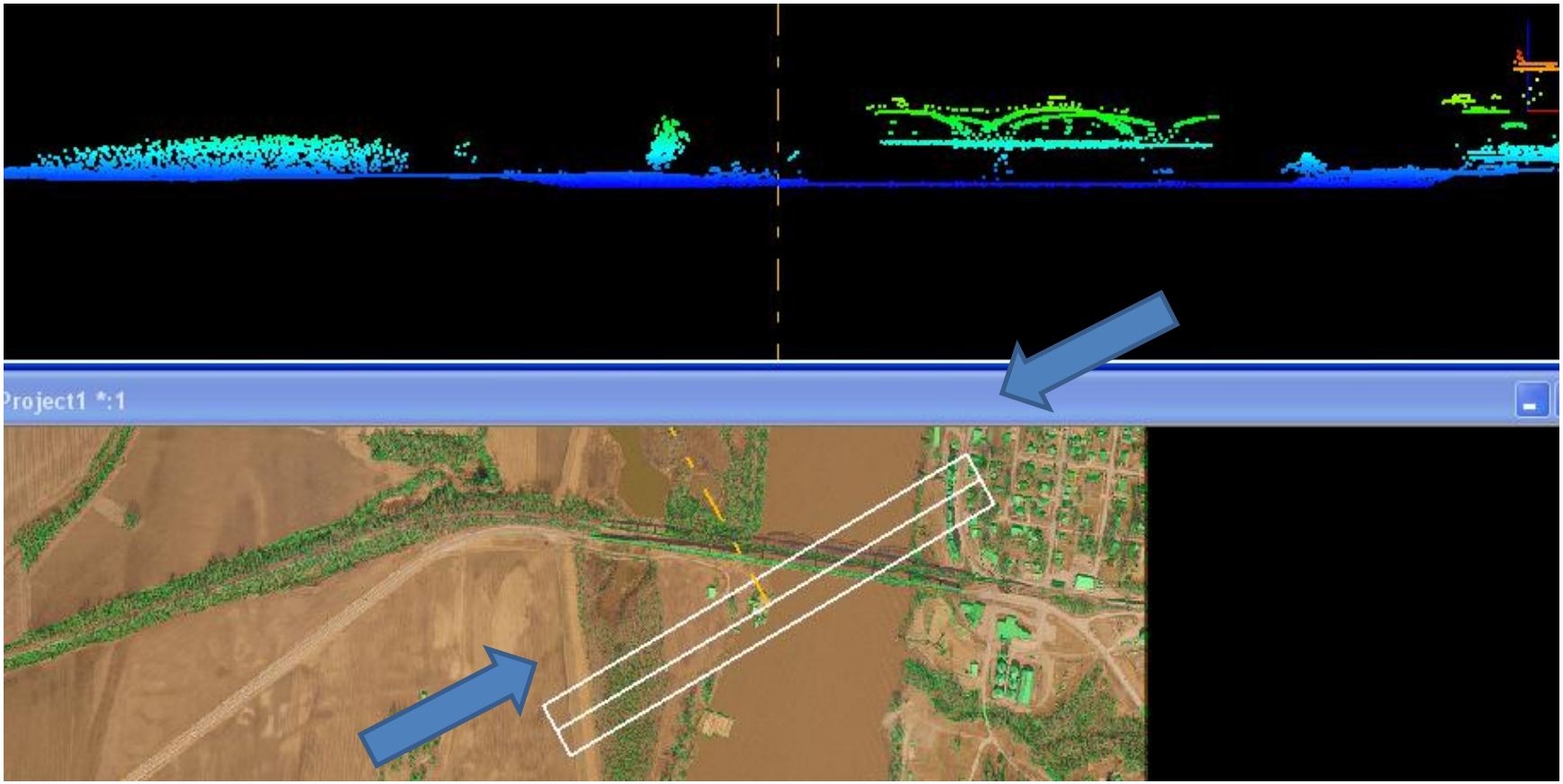
1. **Airborne GPS**
2. **Inertial Measurement Unit (IMU)**
3. **Laser Scanner**



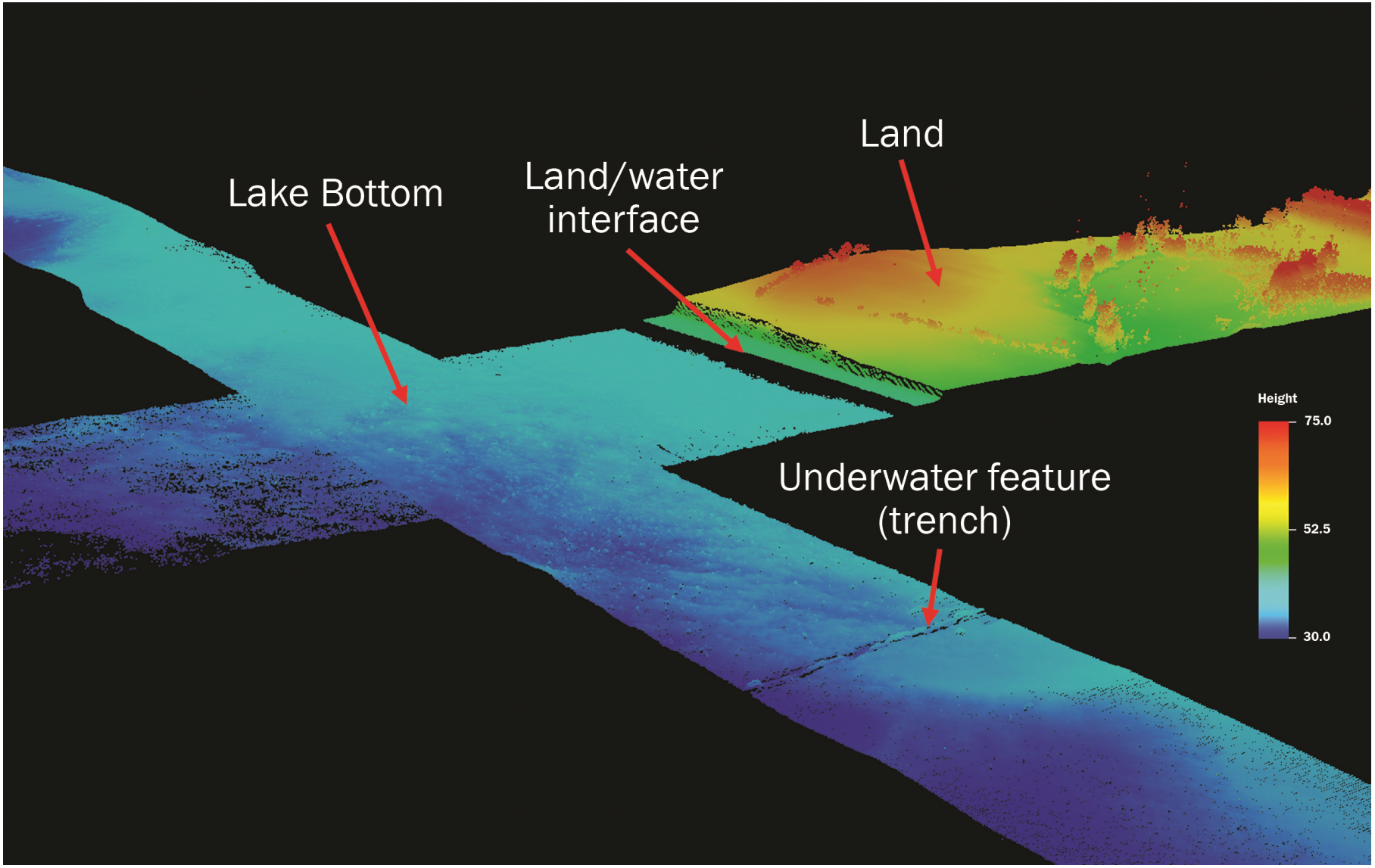
LiDAR point cloud



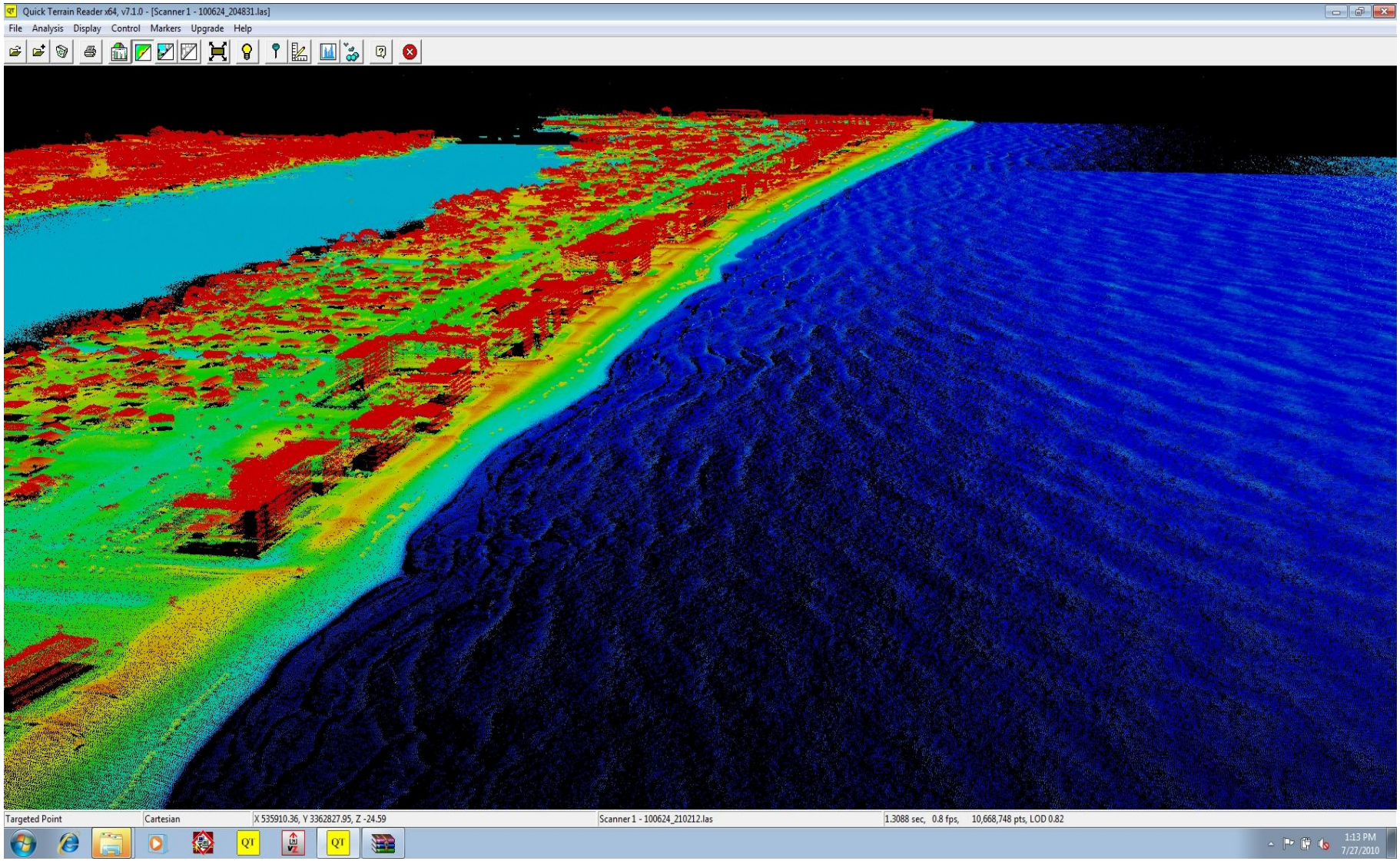
LiDAR cross section for horizontal/vertical measurements



Runoff and/or Pollution Patterns



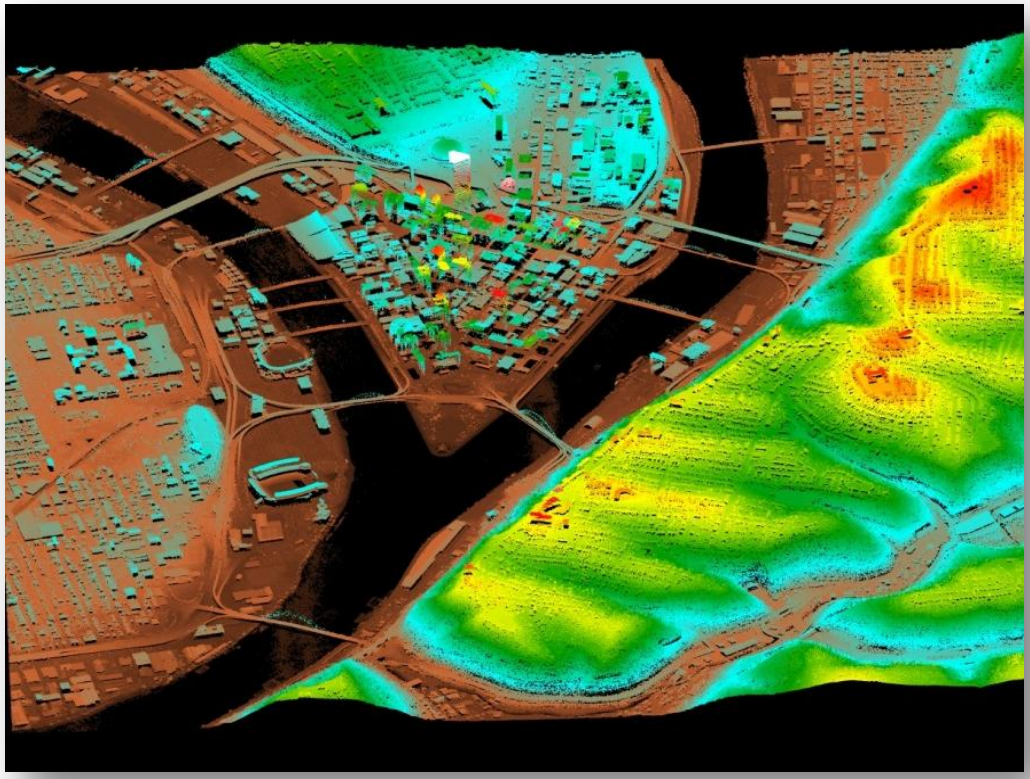
LiDAR Imagery of Florida Coastline



Infrastructure

Construction and Management LiDAR Applications

- Route, grade, line-of-sight, and utility surveys and corridor mapping
- Terrain and other obstruction identification
- Dam, levee, and coastal structure failure modeling and mitigation
- Hydraulic and hydrologic modeling
- Geotechnical evaluations
- Permit application and construction plan development and evaluation
- As-built model development
- Preliminary engineering, estimate development, and quantity estimation activities

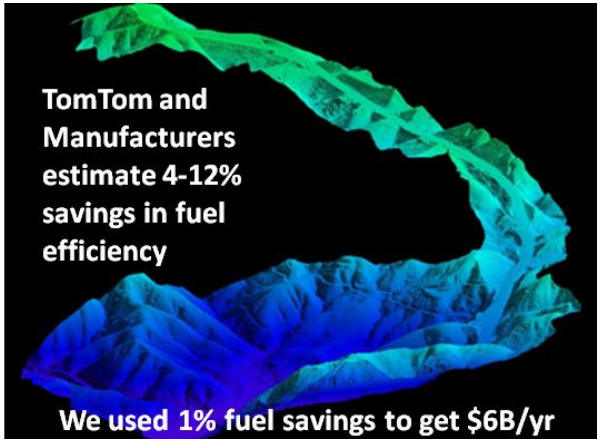


Pittsburgh, PA

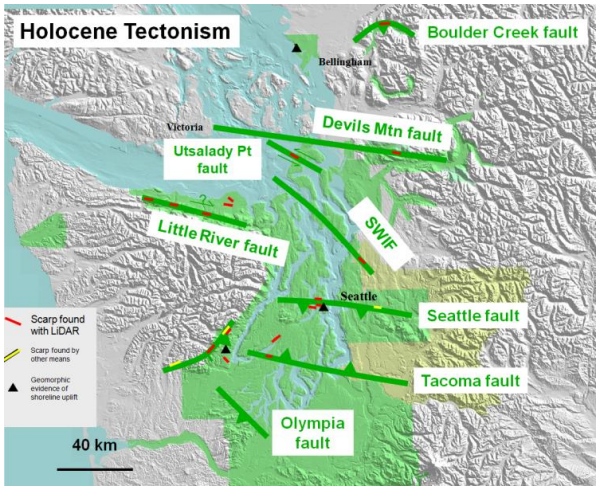
Potential annual $ benefits from LiDAR

QL3, $2B/yr for agriculture and precision farming

QL3, $7B/yr for land navigation & safety, fuel savings, transmission control

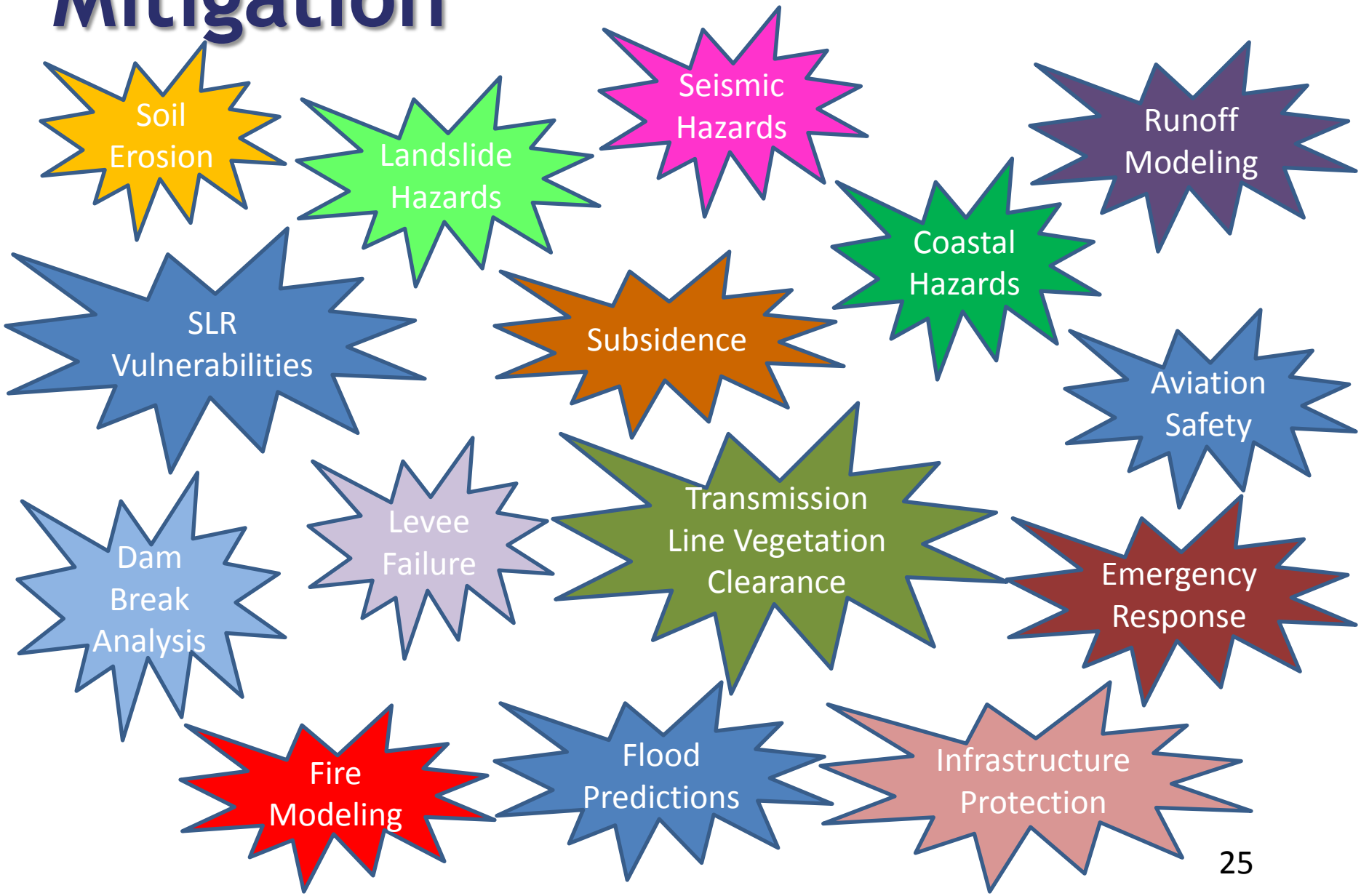


QL3, $500M/yr for flood risk management

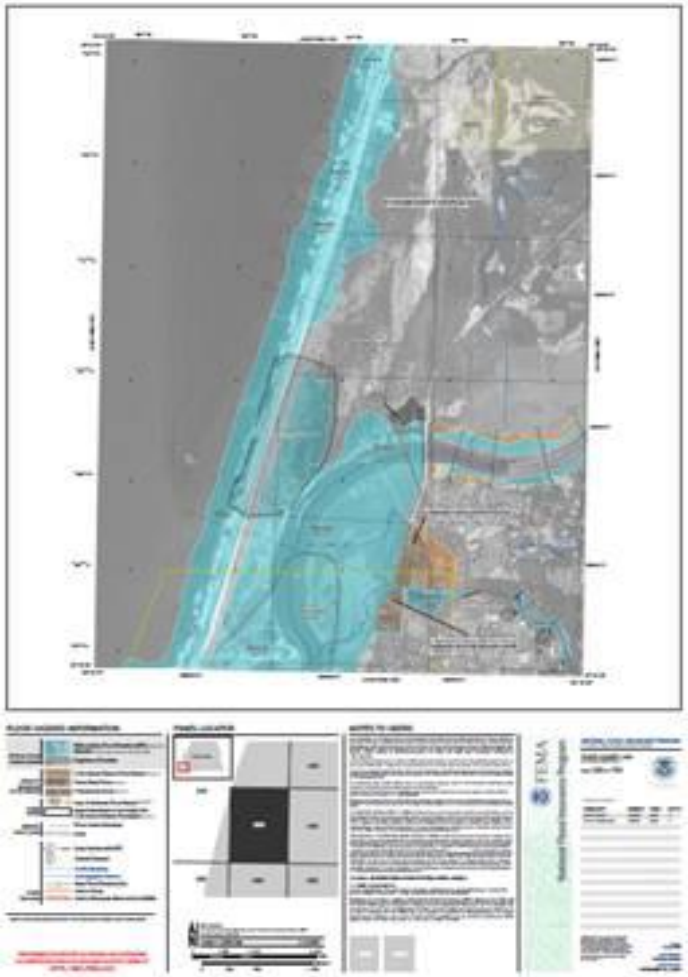


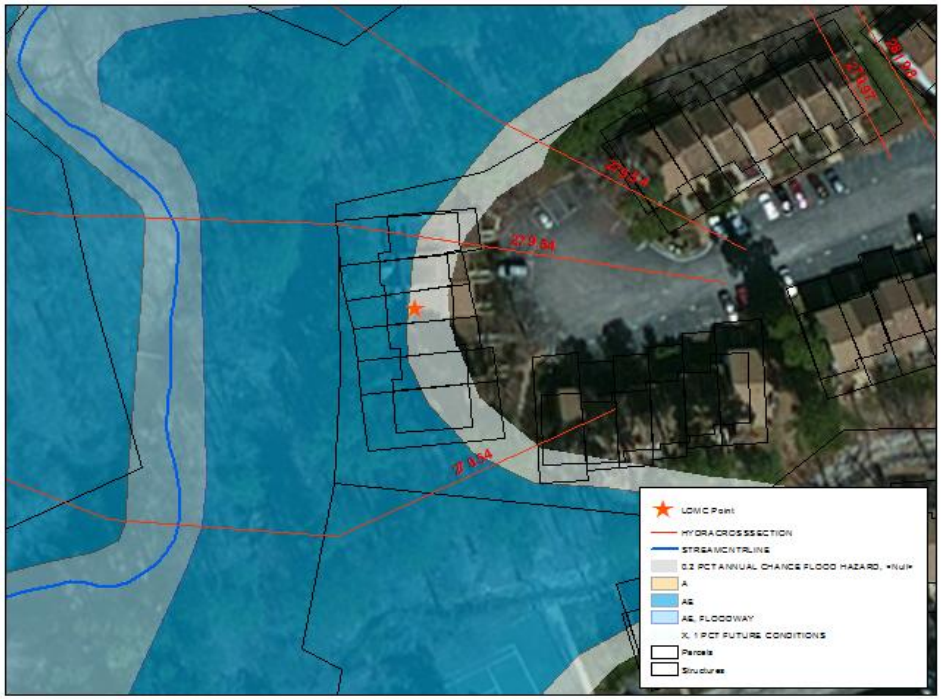
QL1 or QL2, $1B/yr for geologic resource assessment & hazard mitigation

LiDAR for Multi-Hazard Mitigation



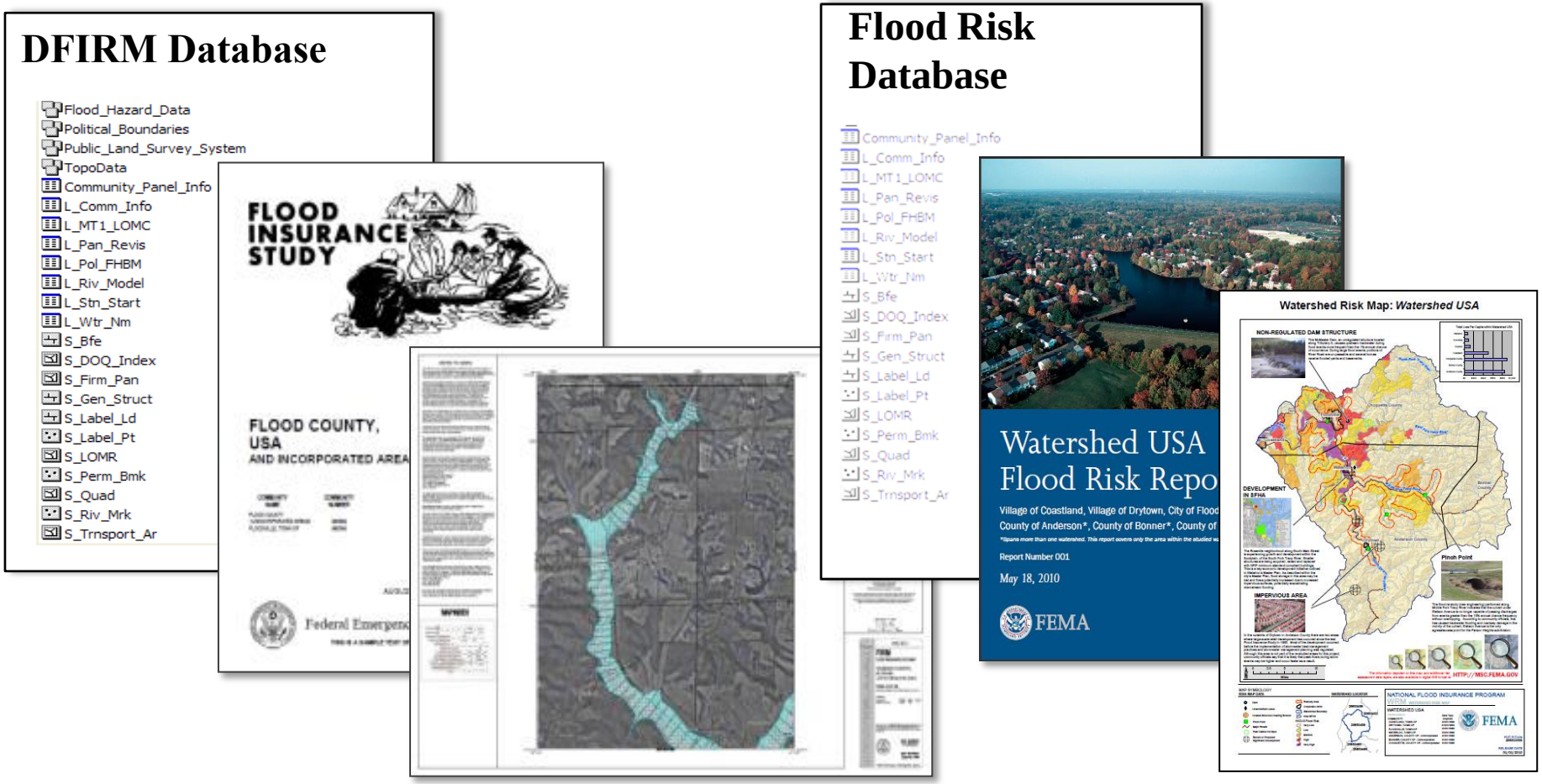
Digital Flood Insurance Rate Map (DFIRM)



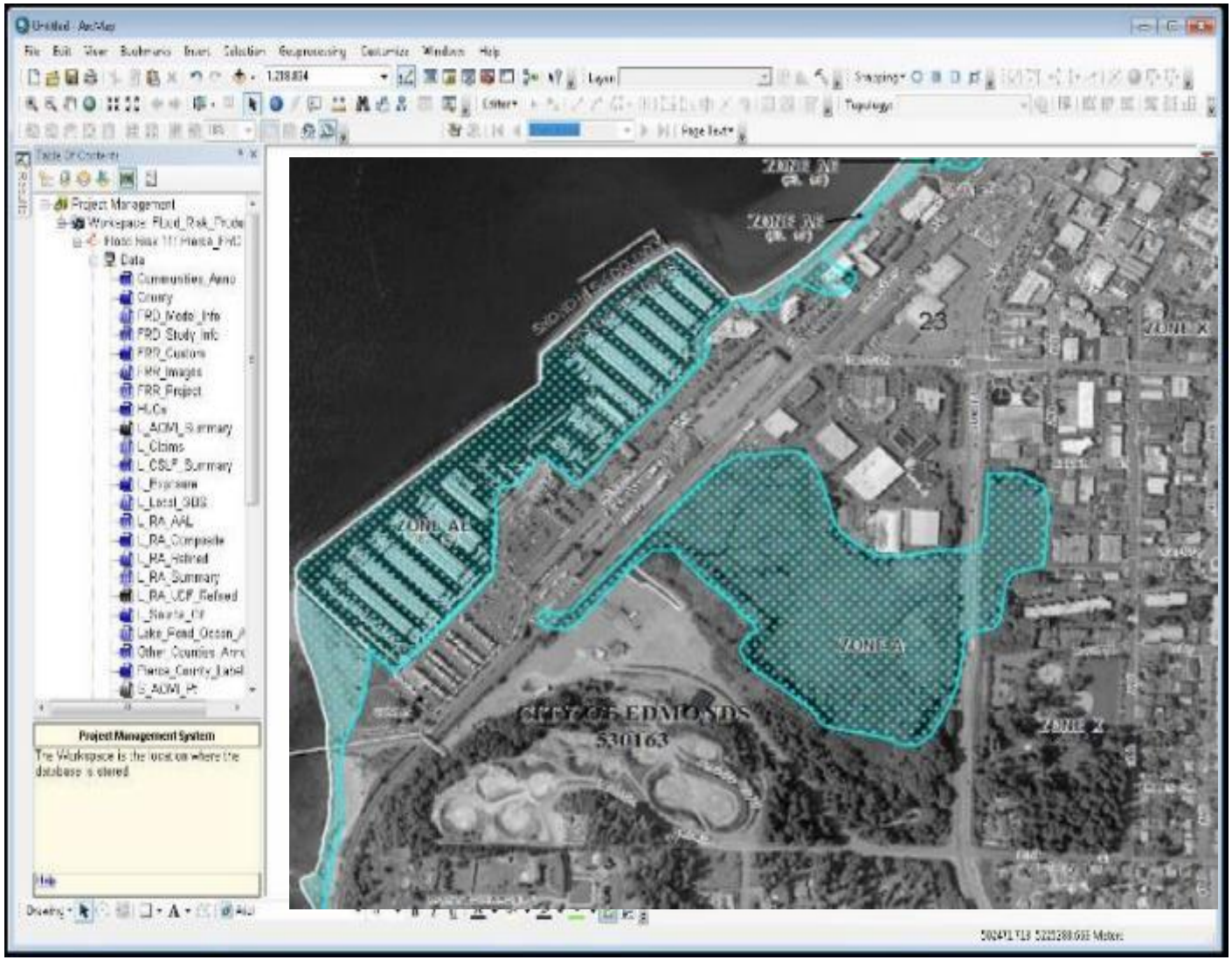


Regulatory Products

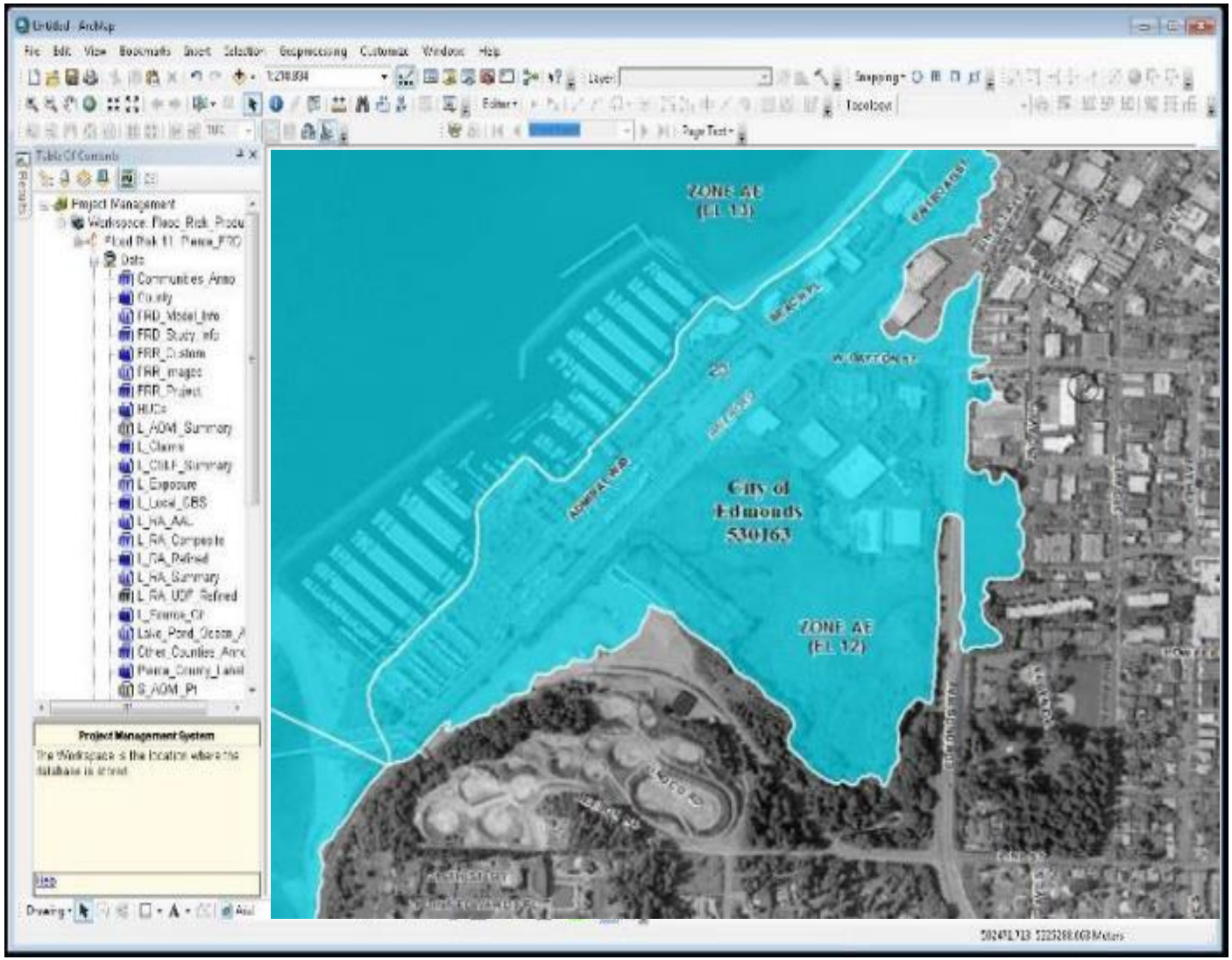
Non-Regulatory Products



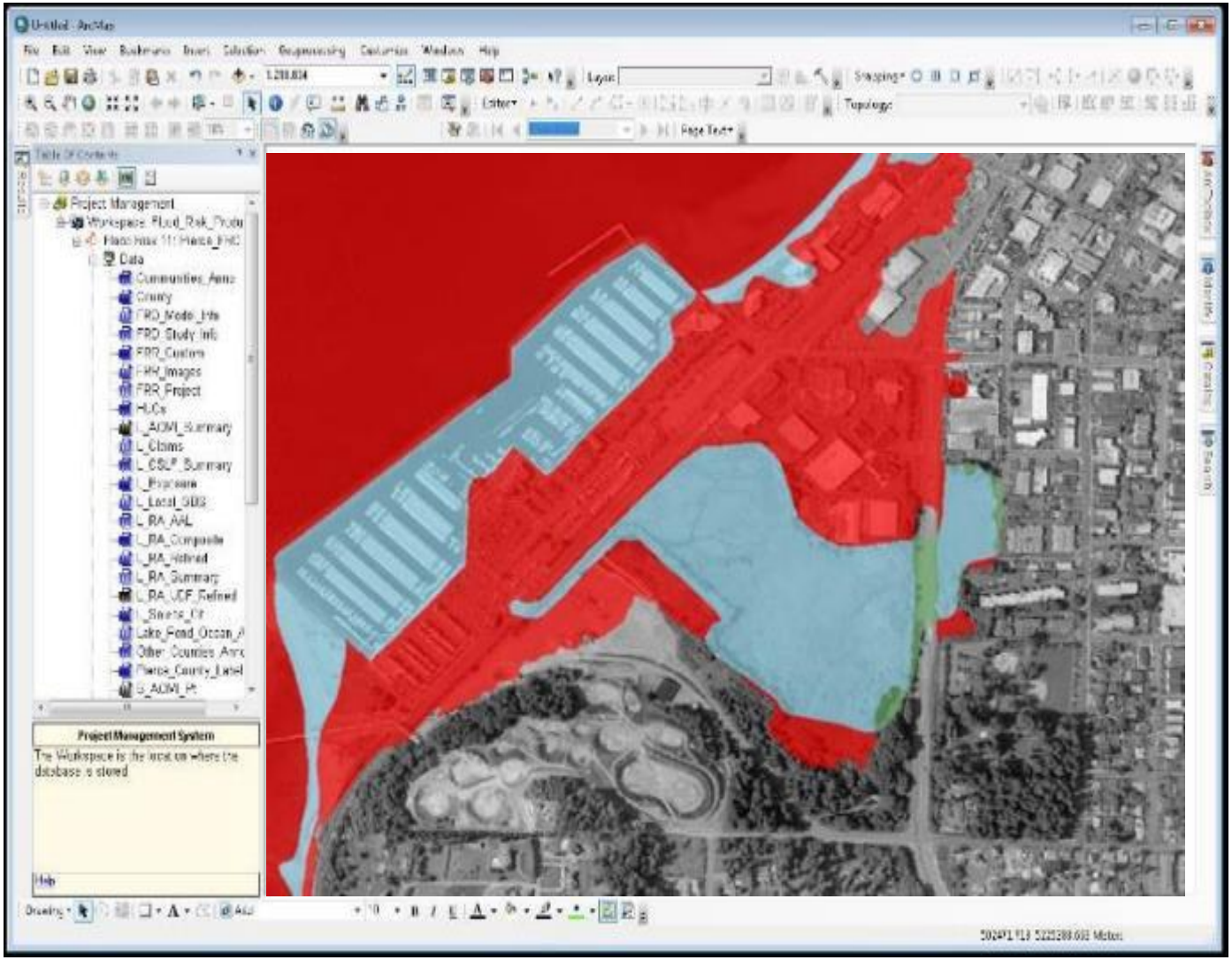
Changes Since Last FIRM - Before



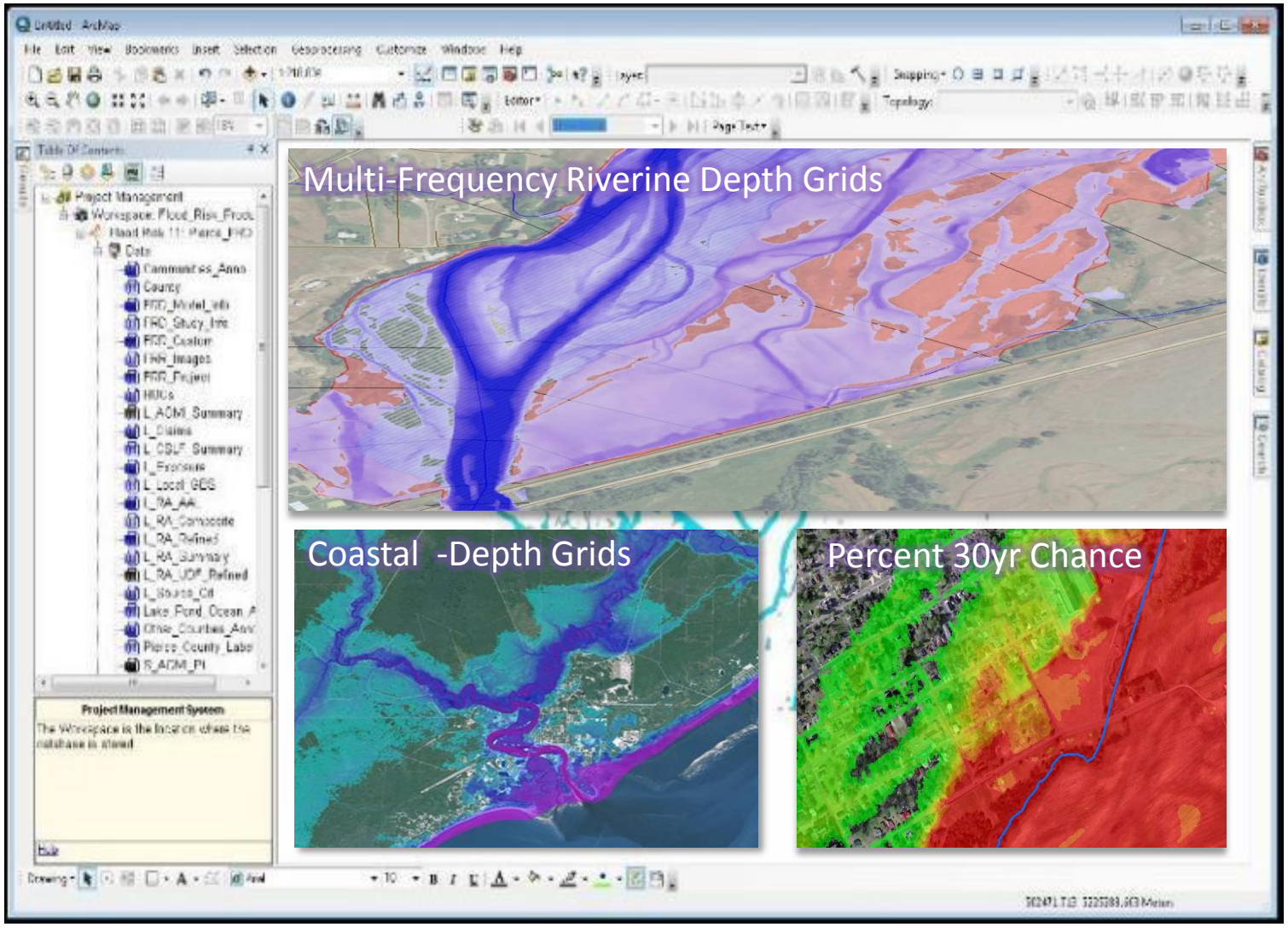
Changes Since Last FIRM - After



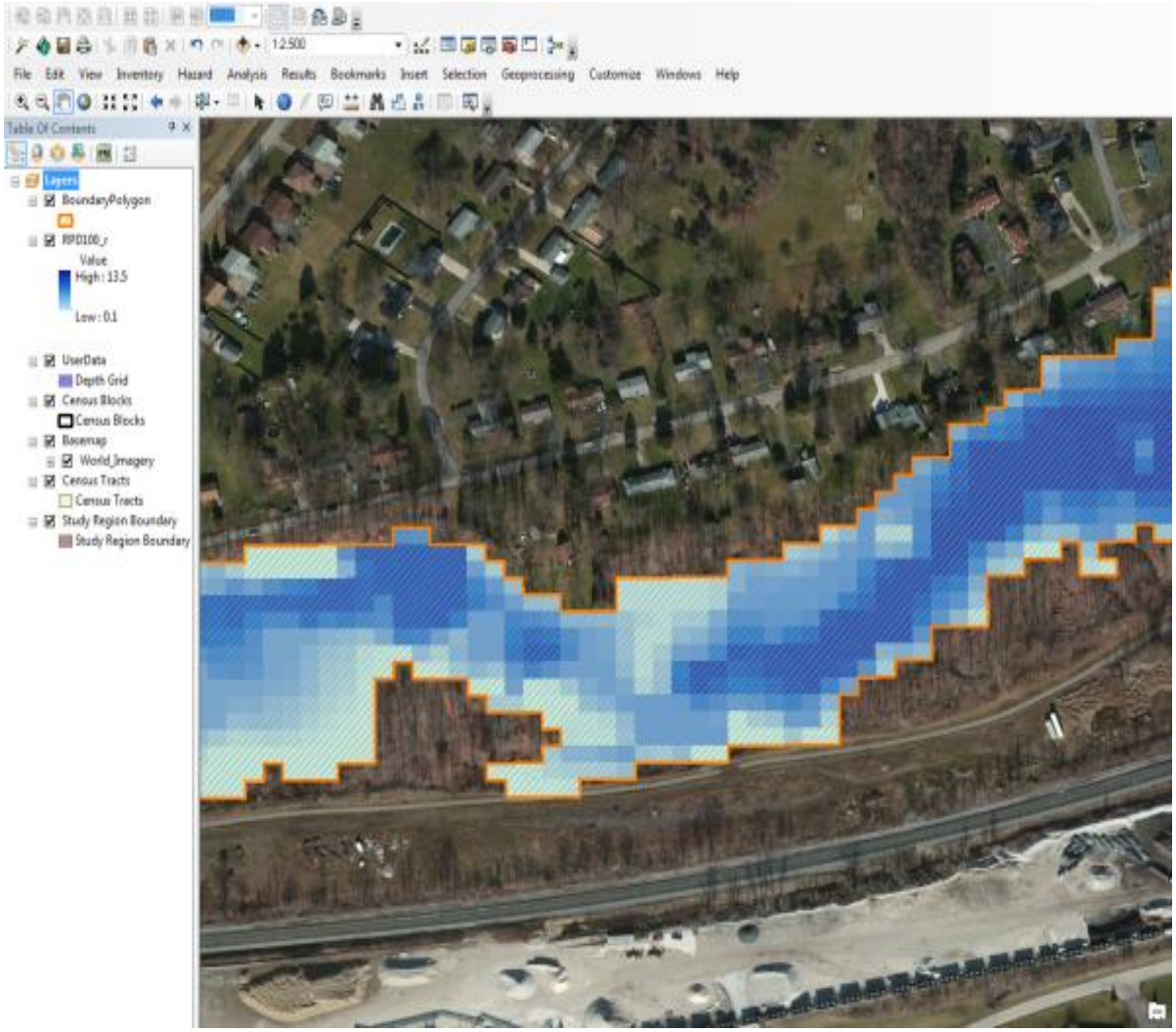
Changes Since Last FIRM – Net Change



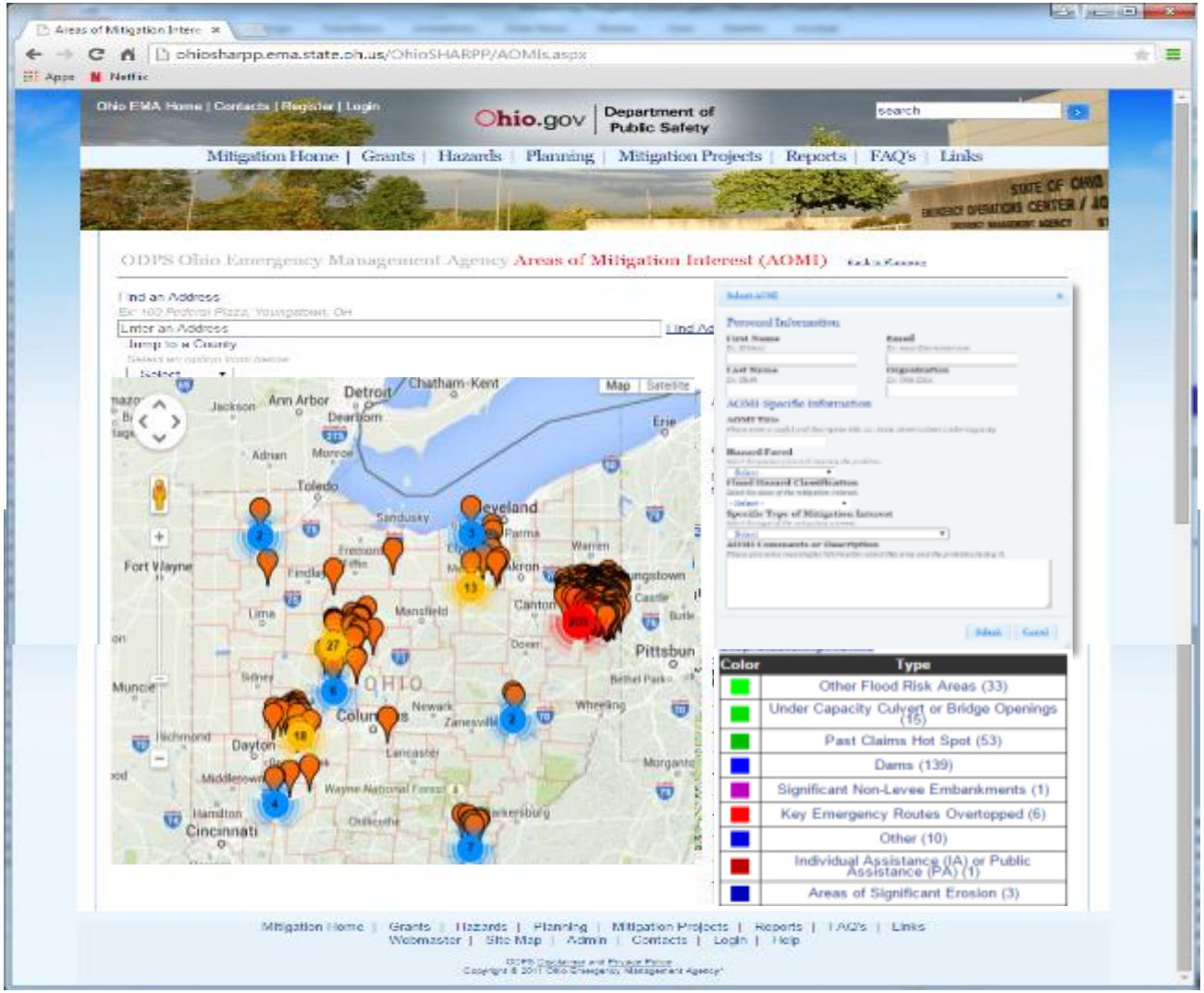
Flood Risk Depth Grids



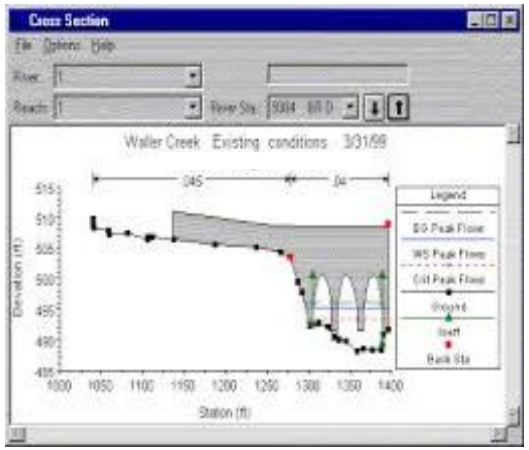
Updating Risk Assessments



Areas of Mitigation Interest



Assessing Pinch Points or road overtopping



MAP-21 Act

- Congress passed the MAP-21 Act in 2012, reauthorizing the federal highway program, reforming and reauthorizing the FEMA flood mapping and insurance program, and reforming student loans.
- Agencies are implementing key sections of that law -
  - FEMA on flood mapping;
  - The elevation provisions effectively provide a specific Congressional authorization for the 3DEP program USGS has launched.

MAP-21 Importance

- **NFIP Provisions…**
- Numerous MAPPS and NSPS initiated provisions, including those of the MAPPS FEMA task force;
  - Section 100215 establishes a FEMA technical mapping advisory council (TMAC), to include:
    - a member of a recognized professional surveying association or organization;
    - a member of a recognized professional mapping association or organization;
  - Section 100216 requires National Flood Insurance Program rate maps to use “the most accurate ***topography*** and ***elevation*** data available”

MAP-21 Importance

- Numerous MAPPS-initiated provisions, including those of our FEMA task force (Section 100216):
  - assesses the accuracy of current ground elevation data used for hydrologic and hydraulic modeling of flooding;
  - sources and mapping of the flood hazard and wherever necessary acquire new ground elevation data utilizing the most up-to-date geospatial technologies in accordance with guidelines and specifications of the Federal Emergency Management Agency;
  - develops National Flood Insurance Program flood data on a watershed basis;

MAP-21 Importance

- eliminates, to the maximum extent possible, discrepancies in base flood elevations between adjacent political subdivisions;
- publishes maps in a format that is digital geospatial data compliant; and
- authorizes appropriations $400,000,000 for each of fiscal years 2013 through 2017 (Section 100216)

MAP-21 Importance

- Section 100220:
  - Develops a funding strategy to leverage and coordinate budgets and expenditures, and to maintain or establish joint funding and other agreement mechanisms with other Federal agencies and units of State and local government to share in the collection and utilization of geospatial data among all governmental users.
  - Specifically mentions OMB, FEMA, USGS, NOAA &USACE

MAP-21 Importance

- Section 100121 includes a NAPA study on how FEMA can –
  - improve interagency and intergovernmental coordination on flood mapping, including a funding strategy to leverage and coordinate budgets and expenditures; and
  - establish joint funding mechanisms with other Federal agencies and units of State and local government to share the collection and utilization of data among all governmental users.

3D Elevation Program (3DEP)

- The National Enhanced Elevation Assessment (NEEA) demonstrated the potential to generate $1.2 billion to $13 billion new benefits annually
- Based on the NEEA findings, a cooperatively funded national 3-Dimensional Elevation Program (3DEP) executed by USGS
- Plan to acquire high resolution LiDAR data for 49 states, IFSAR in Alaska
- The goal is to achieve an 8-year acquisition cycle ($146 Million per year), will satisfy 58% of NEEA-identified requirements
- Provide bare earth elevation, point cloud and other data derivatives

3DEP

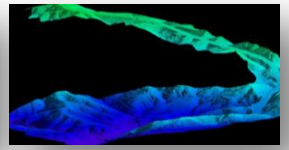
- National LiDAR coverage with ifsar in Alaska in 8 years
- Address the mission-critical requirements of 34 Federal agencies, 50 states, and other organizations documented in the National Enhanced Elevation Assessment
- Return on investment 5:1, conservative benefits of $690 million/year with potential to generate $13 billion/year
- Leverage the capability and capacity of private sector mapping firms
- Achieve a 25% cost efficiency gain by collecting data in larger projects
- Completely refresh national elevation data holdings with new LiDAR and ifsar elevation data products and services


Natural Resource Conservation


Infrastructure Management

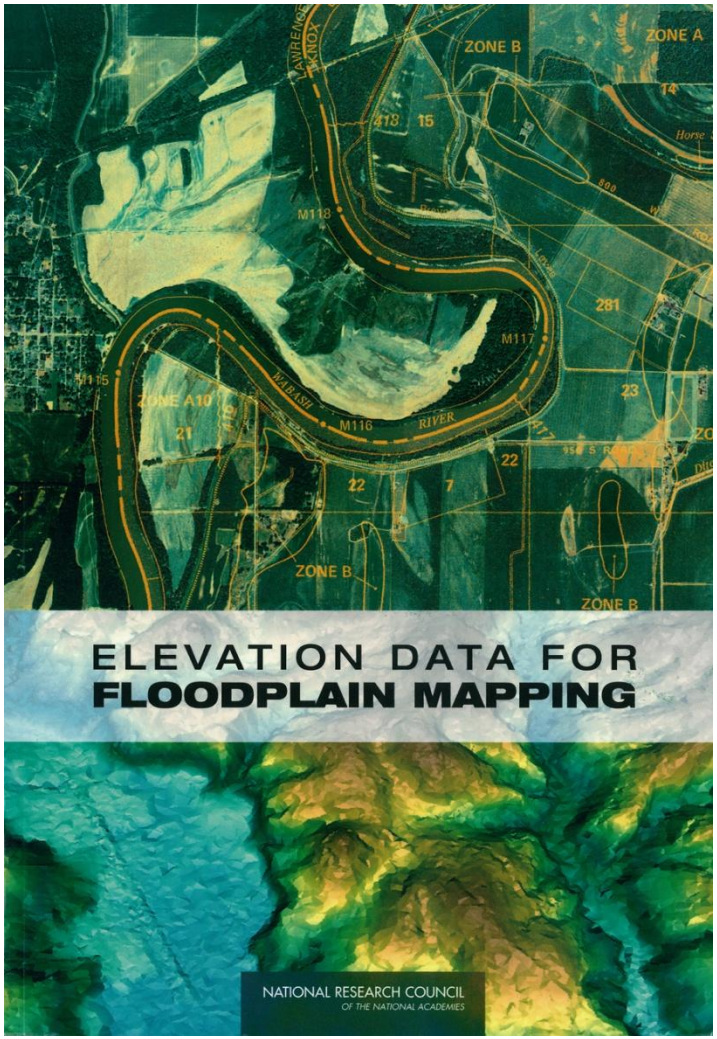

Flood Risk Mitigation


Precision Farming


Land Navigation and Safety

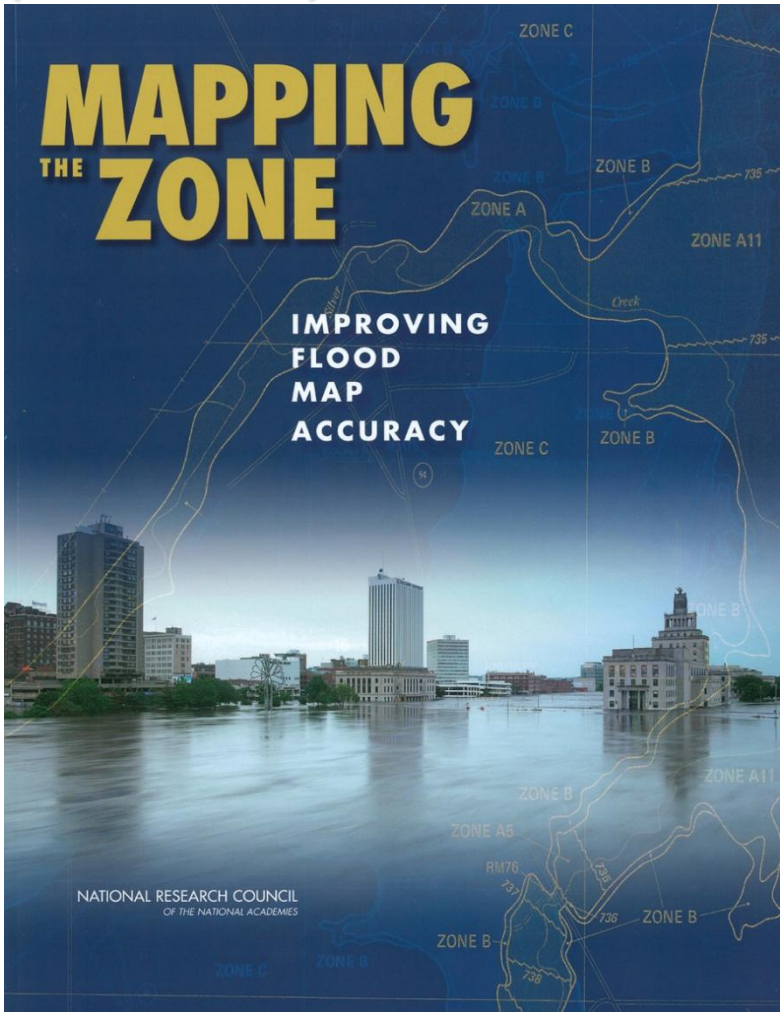

Geologic Resources and Hazards Mitigation

National Research Council (2007)



- Existing elevation data are inadequate to support FEMA's needs for the NFIP.
- Nationwide LiDAR data are required with 2-foot contour accuracy in most terrain and 1-foot contour accuracy in very flat coastal or inland floodplains.
- Nationwide LiDAR has applications well beyond FEMA's Map Modernization Program.
- Recommended *Elevation for the Nation (EFTN) – now known as the 3D Elevation Program (3DEP)*

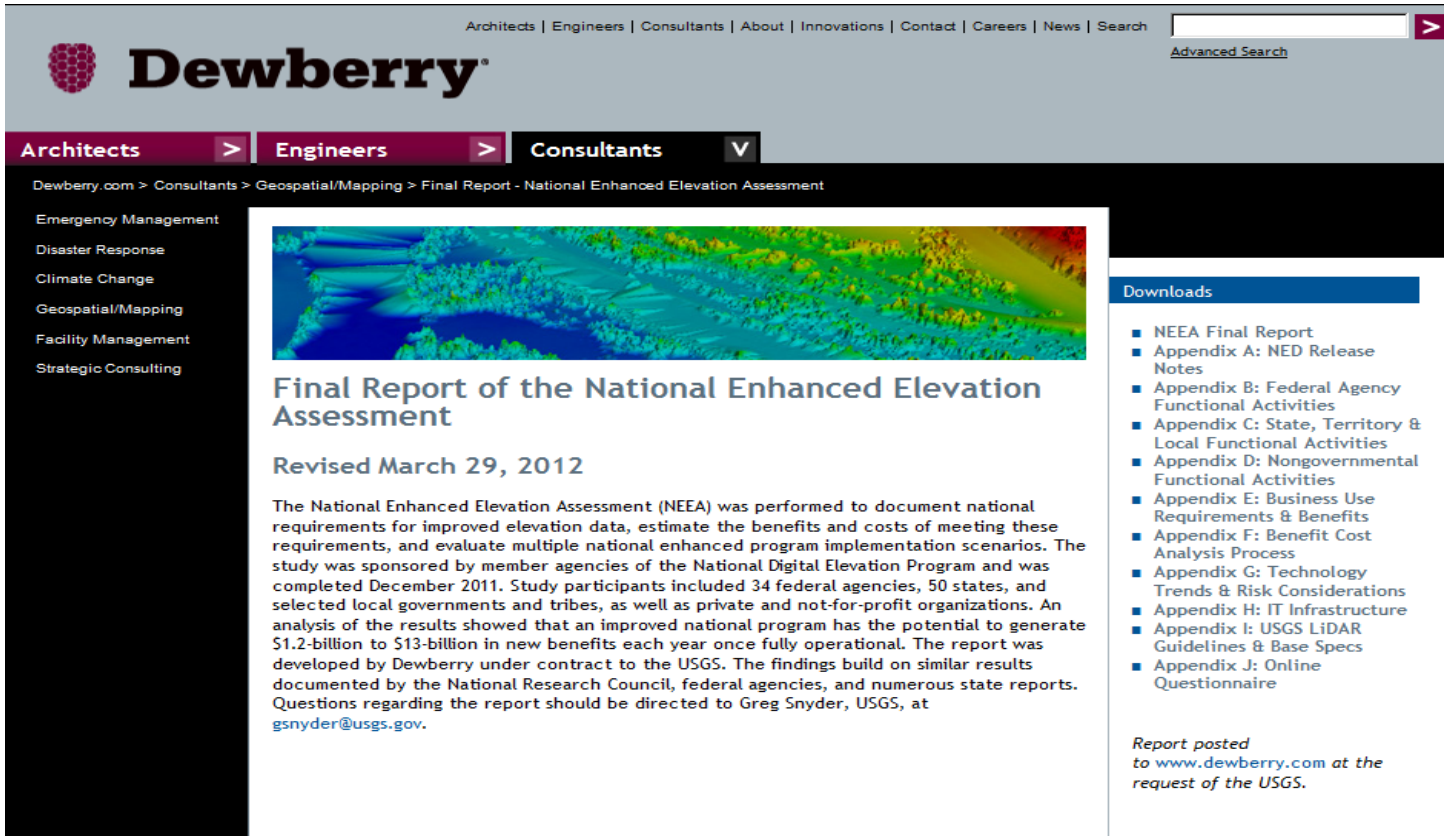
National Research Council (2009)



"Finding 1. Topographic data are the most important factor in determining water surface elevations, base flood elevation, and the extent of flooding and, thus, the accuracy of flood maps in riverine areas.

"Recommendation: FEMA should increase collaboration with the USGS and state and local government agencies to acquire high-resolution, high-accuracy topographic data throughout the nation."

“The most comprehensive benefit/cost analysis ever performed for any layer of The National Map”



27 Business Uses (BU's)

1. Natural resources conservation
2. Water supply and quality
3. River & stream resource management
4. Coastal zone management
5. Forest resources management
6. Rangeland management
7. Wildlife and habitat management
8. Agriculture and precision farming
9. Geologic resource assessment and hazard mitigation
10. Resource mining
11. Renewable energy resources
12. Oil and gas resources
13. Cultural resources preservation and management
14. Flood risk management
15. Sea level rise and subsidence
16. Wildfire mgt, planning, response
17. Homeland security, law enforcement, disaster response
18. Land navigation and safety
19. Marine navigation and safety
20. Aviation navigation and safety
21. Infrastructure and construction management
22. Urban and regional planning
23. Health and human services
24. Real estate, banking, mortgage, insurance
25. Education K-12 and beyond
26. Recreation
27. Telecommunications

But 602 Functional Activities described in users' own words, linked to these BU's

National Enhanced Elevation Assessment (NEEA)

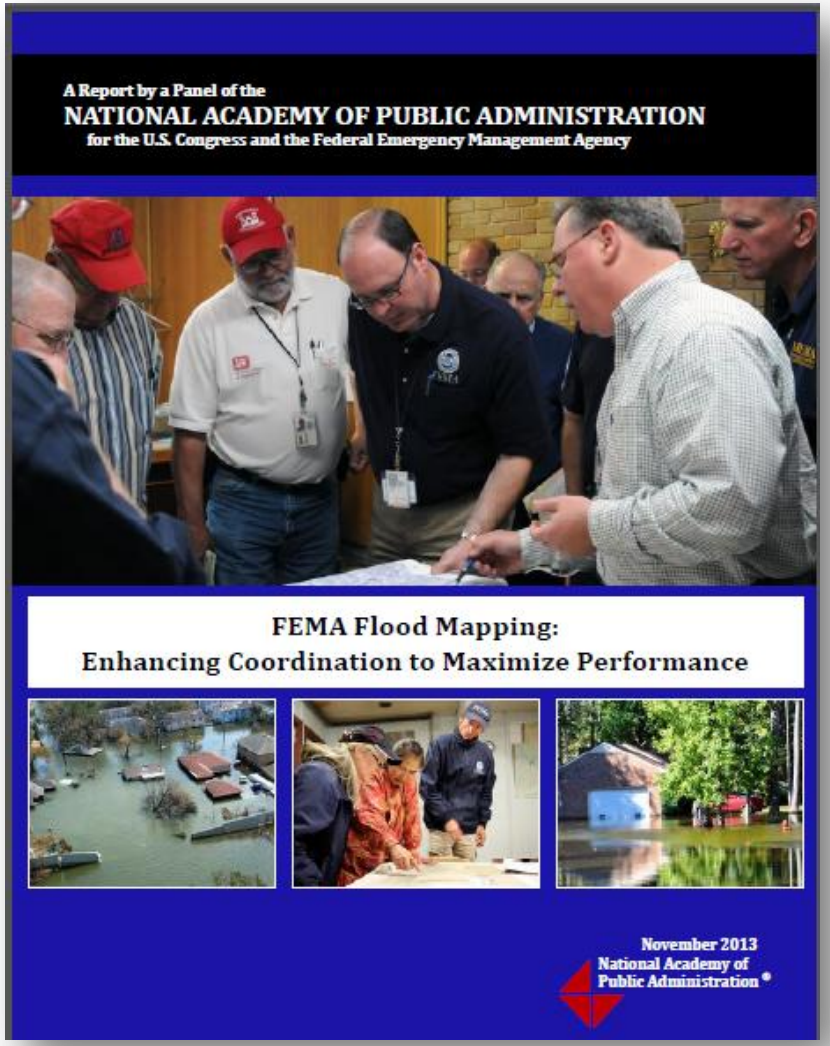
– Summary of Benefits for Top Business Uses

		Annual Benefits	
Rank		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**

3DEP

For Flood Mapping

- **NAPA Report Recommendation 15:** **“**The Office of Management and Budget should use the 3DEP implementation plan for nationwide elevation data collection to guide the development of the President’s annual budget request”
- 3DEP under discussion in the **Technical Advisory Mapping Council (TMAC)**
- NAPA recommendation was endorsed by the National Geospatial Advisory Committee in June, 2015



3DEP

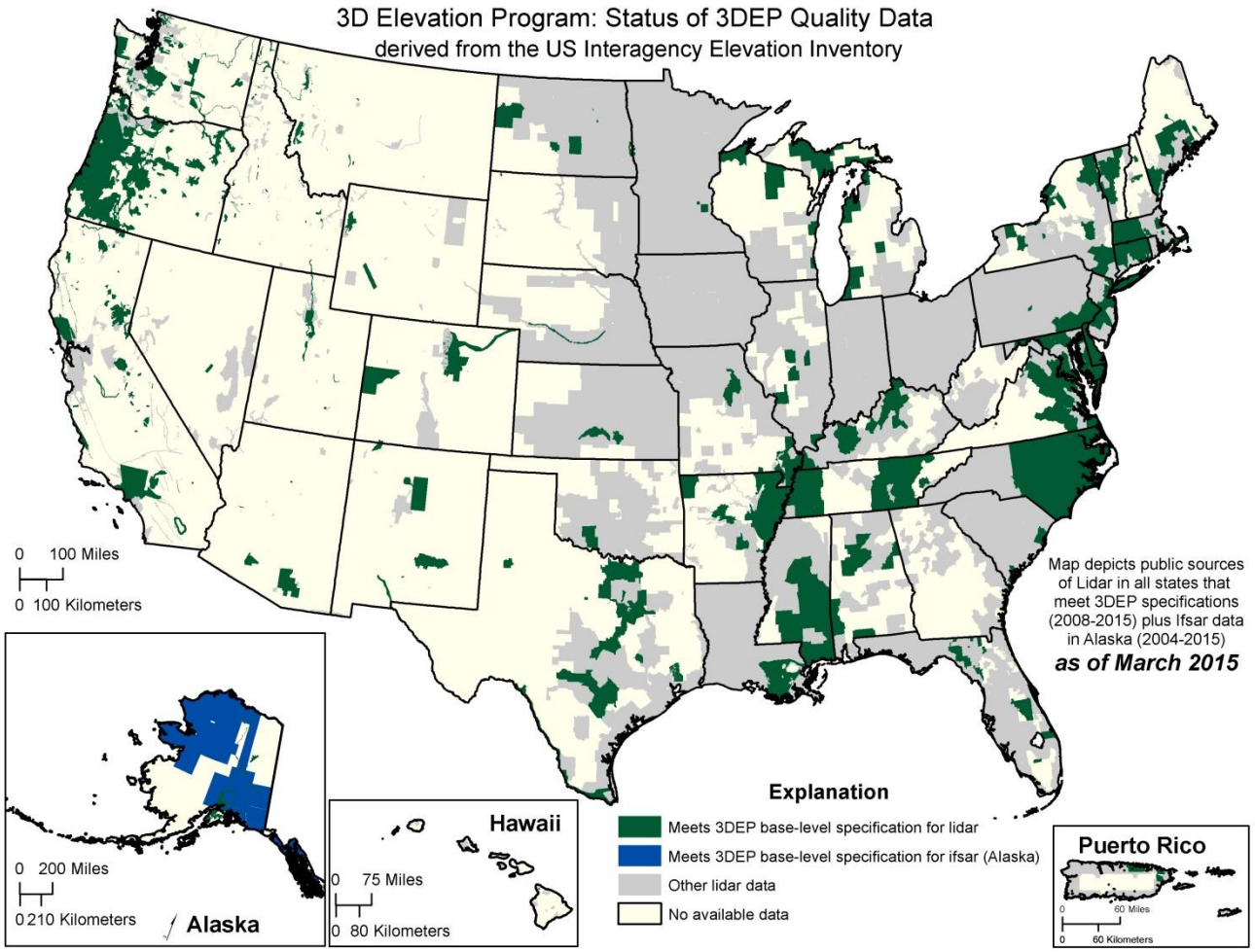
Endorsements

- American Society for Photogrammetry and Remote Sensing (ASPRS)
- Association of American State Geologists (AASG)
- Association of State Floodplain Managers (ASFPM)
- Coalition of Geospatial Organizations (COGO)
- Management Association for Private Photogrammetric Surveyors (MAPPS)
- National Geospatial Advisory Committee (NGAC)
- National Society of Professional Surveyors (NSPS)
- National States Geographic Information Council (NSGIC)

- ***PERHAPS…SMARTERSAFER Coalition???***
- ***PERHAPS…Individual Members of the SMARTERSAFER Coalition???***

U.S. Interagency Elevation Inventory

- 2015 PRELIMINARY Results – Subject to Revision
- Will be published in 3DEP FY15 Annual Report



3.1% (110,897 sq. mi.) of entire US was acquired to 3DEP quality in FY15 - includes complete, in progress, and planned/funded

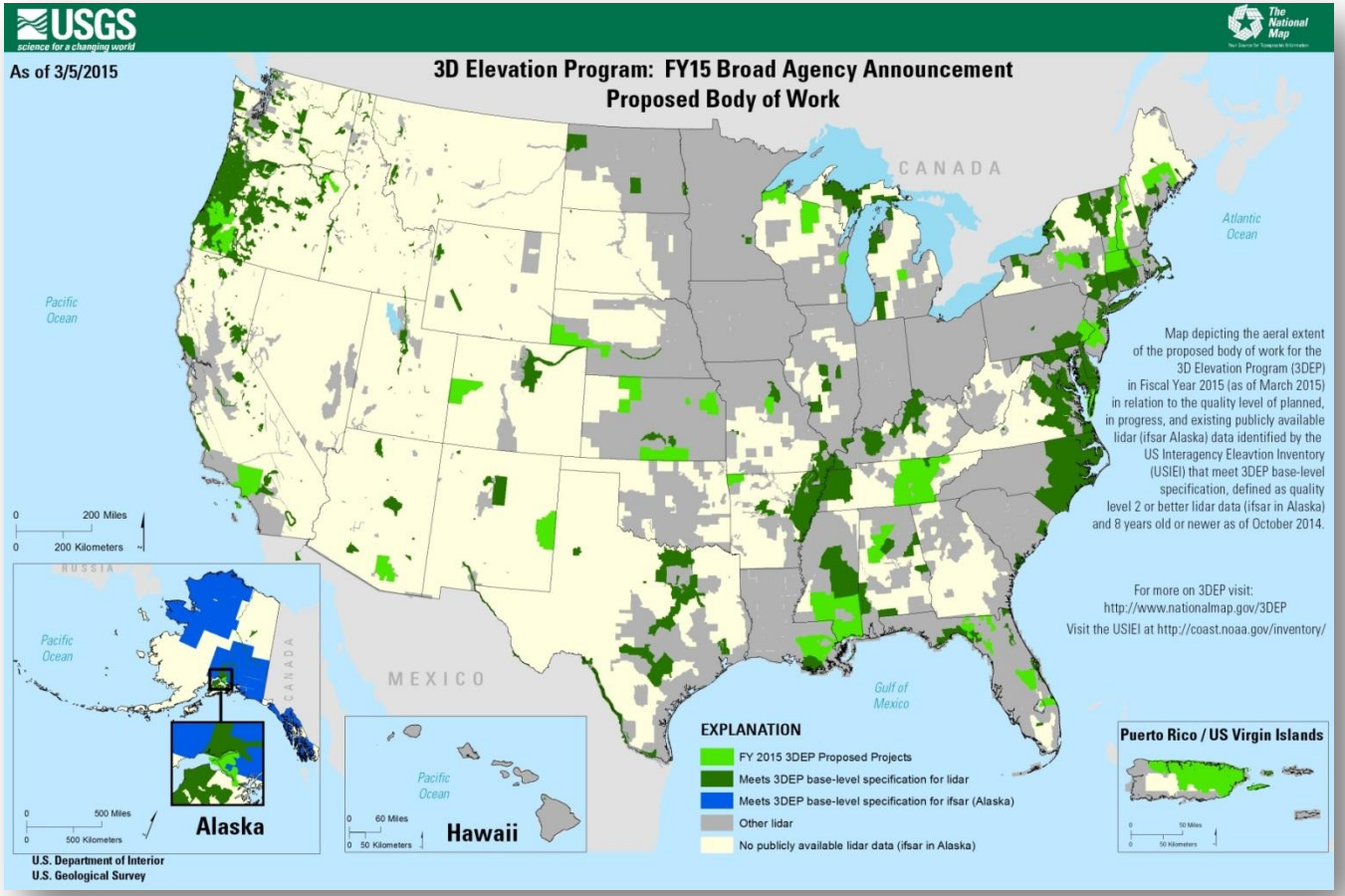
10.2% of Lower 49 Meets 3DEP quality (308,648 sq. mi. - 2008-2015 only)

54.5% of AK Meets 3DEP quality (QL5 – ifsar, 314,834 sq. mi.)

FY14/15 Broad Agency Announcement

3DEP Data Acquisition

- 72 pre-proposals submitted requesting funds over $50M
- 29 projects were funded
- USGS, FEMA, and NRCS committed $9.8M, with a total estimated value from partners of $26.5M



+ Results available at http://nationalmap.gov/3dep

3DEP

+ Funding Profile

- Currently funded at ~$20 million annually to carry out the acquisition, management and distribution of data
- At this level, it will require about 26 years to complete once over coverage national coverage

USGS 3DEP funding level	Annual LiDAR data collection (sq. mi.)	Collection rate (% of Nation)	Years to complete coverage
$20 M (FY15 level)	100,000	3.9%	26 years
$25 M (President's FY16 Req +$5 M)	130,000	5.0%	21 years
$34 M (+$14 M)	172,000	6.7%	15 years
$39 M (+19 M)	215,000	8.3%	12 years
$43. M (+23 M)	258,000	10.0%	10 years
$50 M (+30 M)	322,000	12.5%	8 years

Suggested Appropriations Language:

"MAPPS and NSPS respectfully urge Congress to cooperatively fund the 3DEP program. For USGS, in the Interior, Environment and Related Agencies appropriations bill for Fiscal Year 2016, it is suggested that Core Science Systems include an increase of $28.7 million above the President's request for 3DEP. For the Natural Resources Conservation Service (NRCS) in the Agriculture and Related Agencies appropriations bill for Fiscal Year 2016, it is suggested that LiDAR-Enhanced Soil Survey (LESS) include no less than $20 million to acquire enhanced elevation data that can contribute to 3DEP. For the Federal Emergency Management Agency (FEMA) in the Department of Homeland Security appropriations bill for Fiscal Year 2016, it is suggested that the National Flood Insurance Program (NFIP) include no less than $20 million to acquire enhanced elevation data compatible with 3DEP.

Additionally: To visit the 3DEP website, you can do so here: www.3DEP4America.com
3DEP "Coffee Table" Book - www.shareandflip.com/3DEP/
And, here is the news release from efforts underway:
Joint MAPPS-NSPS Issue Paper: 3DEP Issue Paper
Also, the USGS 3DEP state-by-state fact sheets.

CREDITS: Text and imagery were provided by the following organizations and firms, at the very least: FEMA, MAPPS, NSPS, USGS, ATKINS, Dewberry, ESP Associates, P.A., Michael Baker International, Stantec