USGS Streamgaging

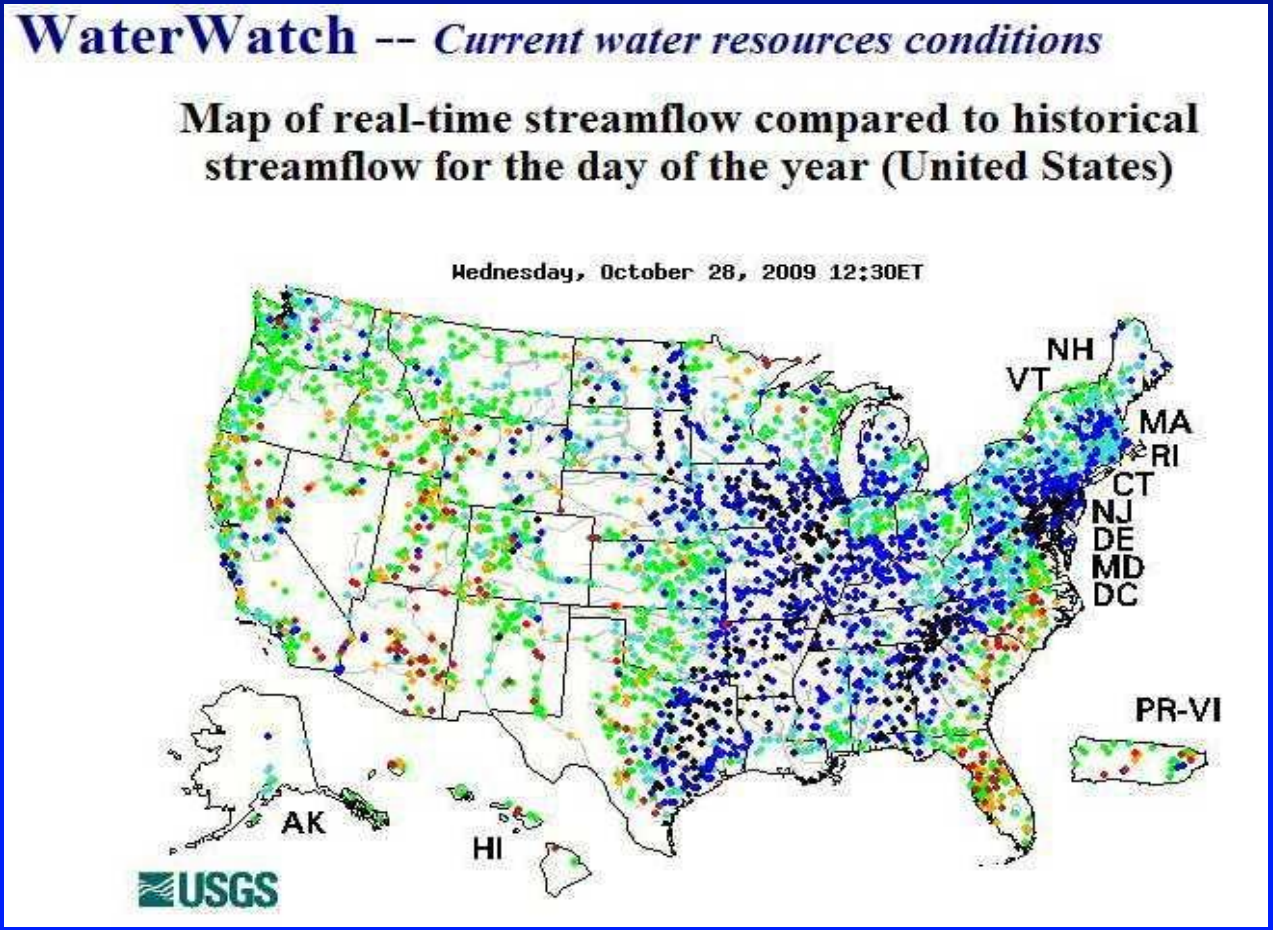
Streamgage Network

7,500 streamgages

97 % real-time

$136.6M per year

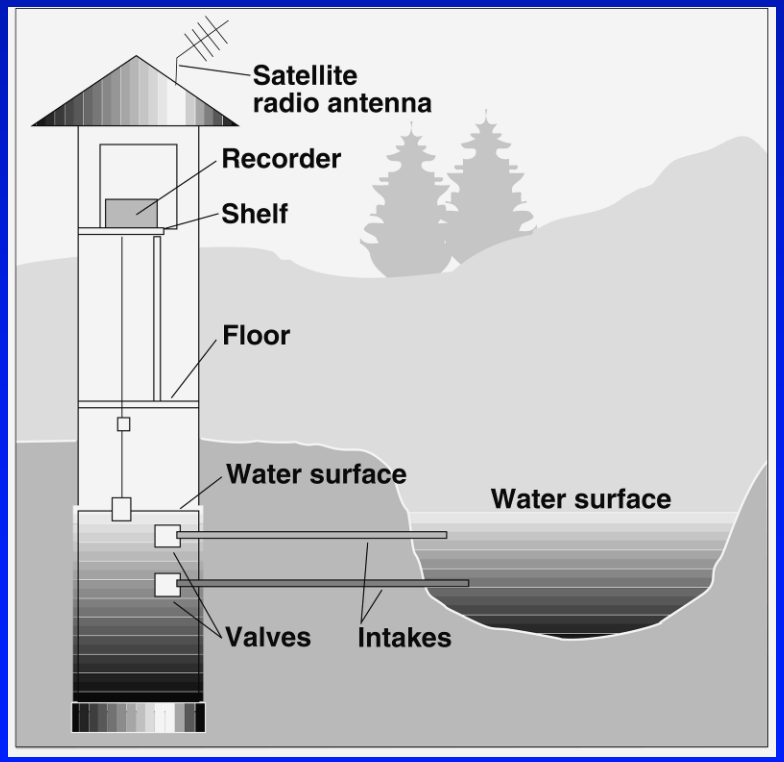
850+ Cooperators



USGS

How do we determine how much water is flowing in the rivers? (discharge)

First, we put equipment in rivers to measure the water level (stage or gage height)



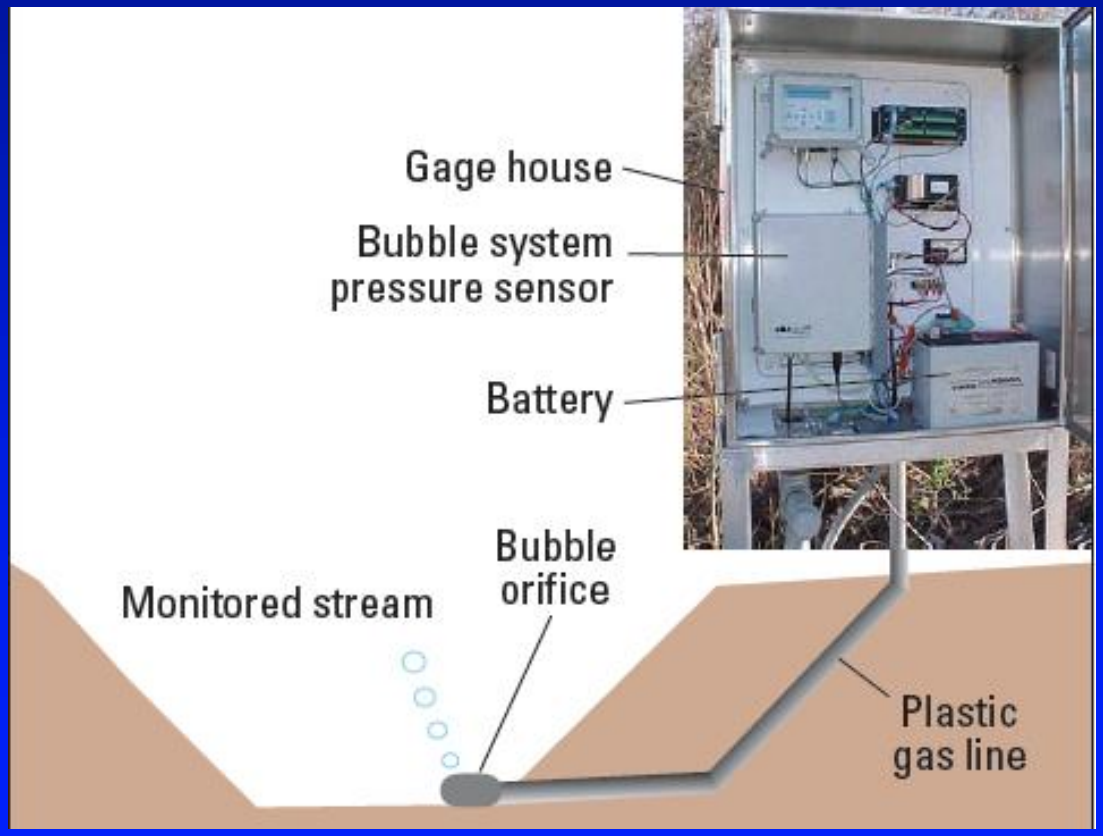
USGS

Measuring water level

Equipment – Stage sensors:

Pressure transducers

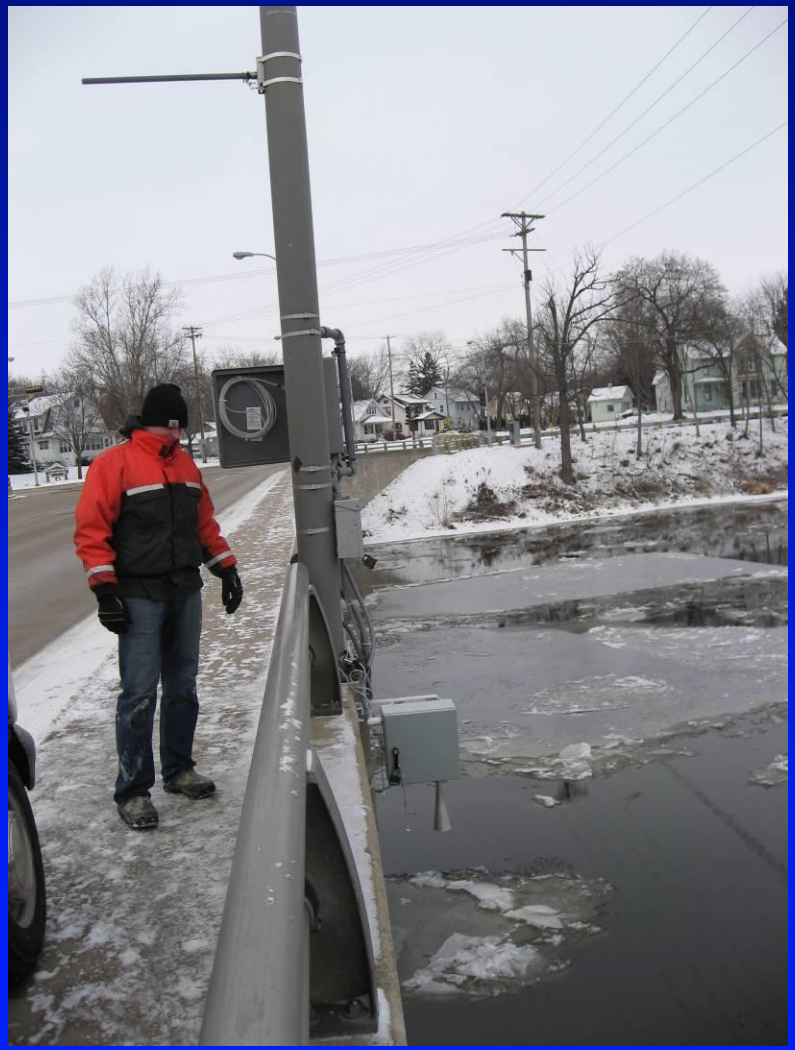
submersible & non-submersible



USGS

Measuring water level

Equipment – Stage sensors: Radar – non-contact



USGS

Retrieving the Data

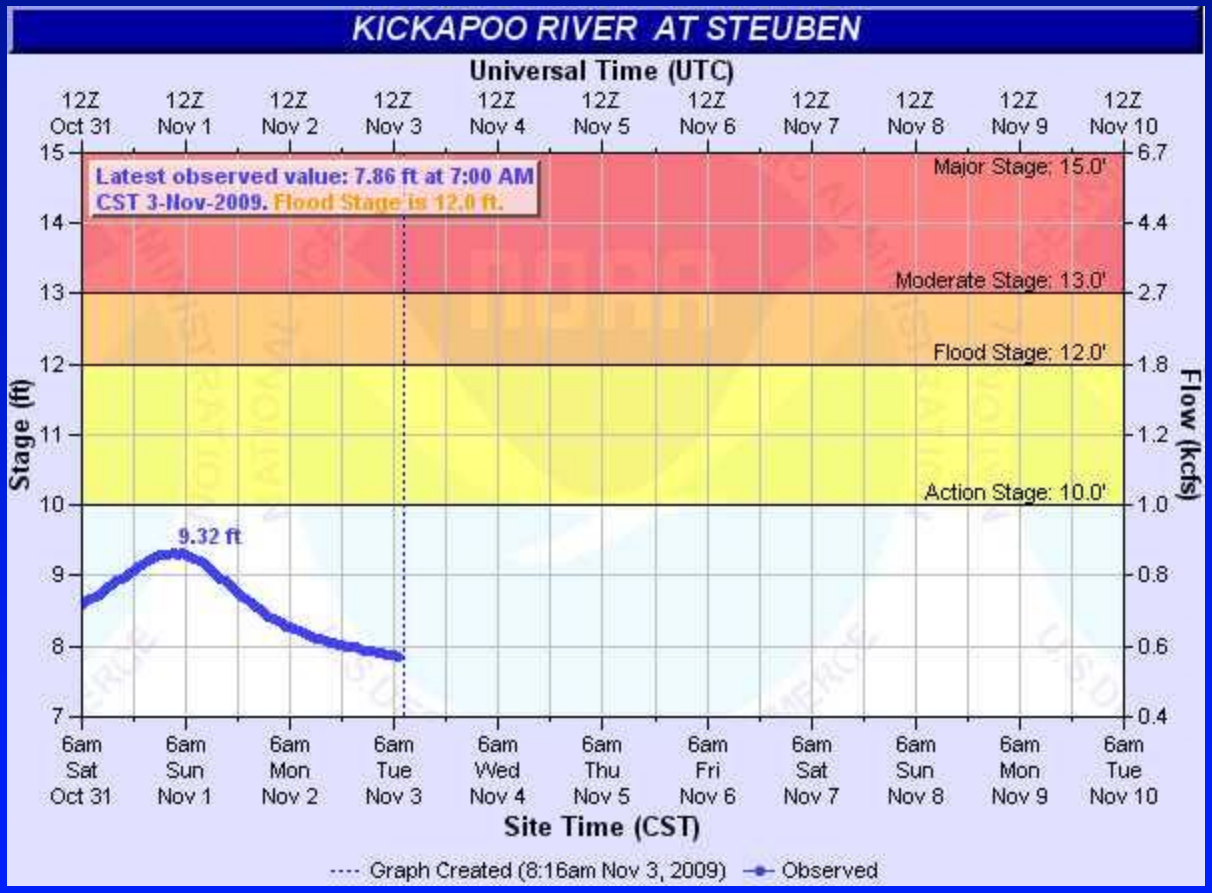
The data gets transmitted back to the office every few hours

USGS

Streamgaging

It would be pretty easy if this was all there was to it.

And with just stage data you can get the site on the NWS flood forecast page.

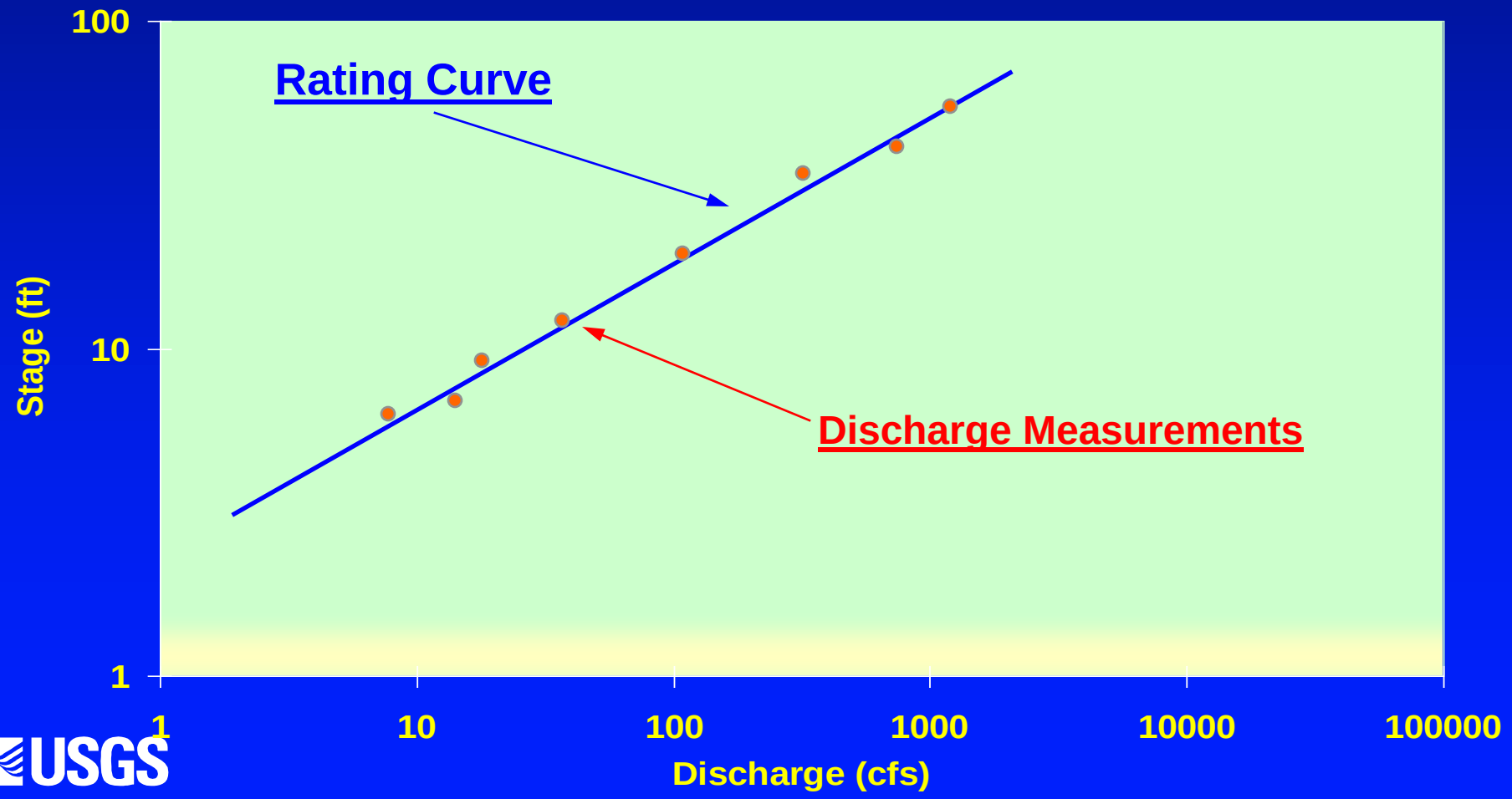


USGS

USGS generally runs *discharge* sites

We've got water level – how do we get discharge?

Use **stage-discharge ratings** to translate stage to discharge.
Discharge measurements are used to develop rating curves



USGS

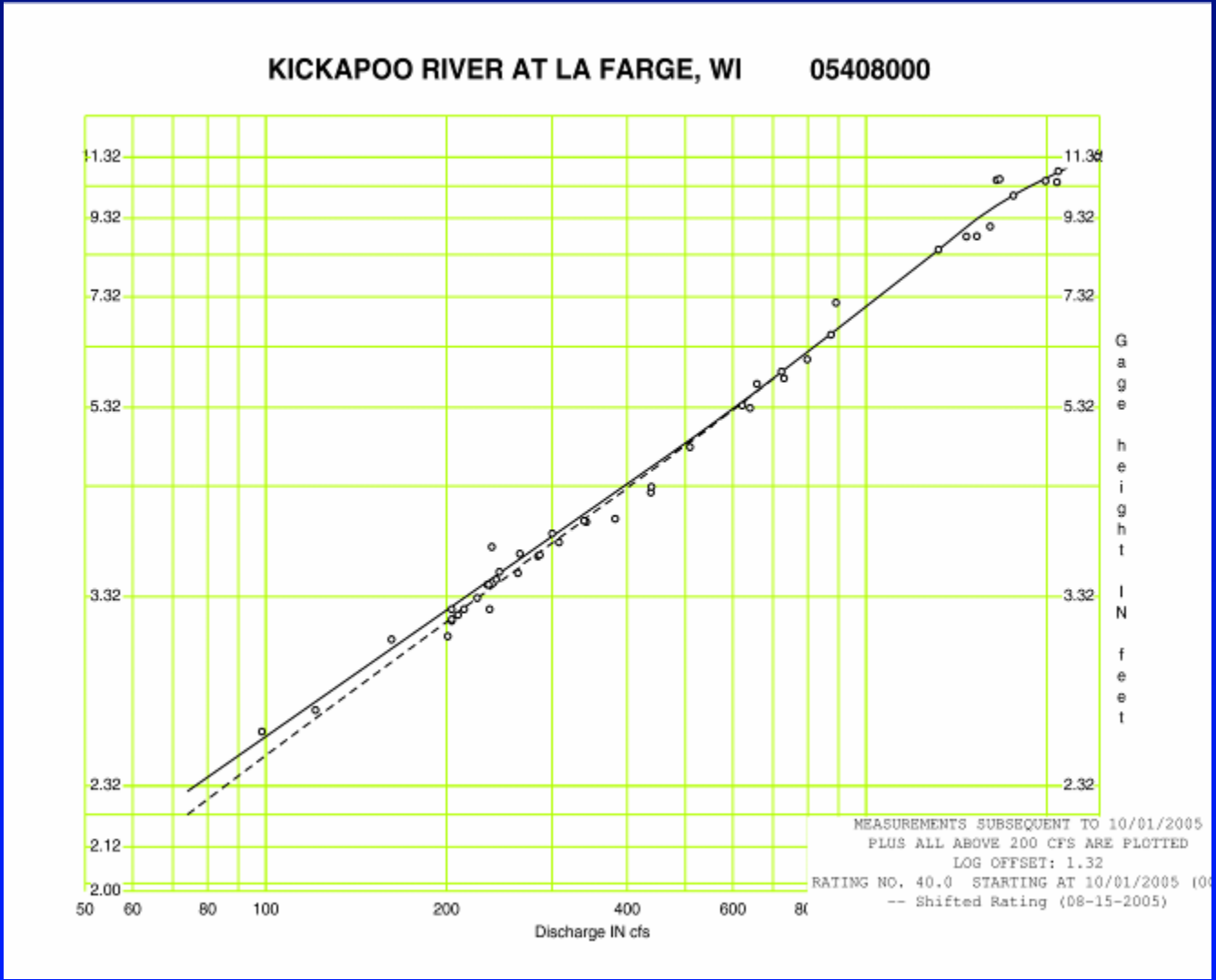
Stage-discharge rating complications

Stream channel geometry isn't constant.

-Scour & deposition

-Weed growth

This necessitates "shifts" to the rating



USGS

Discharge Measurements

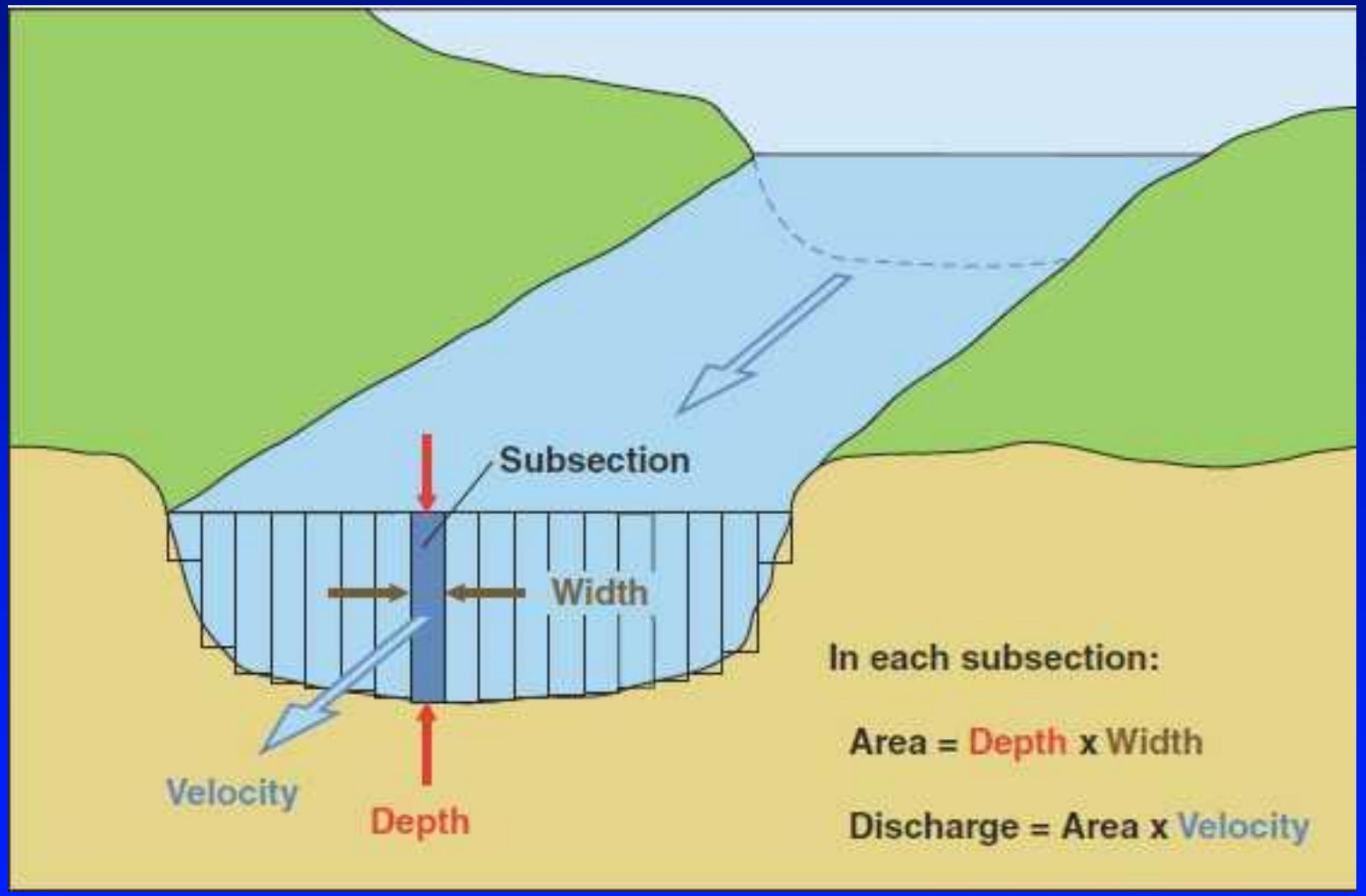
We need to physically collect measurements at the site to:

1. Develop the stage-discharge ratings
2. Verify the rating
3. Define shifts

USGS

Discharge Measurements

Discharge = Area x Velocity



USGS

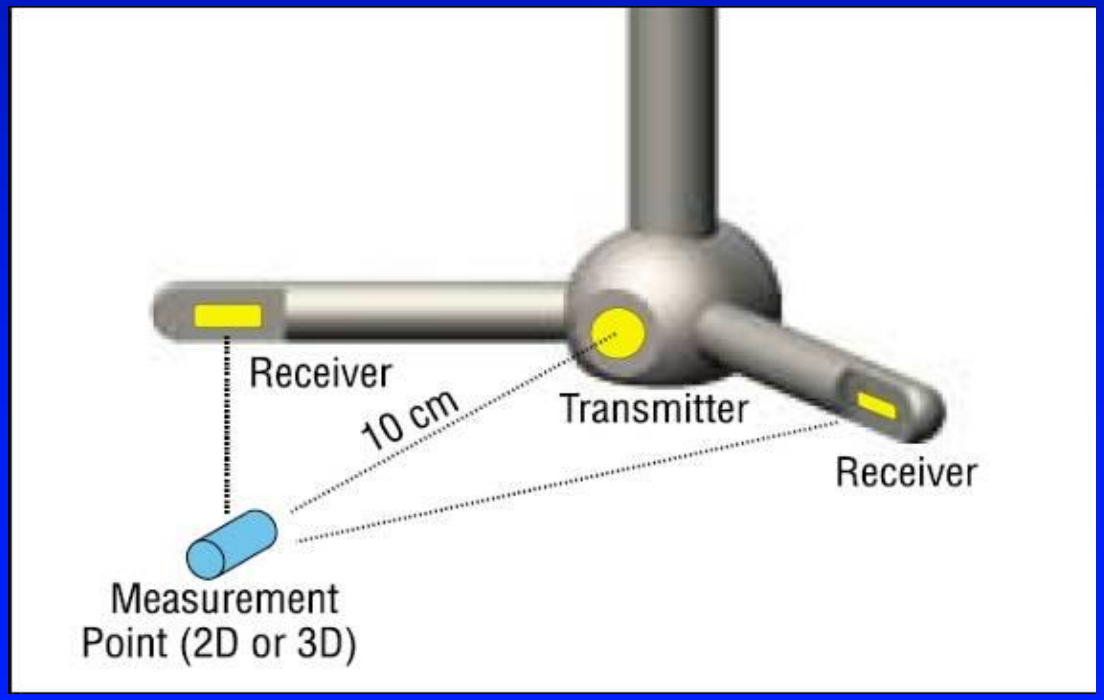
Discharge Measurements

Wading Discharge Measurement

USGS

Discharge Measurements

Wading Discharge Measurement – Velocity meters



USGS

Discharge Measurements

From a Bridge – With a Price AA

USGS

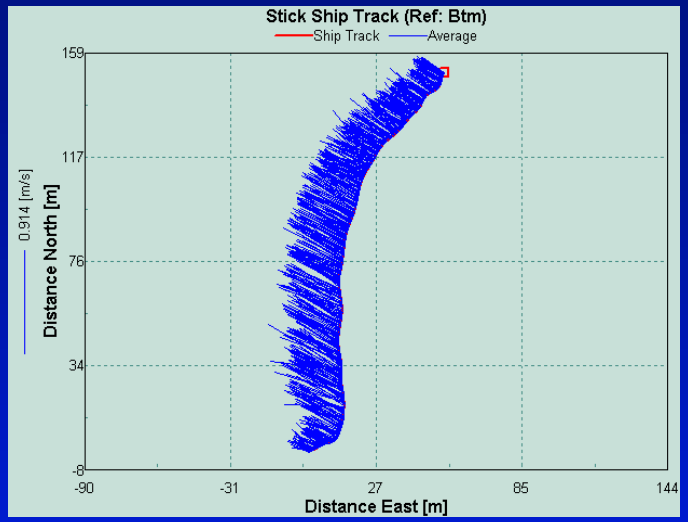
Discharge Measurements

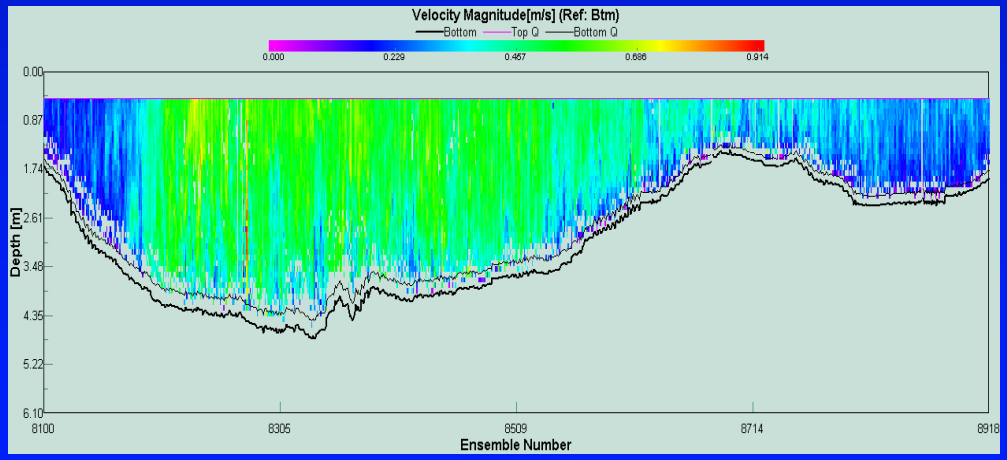
From a Bridge – With an acoustic meter

USGS

Discharge Measurements

From a boat – With an acoustic meter





USGS

Discharge Measurements

Through Ice

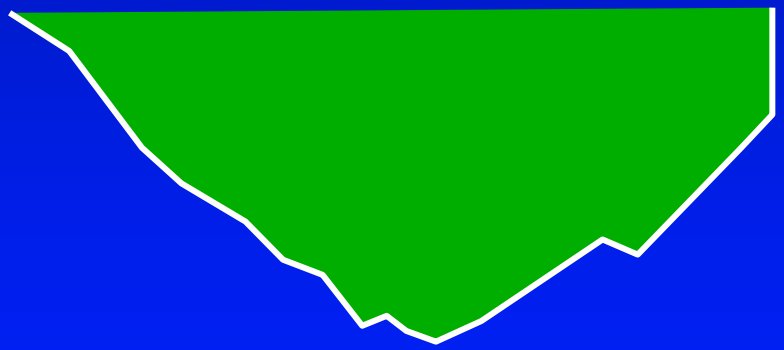
USGS

Discharge rating complications (part2)

Some sites can have several discharges for a given stage (ex sites by large bodies of water)

For these site you can use index velocity meters

Discharge = (Area of water in cross section) x (Water velocity)



x Water Velocity

Cross section area

USGS

Velocity Ratings

Backwater - affects stage-discharge relation

Velocity meters to compensate for backwater

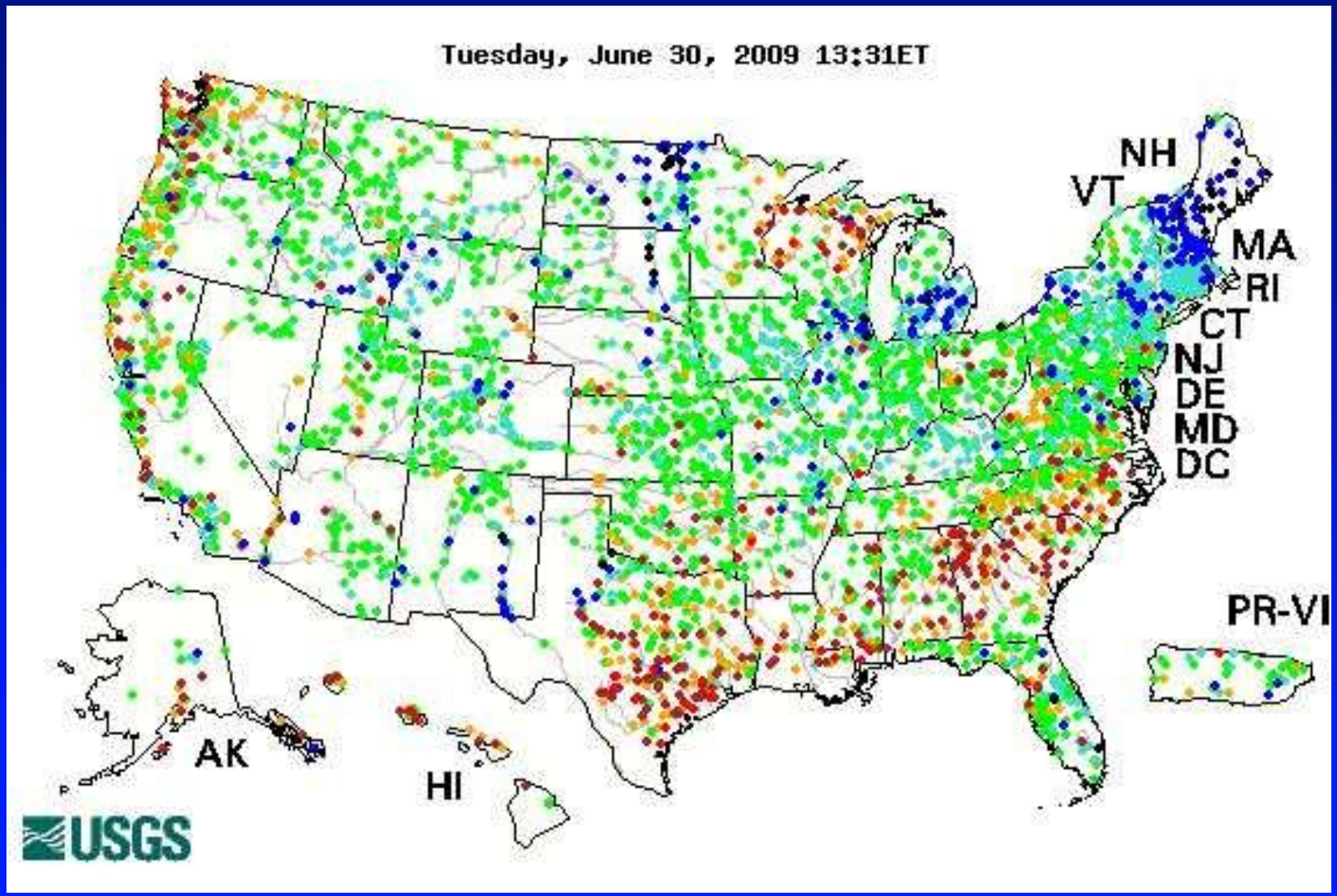
USGS

Beyond Discharge

Continuous water-quality, automatic samplers

USGS

Making the data available:
WaterWatch – our most popular product



USGS

Making the data available:

Real-time pages

USGS 05410490 KICKAPOO RIVER AT STEUBEN, WI

PROVISIONAL DATA SUBJECT TO REVISION

Available data for this site | Time-series: Real-time data | GO

LOCATION.--Lat 43°10'58", long 90°51'30", in NE 1/4 SW 1/4 sec.9, T.8 N., R.4 W., Crawford County, Hydrologic Unit 07070006, on right bank at upstream corner of town road bridge at Steuben and 18.6 mi upstream from mouth.

DRAINAGE AREA.--687 square miles.

PERIOD OF RECORD.--May 1933 to present. Prior to October 1982, all records published under station number 05410500.

REVISED RECORDS.--WSP 855: Drainage area. WSP 1438: 1933-38. WDR WI-79-1: 1978 (M).

GAGE.--Water-stage recorder and crest-stage gage. Datum of gage is 657.00 ft above sea level. May 1933 to Oct. 19, 1938, nonrecording gage at same site at datum 1.7 ft higher. Oct. 20, 1938 to September 1982, recording gage at site 1.2 mi downstream at datum 0.36 ft higher.

REMARKS.--Data-collection platform and gage-height telemeter at station.

OPERATED IN COOPERATION WITH:

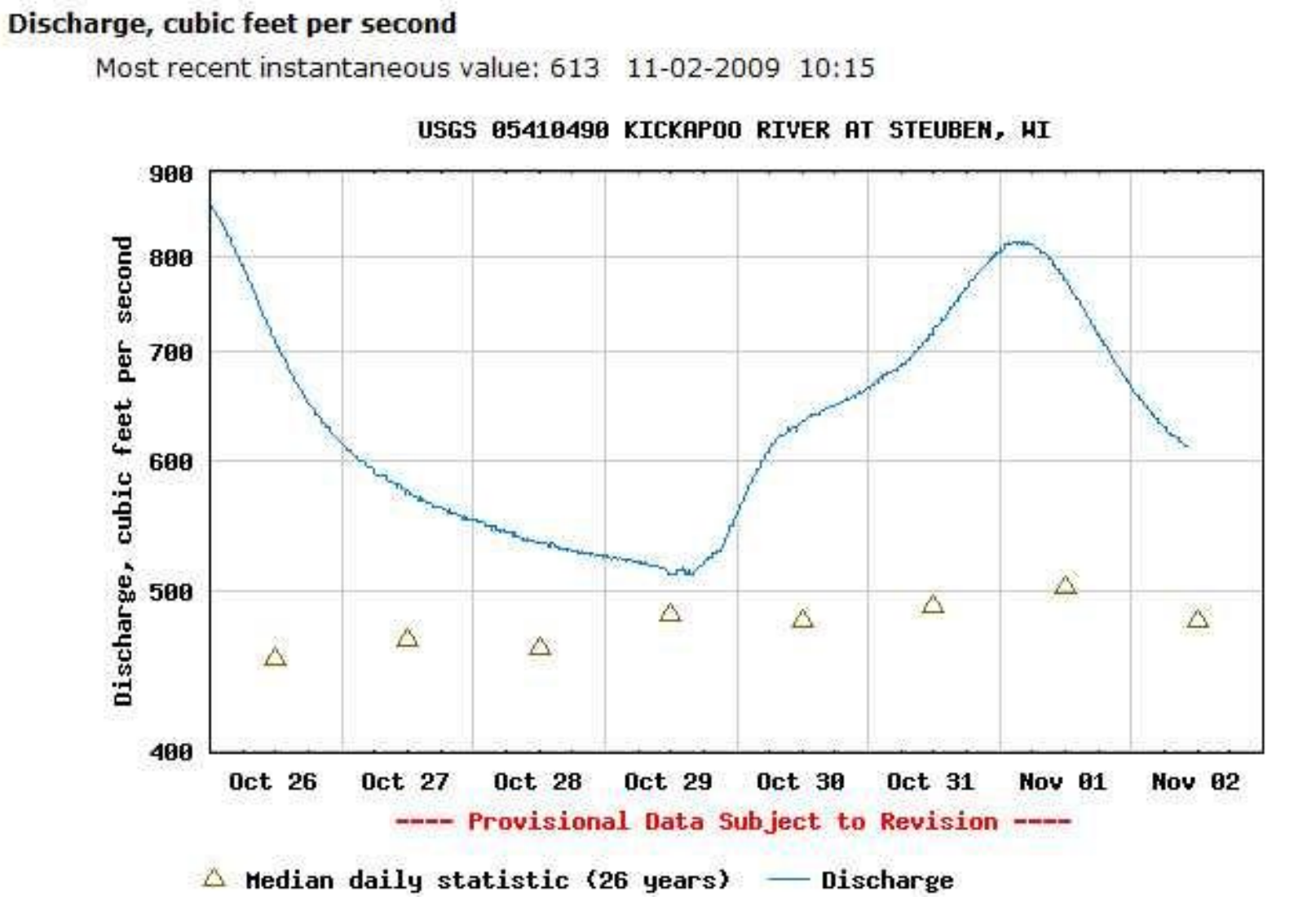
U.S. Army Corps of Engineers - St. Paul District

Additional Information:

National Weather Service Flood Forecast Page

USGS

Making the data available:
Real-time pages

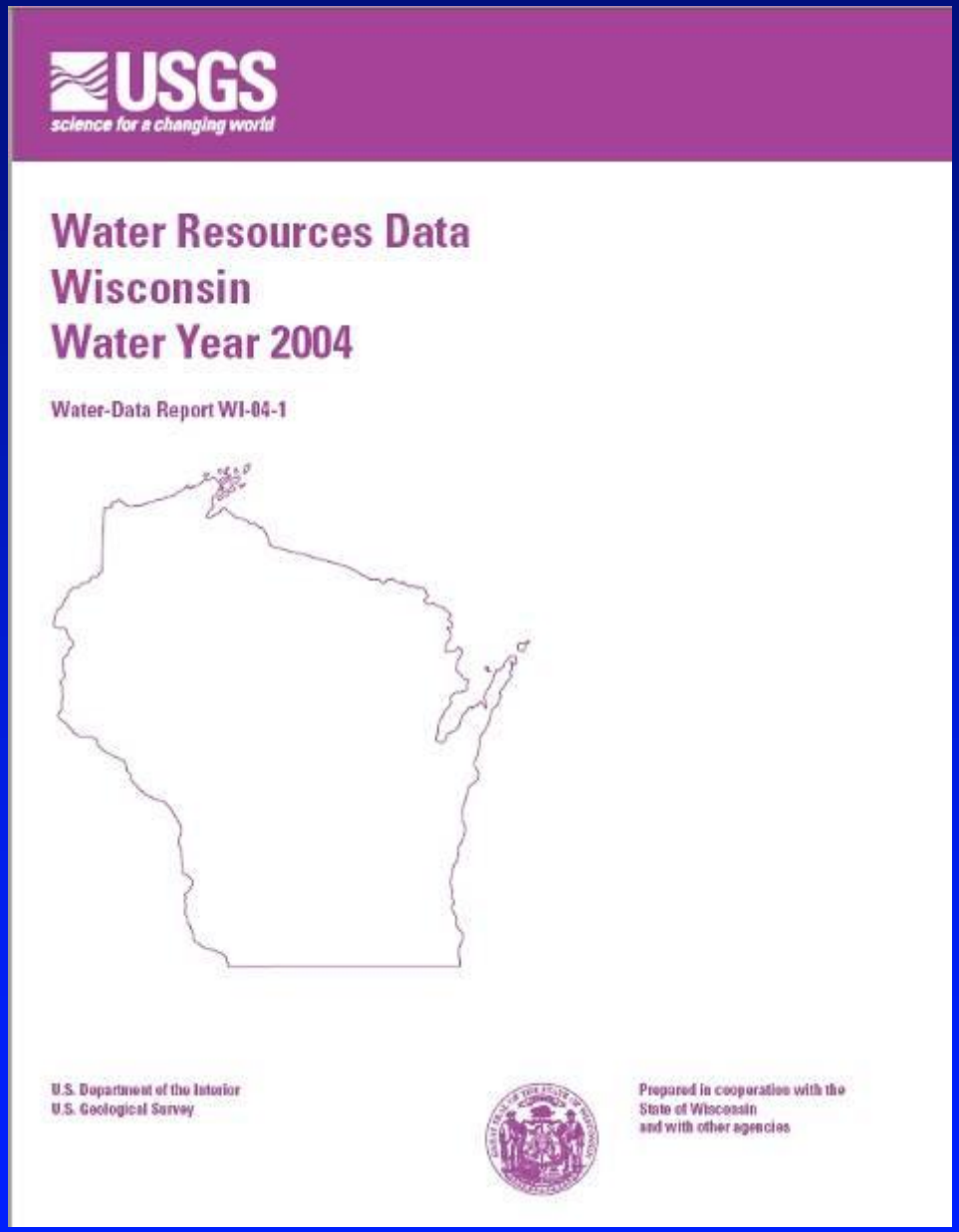


USGS

USGS Streamgage Data

The finalized data is published in our annual water data report available via the web.

The data is archived ‘forever’ Don’t trivialize this.

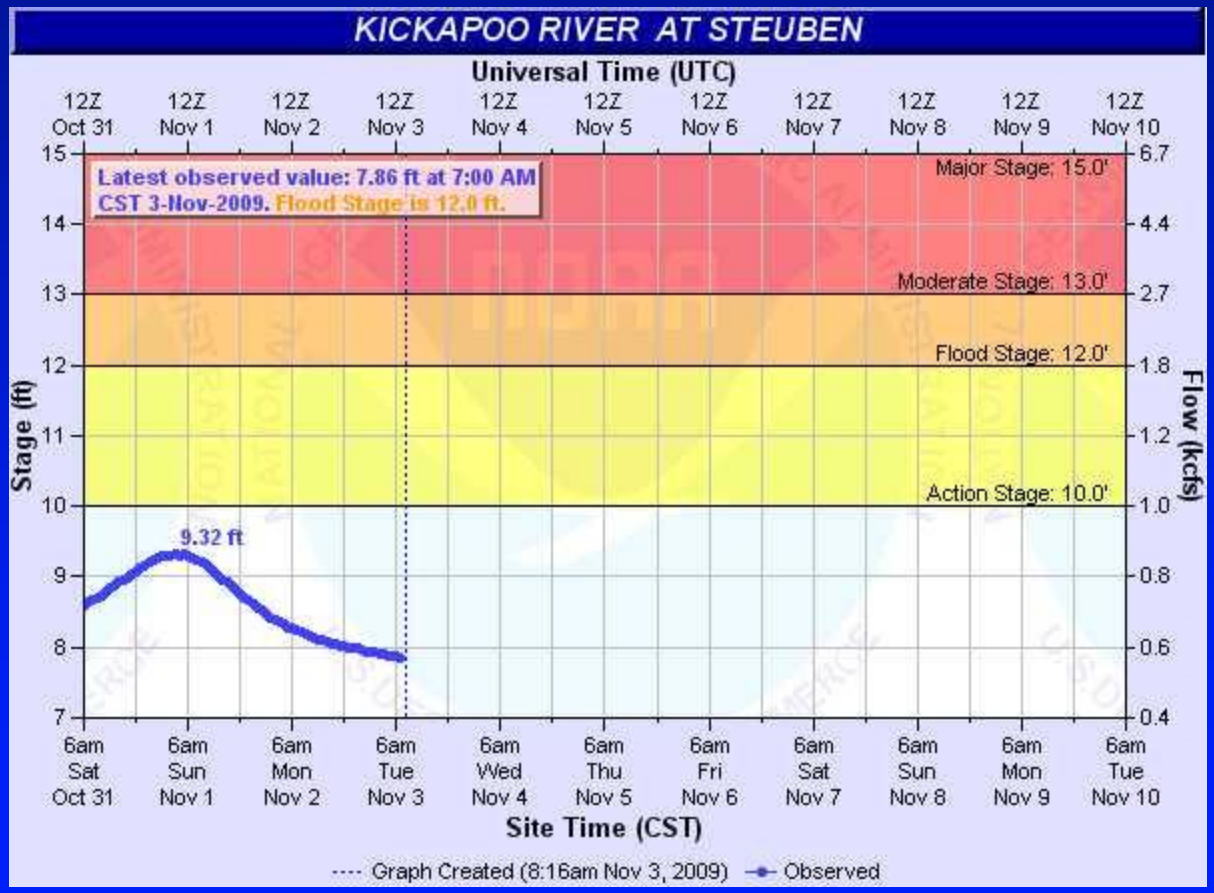


USGS

If discharge is so much more work why not just stick with stage-only?

Discharge data is much more versatile!

Stage data is useful for flood forecasting but discharge is useful for so much more.



USGS

Some uses of Streamflow data

Flood Frequency Statistics - Streamflow data is used to determine flood recurrence intervals like the 100 yr flood (or the 1% chance flood).

Flood frequency statistics are used for LOTS of things

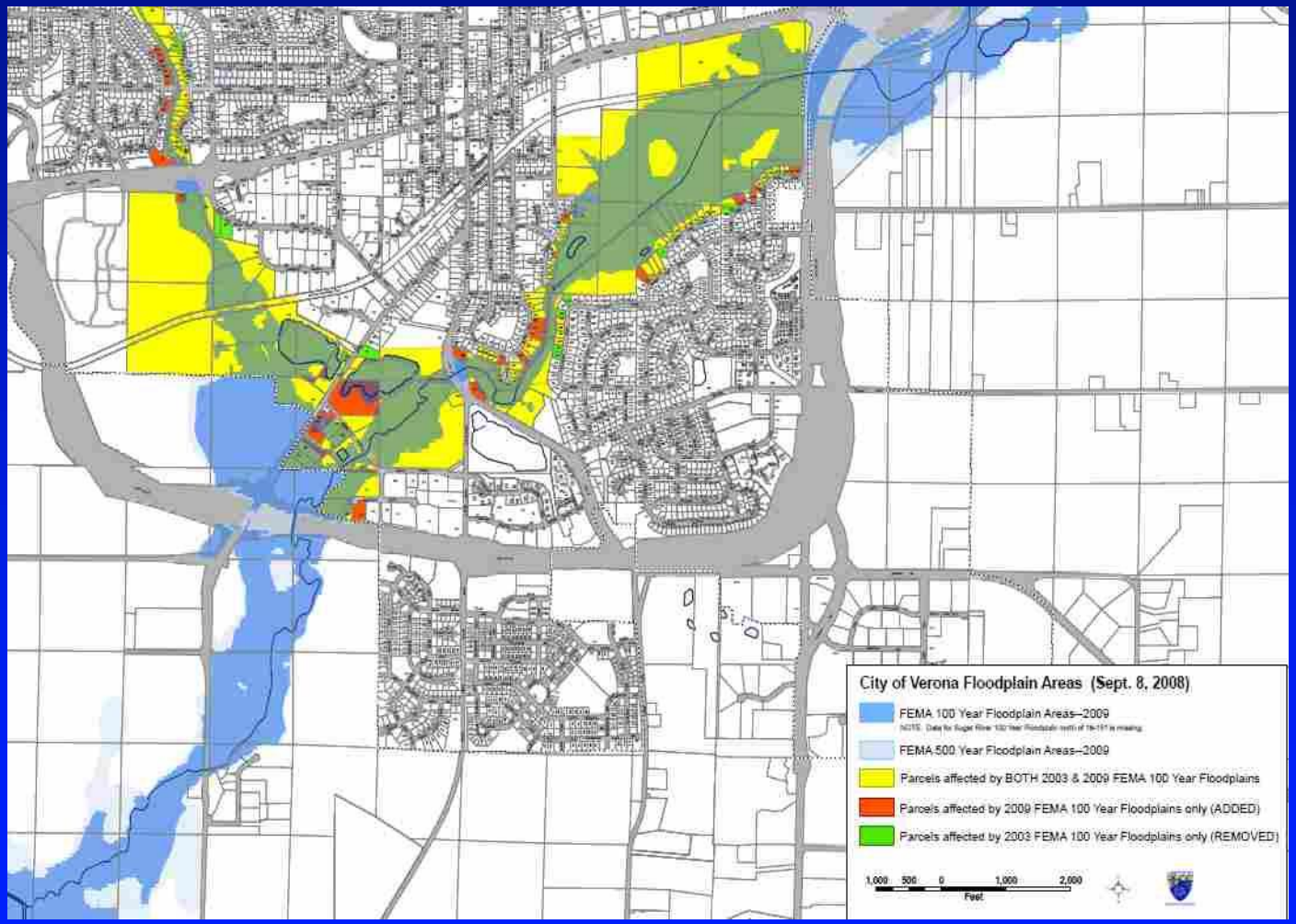
Can't do this with stage only!

USGS

Some uses of Streamflow data

Flood Frequency Statistics - are used for:

Floodplain delineation



Again, these are based on <u>discharge</u>

USGS

Some uses of Streamflow data

Flood Frequency Statistics - are used for:

Highway Bridge Design- Many highway bridges are designed for a 50- or 100-year flood. Stream data assist in design decisions by providing the data needed to develop a design flood. A design flood that is too small could lead to water to back-up and road inundation or even bridge failure. Too large a design flood can lead to designs that are wasteful and require the highway being placed higher than needed.

Based on discharge

USGS

Some uses of Streamflow data

Water Supply – for daily operational decisions for dealing with water requirements for **municipal**, **industrial**, and **agricultural** purposes, as well as demands for **hydroelectric** power generation and space for flood control in **reservoirs**.

Discharge is used for these!

USGS

Some uses of Streamflow data

Low-flow Frequency Statistics

Wastewater Treatment Plant Design & Operation

These facilities need to have estimates of streamflows to allow for the proper dilution of treated wastewater releases.

Again, discharge is required for these

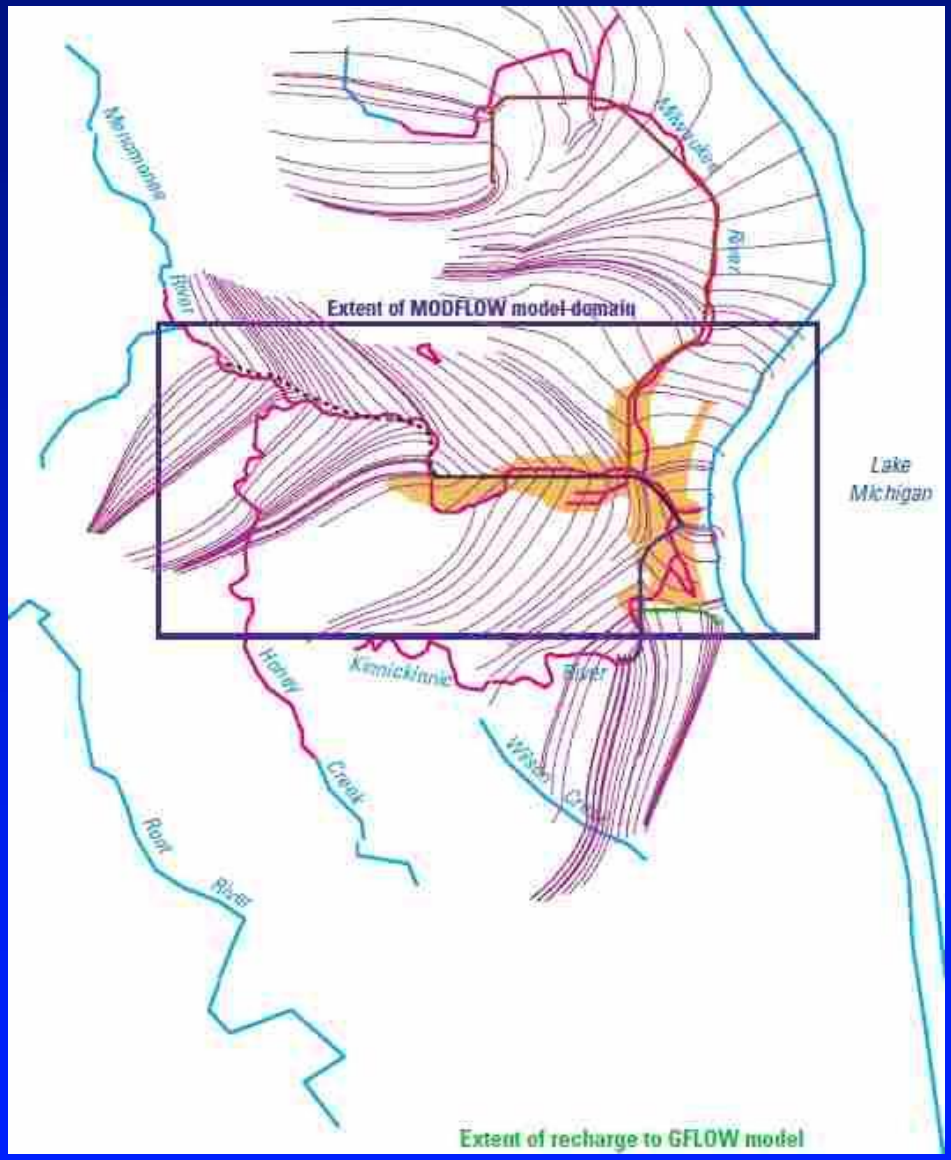
USGS

Some uses of Streamflow data

Groundwater Model Calibration

When groundwater models are developed quite often streamflow data is used as a calibration point.

They use <u>discharge</u> for this



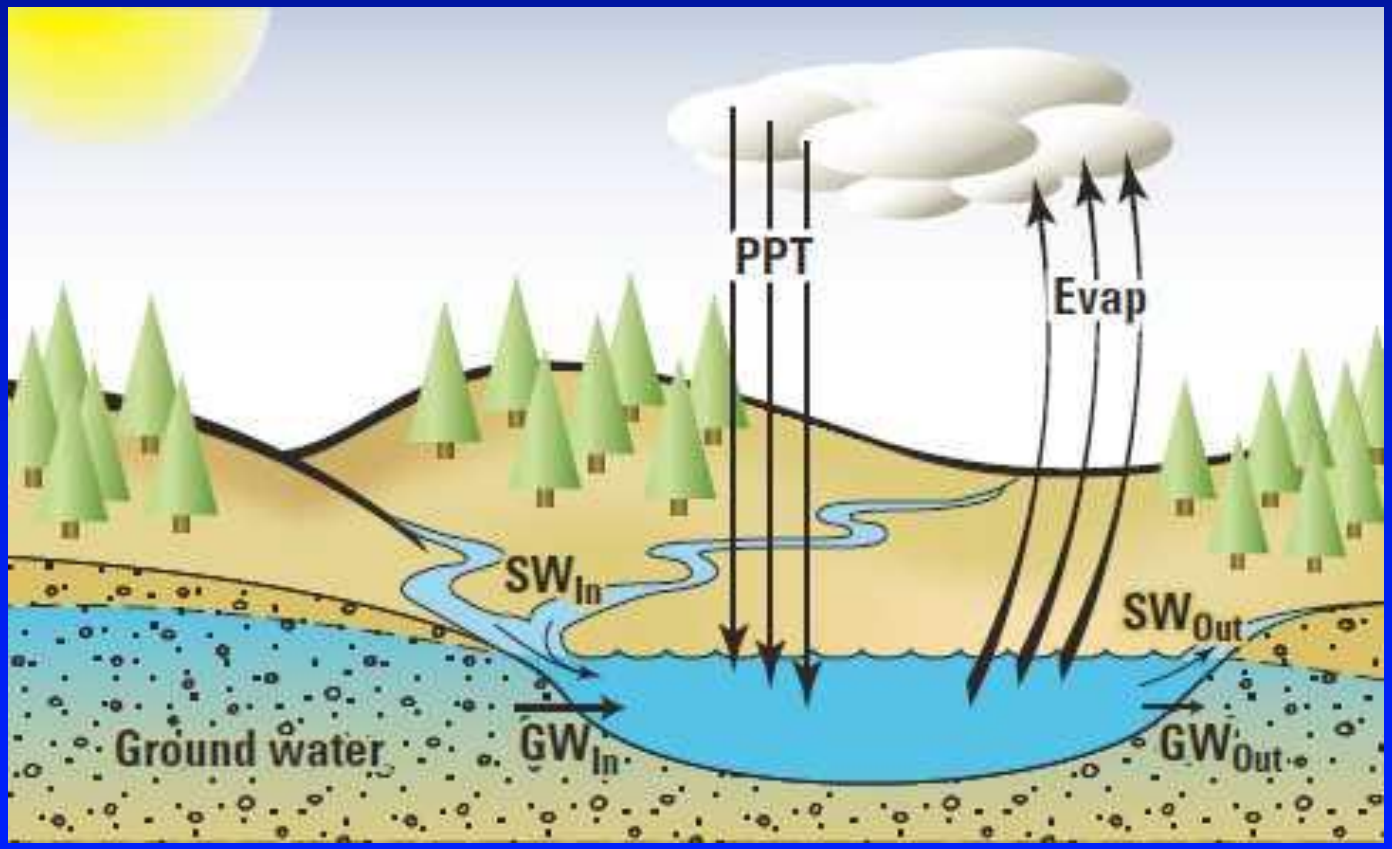
USGS

Some uses of Streamflow data

Water & Nutrient Budgets:

Lakes, wetlands, aquifers….

Need <u>discharge</u> for this



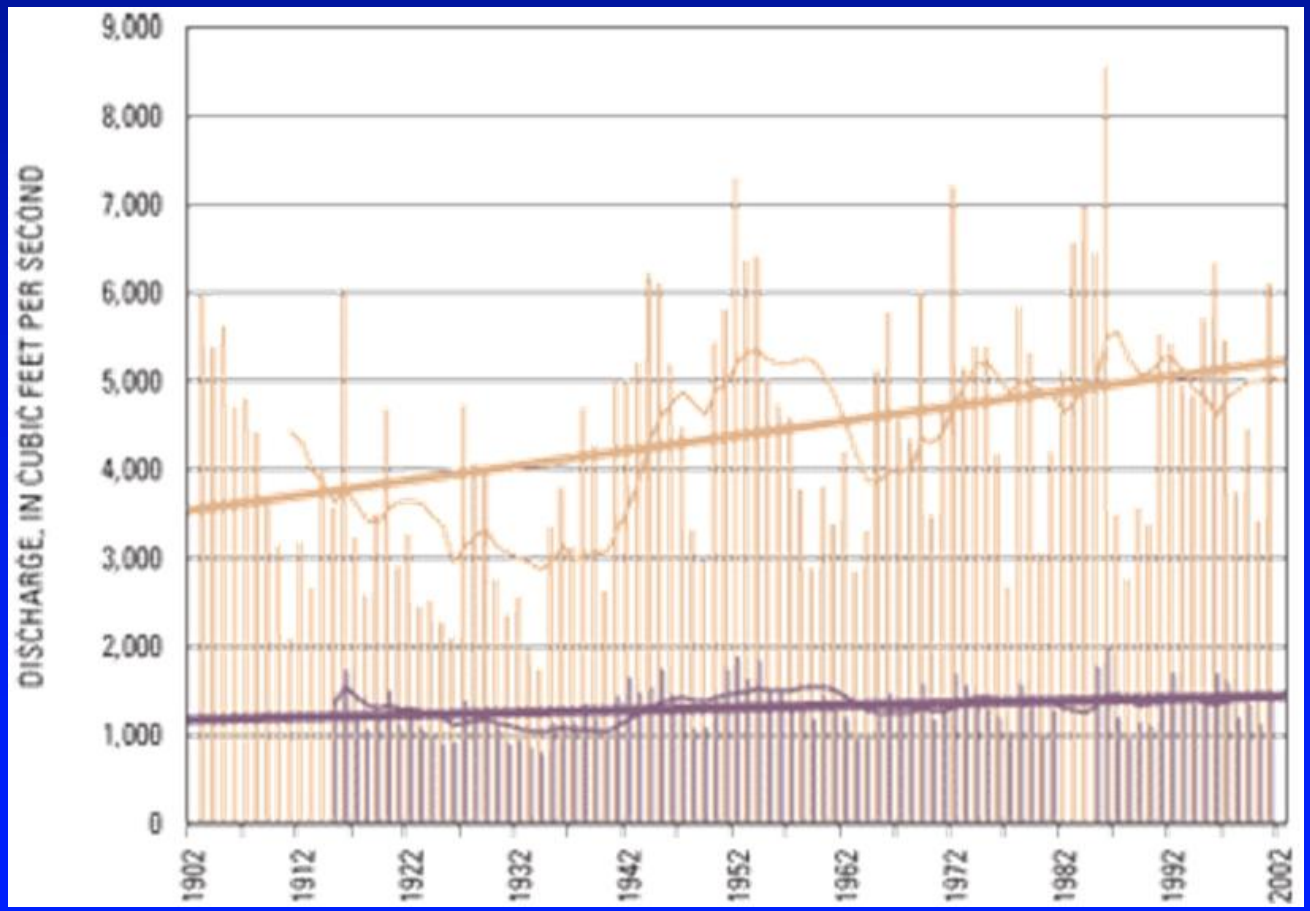
USGS

Some uses of Streamflow data

Trend Analyses:

If you build a new bridge or change the channel that's going to affect the stage but not the flow

Need <u>discharge</u> for this



USGS

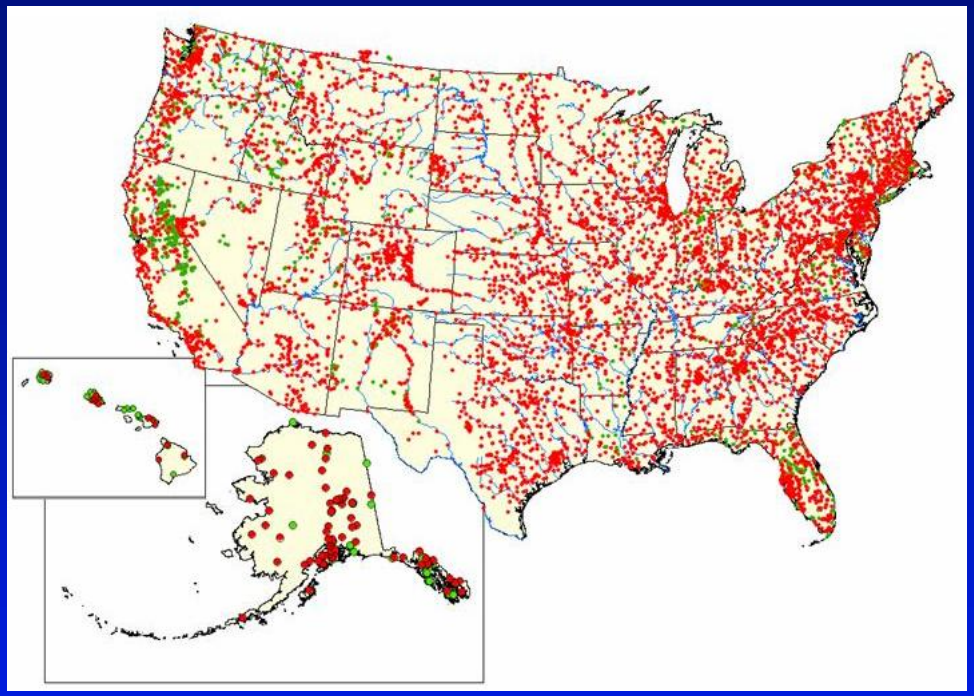
Some uses of Streamflow data

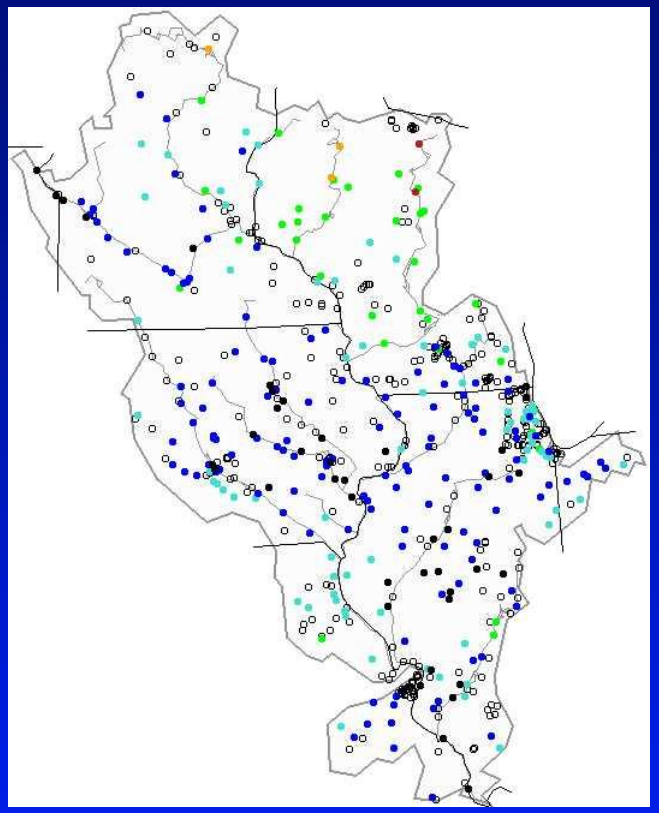
Recreation

Information about how high or low the water in a stream is or how fast the water is flowing is an important factor in recreation activities. Such information benefits countless outdoor enthusiasts, from canoeists and whitewater rafters, to fisherman and swimmers. **Stage is probably useful but discharge is better.**

USGS

How are USGS streamgages funded?





Funding Sources (2008)

State / Local agencies ($63.8M)	46%
Other Federal agencies ($28.5M)	21%
USGS Cooperative Water Program ($24.2M)	18%
USGS NSIP ($20.1M)	15%

USGS

GAO

Report to the Chairman, Subcommittee on Water Resources and Environment, Committee on Transportation and Infrastructure, House of Representatives

June 2004

WATERSHED MANAGEMENT

Better Coordination of Data Collection Efforts Needed to Support Key Decisions

Water Quantity Data Are Limited, but Efforts to Collect Them Are Generally Well-Coordinated

Numerous federal and state officials cited an overall lack of water quantity data as a major concern. Nonetheless, broad consensus emerged among the federal and state officials GAO interviewed that where water quantity data are being collected, coordination has been comparatively successful.

USGS

USGS Contacts

Iowa – Greg Nalley, 319-358-3630
gmnalley@usgs.gov

Illinois – Gary Johnson, 217-328-9720
gjohnson@usgs.gov

Minnesota – Jim Fallon, 763-783-3255
jfallon@usgs.gov

Wisconsin – Rob Waschbusch, 608-821-3868
rjwaschb@usgs.gov

USGS

Other USGS Capabilities

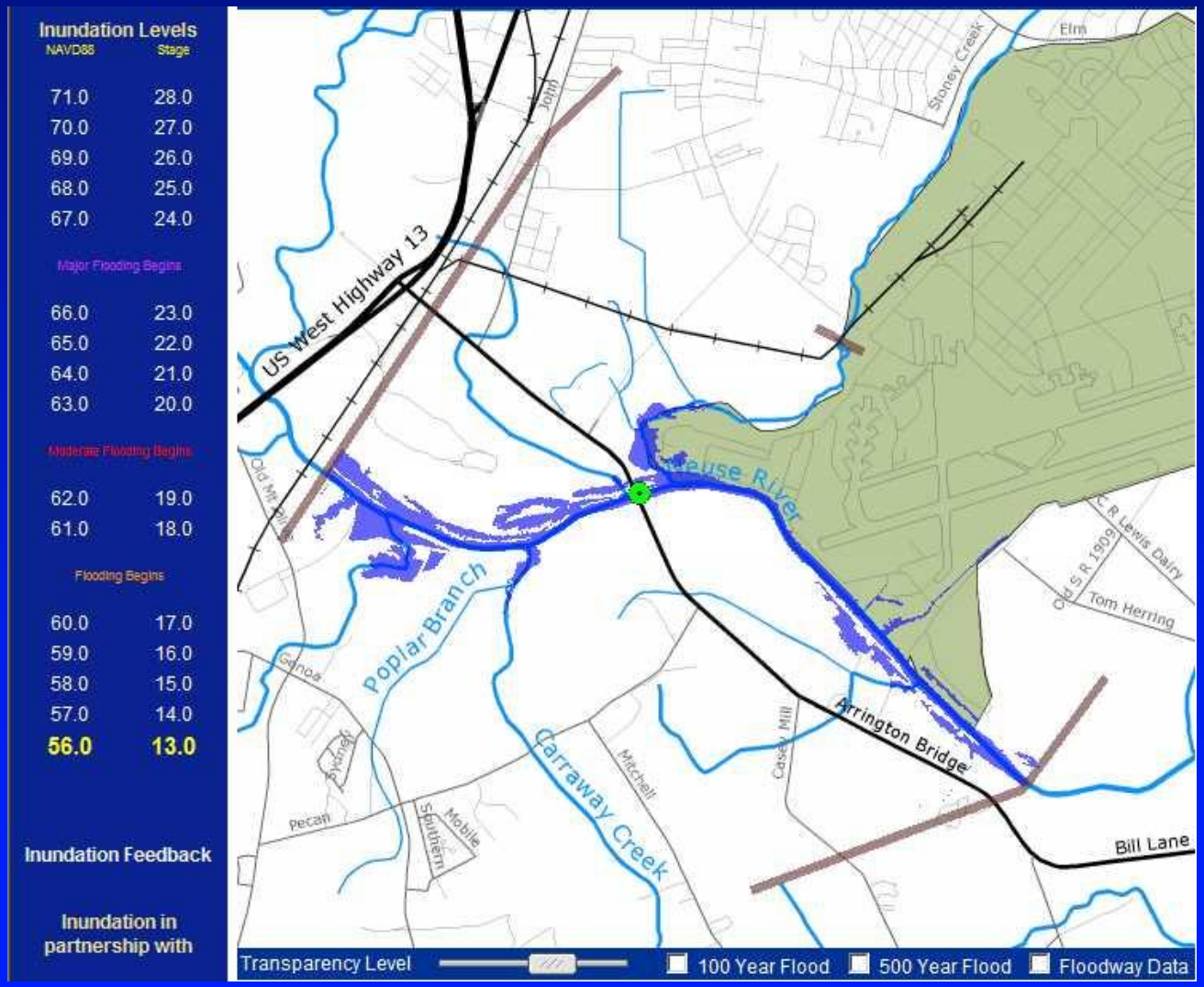
Inundation Mapping:

Some USGS offices have done this. In WI we haven't but they tell me we're primed and ready to go. The pieces are in place to be fairly efficient at it.

USGS

Other USGS Capabilities

Inundation Mapping: demo



USGS

Other USGS Capabilities

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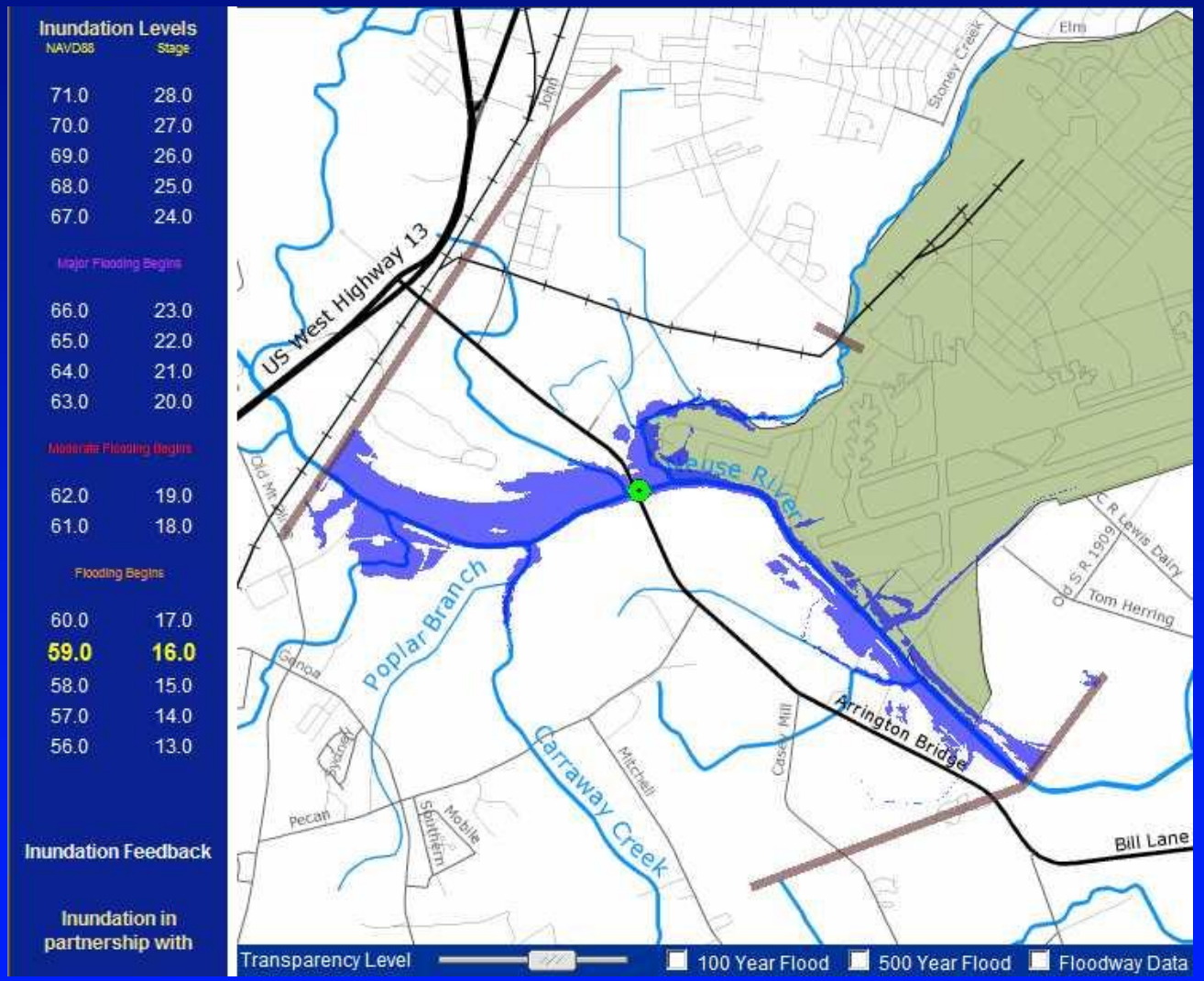
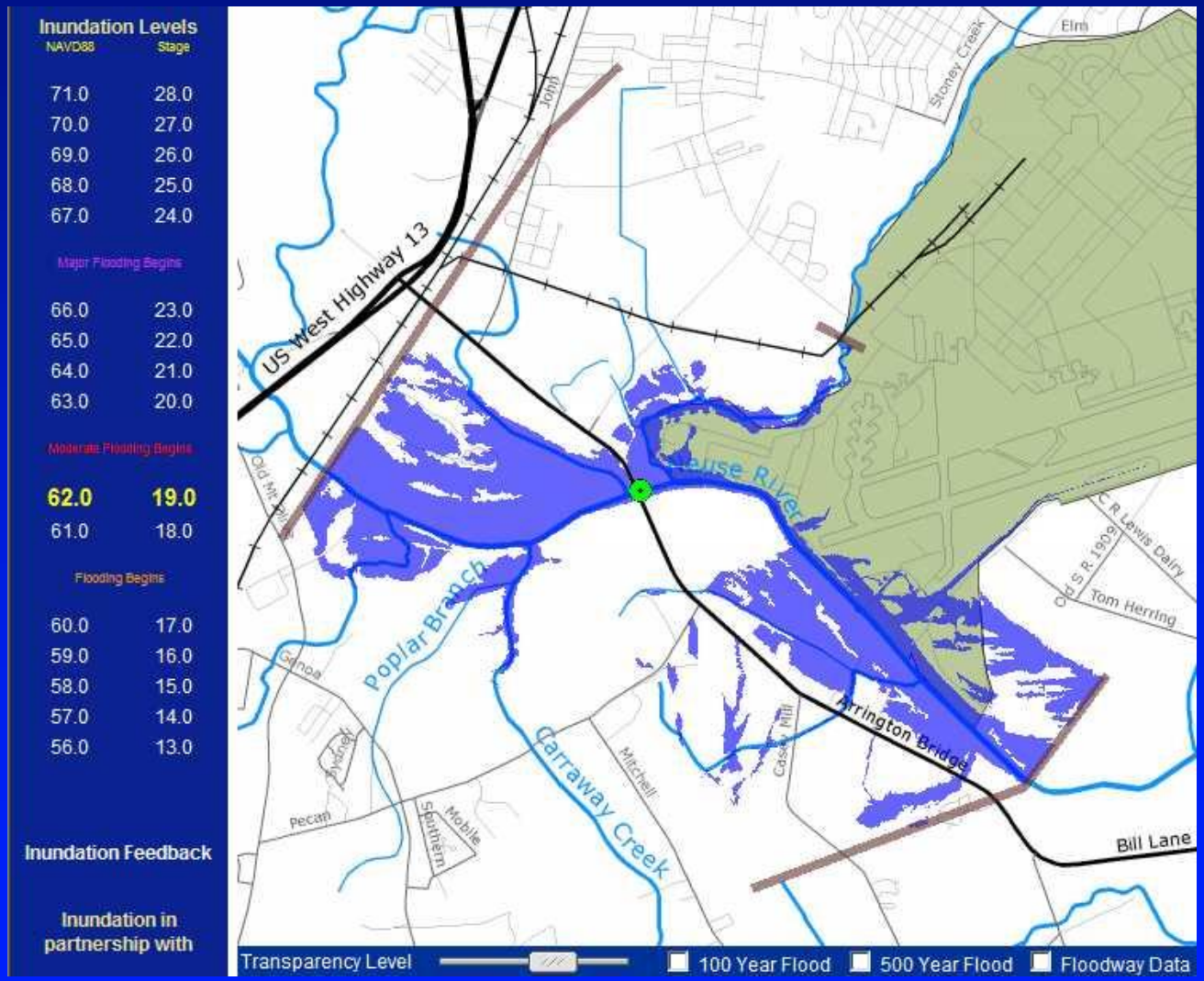


USGS

Other USGS Capabilities

Inundation Mapping: demo



USGS

Other USGS Capabilities

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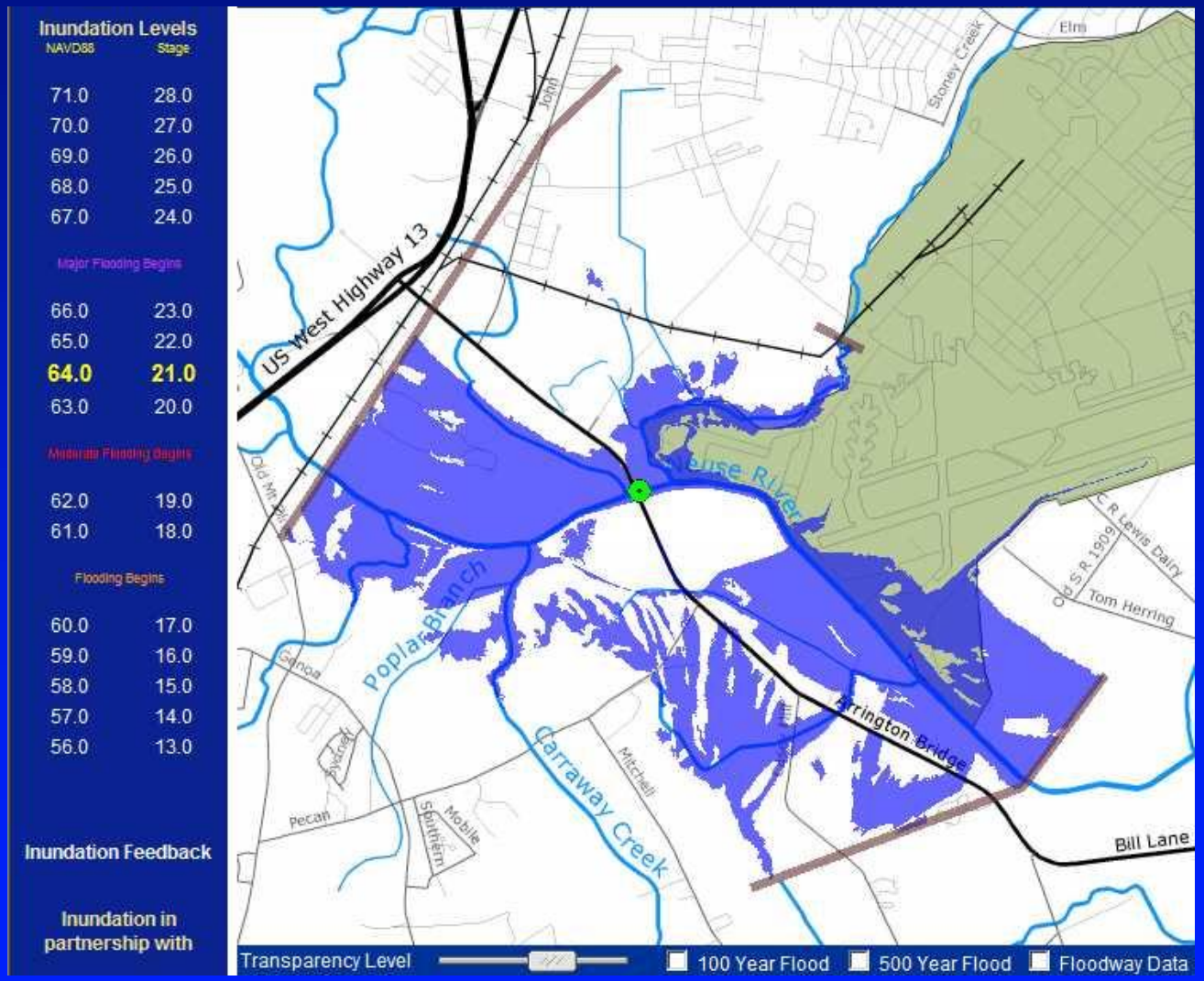

USGS

Other USGS Capabilities

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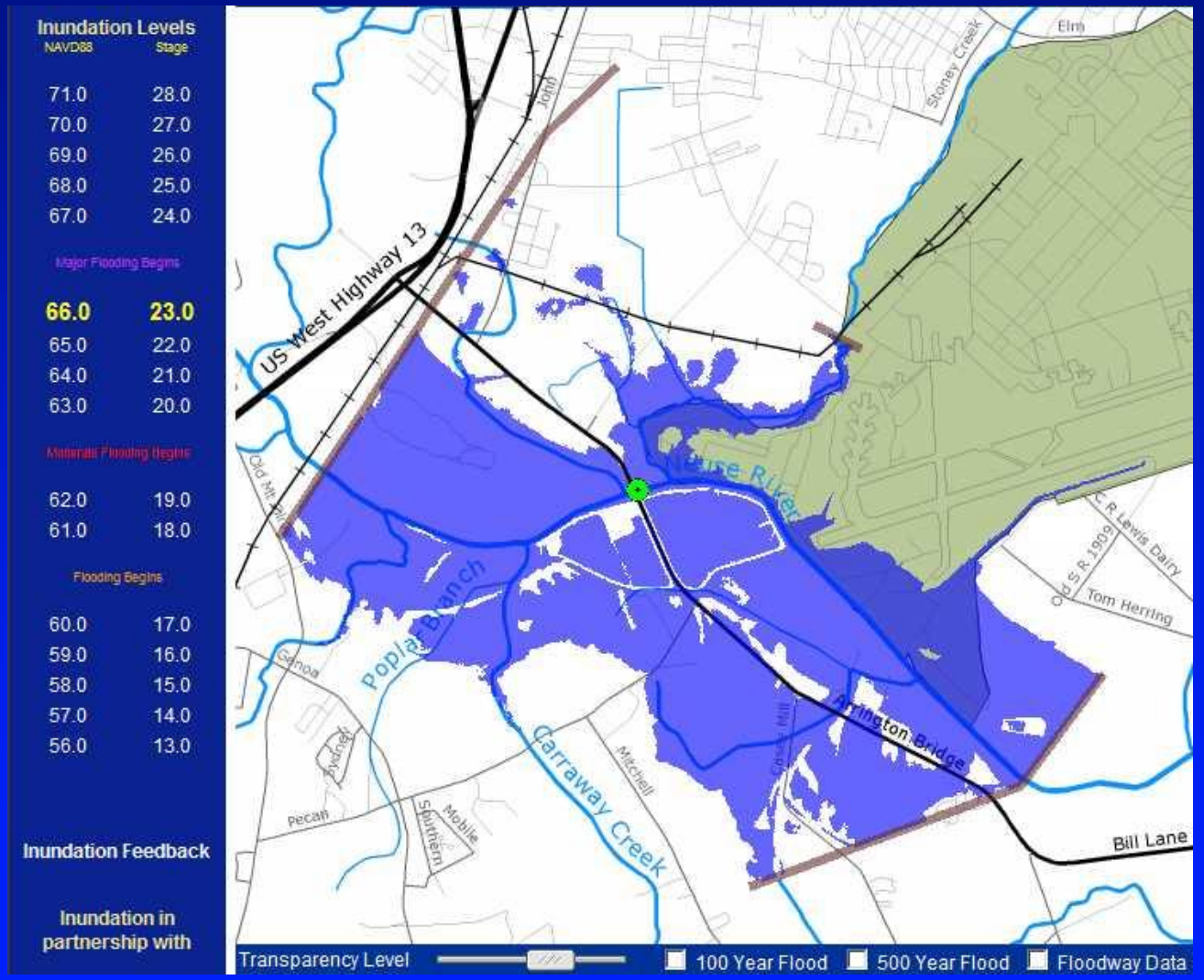

USGS

Other USGS Capabilities

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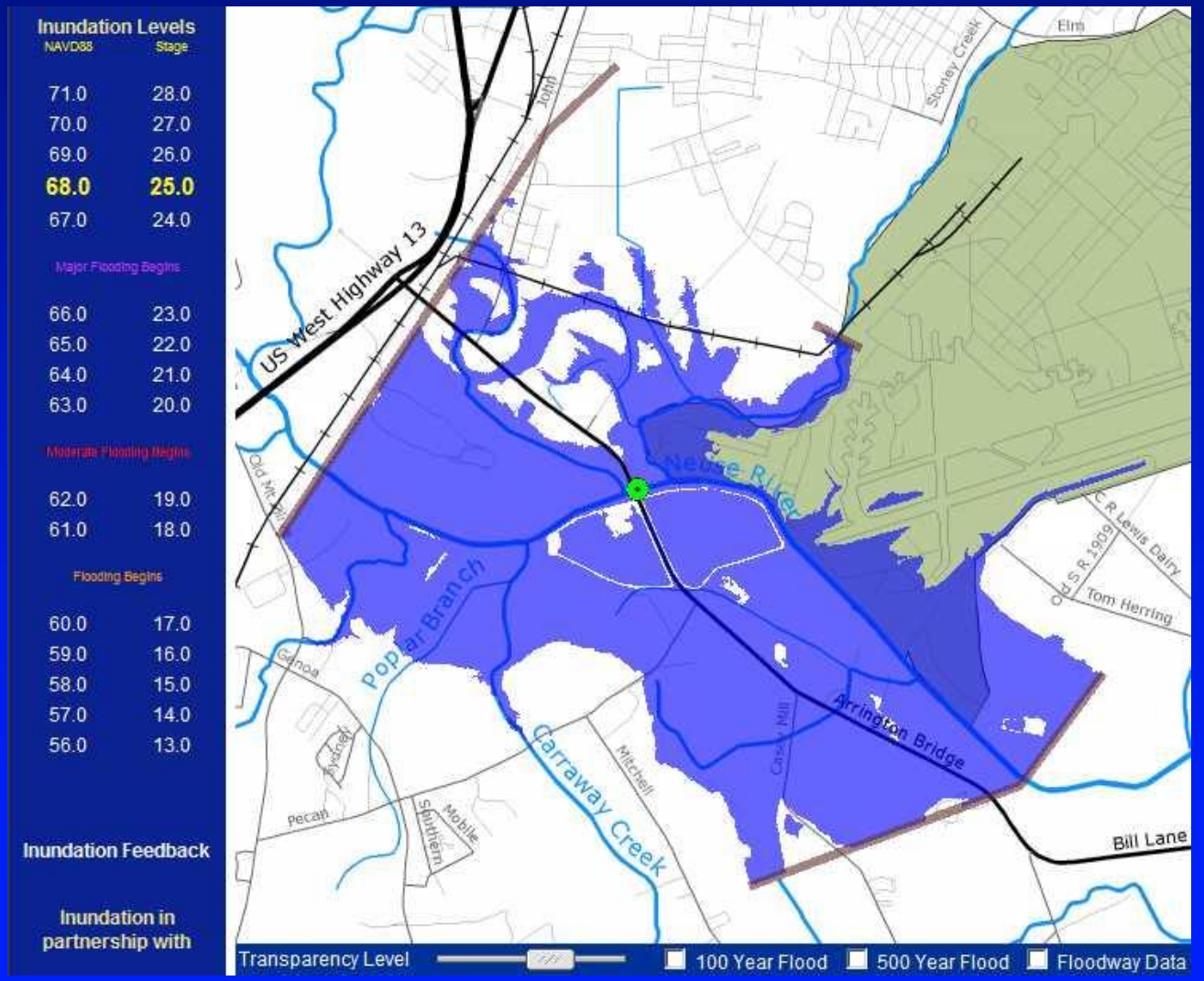

USGS

Other USGS Capabilities

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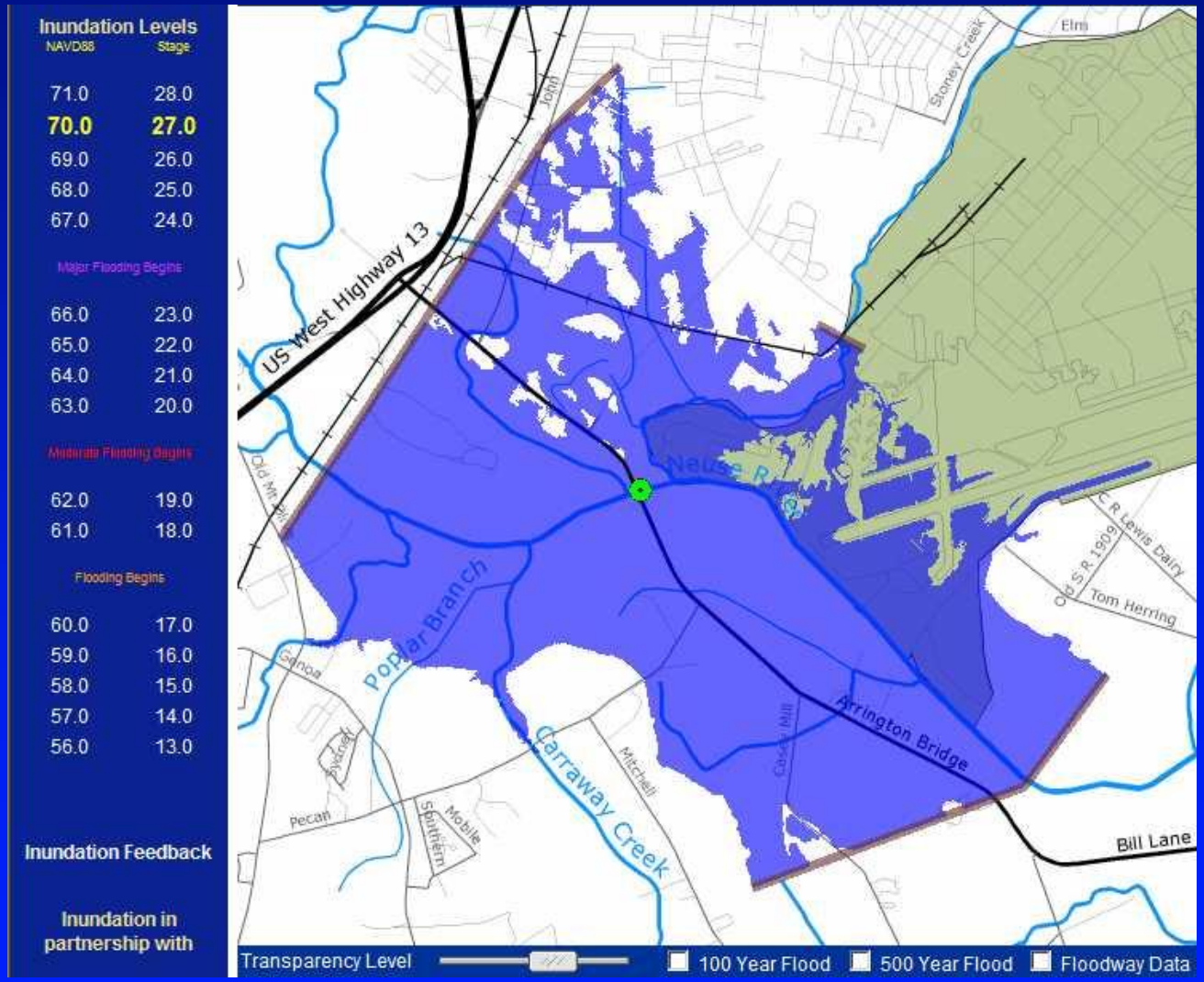

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Other USGS Capabilities

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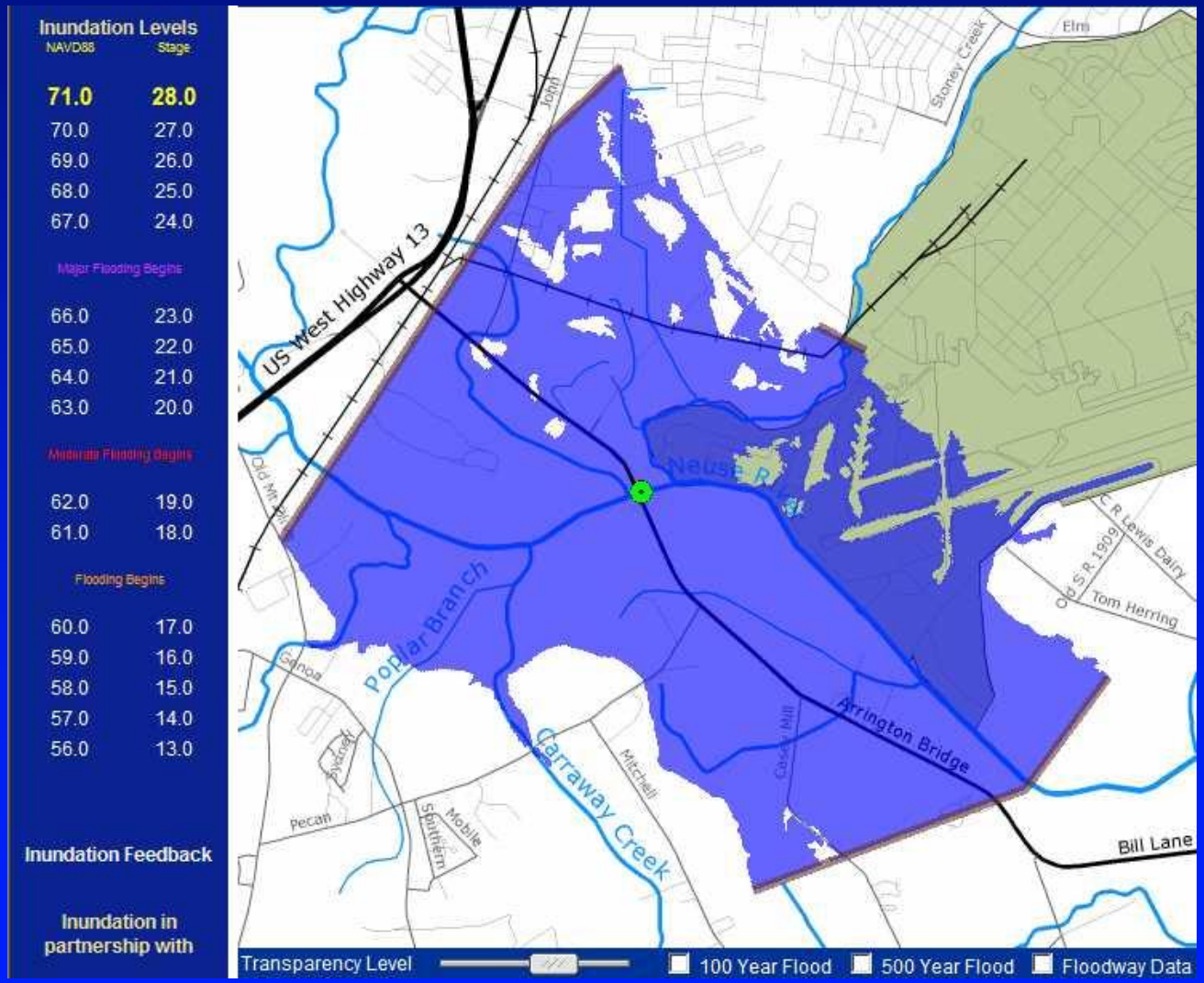

USGS