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Water Science at Work

A sampling of USGS activities in eastern North Carolina

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U.S. Geological Survey

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New Bern, NC
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USGS at a glance

- Water Program: hydrologists, biologists, engineers, geologists, chemists, technicians, geographers and statisticians
- Monitor river stage, streamflow, groundwater, precipitation, and water quality
- Unbiased scientific interpretation
- Technical support

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Some Current Activities

- Hurricane Irene storm-tide monitoring
- Roanoke River dissolved-oxygen monitoring and modeling
- Nutrient investigations
- Water-supply quality and sustainability

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1. Documenting storm tides during Hurricane Irene

- Funding support from FEMA
- Collaboration with other federal and state agencies and universities
- Supplement
  - High water marks
  - River levels and discharge (flow)

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Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

USGS Storm-Tide Program Objectives

Provide data for:

- Development of inundation maps
- Calibration/verification of storm-surge models
- Assess performance of topographical or engineered structures

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Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

Problem: Need inland storm-tide data

- High water marks provide limited information
- Coastal gages are sparse and vulnerable (USGS and NOAA lost about 35 gages during Katrina)
- Need data across several states, collected consistently

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Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

Approach

- Deploy a dense network of mobile, temporary gages in advance of storm
- Retrieve, quality assure, and release the data quickly after storm
- Collaborate to build complementary datasets

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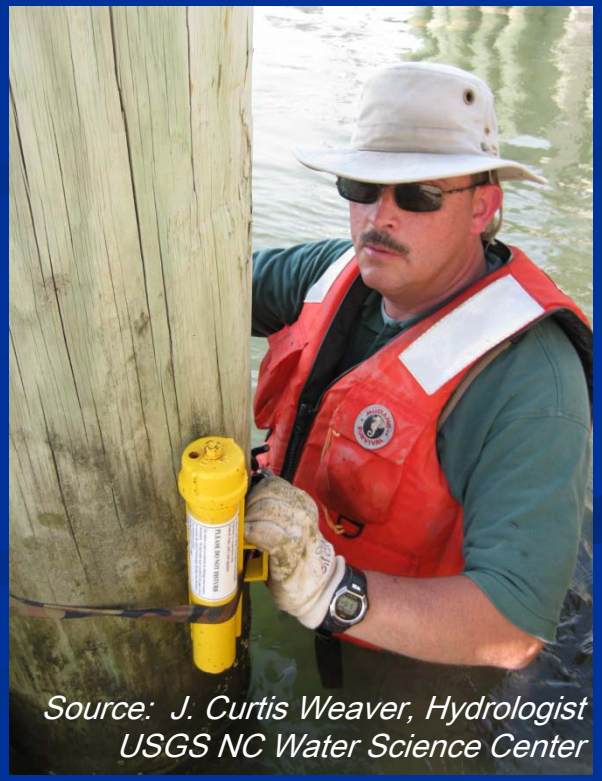
Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

New Sensor Technology

- Unvented pressure transducers
  - Record temperature and pressure for 8 days at 30 second intervals
  - Self-contained
  - Inexpensive
  - Accurate (+/- 0.05’)
- Entire hydrograph—not just peak



Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

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Sensor Deployment

- 2-person crews

  Irene: 24 personnel, incl. 10 from GA & MS
- Deploy 24-36 hours prior to landfall
- Strap-on sensors, mark reference points, take pictures, get GPS coordinates
- “Clear out” at 12 hours to landfall

Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

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Sensor Recovery

- Retrieve sensors, flag HWMs, tape-down to H_2O, run local levels, download, adjust data for barometric pressure, salinity, and upload to web
- Follow-on GPS crews determine local datum for corrected data adjustment

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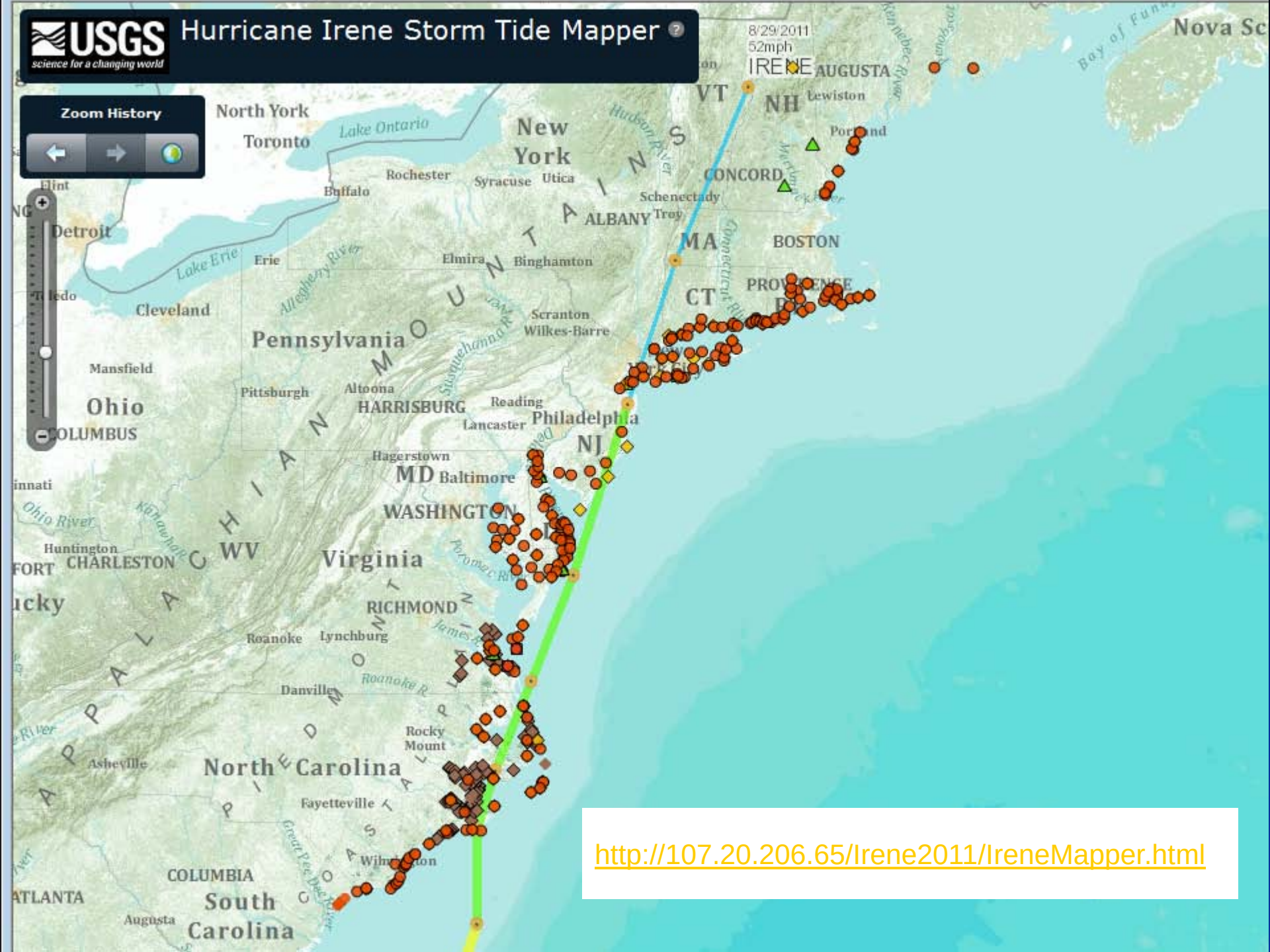
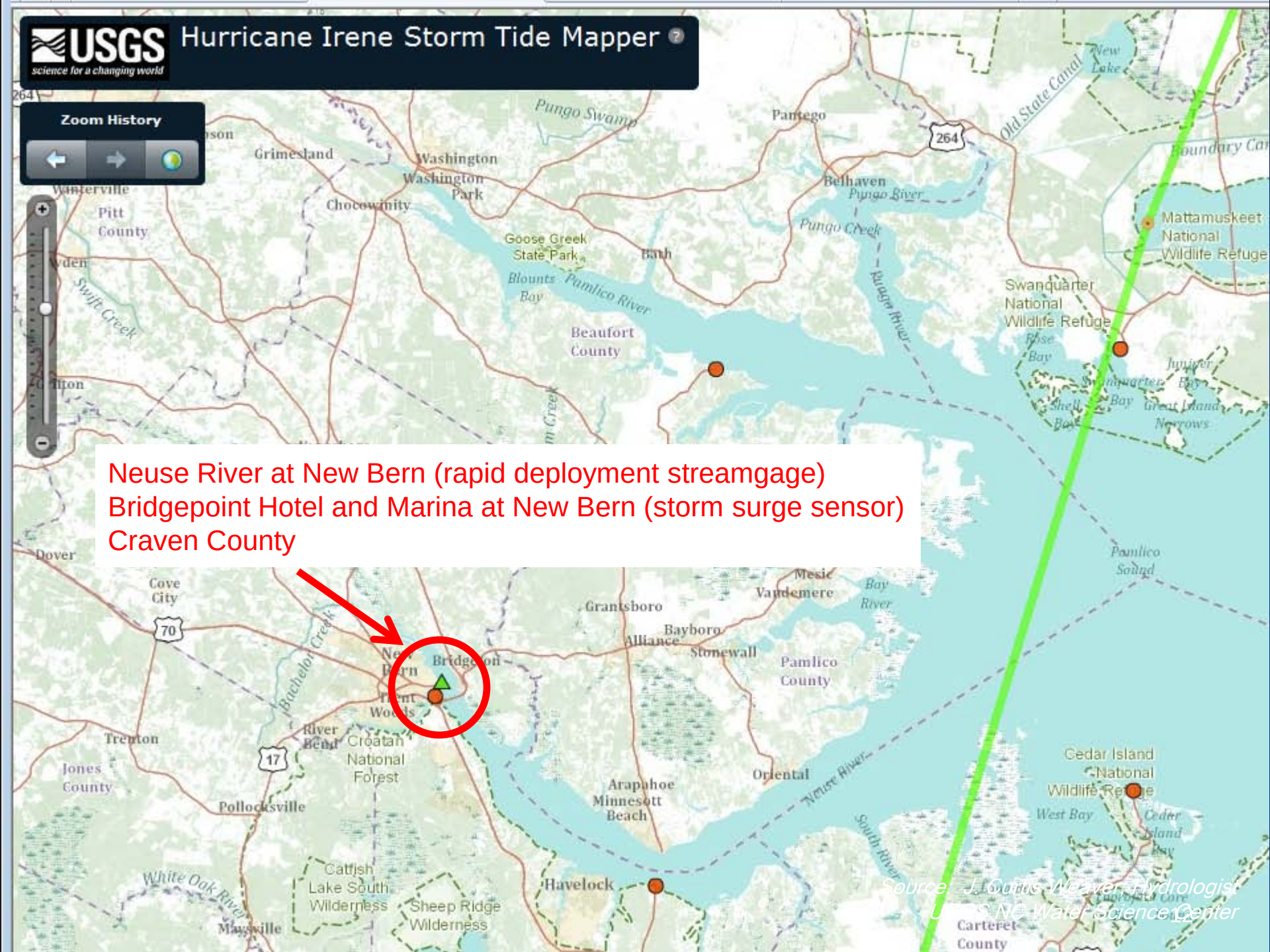
Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center



http://107.20.206.65/Irene2011/IreneMapper.html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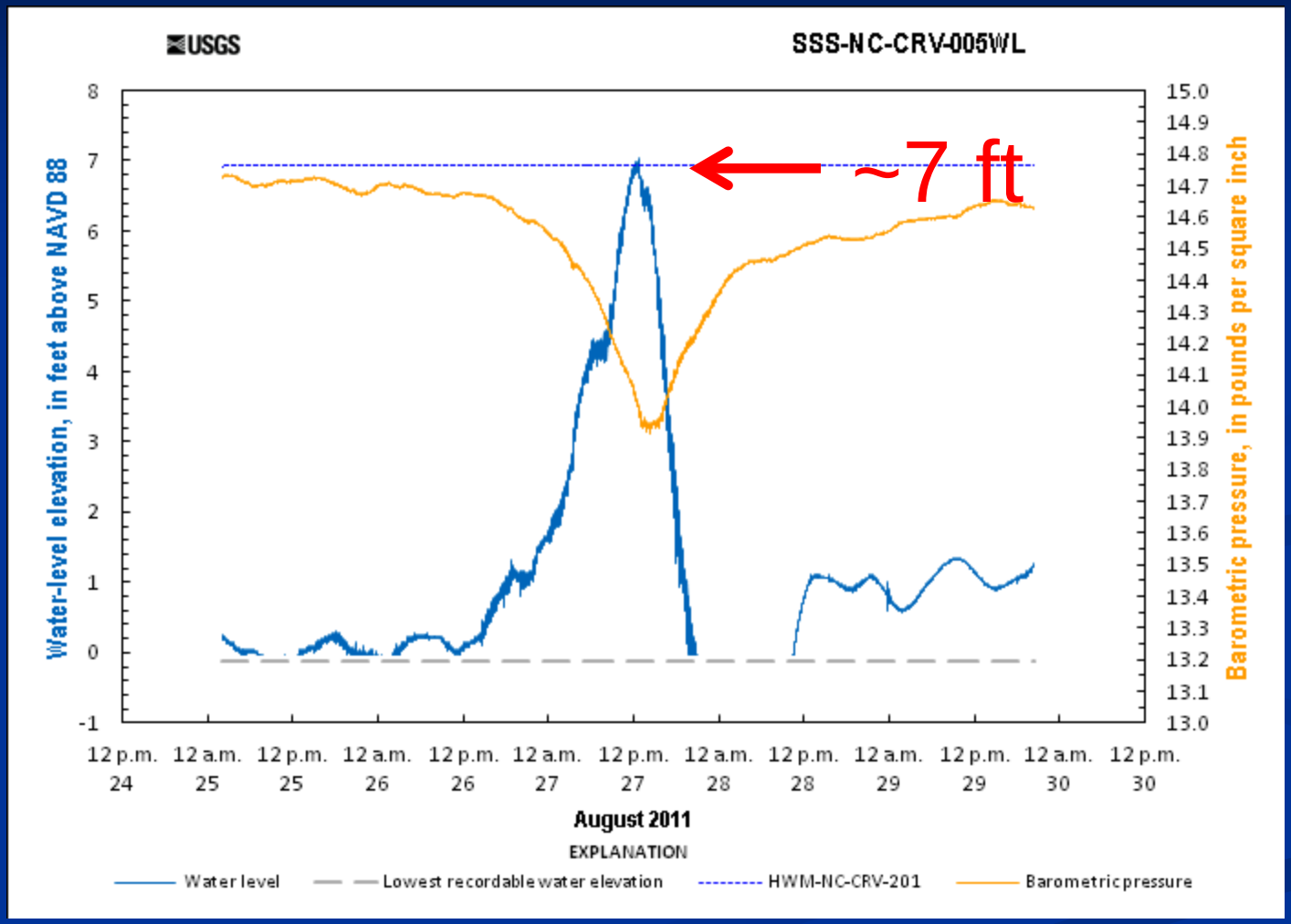
Hurricane Irene Storm Tide Mapper
Zoom History
Neuse River at New Bern (rapid deployment streamgage)
Bridgepoint Hotel and Marina at New Bern (storm surge sensor)
Craven County
Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

Neuse River at New Bern SSS



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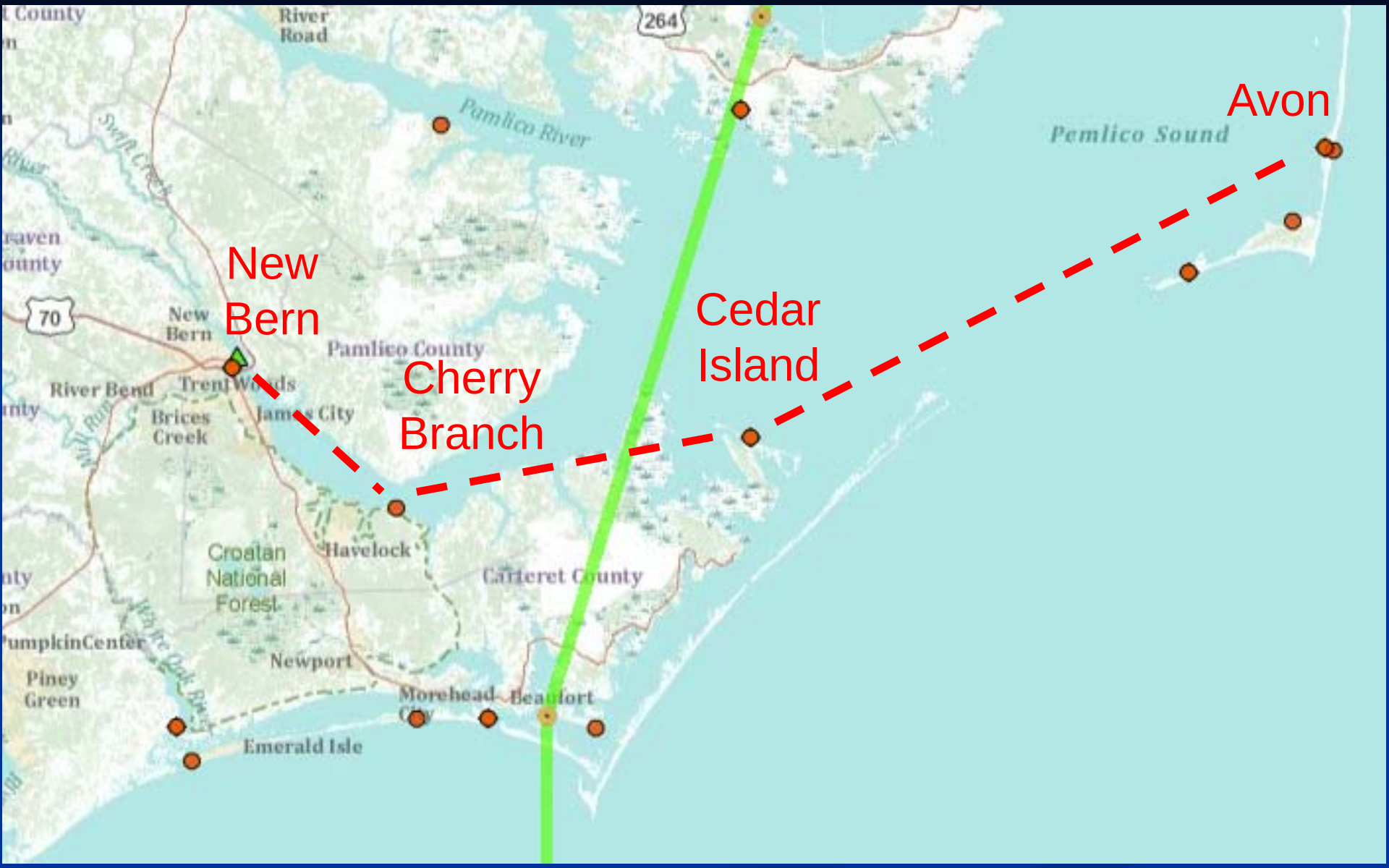
Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center



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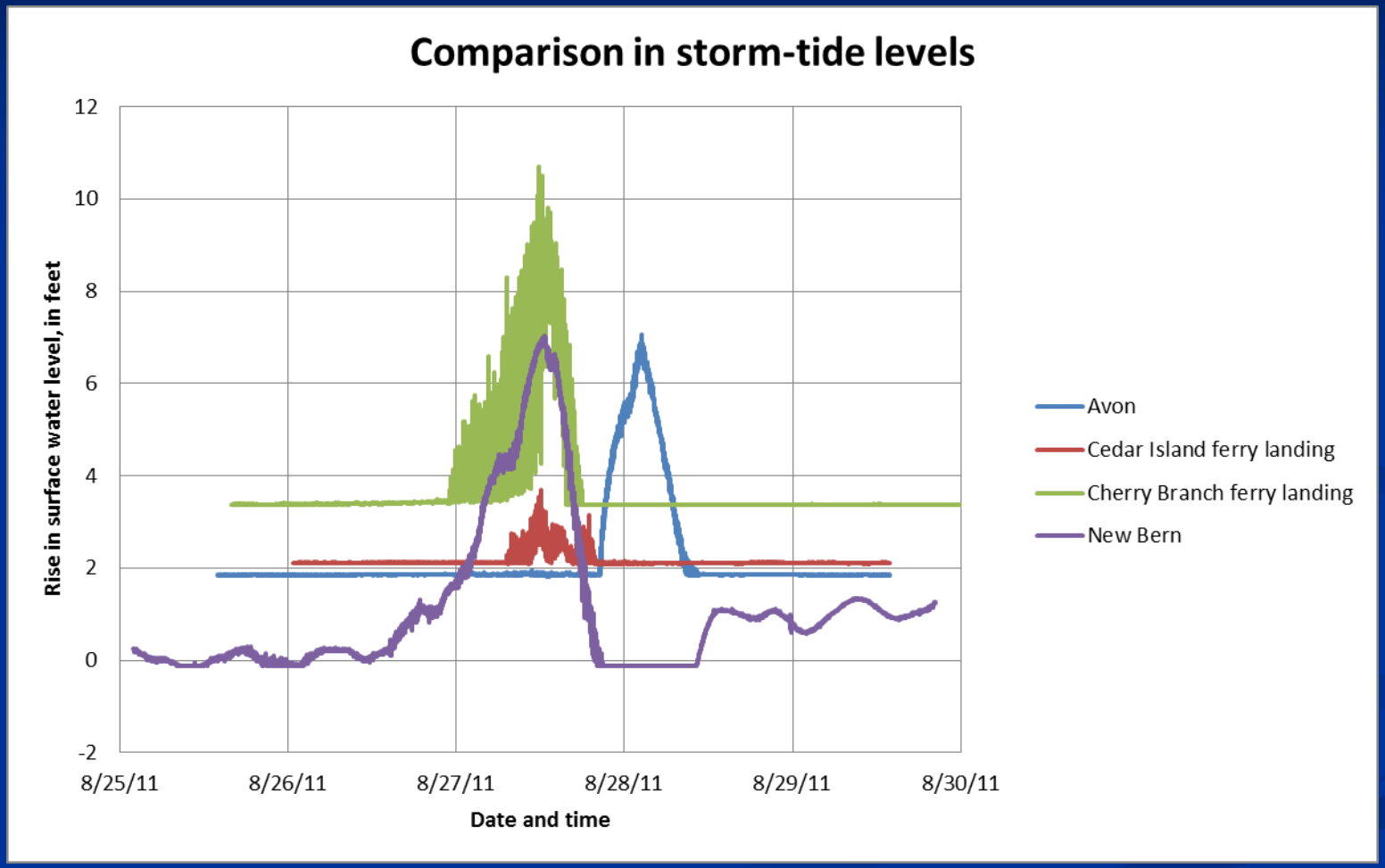
Source: J. Curtis Weaver, Hydrologist
USGS NC Water Science Center

Comparison in storm-tide levels…



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2. Lower Roanoke River Dissolved-Oxygen Monitoring and Modeling

Objective: provide the data and modeling tools needed to assess the effects of dam operations on Roanoke River flows, floodplain inundation, DO levels in the river, and intrusion of brackish water from Albemarle Sound.

Roanoke River at Roanoke Rapids, NC.
Source: USGS.

Funding support: U.S. Army Corps of Engineers; Dominion Power; Domtar

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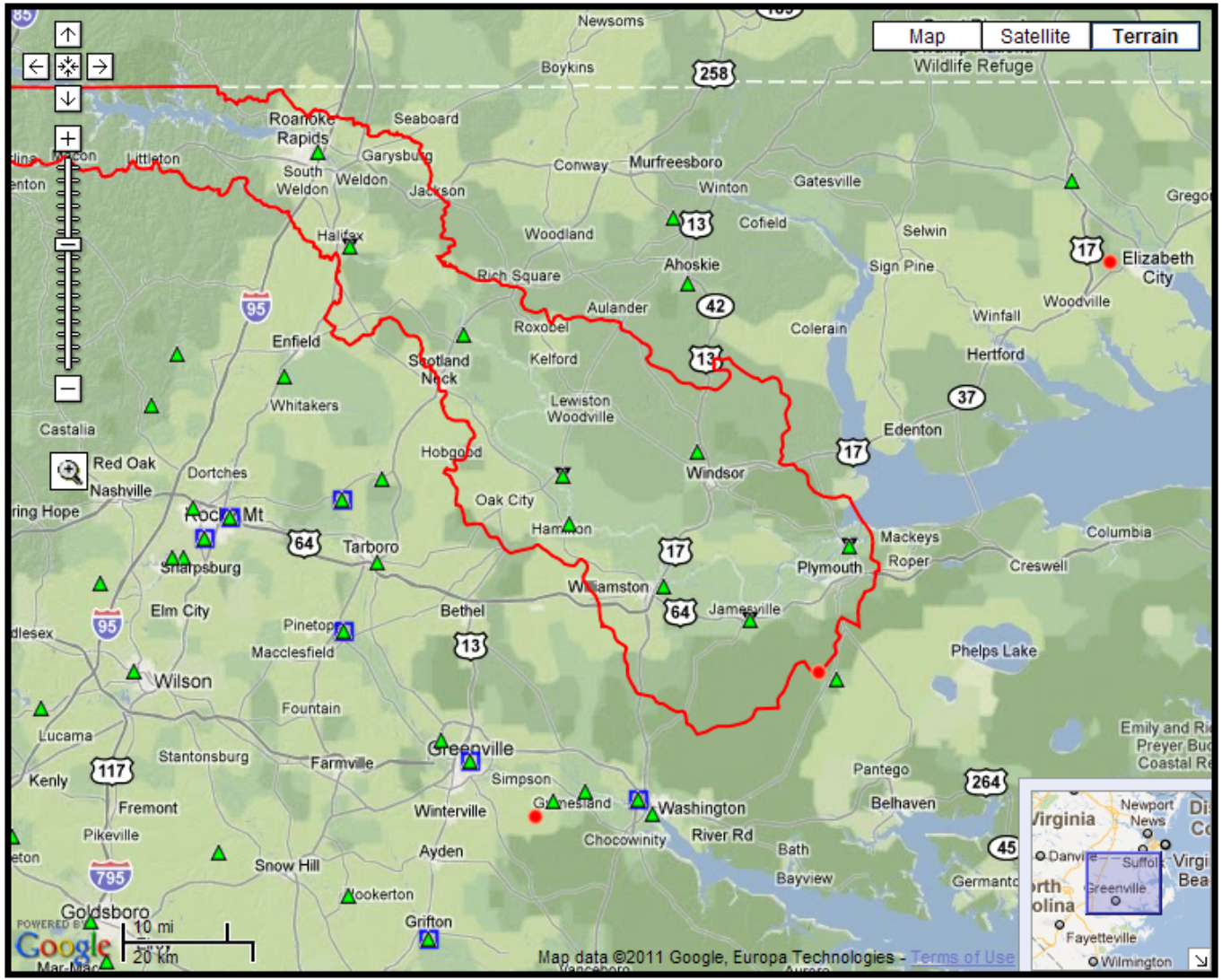
Real-Time Water Data for Roanoke Watershed (030101)



Data Types: **Status:**

- ☑ Surface Water ✔
- ☑ Groundwater ✔
- ☑ Water Quality ✔
- ☑ Precipitation ✔

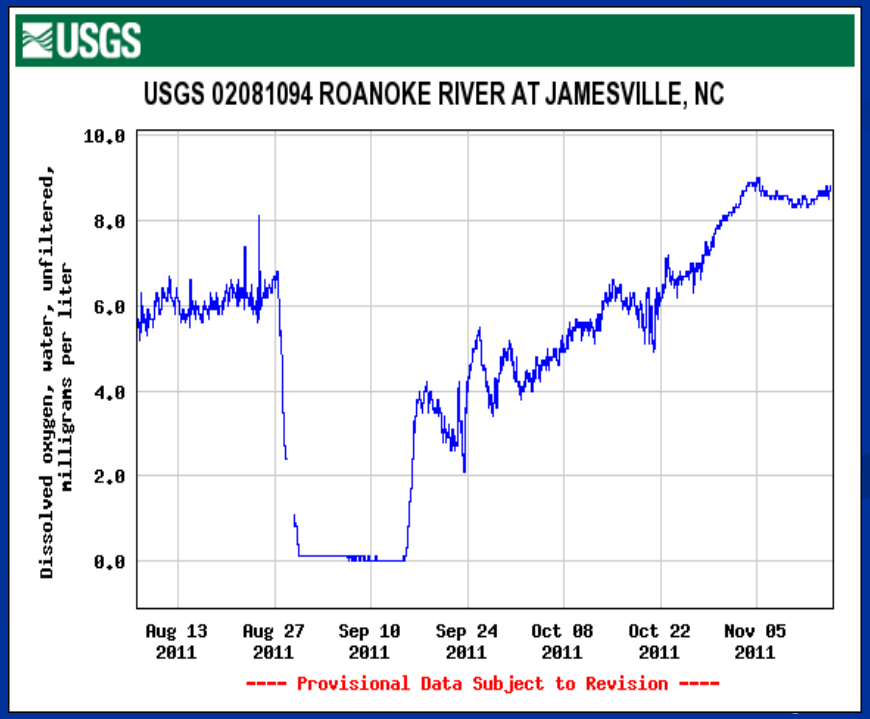
✔ =Download Successful
✘ =Data Missing From Map
If missing data persists, please try again later.

View By Watershed:

Basin Map
All North Carolina
Broad
Cape Fear
Catawba
Chowan-Pasquotank
French Broad
Hiwassee
Little Tennessee
Lumber
Neuse
New
Roanoke
Savannah
Tar-Pamlico
Watauga
Yadkin-Peedee

Real-time monitoring

- 8 River stage gages
- 1 River discharge gage
- 4 Water-quality sites recording every 15 minutes
  - Water temperature
  - Dissolved oxygen
  - Specific conductance
  - pH



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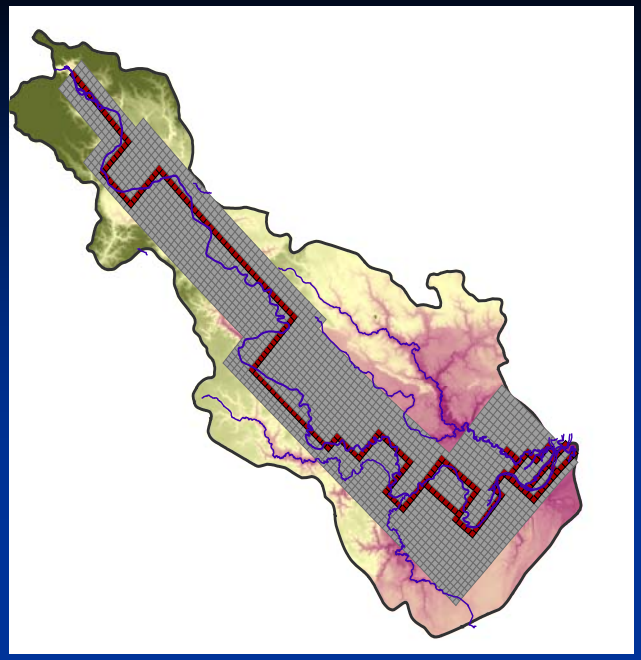
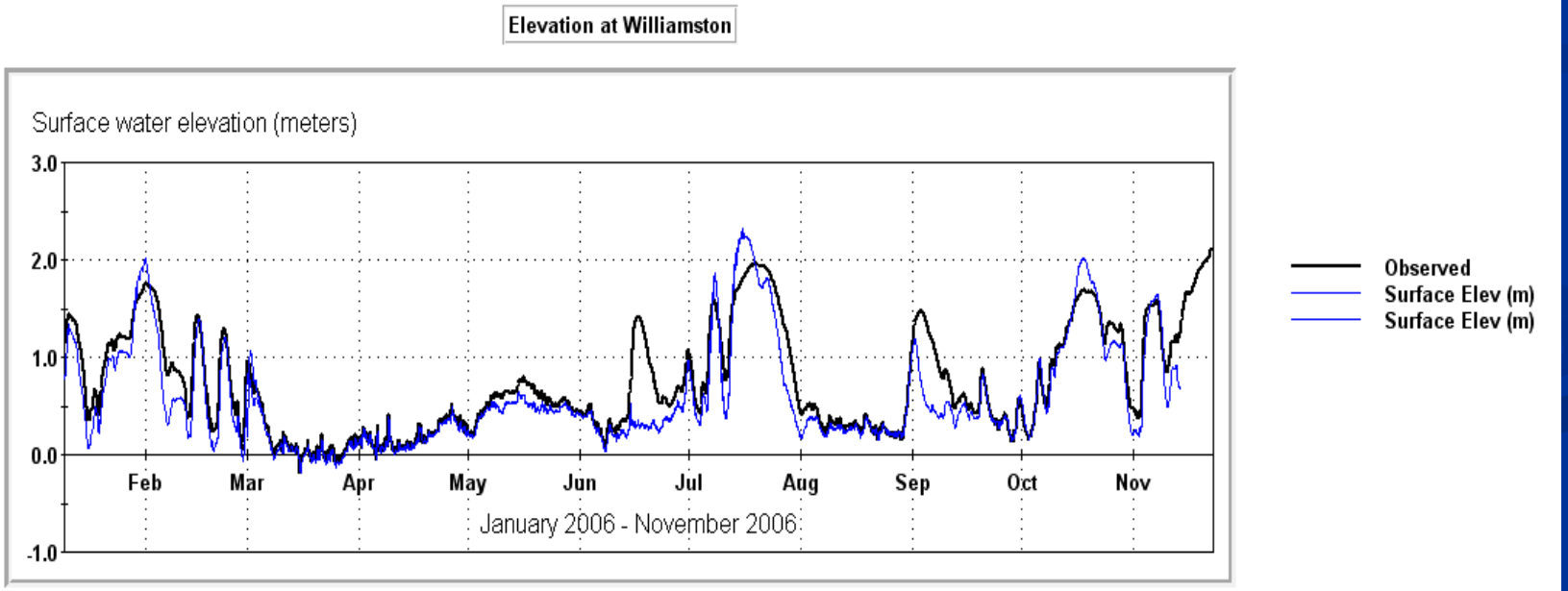


The EFDC 3D model was used to simulate instream flow and floodplain inundation from Roanoke Rapids to Jamesville

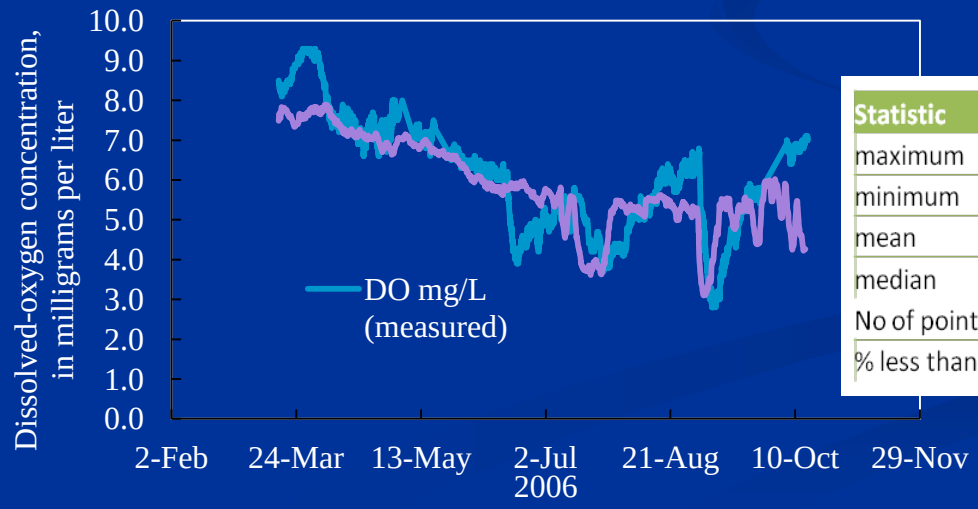
Source: Ana Garcia, Hydrologist
USGS NC Water Science Center



WASP water-quality model

- Water-quality modeling has been completed to simulate the impact of various water-management scenarios on DO concentrations in the lower Roanoke River
- Report is in review

Water-quality calibration for Jamesville



Statistic	Observed	Predicted
maximum	9.30	7.89
minimum	2.80	3.10
mean	6.08	5.88
median	6.10	5.72
No of points	4562	2123
% less than 5 mg/l	27	16

Source: Ana Garcia, Hydrologist
USGS NC Water Science Center

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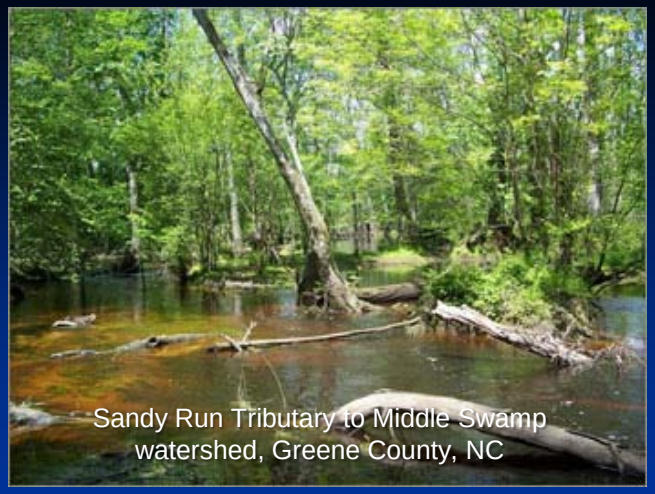
3. Nutrient investigations


Sandy Run Tributary to Middle Swamp watershed, Greene County, NC

- Nutrient source tracking using stable isotopes
- Nutrient trends in the Southeastern U.S.
- Southeastern U.S. map of watershed potential to contribute P from geologic sources
- SPARROW modeling for the Southeast

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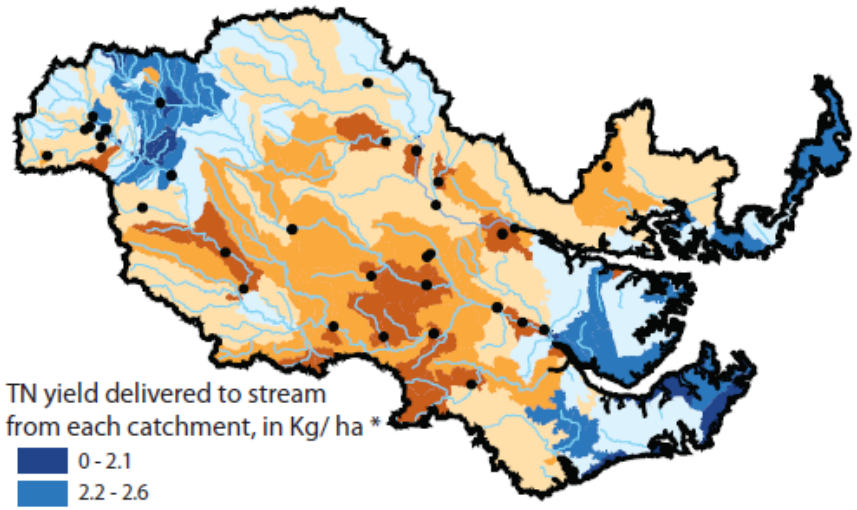
SPARROW Model Estimates of Nitrogen Delivered to Streams and Coastal Areas in the Pamlico and Bogue Sounds

Which areas contribute the largest amounts of total nitrogen annually:

to local streams?

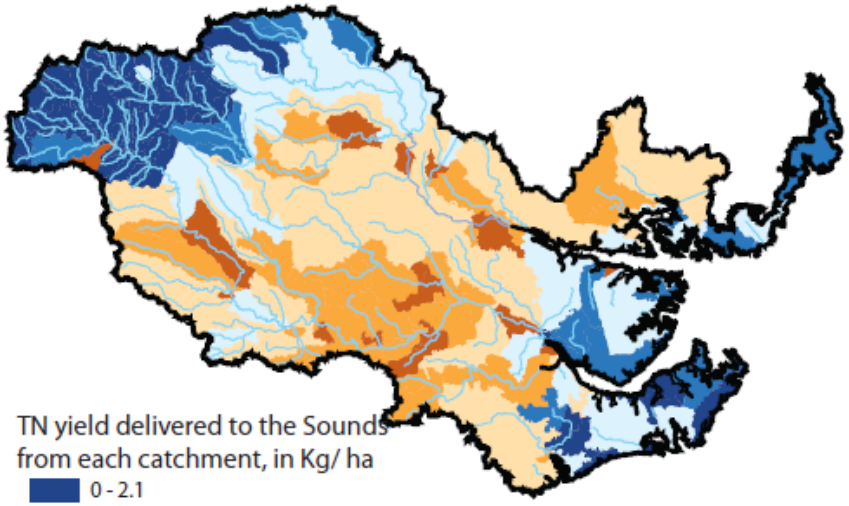


TN yield delivered to stream from each catchment, in Kg/ ha *

- 0 - 2.1
- 2.2 - 2.6
- 2.7 - 3.6
- 3.7 - 5.3
- 5.4 - 7.0
- 7.1 +

• Location of monitoring site with nitrogen load estimate, 2002

to the Pamlico and Bogue Sounds?



TN yield delivered to the Sounds from each catchment, in Kg/ ha

- 0 - 2.1
- 2.2 -2.6
- 2.7 - 3.6
- 3.7 -5.3
- 5.4 - 7.0
- 7.1 +

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Water supply quality and sustainability

- Triangle Area long-term, water-supply monitoring project
- Neuse River at Smithfield included in a national source-water assessment
- Onslow County Region groundwater model

Little River Reservoir
Durham, NC

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For more information

USGS North Carolina Water Science Center

http://nc.water.usgs.gov

USGS North Carolina - Information Requests

http://nc.water.usgs.gov/about/inforequests.html

USGS Inland Storm-Tide Documentation Program:

http://water.usgs.gov/osw/programs/storm_surge.html

Contact info:

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