

Map of Horry County Parks & Recreation Facilities, 2016

Last year's title slide



Susan Libes
Director, Waccamaw Watershed Academy
Coastal Carolina University



Waccamaw River Flooding

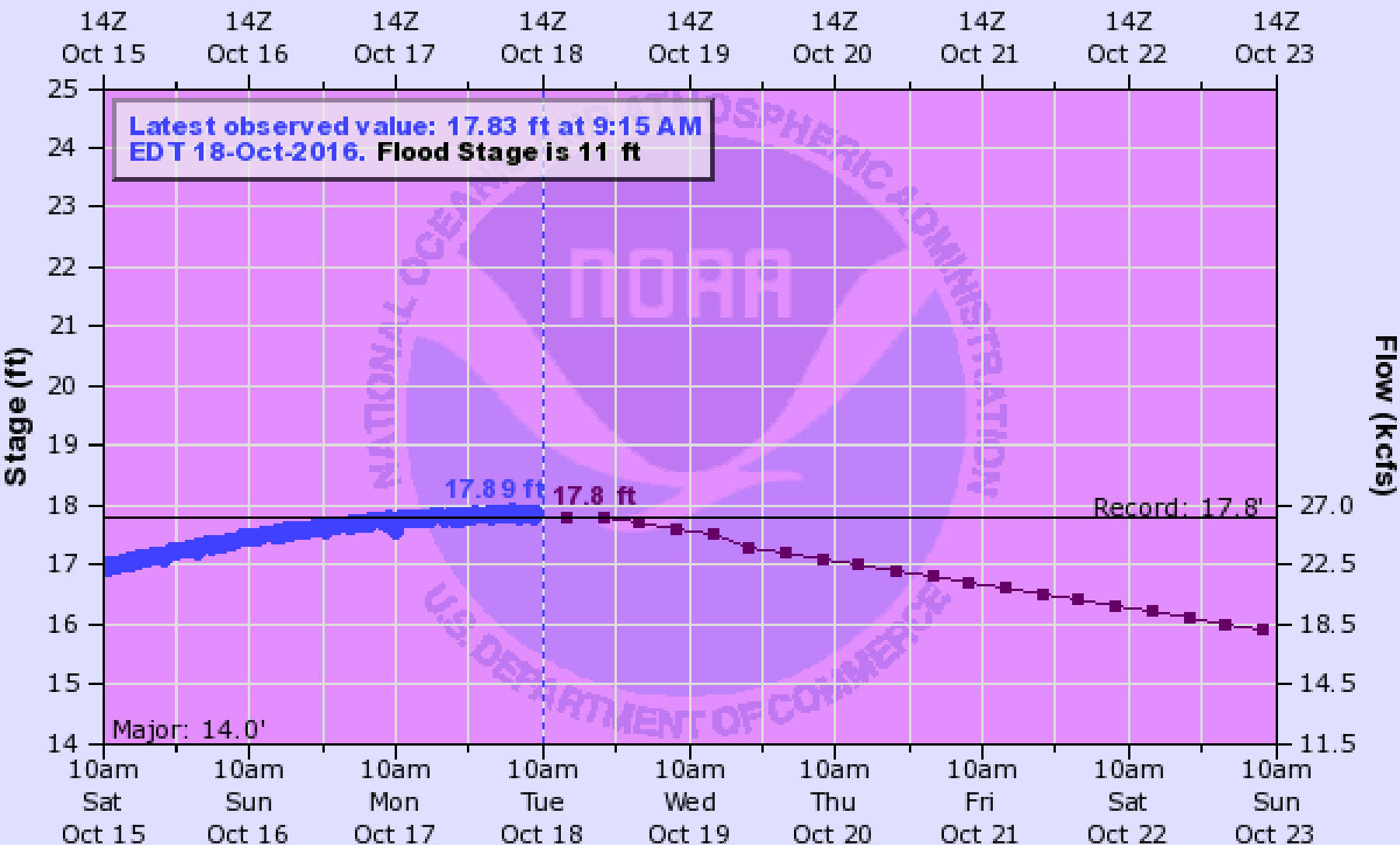
Sat. October, 15 2016

17.07 Feet



WACCAMAW RIVER NEAR CONWAY

Universal Time (UTC)



Historic Crests

- (1) 17.80 ft on 09/30/1928
- (2) 17.60 ft on 09/27/1999
- (3) 16.20 ft on 10/10/2015
- (4) 16.07 ft on 10/08/2015
- (5) 15.60 ft on 09/29/1945

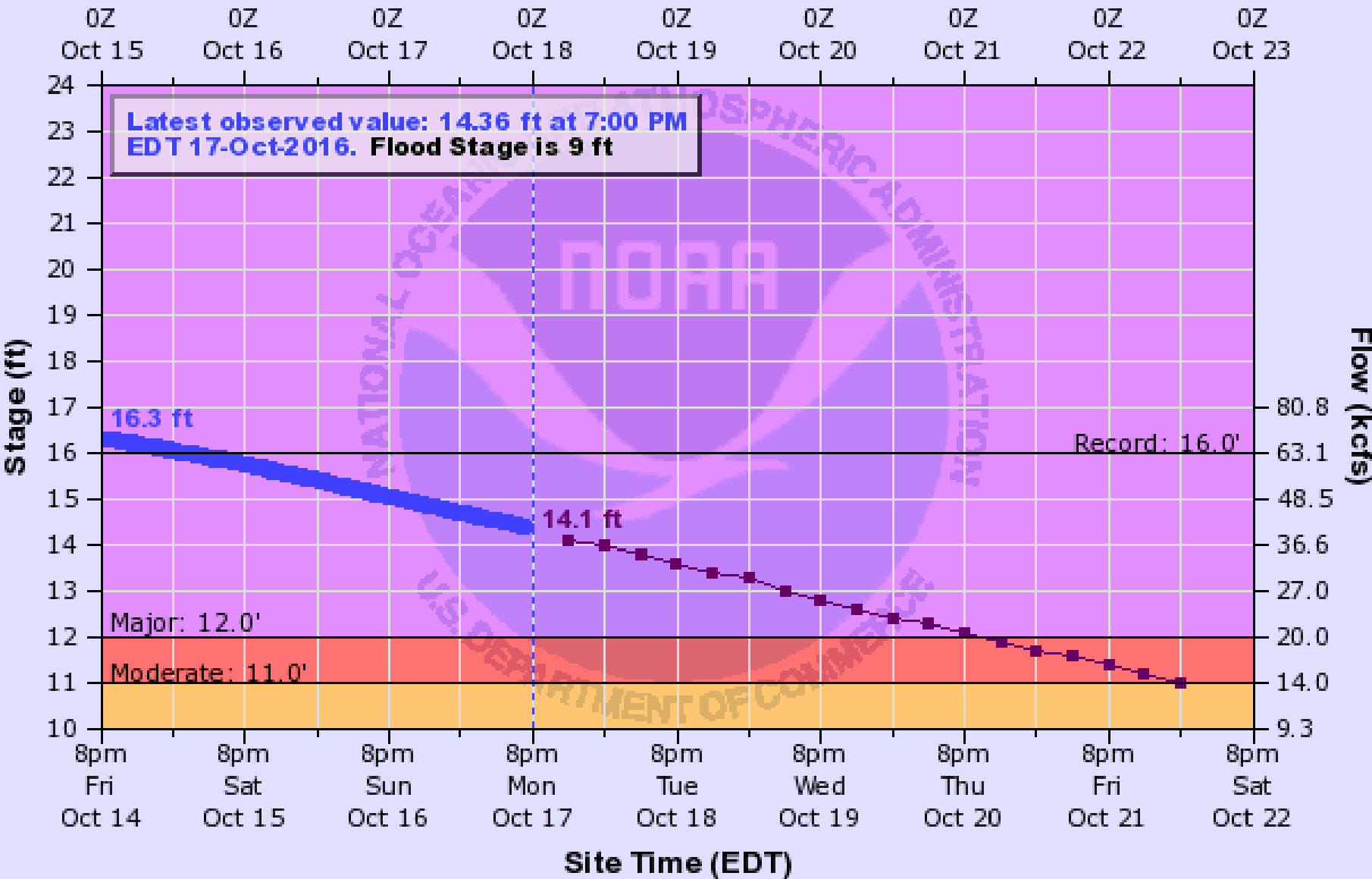
--- Graph Created (10:19AM Oct 18, 2016) ● Observed ■ Forecast (issued 8:44AM Oct 18)

CNWS1 (plotting HGIRG) "Gage 0" Datum: -5.06'

Observations courtesy of US Geological Survey

LITTLE PEE DEE RIVER NEAR GALIVANTS FERRY

Universal Time (UTC)



Historic Crests

- (1) 16.00 ft on 09/15/1928
- (2) 13.23 ft on 09/23/1945
- (3) 13.01 ft on 10/09/1964
- (4) 12.71 ft on 03/22/1983
- (5) 12.47 ft on 01/14/1993

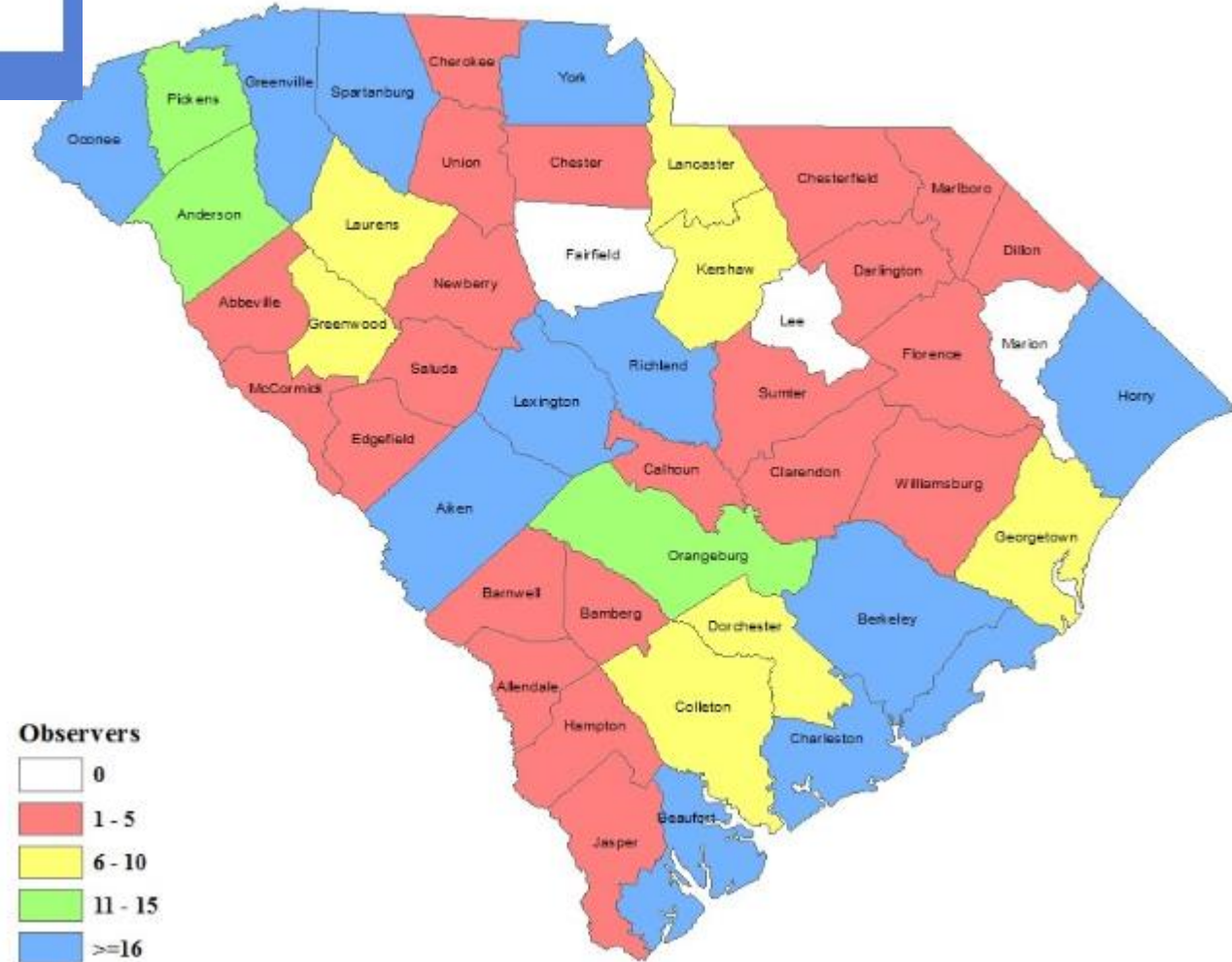
----- Graph Created (8:12PM Oct 17, 2016) ● Observed ■ Forecast (issued 8:13AM Oct 17)

CAROLINA COCORAHS

Community Collaborative Rain, Hail, and Snow Network
"CoCoRaHS-Because Every Drop Counts!"



Active Observers by County




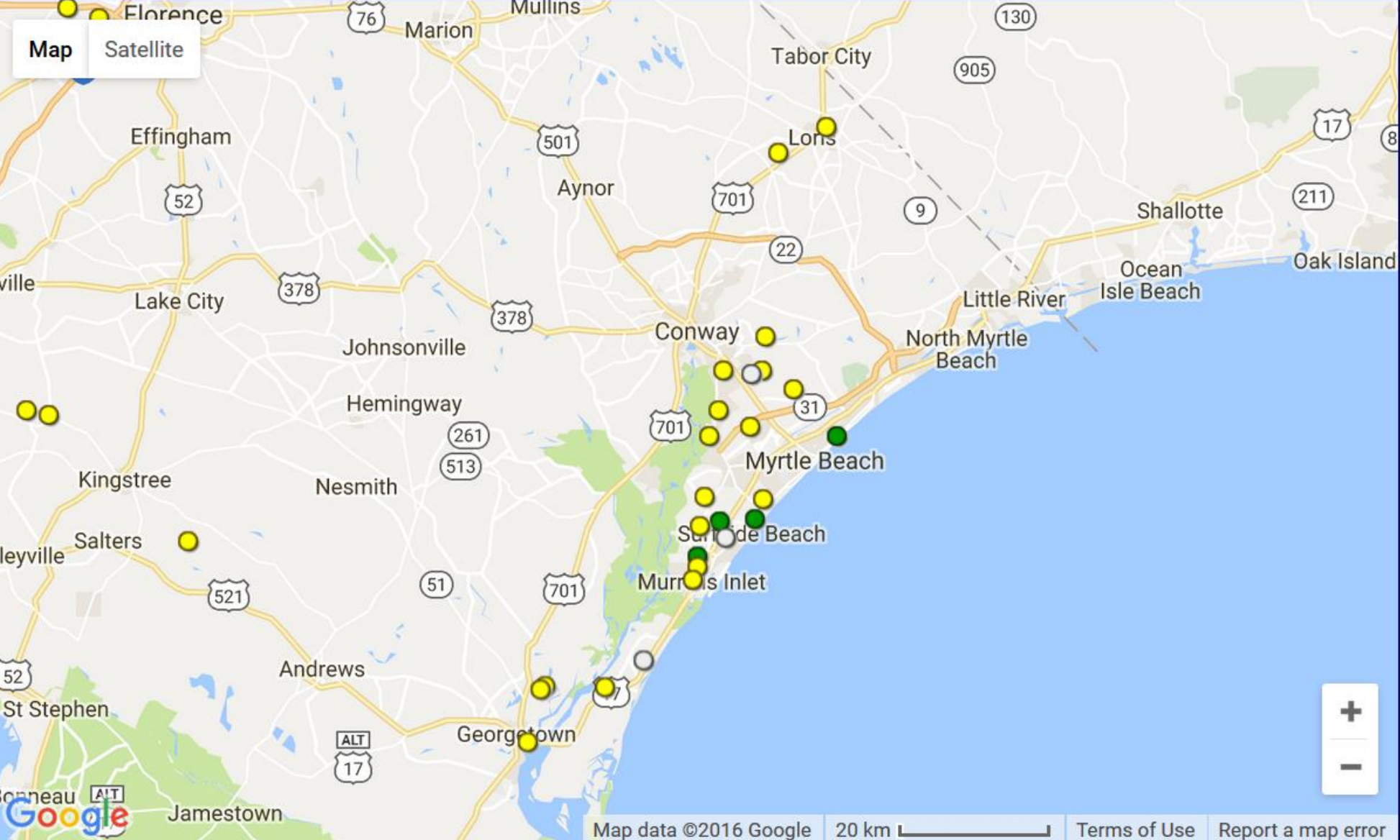
www.facebook.com/CoCoRaHS.SouthCarolina

434 total active observers

Interactive journal from
Joaquin

<http://scdnr.maps.arcgis.com/apps/MapJournal/index.html?appid=bc1ea6edf5eb495189be4968e0cd0edb>

Start of Hurricane Matthew



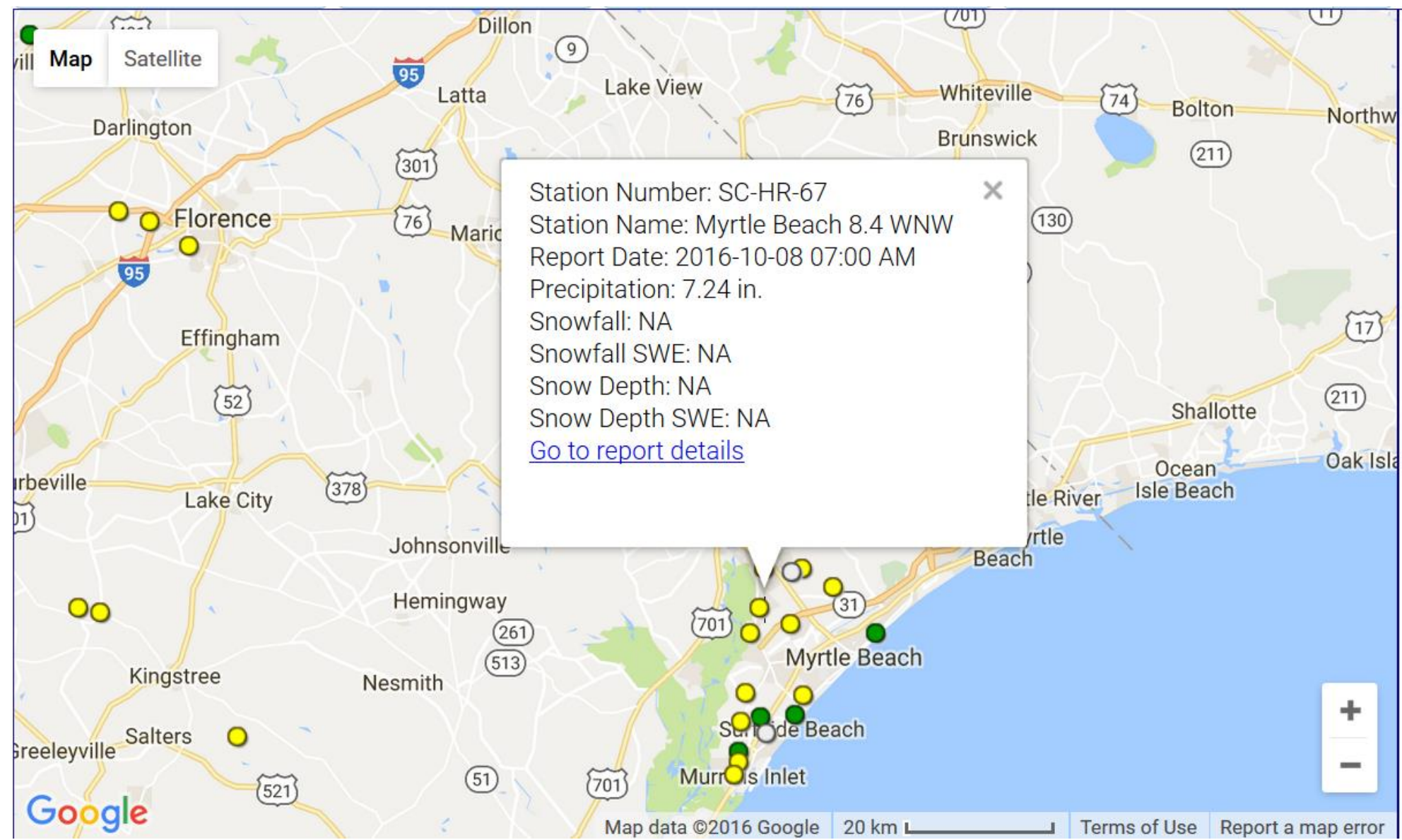
CoCoRaHS
Precipitation Map

Date: 10/08/2016
Country: USA
State: SC
Units: US Units

- Zero
- Trace
- 0.01 - 0.83 in.
- 0.84 - 1.66 in.
- 1.67 - 4.14 in.
- 4.15 - 9.94 in.
- 9.95 - 14.91 in.
- 14.92 - 16.56 in.

Show US Active Fire Perimeters

Source: [GEOMAC](#). GEOMAC wildfire data layers courtesy of the [U.S. Geological Survey](#).



Station Number: SC-HR-67
 Station Name: Myrtle Beach 8.4 WNW
 Report Date: 2016-10-08 07:00 AM
 Precipitation: 7.24 in.
 Snowfall: NA
 Snowfall SWE: NA
 Snow Depth: NA
 Snow Depth SWE: NA
[Go to report details](#)

CoCoRaHS CoCoRaHS Precipitation Map

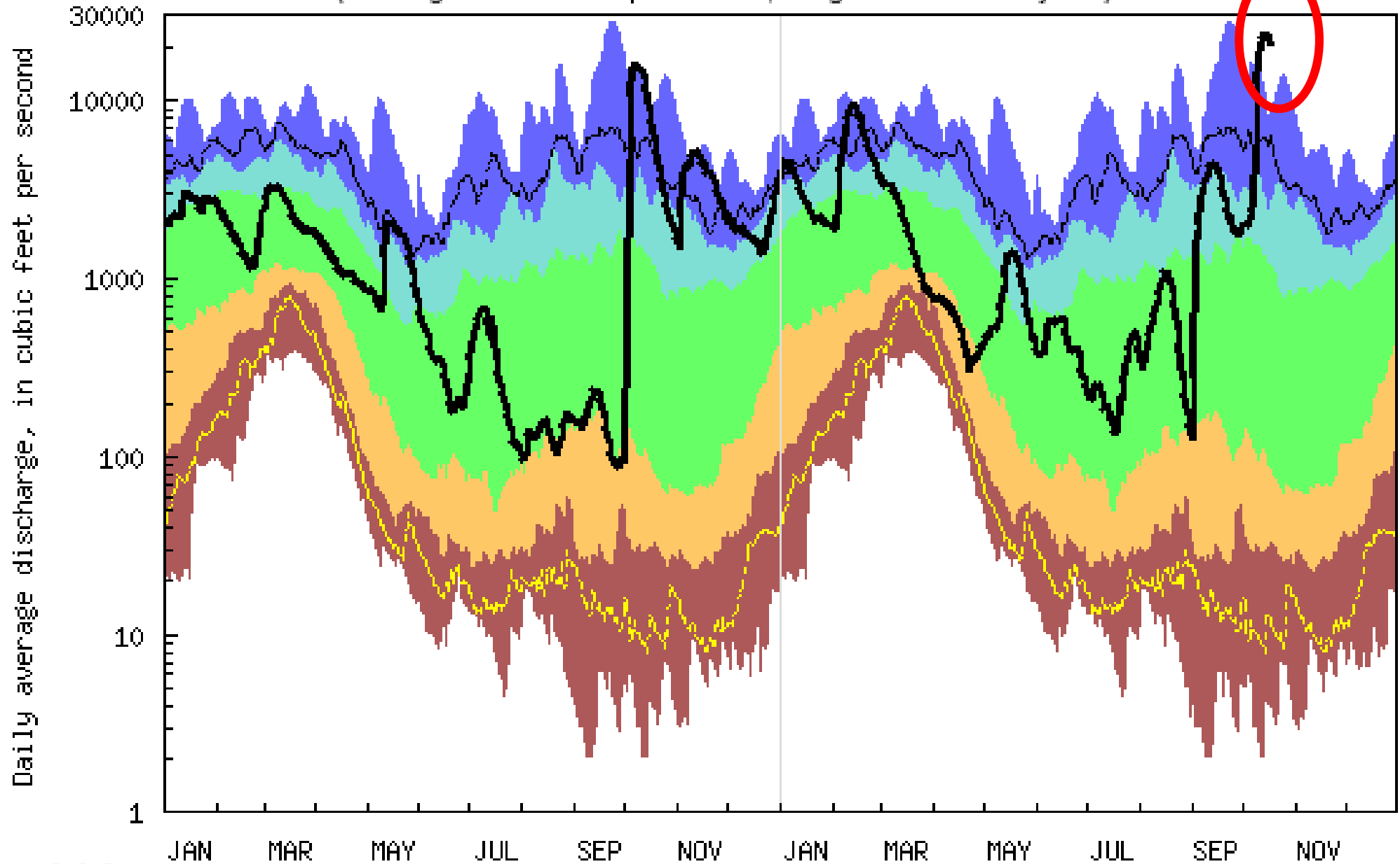
Date: 10/08/2016
 Country: USA
 State: SC
 Units: US Units

- Zero
- Trace
- 0.01 - 0.83 in.
- 0.84 - 1.66 in.
- 1.67 - 4.14 in.
- 4.15 - 9.94 in.
- 9.95 - 14.91 in.
- 14.92 - 16.56 in.

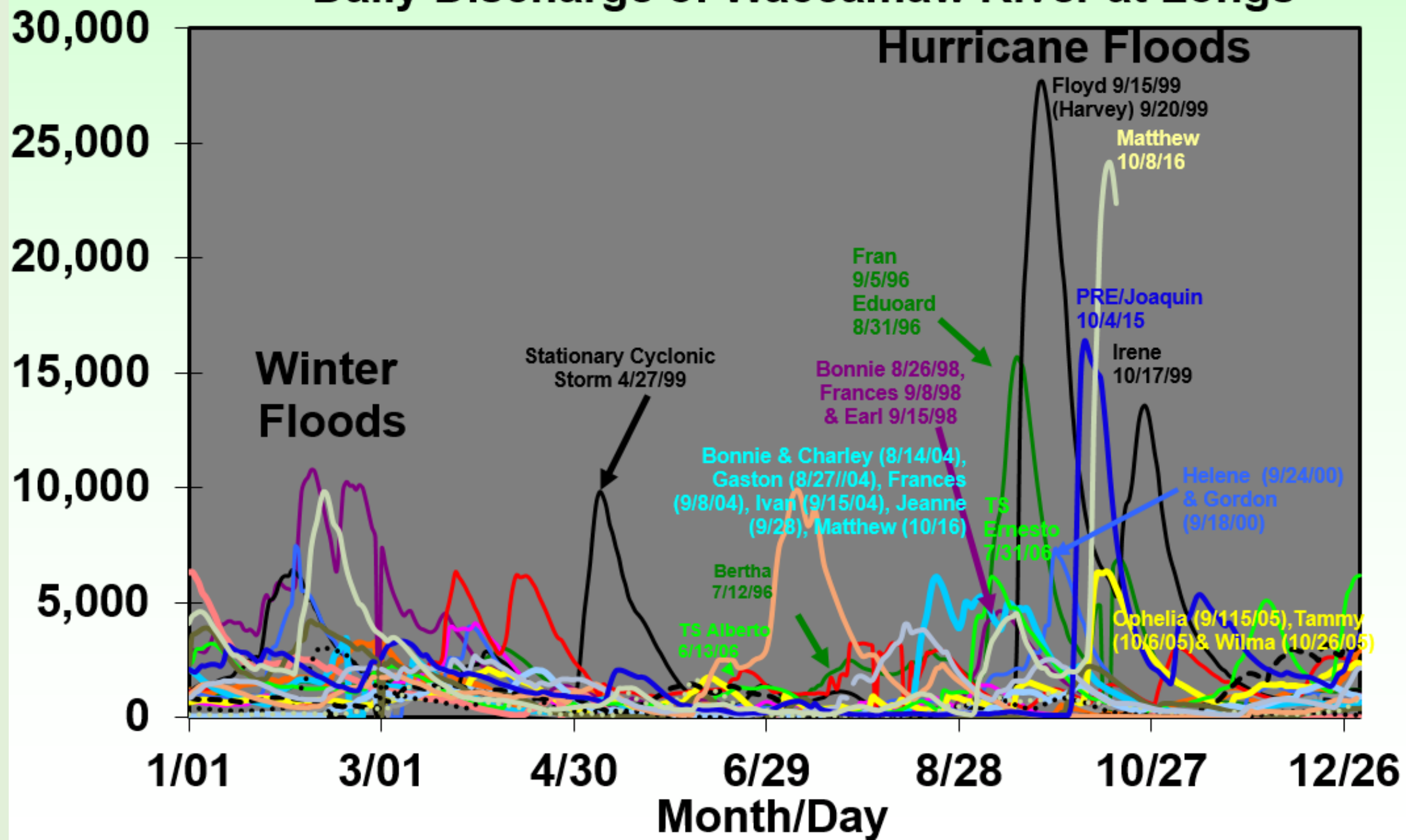
Show US Active Fire Perimeters
 Source: [GEOMAC](#). GEOMAC wildfire data layers courtesy of the [U.S. Geological Survey](#).

Blackstone Drive in Legends Golf Course off Hwy 544

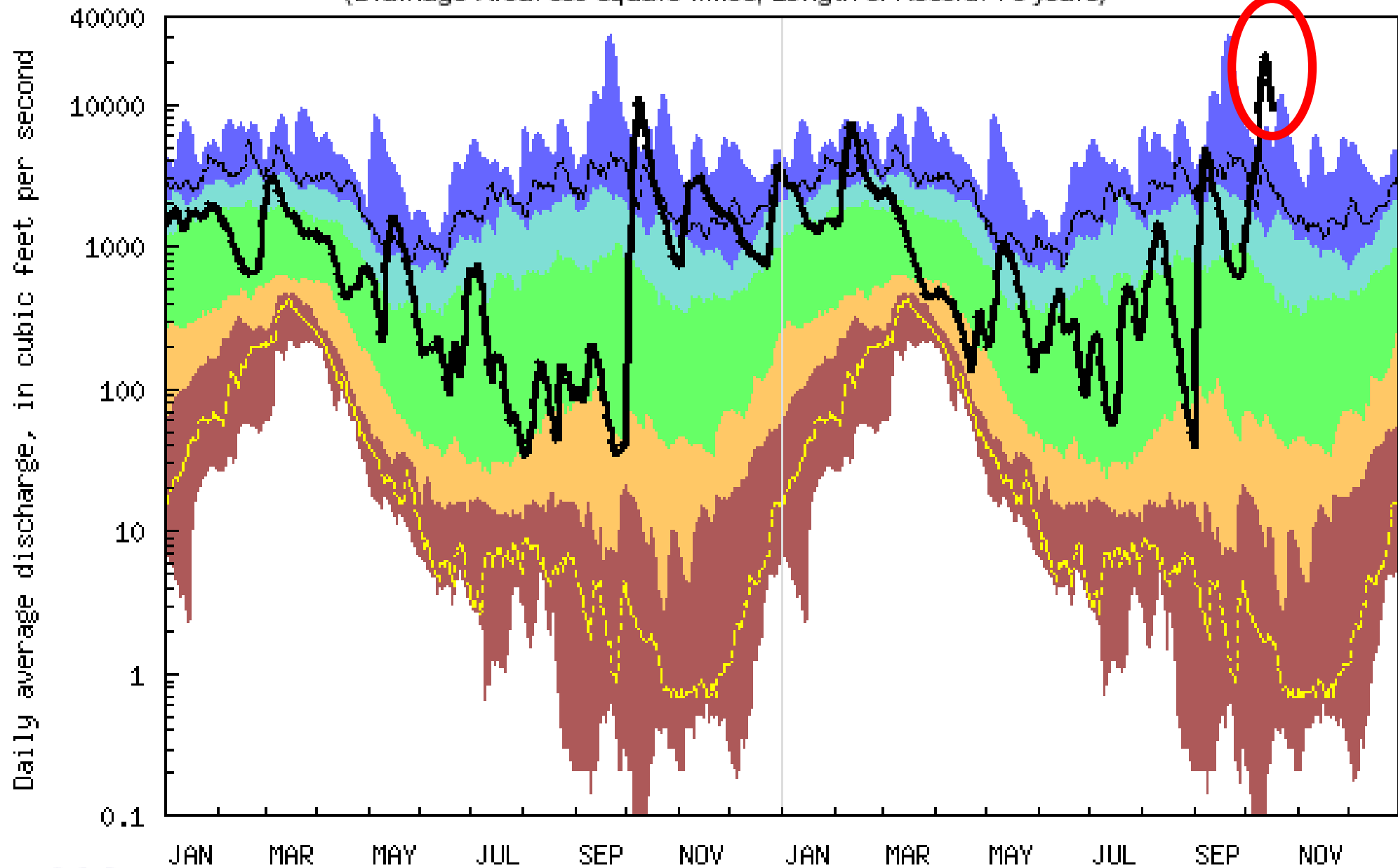
USGS 02110500 WACCAMAW RIVER NEAR LONGS, SC
(Drainage Area: 1110 square miles, Length of Record: 65 years)



Daily Discharge of Waccamaw River at Longs



USGS 02109500 WACCAMAW RIVER AT FREELAND, NC
(Drainage Area: 680 square miles, Length of Record: 76 years)



Factory farming practices are under scrutiny again in N.C. after disastrous hurricane floods

By **Arelis R. Hernández**, **Angela Fritz** and **Chris Mooney** October 16 at 5:00 PM









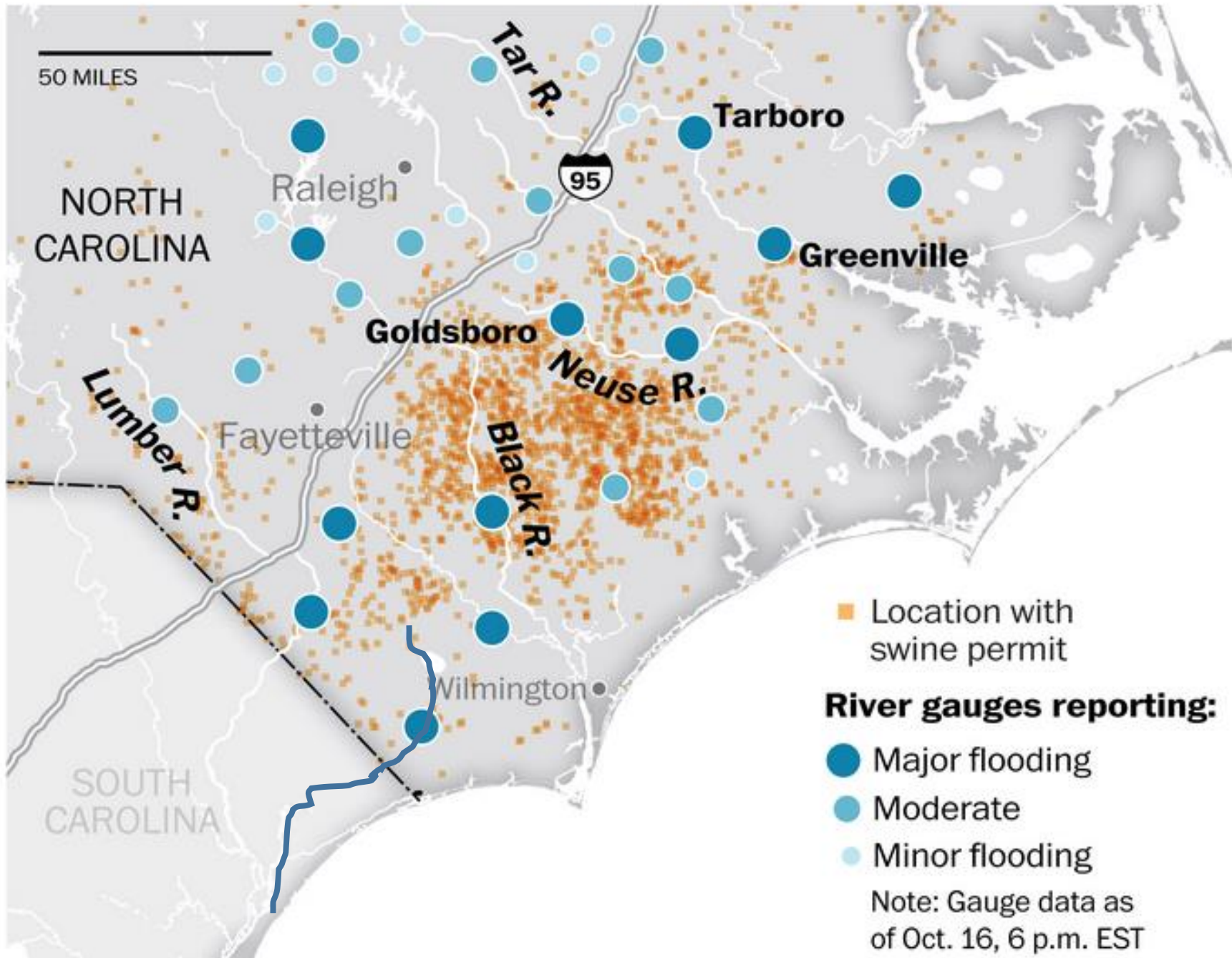
In North Carolina, massive flooding in the wake of Hurricane Matthew isolated or swamped these and other hog farms and their waste lagoons, raising fears of environmental contamination. (Arelis Hernández/The Washington Post)

Most Read

- 1 DNA testing links 300-year-old remains of a baby to a Colonial Md. governor
- 2 Factory farming practices are under scrutiny again in N.C. after disastrous hurricane floods
- 3 Want college to pay off? These are the 50 majors with the highest earnings.
- 4 Meet the other Donald Trump, whom candidate Trump once called 'the more important' one
- 5 Nation's high school graduation rate reaches new record high

At a Glance

Mon.	Tue.	W
		
- /82°	62° /85°	64°
Thu.	Fri.	S
		



Ash ponds, hog lagoons and septic tanks have SC residents nervous as river rises

<http://www.thestate.com/news/local/article108374052.html>



Water is within three feet of the top of a retaining wall around the Grainger site near Conway, said Waccamaw Riverkeeper Emma Gerald Boyer.

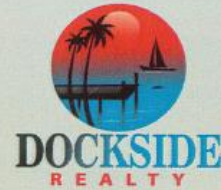
... Santee Cooper has noticed some seepage in the waste lagoon and is now pumping water back into it to relieve pressure from the rising Waccamaw. Pond levels had been lowered long before Matthew as part of a plan to dig up and remove all of the coal ash. About half of it remains. The seepage is in an area where ash has largely been cleaned out, she said.

“We are proactively working to mitigate this pressure from the flooding river,” Gore said.

A statement from the S.C. DHEC said the agency had been told by the power company there are no problems.

±.51 Acres Zoned SF 40

LAND
FOR SALE



MLS# 1617720

A boaters dream! This is a beautiful wooded lot on the Waccamaw River, located near the dead end of Rowe Pond Road. Recently cleared, and **improved with approx. 70' of seawall.** **Concrete pad approx. 10' x 70' along top of seawall** and additional concrete pad approx. 20' x 33'. **No HOA fee!** ± .51 acres - \$125,000. Call today!

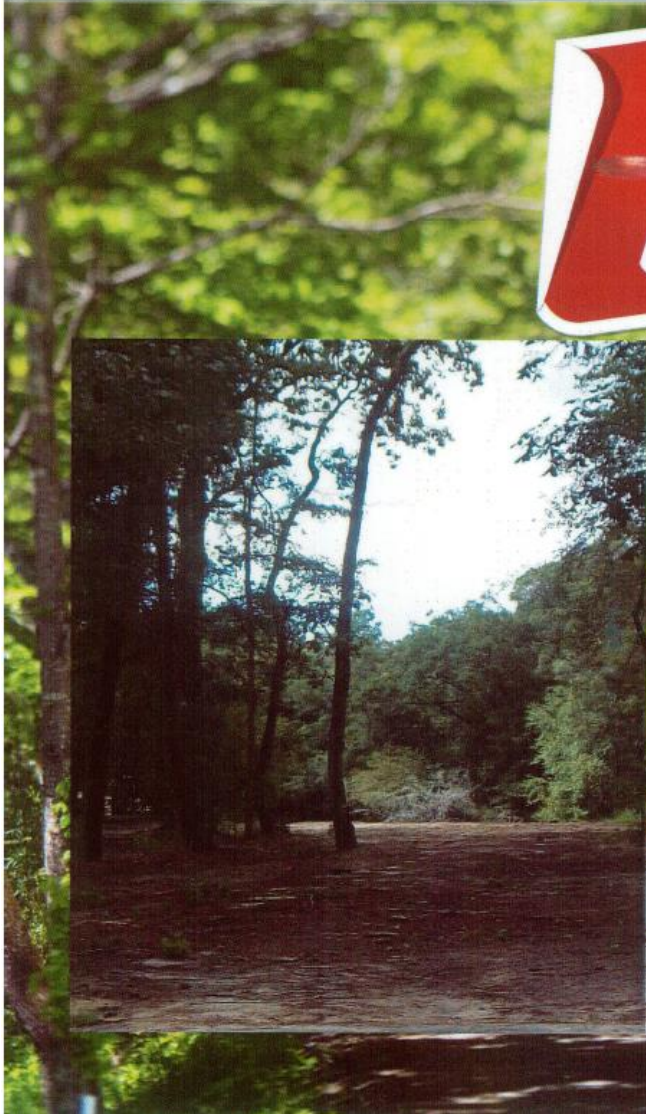
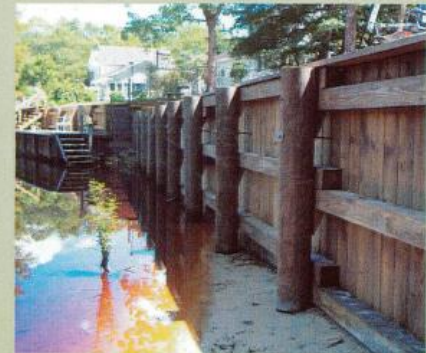


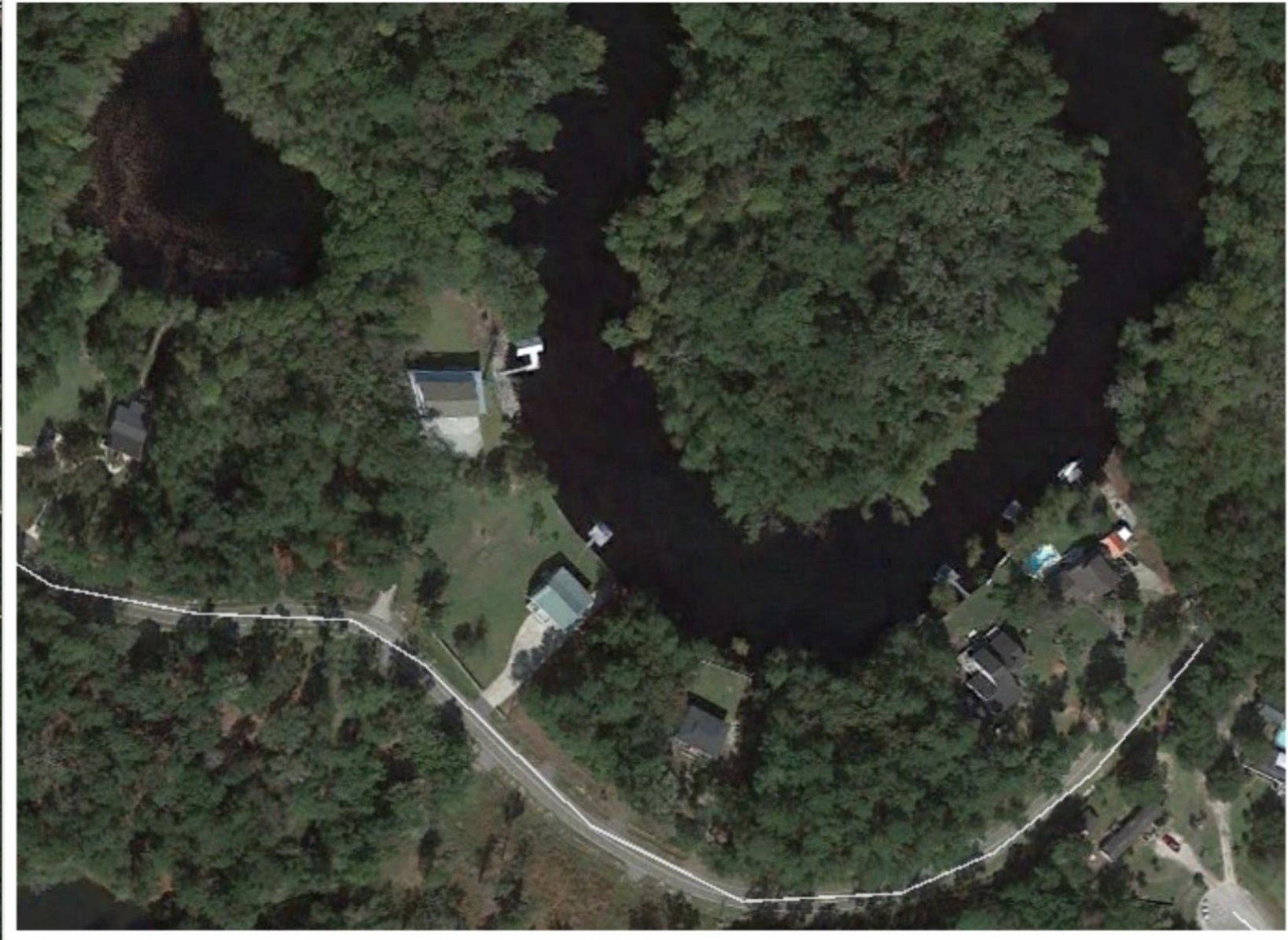
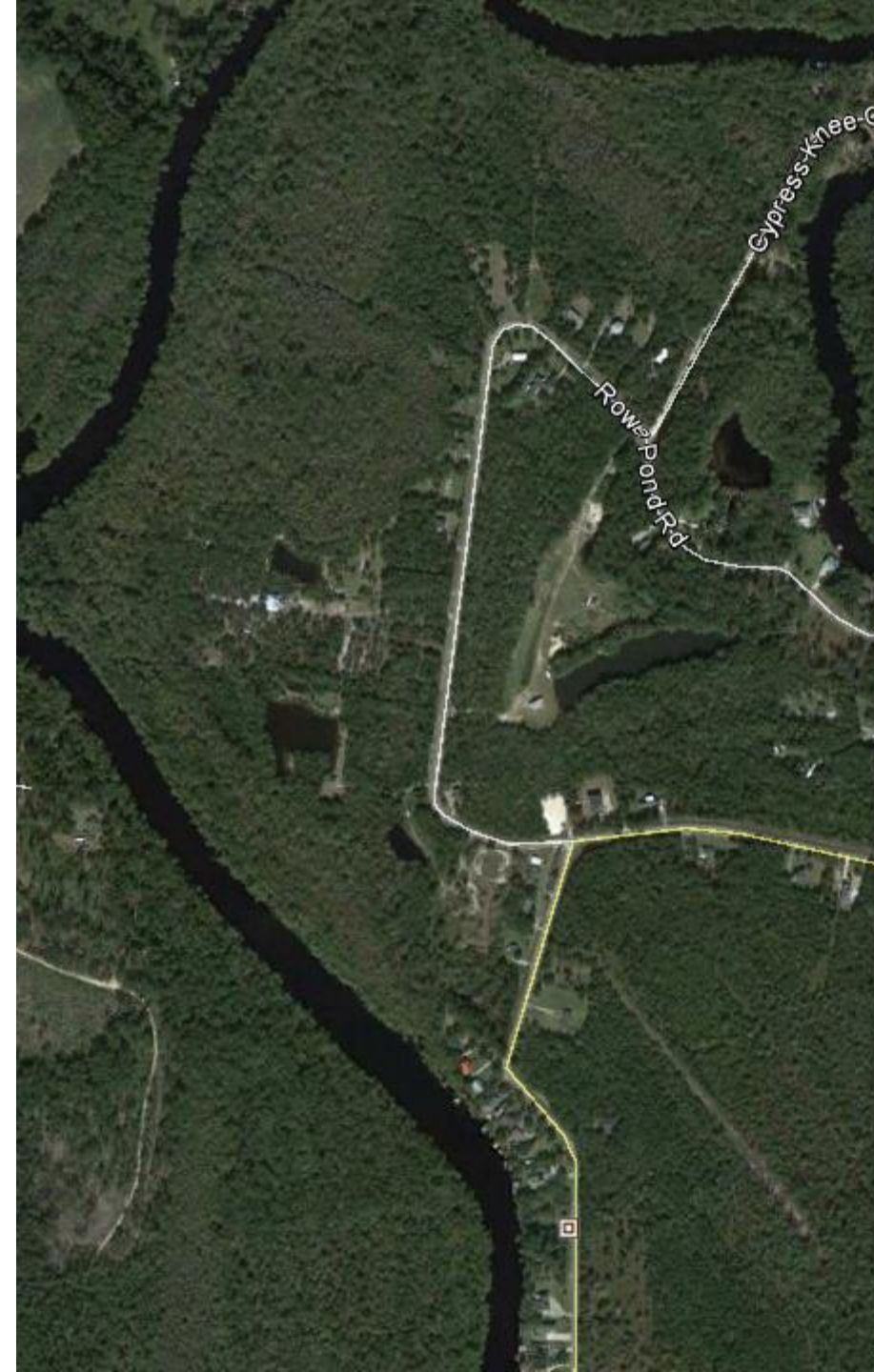
Patti Kielty

Realtor

843-685-6014

pattileah@gmail.com
www.pattikielty.com





Waccamaw River at Longs **since 2006**

Historic Crests

- (1) 17.94 ft on 09/22/1999
- (2) 15.17 ft on **10/06/2015**
- (3) 14.95 ft on 09/15/1996
- (4) 14.87 ft on 08/23/1981
- (5) 14.87 ft on 02/08/1998
- (6) 14.86 ft on **10/10/2015**
- (7) 14.49 ft on 10/25/1999
- (8) 14.40 ft on 03/26/1983
- (9) 13.94 ft on 07/06/1961
- (10) 13.82 ft on 09/29/1955
- (13) 13.43 ft on **07/09/2013**

Low Water Records

- (1) 0.10 ft on **07/23/2011**
- (2) 0.39 ft on 07/21/2002
- (3) 0.46 ft on **09/24/2010**
- (4) 0.55 ft on **10/16/2007**
- (5) 0.65 ft on **08/22/2007**
- (6) 0.67 ft on **08/10/2007**
- (7) 0.72 ft on **09/22/2009**
- (8) 0.75 ft on **06/20/2008**
- (9) 1.27 ft on **07/27/2010**
- (10) 1.30 ft on **10/04/2009**

Major droughts: 2000-2002, 2007-2012

CLIMATE CHANGE

Stationarity Is Dead: Whither Water Management?

P. C. D. Milly,^{1*} Julio Betancourt,² Malin Falkenmark,³ Robert M. Hirsch,⁴ Zbigniew W. Kundzewicz,⁵ Dennis P. Lettenmaier,⁶ Ronald J. Stouffer⁷

Systems for management of water throughout the developed world have been designed and operated under the assumption of stationarity. Stationarity—the idea that natural systems fluctuate within an unchanging envelope of variability—is a foundational concept that permeates training and practice in water-resource engineering. It implies that any variable (e.g., annual streamflow or annual flood peak) has a time-invariant (or 1-year-periodic) probability density function (pdf), whose properties can be estimated from the instrument record. Under stationarity, pdf estimation errors are acknowledged, but have been assumed to be reducible by additional observations, more efficient estimators, or regional or paleohydrologic data. The pdfs, in turn, are used to evaluate and manage risks to water supplies, water-



An uncertain future challenges water planners.

Climate change undermines a basic assumption that historically has facilitated management of water supplies, demands, and risks.

- Climate change will be accompanied by an increased frequency of extreme events.
- We can't predict the future from our historical past.
- An uncertain future is a challenge for water resource planners.

Here's what

- Several “large” events
- Dissolved Oxygen
- Surprisingly turbid water
and perhaps Caw
 - Crabtree Canal
studies.
- Have not seen and
Site 9, Murrells Lake
last November's event
 - Implementing
 - Discussed micro
 - Doing microbial
- Sterritt Swamp collection
is following up on



C

m
on

er

Dissolved salts

Low levels are reported as “Conductivity” or “TDS” aka “Total Dissolved Solids”.

High levels are reported as “Salinity”.

Good water source tracer.

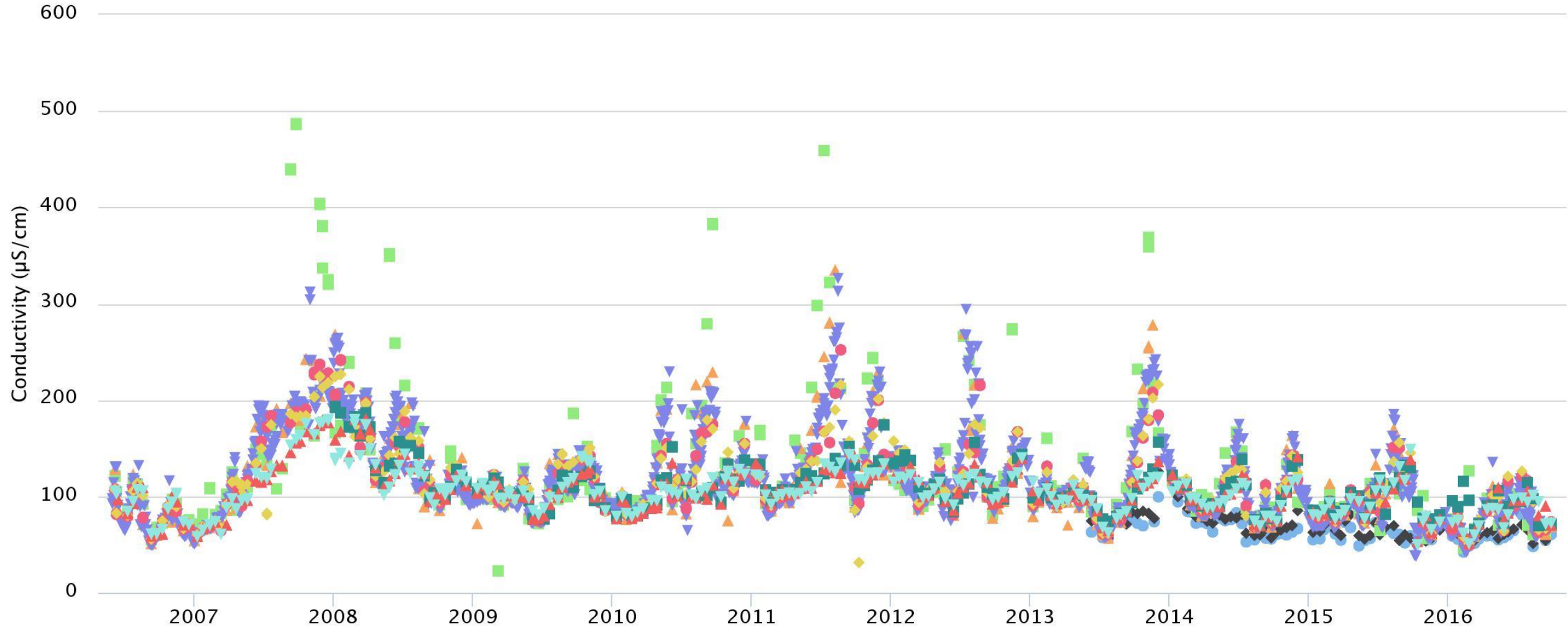
Groundwater has high salt levels

Rain water has very low salt levels

Polluted runoff can have high levels.

Conductivity ($\mu\text{S}/\text{cm}$)

Data collected between Jun 06, 2006 and Sep 28, 2016

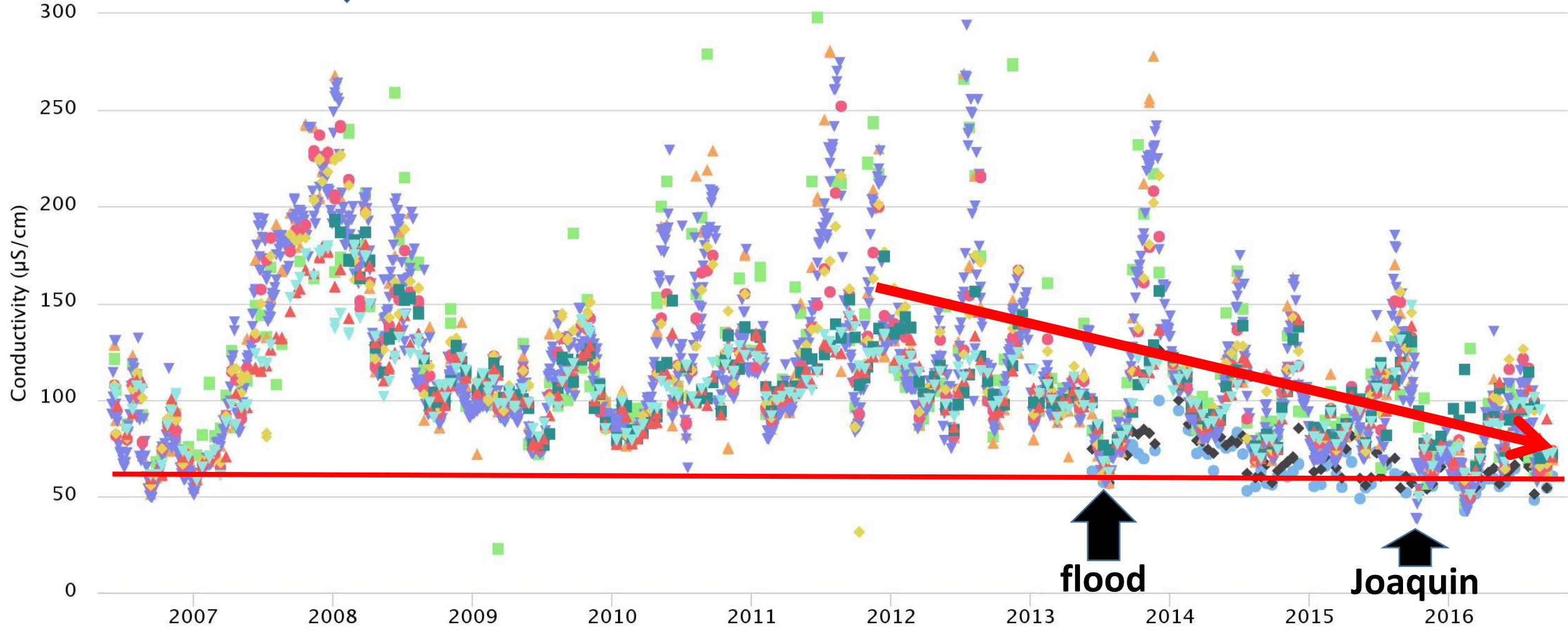


- Babson's
- Pireway
- Highway 9
- Reaves Ferry
- Murrells Landing
- Conway Waterfront
- Pitch Landing
- Peachtree Landing
- Enterprise Landing
- Bucksport Landing
- Wachesaw Landing

drought

Conductivity ($\mu\text{S}/\text{cm}$)

Data collected between Jun 06, 2006 and Sep 28, 2016

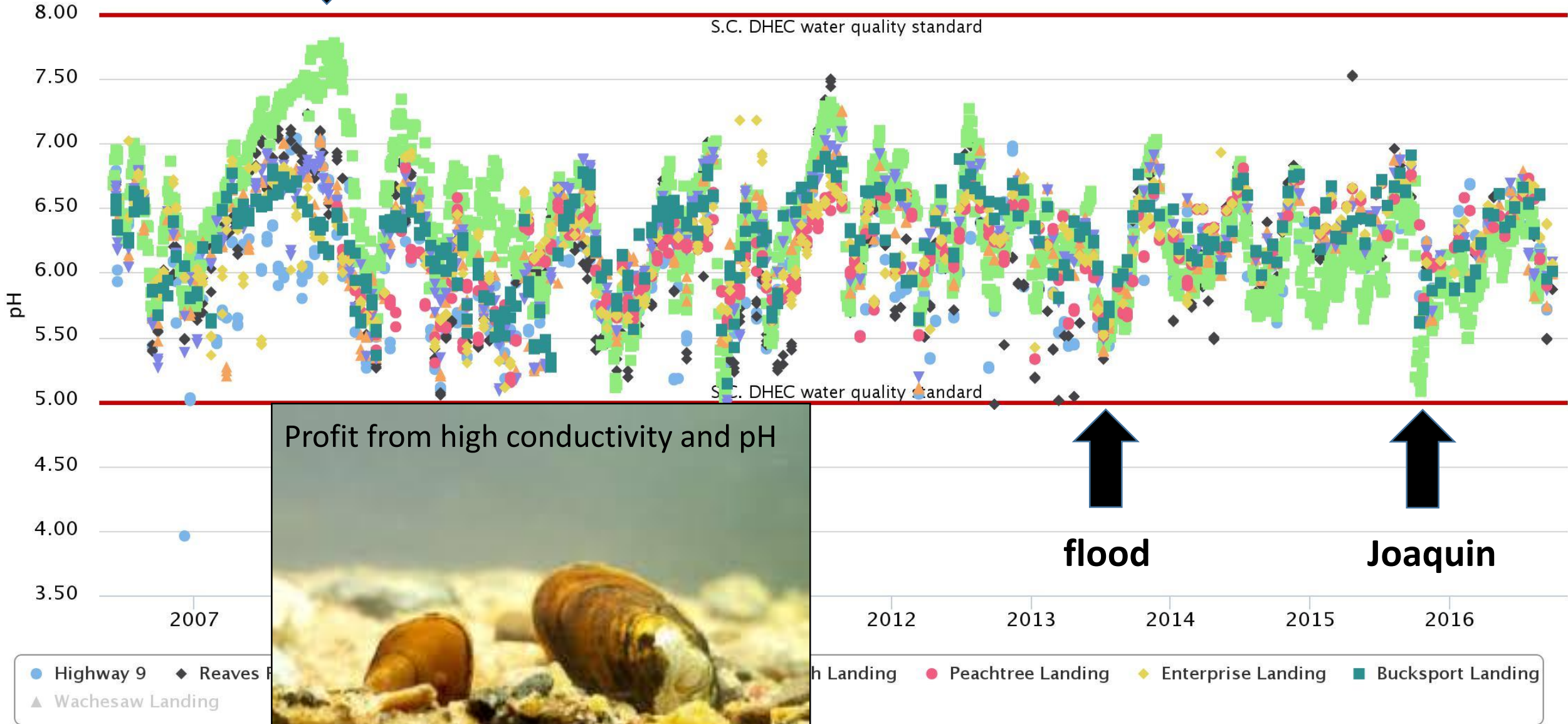


- Babson's
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- Murrells Landing
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- Pitch Landing
- Peachtree Landing
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- Bucksport Landing
- Wachesaw Landing

drought

pH

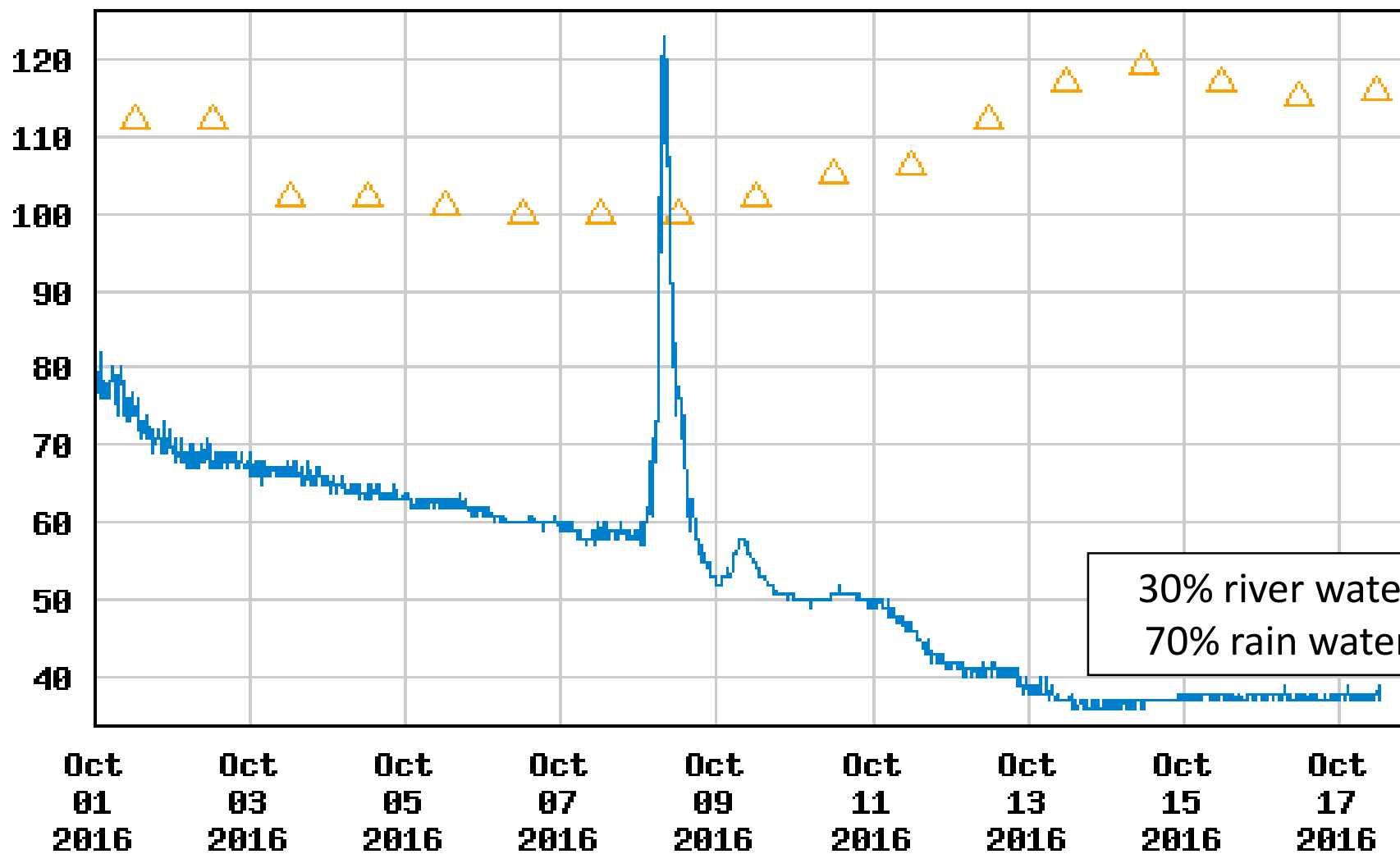
Data collected between Jun 06, 2006 and Sep 28, 2016



CONDUCTIVITY

USGS 02110500 MACCAMAH RIVER NEAR LONGS, SC

Specific conductance, water,
unfiltered, microsiemens per centimeter
at 25 degrees Celsius



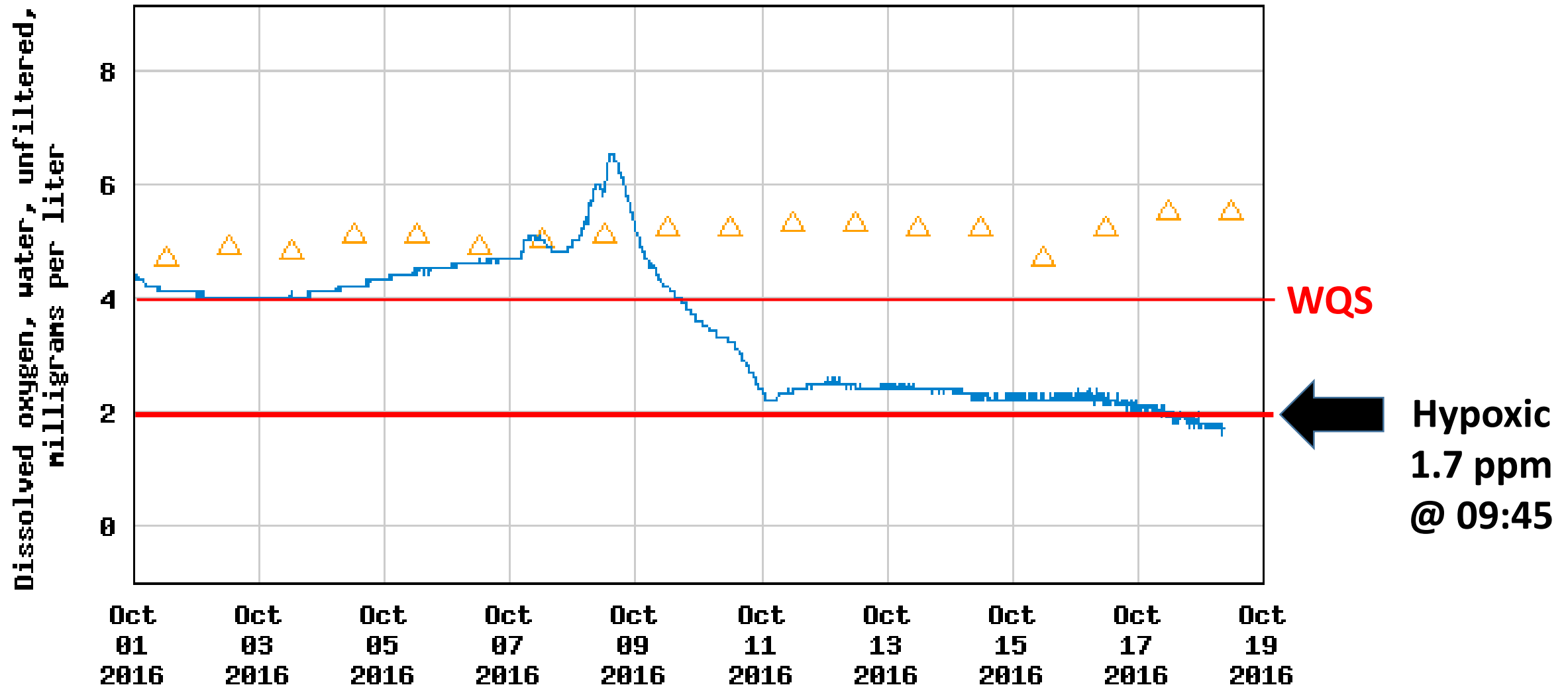
30% river water
70% rain water

---- Provisional Data Subject to Revision ----

△ Median daily statistic (8 years) — Specific conductance

DISSOLVED OXYGEN

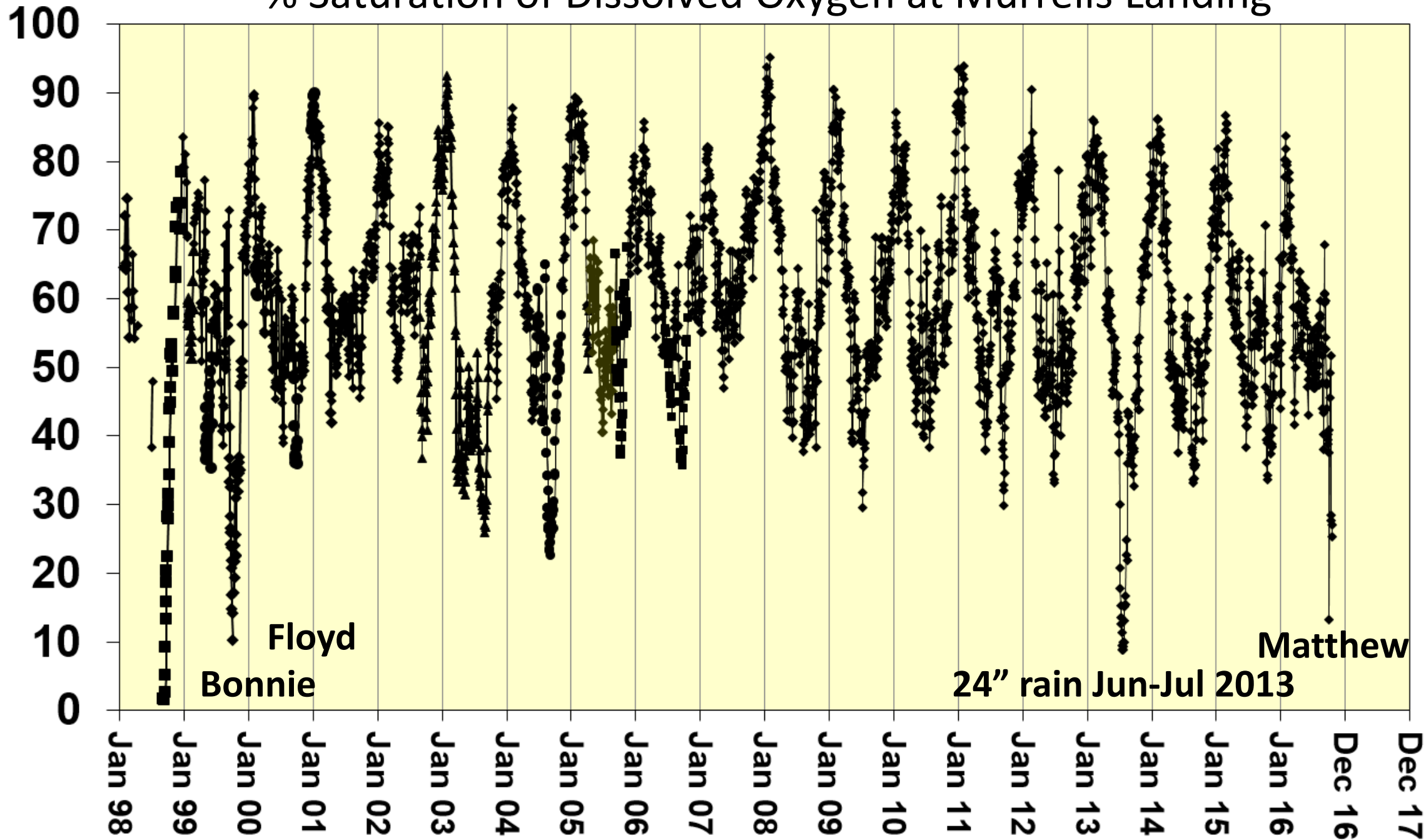
USGS 02110500 MACCAMAH RIVER NEAR LONGS, SC



---- Provisional Data Subject to Revision ----

△ Median daily statistic (7 years) — Dissolved oxygen

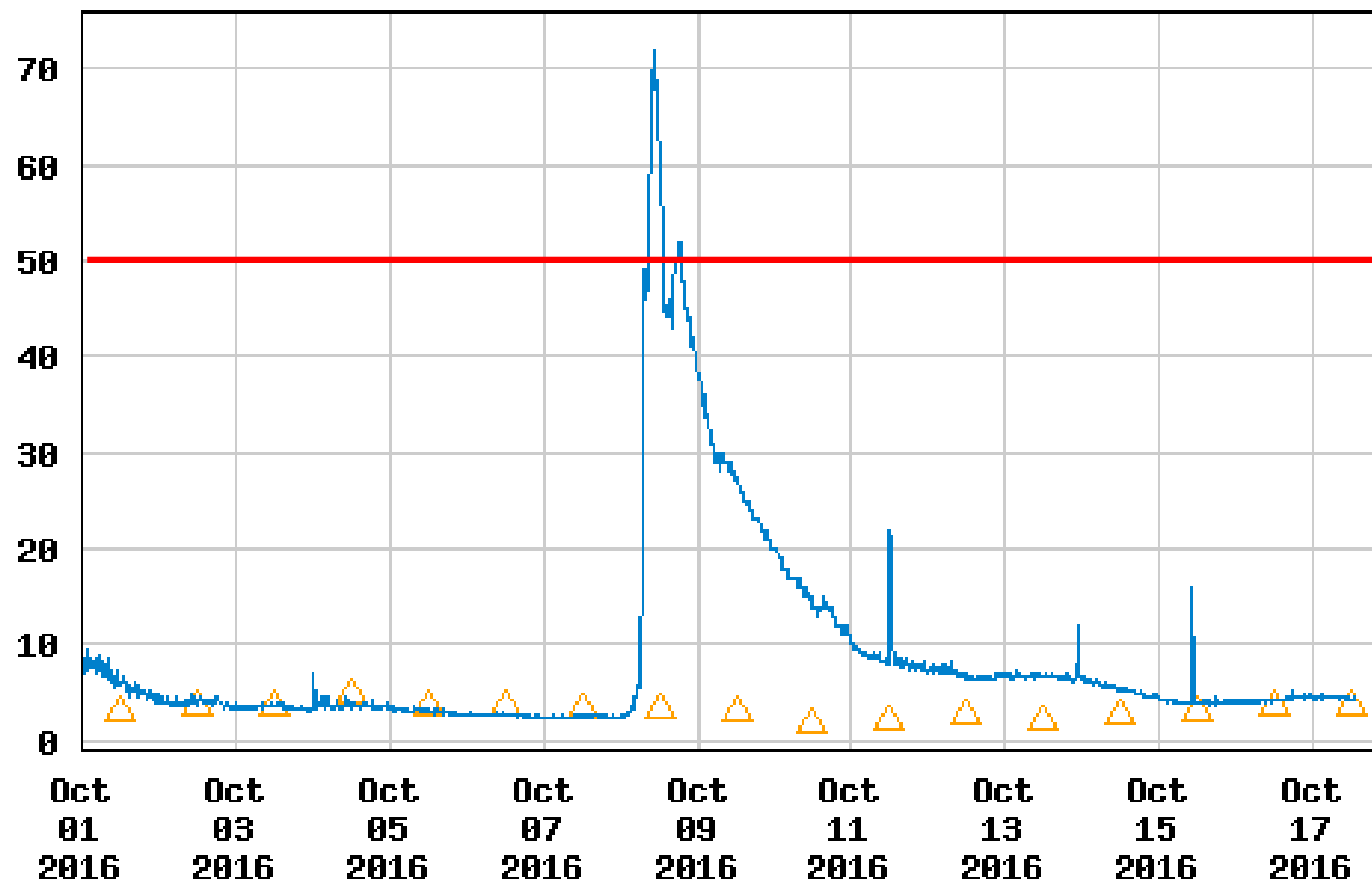
% Saturation of Dissolved Oxygen at Murrells Landing



Turbidity

USGS 02110500 MACCAHAM RIVER NEAR LONGS, SC

Turbidity, water, unfiltered,
monochrome near infra-red LED light,
780-900 nm, detection angle 90 +/-2.5
degrees, formazin nephelometric units
(FNU)



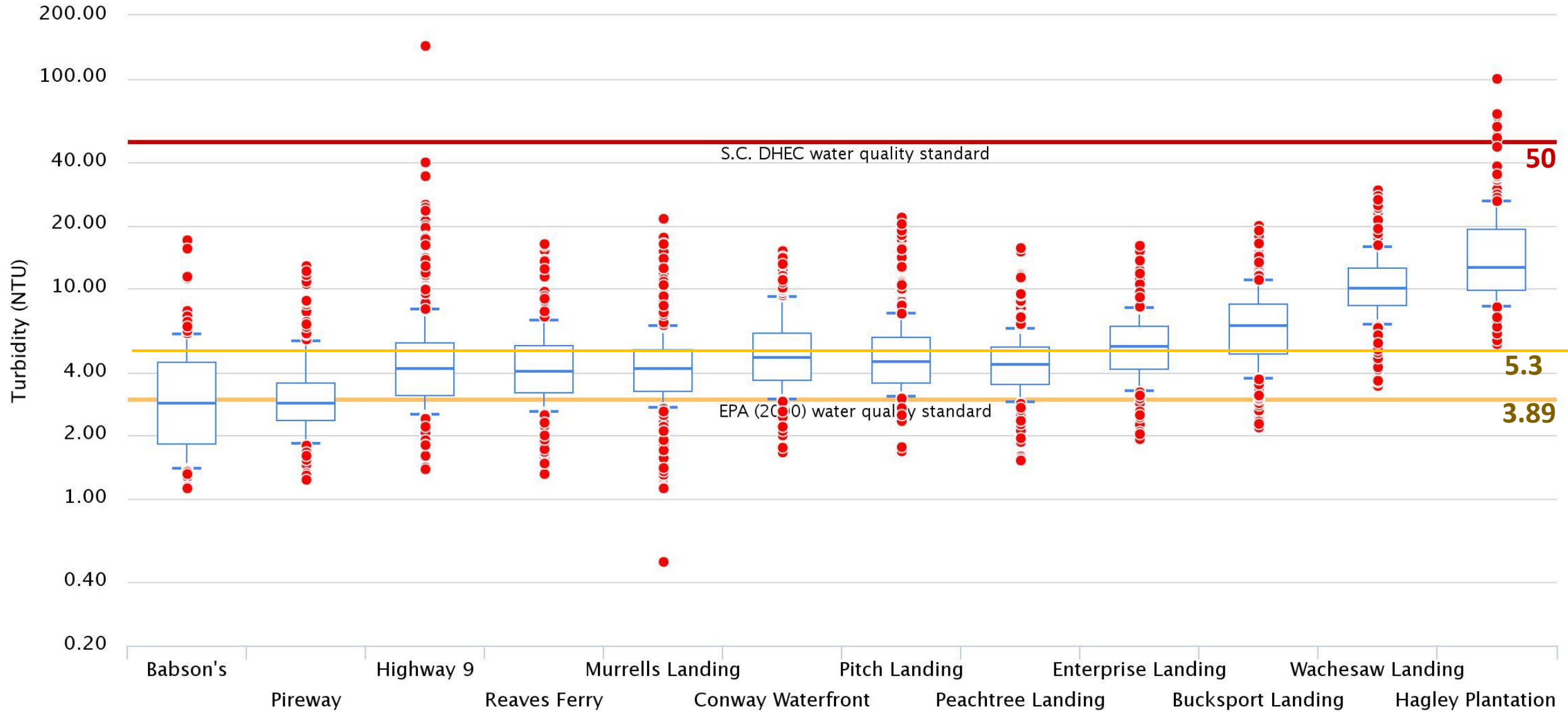
WQS

---- Provisional Data Subject to Revision ----

△ Median daily statistic (5 years) — Turbidity

Waccamaw River Turbidity

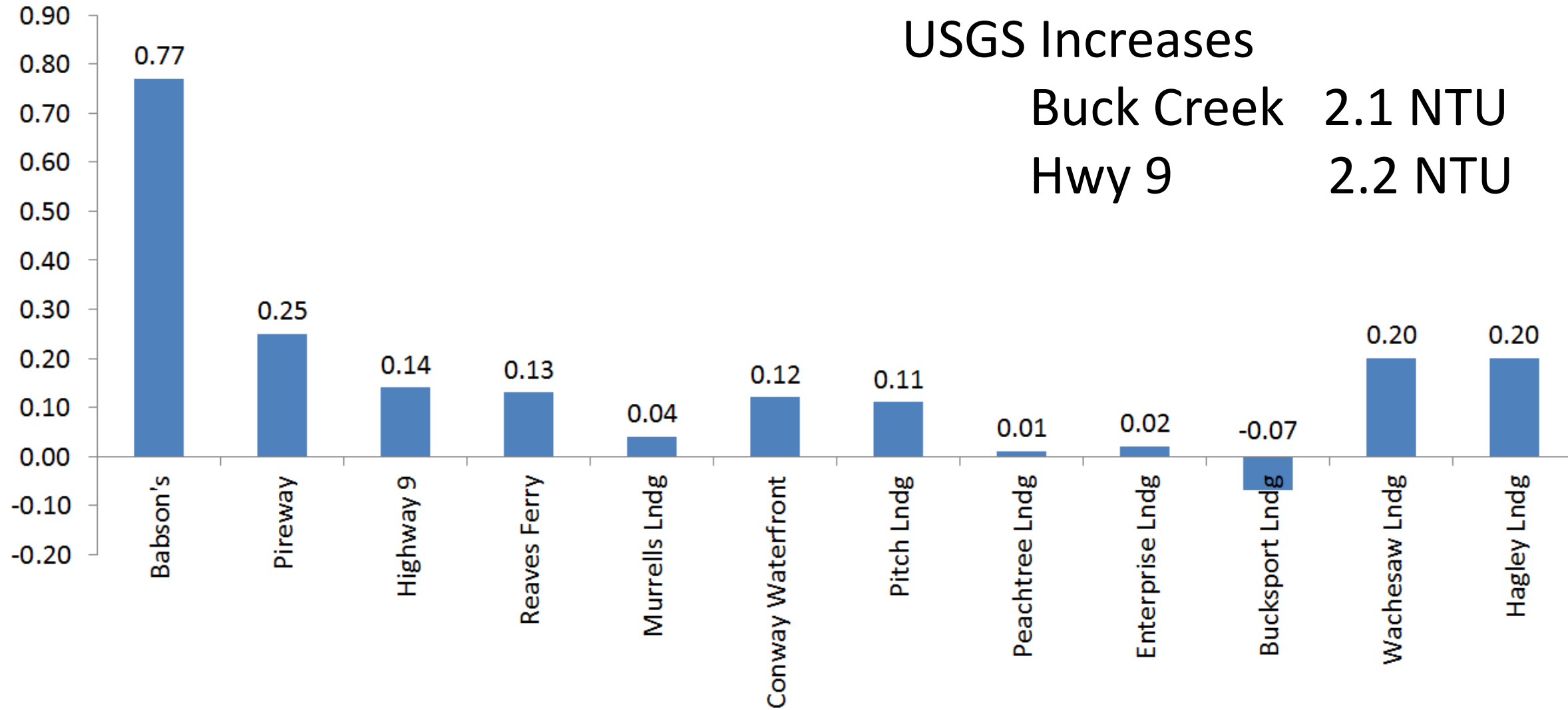
Data collected from June 06, 2006 and Sept 28, 2016



N = 240

Volunteer Monitoring Site Turbidity (NTU)

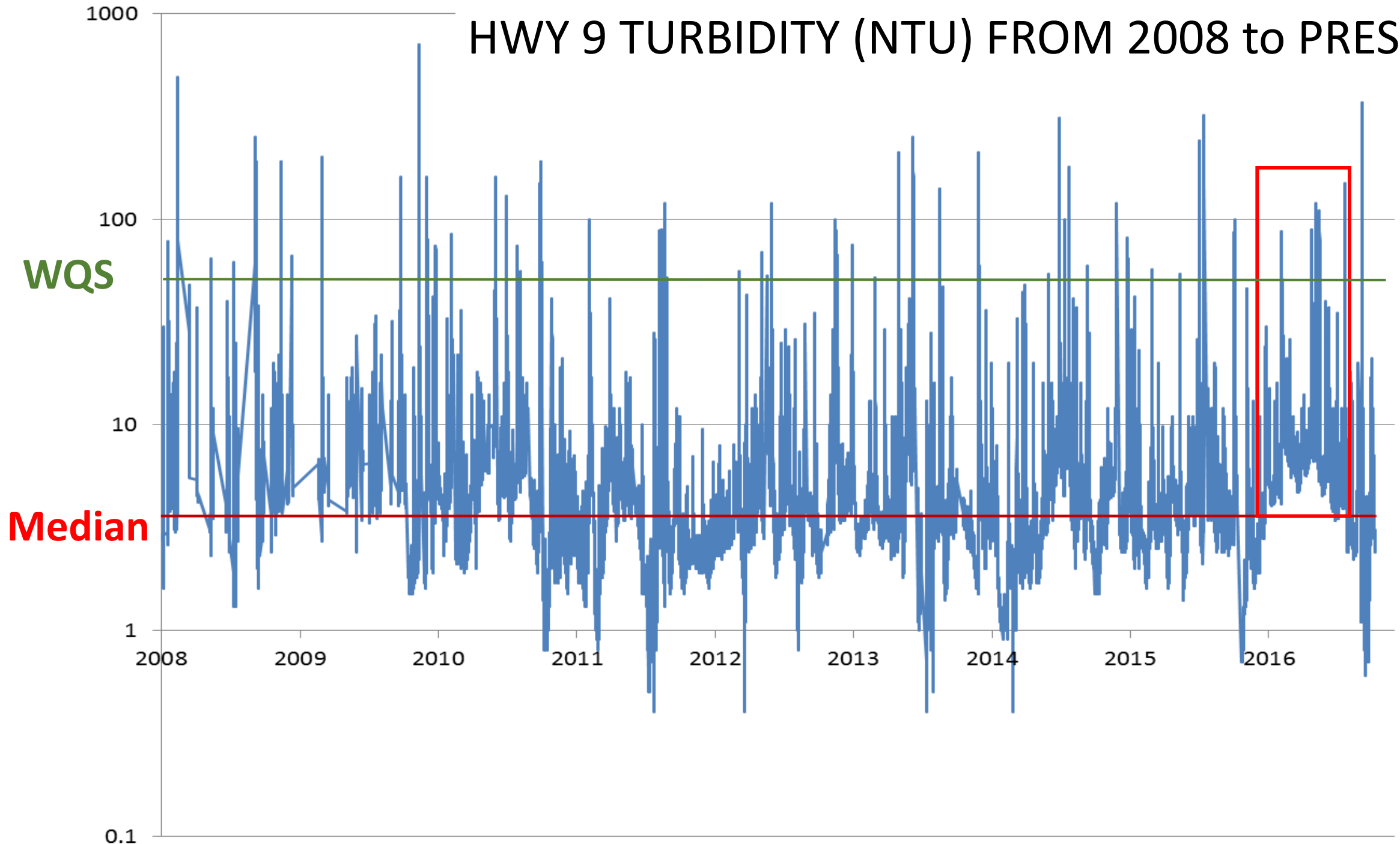
Increase in median value: pre 2016 vs 2016



USGS Increases

Buck Creek 2.1 NTU
Hwy 9 2.2 NTU

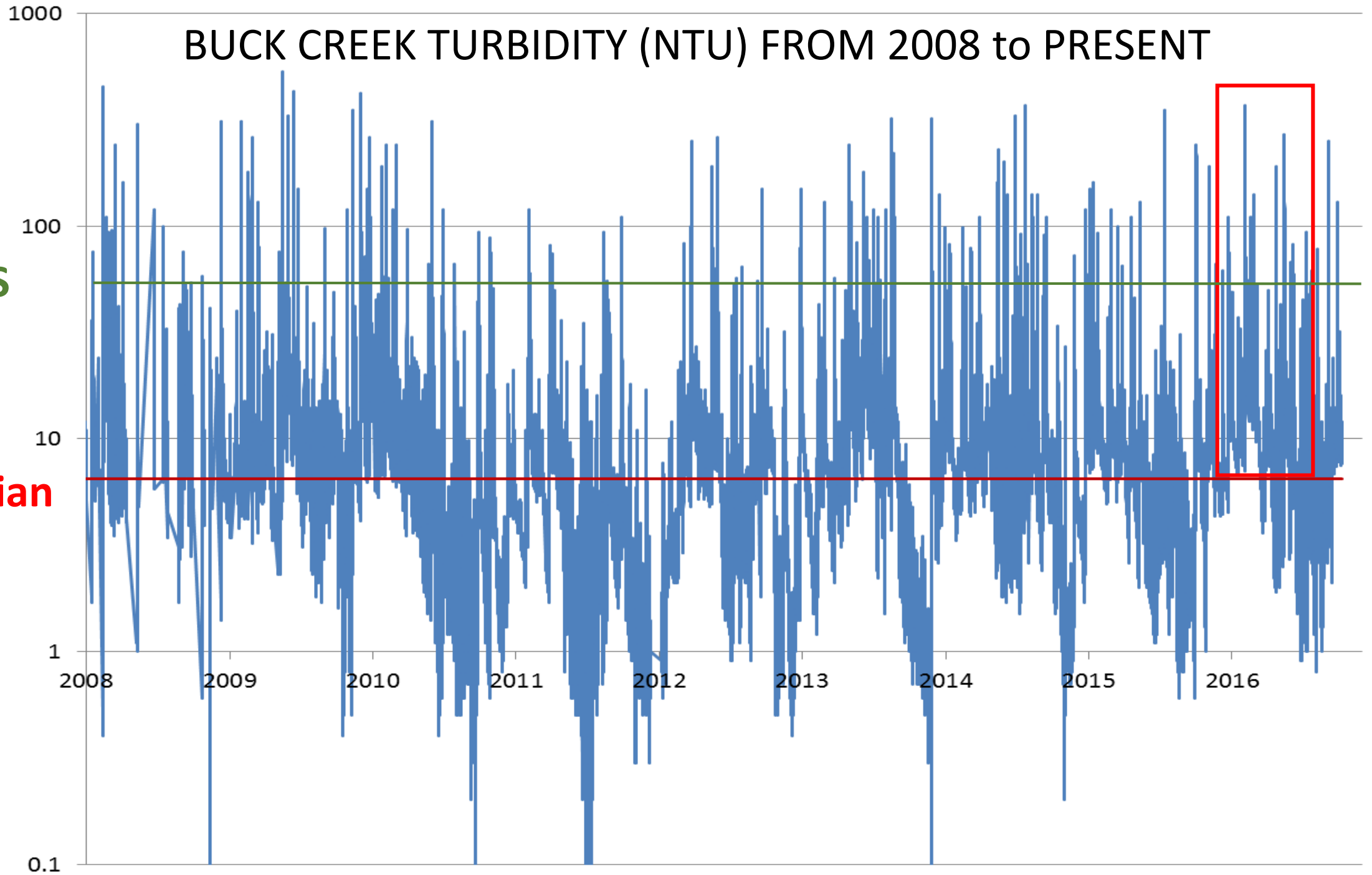
HWY 9 TURBIDITY (NTU) FROM 2008 to PRESENT



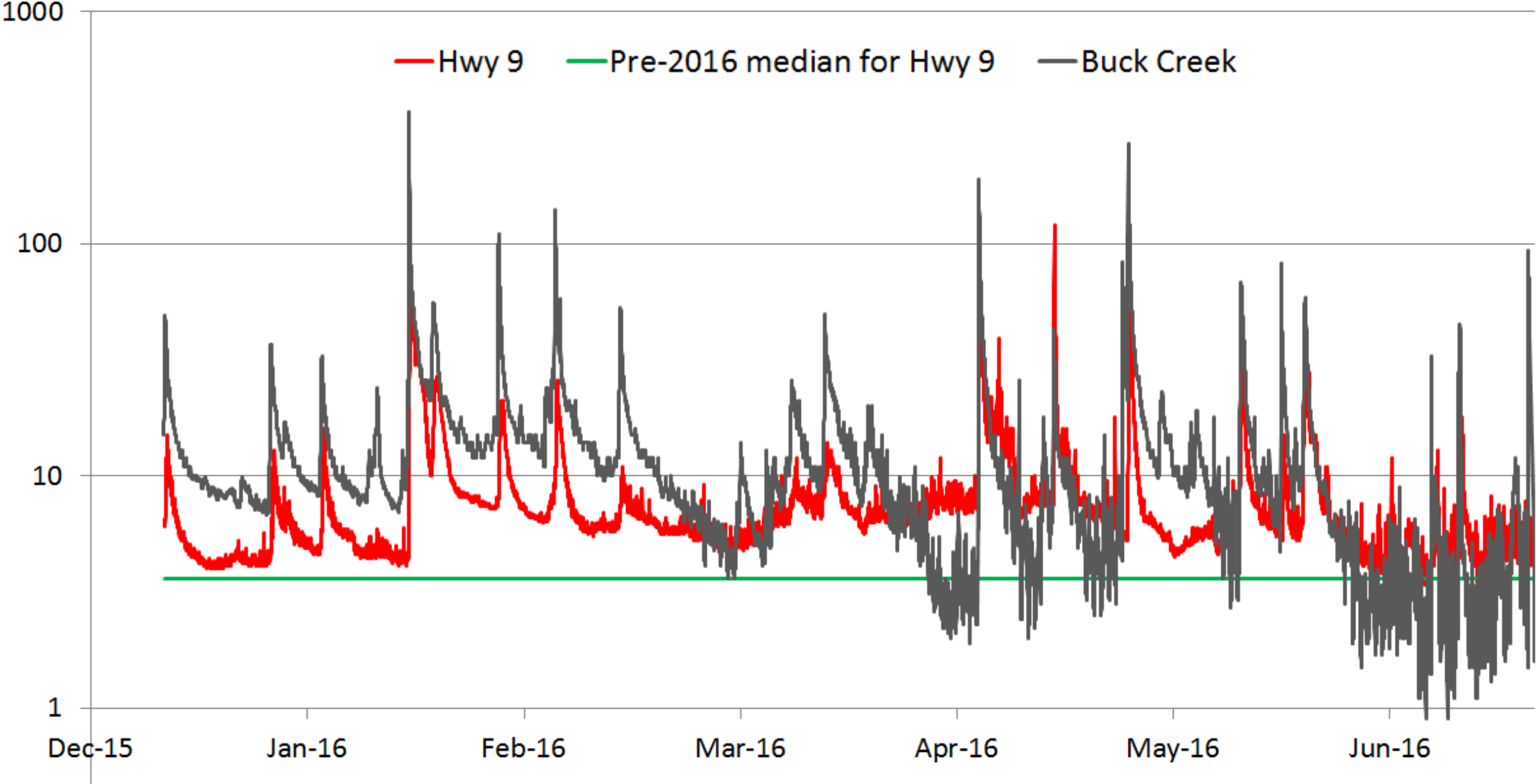
BUCK CREEK TURBIDITY (NTU) FROM 2008 to PRESENT

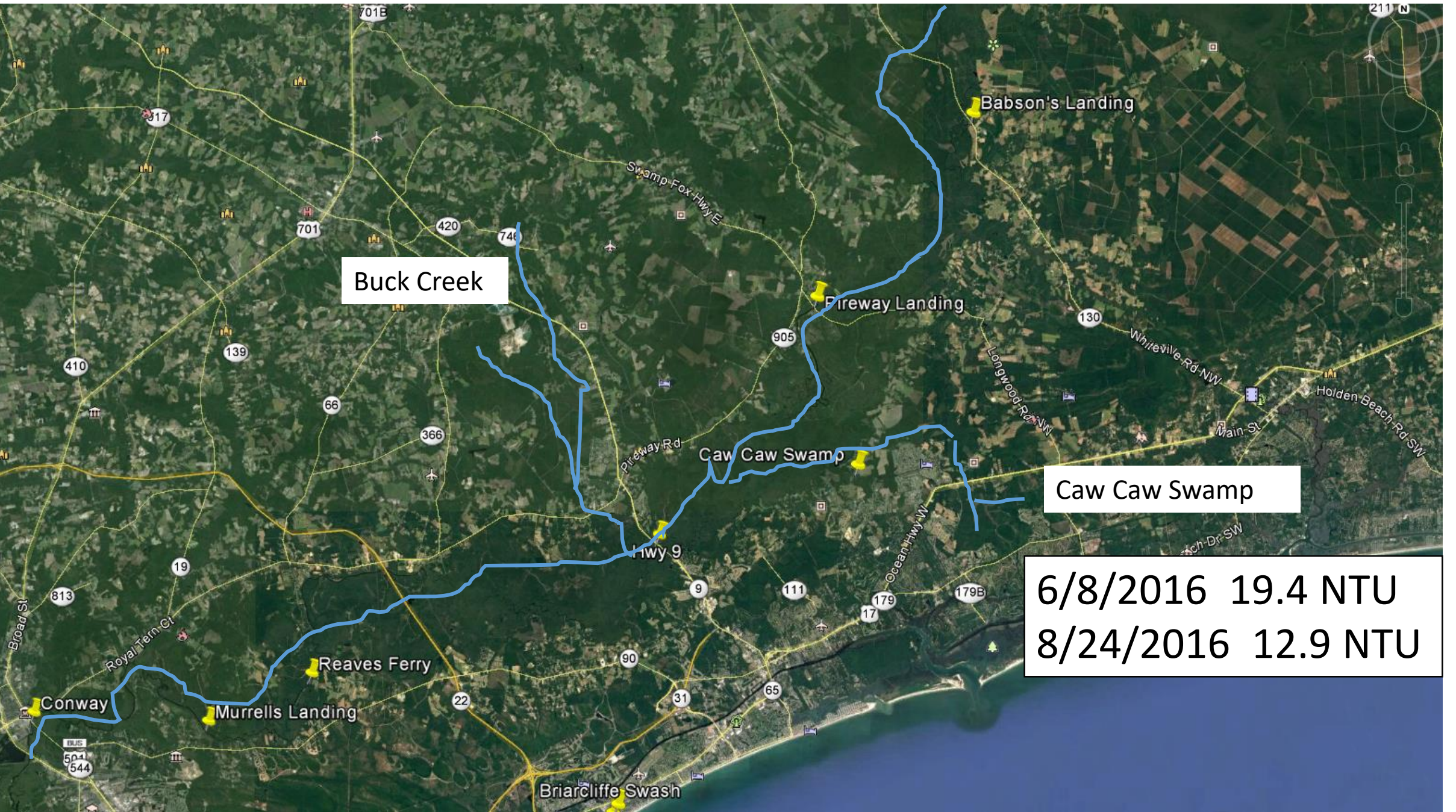
WQS

Median



Rain pulsing of turbidity from Buck Creek

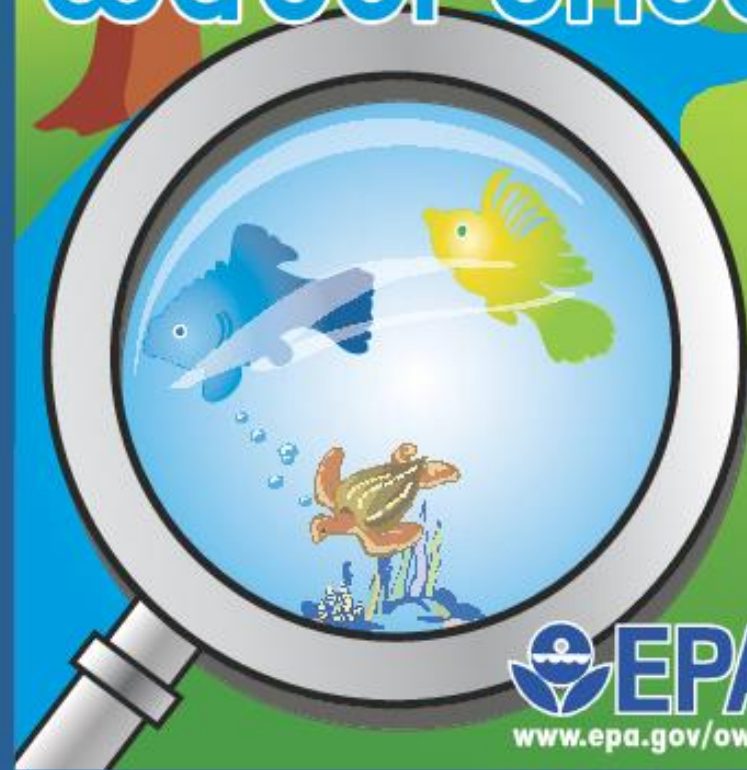




Acknowledgements



mónitór
your
watershed



 EPA
www.epa.gov/owow

Site 9
Murrells Landing



Murrells
Landing
10/8/15



Murrells
Landing
10/17/16

