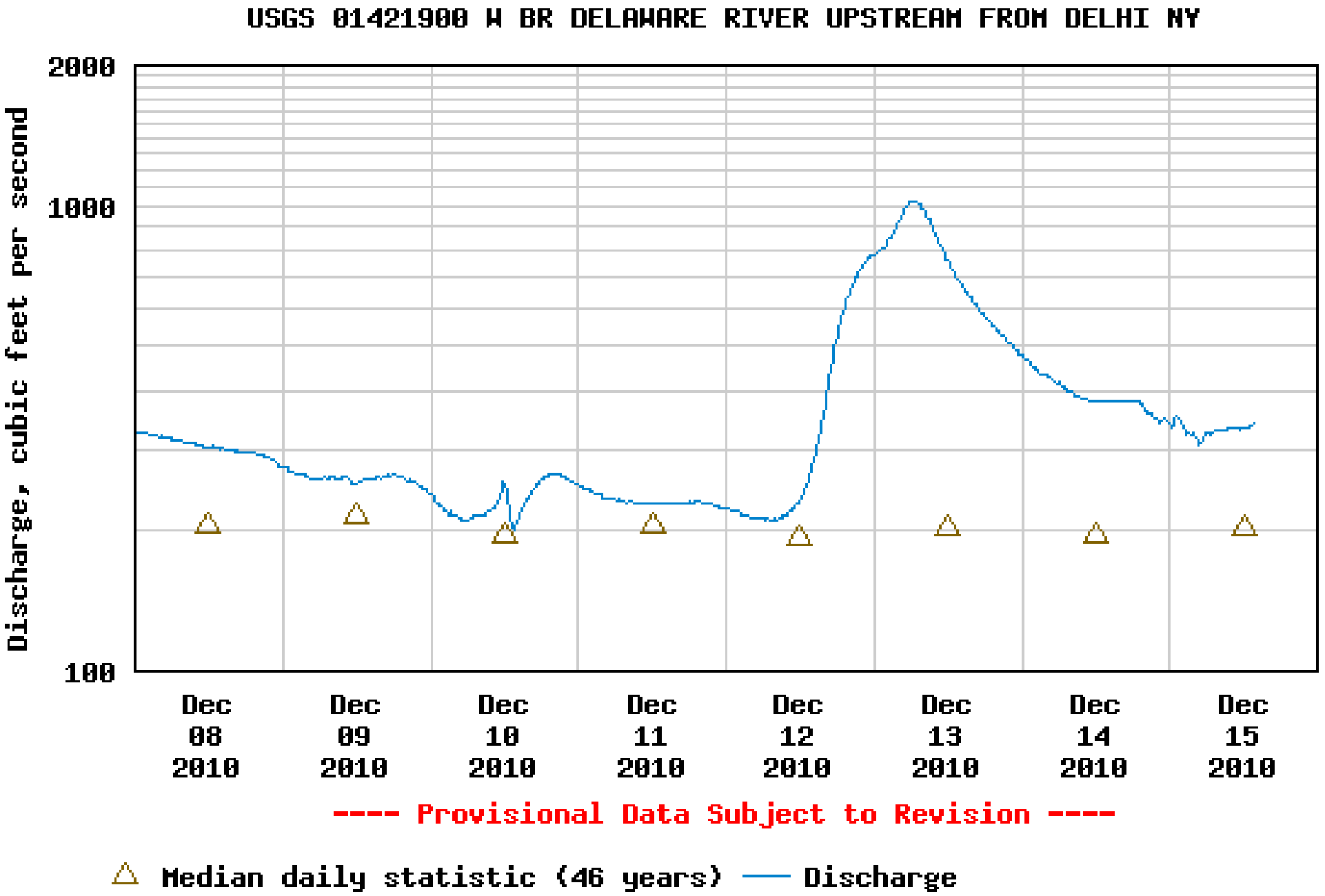
U.S. Geological Survey Flood-Inundation Mapping

A Tool for Emergency Managers and Responders

USGS
science for a changing world

What information is currently available to assist emergency responders during a flood?

Bridge Street, Delhi, Oct. 1, 2010 (WBNG 12 Action News)



http://waterdata.usgs.gov/nwis/

USGS
science for a changing world

USGS WaterAlert http://water.usgs.gov/wateralert/

USGS WaterAlert [version 1.1]

Subscription Form

Site Info:		
Site Number:	01421900	
Site Name:	W BR DELAWARE RIVER UPSTREAM FROM DELHI NY	
Agency:	USGS	
Transaction ID:	cmWfb	
Send Notification To:	about this...	
◉ My email address ○ My mobile phone	email address	
Notification Frequency:	about this...	
Hourly	○	
Daily	◉	
Streamflow Parameter:	about this...	Recent value:
Discharge (cfs)	○	333
Gage height (ft)	◉	3.34 (NWS flood stage = 8)
Threshold Condition:	about this...	
◉ Greater than (>) ○ Less than (<) ○ Outside a range (< or >) ○ Inside a range (> and <)	Real-time value is greater than: 7.0 ft	

☐ I have read and acknowledge the Provisional Data Statement and Disclaimer.

Submit Reset Cancel

Alternative threshold: discharge > 2,900 cfs

USGS science for a changing world

USGS WaterNow http://water.usgs.gov/waternow/

Current conditions for water data can be obtained via a text message or email to

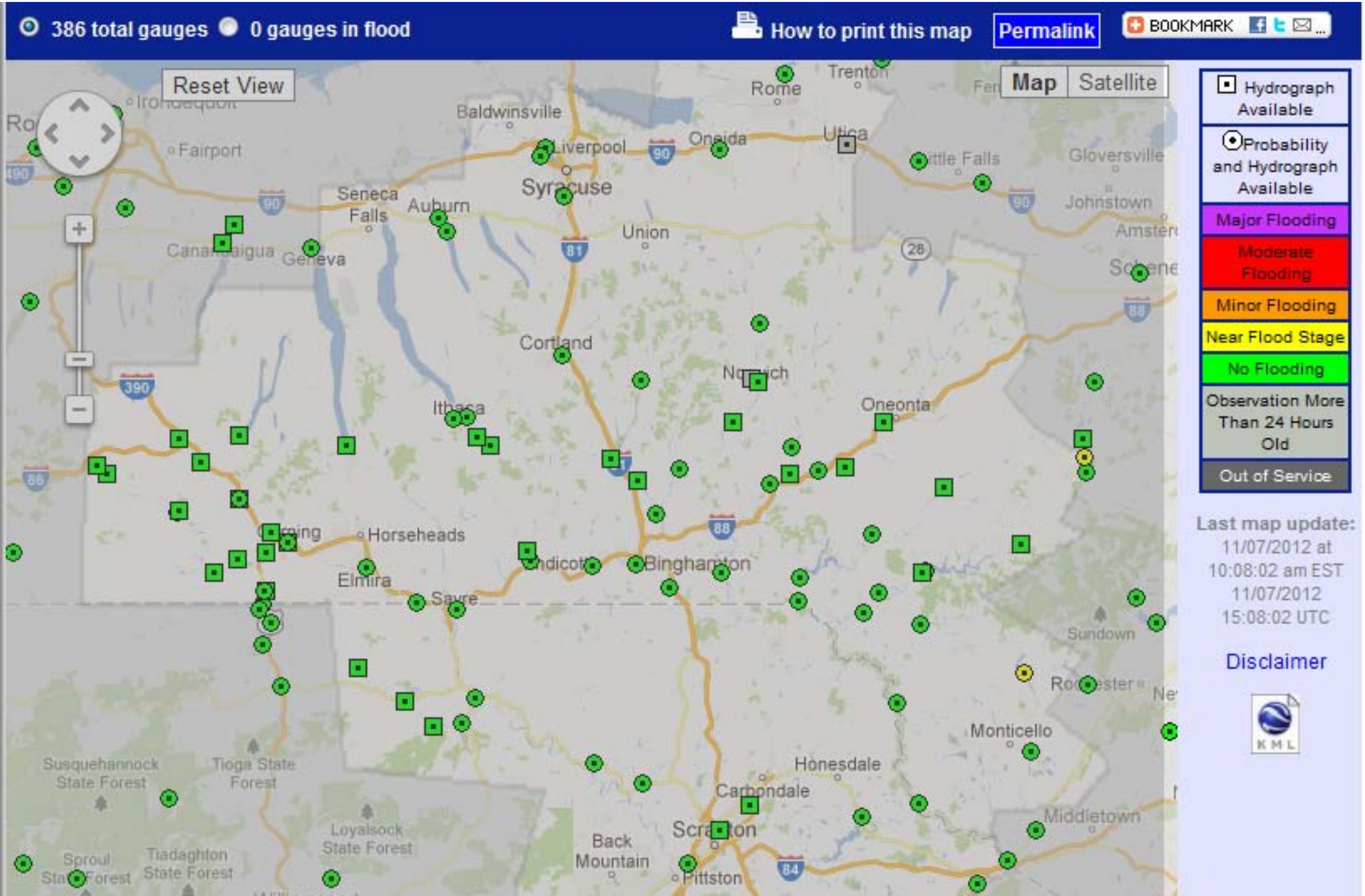
WaterNow@usgs.gov

Just enter the USGS station number in the message or subject line

USGS
science for a changing world

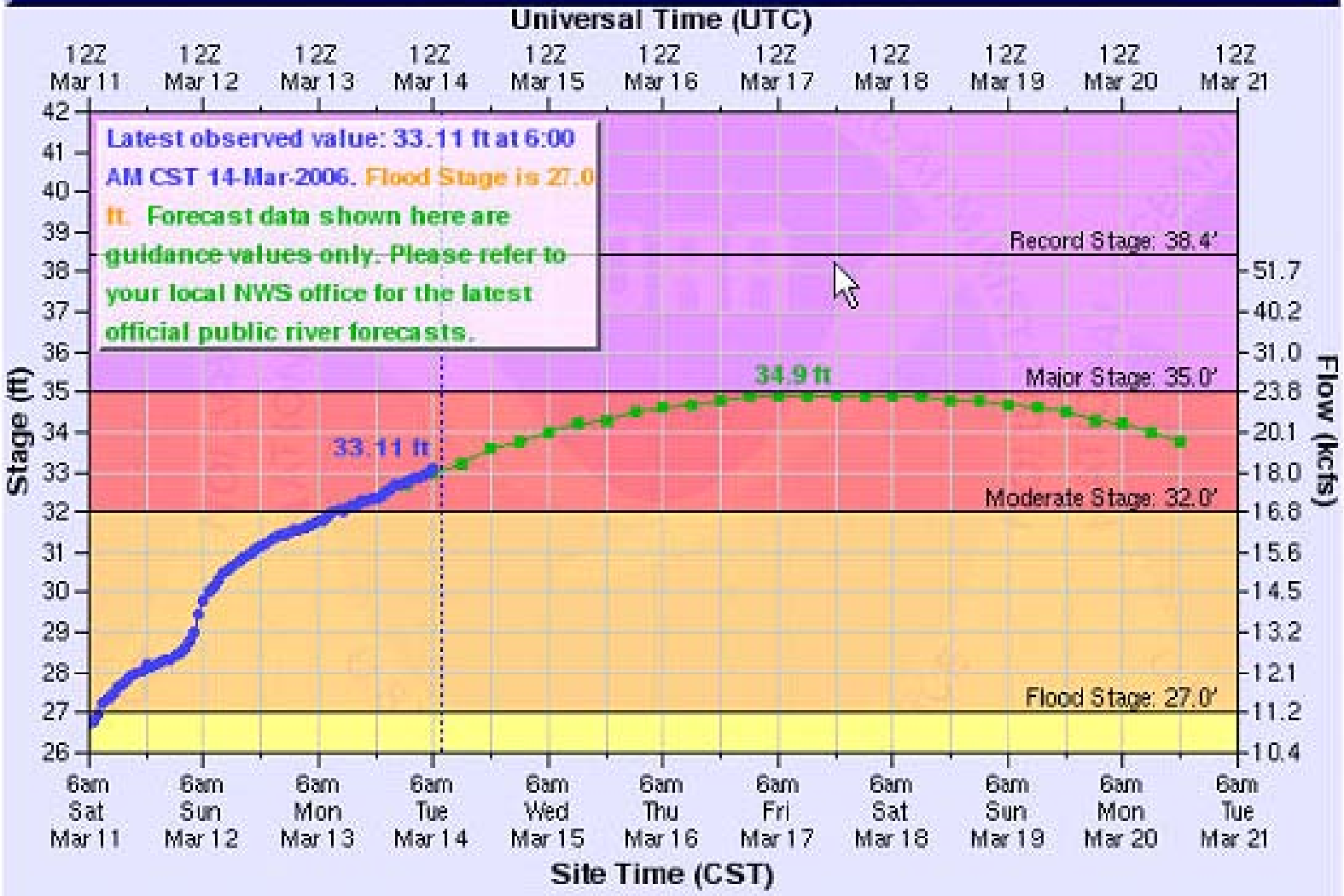
NOAA-NWS Advanced Hydrologic Prediction Service

http://water.weather.gov/ahps/



Hydrograph | River at a Glance | Weekly Chance of Exceeding Levels | Chance of Exceeding Levels During Entire Period

Little Wabash River AT Carmi



CARI2 (plotting HGIRG) "Gage 0" Datum: 339.9'

Observations courtesy of the US Geological Survey

Printable Image

About this graph

Tabular Data

XML Data

NOTE: Forecasts for the Little Wabash River at Carmi are issued routinely year-round.

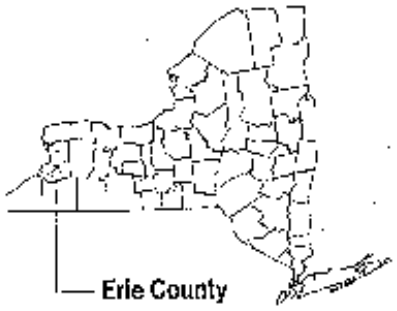
Default Hydrograph

Return to Area Map

USGS science for a changing world

FLOOD INSURANCE STUDY

ERIE COUNTY, NEW YORK
(ALL JURISDICTIONS)



COMMUNITY NAME	COMMUNITY NUMBER
BUFFALO, CITY OF	360230
COLLINS, TOWN OF	360234
GOWANDA, VILLAGE OF	360075
GRAND ISLAND, TOWN OF	360242
HOLLAND, TOWN OF	360246
TONAWANDA, CITY OF	360259
WALES, TOWN OF	360251
WILLIAMSVILLE, VILLAGE OF	360265

SEPTEMBER 26, 2008

Federal Emergency Management Agency

FLOOD INSURANCE STUDY NUMBER
36029CV000A

Provides water-surface profiles for 4 flood magnitudes (10, 2, 1, and 0.2-percent annual exceedance probability flows) and flood maps for 2 flood magnitudes (1 and 0.2% AEPF).

USGS
science for a changing world

Current Situation

Emergency managers can obtain current water levels from a streamgage and, if available, forecasted peak stage and time from AHPS.

What's Missing?

The ability to relate the peak stage value to flood impacts that are likely to occur in nearby areas

USGS
science for a changing world

Solution

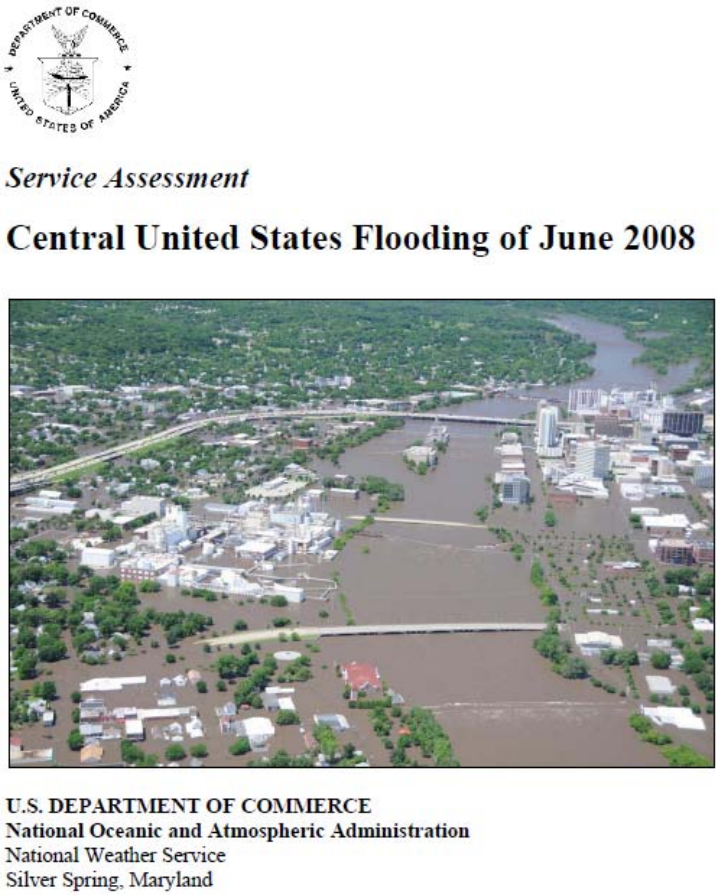
Following the devastating floods that occurred in central U.S. during June 2008, a joint agency team, comprised of NWS, USACE, and USGS

Found that:

Flood inundation mapping would help the public, media, emergency responders, and others visualize the spatial extent and depth of flood waters in the vicinity of NWS river forecast locations.

And recommended that:

The NWS should expand efforts with state and federal agencies and others to accelerate the implementation of flood inundation mapping across the U.S.



Service Assessment

Central United States Flooding of June 2008

U.S. DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Weather Service
Silver Spring, Maryland

USGS
science for a changing world

USGS Flood-Inundation Mapping Initiative (FIMI)

In 2009, the USGS Eastern Region initiated a national flood-inundation mapping program

- To promote a uniform approach and consistent products for flood-mapping efforts
- To provide a key area of collaboration with Federal partners, particularly NWS, USACE, and FEMA

USGS
science for a changing world

FIMI Objective

For a given reach,
to create a static library of pre-made maps
at 1-foot intervals of flood stage
that can be referenced to the stage
recorded at a USGS real-time
streamgage / NWS river forecast site

USGS
science for a changing world

Coordination with National Weather Service

USGS and NWS have collaborated on guidelines for creation of flood-inundation-map libraries.

QA/QC procedures include NWS involvement/review at 4 points during the flood-mapping project.

Approved maps are posted on NWS AHPS site.

USGS
science for a changing world

FIMI Approach

- Use a hydraulic model (HEC-RAS steady-state flow), either existing or new, to create water-surface profiles at 1-ft increments of stage referenced to USGS gage

  Range in stage would correspond with flows from bank-full to the 500-year flood or flood of record

- Use flows from the most current stage-discharge relation
- Obtain high-accuracy digital elevation model (DEM) created from LiDAR data for accurate mapping of inundated areas

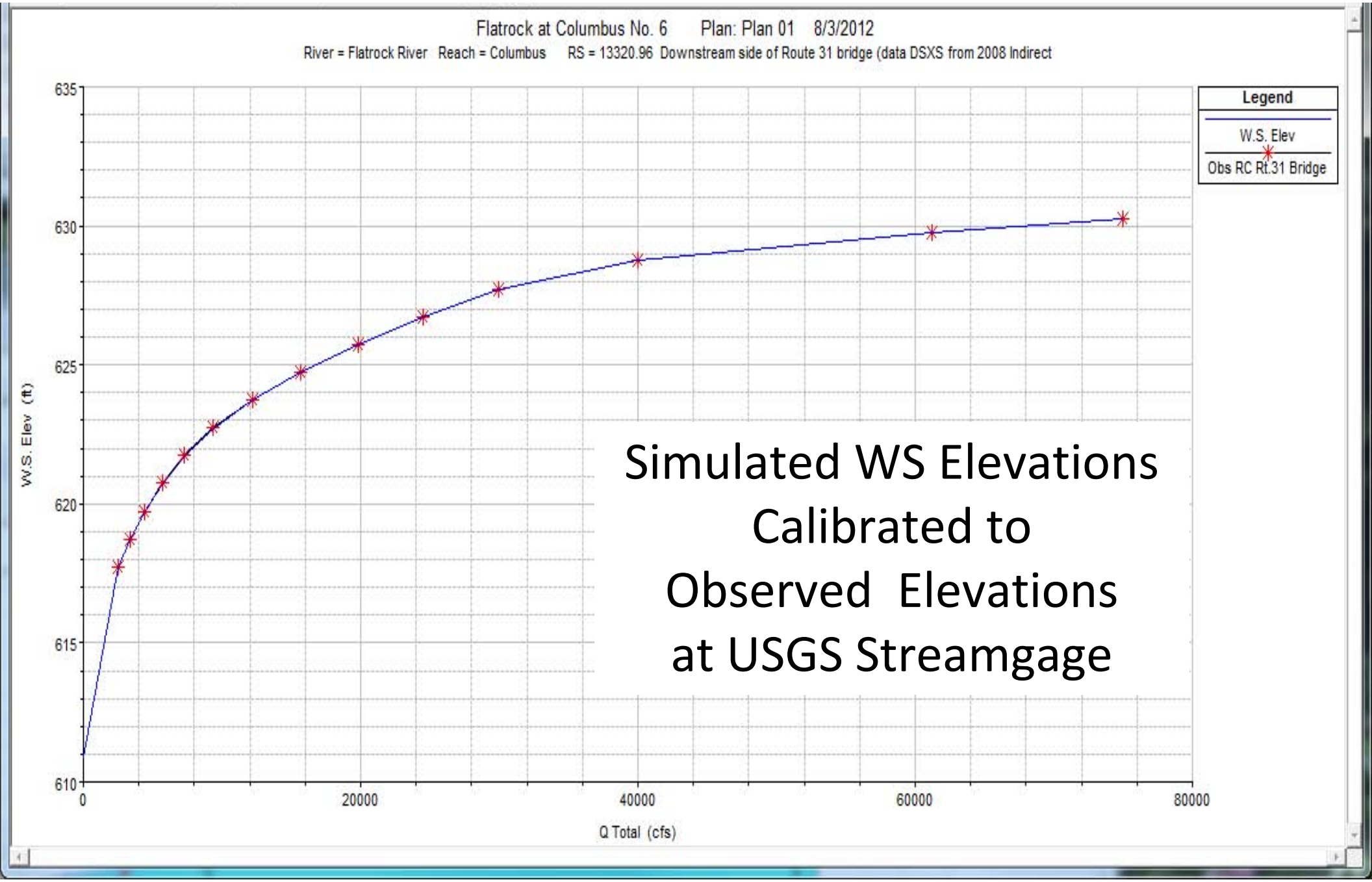
USGS
science for a changing world

FIMI Approach

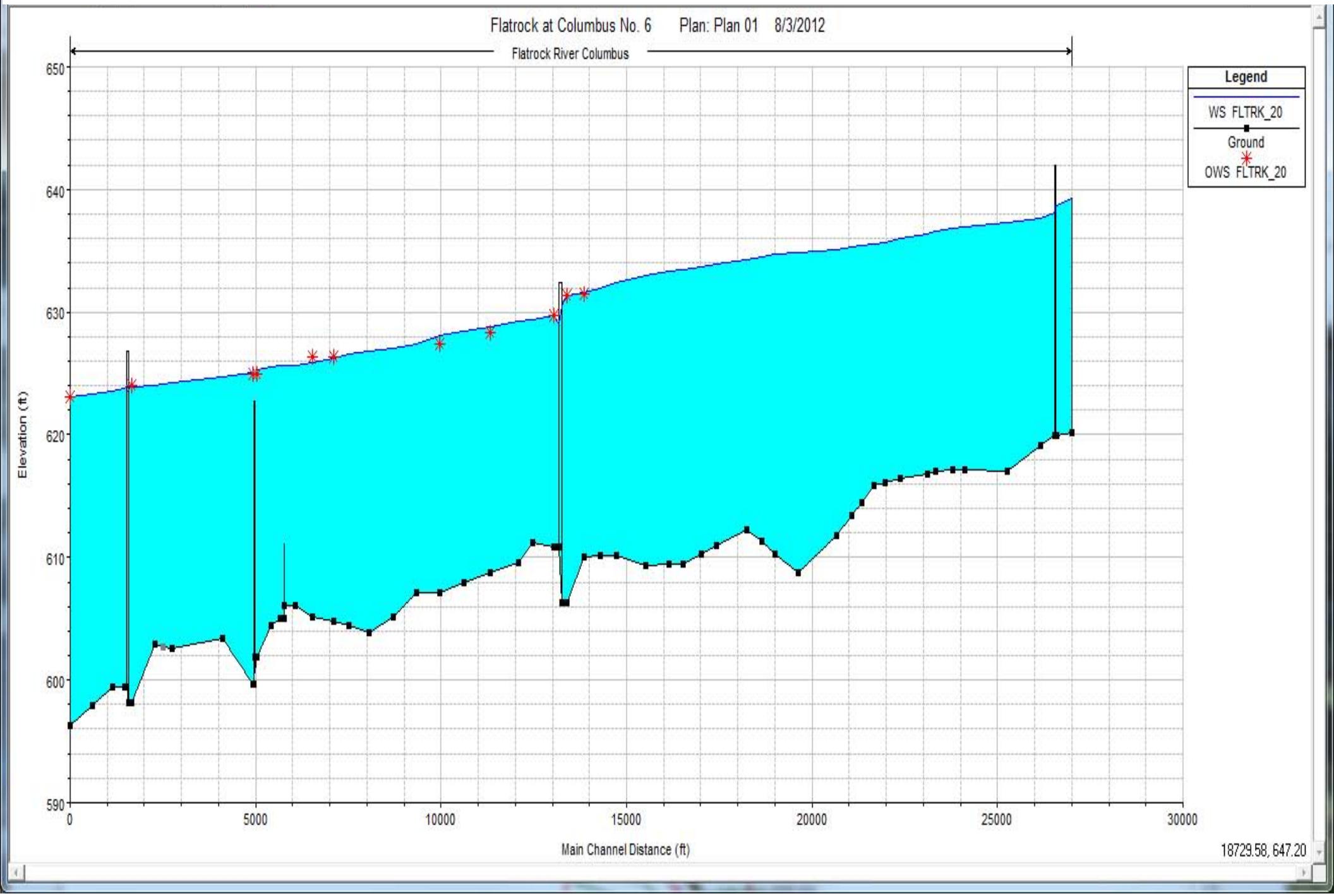
- Use HEC-RASMapper or HEC-GeoRAS to delineate flood areas
- Create ArcMap polygon shapefiles and depth grids
- Write report to document work completed
- Display flood maps on high-resolution orthoimagery in PDF and KMZ formats
- Display maps on interactive USGS Flood Mapper and NWS AHPS websites

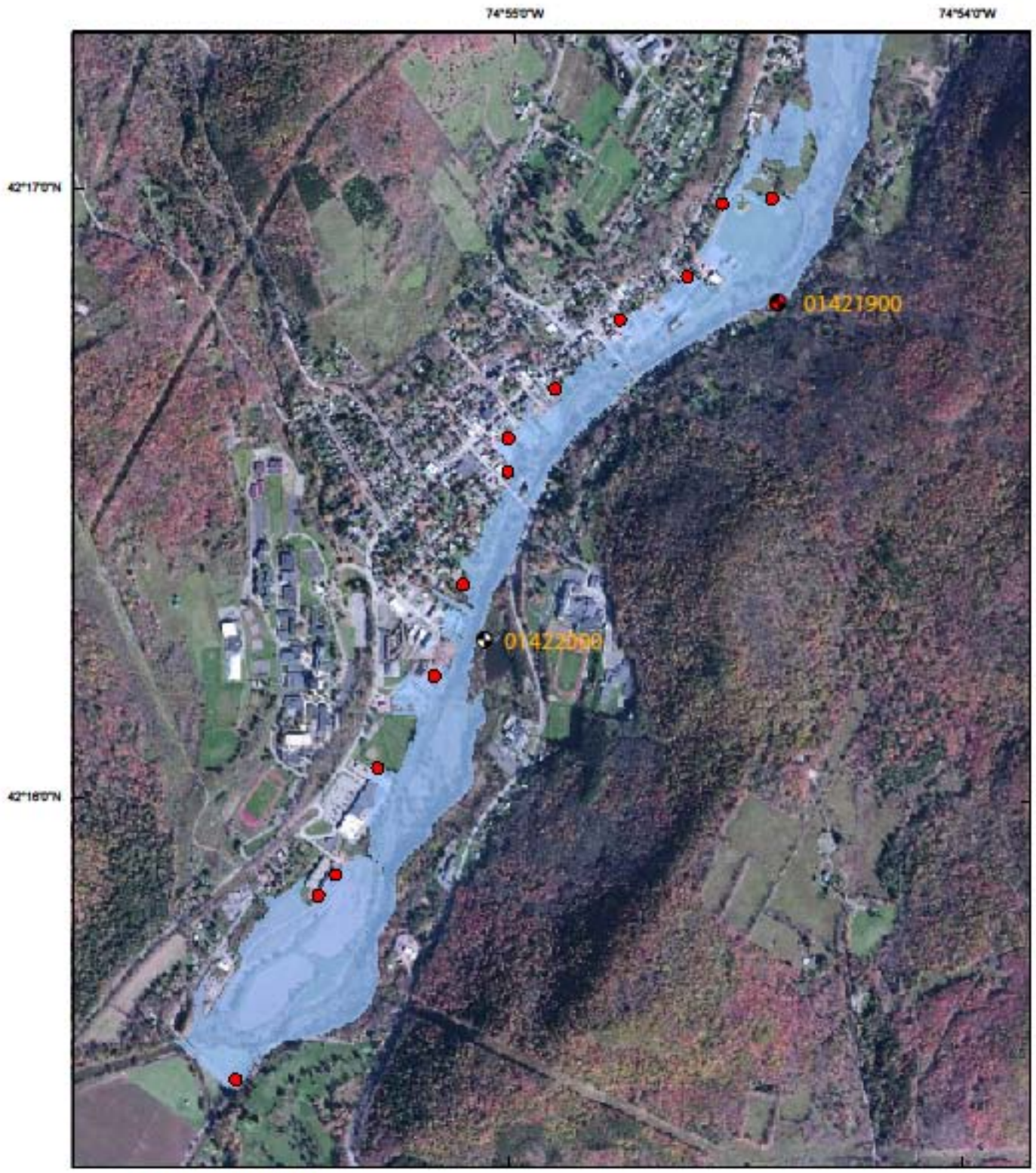
USGS
science for a changing world

Hydraulic Models are Calibrated to all available data



Flood Profile Calibrated to Surveyed High-Water Marks





Flood-mapped boundaries are verified whenever possible.

GPS-located high-water marks were used to verify the flood extent for the Aug. 28, 2011 (Hurricane Irene), flood in Delhi, NY,

USGS
science for a changing world

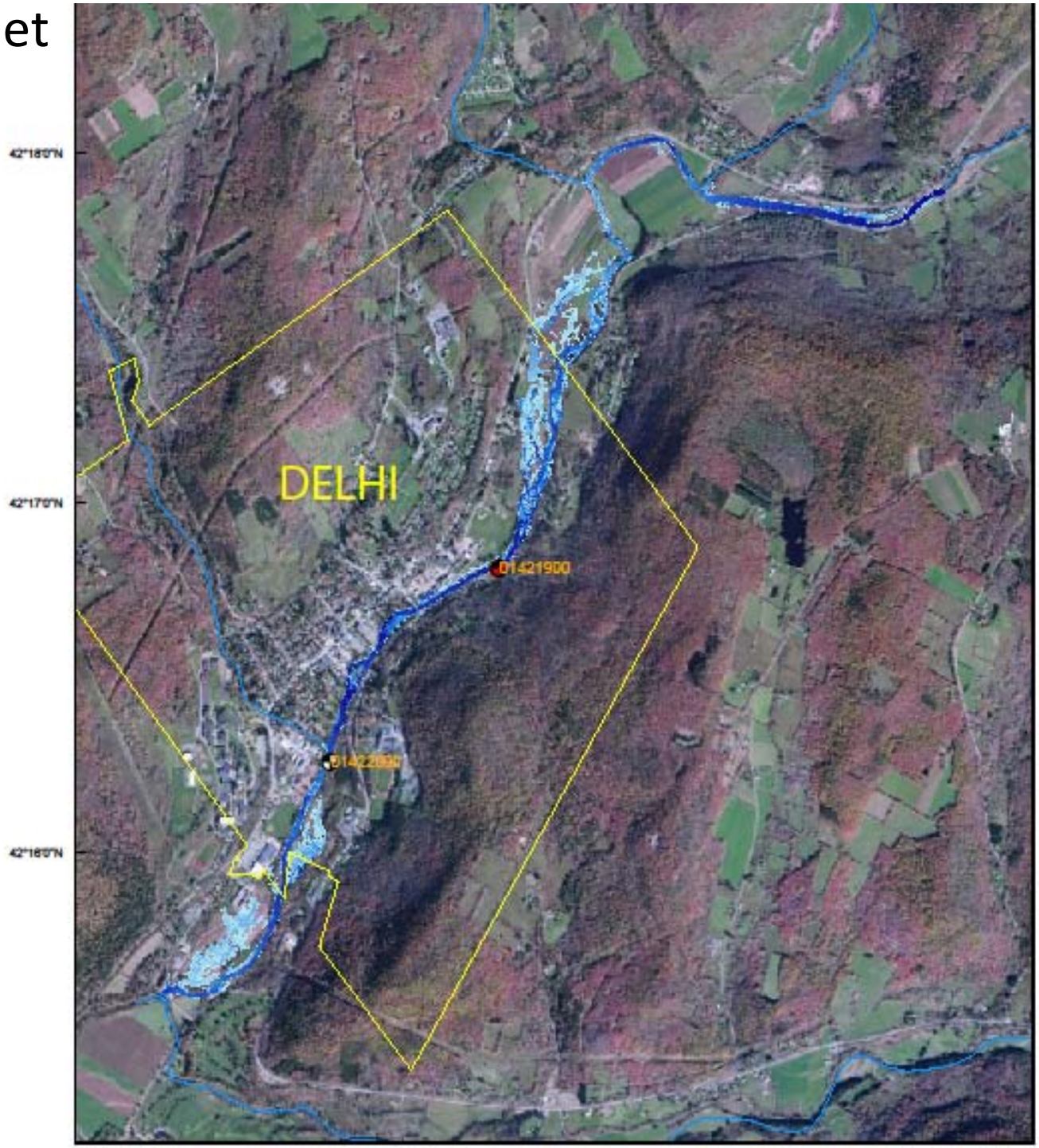
U.S. Geological Survey
Flood Inundation Mapping

New York

Water Science Center

USGS
science for a changing world

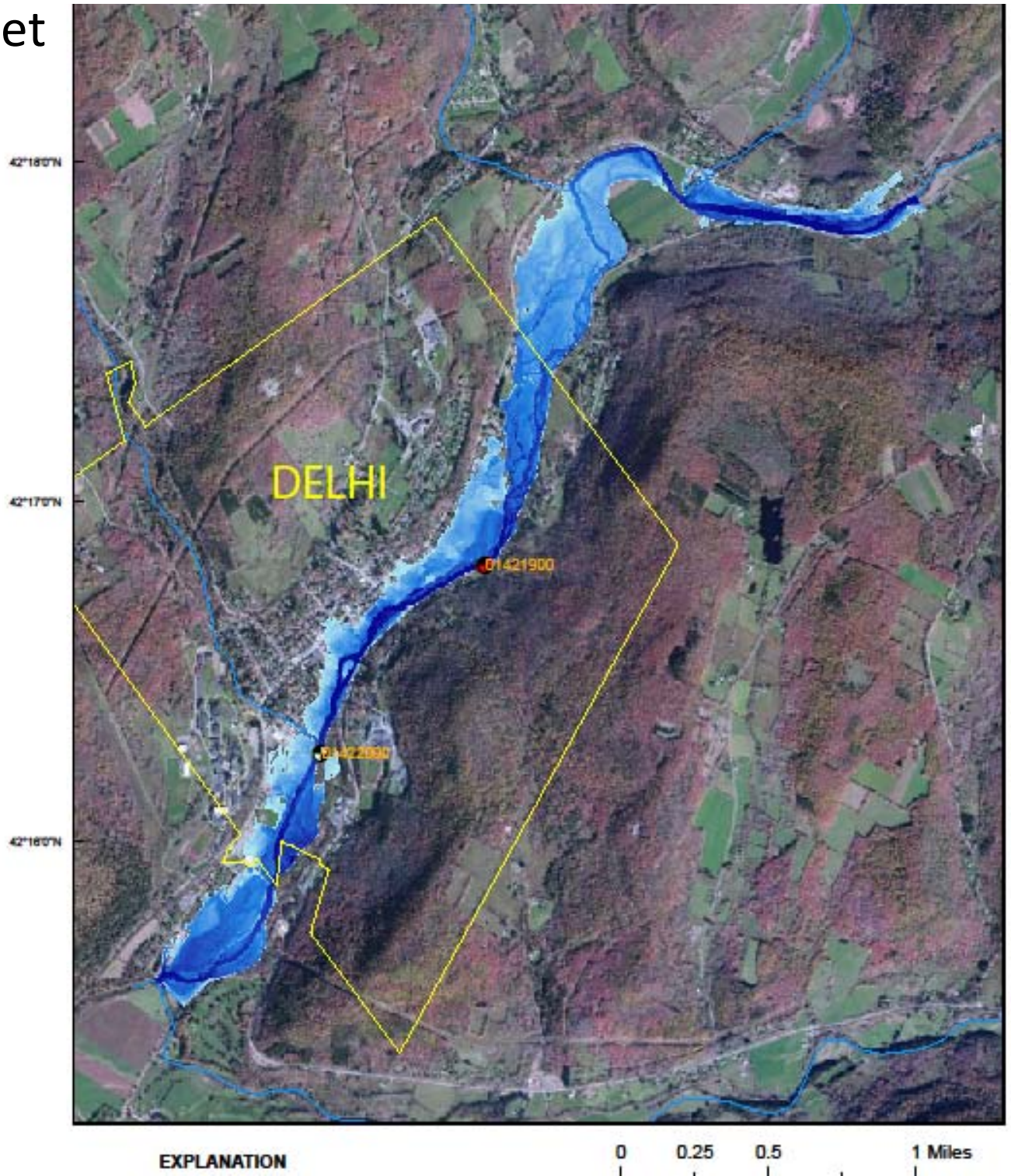
West Branch Delaware River at Delhi, N.Y. Stream Stage 7 feet



10 Flood Maps

USGS science for a changing world

West Branch Delaware River at Delhi, N.Y. Stream Stage 16 feet



Stage 16.0 ft

(exceeds the stage of the 500-yr flow and the maximum recorded flow, 13,000 cfs on Jan. 19, 1996)

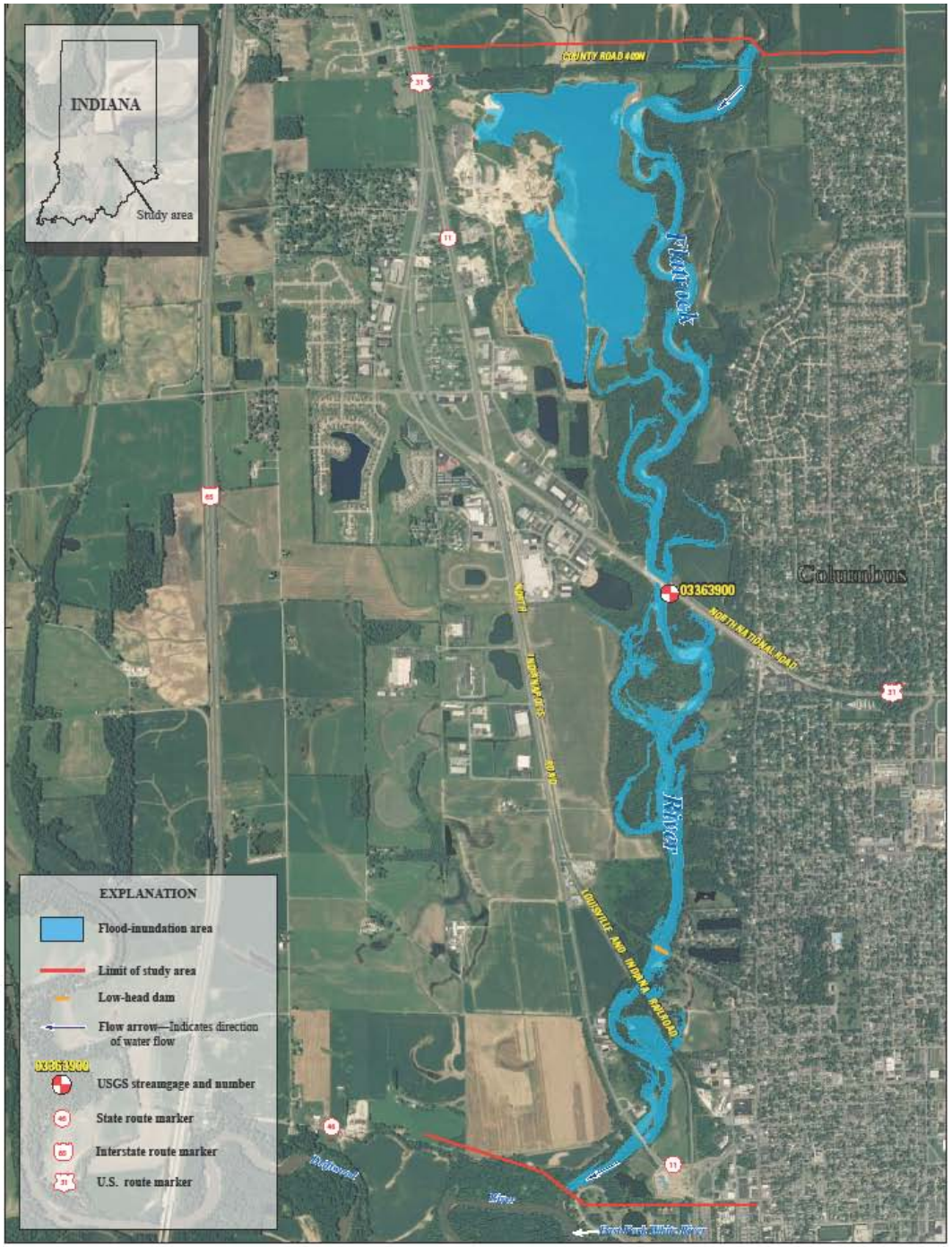
USGS
science for a changing world

Indiana USGS Statewide Program

3-year project (2011-13)
28 sites
6 hydrologists in 4 states

USGS
science for a changing world

Flatrock River at Columbus, Indiana Stream Stage 9 feet



12 Flood Maps

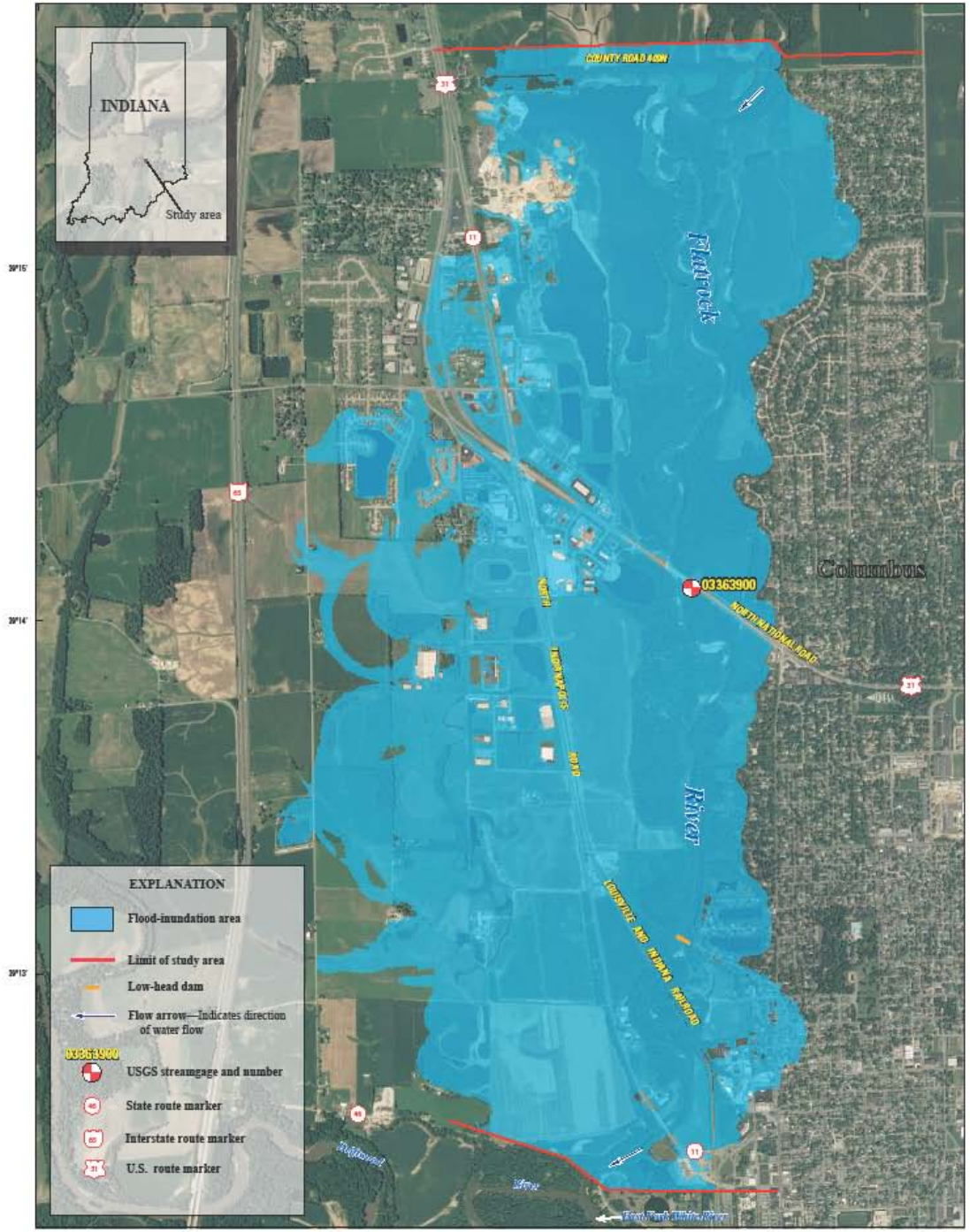
USGS for a changing world

DISCLAIMER FOR FLOOD-INUNDATION MAPS

Inundated areas shown should not be used for navigation, regulatory, permitting, or other legal purposes. The USGS provides these maps "as is" for a quick reference, emergency planning tool but assumes no legal liability or responsibility resulting from the use of this information.

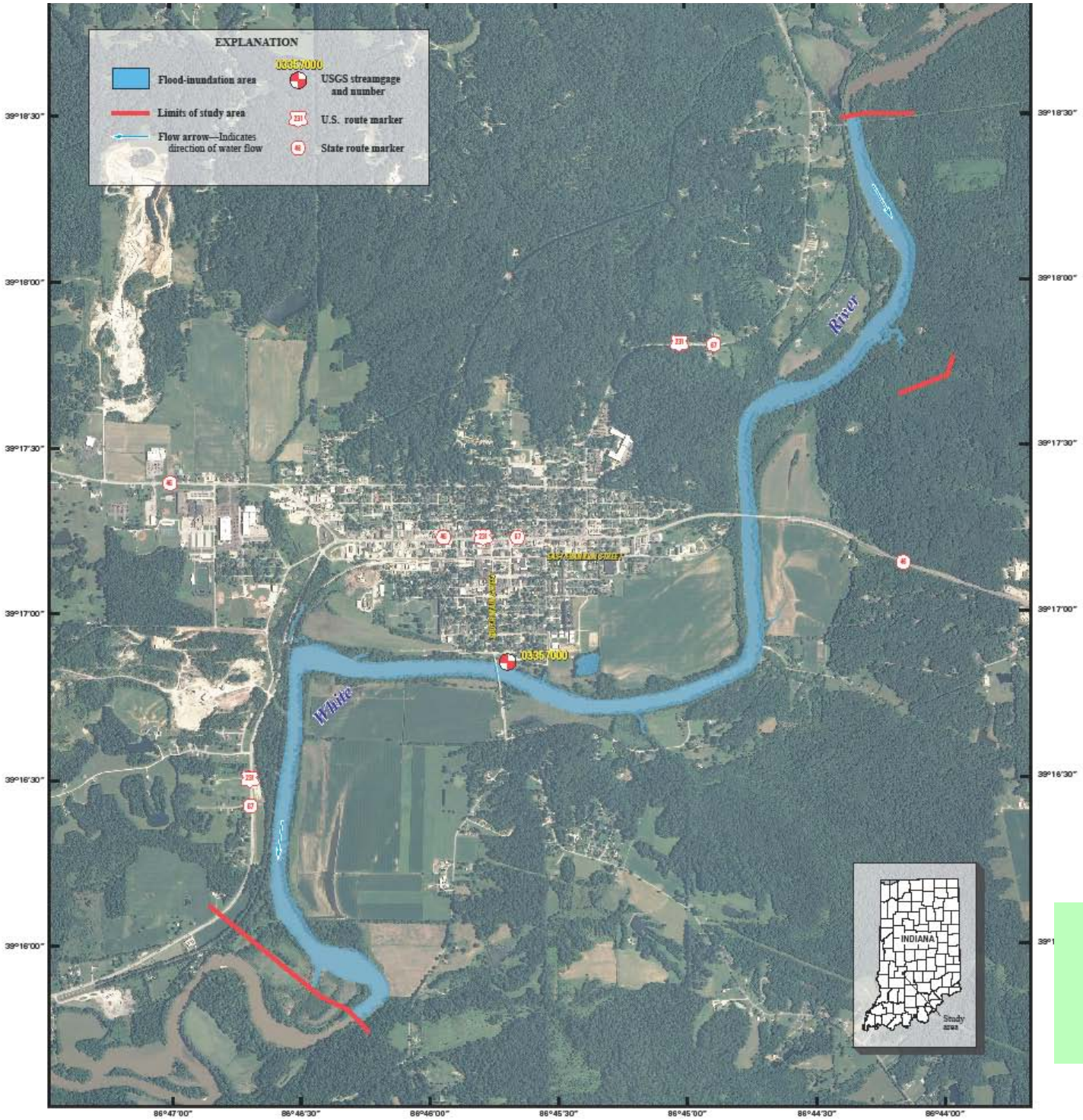
UNCERTAINTIES AND LIMITATIONS REGARDING USE OF FLOOD-INUNDATION MAPS

Flatrock River at Columbus, Indiana Stream Stage 20 feet



USGS
for a changing world

White River at Spencer, Indiana Stream Stage 9 feet

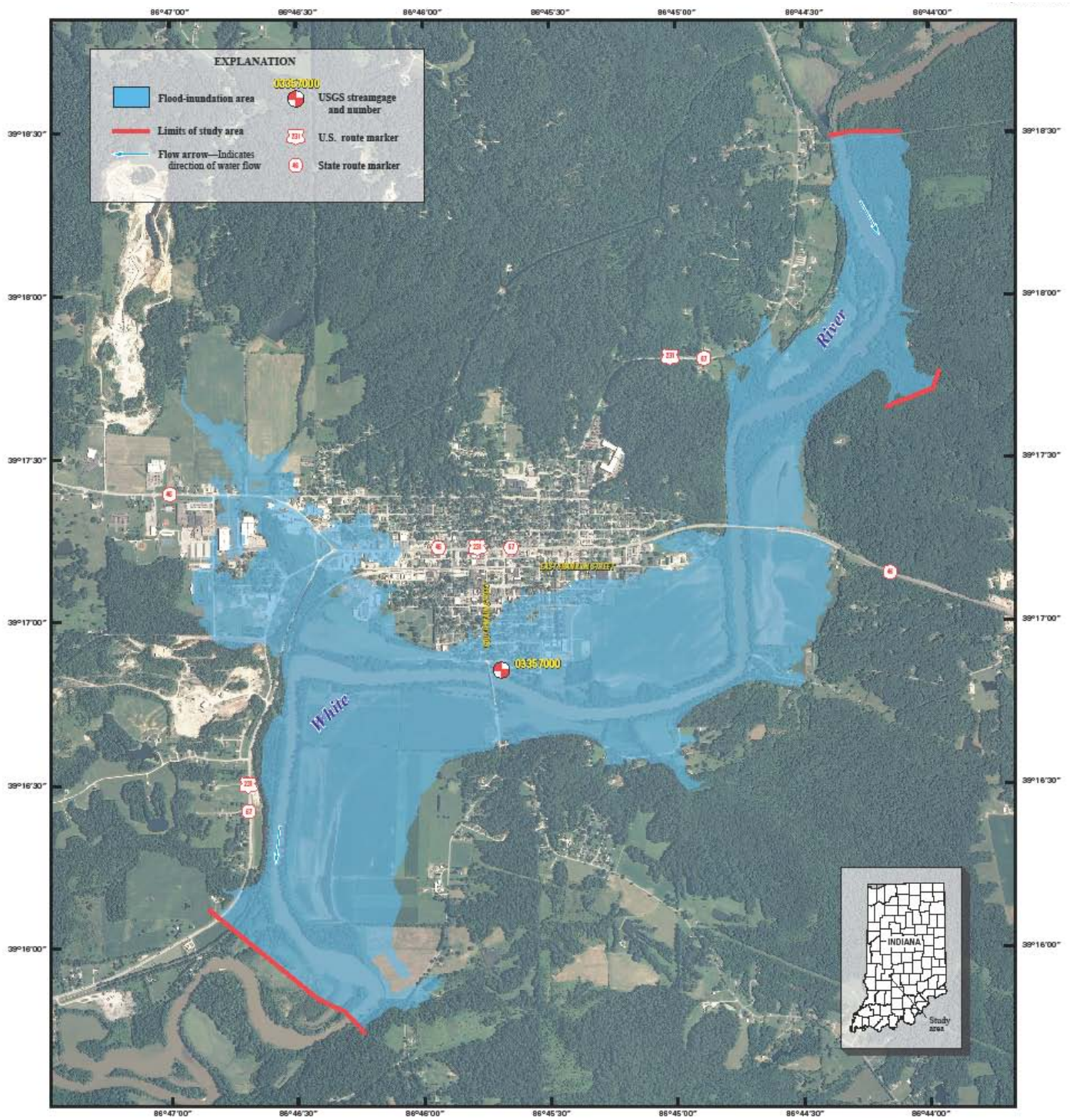


20 Flood Maps

USGS for a changing world

UNCERTAINTIES AND LIMITATIONS FOR USE OF FLOOD-INUNDATION MAPS

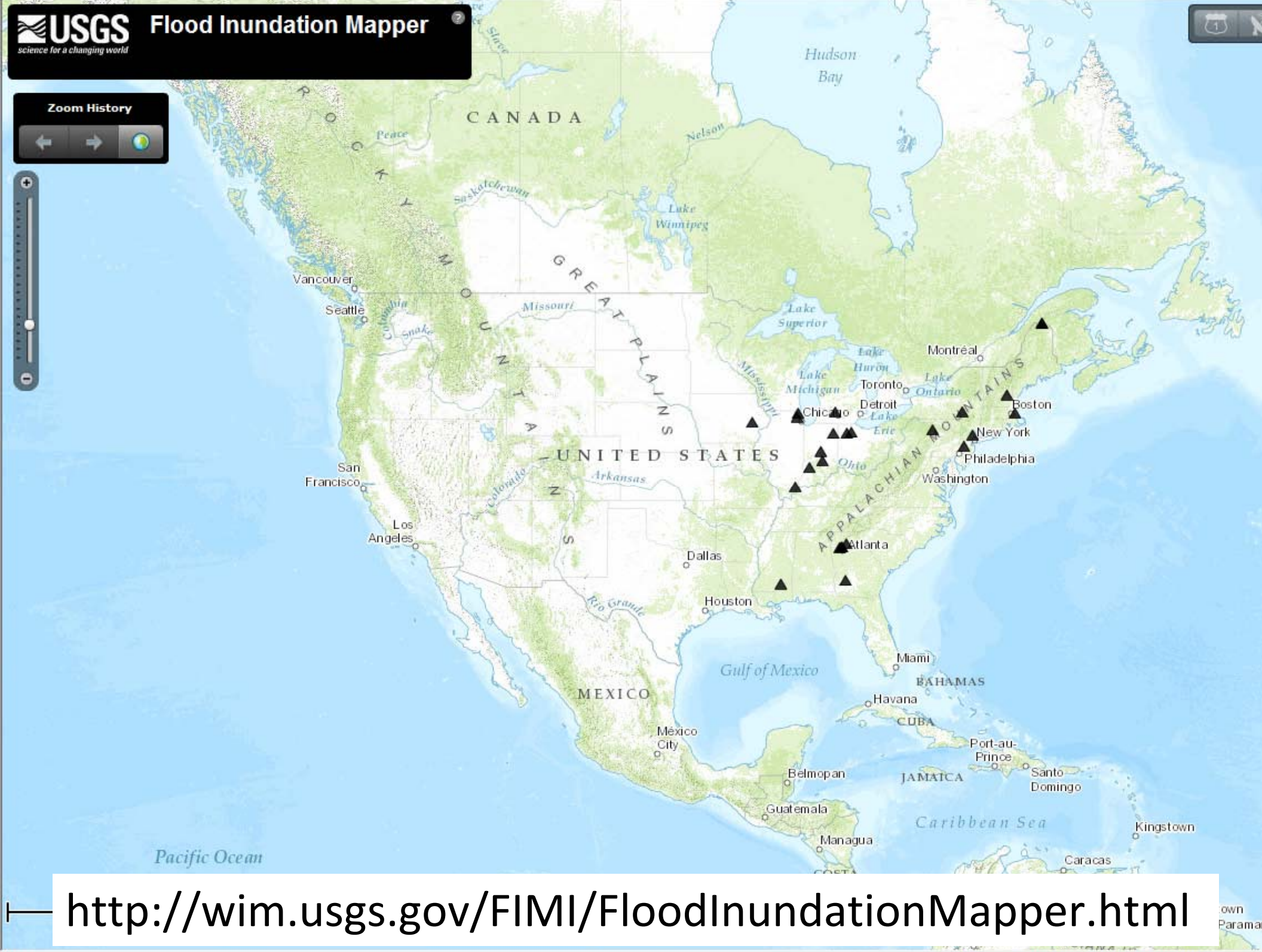
White River at Spencer, Indiana Stream Stage 28 feet



UNCERTAINTIES AND LIMITATIONS FOR USE OF FLOOD-INUNDATION MAPS

Although the flood-inundation maps represent the boundaries of inundated areas with a distinct line, some uncertainty is associated with these maps. The flood boundaries shown were estimated based on water stages (water-surface elevations) and streamflows at selected USGS streamgages. Water-surface elevations along the stream reaches were estimated by steady-state hydraulic modeling, assuming undobstructed flow, and using streamflows and hydrologic conditions anticipated at the USGS streamgage(s). The hydraulic model reflects the land-cover characteristics and any bridge, dam, levee, or other hydraulic structures existing as of July 2012. Unique meteorological factors (timing and distribution of precipitation) may cause actual streamflows along the modeled reach to vary from those assumed during a

USGS
ce for a changing world



http://wim.usgs.gov/FIMI/FloodInundationMapper.html

Benefits of Flood-Inundation Maps

1. Pre-flood benefits

- Polygons of delineated flood areas can be used to identify flooded properties at each flood stage
- Use GIS database to provide address-level information and create Reverse-911 warning system
- Plan in advance for what will need to be done at each flood stage

USGS
science for a changing world

Benefits of Flood-Inundation Maps

2. Proactive response during flood

- On basis of forecasted flood stage, identify where flooding is expected
- Use Reverse 911 system to notify residents
- Emergency managers have time to plan and mobilize personnel
- Evacuate residents in a timely and safe manner
- Road closures and detours set up prior to actual flooding

USGS
science for a changing world

Benefits of Flood-Inundation Maps

3. Post-flood benefits

- Maps delineating flood area already in hand

- Flood data would be compatible with FEMA HAZUS software

USGS
science for a changing world

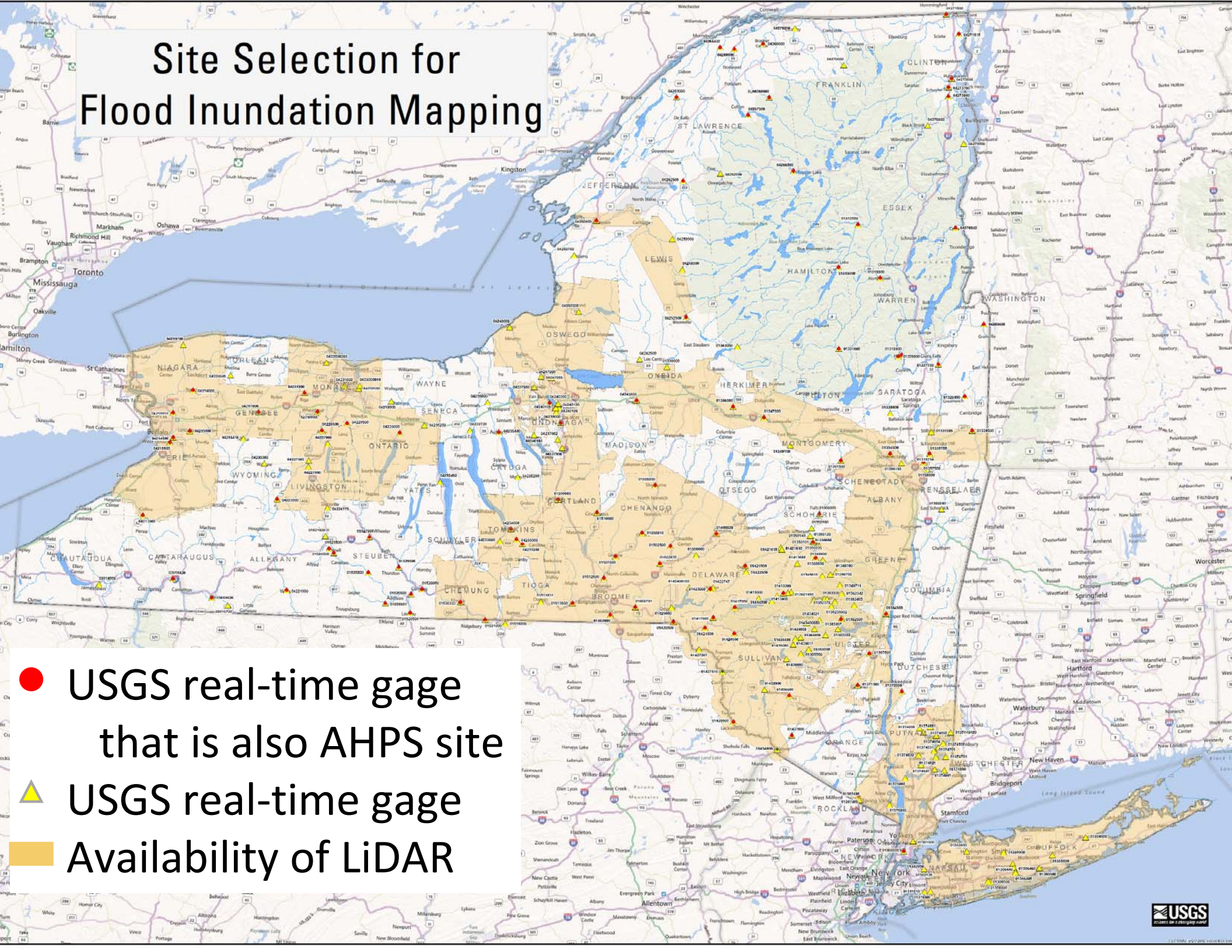
CURRENT EFFORT IN N.Y.

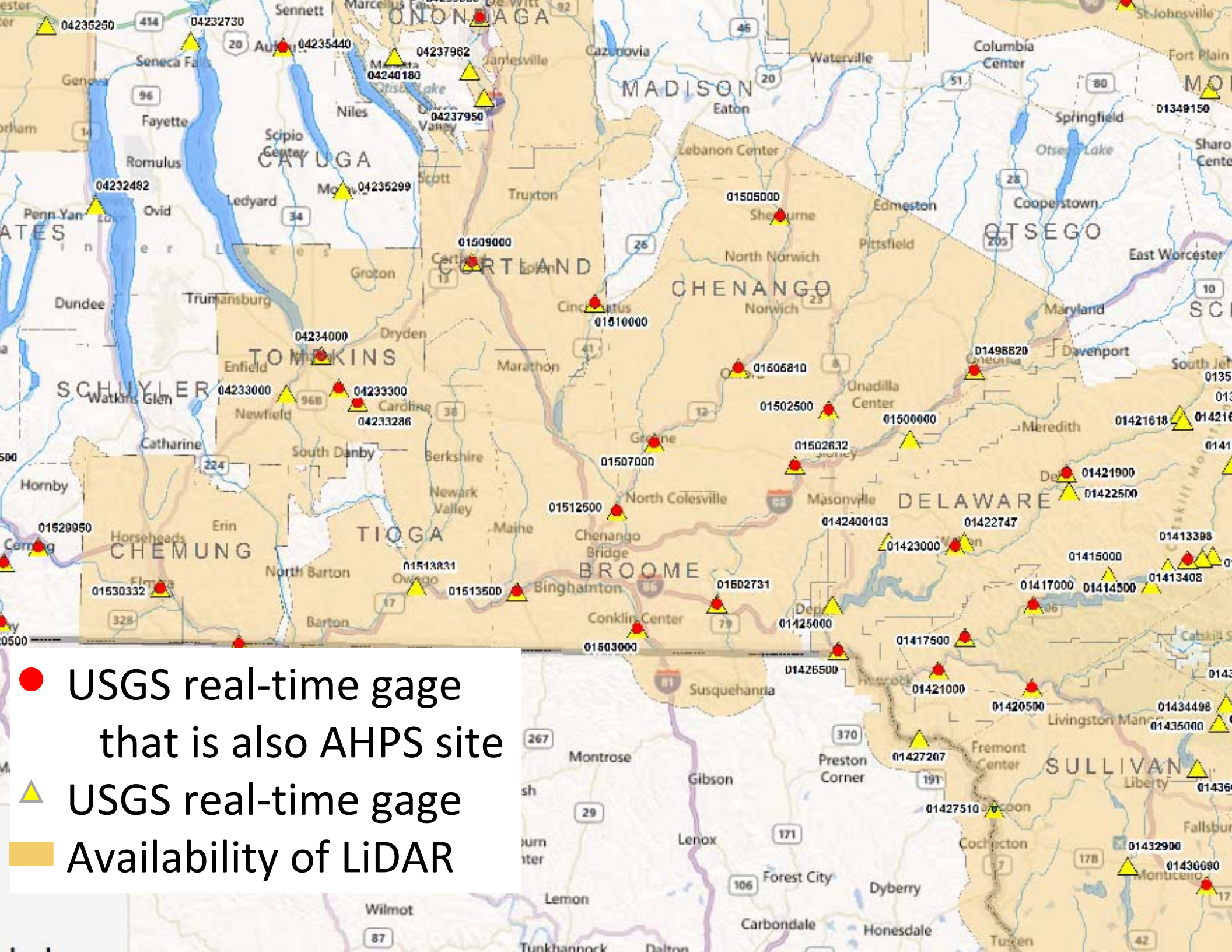
Compilation of prospective sites for flood-inundation mapping

Info being collected includes:

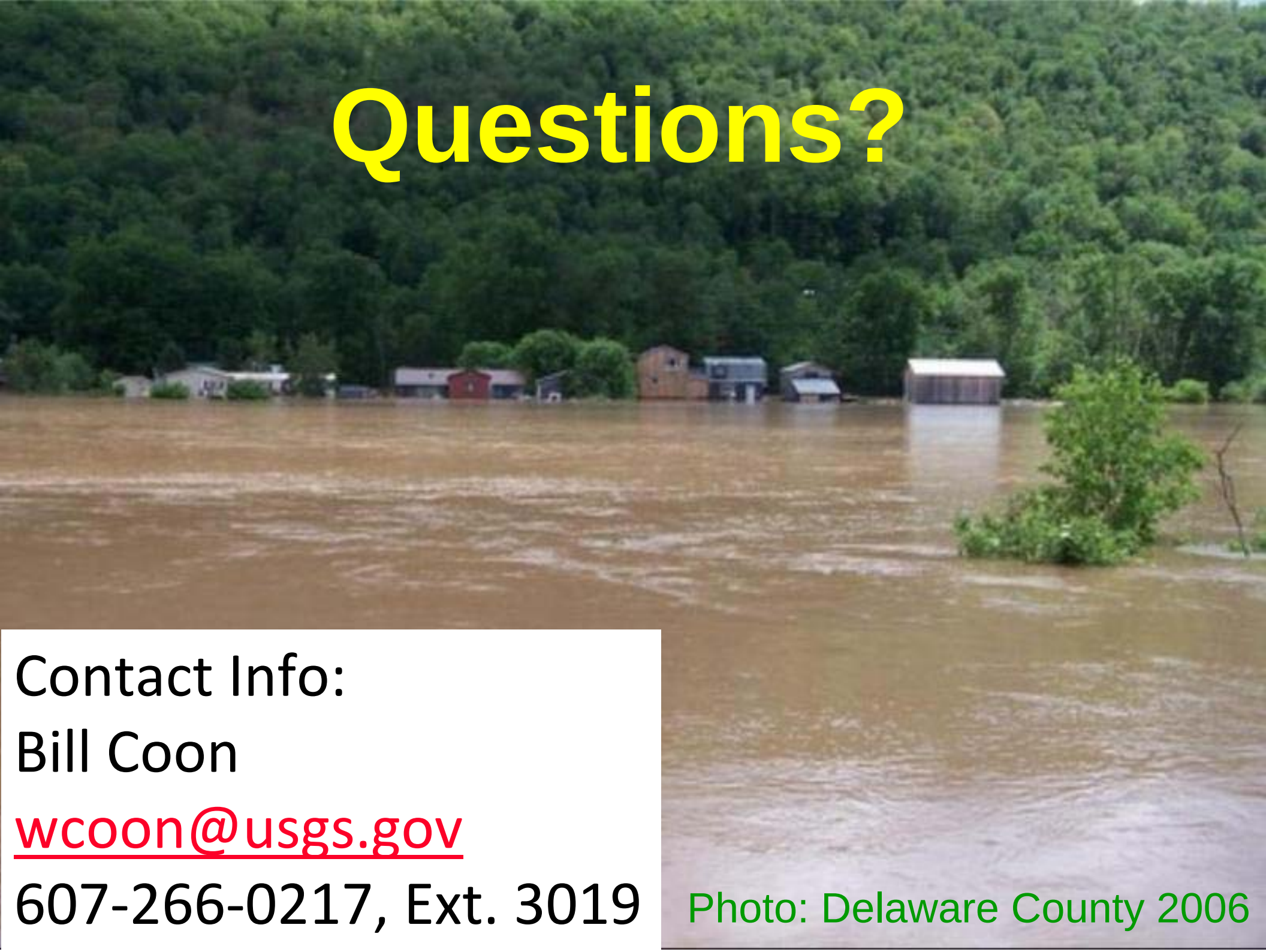
- USGS streamgages that are also AHPS sites
- Availability of real-time data transmission
- Availability of LiDAR
- Size of drainage basin
- Date of effective FIS

USGS
science for a changing world


Site Selection for
Flood Inundation Mapping
USGS real-time gage that is also AHPS site
USGS real-time gage
Availability of LiDAR
USGS

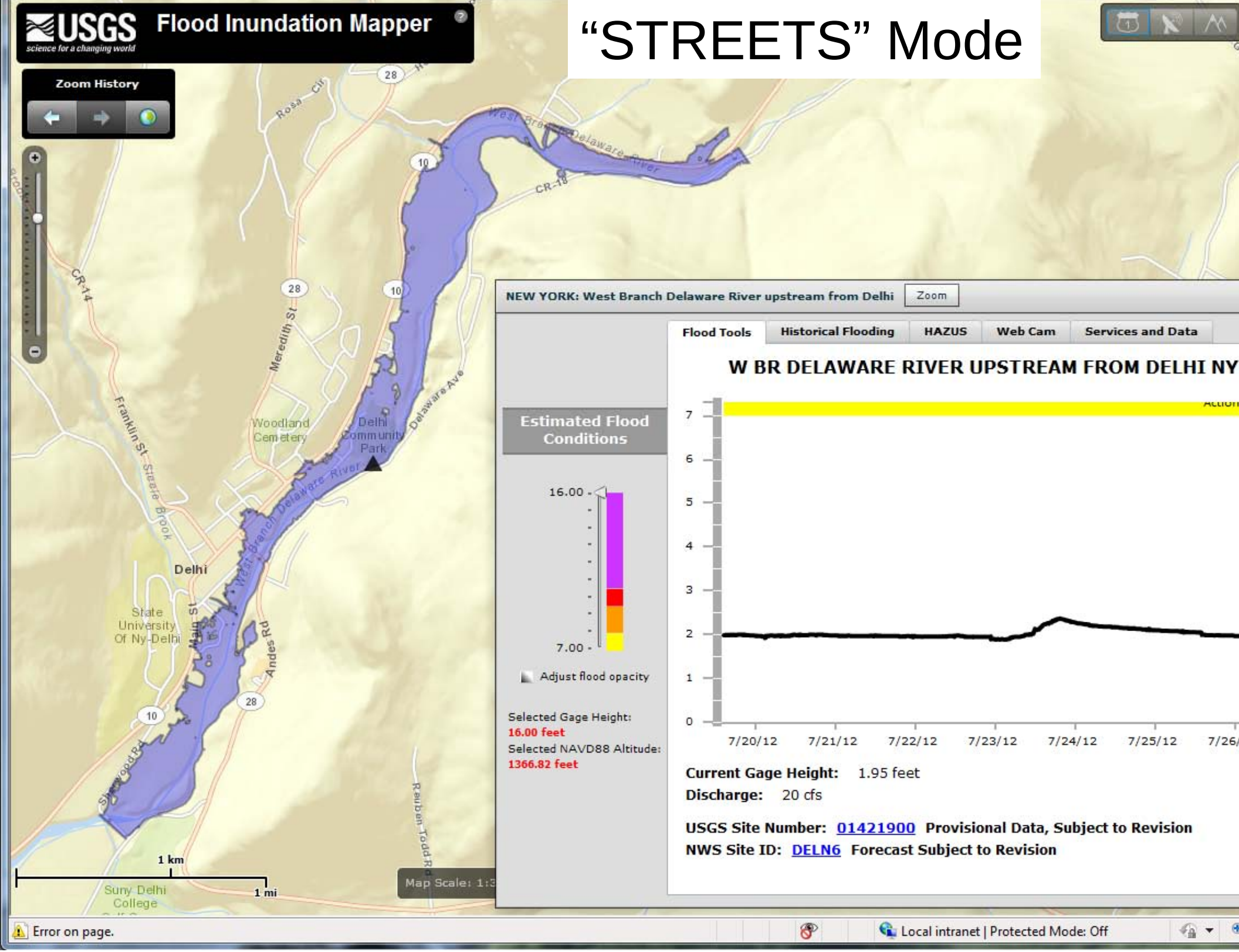

USGS real-time gage that is also AHPS site
USGS real-time gage
Availability of LiDAR
04235250
04232730
04235440
04237962
04240180
04237950
04232482
04235299
01509000
01505000
01510000
04234000
04233000
04233300
04233286
01498820
01606810
01502500
01500000
01421618
01502632
01507000
01421900
01422500
01512500
01422400103
01422747
01423000
01529950
01530332
01513831
01513500
01502731
01425000
01503000
01417500
01421000
01420500
01427207
01427510
01432900
01436690
01349150
Seneca Falls
Auburn
Niles
Scipio Center
Romulus
Fayette
Ovid
Penn Yan
Ledyard
Truxton
Cortland
Groton
Dundee
Trumansburg
Dryden
Enfield
Ithaca
Watkins Glen
Newfield
Caroline
Catharine
South Danby
Berkshire
Newark Valley
Hornby
Horseheads
Erin
Elmira
North Barton
Barton
Owego
Binghamton
Conklin Center
Chenango Bridge
North Colesville
Maine
Marathon
Greene
Sherburne
North Norwich
Norwich
Lebanon Center
Eaton
Cazenovia
Waterville
Columbia Center
Springfield
Cooperstown
Otsego Lake
Edmeston
Pittsfield
East Worcester
Maryland
Davenport
Unadilla Center
Meredith
Masonville
Delhi
Susquehanna
Montrose
Gibson
Lenox
Forest City
Dyberry
Carbondale
Honesdale
Wilmot
Lemon
Preston Corner
Fremont Center
Livingston Manor
Cochecton
Monticello
Liberty
Fallsburg
Tunkhannock
Dalton
Tuscarora
CAYUGA
TOMPKINS
SCHUYLER
TIOGA
CHEMUNG
BROOME
CHENANGO
DELAWARE
OTSEGO
MADISON
ONONDAGA
SULLIVAN

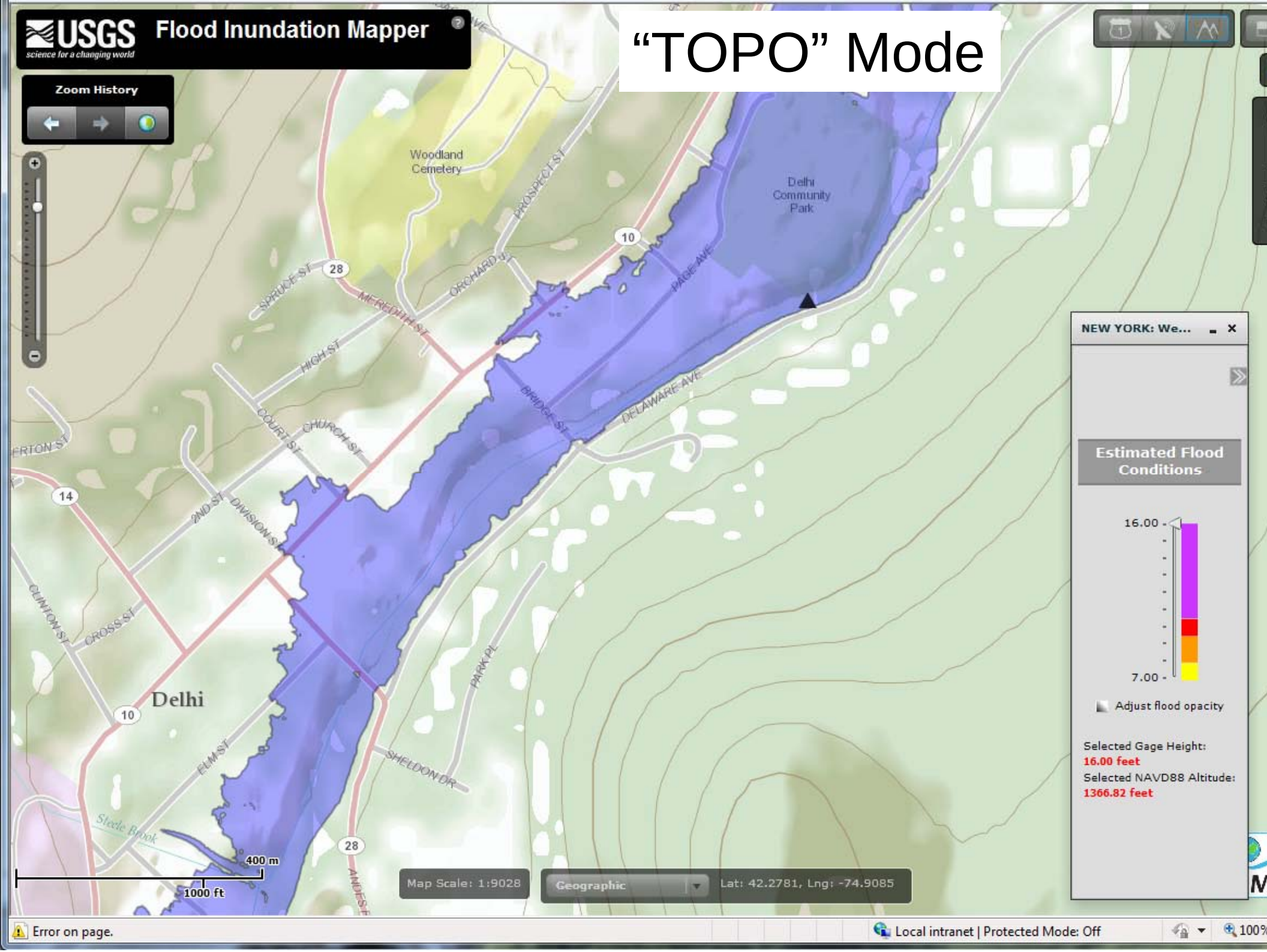
Questions?

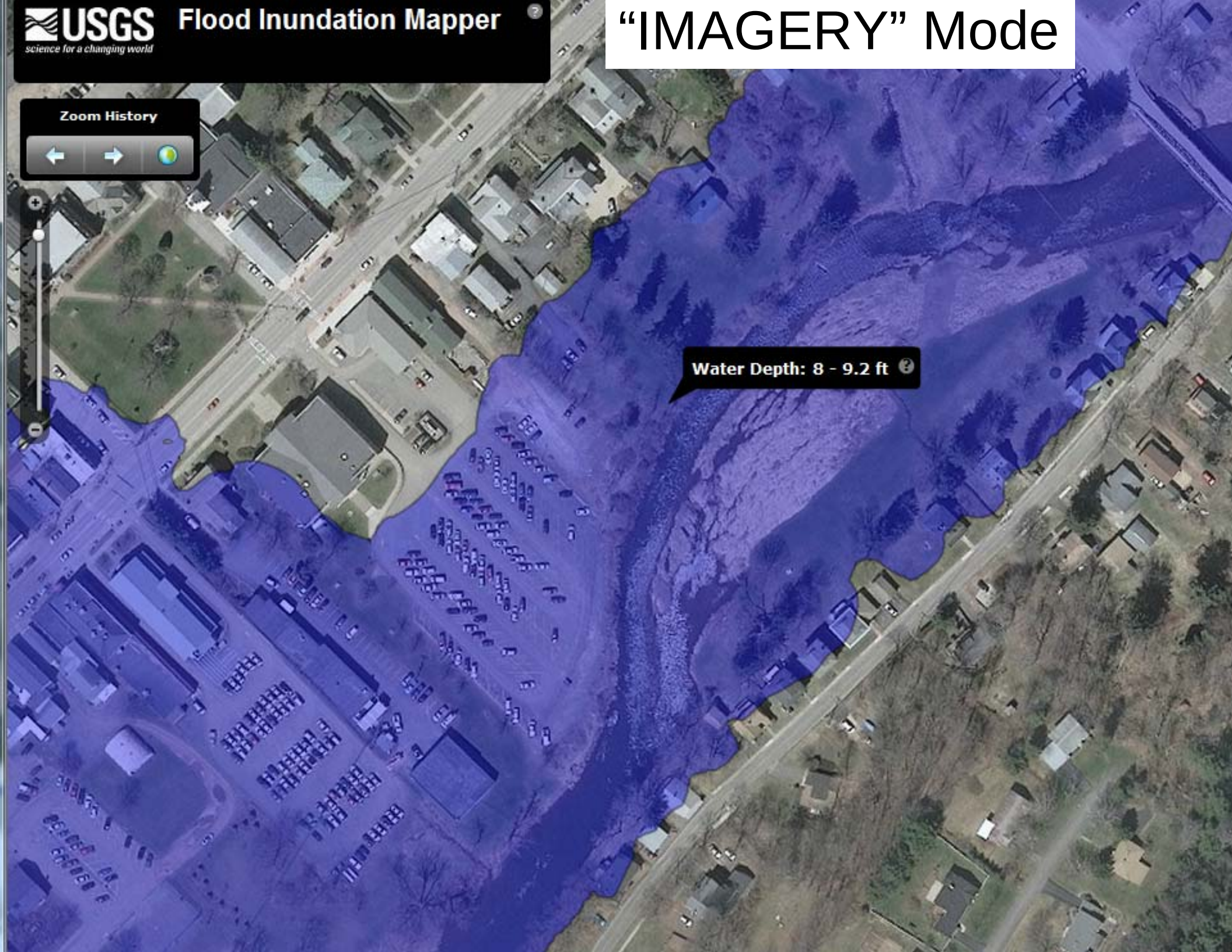


Contact Info:
Bill Coon
wcoon@usgs.gov
607-266-0217, Ext. 3019

Photo: Delaware County 2006


USGS
science for a changing world
Flood Inundation Mapper
"STREETS" Mode
Zoom History
NEW YORK: West Branch Delaware River upstream from Delhi
Zoom
Flood Tools
Historical Flooding
HAZUS
Web Cam
Services and Data
W BR DELAWARE RIVER UPSTREAM FROM DELHI NY
Estimated Flood Conditions
16.00
7.00
Adjust flood opacity
Selected Gage Height:
16.00 feet
Selected NAVD88 Altitude:
1366.82 feet
7
6
5
4
3
2
1
0
7/20/12
7/21/12
7/22/12
7/23/12
7/24/12
7/25/12
Current Gage Height: 1.95 feet
Discharge: 20 cfs
USGS Site Number: 01421900 Provisional Data, Subject to Revision
NWS Site ID: DELN6 Forecast Subject to Revision
Delhi
Woodland Cemetery
Delhi Community Park
State University Of Ny-Delhi
Suny Delhi College
West Branch Delaware River
Delaware Ave
Main St
Andes Rd
Meredith St
Franklin St
Steele Brook
Sherwood Rd
Reuben Todd Rd
CR-14
CR-18
28
10
1 km
1 mi
Map Scale: 1:
Error on page.
Local intranet | Protected Mode: Off


USGS
science for a changing world
Flood Inundation Mapper
Zoom History
"TOPO" Mode
Woodland Cemetery
Delhi Community Park
PROSPECT ST
ORCHARD ST
PAGE AVE
SPRUCE ST
MEREDITH ST
HIGH ST
COURT ST
CHURCH ST
BRIDGE ST
DELAWARE AVE
2ND ST
DIVISION ST
CLINTON ST
CROSS ST
PARK PL
ELM ST
SHELDON DR
Steele Brook
Delhi
28
10
14
NEW YORK: We...
Estimated Flood Conditions
16.00
7.00
Adjust flood opacity
Selected Gage Height:
16.00 feet
Selected NAVD88 Altitude:
1366.82 feet
400 m
1000 ft
Map Scale: 1:9028
Geographic
Lat: 42.2781, Lng: -74.9085
Error on page.
Local intranet | Protected Mode: Off
100%

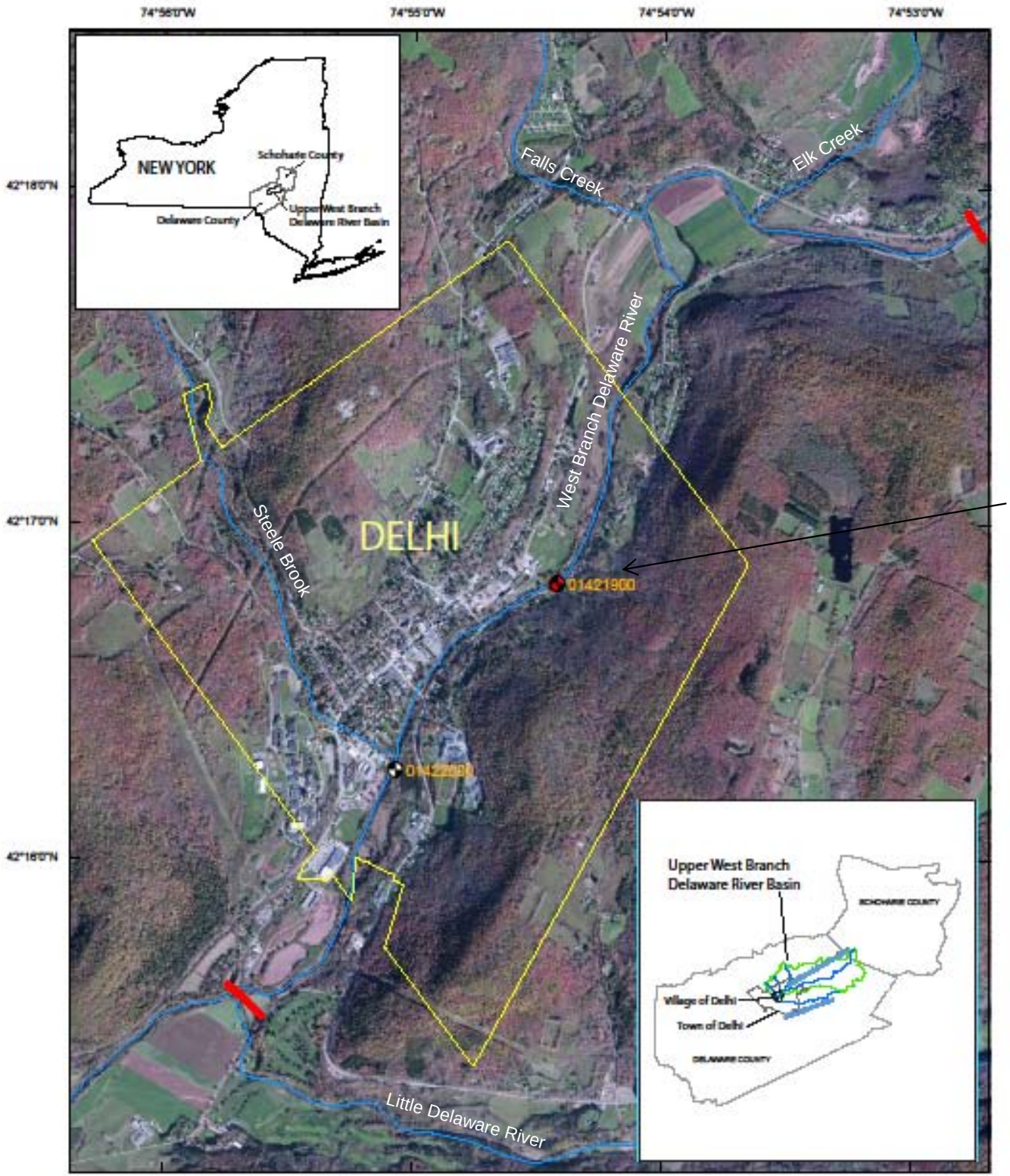


"IMAGERY" Mode

Flood Inundation Mapping
West Branch Delaware River
Delhi, N.Y.

USGS
science for a changing world

Limits of Study area (red bars)



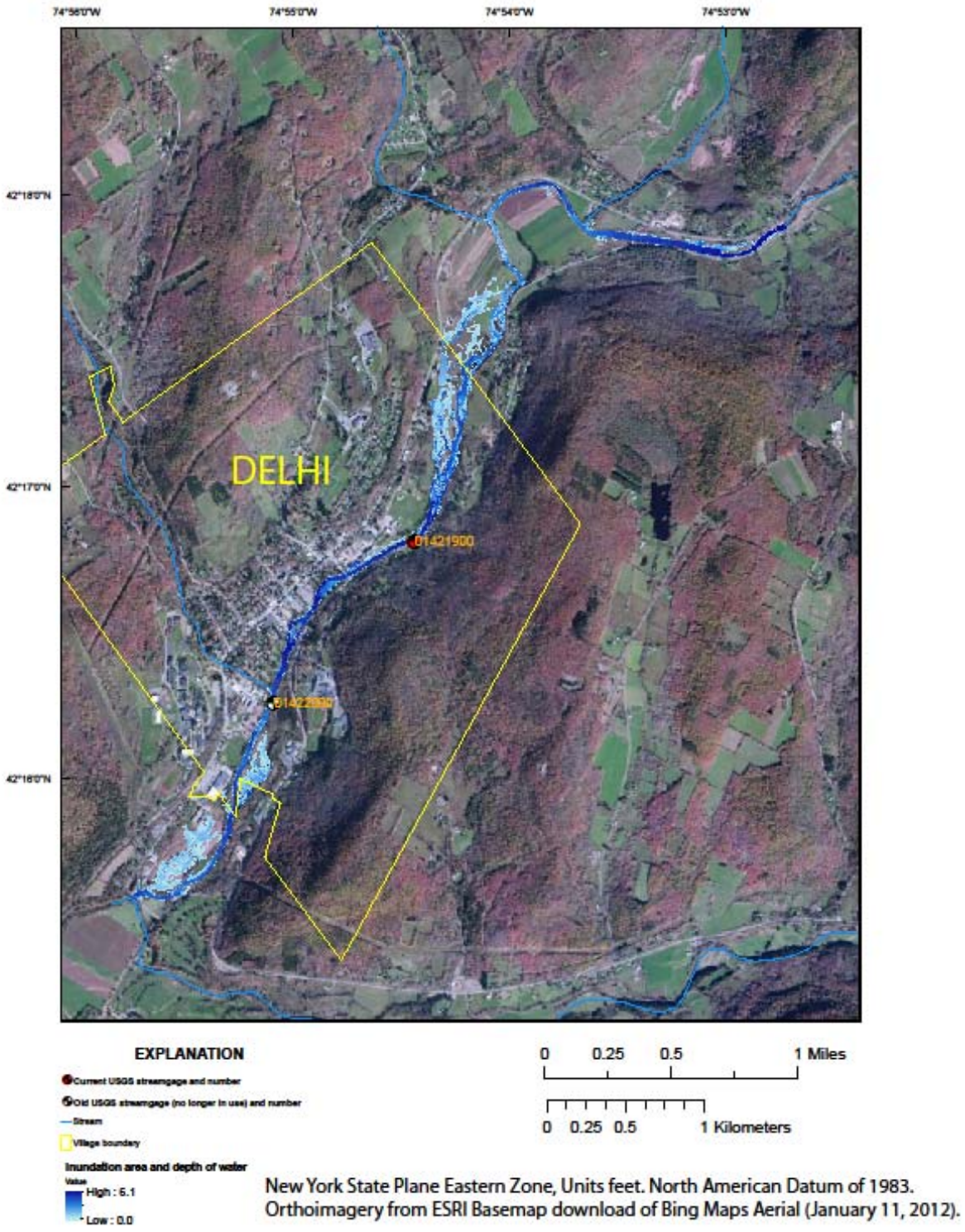
Reference gage

New York State Plane Eastern Zone, Units feet. North American Datum of 1983.
Orthoimagery from ESRI Basemap download of Bing Maps Aerial Imagery (January 11, 2012)

0 0.25 0.5 1 MILE

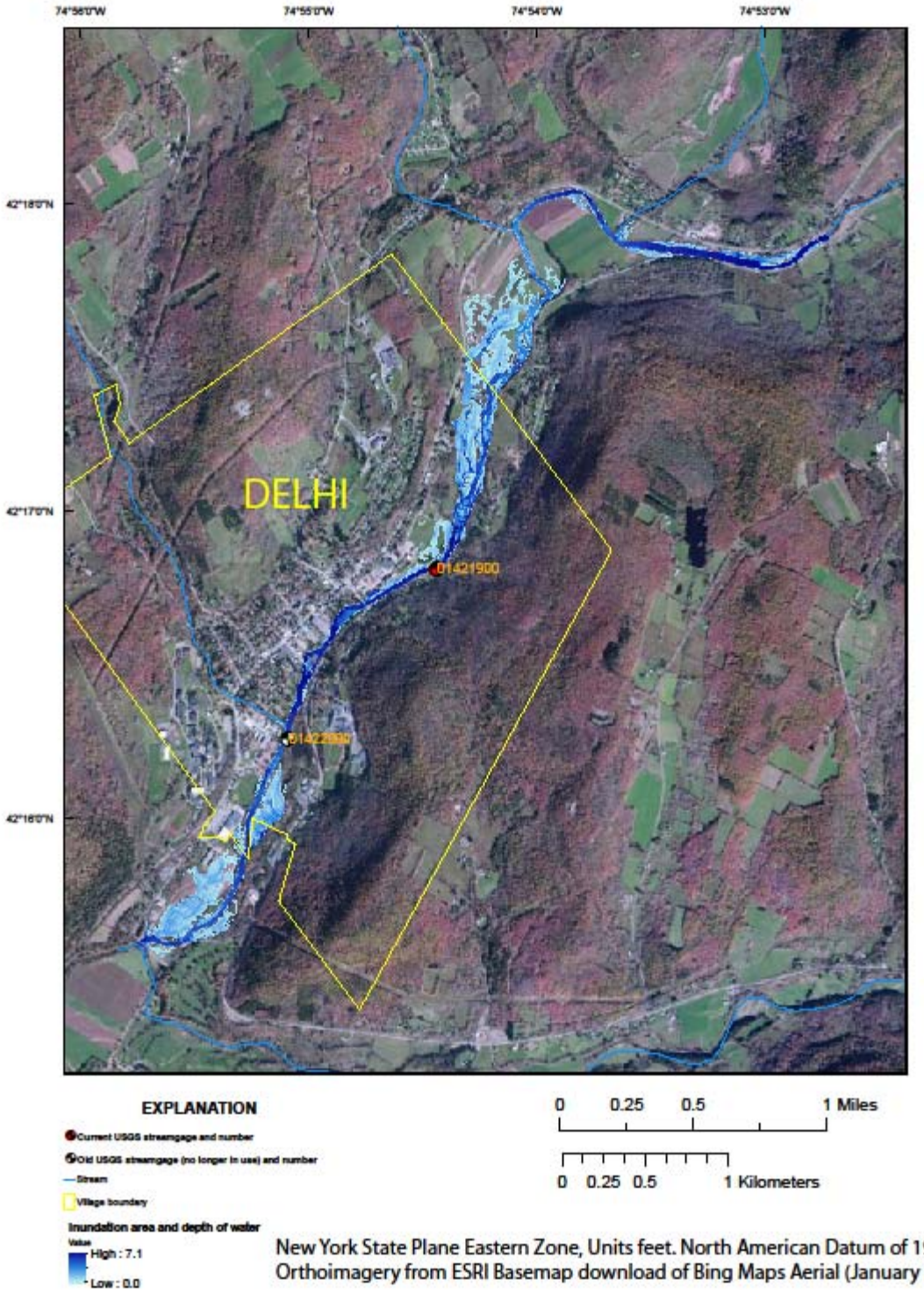
USGS
cience for a changing world

Stage 7.0 ft
(near bankfull)



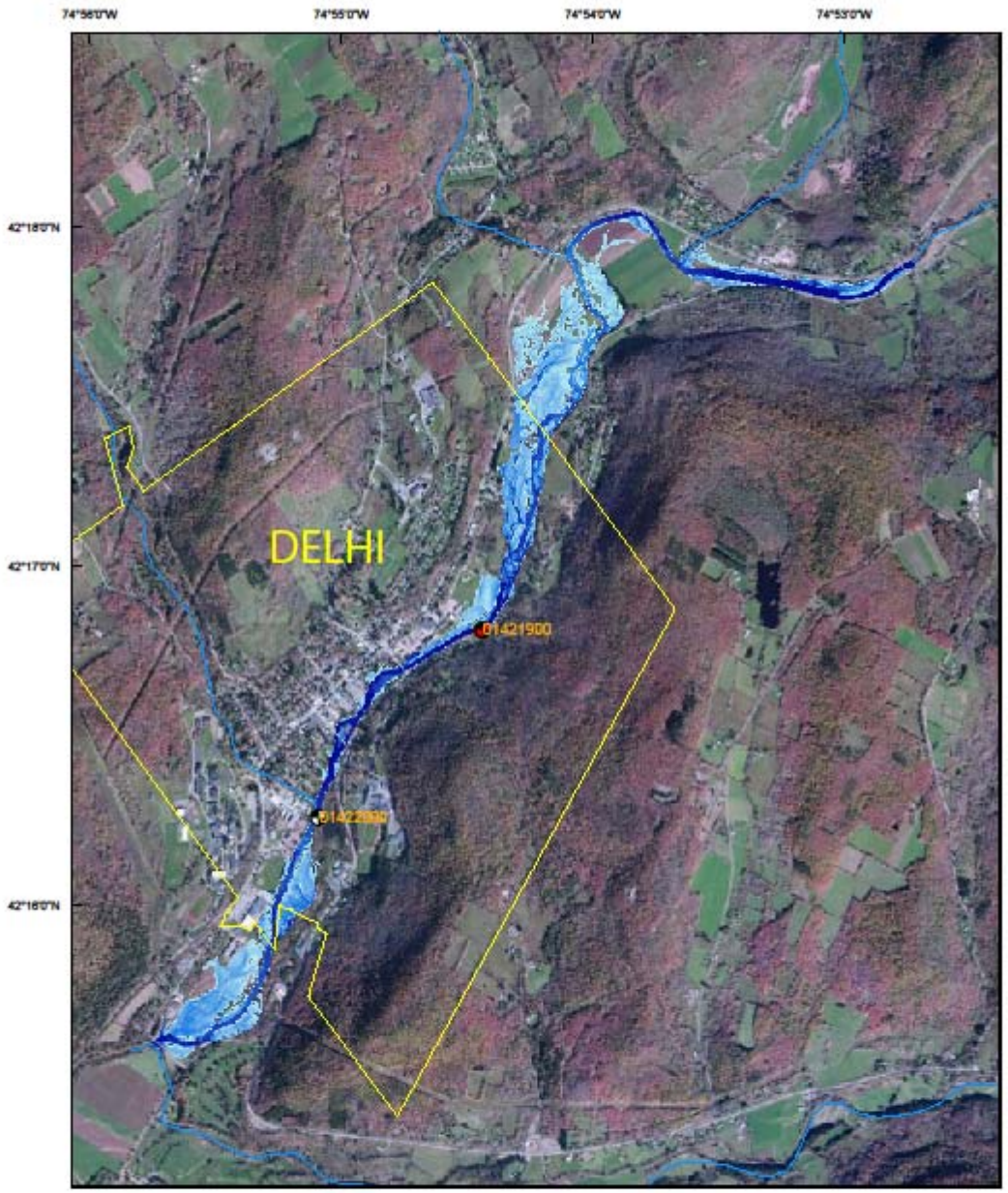
USGS
science for a changing world

Stage 8.0 ft



USGS
science for a changing world

Stage 9.0 ft



EXPLANATION

- Current USGS streamgage and number
- Old USGS streamgage (no longer in use) and number
- Stream
- Village boundary

Inundation area and depth of water

Value
High : 8.2
Low : 0.0

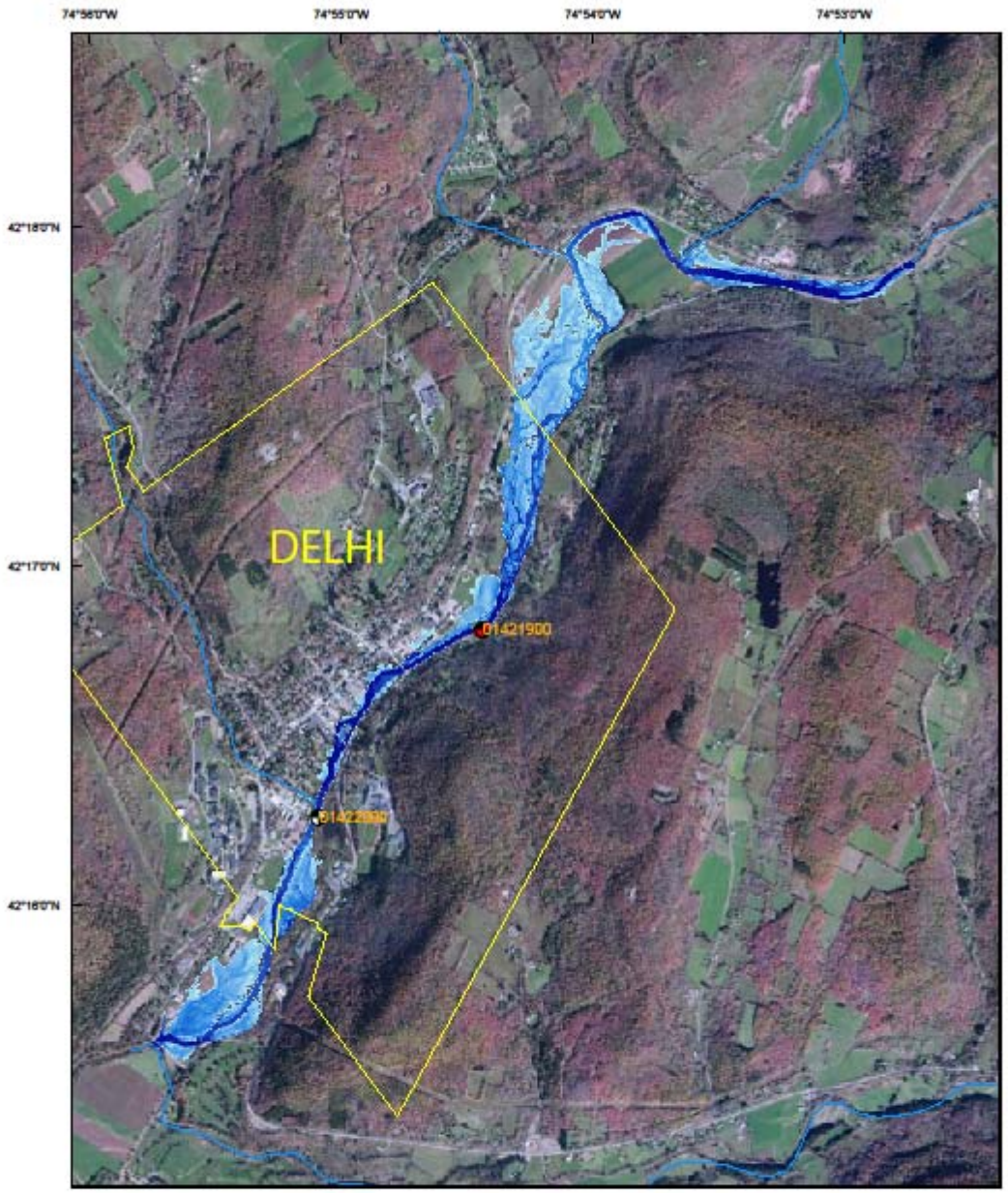
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

New York State Plane Eastern Zone, Units feet. North American Datum of 1983.
Orthoimagery from ESRI Basemap download of Bing Maps Aerial (January 11, 2012).

USGS
science for a changing world

Stage 10.0 ft



EXPLANATION

- Current USGS streamgage and number
- Old USGS streamgage (no longer in use) and number
- Stream
- Village boundary

Inundation area and depth of water

Value
High : 9.2
Low : 0.0

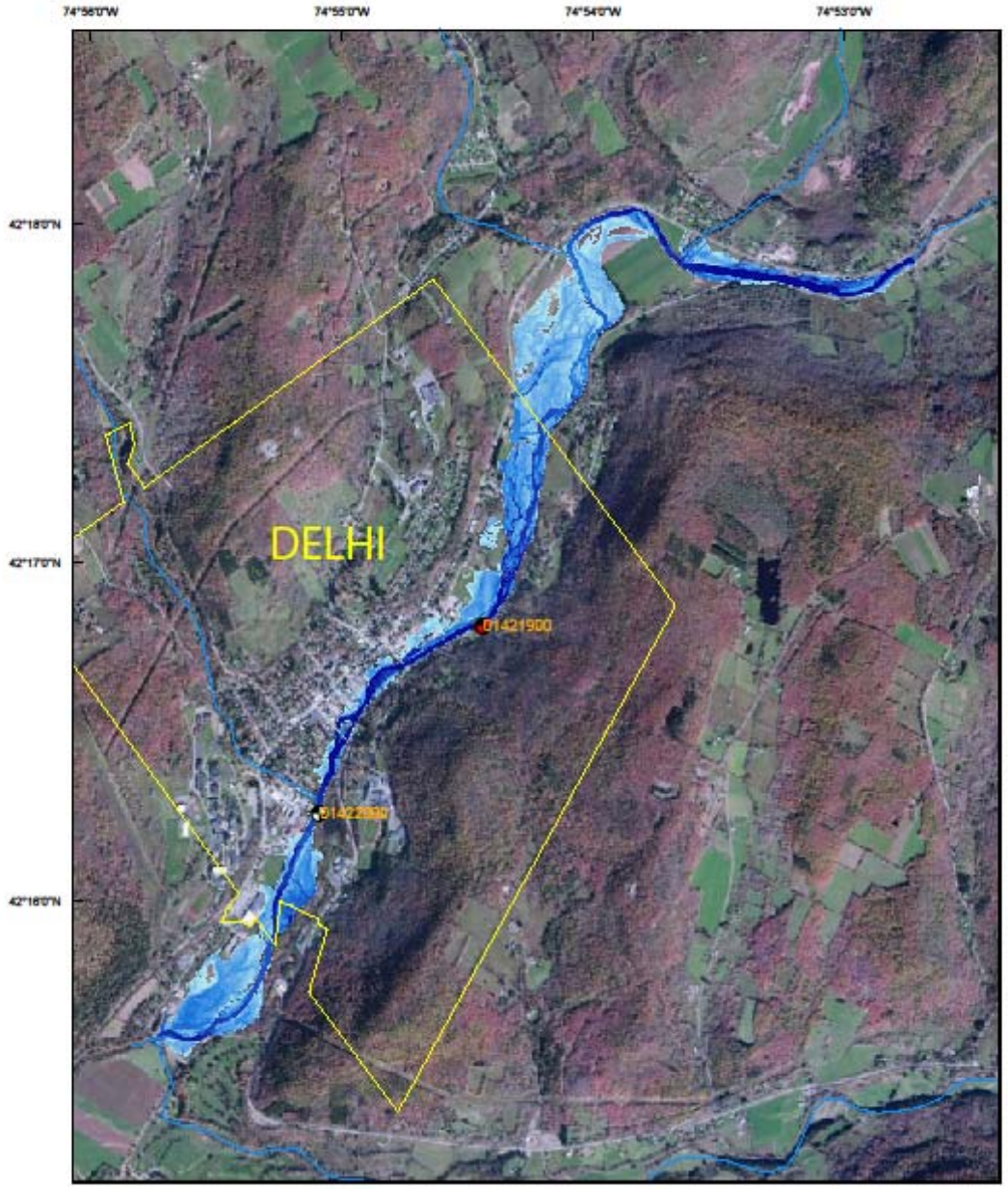
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

New York State Plane Eastern Zone, Units feet. North American Datum of 1983.
Orthoimagery from ESRI Basemap download of Bing Maps Aerial (January 11, 2012).

USGS
science for a changing world

Stage 11.0 ft



EXPLANATION

- Current USGS streamgage and number
- Old USGS streamgage (no longer in use) and number
- Stream
- Village boundary
- Inundation area and depth of water
  - Value
  - High : 10.3
  - Low : 0.0

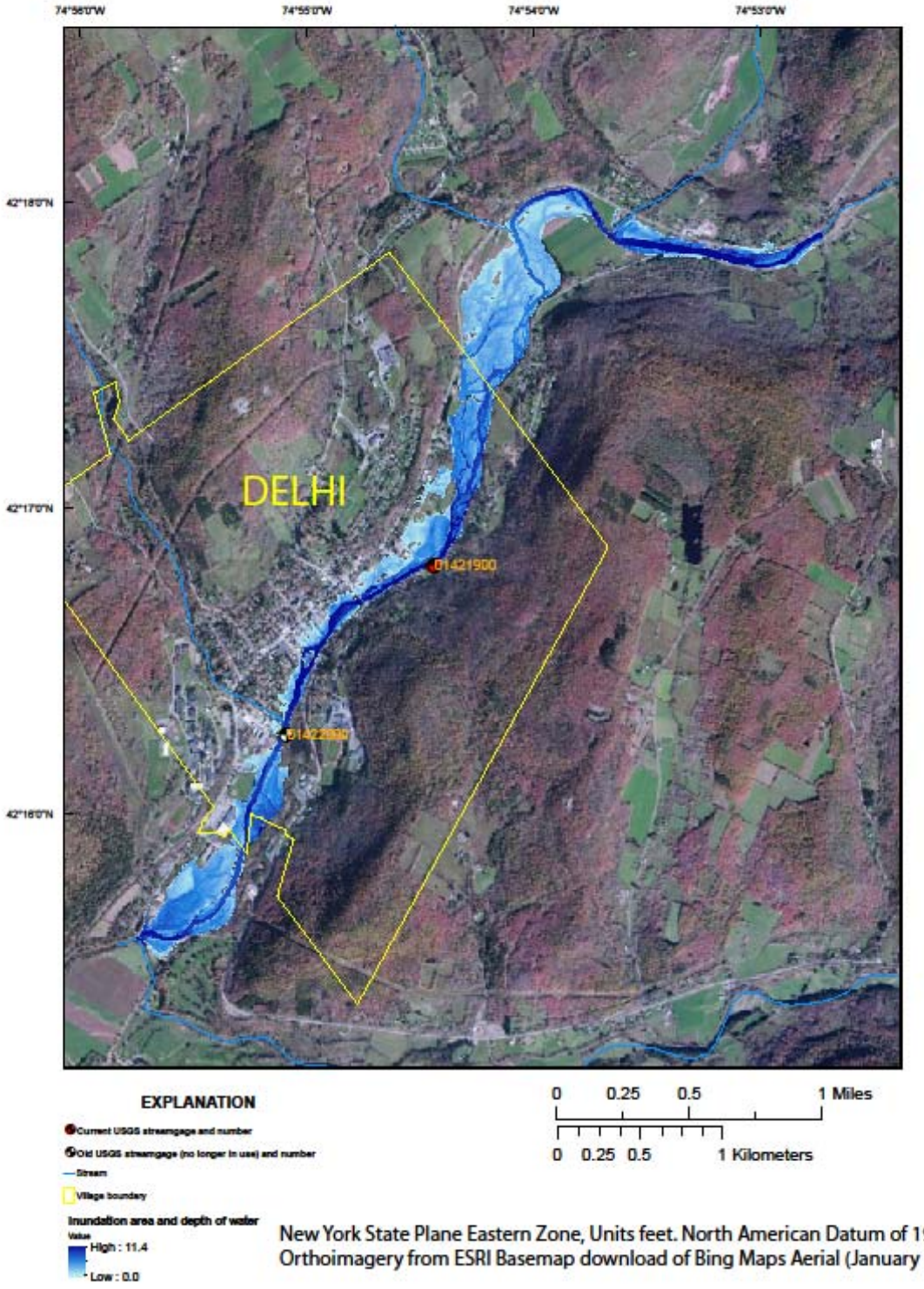
0 0.25 0.5 1 Miles

0 0.25 0.5 1 Kilometers

New York State Plane Eastern Zone, Units feet. North American Datum of 1983.
Orthoimagery from ESRI Basemap download of Bing Maps Aerial (January 11, 2012).

USGS science for a changing world

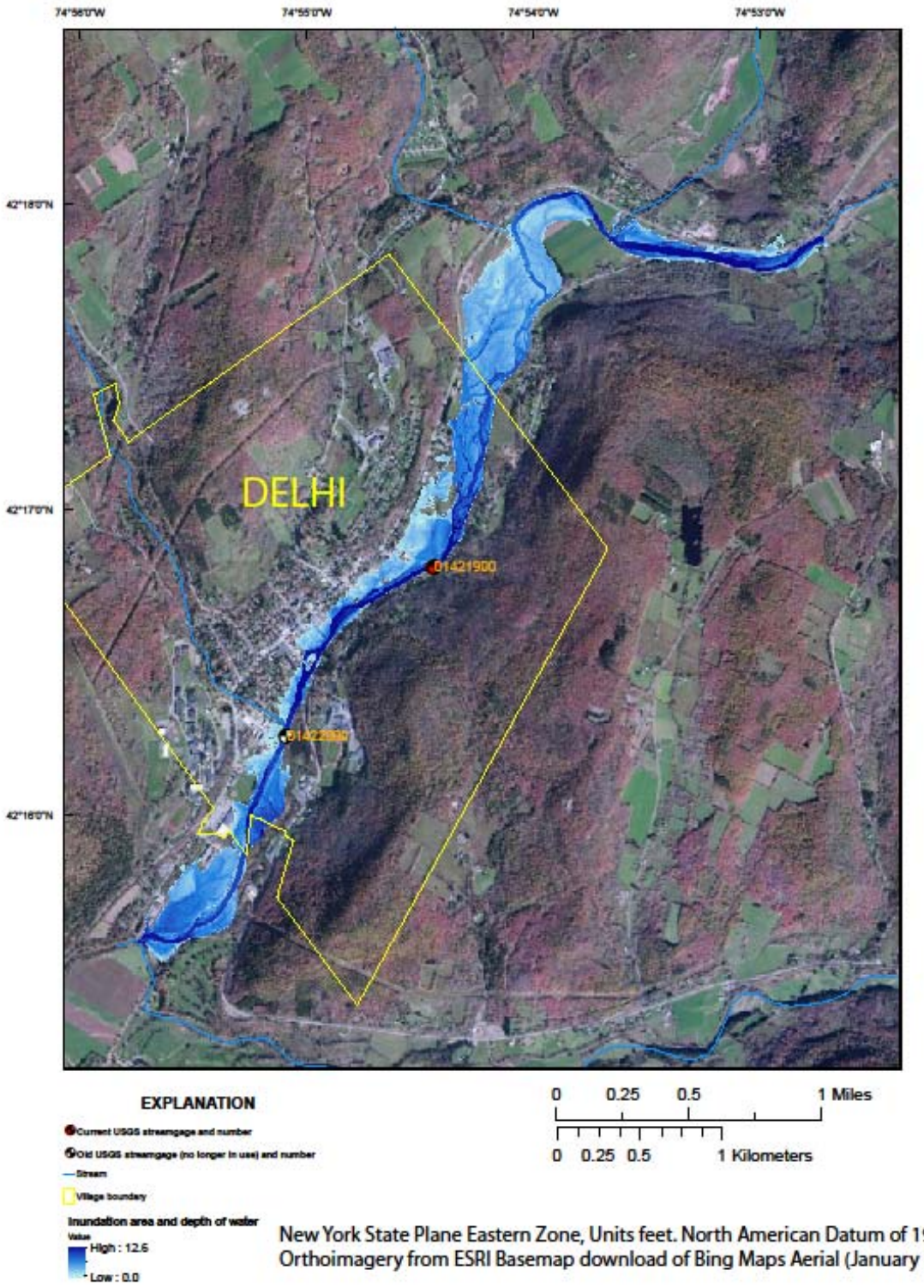
Stage 12.0 ft



USGS
science for a changing world

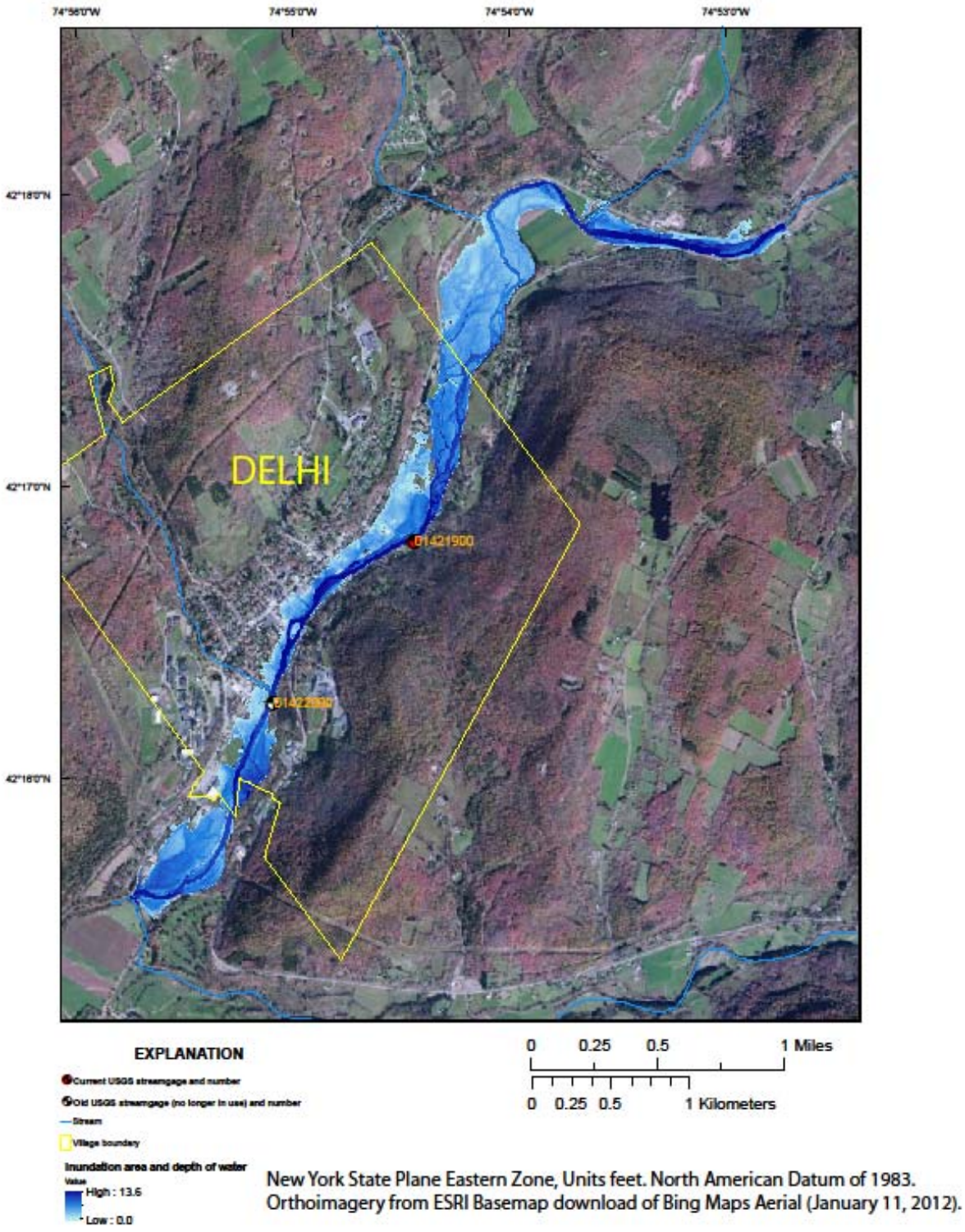
Stage 13.0 ft

(Stage of 100-yr flow is 13.3 ft)



USGS
science for a changing world

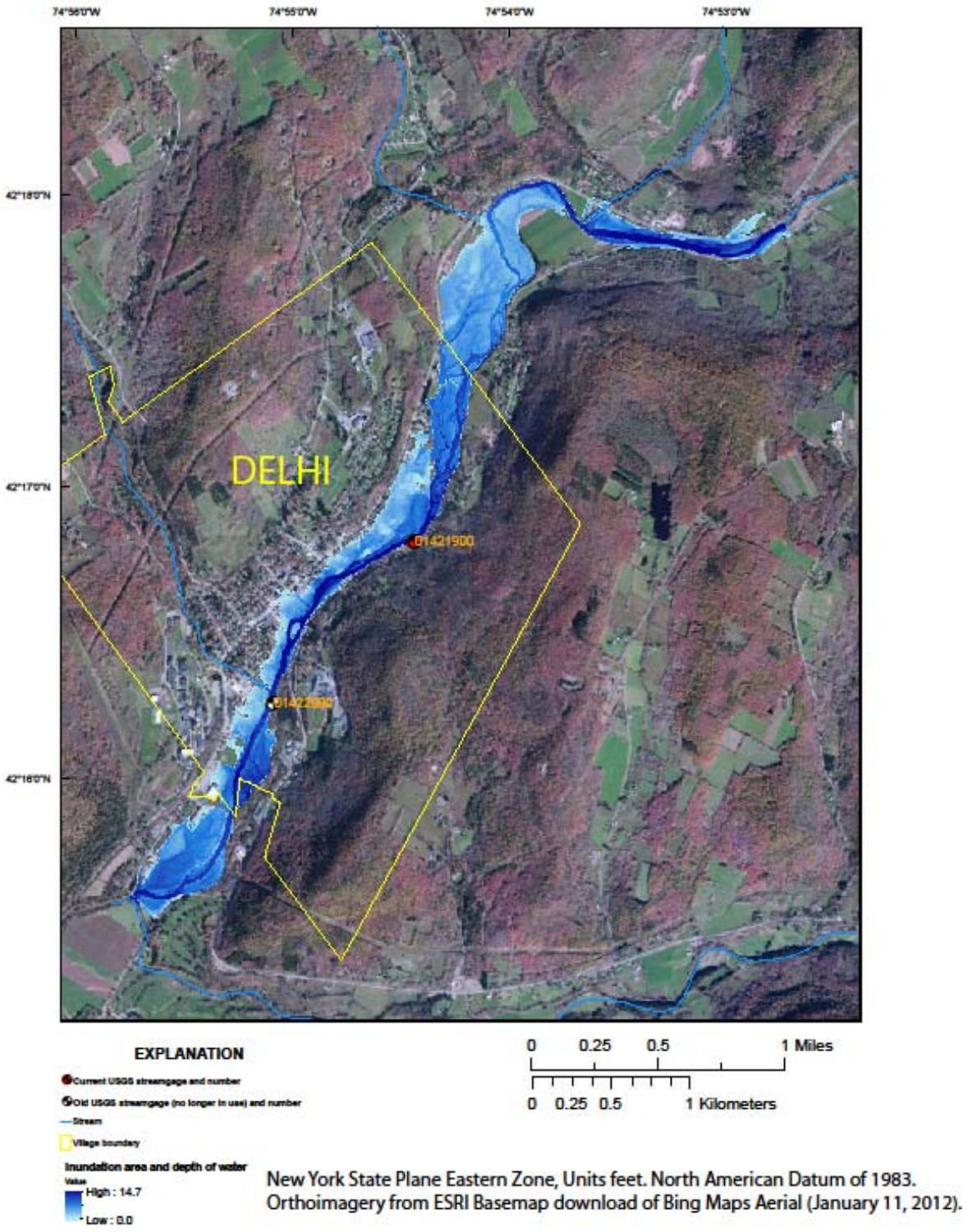
Stage 14.0 ft



USGS
science for a changing world

Stage 15.0 ft

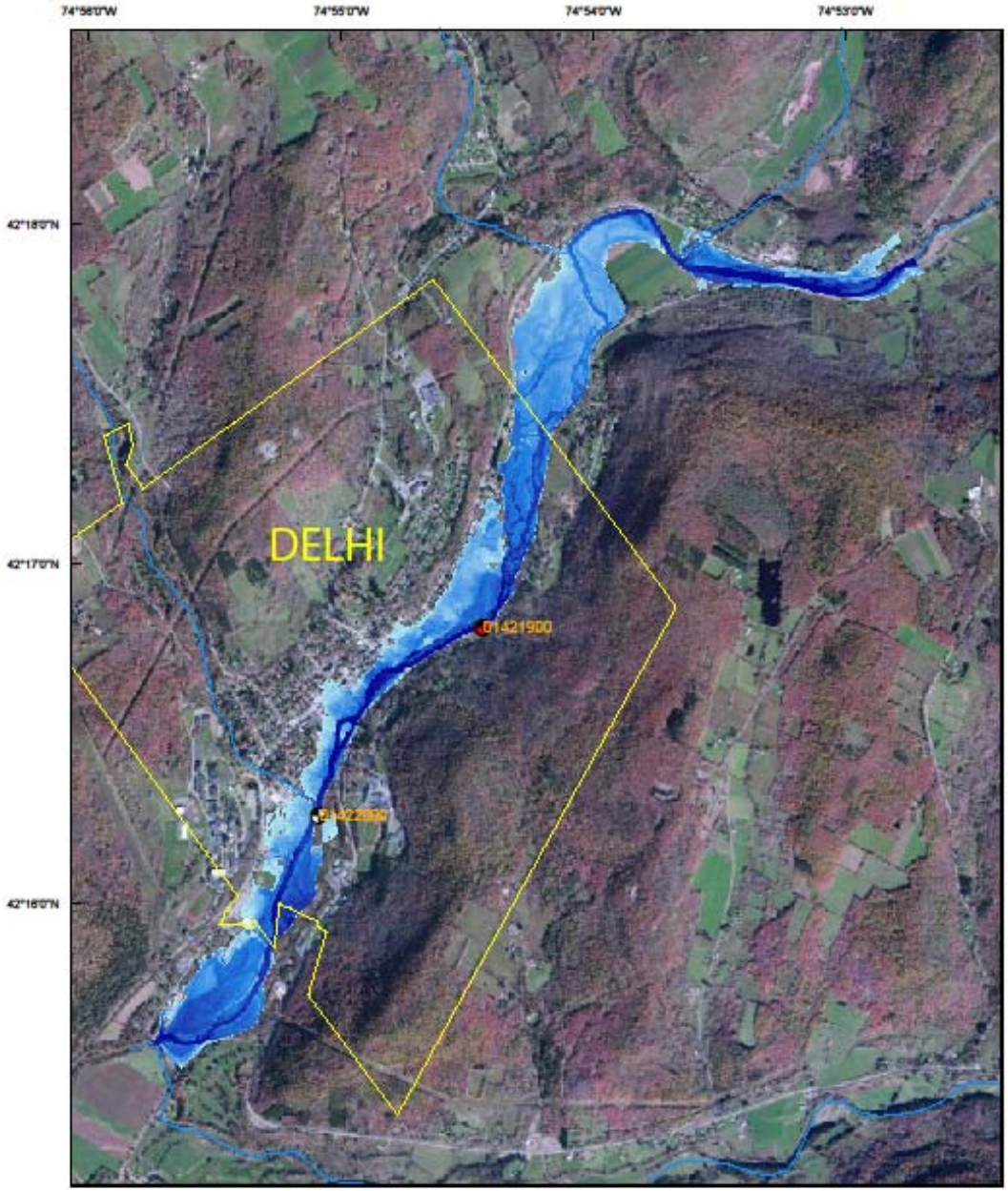
(Stage of 500-yr flow is 15.2 ft)



USGS
science for a changing world

Stage 16.0 ft

(exceeds the stage of the 500-yr flow and the maximum recorded flow, 13,000 cfs on Jan. 19, 1996)



New York State Plane Eastern Zone, Units feet. North American Datum of 1983.
Orthoimagery from ESRI Basemap download of Bing Maps Aerial (January 11, 2012).

USGS science for a changing world