

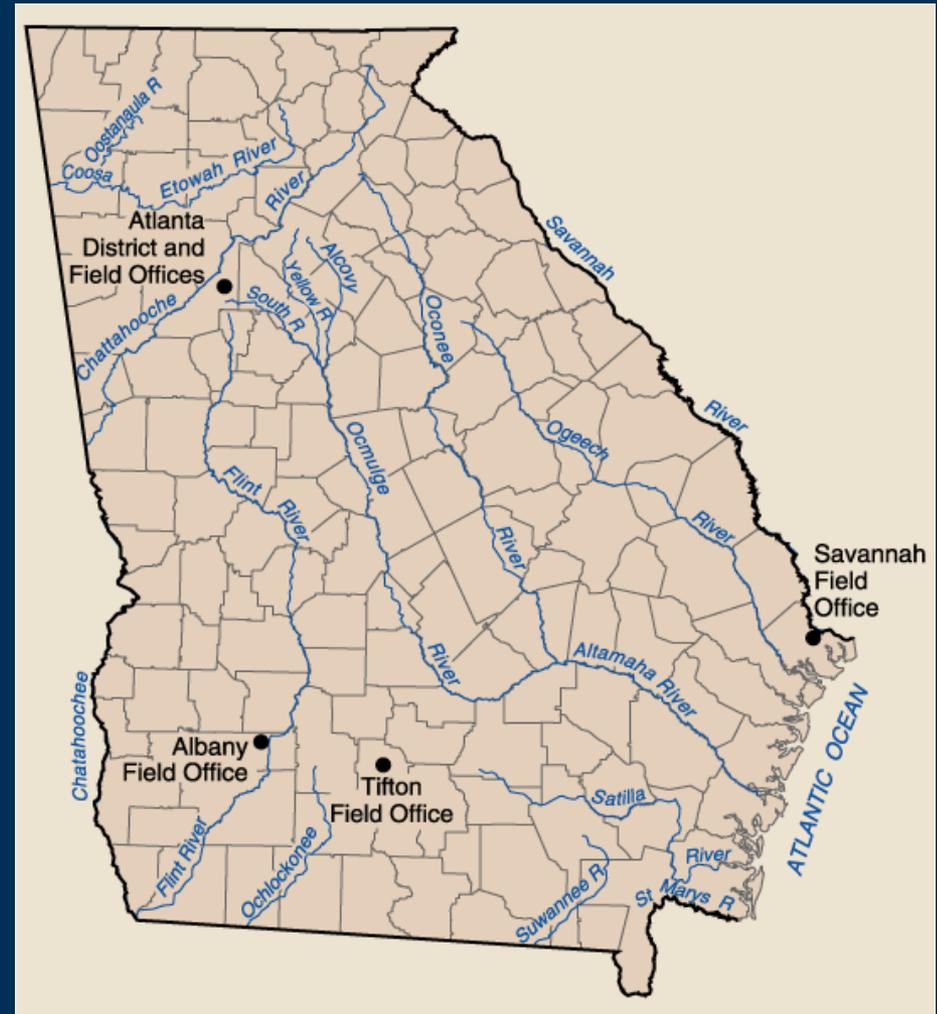


September 2009 Flooding in Metro Atlanta

Tony Gotvald, USGS GA Water Science Center
2011 National Severe Weather Workshop
March 3, 2011

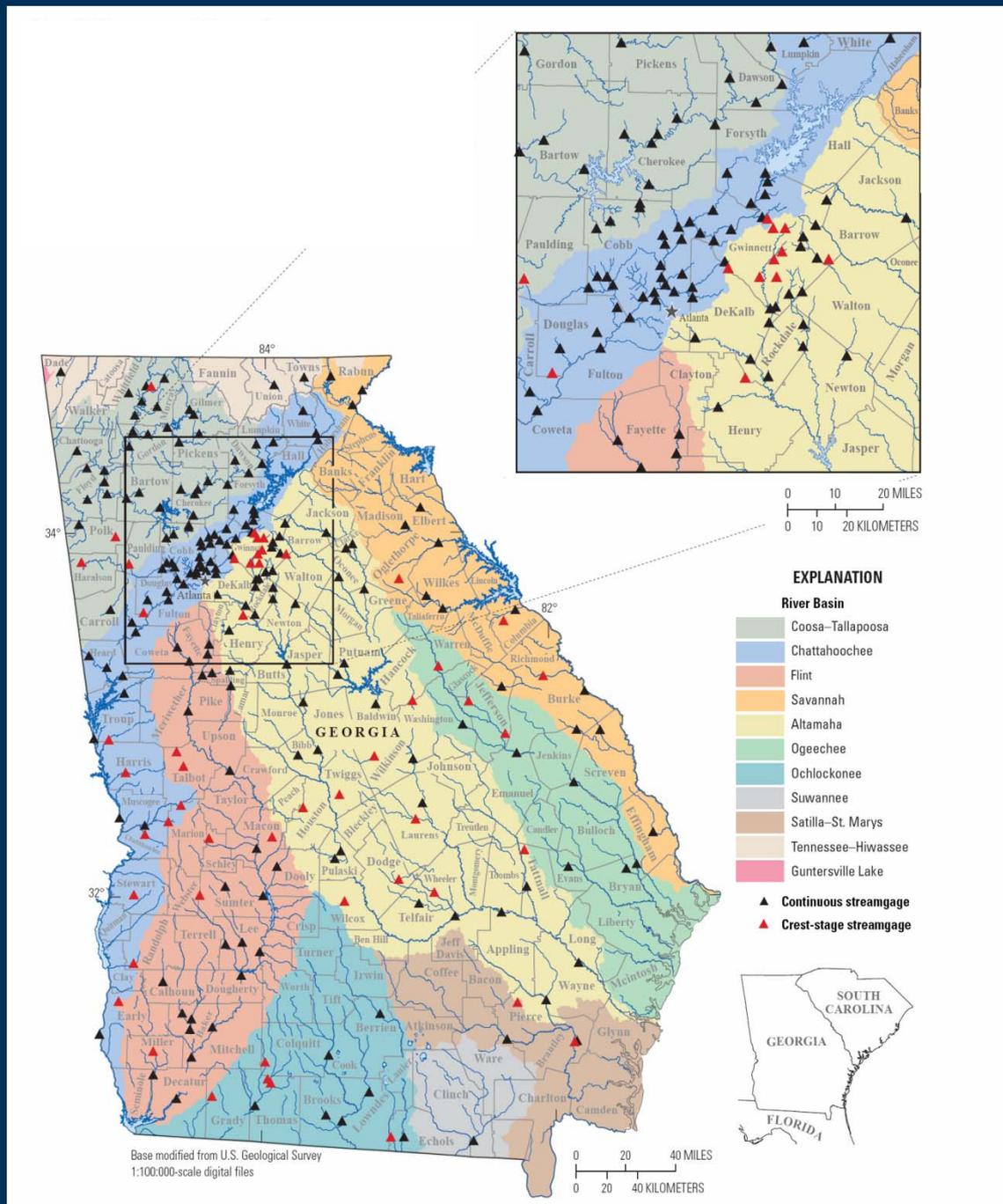
The USGS in Georgia

- Main Office—Atlanta
- About 80 employees
- Four field offices
 - Atlanta
 - Albany
 - Savannah
 - Tifton



USGS in Georgia

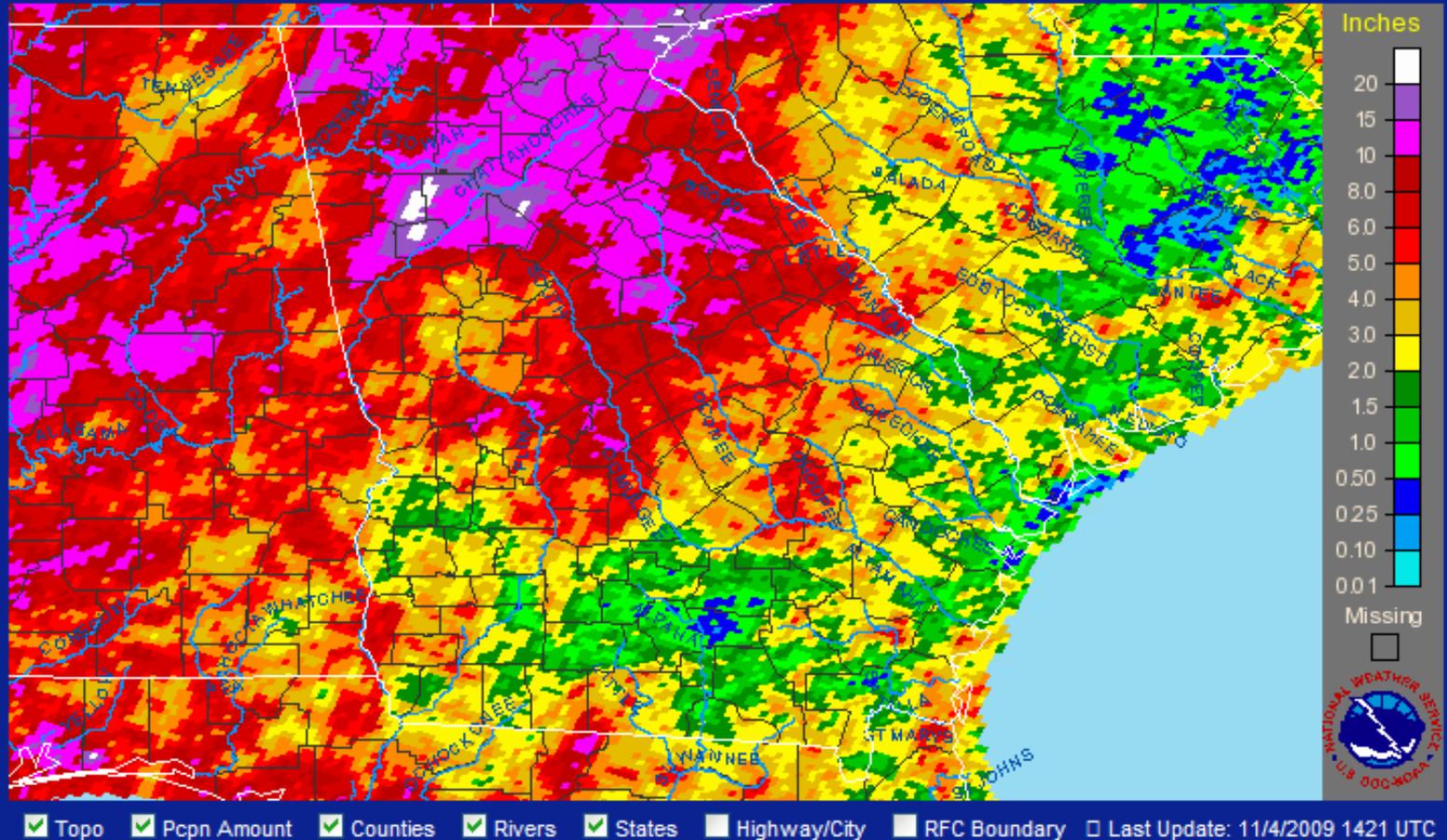
- 325 real-time surface-water stations
- 263 have raingages
- 58 have continuous water-quality
- 100% transmit hourly
- All have emergency random transmissions
- 60 crest-stage gages



The Making of a Disaster

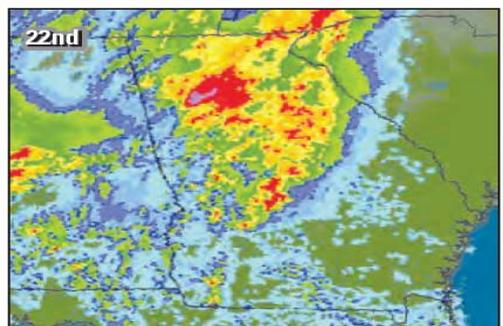
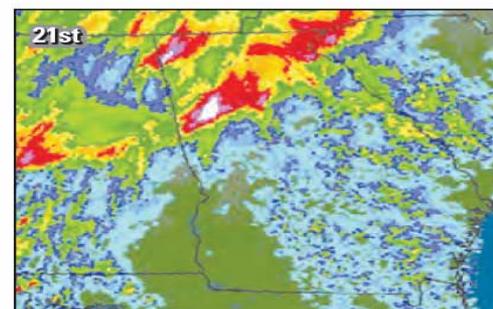
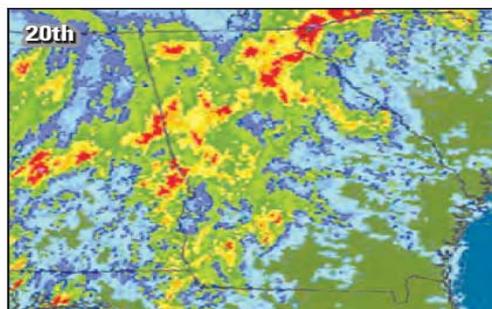
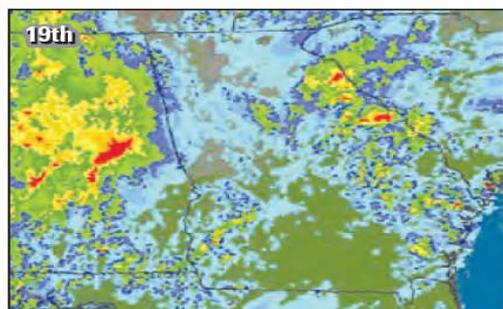
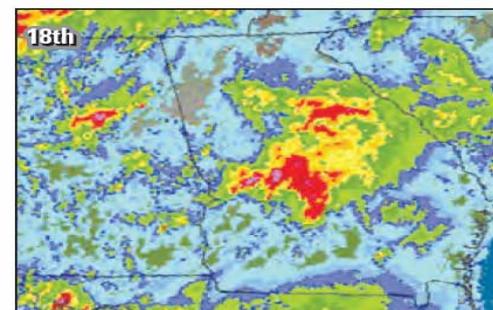
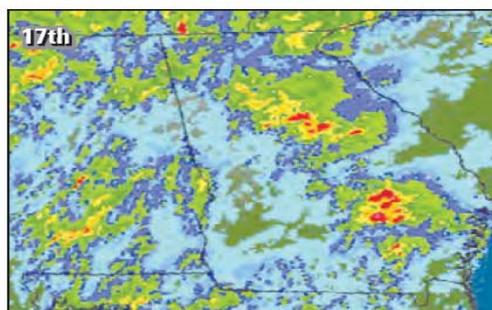
Georgia
September, 2009 Monthly Observed Precipitation

Click on the image to zoom in
Click on "States" to zoom out



Average annual rainfall = 50.2 inches (Wikipedia)

September 2009



EXPLANATION

Observed daily precipitation, in inches

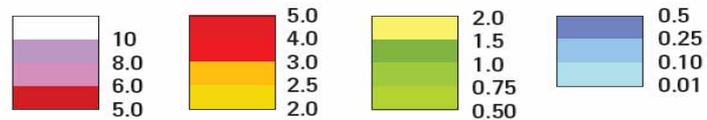
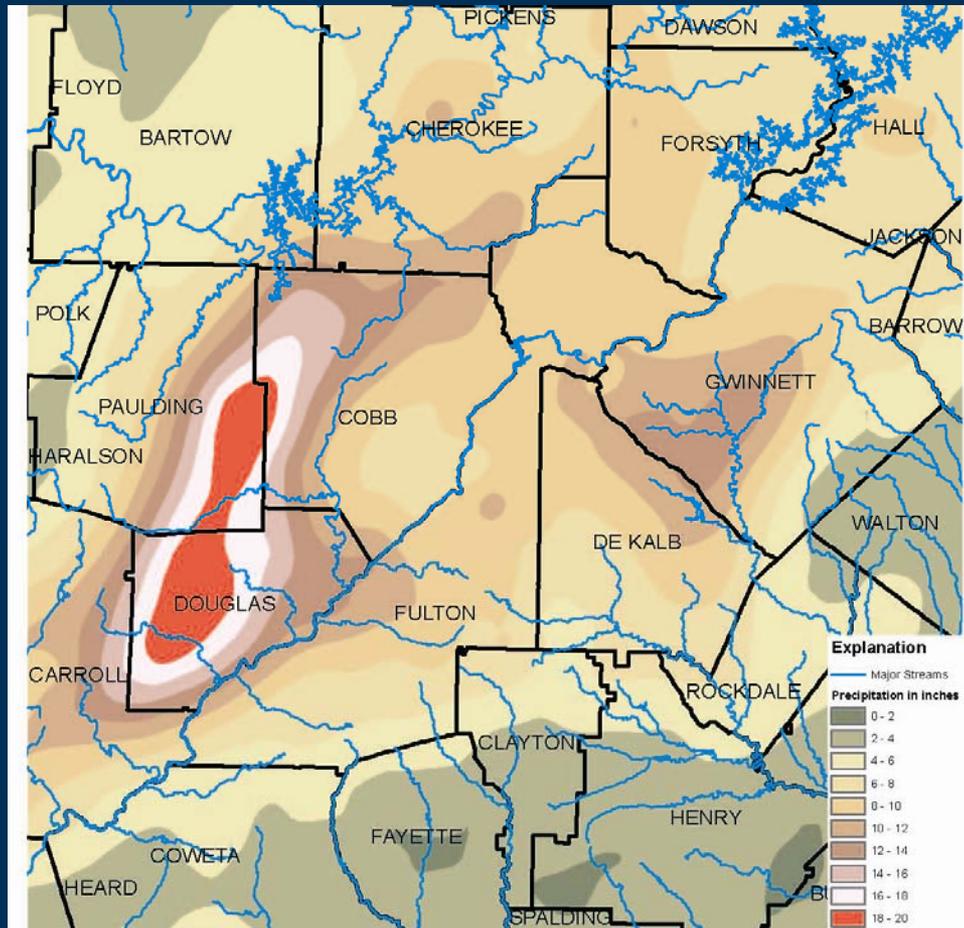


Figure 3. Daily rainfall totals in Georgia from September 16 through 22, 2009 (images from the National Weather Service, 2009b).

The Making of a Disaster

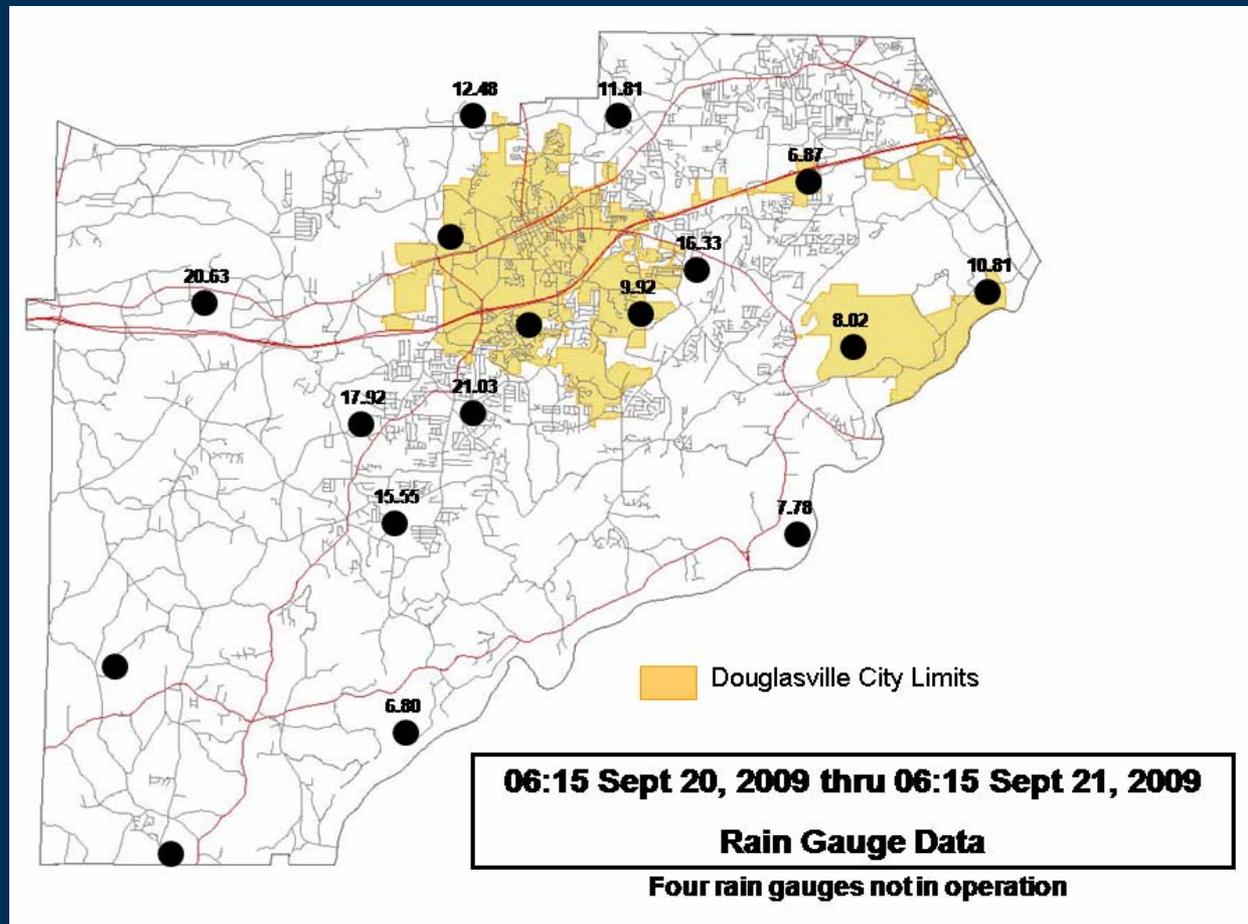


Rainfall in inches, from National Weather Service Hourly Precipitation Analysis
http://www.srh.noaa.gov/rfcshare/precip_analysis_hourly.php
September 18 through 22, 2009 in the Atlanta, Georgia Area - Provisional data



Average annual rainfall = 50.2 inches (Wikipedia)

The Making of a Disaster



Courtesy: GEMA



Average annual rainfall = 50.2 inches (Wikipedia)

The Making of a Disaster

Pumps were primed

- September was a wet month due to tropical moisture
- Weekend of September 18th had persistent rainfall
- Evening of Sunday, September 20th was when the sky began falling...
- By Monday, September 21st, 7 am, USGS crews were out measuring the flows



Storm Operations

By Monday afternoon, almost 50 streamgages were above their ratings

By Monday evening, more than 15 streamgages were not reporting because they were under water

By Tuesday, the Chattahoochee at GA 280 and Fairburn gages were lost to floodwaters



Storm Operations

In a five day period starting Monday, September 21st, USGS crews:

- Made nearly 75 discrete flood measurements
- Flagged HWMs at about two dozen locations
- Repaired or installed temporary real-time gages at all 20 destroyed gages
- Deployed hurricane storm surge sensors to attempt to get recession limb data and prep for next storm



Storm Operations

In a five day period starting Monday, September 21st, USGS crews:

- Extended ratings at more than 49 stations
- Computed flood frequencies “on-the-fly”
- Collected water-quality samples throughout flooded region
- Routine briefings to USGS HQ
- Brought in two crews and spare equipment from NC & SC
- Released two press releases
- Performed at least 5 media interviews
- Captured event in digital photos



Photo Gallery

Monday, Sept. 21st

USGS crews
measuring Crooked
Creek at Norcross



Photo Gallery

Tuesday, Sept. 22st

USGS crews
measuring
Sweetwater Creek
near Austell...

...in a boat on I-20!



Photo Gallery

Tuesday, Sept. 22st

USGS hydrographer
measuring flood
flows with Acoustic
Doppler Current
Profiler (ADCP) on
Sweetwater Creek



Photo Gallery

Monday, Sept. 21st

Chattahoochee at
Morgan Falls Dam



Tuesday, Sept. 22st

*USGS hydrographer
preparing to
measure by boat*



Photo Gallery

Monday, Sept.
21st

Bridge and
nearby area
flooded at
Powder
Springs
Creek at
Powder
Springs



Photo Gallery

Monday, Sept. 21st

USGS Hydrographer inspects flooded car for emergency officials at Peachtree Creek at Atlanta (Northside Drive)

(courtesy AJC)



Photo Gallery

Tuesday, Sept. 22st

Chattahoochee River at
Atlanta (Vinings)



Photo Gallery

Dog River at GA 5
near Fairplay

Water was 12 feet
above the gage
house



Post-Storm Analyses

Indirect measurements were surveyed and computed at nineteen locations

High-water marks were used at about 6 more locations to extend ratings

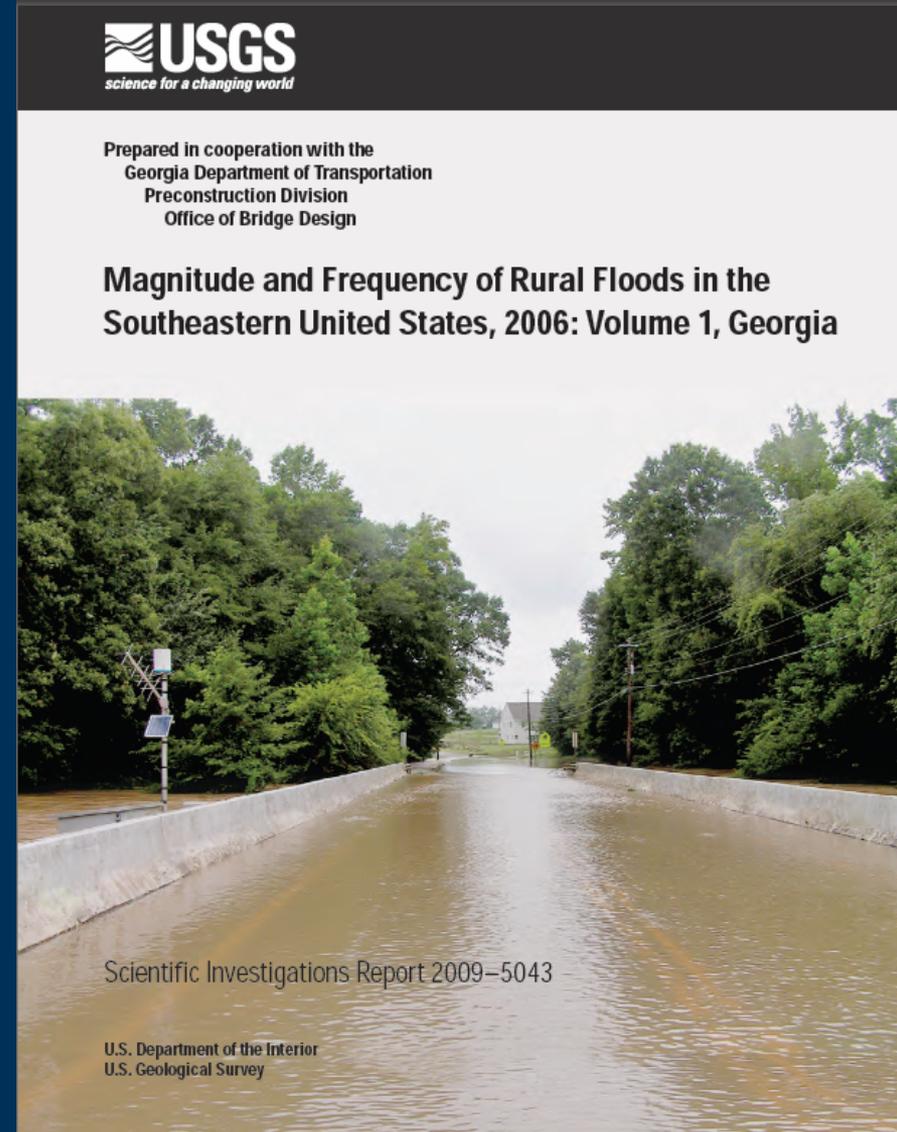


Post-Storm Analyses

“Rural” flood frequencies determined by Log Pearson Type III regression with a generalized-skew coefficient using Bayesian general-least squares regression model. (*Gotvald, others, 2009*)

USGS has effort underway to update the same report for urbanized areas. Due in spring of 2011.

Flood frequencies from this event were calculated using provisional equations from unpublished urban effort.



Post-Storm Analyses

For large magnitude floods, the rural and urban curves begin to converge

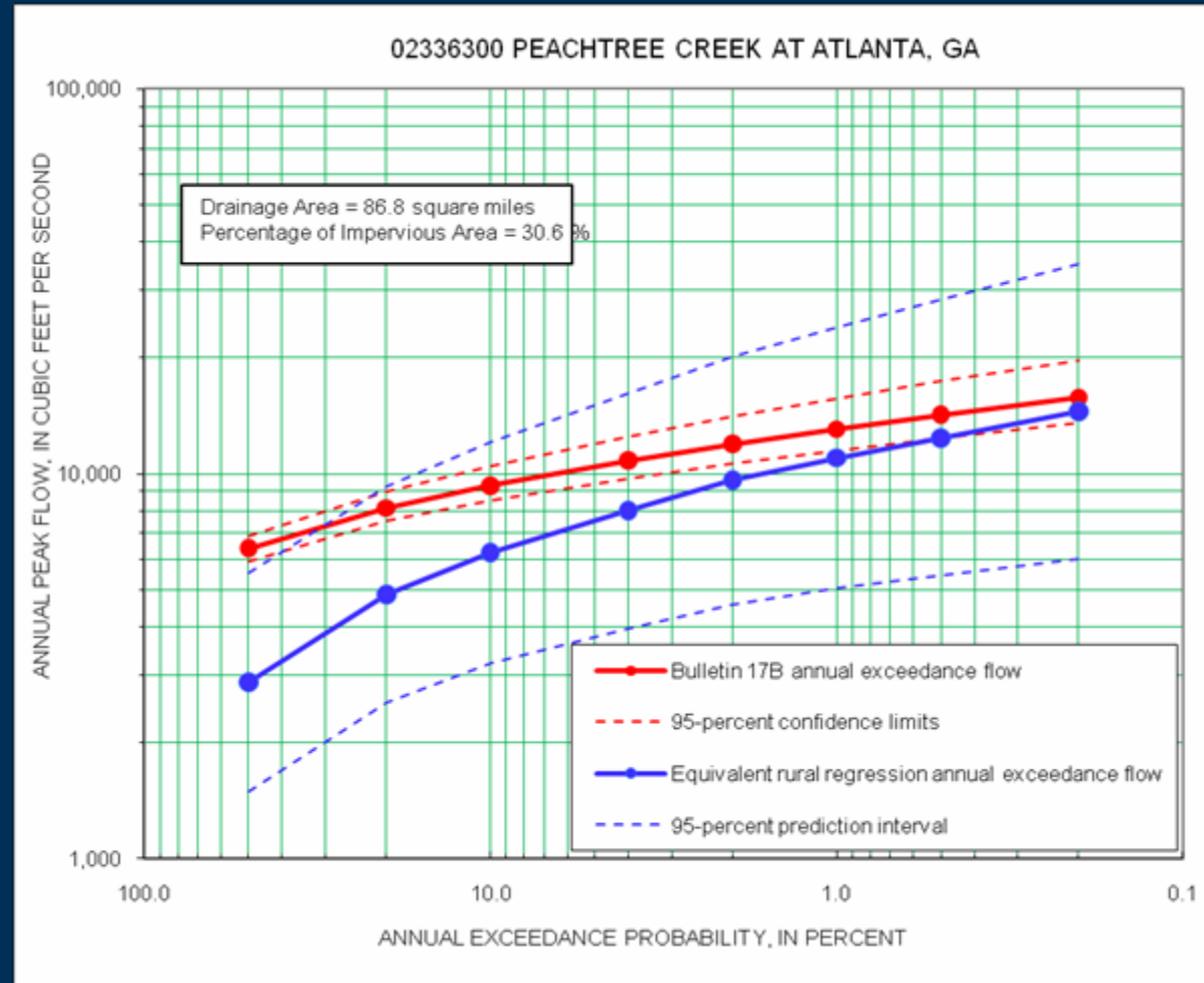
At these magnitudes, alterations to watershed are “drowned” out

Large urban effect for smaller floods

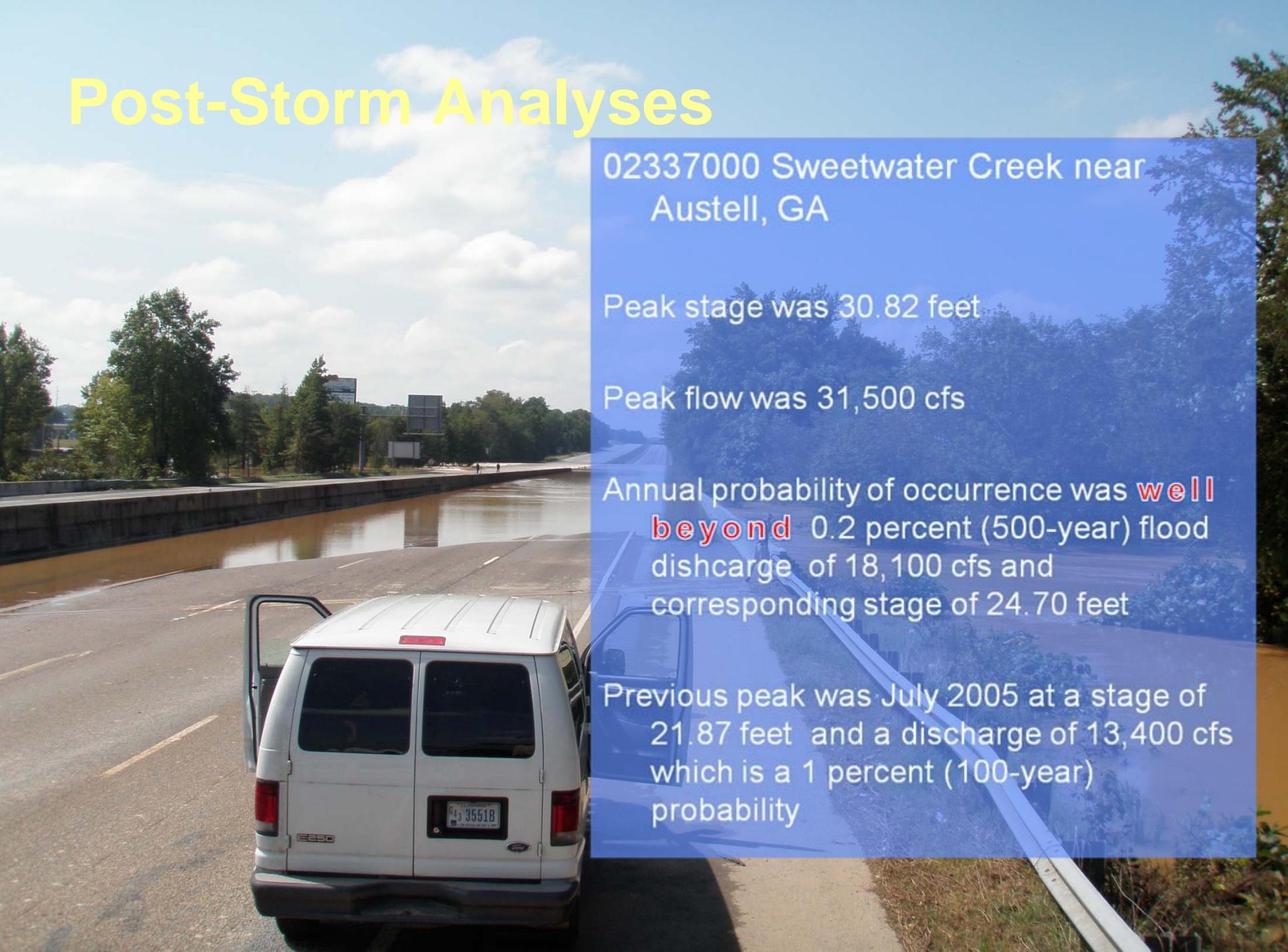
% impervious = 30.6



***Results are provisional and subject to change upon further review**



Post-Storm Analyses



02337000 Sweetwater Creek near
Austell, GA

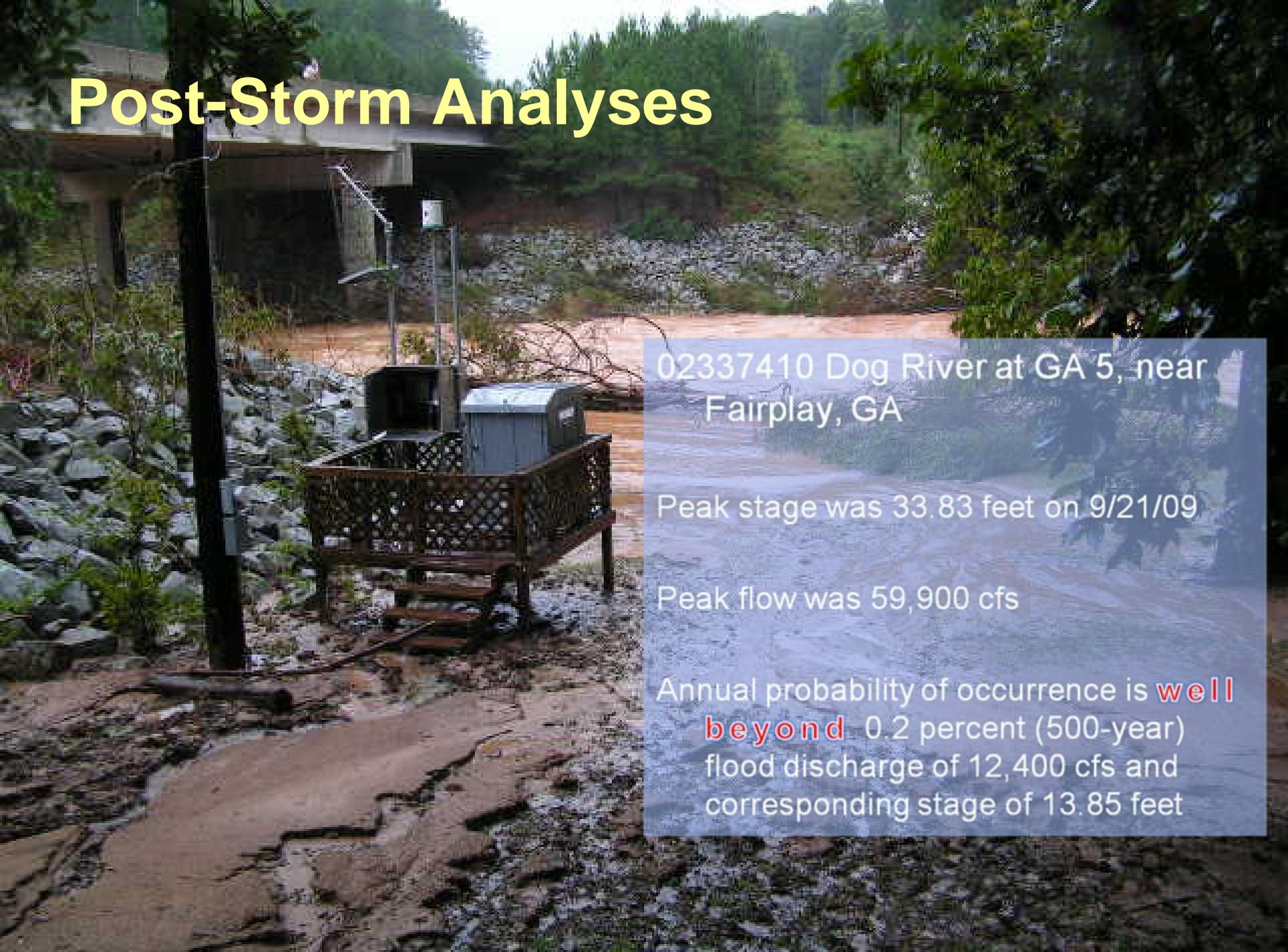
Peak stage was 30.82 feet

Peak flow was 31,500 cfs

Annual probability of occurrence was **well beyond** 0.2 percent (500-year) flood discharge of 18,100 cfs and corresponding stage of 24.70 feet

Previous peak was July 2005 at a stage of 21.87 feet and a discharge of 13,400 cfs which is a 1 percent (100-year) probability

Post-Storm Analyses



02337410 Dog River at GA 5, near
Fairplay, GA

Peak stage was 33.83 feet on 9/21/09

Peak flow was 59,900 cfs

Annual probability of occurrence is **well
beyond** 0.2 percent (500-year)
flood discharge of 12,400 cfs and
corresponding stage of 13.85 feet

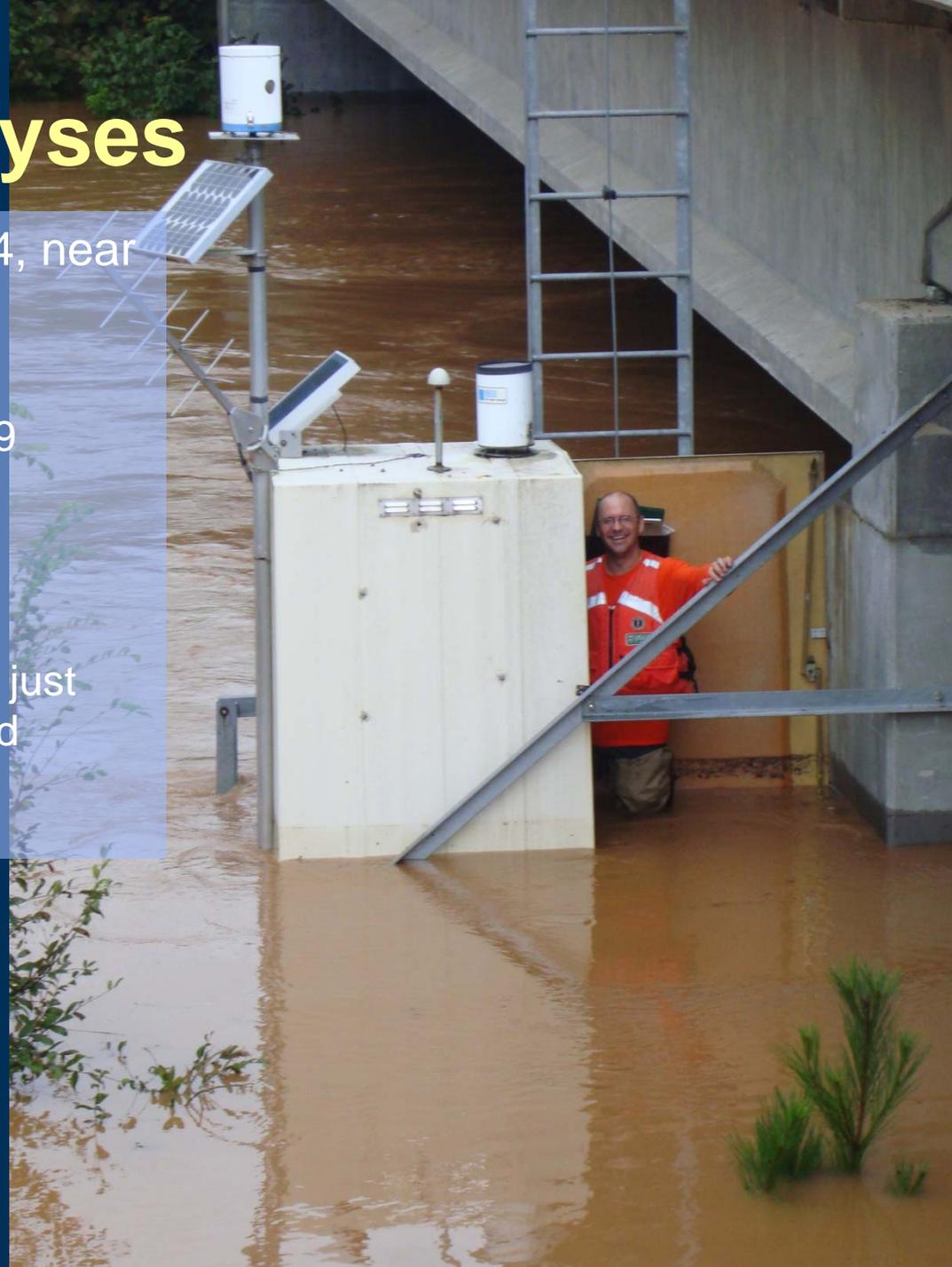
Post-Storm Analyses

02207120 Yellow River at GA 124, near
Lithonia, GA

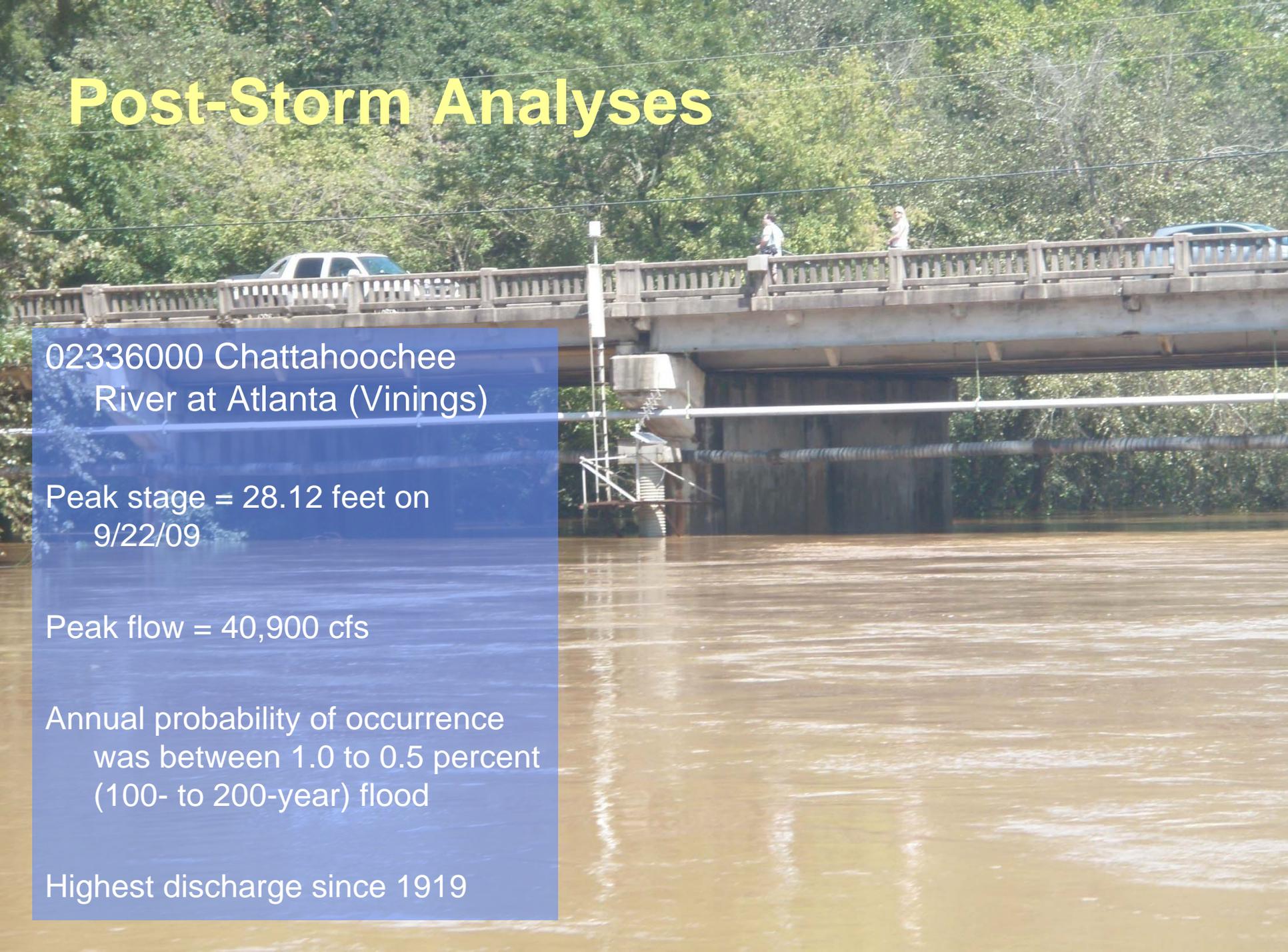
Peak stage was 27.47 feet on 9/22/09

Peak flow was 16,500 cfs

Annual probability of occurrence was just
above 1.0 percent (100-year) flood
discharge, which is 16,400 cfs



Post-Storm Analyses



02336000 Chattahoochee
River at Atlanta (Vinings)

Peak stage = 28.12 feet on
9/22/09

Peak flow = 40,900 cfs

Annual probability of occurrence
was between 1.0 to 0.5 percent
(100- to 200-year) flood

Highest discharge since 1919

Post-Storm Analyses

02337500 Snake Creek near
Whitesburg

Peak stage = 19.42 feet on 9/21/09

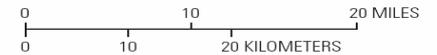
Peak flow = 13,500 cfs

Annual probability of occurrence
exceeded the 0.2 percent (500-
year) flood discharge of 11,100
cfs

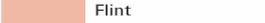
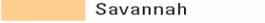
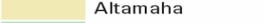
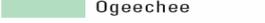




Base modified from U.S. Geological Survey
1:100,000-scale digital files

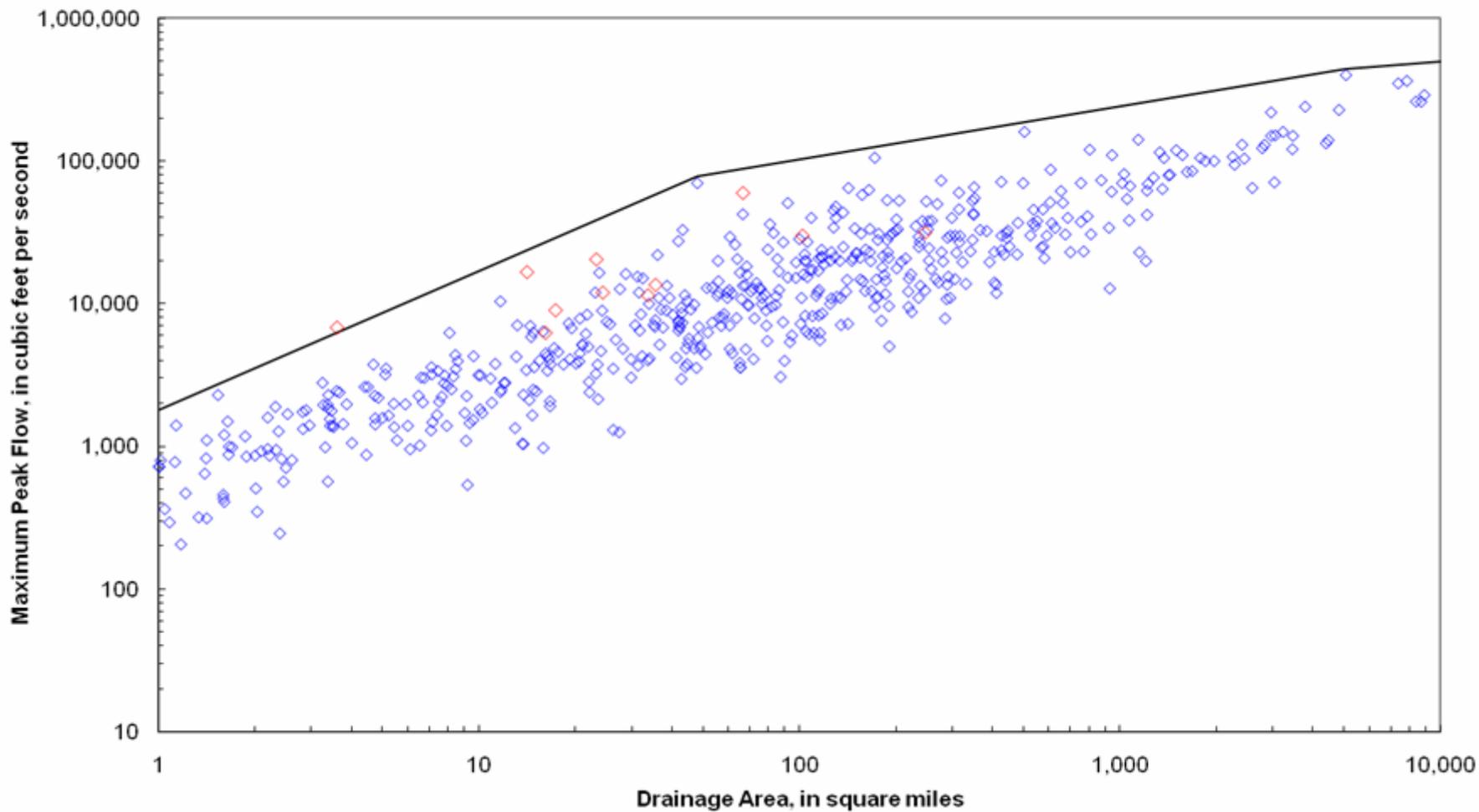


EXPLANATION

River Basin		Annual exceedance probabilities	
	Coosa–Tallapoosa		< 0.2
	Chattahoochee		0.5 to 0.2
	Flint		1 to 0.5
	Savannah		2 to 1
	Altamaha		4 to 2
	Ogeechee		10 to 4
	Ochlockonee		> 10
	Suwannee		Regulated
	Satilla–St. Marys		Unknown due to backwater
	Tennessee–Hiwassee		
	Guntersville Lake		



Maximum Peak Flow: Above Fall Line



◇ Maximum Peak Flow for GA, SC, NC — Above Fall Line Envelope Curve ◇ September 2009 peaks



Post-Storm Analyses

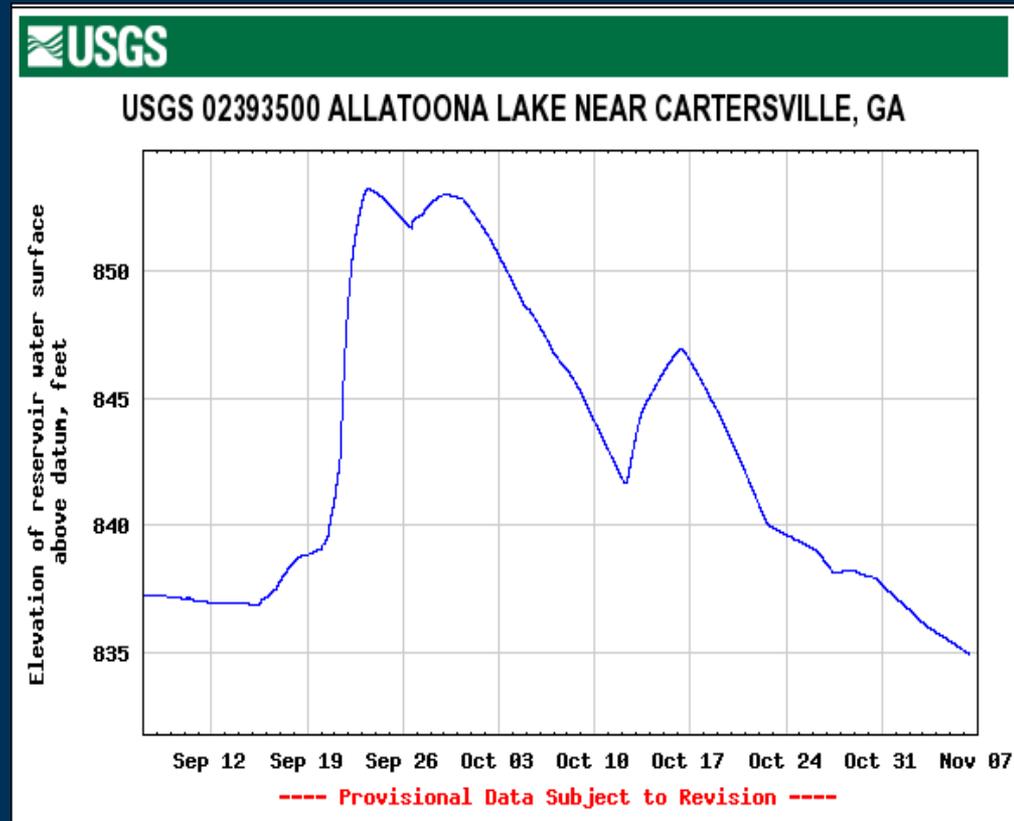
Lake Lanier

- Was just over 1064 feet
- Rose to over 1068 feet
- Full pool is 1071 feet

Lake Allatoona

- Was at 837 feet before
- Rose to 853.2 feet
- Full pool is 840.0 feet

USACE estimated that flood on Chattahoochee would have been 4 feet higher



Post-Storm Analyses

Other general items of interest (Nov. 2009):

16,981 dwellings impacted (FEMA)

3,482 businesses impacted (SBA)

10 lives lost (Georgia Medical Examiner)

\$193,403,000 total estimated damages

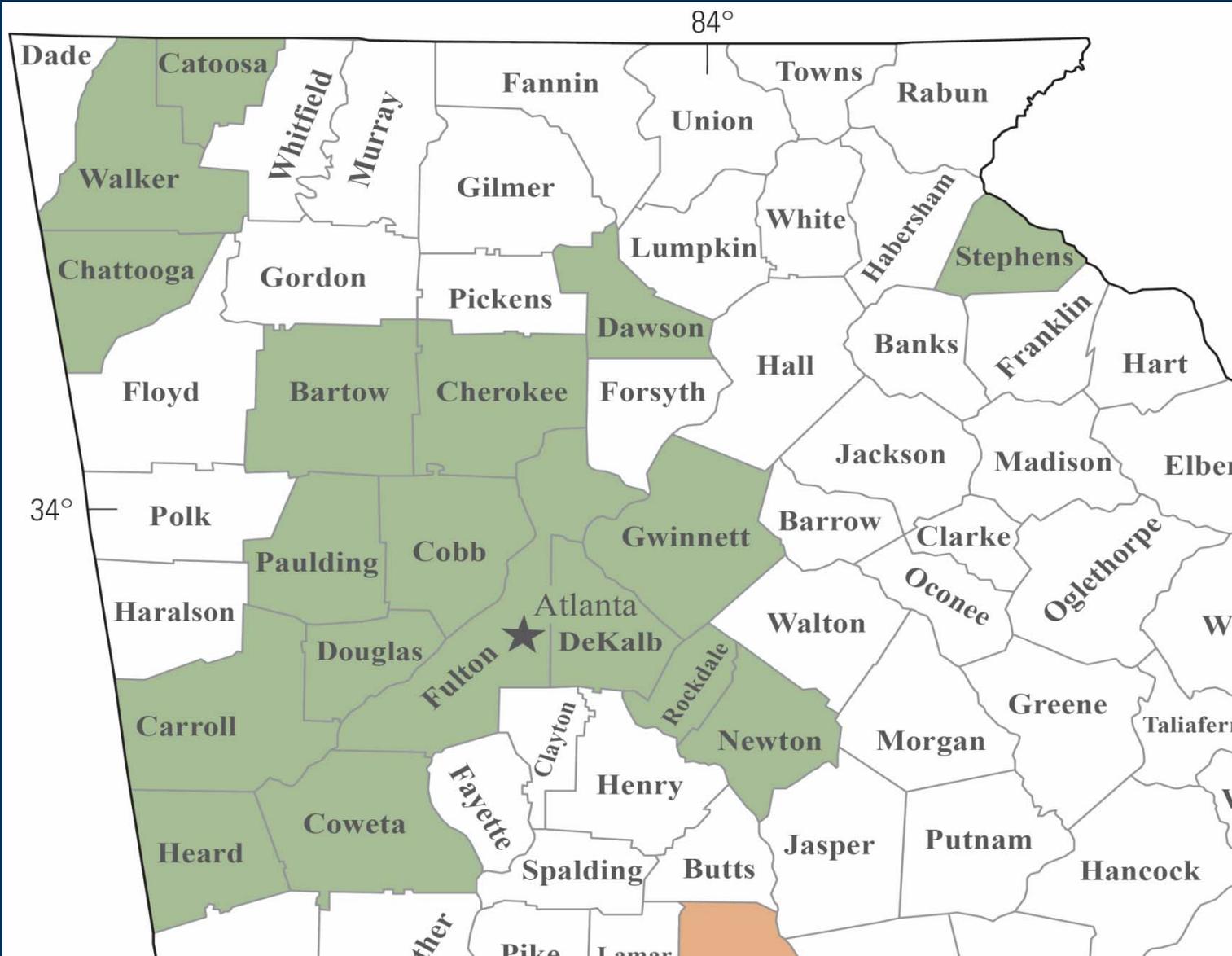
- \$50,253,000 individual assistance
- \$143,150,000 public assistance projects

Hundreds of roads & bridges damaged



Courtesy AJC





Georgia counties declared as disaster areas on September 24, 2009, under FEMA declaration 1858

Lessons Learned

Investments in Streamgaging Network paid off!

- Most gages were upgraded to HDR
- Acoustic technologies allowed for faster, safer measurement of flood
- Network is almost 3X bigger than 10 years ago—better density of gages
- Rapid Deployment Gages—Not so *rapid!*



Lessons Learned

Never bet against Mother Nature!

- **Event was a surprise**
- **Magnitude and extent was amazing**
- **No chance for preparation**
- **Flood chasing in deadlock traffic was extremely difficult**



Lessons Learned

Still a ways to go to better communicate flood threat

- **Worked well with NWS**
- **Communicated frequently with county officials**
- **Sheer magnitude of flood fight precluded communications**
- **Still some misunderstanding of how real-time data is presented**

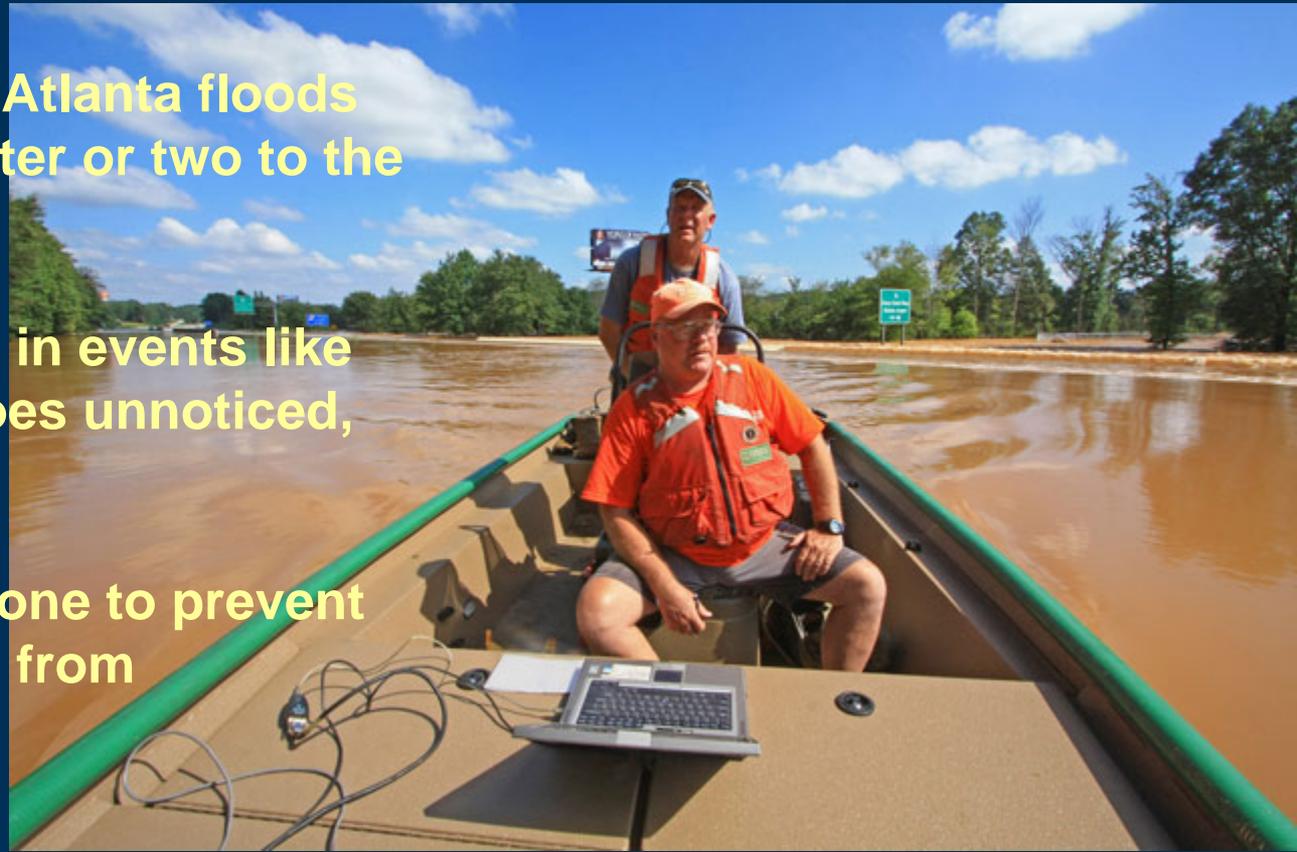


Summary

The September 2009 Atlanta floods added a new chapter or two to the record books

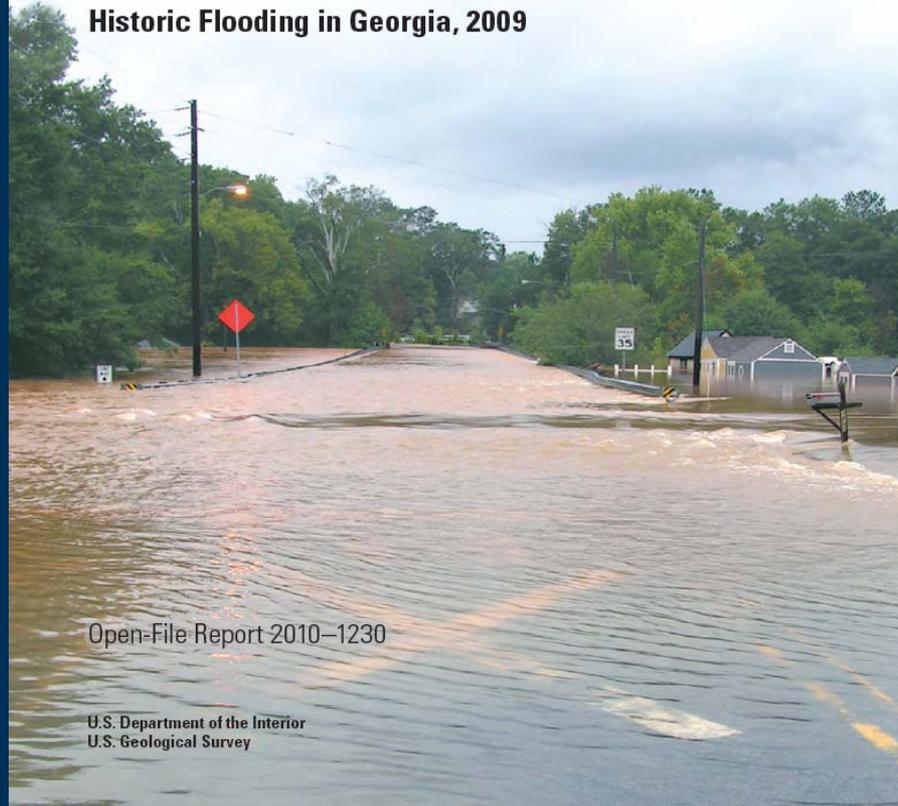
The role of the USGS in events like this sometimes goes unnoticed, but is a vital one

Not much could be done to prevent a disaster like this from happening



Prepared in cooperation with the
Georgia Department of Transportation
Preconstruction Division
Office of Bridge Design

Historic Flooding in Georgia, 2009



Open-File Report 2010-1230

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

Questions...?

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