

# Moving to the Future of Hydrologic Data Processing...

...or seamless data processing from gage to page



We're moving away from paper records and annual production cycle of records....



# We're moving toward electronic, continuous records ....

Window Edit Options

```
~/# cd /datasection/SWRarchive/12370000/2006

/datasection/SWRarchive/12370000/2006$ ls
12370000.2006.Anal.pdf          12370000.2006.level
12370000.2006.Desc.pdf        12370000.2006.msts.
12370000.2006.adapSA.pdf      12370000.2006.priar
12370000.2006.adapsA.pdf      12370000.2006.ratin
```

AUTOSWR File Chooser - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://me.water.usgs.gov/usgs/AUTOSWR/

Customize Links RealPlayer Windows Marketplace Windows Media Windows

**USGS**  
Internal USGS Access Only

### AUTOSWR Chooser

Choose a Science Center:  
ME

Choose a station:  
01017000

Choose a year:  
2006

NOTE: Drag frame border to resize >>>

11 Files Available:

- 01017000.2006.adapsA.pdf: 8 KB (3/27/07 20:12 EDT)
- 01017000.2006.cq.uvinv.pdf: 7 KB (3/27/07 20:12 EDT)
- 01017000.2006.dvtable.pdf: 12 KB (3/27/07 20:12 EDT)
- 01017000.2006.egh.uvinv.pdf: 7 KB (3/27/07 20:12 EDT)
- 01017000.2006.eosum.pdf: 4 KB (3/27/07 20:12 EDT)
- 01017000.2006.msts.9207.pdf: 8 KB (3/27/07 20:12 EDT)
- 01017000.2006.shift\_anly.pdf: 3 KB (3/27/07 20:12 EDT)
- 01017000.DV\_hydro\_out.2006.pdf: 41 KB (3/27/07 20:12 EDT)
- 01017000.uv\_hydro\_out.2006.pdf: 339 KB (3/27/07 20:12 EDT)
- 01017000.vrat\_out.2006.1.pdf: 15 KB (3/27/07 20:13 EDT)
- 01017000.vshift\_out.2006.1.pdf: 10 KB (3/27/07 20:13 EDT)

Done

**USGS** science for a changing world

## SIMS - Site Information Management System

For Internal USGS Access Only [Ligon](#)

Choose a WSC:   [Choose WSC from National Map](#) | [ADR publications efforts](#)

Choose a search method:

By office:   **Responsible Office**  
U.S. Geological Survey

Montana SW Archive Station Page - Windows Internet Explorer

http://sdrnthn.cr.usgs.gov/office/stations/Archive/index.html

Montana SW Archive Station Page

**USGS** MONTANA WATER SCIENCE CENTER - SURFACE WATER ARCHIVE

Station: 12354500  
2006 Archive

Station Analysis  
Station Description  
Station Manuscript  
ADAPS Analysis  
Daily Values Table  
End of Year Summary  
Station Hydrograph  
Station Level Summary  
Measurement Summary  
Primary Computation  
ADAPS Shift Analysis  
October 2005 UV Plot  
December 2005 UV Plot  
February 2006 UV Plot  
April 2006 UV Plot  
June 2006 UV Plot  
August 2006 UV Plot

Rating Plot  
V-Shift Diagram

Home

12334510 Rock Creek near Clinton MT | [Email Request](#) | [NWIS Web](#)

**USGS**

# Here's a bit of history

- “Historical process” (1889-1970)
  - Records collected, analyzed at the end of the year, daily values published
- Internal Real-time (1970s)
  - Records collected, analyzed at the end of the year, daily values published
- Public real-time (1990s)
  - Daily and unit values collected and presented in real-time “as-is”
  - Records analyzed at the end of the year, daily values published
- Continuous, electronic records (2000s)
  - Records collected and analyzed continuously. “Published” DVs and UVs as soon as possible. Records and all supporting documents electronically computed, reviewed, and archived.

# Vision

## Seamless, electronic , continuous records computation from gage to page

- True seamless field connectivity
- More automated, continuous data computation
  - Application of shifts and data corrections
  - Data validation and cleanup
  - Estimating missing or backwater affected data
  - Warnings for performance, rating, data issues
- Efficient data review
  - Daily, trip-to-trip and annual reports with graphical visualization, review of automated decisions, and editing capability
  - Complete audit trail of automated/human decisions and necessary documentation (station analysis)!!!! (meaning this is really important!)
- Seamless connection to NWISWeb/Data Report

# The principles haven't changed... ..... and won't!

- Impartial
- Peer reviewed
- Highest quality
- Verifiable
- Consistent
- Comparable

# The foundation for USGS water information is NWIS – National Water Information System

- Requires nationally consistent field and office protocols/procedures
- Data collected and computed are directly comparable throughout nation
- Programs, procedures, and data formally reviewed and quality assured/controlled by national team of experts in addition to internal reviews

Starting at the gage and going to the page:

## Going to the Field....

Go2 script will tell us where to go and what to do..

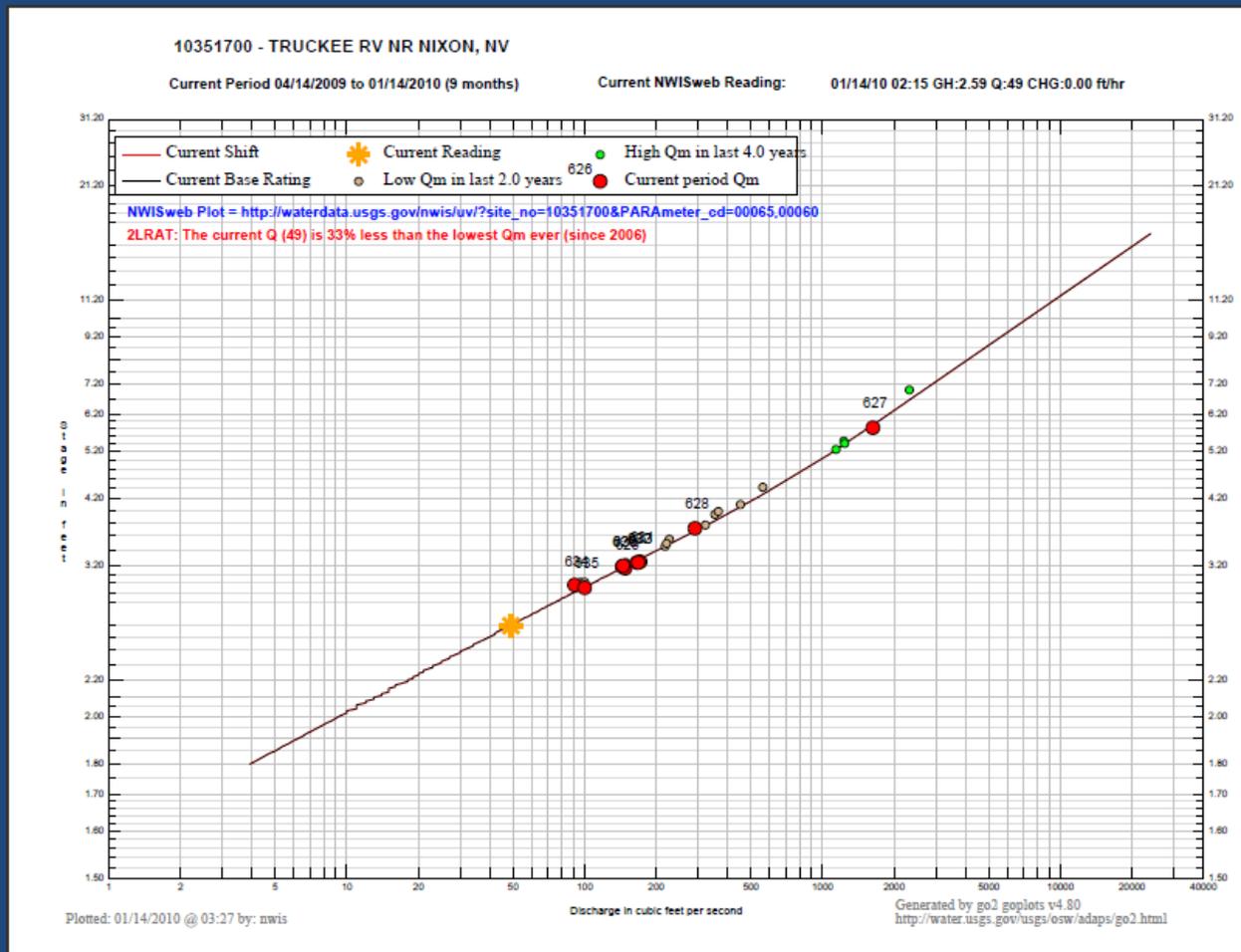
- Office of Surface Water utility script to tell when site visits needed
- Operational software used to monitor and review real-time data, ratings, station health, etc.
- Produces utility plots and email messages / reminders

# Go2 tests and evaluates incoming data....

- Time
- Rating
- DCP/Modem
- Spike
- Dam
- Critical Streamflow



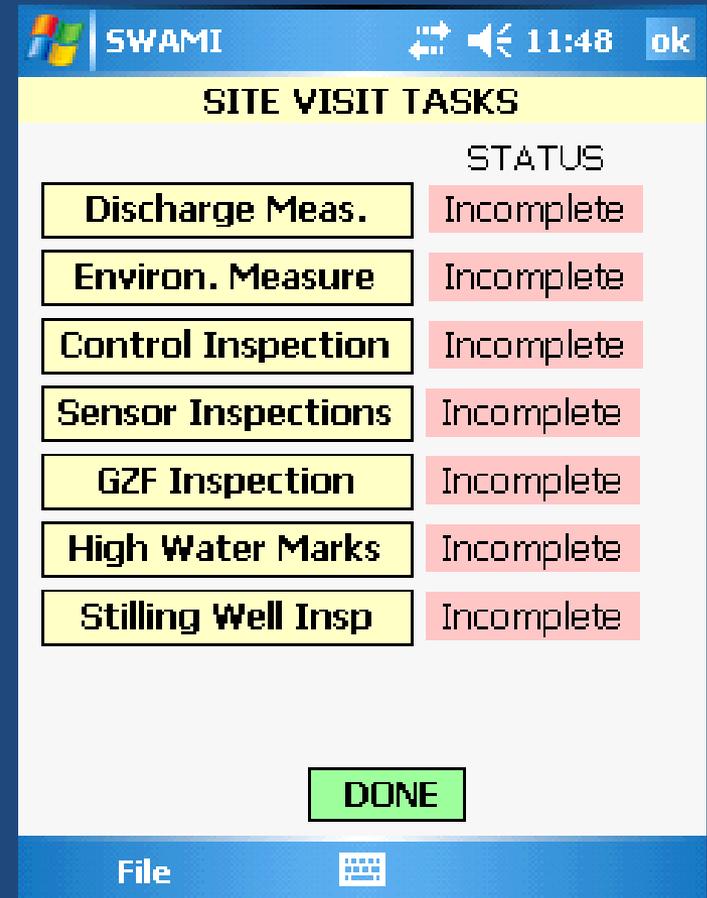
# Go2 plot indicates a measurement is needed





# We're moving toward paperless field documentation with SWAMI....

- SWAMI - Electronic Surface Water Measurement and Inspection Field Form
- Supports
  - Measurements
  - Instrument inspections and readings
  - Control inspections
  - High-water marks
  - Station Levels
  - Air and water temperature (environmental measurements)



The screenshot displays the SWAMI software interface. At the top, the title bar shows the Windows logo, the text 'SWAMI', and system icons for network, volume, and time (11:48). Below the title bar is a yellow header with the text 'SITE VISIT TASKS'. The main content area is a table with two columns: task names and status. All tasks are listed as 'Incomplete'. At the bottom of the table area is a green button labeled 'DONE'. The bottom of the screen features a blue taskbar with the word 'File' and a keyboard icon.

	STATUS
Discharge Meas.	Incomplete
Environ. Measure	Incomplete
Control Inspection	Incomplete
Sensor Inspections	Incomplete
GZF Inspection	Incomplete
High Water Marks	Incomplete
Stilling Well Insp	Incomplete

DONE

File

# What is SWAMI?

- Field application for recording all aspects of a Surface Water Site Visit using handheld PocketPC or laptop
- Direct collection of measurement data
- Outputs files for direct processing into NWIS via the SiteVisit loader
- Fits vision of SiteVisit system in ADAPS
  - Seamless electronic data collection TO →
  - Complete and automatic data input TO →
  - Data archival

# We're Moving to Seamless input of Field Data to Data Base Using SiteVisit

- Database (29 fields to hundreds) for all aspects of measurements and inspections
- Windows desktop graphical user interface
  - Quick Entry
  - Full editor
  - Reports
- Supports SWAMI/CHIMP field software

# Vision of SiteVisit

- Electronic data collection
  - Direct entry info field computer using SWAMI
  - No paper
- Complete and automatic loading
  - All data into database
  - No hand entry
- Data archival
  - Storage of original data in un-editable file  
(Measured unit values for site visit data)

# We're moving toward paperless in the office ...ratings and shifts using GRSAT



AQUARIUS GRSAT - Rating: STGQ-10.0

View Edit Setup Overlay Rating Window Help

Q-9.0 Rating: STGQ-10.0

Site Visit Data

Status	Meas. ID	Date	Time	Stage	Discharge	Qt
		MM/DD/YYYY	HH:MM:SS	feet	cfs	
	677	02/24/2005	13:06	4.69	10600.00	G
✓	678	06/06/2005	14:25	12.00	59400.00	E

Rating Table Site Visit Data

Room 1

Site Number: 12389000 - Site Name: Clark Fork near Plains MT - DD: 2 - Rating Number: 10.0

AQUARIUS GRSAT Message

The slope from Y1 = 7.39 to Y2 = 14.12 is equal to 1.89  
Selected rating segment implies: Channel Control

OK

Shift Manager

Shift List

Start Time	End Time
10/01/2004 00:01 [MDT]	
10/14/2004 13:00 [MDT]	
10/16/2004 13:00 [MDT]	

Shift Diagram

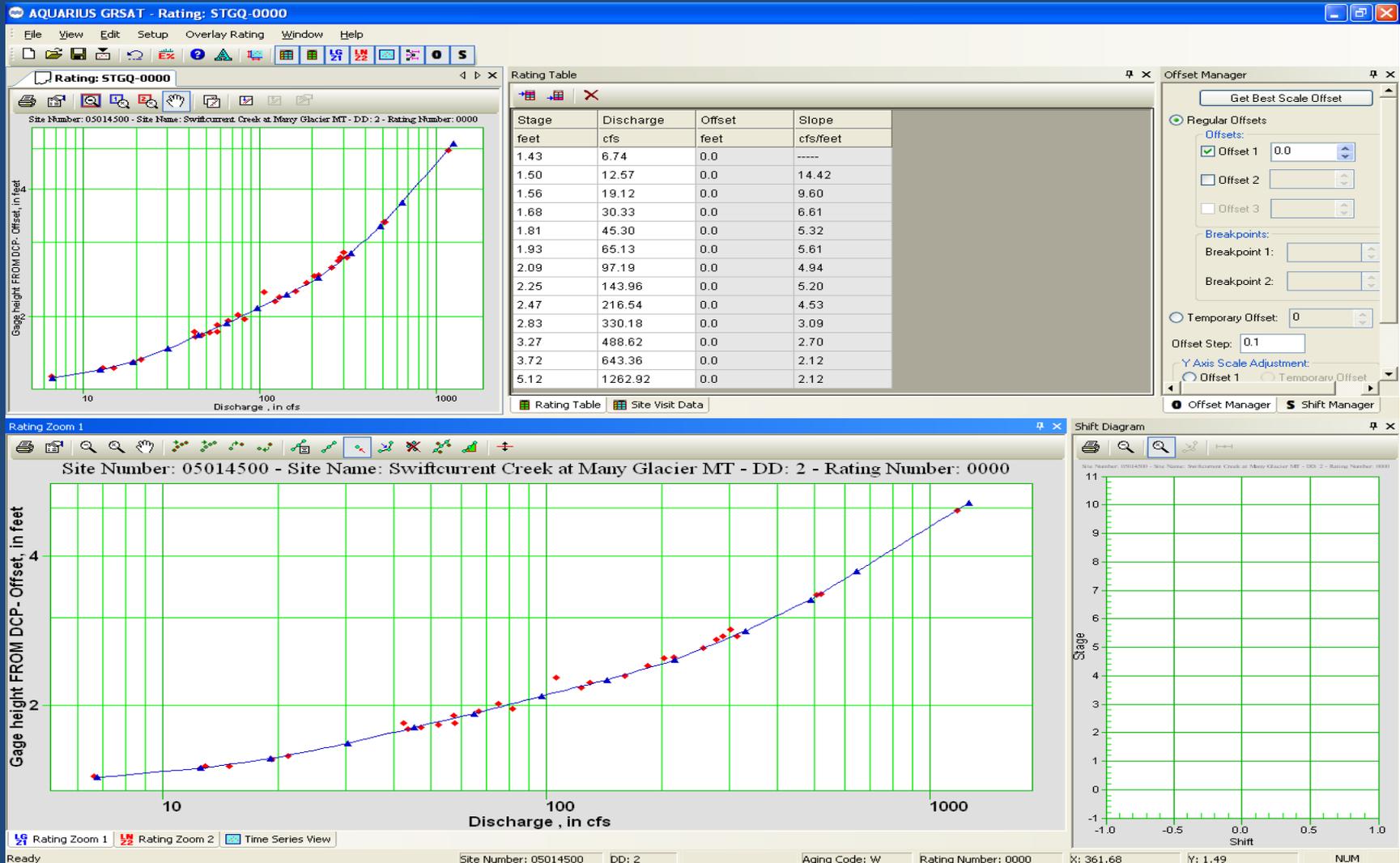
TCODE Aqno Code: W Rating Number: 10.0 X:



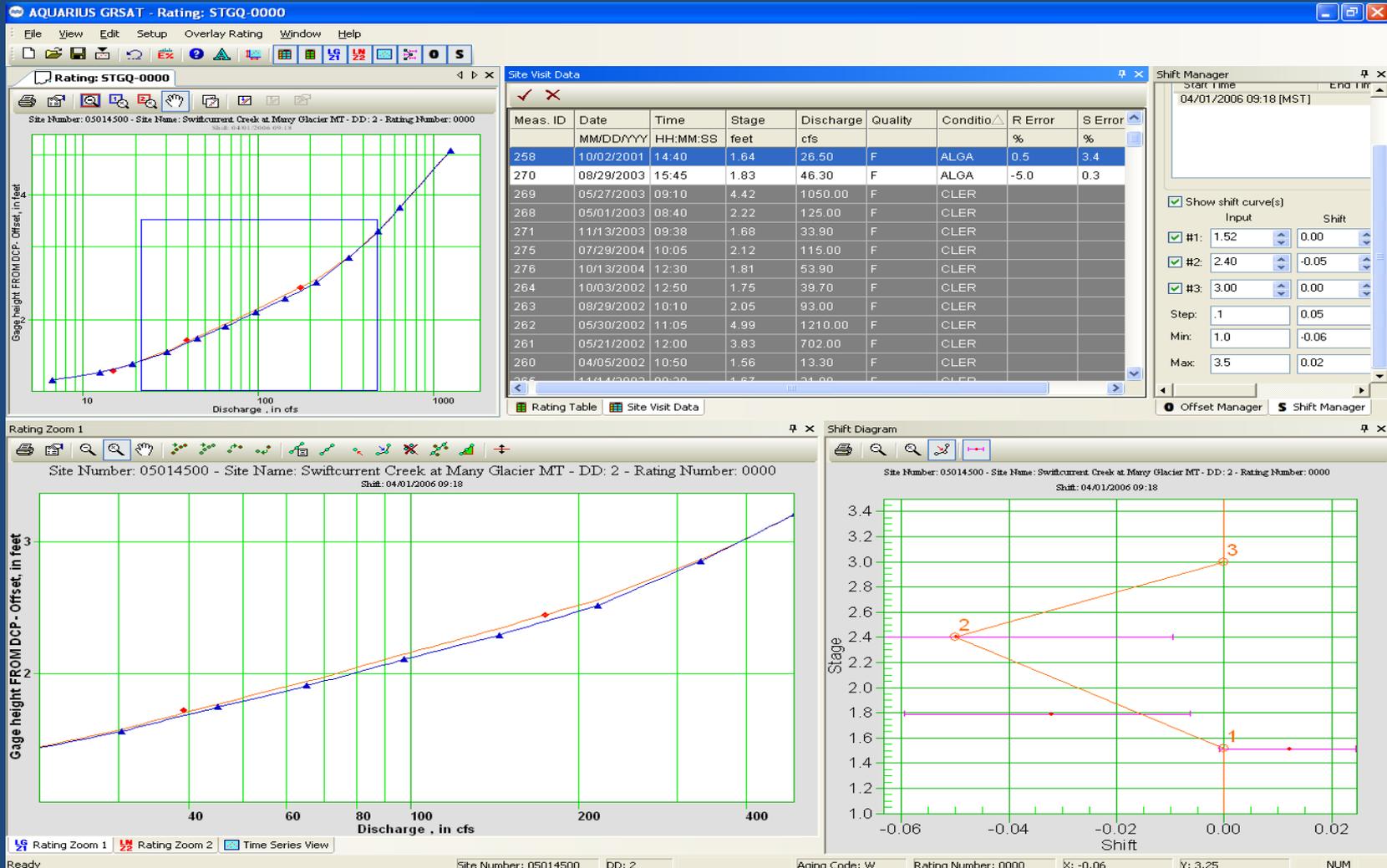
# What does GRSAT do??

- GRSAT – Graphical Rating and Shift Application Tool
- GRSAT enables you to quickly and intuitively develop stage-discharge curves and shift corrections in a digital environment.
- GRSAT is a PC-based application that interacts with NWIS databases to provide a graphical interface to rating and shift development.
- GRSAT follows the standards for rating curves developed by the United States Geological Survey.

# Using GRSAT for rating development



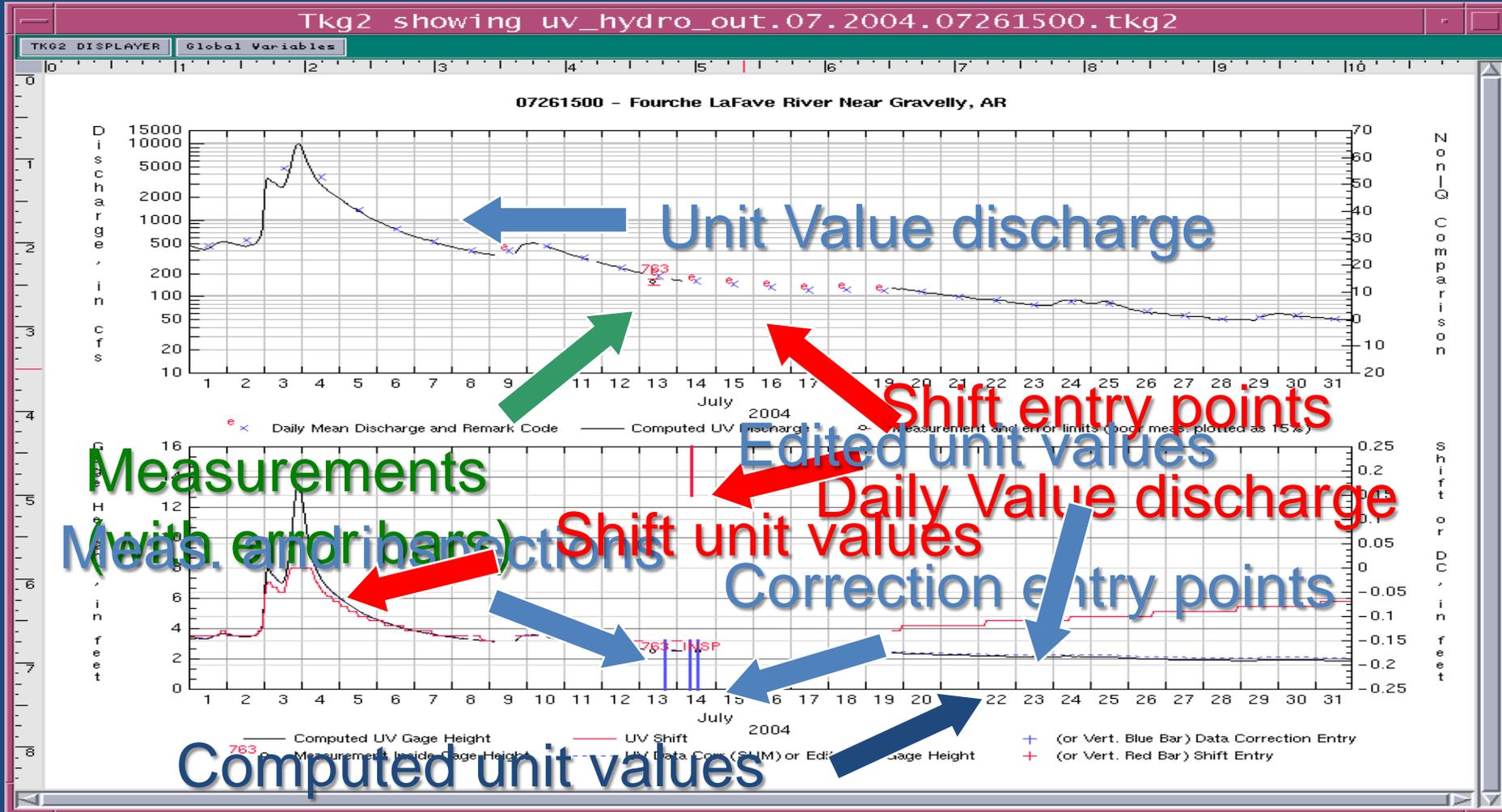
# Using GRSAT for shift development



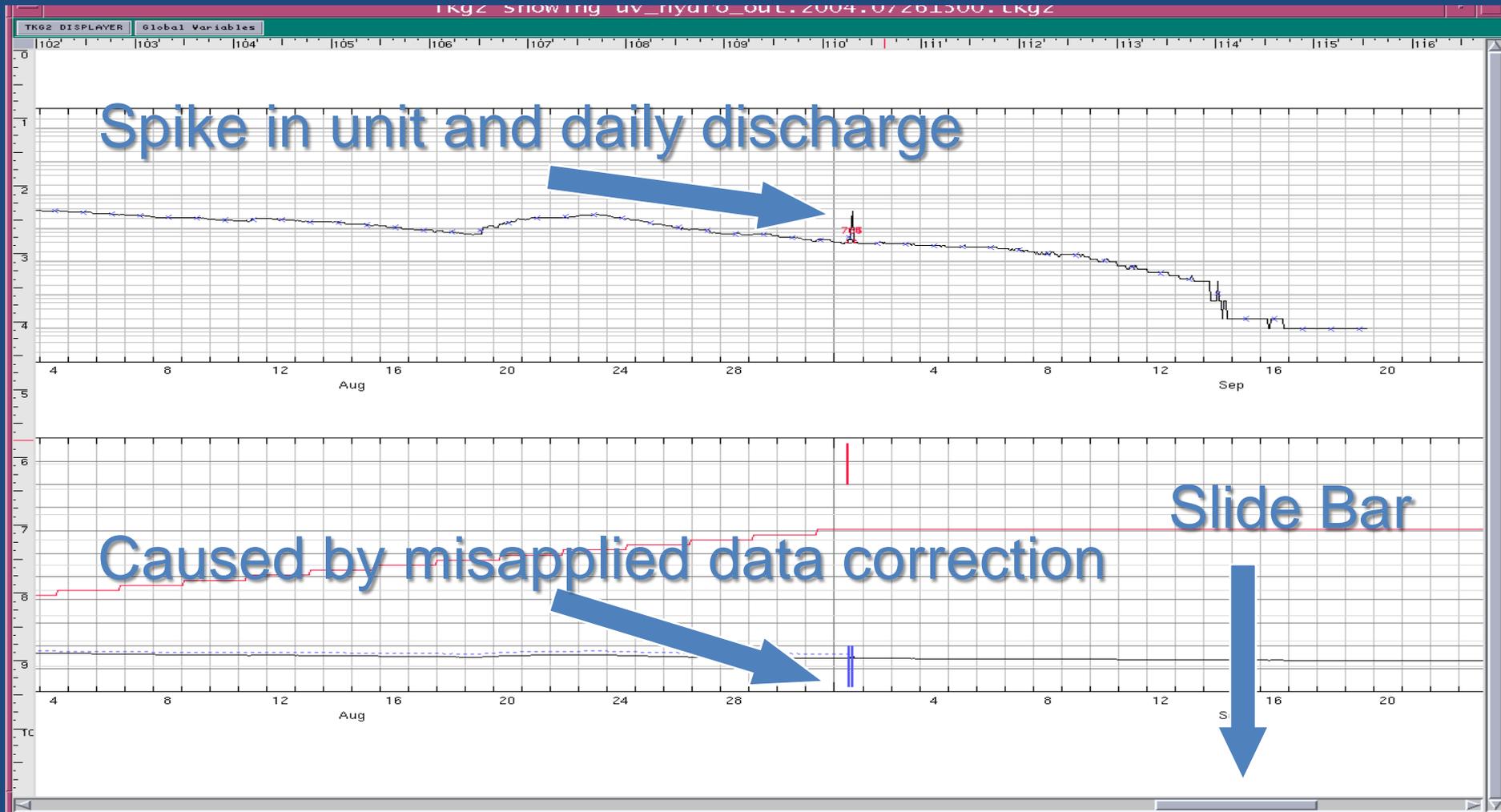
# We're moving toward paperless reviews of streamflow records using SWReview

- SWReview script is a method to facilitate review of surface-water time-series records by retrieval of various graphical plots and ADAPS tables.
- Coupled with the Station Analysis, SWReview output makes a “complete” records package.

# Monthly Plot



# Annual Plot



07040450 - St. Francis River at Lake City, AR

Shifts to effective rating starting during period 10/01/2003 to 09/30/2004

Horizontal red bars are the Max and Min Gage Height for the period

Station	Date	Time	Variable	Shift	Point	Curve
3.0	20031011	130000	3.00	0.23	6.00	0.23 10.00 0.00 1
3.0	20031023	120000	3.00	0.25	6.00	0.25 10.00 0.00 2
3.0	20031113	000000	3.00	0.25	6.00	0.25 10.00 0.00 2
3.0	20031119	210000	3.00	0.23	6.00	0.23 20.00 0.00 3
3.0	20031230	030000	3.00	0.23	6.00	0.23 10.00 0.00 1
3.0	20040102	230000	3.00	0.25	6.00	0.25 10.00 0.00 2
3.0	20040204	230000	3.00	0.25	6.00	0.25 10.00 0.00 2
3.0	20040206	000000	3.00	0.00	6.00	0.00 10.00 0.00 4
3.0	20040309	000000	3.00	0.00	6.00	0.00 10.00 0.00 4
3.0	20040316	000000	3.00	0.23	6.00	0.23 10.00 0.00 1
3.0	20040423	100000	3.00	0.23	6.00	0.23 10.00 0.00 1
3.0	20040426	200000	3.00	0.00	6.00	0.00 10.00 0.00 4
3.0	20040513	030000	3.00	0.00	6.00	0.00 10.00 0.00 4
3.0	20040530	110000	3.00	0.25	6.00	0.25 10.00 0.00 2
3.0	20040623	210000	3.00	-0.25	6.00	-0.25 10.00 0.00 2
3.0	20040624	000000	3.00	0.23	6.00	0.23 10.00 0.00 1
3.0	20040806	100000	3.00	0.23	6.00	0.23 10.00 0.00 1

Shift Plot

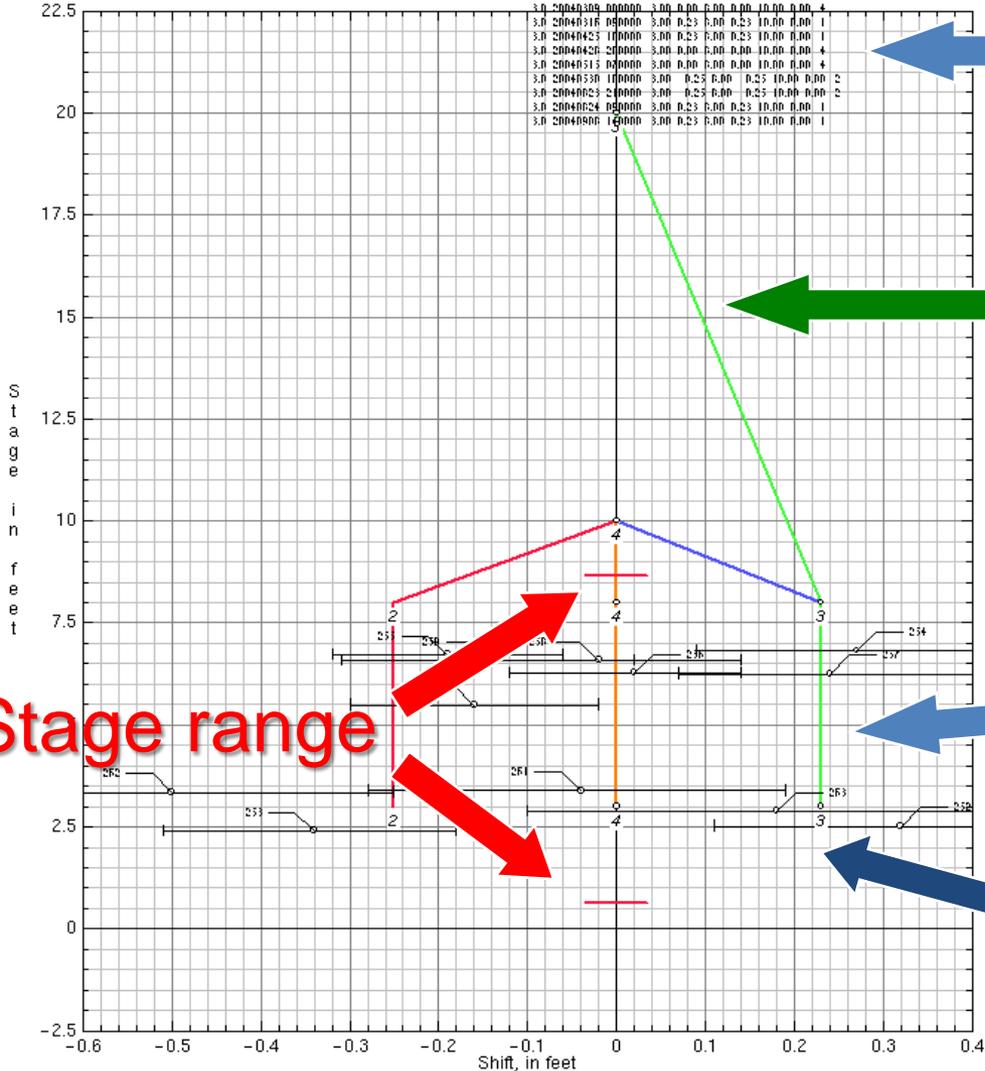
Shift table

Bad input point

All shifts

Qm with error bars

Stage range



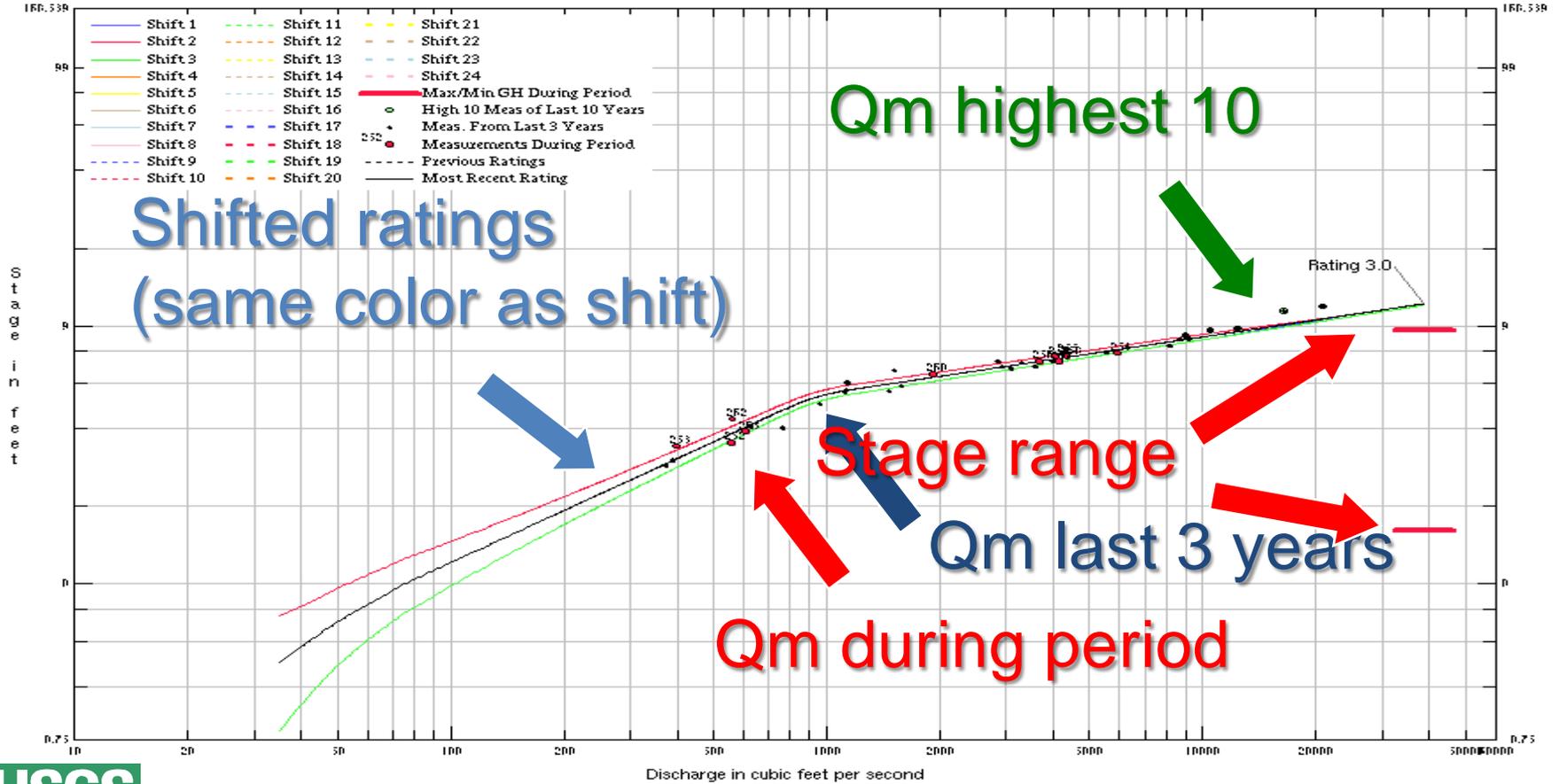
# Rating Plot

Tkg2 showing vrat\_out.2004.07040450.tkg2

TKG2 DISPLAYER Global Variables

07040450 - St. Francis River at Lake City, AR

Shifted ratings starting during period 10/01/2003 to 09/30/2004



Discharge in cubic feet per second

# Augmented ADAPS Station Analysis

note: Measurement and peak sections below are added as part of the swreview program and are not supported by NWIS. Please direct comments, questions, or problem reports to GS-W OSW Scripts@usgs.gov

## MEASUREMENTS

Number of measurements - 10  
Number of inspections - 0  
Range of measurement numbers : #332 to #341  
Range of measured discharge : 7.86 to 1510.0  
Range of computed discharge : 2.4 to 15100  
# of DVs 50% over max. meas. Q : 12  
# of DVs 50% below min. meas. Q : 0  
Range of measured gage height : 10.43 to 12.71  
Range of computed gage height : 10.30 to 26.24  
Range of measurement shifts : -0.02 to 0.12  
Range of percent differences : -3.6 to 3.6



Measurement  
info

## PEAK DISCHARGE

Five highest instantaneous discharges for water year 2005:

note: Only highest discharge shown if multiple peaks occurred on the same day.

Date	Time	Q	Qrem	Qflag	Ght	GHTrem	GHTflag
2004.11.24	033000	12100			24.88		
2004.11.30	153000	10800			23.76		
2004.12.06	200000	15100			26.24		
2004.12.23	003000	10800			23.78		
2005.08.30	050000	12500			25.18		



Peaks

# We're moving to Continuous Records Processing so hydrologic data is quickly approved and finalized

- **Continuous records processing is the collection, analysis, review, and approval of time-series hydrologic data on a continuous (sub-water year) basis. At any given time, the time-series data will be as close to approval as computational methods and hydrologic interpretation will allow.**

# *CRP Guiding Principles*

- Data Driven

- This means that streamflow or other time-series information is not approved until the analyst and reviewers are satisfied that the data are ready for **approval and distribution without caveat**.
- The approval criteria will **depend on the individual site** and its climatic and hydraulic characteristics, the stability of those characteristics, and the field protocols being used at that site.

# *CRP Guiding Principles*

- Accuracy maintained
  - High standards of accuracy and precision must be maintained in all data collection and analysis procedures.
  - The USGS must provide the best data to the public as soon as possible.

# Into the Future....

We're moving to increase our functionality of communicating hydrologic data

## Strategic Actions

- Expand and modernize USGS monitoring and **communications** capabilities to take full advantage of technology advances in order to deliver robust and reliable products.
- Develop communication strategies and decision-support products that focus on understanding societal risk and resilience to natural hazards, and develop new individualized ways of **communicating** hazards and hazard assessments to local audiences and to targeted audiences with different needs.

# Immediate Needs

- RTAlert—Streamgage alert notification program using data from NWISWeb
  - Deliver via email & text
  - Must be for SW, GW, QW
  - User defined thresholds
  - Similar to NC WSC system

<http://nc.water.usgs.gov/alert/>

# Immediate Needs

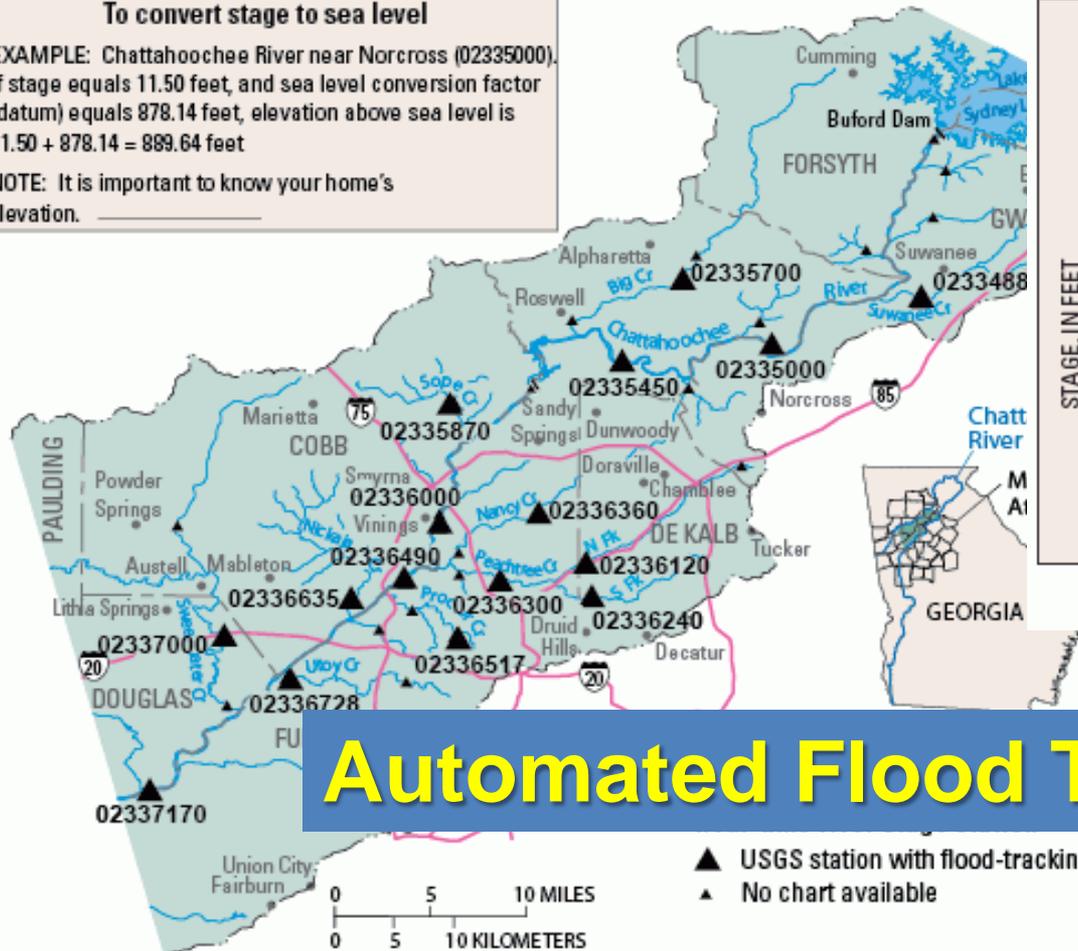
- Alternatives to Web delivery of RT data
  - Media such as Facebook, Twitter, and YouTube
  - National support for Streamail (GaWSC)
  - XM radio and/or GPS delivery to push data to vehicles via satellite
  - Automated voice servers & fax services
  - Create an IT infrastructure convenient to data mining – work with partners including private sector
  - Reverse 911 systems

# Intermediate Needs

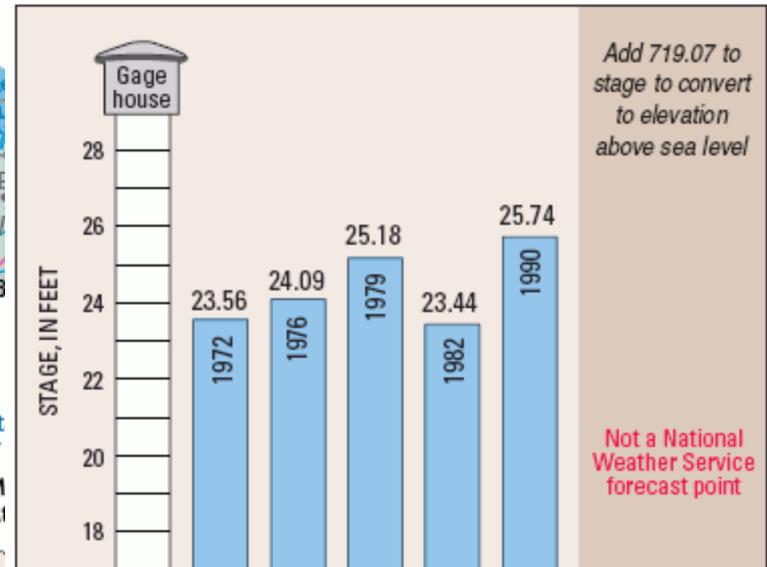
## To convert stage to sea level

EXAMPLE: Chattahoochee River near Norcross (02335000).  
If stage equals 11.50 feet, and sea level conversion factor (datum) equals 878.14 feet, elevation above sea level is  $11.50 + 878.14 = 889.64$  feet

NOTE: It is important to know your home's elevation. \_\_\_\_\_



**\*Chattahoochee River near Fairburn, Ga.**  
(02337170) 1966–2004



\*Peak stages for Chattahoochee River sites are after 1956, when Buford Dam became operational

## Automated Flood Tracking Charts

- ▲ USGS station with flood-tracking chart
- ▲ No chart available

# Intermediate Needs

## Blanchard River at Findlay, OH (FDYO1)

### Data Type

- Inundation Levels
- Flood Categories
- Current/Forecast

### Inundation Levels

NAVD88 Stage

**772.2 18.4**

771.8 18.0

770.8 17.0

770.3 16.5

769.8 16.0

769.3 15.5

768.8 15.0

767.8 14.0

766.8 13.0

Major Flooding Begins

765.8 12.0

To see all current watches and warnings, [click here](#)

## Inundation mapping

2500 5000 10000 Feet

Chance of Exceeding Levels During Entire Period

Image Type:  Standard (Faster Download)  Detailed (Slower Download)

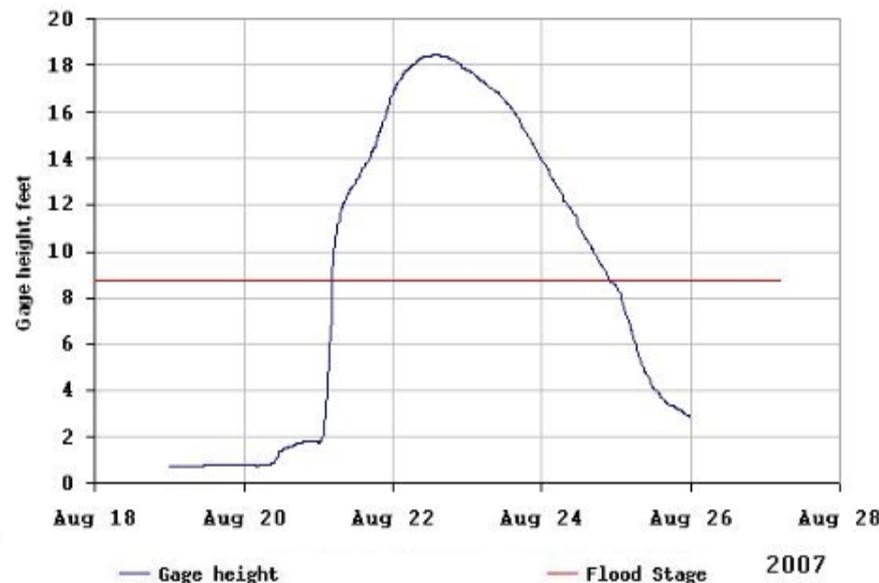
Current Stage: 1.60 ft at 20:00 UTC 04/29



Transparency Level

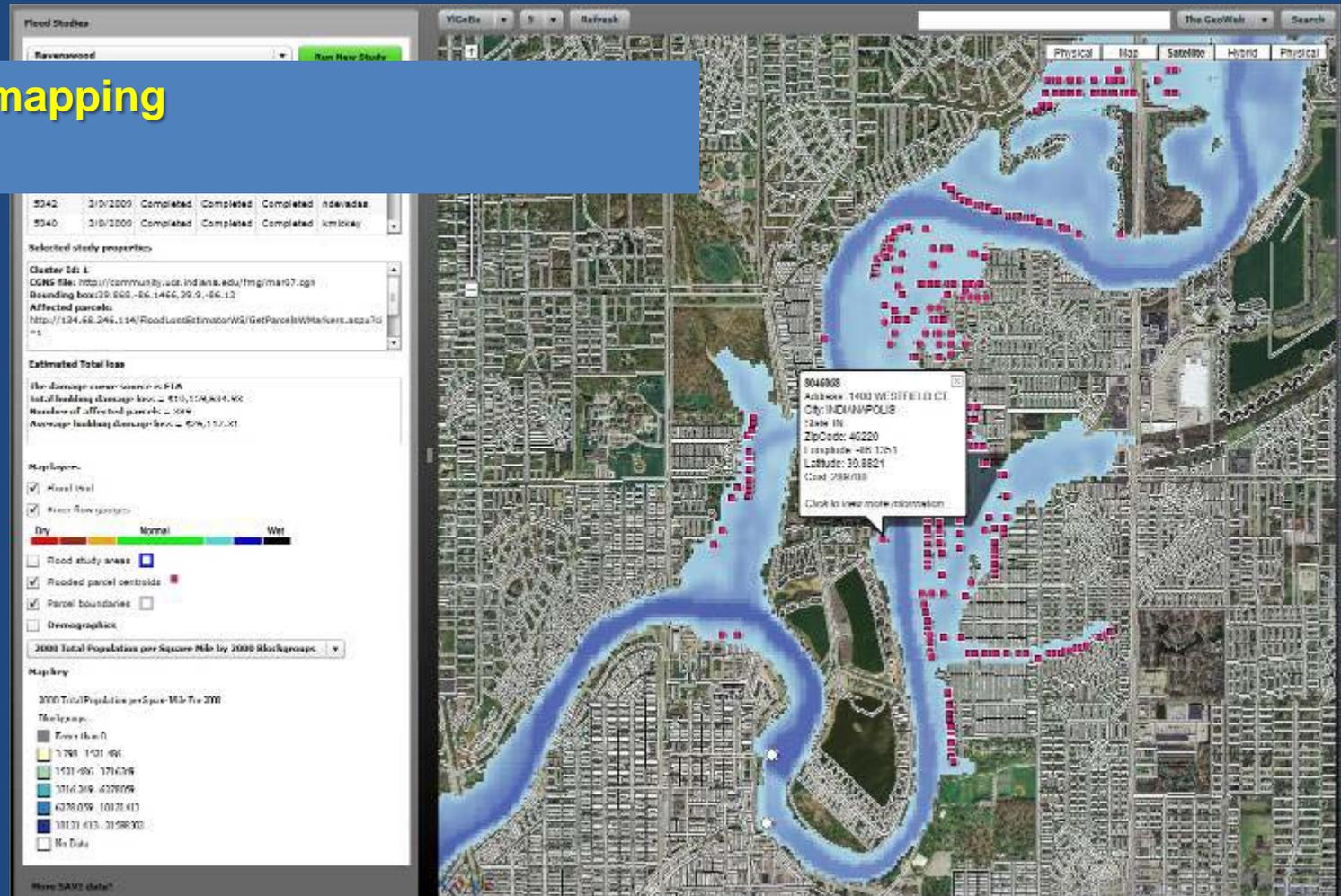


USGS 04189000 Blanchard River near Findlay OH



# Intermediate Needs

## Inundation mapping



# Moving to the Future of Hydrologic Data Processing



“Old Streamgagers Never Die.....”