



# USGS Flood Inundation Mapping (FIM) Program - Linking Streamgages, Flood Forecasts, Inundation Mapping, and HAZUS

## 2013 Hazus Symposium

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



# March 1913



"The Cutler Gackets Performed Many Heroic Deeds in Rescuing the Flood Sufferers. This Shows a Typical Scene." Logansport, Indiana March 1913. Photo courtesy Cutler Academics, [www.cutler.org](http://www.cutler.org)



POSSA ALBUM 0044



During March, 1913. Photo courtesy Maure County Museum and Historical Society, Inc., Peru, IN.



Downtown Dayton, Ohio on March 25, 1913. Courtesy Wright State University Library.

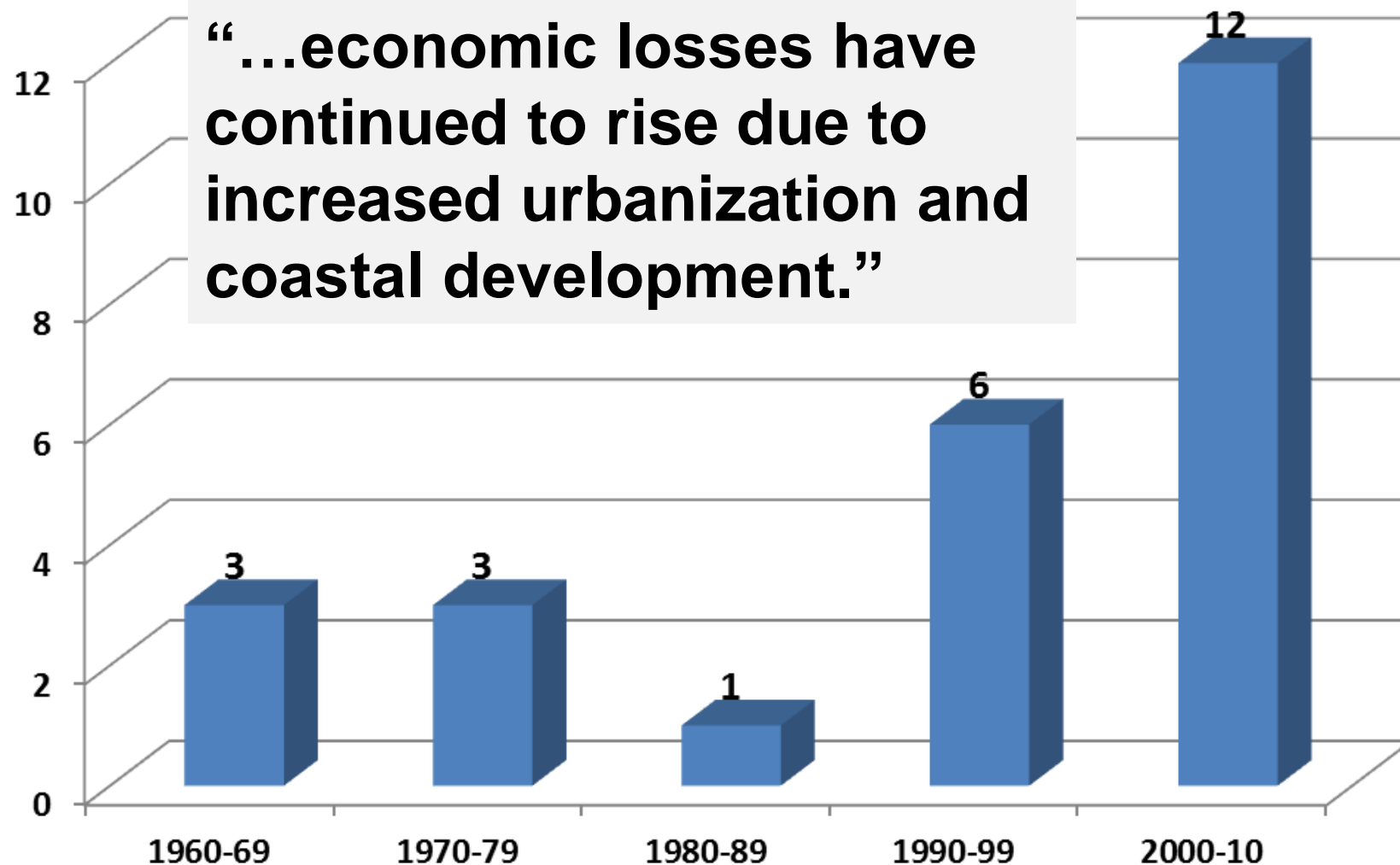
**“The flood was second only to Noah's”**

Bishop Milton Wright, father of Orville and Wilbur and Dayton flood survivor



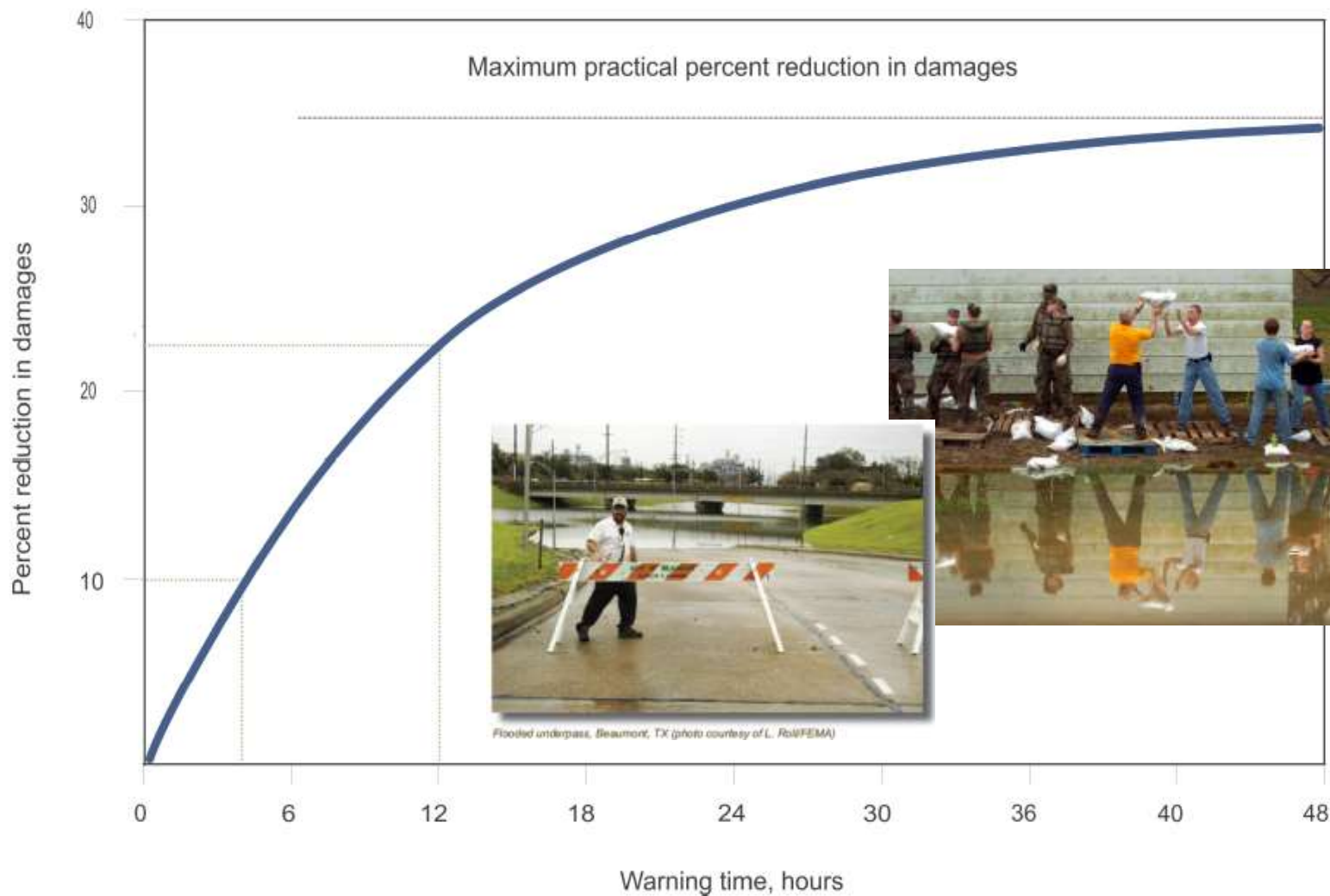
**Although loss of life to floods during the past half-century has declined, mostly because of improved warning systems,...”**





## Indiana Federal Flood Disaster Declarations





Day, H.J. (1970). "Flood warning benefit evaluation-Susquehanna River Basin (urban residences)." ESSA technical memorandum WBTM Hydro-10. National Weather Service. Silver Spring, MD.



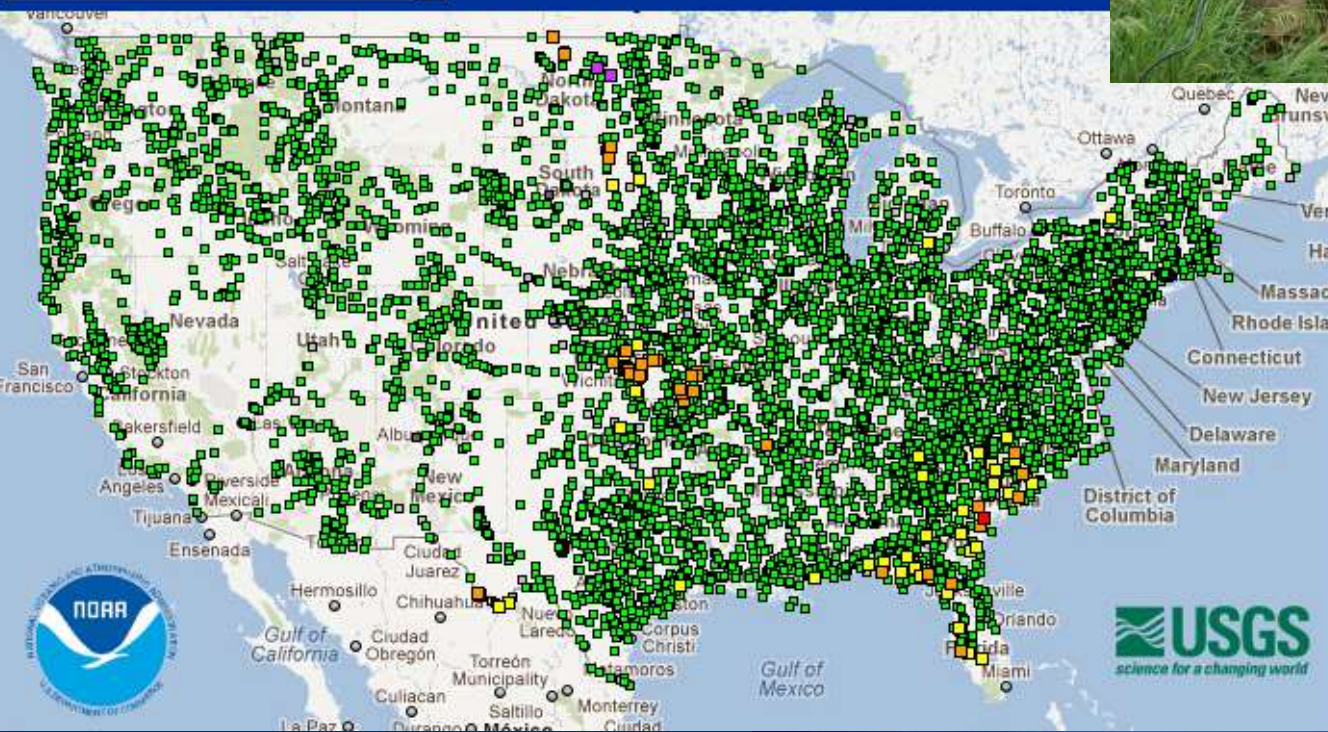
# A Federal Partnership A National Network

River Observations

River Forecasts

Experimental  
Long-Range River Flood Risk

All Locations



below:

United States

NWS Weather Forecast Offices

NWS River Forecast Centers

Water Resources Regions

6070 total gauges

Show all locations in flood (36)

- 2 Gauges: Major Flooding
- 1 Gauges: Moderate Flooding
- 33 Gauges: Minor Flooding
- 46 Gauges: Near Flood Stage
- 5666 Gauges: No Flooding
- 290 Gauges: Observations older than 24 hours
- 32 Gauges: Out of Service

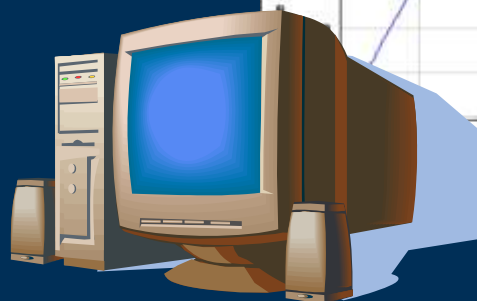
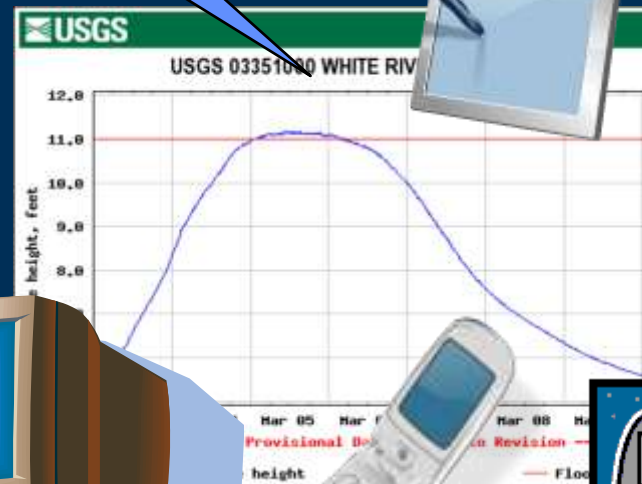
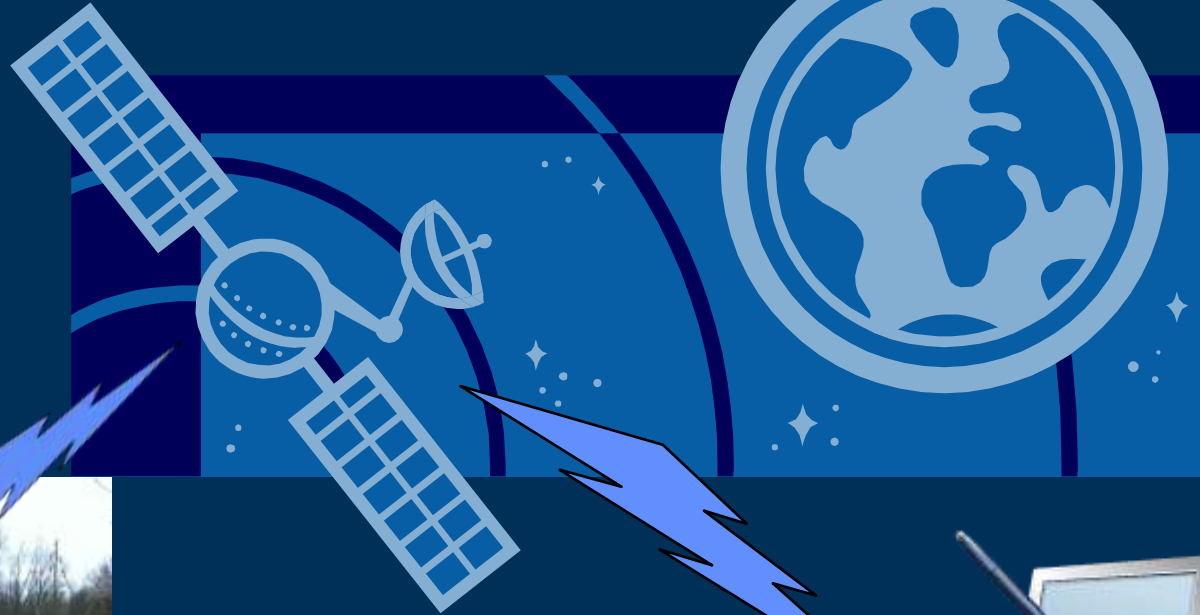
Show all locations

Last map update: 07/31/2013 at 11:40:15 am EDT  
07/31/2013 15:40:15 UTC



National Oceanic and Atmospheric Administration's  
National Weather Service

# “From gage to page”



**Water Alert**



# National Weather Service flood forecasting

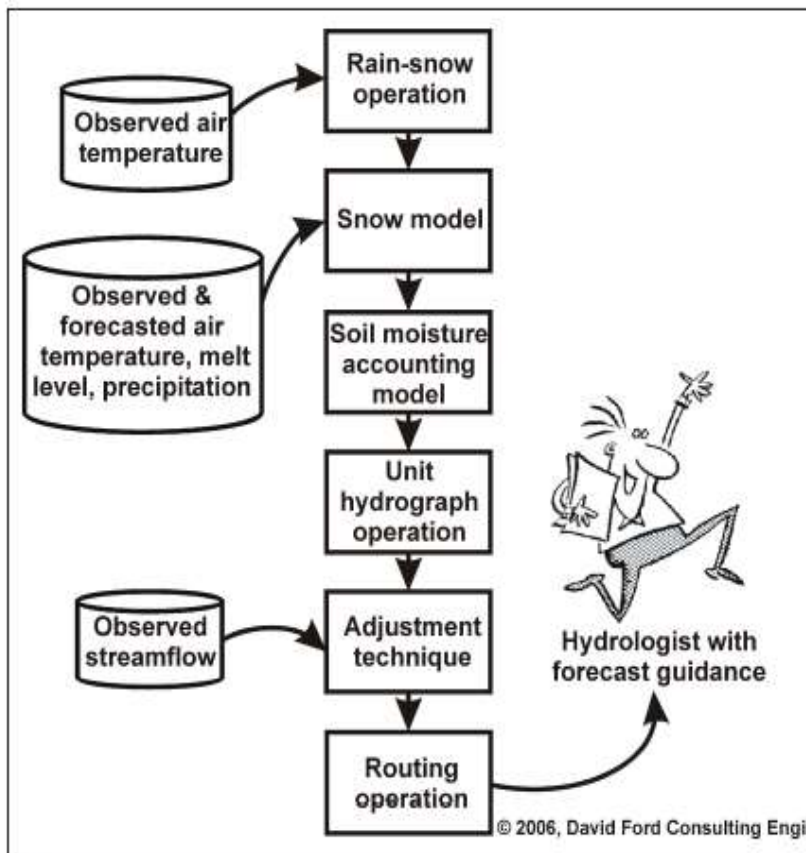
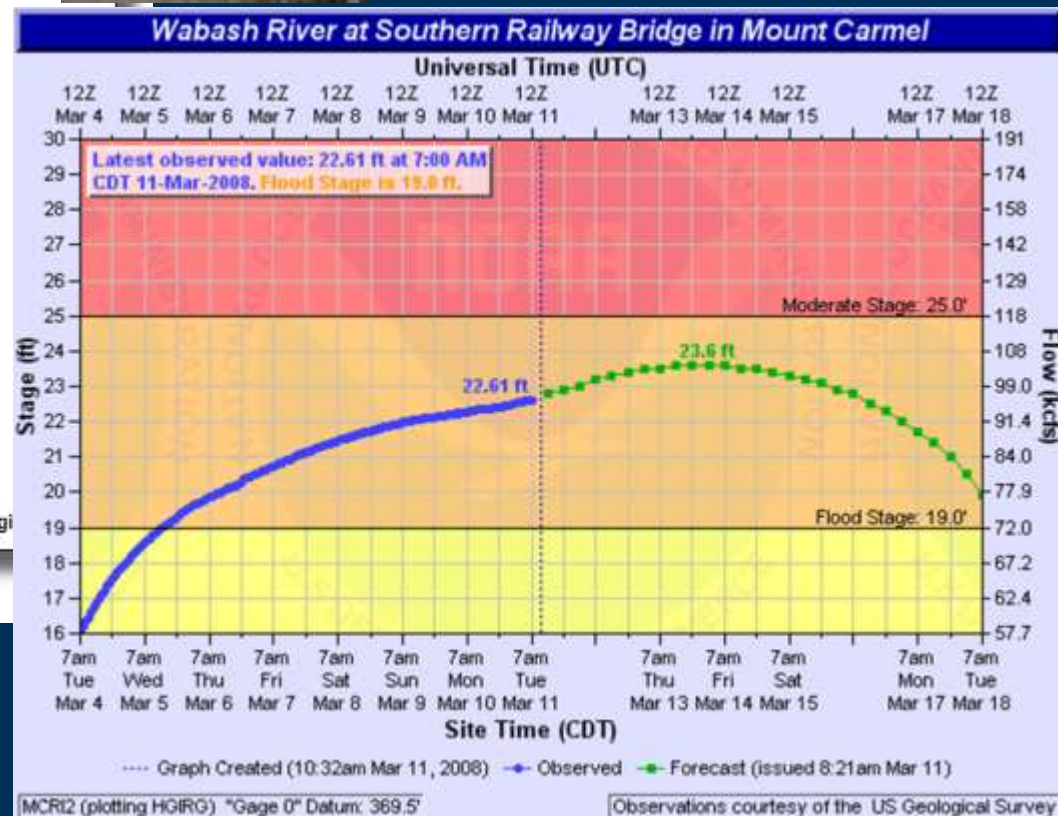


Figure 4. Typical NWSRFS configuration

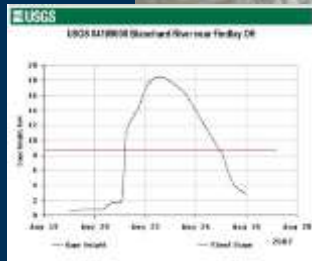




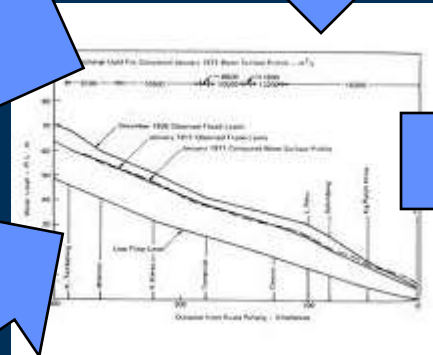
# Flood info – from a point on the landscape to geospatial products



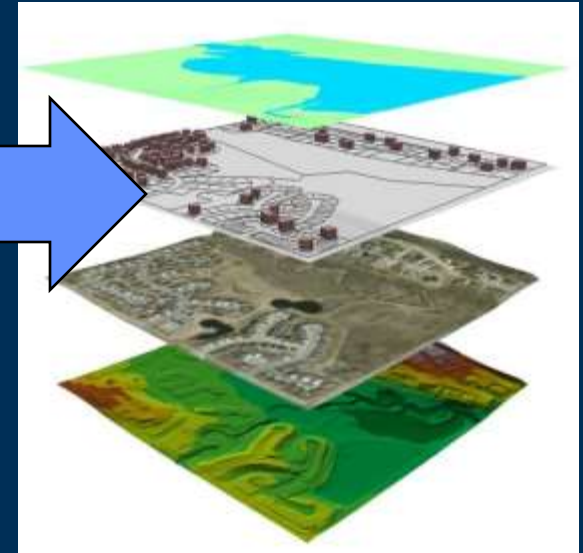
High-water marks



USGS Real-time streamgage data



Hydraulic model

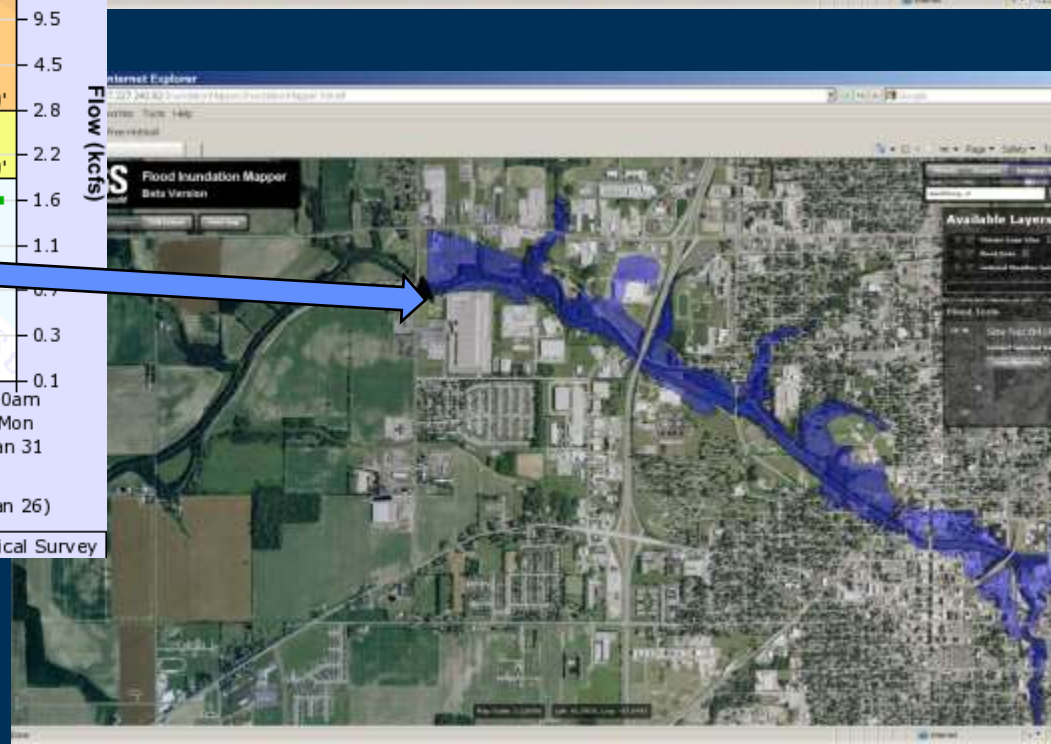
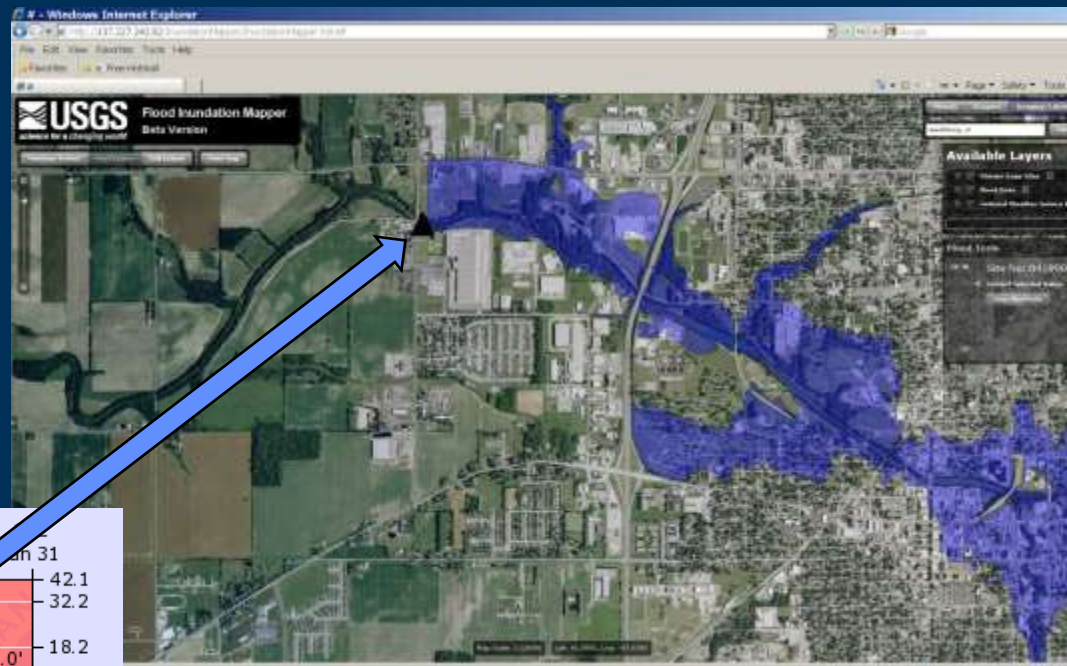
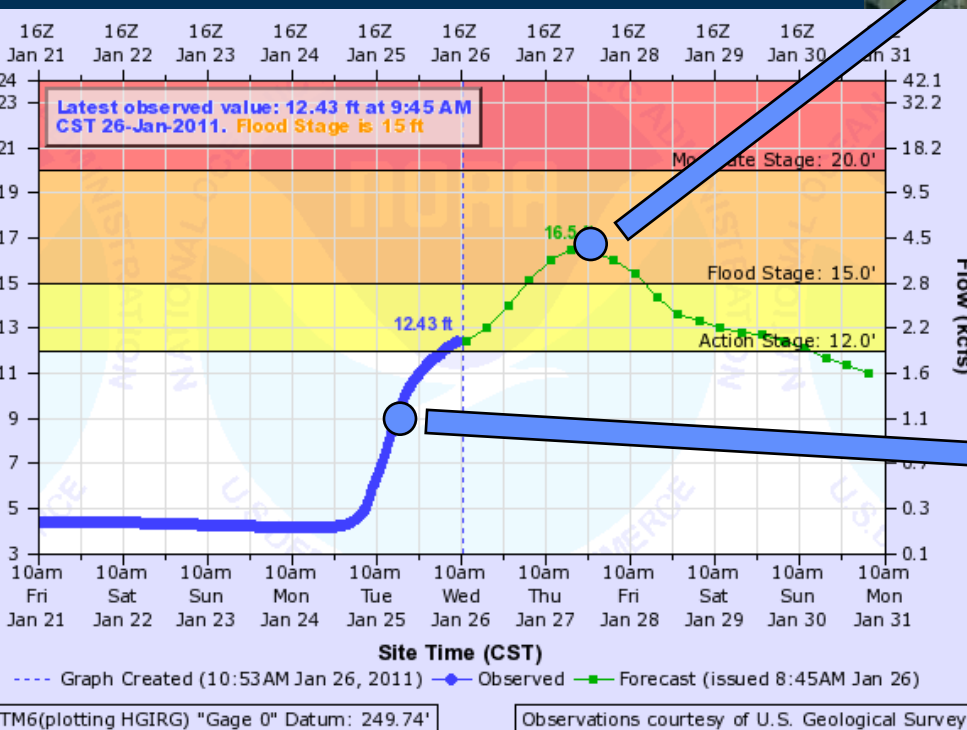


[http://las.depaul.edu/geography/images/Misc\\_Images/gis.jpg](http://las.depaul.edu/geography/images/Misc_Images/gis.jpg)



National Weather Service flood forecasts

# Flood Inundation Maps translate a hydrograph into operational maps that communicate risk and consequences

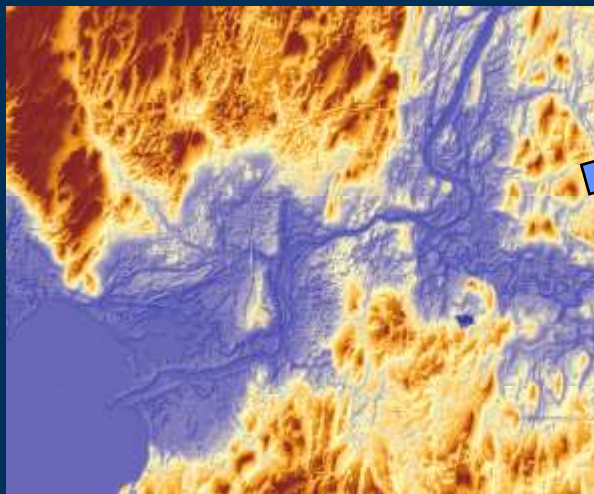
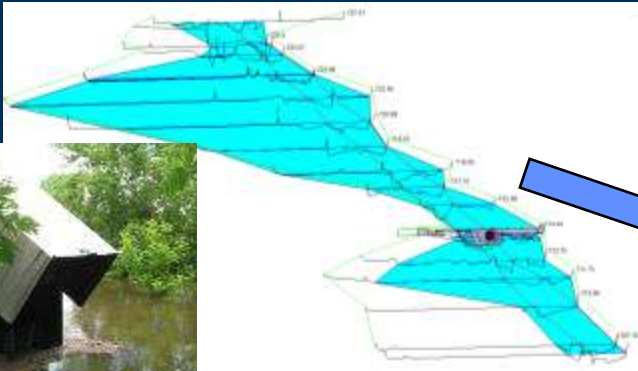




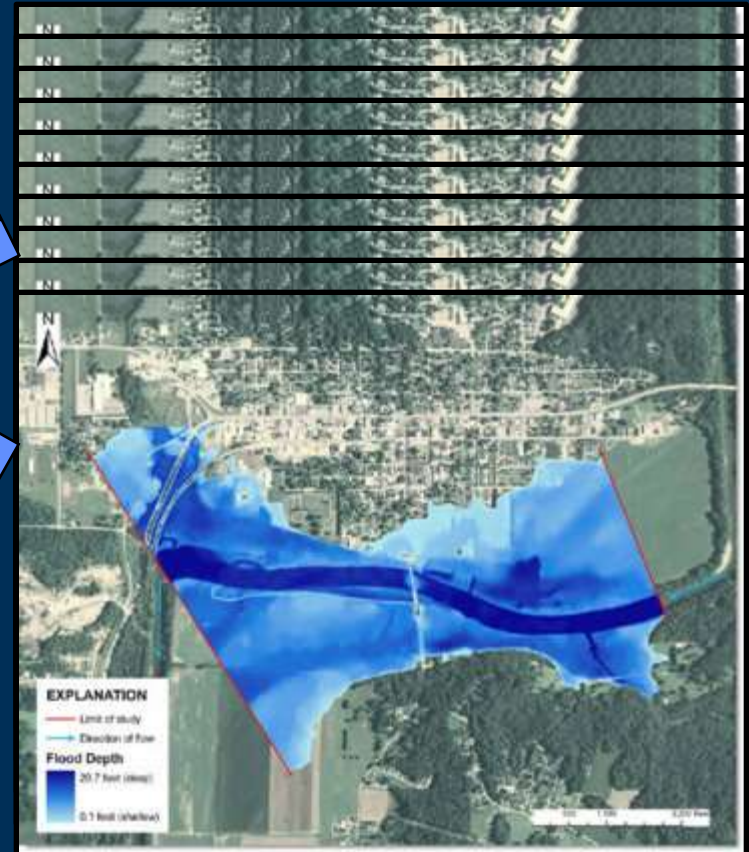
# Creation of Inundation Map Libraries



Gage/HWM Calibrated Hydraulic Model



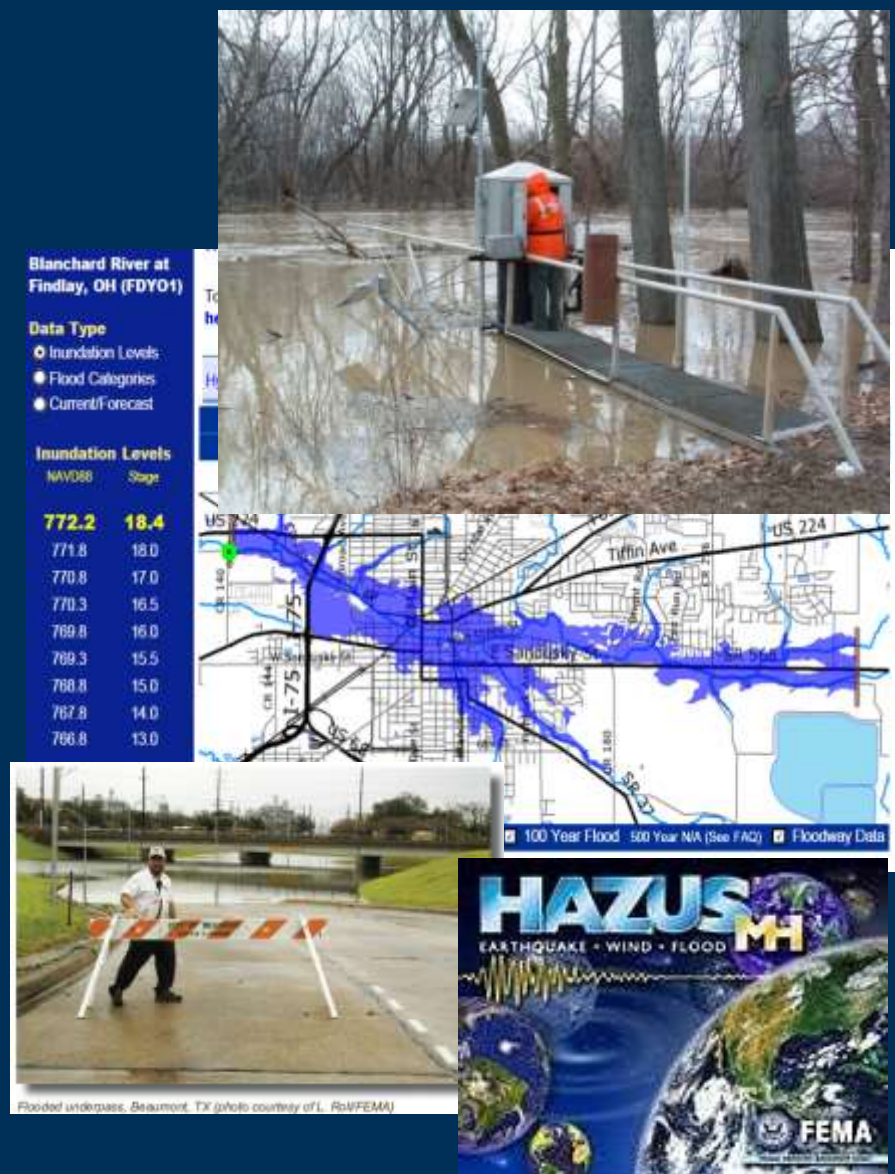
High Quality Elevation Data (LiDAR)



Series of sequential maps showing probable areas of inundation from bankfull to record stages

# An Inundation Map is a tool for:

- Flood Preparedness
  - “What-if” scenarios
- Flood Response
  - Tied to gage & forecast data
- Flood Recovery
  - Damage assessment
- Mitigation & Planning
  - Flood risk analyses
- Environmental & Ecological Assessments





# An Interagency Program

- **NWS** – Technical guidance, connection to shareholders, outreach
- **USACE** – Technical guidance, flood-control risk assessment
- **FEMA** – Hazard mitigation, risk and vulnerability assessment
- **USGS** – Science and technology development, documentation and distribution of technical methods, map display



# IWRSS – Integrated Water Resources Science and Services

- Consortium of federal agencies with complementary water resources missions
- Goals
  - integrate information delivery and simplify access to these data,
  - increase accuracy and timeliness of water information, and
  - provide “summit-to-the-sea” high resolution water resources information





# National Flood Inundation Mapping Requirements Team

## Purpose and Scope

- Define requirements and tech specs for products and services
- Evaluate and propose a viable concept of operations
- Evaluate and specify the general requirements for mutual modeling and information services ( a common operating picture)

## Requirements Topics

- Project scoping
- Elevation data
- Hydraulic modeling
- Mapping products
  - Map layers, projection, scales
  - Metadata
- Map features
  - Title, date, depth grids, levees
  - Uncertainty, flood impact statements, loss estimation
  - QA/QC - short term & long term



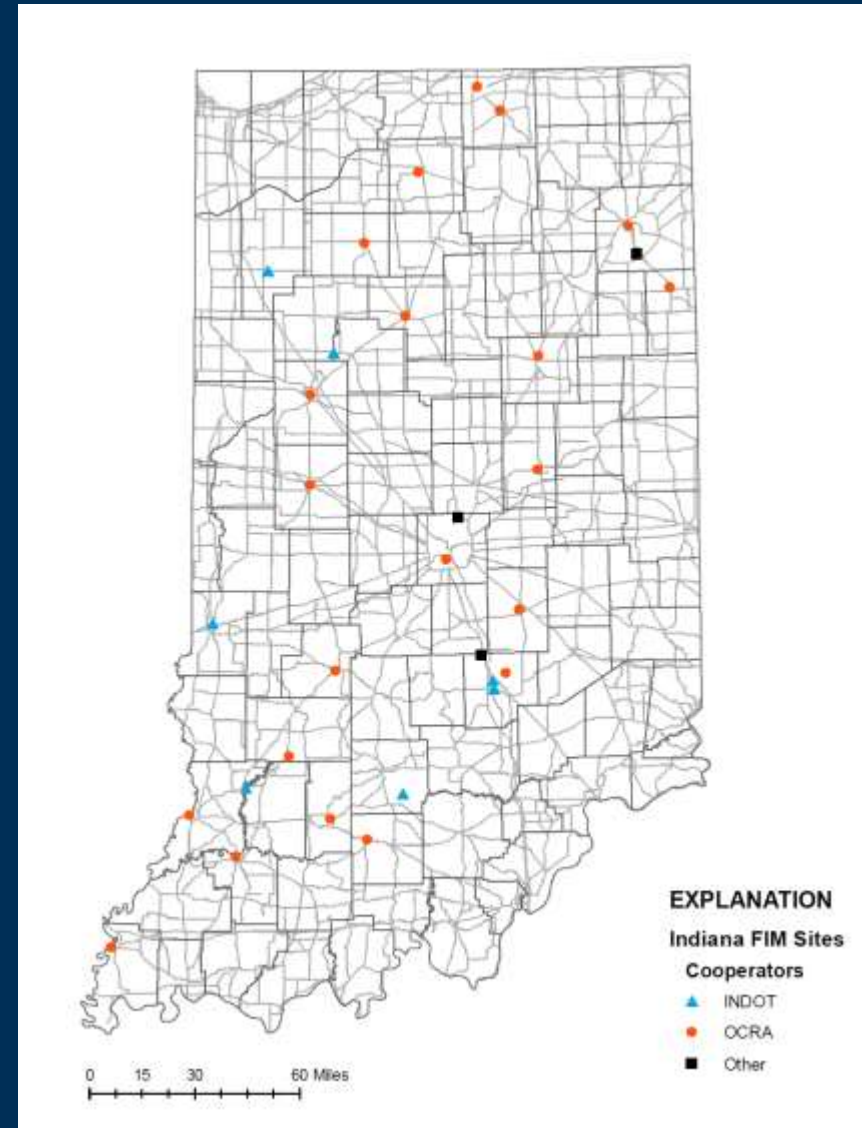
# FIM: Partnering at the State and Local Level



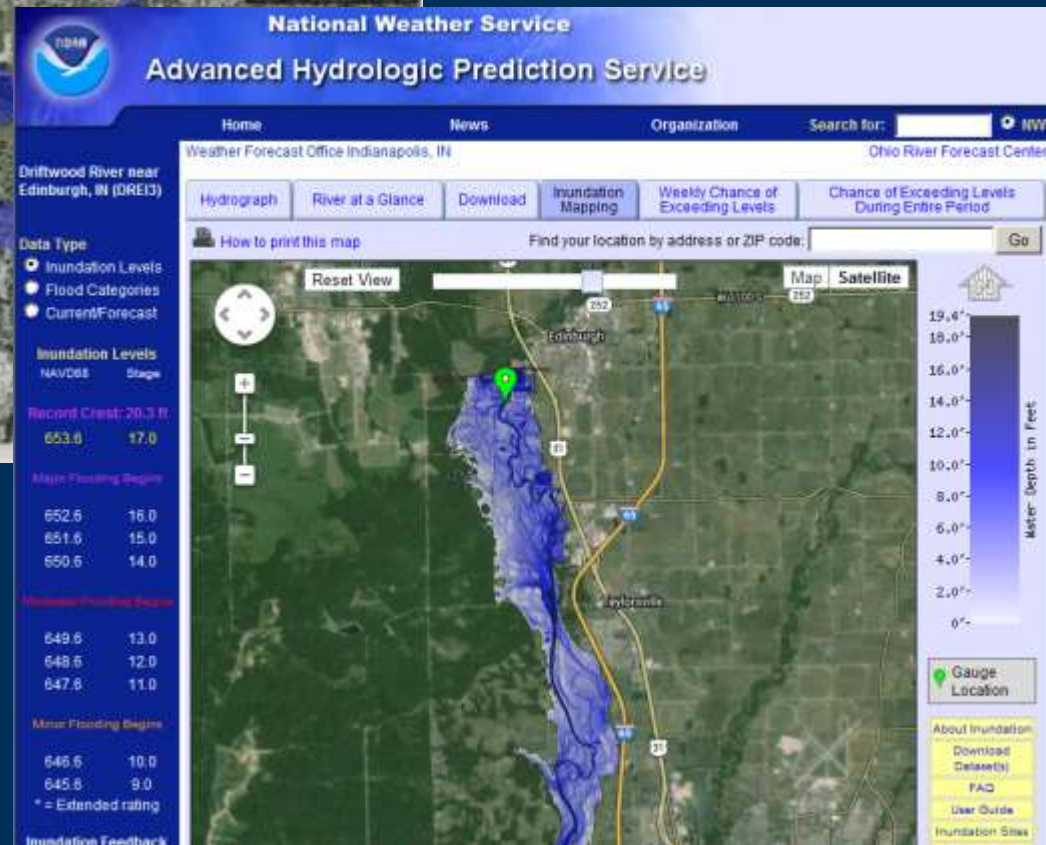
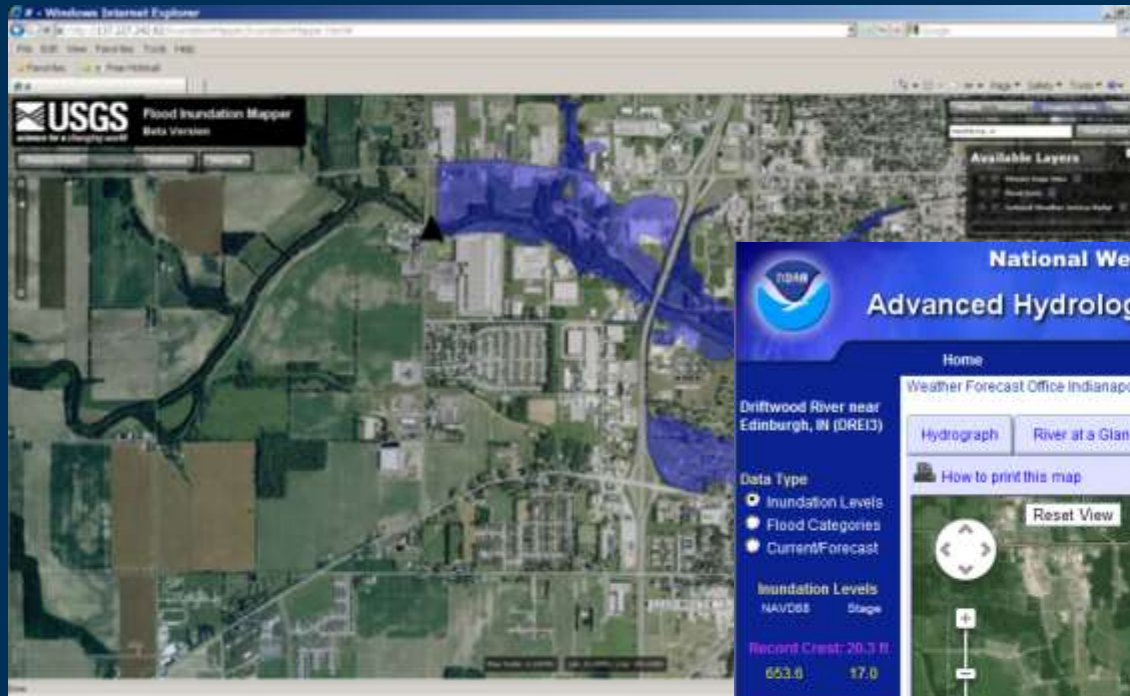


# Indiana Silver Jackets Indiana Flood Inundation Mapping (FIM) Program

- Indiana Office of Community and Rural Affairs
- Indiana Department of Transportation
- City of Indianapolis and City of Fort Wayne
- Indiana Department of Homeland Security
- USGS Cooperative Water Program
- National Weather Service
- Indiana Department of Natural Resources
- U.S. Army Corps of Engineers
- Army National Guard
- The Polis Center



# Interactive Web Mapping Applications: The Core of FIM

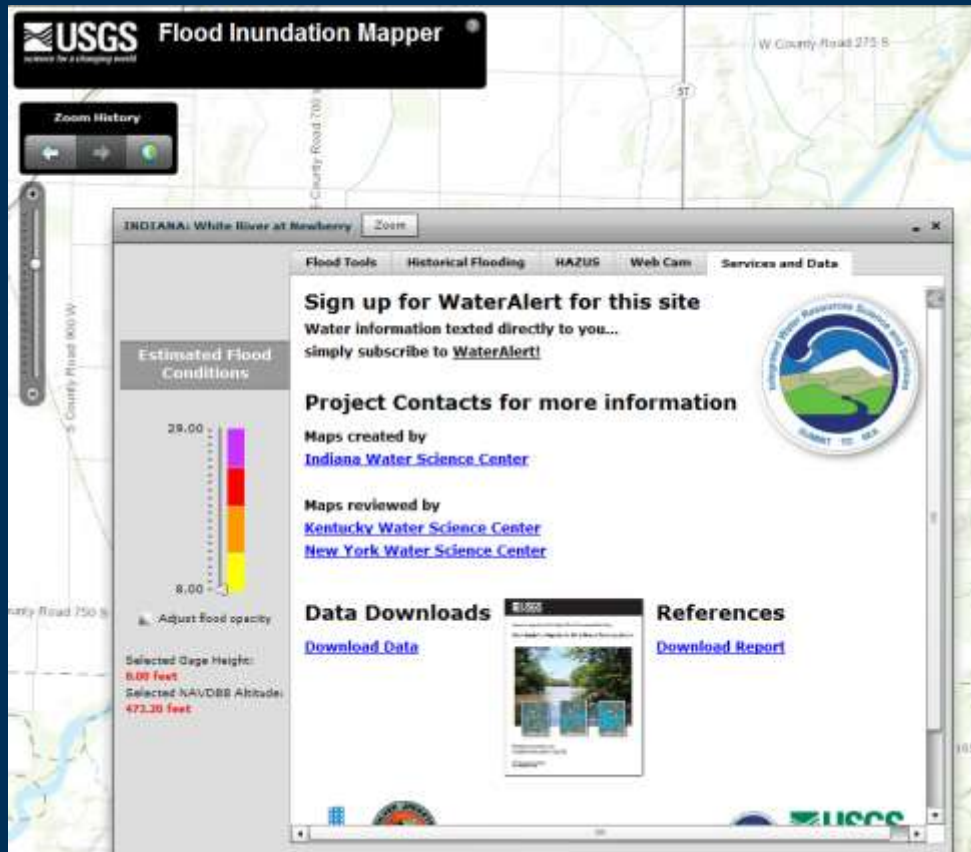


USGS - <http://wim.usgs.gov/FIM/>  
NWS - <http://water.weather.gov/ahps/inundation.php>



# HAZUS Users

Downloadable Shapefiles  
for all stages available  
from both Mappers



**National Weather Service**  
**Advanced Hydrologic Prediction Service**

Home News

Weather Forecast Office Indianapolis, IN

Go s p p ist tion ns ck GOV Fany

Hydrograph River at a Glance Download Inundation Mapping

**Downloads for Driftwood River near Edinburgh (DREI)**  
Hydrographs:

- Default Hydrograph (0k)
- Scale to Flood Categories (0k)

**RSS Feeds:**

- RSS files for DREI3

**Weekly Chance of Exceeding Levels Images:**

- Stage (appr. 15k)
- Flow (appr. 15k)
- Volume (appr. 15k)

**Chance of Exceeding Levels During Entire Period Images:**

- Stage (appr. 15k)
- Flow (appr. 15k)

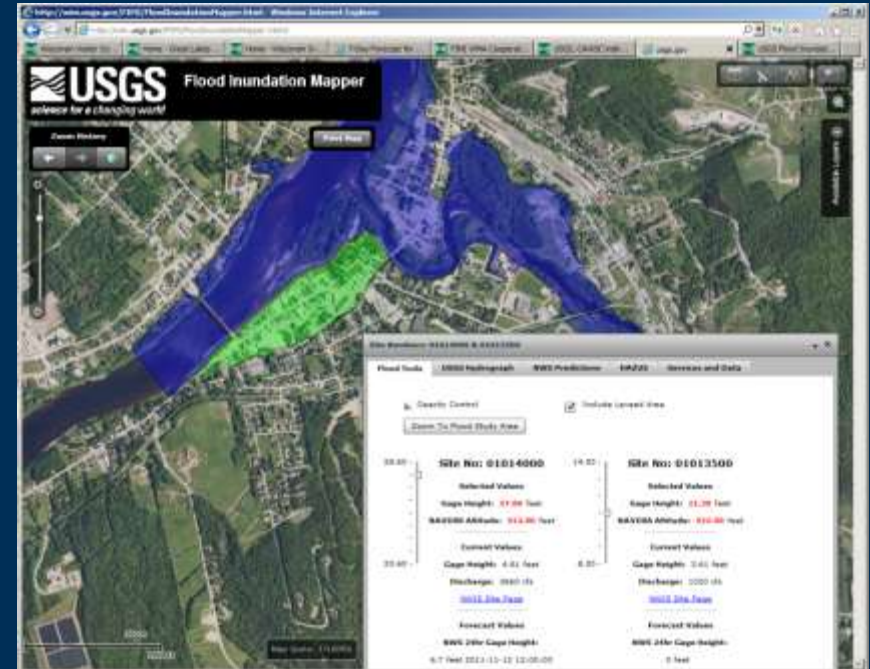
**Inundation Raster and/or Shapefiles:**

- DREI3 Shapefile File (35,282k - Last Updated 9/12/2012 11:31 pm)

**Inundation KMZ Files:**

- DREI3 KMZ File (7,156k - Last Updated 9/12/2012 11:31 pm)

- Written in Adobe Flex and hosted on an ESRI
- Background data is ESRI data through a USGS enterprise license
- Quick links to real-time streamgage data, NWS flood forecast, historic data
- ArcServerDecision Matrix – ability to show two linked gage/forecast sites for one reach
- Display of leveed areas
- **HAZUS flood loss estimation services available**



<http://wim.usgs.gov/FIMI/>

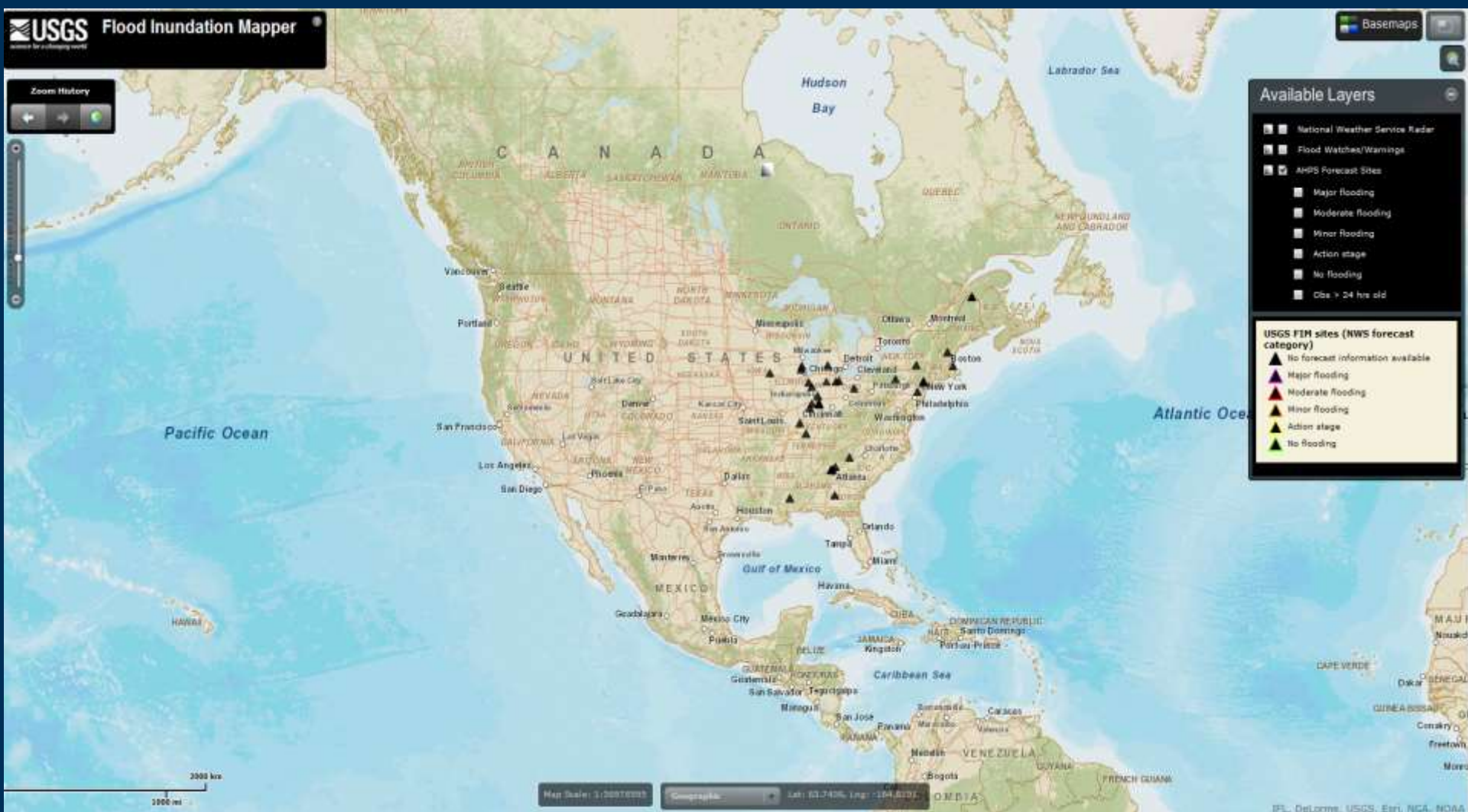


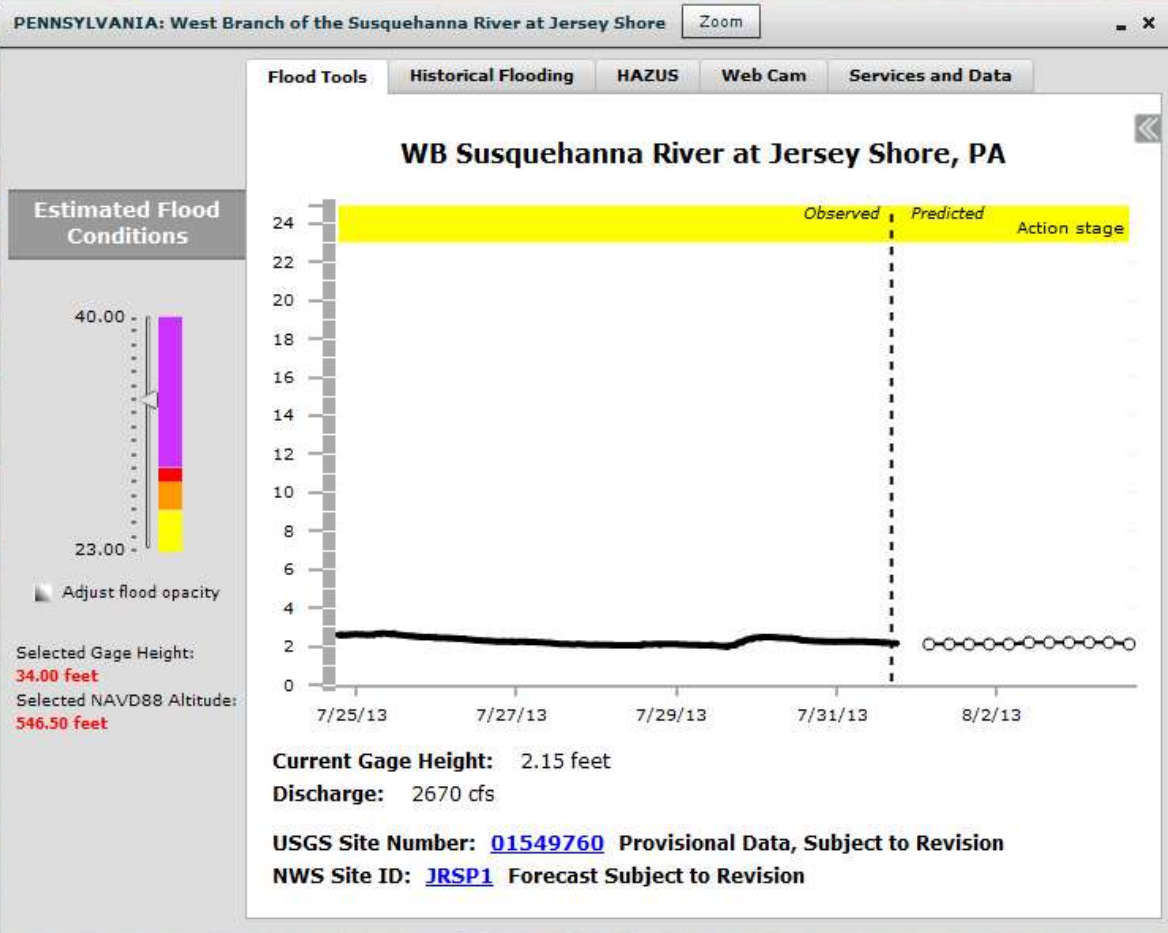
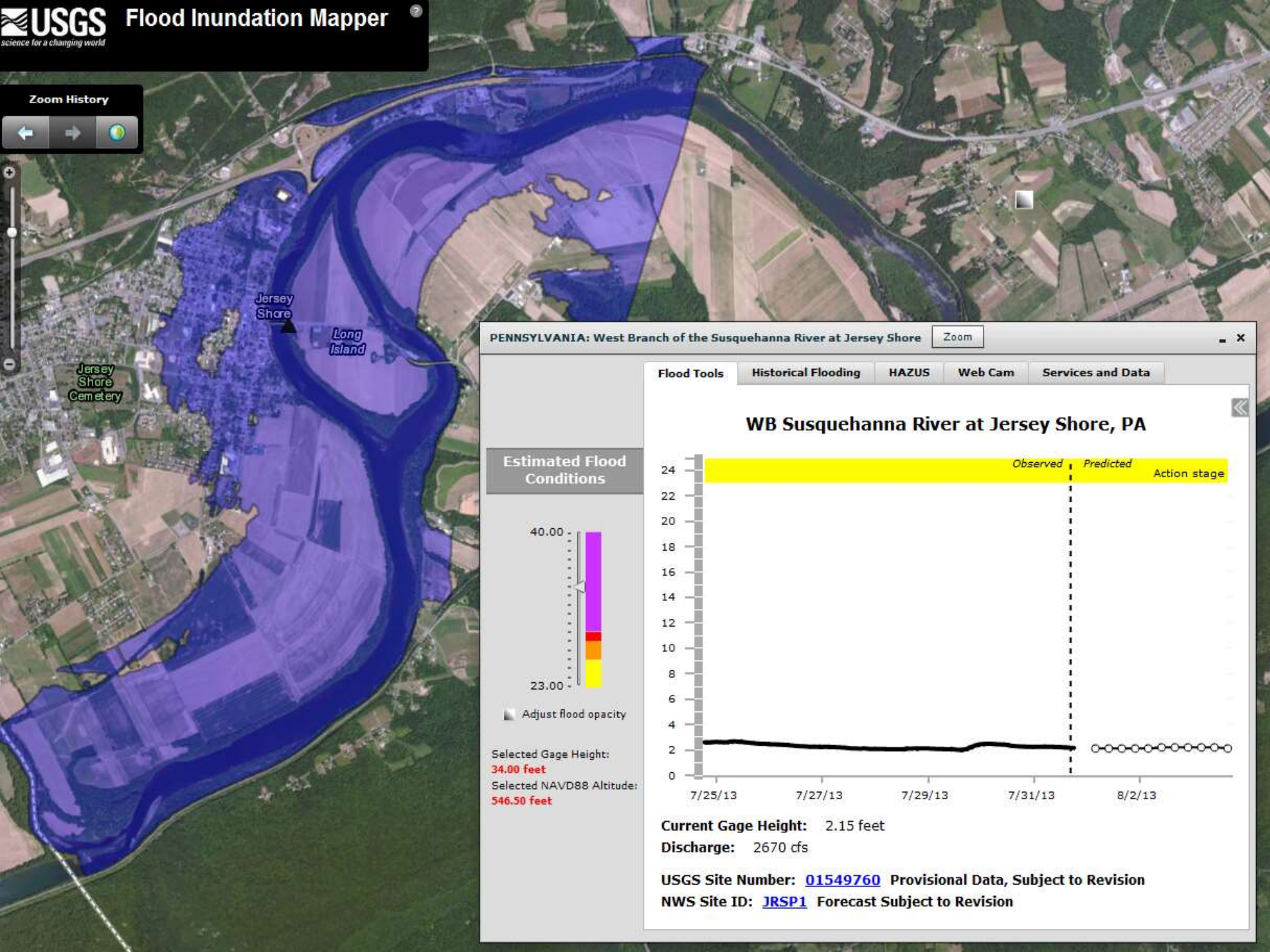
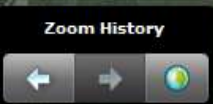
**Available Layers**

- ☒ National Weather Service Radar
- ☒ Flood Watches/Warnings
- ☒ NWS Forecast Sites
  - ☐ Major flooding
  - ☐ Moderate flooding
  - ☐ Minor flooding
  - ☐ Action stage
  - ☐ No flooding
  - ☐ Obs > 24 hrs old

**USGS FIM sites (NWS forecast category)**

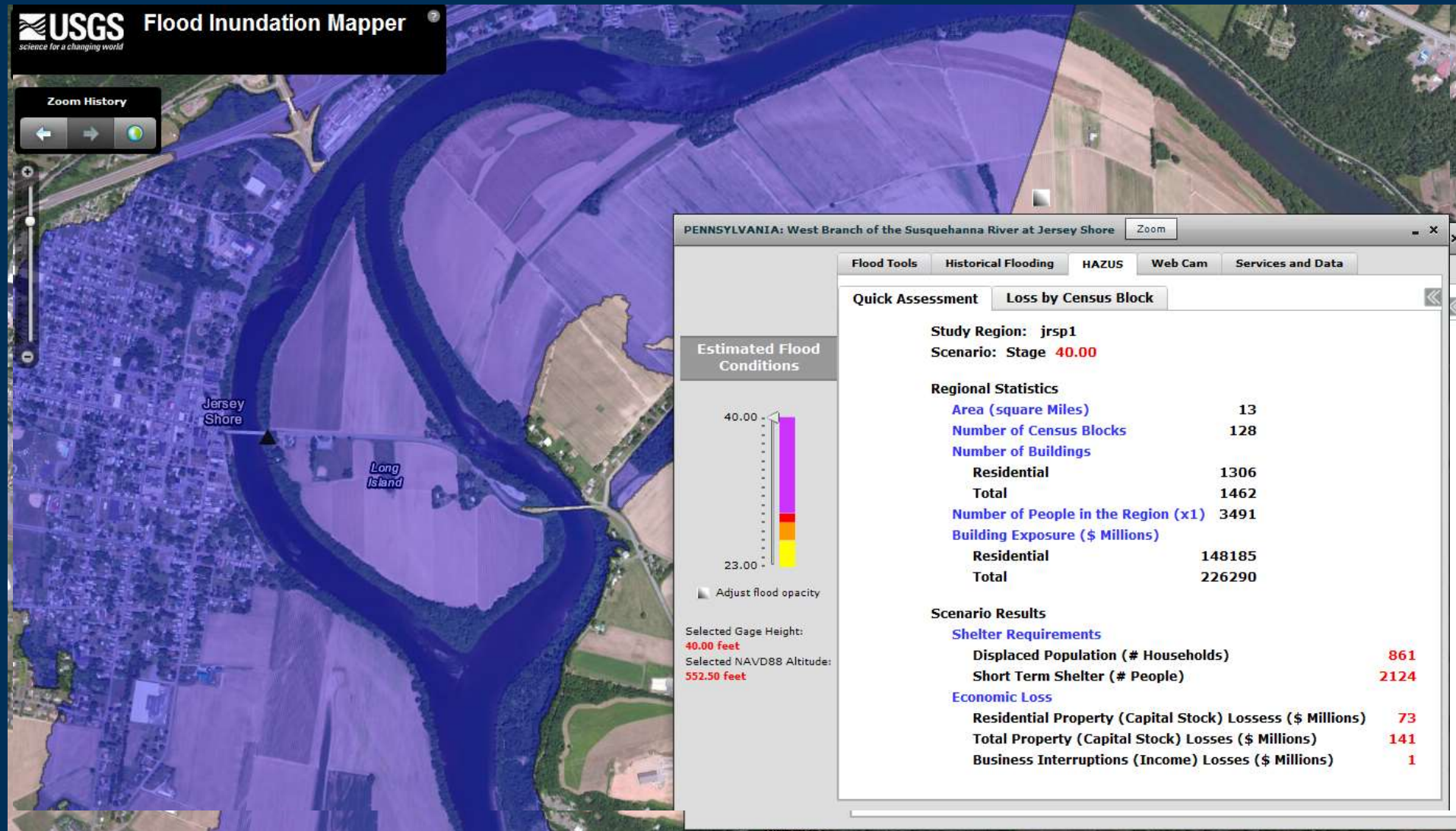
-  No forecast information available
-  Major flooding
-  Moderate flooding
-  Minor flooding
-  Action stage
-  No flooding







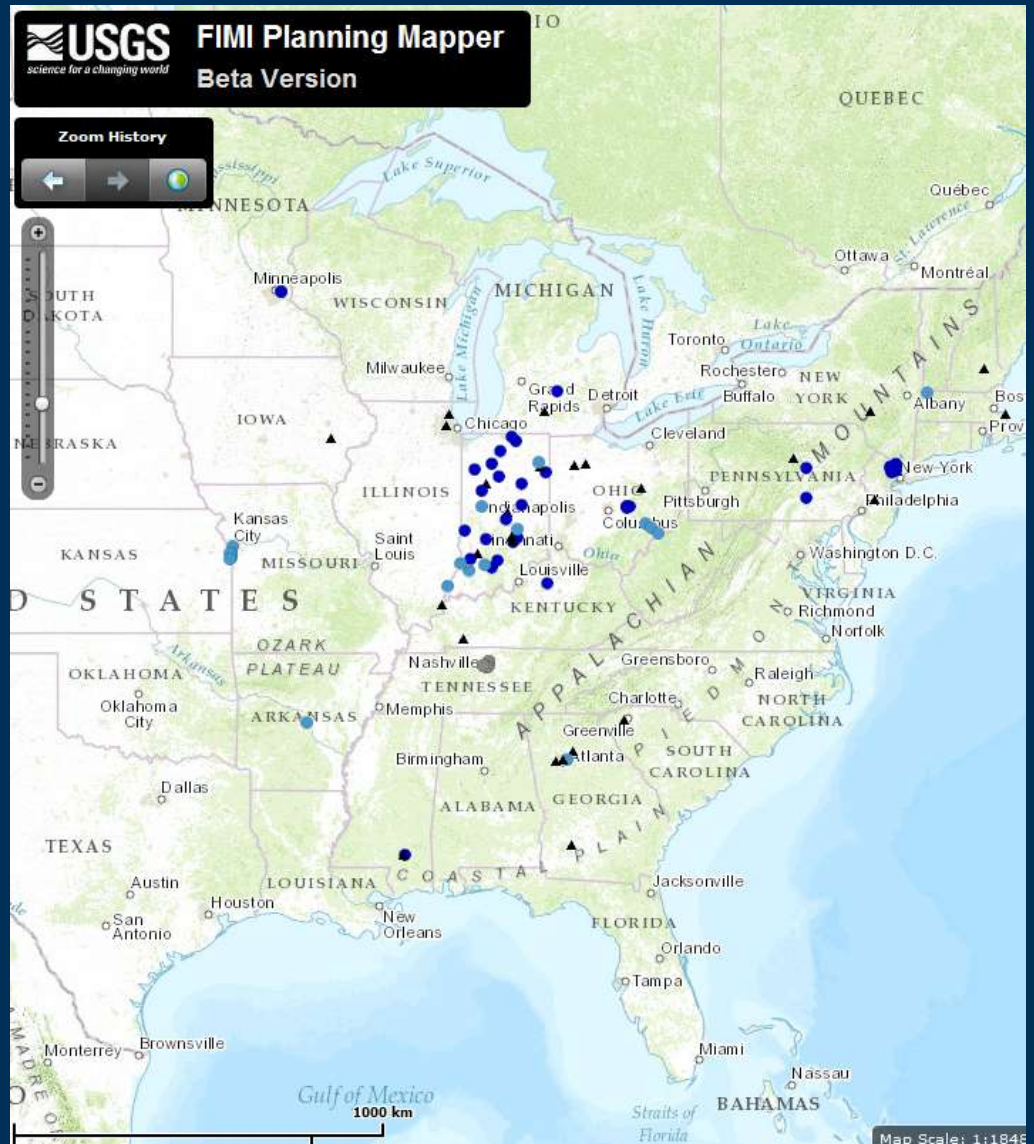
# Mapper HAZUS Service





# USGS FIM Library Status

- 31 complete
- 44 more by 2015
- HAZUS sites
  - PA (3)
  - IA
  - NJ
  - GA
  - MA
  - IN (34 coming)

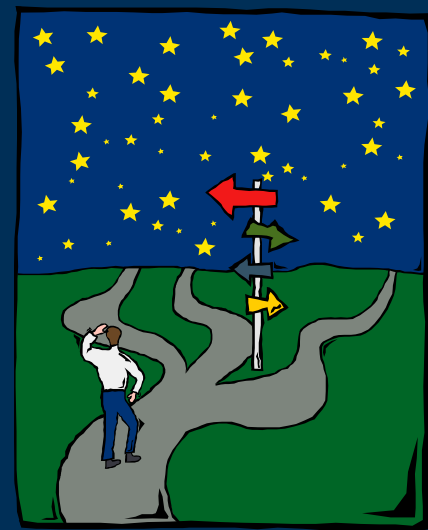


# Path Ahead

## FIM Requirements Team

- Requirements document delivery – Sept. 2013
- Form and Develop Charge to Design Team
- Form and Develop Charge to Implementation Team
- Schedule dependent on availability of resources

Continue partnering on a local level to fund and develop FIM libraries



# Selected Web Links

## Silver Jackets 1913 Flood

- <http://silverjacketsfloodready.com/>
- <http://mrcc.isws.illinois.edu/1913Flood/index.shtml>

## USGS

- Real-time gage data - <http://waterdata.usgs.gov/in/nwis/rt/>
- WaterWatch - <http://waterwatch.usgs.gov/index.php>
- WaterAlert - <http://water.usgs.gov/wateralert/index.html>
- Flood Mapper - <http://wim.usgs.gov/FIMI/>

## National Weather Service

- QPF - <http://www.hpc.ncep.noaa.gov/qpf/qpf2.shtml>
- Significant Flood Outlook- <http://www.hpc.ncep.noaa.gov/nationalfloodoutlook/>
- AHPS - <http://water.weather.gov/ahps/>
- AHPS Flood Mapper - <http://water.weather.gov/ahps/inundation.php>
- GIS Portal - <http://www.nws.noaa.gov/gis/>





# Thank You!

**Scott Morlock**

**Office 317-600-2753**

**Cell 317-716-8412**

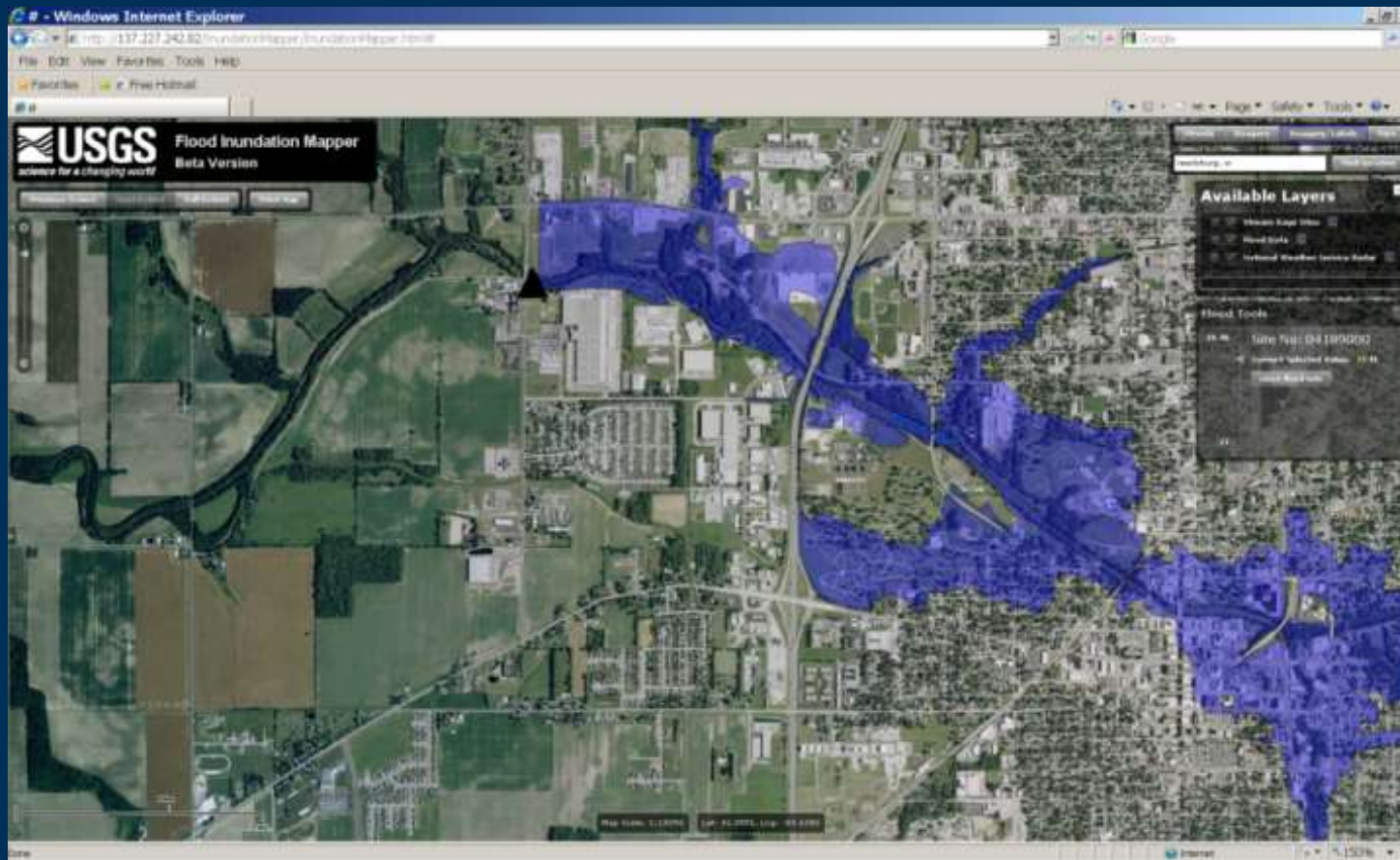
**Fax 317-290-3313**

**smorlock@usgs.gov**

**<http://in.water.usgs.gov>**



# Web Mapping Application



USGS - <http://wim.usgs.gov/FIMI/>

NWS - <http://water.weather.gov/ahps/inundation.php>