What’s new at the New Jersey Water Science Center: Data Collection and Delivery

U.S. Geological Survey
New Jersey Water Science Center
West Trenton, New Jersey

New Jersey Water Monitoring Summit
Ewing, New Jersey
December 2, 2011

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Chief, Hydrologic Data Assessment Program

Providing reliable, impartial, and timely data to assess the quantity and quality of our nation’s water resources
History of Hydrologic Monitoring by USGS in New Jersey

- First USGS streamgage data at Passaic River at Paterson & Delaware River at Lambertville in 1897
- Ground-water levels data since 1923
- Water Quality data since 1923, NJDEP/USGS coop network since 1976
- Cooperative Water Program with State & local agencies established in 1921 at the NJ USGS office
Surface Water Stage & Flow Networks

- Streamgages (130)
- Stage-only, non-tide (48)
  - 8 lake/reservoir, 40 stream
- Stage-only, tide (24)
- Precipitation (41)
- Crest-stage gages (17)
- Tidal Crest-stage gage (32)
- Low-flow sites (96)
- Miscellaneous Flow sites (127)
- Scour Monitoring (22)

http://nj.usgs.gov/infodata/surfacewater.html
New Gaging Station Design
Satellite Telemetry

- **Geostationary Operational Environmental Satellite (GOES)**
  - Operated by NOAA (National Oceanic and Atmospheric Administration)
  - Reliable
  - Automatic switchover during primary failure
- Timed transmissions every hour
- Random transmissions when thresholds are exceeded
  - Stream reaches & exceeds flood stage
- Data transmitted to computer base stations and USGS archival database
Radar Non-contact stage sensor

- 6 Delaware River stage gages, First installed Oct. 5, 2005 Del River at Phillipsburg
- A microwave transmitter (9.5 – 10.5 GHz) and receiver aimed at water surface from bridge (2” to 115’)
- Echo is received and evaluated to determine distance to water surface
- SDI-12 digital communication
- Sensor output is compatible with our satellite telemetry (DCPs)
- Distance, elevation, and signal strength stored
- Accuracy $\pm 0.01$ ft
Streamflow Data Collection

Traditional Methods
Acoustic Methods

Boat Mounted

Wading

Acoustic Doppler Current Profiler


Acoustic Doppler Velocimeter

Global Positioning System (GPS) Antenna
Acoustics at Gages

- Acoustic Velocity Meter
  - Delaware & Raritan Canal at Port Mercer 1988-2010
- ADVM
  - Installed summer 2010
- Velocity
  - Range: ± 20 ft/s
  - Resolution: 0.003 ft/s
  - Accuracy: ± 0.015 ft/s
- 2 horizontal Beam transducer
  - Beam range: 1.6 – 66 ft
- 1.5 MHz signal
- Multi-cell current profiling
Common uses of USGS streamflow data

- Flood forecasting and flood warning by National Weather Service and other emergency managers
- Compute flood annual exceedance probabilities for designing bridges, dams, flood control structures & flood plain designation
- Determine stream discharge and water withdrawal limits for regulatory purposes
- Water supply planning & drought management
- Compute loads to develop water-quality standards and TMDL’s
- Study trends in water quantity and quality
- Plan recreational activities
Precipitation Gages

- 41 gages – 40 have real-time data located on homepage http://nj.usgs.gov/index.html
Surface Water Sampling Sites

**Cooperative Networks**

- 113 Site network with NJDEP
- 2 sites with NJWSA
- 1 site with DRBC
  - Station Types in NJDEP network:
    - 7 Background, 23 Watershed Integrator, 43 Land-use Indicator, 40 HUC14 and Watershed reconnaissance sites
- Coop network since 1976
Sampling Schedule & Constituent List

Routine parameters at all sites quarterly: field parameters, major ions, nutrients, suspended sediment, DOC & particulate carbon

- Nov./Dec.: routines only
- Feb./March: trace elements at 7 Background & 40 HUC14 sites
- May/June: pesticides at 20 HUC14, 3 BKG
- Aug/Sept: trace elements at all 40 HUC14 and 7 background stations and bed sediments (analyzed for nutrients, carbons, trace elements and polyaromatic hydrocarbons) collected at 20 selected HUC14 sites each year

Streamflow provided at 73 fixed sites
Groundwater Sampling network

150 shallow wells sampled cooperatively with NJDEP

- 60 urban, 60 Ag, 30 undeveloped
- 30 wells sampled per year, resulting in a five-year rotation
- Focuses on nonpoint source pollution of GW
- Randomly stratified as a function of land-use
Long-term Continuous Water Quality Monitoring

- 13 monitors active
  - 7 year-round, 6 seasonal (5 temp only)
- Temp., SC, pH, DO, turbidity, Nitrate, chlorophyll
- Provisional temp at 32 streamgages

USGS
Nitrate and Chlorophyll-a Sensors

Passaic River at Two Bridges

http://waterdata.usgs.gov/nj/nwis/uv/?site_no=01389005&PARAmeter_cd=00010,00095,00300,00301,00400,63680
Short-term continuous QW monitoring

- **Purpose:** assess 3-6 day diurnal physical measurements and constituent concentrations at a subset of network sites
- **Selection Criteria:** previous occurrences of Dissolved Oxygen (DO) supersaturation (>120%), DO undersaturation (<60%) or DO less than the instream standard
- **Data Management:**
  - Data stored in our national NWIS database
  - Published in annual data report
Ground-water Level Observation Well Network

- 193 wells in Long-term networks
  - 133 continuous-record
- NJDEP/USGS: 162 wells
  - 105 continuous-record
  - 56 manual
  - 1 subsidence
- NJDEP/USGS: Drought network
  - 19 continuous-record
  - 3 manual
  - Real-time data on 20 shallow wells
- Local Municipalities: 9 continuous-record wells

USGS
Data Delivery Methods

- Water Watch: Near Real-time and Historical Data
- Monthly Hydrologic Conditions Report
- Annual Water Data Report
- National Water Information System (NWIS WEB)
- Instantaneous Streamflow & Peak Databases
- Stage/Discharge Ratings Depot
- Alert Systems: StreaMail & Water Alert
- Flood Reports
- Streamflow Statistics (StreamStats)
Water Watch
Near Real-time Surface Water Data

http://nj.usgs.gov

http://waterwatch.usgs.gov

Duration hydrograph of daily average streamflow for USGS 01463500 (Drainage Area: 6780 square miles, Length of Record: 98 years)

01411456
Little Ease Run at Clayton
Water Quality Watch

- Near Real-time water quality parameters
  - Temp, SC, pH, DO, turbidity, nitrate
- Google map interface
- Links to NWIS & technical resources
- Links to sites displaying surrogate data (suspended sediment, TP, TN)

http://water.usgs.gov/waterwatch/wqwatch
Groundwater Watch

- Field measurements
- Daily Data
- Daily, monthly and annual statistics
- Well information
- Data in plots and tables
- Display wells on Google map

http://groundwaterwatch.usgs.gov/NJN/StateMaps/NJ.html
http://groundwaterwatch.usgs.gov/
Annual Water Data Report & Monthly Hydrologic Conditions Report

- National Reports since water year 2006
  http://wdr.water.usgs.gov/

- Mapper Interface http://wdr.water.usgs.gov/adrgmap

- New Jersey Water Science Center publishes NJ data online and on CD
  http://nj.usgs.gov/publications/adr/adr2009/Main_Index.html

- Monthly Hydrologic Conditions Report
National Water Information System (NWIS WEB)

• Much of the hydrologic data collected by the USGS is available through the NWIS Web interface

• Surface water - Water flow and levels in streams, lakes, and springs

• Ground water - Water levels in wells

• Water quality data - Chemical and physical data for streams, lakes, springs, and wells


Site mapper  http://wdr.water.usgs.gov/nwisgmap

National NWISWeb  http://waterdata.usgs.gov/nwis
Instantaneous Data Archive

- Time-series discharge data now available online at the Instantaneous Data Archive (IDA)
- Enter station # or get a list of gages by state
- Available for New Jersey gages back to October 1981

Site Inventory [http://waterdata.usgs.gov/nj/nwis/inventory](http://waterdata.usgs.gov/nj/nwis/inventory)
Peak Streamflow Data
http://nwis.waterdata.usgs.gov/nj/nwis/peak

USGS 01463500 Delaware River at Trenton NJ

Annual Peak Streamflow, in cubic feet per second

Stage/Discharge Ratings Depot

- Expanded Base ratings, and latest shift-adjusted rating retrieved from all stage-discharge sites at 8 PM local time
- Tab delimited (rdb) format
- Detailed information on current variable stage shifts included
- Rating plots now available through WaterWatch website
StreaMail

- Request, by email or cellphone text message, the most recent USGS river stage and streamflow data for streams in the United States.

- To use the system, send an email to "streamail@usgs.gov" and in the "Subject" line, put in a USGS station (site) number. Station numbers available at http://waterdata.usgs.gov/usa/nwis/rt

- An email will be sent back to you with the most recent stream stage and flow.


USGS
Example of StreaMail Response

- **U.S. Geological Survey (USGS) StreaMail:**
  The latest river stage and streamflow values you requested from StreaMail. Site: 01463500
  Station name: Delaware River at Trenton NJ
  Date: 11/28/2011
  Time: 10:15:00
  Stage: 11.34 feet
  Streamflow: 22,300 cubic feet per second (cfs)

- **Link to charts for 01463500:**

- The U.S. Geological Survey's (USGS) StreaMail system allows you to request, by email, the most recent USGS river stage and streamflow data for streams in the United States. To use the system, send an email to "streamail@usgs.gov" and in the "Subject" line, put in a USGS station (site) number. An email will be sent back to you with the most recent stream stage and flow.

- If you need help, contact Howard Perlman (hperlman@usgs.gov)
Water Alert

- Threshold notification system
- User selects station & desired notification settings; i.e. data type, threshold condition, and frequency
- Interactive map with search options
- Subscription form and Confirmation
- Text message or email sent to subscriber
Thank you. Your form has been submitted (ID=hBbmx).

A confirmation message has been sent to rreiser@usgs.gov.

You must reply to the confirmation message before Thursday, December 01, 2011 2:26:45 PM in order to activate this subscription.

USGS Real-Time Hydrologic Notification System subscription for:

Site number: 01463500
Site name: Delaware River at Trenton NJ
Notification Method (e): email message to rreiser@usgs.gov
Parameter Code: 00065
Parameter Name: Gage height (ft)
Notification interval: Daily
Threshold condition: value > 18

Check your "Spam" mail folder if you don't receive a confirmation email from the USGS within a few minutes.
Your USGS WaterAlert request has been processed.

The notification threshold for your existing entry is changed
from: exceeds subscriber threshold of 15.0
to: exceeds subscriber threshold of 18

Site Number: 01463500
Station Name: Delaware River at Trenton NJ
Parameter Code: 00065
Parameter Name: Gage height
Agency Code: USGS
Notify when value exceeds subscriber threshold of 18 ft
Notification interval, no more often than: Daily
Address: rreiser@usgs.gov
Message type (e=email, t=text msg): e
Notification id: hni-m3cPv

For Help: http://water.usgs.gov/hns/hni-m3cPv:01463500
Water Alert’s Email message when threshold reached

Gage height of 18.5 ft exceeds subscriber threshold of 18.0 at 2011-08-28 06:15:00 EDT
01463500 00065 Delaware River at Trenton NJ
Notification interval, no more often than: Daily

For Realtime Data at this station:
http://waterdata.usgs.gov/nwis/uv/?site_no=01463500

For Subscription Help:
http://water.usgs.gov/hns?m3cPv:01463500

To Sign up for New Notifications:
http://water.usgs.gov/wateralert

Send Questions to: wateralert@usgs.gov
Water Alert’s Help page

- Send email replies to wateralert@usgs.gov
- To Pause this Specific Alert for 5 days: reply with Subject: PAUSE hni-HPUhW 5
- To Pause all Alerts for 5 days: reply with subject: PAUSE ALL hni-HPUhW 5
  (can change 5 to any number of days)
- To Continue (unpause) this or ALL alerts: reply with Subject: CONTINUE hni-HPUhW  CONTINUE ALL hni-HPUhW
- To Delete (signoff) this alert: reply with Subject: SIGNOFF hni-HPUhW
- To List Settings send email with Subject: LIST hni-HPUhW
- To List Settings for all Notifications at same site reply with Subject: LIST ALL hni-HPUhW
- For Help
  reply with Subject: HELP hni-CPUUhW
- To Change existing notification or sign up for New Notifications go to
  http://water.usgs.gov/wateralert
  To Modify a threshold, set a "new" notification with
  the same email address, site number and parameter
  http://water.usgs.gov/wateralert/help/?HPUhW:01463500
Get list of all subscriptions

You may also obtain custom management instructions on ALL your WaterAlerts by submitting this request:

WaterAlert Management Help

Send WaterAlert Help for...
- [ ] my email address
- [ ] my mobile phone

email address

Get My Alerts
Your USGS WaterAlert request has been processed.

Site Number: 01463500
Station Name: Delaware River at Trenton NJ
Parameter Code: 00065
Parameter Name: Gage height
Agency Code: USGS
Notify when value exceeds subscriber threshold of 18.00 ft
Notification interval, no more often than: Daily
Address: rreiser@usgs.gov
Message type (e=email, t=text msg): e
Notification id: hni-HPUhW:01463500
Flood Studies and Reports

- Flood summary reports for major floods (Hurricane Irene) http://nj.usgs.gov/hazards/flood/flood1108/
Contact Information

- Bob Reiser, Chief, Hydrologic Data Assessment Program, USGS New Jersey Water Science Center
  - 609-771-3980  rreiser@usgs.gov
- USGS New Jersey Water Science Center Home Page
- Address:
  - USGS NJ Water Science Center
    810 Bear Tavern Road, Suite 206
    West Trenton, NJ 08628
    (609) 771-3900
StreamStats New Jersey


- Interactive map-based web application available for public use
- Users can obtain flood-frequency statistics and basin characteristics for gaged and ungaged sites
- Developing equations for estimating lowflow statistics

Flood Inundation Mapping

- Passaic River Basin - selected stream reaches
- Flood inundation maps, used in conjunction with USGS real-time streamgage data & NWS flood forecasts, allow users to visualize current and forecasted flood-inundated areas
- EM officials and residents can see where the potential threat of flood water is highest

http://water.usgs.gov/osw/flood_inundation
Fathometer at upstream right wingwall scour hole