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New York Water Science Center News Volume 14, March 2012

U.S. Geological Survey, New York Water Science Center Newsletter

Documenting Irene & Lee | Honnandaga Lake Limeing | Flood Inundation Mapping | Bathymetry & Velocity Mapping | Hydrologic conditions

Documenting the Floods of April 2011 & August 28 – September 10, 2011

The U.S. Geological Survey (USGS), in support of Federal Emergency Management Agency (FEMA) Region II, is planning to document the scope and magnitude of snowmelt flooding in April 2011, flooding caused by Hurricane Irene, and Tropical Storm Lee in August and September 2011. This study will document the effects of flooding in New York from New York City, the eastern end of Long Island, the Hudson Valley, and the Lake Champlain basin. Throughout these regions, record streamflows and damage occurred. This report will describe the meteorological and hydrological impacts in these areas.

Some of the most severe damage occurred in Greene and Schoharie counties. Along the length of the Schoharie Creek, flows were estimated to equal or exceed the 500-year flood (0.2 percent chance).

The USGS collected high-water marks along the length of the Schoharie Creek to provide many of the records that will be detailed in this report. Additional high-water marks were obtained by FEMA . In addition, the New York State Canal Corporation obtained high-water marks at locks and dams along the Mohawk River where debris blockage at several locks and dams resulted in severe impacts to localized areas. All these high-water marks are to be included in this report and tabulated by basin.

Specifically the USGS report will:

- Assess the meteorological conditions associated with the snowmelt flooding and flooding from Hurricane Irene and the remnants of Tropical Storm Lee from the National Weather Service (NWS) and others;
- Document the hydrologic conditions that caused major flooding;
- Tabulate and plot gage-height and streamflow data collected during the floods at selected USGS streamgages;
- Compare high-water mark elevations collected along Schoharie Creek for the flood of August 28, 2011 to flood profiles in FEMA flood insurance studies and to high-water profiles collected by the USGS for the April 1987 and January 1996 floods;
- Estimate the magnitude and recurrence interval of the flooding in the disaster declaration area by evaluating peak streamflow records at USGS streamgages in the study area, and;
- Tabulate and plot peak estuary or ocean elevation records and co-located high-water mark elevations collected along coastal areas of Long Island and New York City for the storm tide from Hurricane Irene

High-water mark over Schoharie Creek., NY

mitigation planning.

Information from this study will serve to aid flood mitigation efforts that contribute to the protection of life and property. Benefits of this study will also provide: (1) a resource for Federal, State, and local officials to assist them in meeting mission requirements related to flood-hazard planning and response as well as infrastructure design and placement; (2) information for New York State's short-, mid- and long-term use in recovery operations and hazard mitigation planning, and; (3) standardized, quality-assured data to national data bases available to the public that will be used to advance the understanding of regional and temporal variations in hydrologic conditions.

A Message from Ward Freeman

New York Water Science Center Director

"It's been a very busy couple of months, since our last newsletter was published. Most of our time has been spent repairing and rebuilding streamgages that were either damaged or destroyed by Tropical Storms Irene and Lee. We've also been documenting the flooding, which is needed if we're going to be ready for the next big flood. Although we've heard countless accounts of how USGS streamgages were instrumental in forecasting the timing and magnitude of flood flows; evacuating people from areas affected by rising water; and post-storm recovery efforts, many of those same streamgages have been in danger of being shut down since October 2011, because of funding cuts. Funding for streamgages is very much a combined Federal, State, and Local partnership. A shortfall in any one of these funding sources can mean that the streamgage you rely on may be shutdown.

Thirty streamgages and 16 precipitation gages in the Susquehanna, Hudson, and Lake Champlain basins were all threatened with closure. I'm happy to report that thanks to the efforts of many of you including Senators Schumer (NY) and Leahy (VT) and New York U.S. Congressional Representatives Hinchey and Owens, funding was found to support all of the sites in the Lake Champlain basin and we're very optimistic that funding for the Susquehanna basin will also be found.

Unfortunately, we've been unable to find funding partners for two very important streamgages on the Hudson River and these sites were shut down March 1st. These streamgages provided a record of the stage of the river, documented the impacts from storm surges or hurricanes, supplied information for commercial navigation, and were sentinel site for tracking the impacts of climate change. Water temperature and specific conductance were also measured at these sites which provided the ability to track the location of the saltwater/freshwater boundary in the Hudson which can be crucial information during drought conditions for those communities and industries that get their water from the Hudson. Temperature and specific conductance [salinity] information are also used in assessing habitat conditions for various aquatic species that depend on certain conditions for some life stages. We had over 20 years of record at these sites and with concerns of sea-level rise and the impacts it may have on communities and infrastructure, loss of these sites leaves a big gap in the long term information that will be needed. We'll continue to try and bolster support for these two streamgages."

Visit the New York Water Science Center Web site at:
http://ny.water.usgs.gov
Or contact
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Whole-Ecosystem Restoration through Liming of Honnandaga Lake Tributary Watersheds.

The Honnandaga Lake watershed, located in the southwestern Adirondack region, is a high-value resource. The drainage waters from this system flow into West Canada Creek and are important to downstream drinking water sources, recreation, and transportation. The 312-ha lake supports one of seven remaining heritage strains of brook trout designated by the State of New York.

Brook trout in spawning colors. Honnandaga has the only population of Honnandaga Heritage Strain brook trout, one of the remaining 7 heritage strains of brook trout remaining in New York. Heritage strain means that it remains genetically unique, without any effects from stocking or mixing with other populations of trout.

Acidic deposition had rendered Honnandaga Lake essentially fishless in the 1970s and 1980s, with only brook trout remaining in few small, well-buffered tributaries. Improvements in water chemistry resulting from decreased acidic deposition led to a modest rebound of the brook trout population, but from 2000 - 2010 the fish density in the lake remained low, ranging from less than 1.2 to 3.7 fish per ha of lake surface (<0.5 to 1.5 fish per acre). Stocking efforts in 2002 and 2003 were unsuccessful in achieving a sustained population increase. Detailed assessments by the Cornell University Adirondack Fishery Research Program determined that continued recovery of the trout population was being suppressed by the lack of suitable spawning and young-of-year tributary habitats. Although the lake has 26 tributary inlets, most are either chronically or episodically acidified to the extent that spawning and occupancy by young-of-year brook trout is not possible.

The application of lime to neutralize the acidity of surface waters in the Adirondacks and elsewhere dates back to the 1970s, and periodic liming of selected, small Adirondack lakes is still conducted to maintain suitable pH for brook trout populations. With a few exceptions, lime is added directly to a lake or stream with the specific purpose of restoring and protecting trout populations. The treatments are generally beneficial to trout, but numerous questions remain regarding the benefits to other components of the lake and stream ecosystems. In one Adirondack study, lime was applied by hand-spreading on the soils in part of the lake watershed and terrestrial effects of the treatment were assessed for two years following treatment. Although the purpose of the treatment was to neutralize lake acidity, (insert a mention of results). To date, restoration liming has not been done for the purpose of replenishing calcium in soils depleted by acidic deposition. However, watershed liming can provide much more than surface-water neutralization. It has the added benefit of restoring the availability of calcium in soils, which is a key nutrient for growth in both terrestrial and aquatic ecosystems, and in these terms, would represent whole-ecosystem restoration.

In concert with emissions reductions that have been beneficial to lakes, selected watershed liming could potentially provide the needed boost for damaged Adirondack streams and forests to achieve a more complete recovery. The information available from liming efforts conducted to date, however, is insufficient for determining the degree of success that could be achieved with various approaches. Therefore, the objective of the proposed study is to investigate the effects of both in-stream liming and tributary watershed liming for the purpose of remediating Adirondack ecosystems damaged by acidic deposition.

Study Design

The study will be conducted in the Honnandaga Lake watershed, where a large amount of information is available on water chemistry, fisheries, and forest management that dates back prior to the onset of acid rain. The liming study is designed to evaluate (1) direct addition to the stream, and (2) aerial addition over the entire watershed of a tributary stream. Six tributary watersheds (two sets of 3) have been selected for study. Three of the streams are chronically acidic, and three are episodically acidic. Within each set of three, one watershed will remain untreated, one watershed will receive in-stream liming, and one will receive aerial liming. To provide realistic recovery targets for the treated watersheds, partial monitoring will be done in a seventh watershed that is relatively rich in calcium

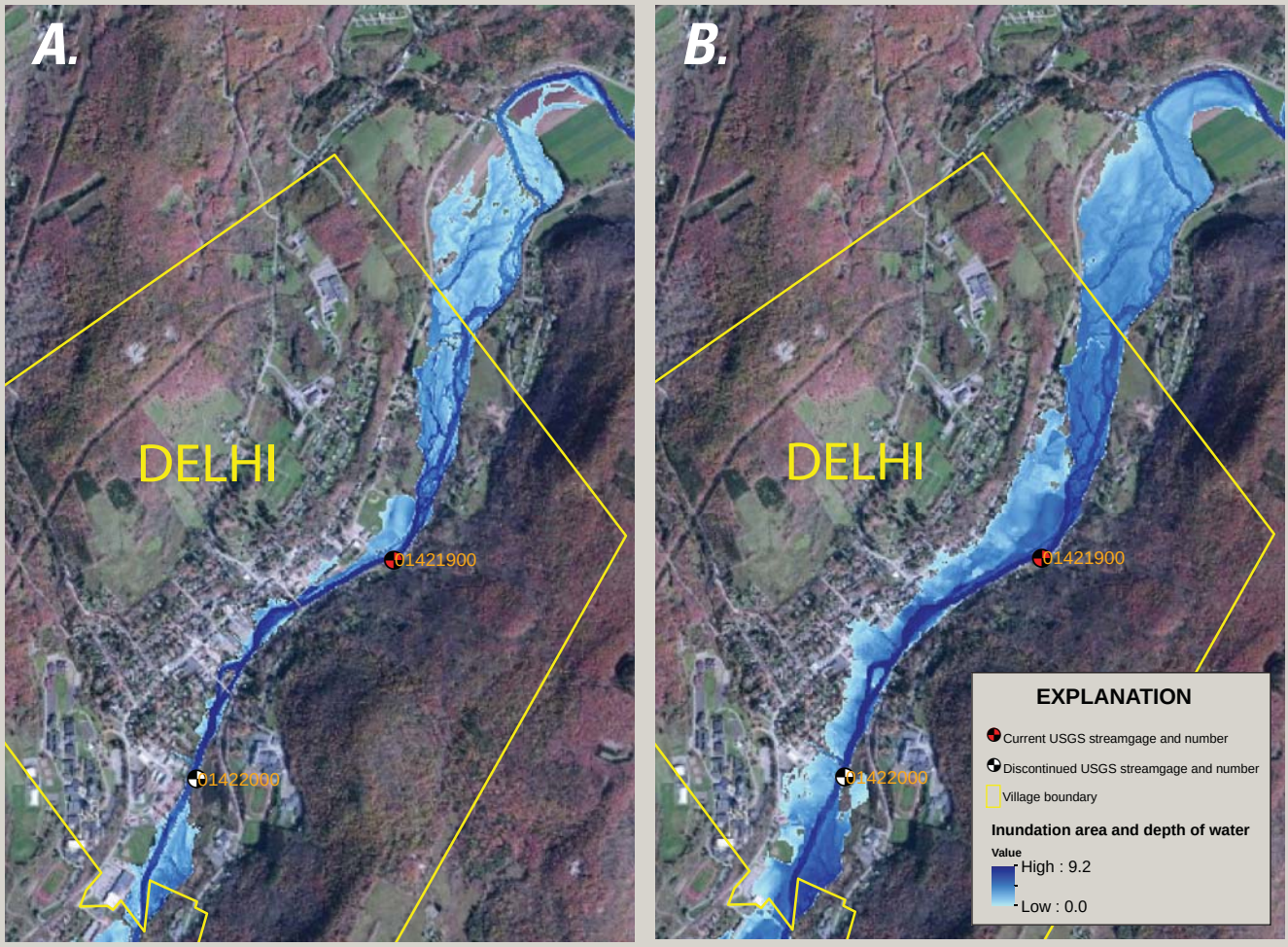
Water chemistry, flow, brook trout populations, and other aquatic biota (including periphyton and macroinvertebrates) will be monitored in each stream channel; soil chemistry, tree health and growth, and terrestrial biota (including amphibians and gastropods) will be monitored in each watershed. The project will be implemented in three consecutive phases. Phase 1 will be the in-stream liming and also serve as the pretreatment monitoring period for the watershed liming. Phase 2 will consist of the aerial liming and two years of post treatment monitoring. Phase 3 will consist of long-term, less-intensive monitoring of selected ecosystem measures that are expected to either (a) respond slowly or (b) respond rapidly, but possibly reverse over a longer period. Measurement details are in development.

The lake is over 5 miles long, but only contains about 800-900 trout and no other fish species.

Flood-Inundation Mapping

Flooding is a ubiquitous problem throughout New York State. The village of Delhi has experienced severe floods, including the devastating flood of January 1996, and the recent floods of October 1, 2010, and August 28, 2011. Before and during a flood, forewarning and emergency response are critical. The rescue efforts of emergency responders are often hampered by lack of an understanding of where flooding is occurring at any given moment, but also where flooding is likely to occur at some time in the near future.

The USGS has conducted a project for the Village of Delhi to create a series of flood-inundation and flood-depth maps at incremental stream stages for West Branch Delaware River at Delhi. The maps are derived from flood water-surface profiles obtained from a hydraulic model that was developed for the most recent FEMA flood-insurance study (FIS). High-accuracy land-surface elevation data (from LiDAR) and a GIS were used to create these maps. In addition to identifying the areal extent of flooding, these maps are color-coded by the depth of flooding; thereby providing valuable information on the severity of flooding. The USGS operates a streamgage on the West Branch Delaware River just upstream from Delhi. By accessing stage data online or by registering with the USGS WaterAlert program to receive an email or voice-mail message when a threshold stage is exceeded, emergency responders can have forewarning of an approaching flood. By referring to the appropriate map that shows the areas likely to be inundated at that particular stage, emergency responders and property owners can immediately obtain a picture of the extent and severity of the flood and make plans for road closures, evacuations, and protection of lives and property before areas are inundated by floodwaters.



Map showing flood-inundation area for West Branch Delaware River , Delhi, N.Y., corresponding to a gage height of (A.) 10.0 feet (1,360.82 feet, North American Datum 1988) and (B) 16.0 feet (1,366.82 feet, North American Datum 1988) at the U.S. Geological Survey streamgage 01421900.

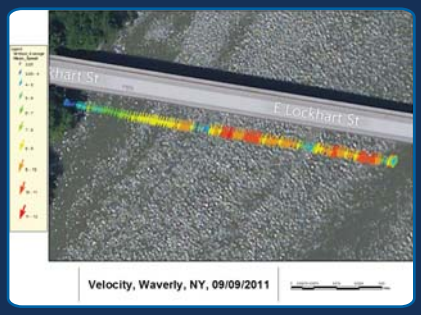
Enhanced Bathymetry and Velocity Mappong for Habitat, Flood Inundation, and Reservoir Capacity

The USGS NYWSC has developed efficient, precise methods utilizing combined hydro-acoustic and geo-spatial data sets for mapping velocities and bathymetric surfaces. Using an ADCP (Acoustic Doppler Current Profiler) combined with RTK (Real-Time Kinematic) GPS; depth, velocity, and position data are collected simultaneously. The new methodology was developed in response to a growing need for accurate data to support habitat restoration projects, sediment transport studies, reservoir capacity calculations, and flood inundation models.

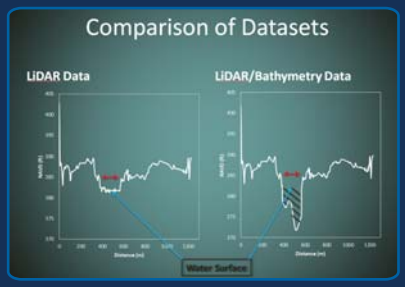
As part of the methodology, data processing tools have been developed to expand the capability of the ADCP equipment generally used for discharge measurements. ADCP's have been used in the USGS since the early 1980's, but with the addition of high-resolution GPS instrumentation, the ADCP can be used as a tool to create precise spatial representations of depth and velocity data collected in reservoirs and streams. Based on specific needs of projects, there are a variety of uses for this data. Bathymetric data measured from the ADCP has 1-percent accuracy (a lower-threshold resolution of 0.001 foot) and a range from about 0.5-260 feet. The data can then be represented as contours, or geospatially in a Geographic Information System (GIS) as a Digital Terrain Model (DTM) or a triangulated irregular network (TIN) depending on the user's needs and applications. For example, using a TIN, reservoir capacity curves can be created during data collection. For an estimate of the cost for acquiring this data and interpretive products contact Lynn Szabo (lszabo@usgs.gov).

Map showing stream-channel morphology for Cayuga Inlet. Water depths were collected using an Acoustic Doppler Current Profiler (ADCP) and the position of each water-depth measurement was determined using global positioning unit (GPS). Water depths and concurrent positions were collected from a small boat. Water depths and positions were entered into a Digital Terrain Model (DTM) and contoured at 1 ft intervals.

Bathymetry and Velocity Mapping



Velocity data can be mapped either normal to, or in the same direction as, velocities within a channel and can be portrayed as an average composite of all velocity layers collected in a vertical profile, or, from individual layers, such as only near the bed of a stream —important data for habitat restoration. Velocity data from specific vertical and horizontal planes can also help identify specific sediment-transport areas in surface water bodies.

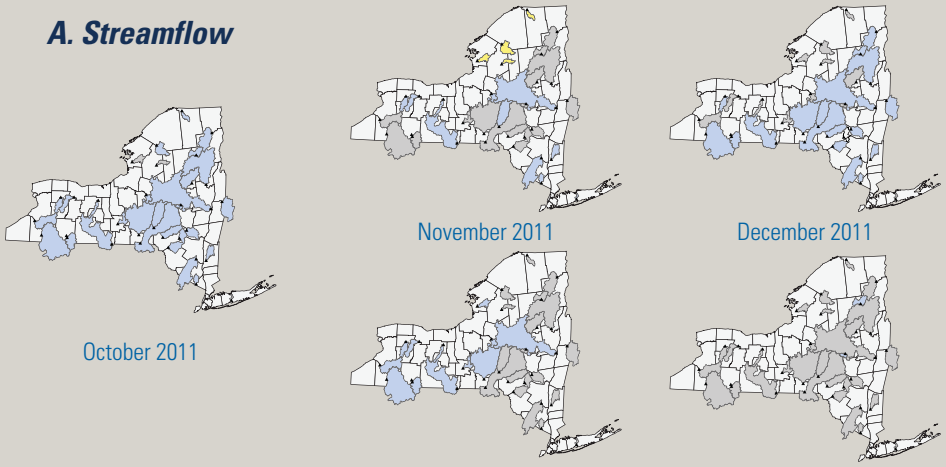


Combining bathymetric data with LIDAR (Light Detection and Ranging) data, a DTM can be created as a continuous, high-resolution representation of the land surface adjacent to and below the water surface. Because LIDAR data is limited by the water surface itself, just relying on LIDAR data is less accurate, especially for input to advanced flood inundation mapping and reservoir capacity calculation,. Whereas, combining LIDAR and ADCP data sets allows a more accurate total terrain model (land-surface and channel-bottom surface), which produces more accurate products for flood inundation mapping and reservoir capacity calculations.

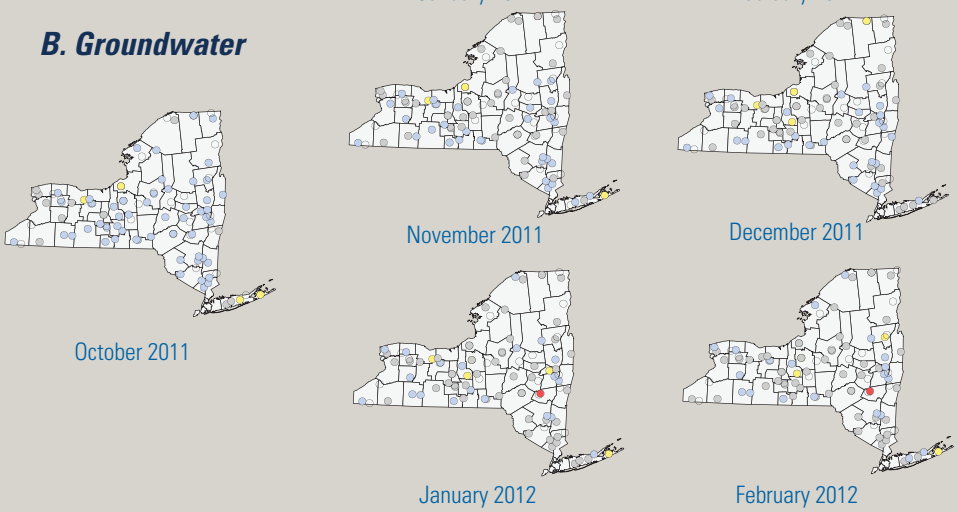
Surface Water and Groundwater Conditions in New York

Monthly, hydrologists at the New York WSC synthesize and summarize streamflows and groundwater levels for New York. Monthly hydrologic condition reports are available at http://ny.water.usgs.gov/infodata/conditions.html. Average monthly streamflow and groundwater conditions across New York have been in the normal or wet ranges over most of the last 5 months. Starting next month the New York WSC will be releasing the Hydrologic Conditions Mapper. The "Mapper" will allow the user to toggle between streamflow, groundwater, and precipitation conditions for each month and download data for each.

A. Streamflow



B. Groundwater



EXPLANATION

Basin boundry | Drought Region | Streamgage | Groundwater well

Percentages of Monthly Means (Period of Record)

WET | NORMAL | DRY | VERY DRY

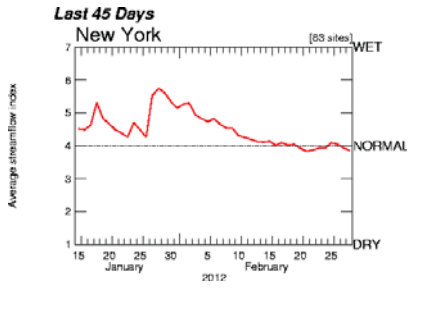
Average monthly conditions at selected (A) streamgages and (B) groundwater wells in New York. USGS maintains and operates most streamgages and groundwater wells in cooperation with various federal, state, and local agencies.

USGS Water Water & Groundwater Watch

WaterWatch is a USGS World Wide Web site that displays maps, graphs, and tables describing real-time, recent, and past streamflow conditions for the Nation. Real-time streamflow information (stage and flow) generally is updated on an hourly basis. WaterWatch provides maps that show the location of more than 3,000 long-term (30 years or more) USGS streamgages.

Groundwater Watch is a USGS World Wide Web site that displays maps, graphs, and tables describing groundwater level data from wells currently in a regular measurement program. Three types of water-level data are displayed, including periodic, continuous data that is periodically retrieved, and real-time data generally updated on an hourly basis. Groundwater Watch contains water levels and well information from more than 20,000 wells that have been measured by the USGS or USGS cooperators at least once within the past 365 days.

45 Day Index Plot



Among other things, WaterWatch summarizes streamflow conditions in a region (state or hydrologic unit) in terms of the long-term typical condition at streamgages in the region. For example, this plot shows that streamflow in January was above the normal whereas streamflow in February was at normal conditions for New York.

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- Minimize loss of life and property as a result of water-related natural hazards, such as floods, droughts, and land movement.
- Effectively manage groundwater and surface-water resources for domestic, agricultural, commercial, industrial, recreational, and ecological uses.
- Protect and enhance water resources for human health, aquatic health, and environmental quality.
- Contribute to wise physical and economic development of the Nation's resources for the benefit of present and future generations.

If you have an environmental or resource-management issue in which you would like to partner with the USGS to investigate, please contact any of our senior management staff (listed below). Projects are supported primarily through the Cooperative Water Program. This is a program through which any State, County, or local agency may work with the USGS to fund and conduct a monitoring or investigation project.

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