The NHWC Transmission

May 2015

CONTENTS

Manasquan Borough Redesigns Emergency Operations Plan Utilizing USGS Real-Time Tide Gage and USGS WaterAlert

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The local Office of Emergency Management in Manasquan, NJ has recently implemented an automated high-water response system that was the culmination of several years of planning, equipment upgrades and collaboration with strategic partners including the US Geological Survey New Jersey Water Science Center (USGS NJWSC), the New Jersey Department of Law and Public Safety, the National Weather Service (NWS) forecast office in Mount Holly, NJ, the Davidson Laboratory at Stevens Institute, as well as local emergency responders.

Tide Gage:

In the wake of Hurricane Sandy, local emergency management officials in Manasquan have been working to identify and correct problems that adversely impacted the emergency response in order to be better prepared for the next storm. After conducting several meetings with the National Weather Service, Rutgers University, New Jersey Sea Grant, as well as State and County Emergency Management officials, one of the major issues identified was the lack of real-time tide and storm surge information in the days and hours leading up to the storm.

The closest tide gage was USGS 01407770 Shark River at Belmar which at the time was capable of recording water levels up to 6.0' NAVD88. During the afternoon prior to Sandy's landfall, the gage maxed out four hours before high tide, rendering the gage useless at that point. The next closest tide gage was NOAA's National Ocean Service (NOS) 8531680 Sandy Hook NJ tidal station, nearly 25 miles to the north. When the tide gage at Sandy Hook failed prior to Hurricane Sandy making landfall, weather forecasters and emergency management officials were forced to rely on a NOAA tide station which was located over 50 miles away in Atlantic City. This tide gage also happened to be south of the eye of the storm and as such was showing surge values approximately 3 feet lower than what was occurring in Monmouth County. This led to a serious lack of real-time surge data in the hours leading up to Sandy's landfall.

In order to be better prepared for the next major coastal storm, the Borough of Manasquan partnered with the USGS NJWSC, the New Jersey Department of Law and Public Safety, the NWS Advance Hydrologic Prediction Service (AHPS), Stevens Institute, and the Monmouth County Engineering Department to install a new tidal station in Manasquan and integrate the data into the USGS National Water Information System Web Interface (NWISWeb), the NWS Advanced Hydrologic Prediction Service (AHPS) and Stevens' Davidson Laboratory Storm Surge Warning Systems. The gage was installed in July of 2013 and is operated and maintained by the USGS NJWSC, in cooperation with the New Jersey Department of Law and Public Safety. The gage provides real-time tidal and storm surge

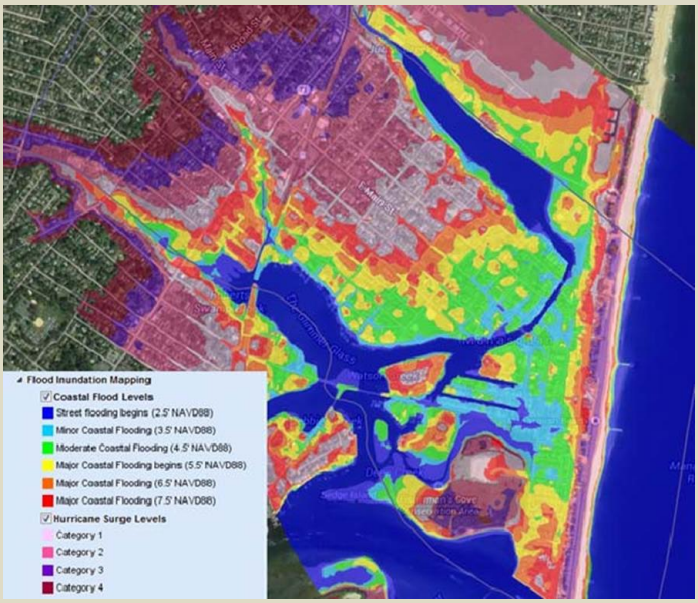
monitoring data for Emergency Management and National Weather Service Forecasters resulting in improved tidal forecasts and refined evacuation zones for residents.

The gage also is part of the USGS WaterAlert system, providing both text and email alerts to emergency officials and residents when tide heights exceed pre-determined thresholds. Real-time tide and weather information including wind speed and direction, air and water temperature, barometric pressure, humidity and precipitation, are available to the public via the USGS NWISWeb Interface.

Web-based coastal flood inundation mapping:

Another critical area identified by local emergency management in the wake of Hurricane Sandy was the need for accurate flood inundation mapping. In 2007, the Army Corps of Engineers released a Hurricane Evacuation Study that included flood inundation maps based upon the latest Sea, Lake and Overland Surges from Hurricanes (SLOSH) computer modeling for Category 1 to Category 4 hurricanes. In 2010, the Borough had this mapping digitized and layered into a user-friendly Google Earth based map available to the public via the internet.

The problem was a lack of inundation mapping for levels below a Category 1 hurricane, specifically, the minor, moderate and major coastal flood levels established by the National Weather Service which are commonly referred to in their Coastal Flood Warning statements.



View of web-based coastal flood inundation maps developed for Manasquan, NJ

The Borough was able to have Dewberry Associates, a regional Engineering Firm already conducting post-Sandy FEMA work in Manasquan, create these maps at no cost to the Borough utilizing the Light Detection and Ranging (LIDAR) survey elevation data for the NJ coastline that was available for free via Rutgers. The

coastal flood inundation maps are specific to Manasquan, and show color-coded flood elevations in1-foot contours for coastal flood levels ranging from Minor Coastal Flooding through Category 4 Hurricane storm surges. These maps are utilized by local emergency management officials and are available to the public via the Borough's website.

Crisis Strikes:

Approximately 90% of the housing stock in the vicinity of the beachfront in Manasquan was significantly damaged or destroyed during Hurricane Sandy. This spurred a multi-year rebuilding effort that is still taking place today, and heavy trucks transporting material and equipment are now commonplace.

One of the three main access bridges to the Manasquan beachfront is a wooden cable-lift bascule bridge spanning the Glimmer Glass that was originally erected in 1939. This narrow historic bridge was not built to today's engineering standards and as such has a 3-ton weight limit, little more than the weight of a full-size SUV. This bridge serves the flood-prone south side of the beachfront and is the only means of access for residents and businesses west of 4th Avenue during any type of coastal flooding event.

The Glimmer Glass Bridge in Manasquan, NJ

On August 7th, 2014, an overweight truck crossed the fragile bridge causing significant damage to sections of the bridge deck. This forced the immediate closure of the bridge, and the need for a major repair contract that would require the closure of this coastal evacuation route for up to a year until the repairs could be completed.

The area served by the bridge is the lowest area in terms of elevation in the Borough. The crown of the roadway in this area is actually below

Glimmer Glass Bridge Closure in Manasquan, NJ

monthly spring high tide levels, and an analysis of data from the USGS tide gage demonstrated that the roads in this area were submerged during 292 high tide cycles over the last year alone and experience tidal flooding on average over 10 hours per week.

Without the bridge for access, when tides are of sufficient height, many areas become stranded and emergency responders are required to use high-water response vehicles for access, causing a delay in their response times. The loss of the bridge presented a serious public safety concern as residents would not be afforded timely emergency response due to the roads being submerged by tidal waters several times per month.

Glimmer Glass Bridge during minor flooding

Recognizing that the only access route for residents and businesses during flood conditions was lost, a State of Emergency was declared on August 22, 2014, empowering the local Office of Emergency Management to modify existing warning & evacuation protocols and devise a plan for emergency access into affected areas during times of high tide.

Putting It All Together:

Although the Borough had successfully responded with high-water teams in the past, it was always called upon during a storm event, or after emergency responders were dispatched to a call and discovered that they could not make it into an area. The goal was to automate this dispatching process and reduce response times into flooded areas.

High-water vehicle used to fight fire during Hurricane Irene

The local Office of Emergency Management (OEM) realized that they had all the tools they needed to implement an innovative program for emergency response into areas inaccessible due to flood waters. These tools included two high-water response vehicles, trained water-rescue personnel available 24/7, a USGS tide gage, the USGS WaterAlert warning system, and identification of flood-prone areas with recently completed inundation mapping.

It was now a matter of pooling all these resources together into a seamless plan that provided an uninterrupted emergency response to areas that become flooded and inaccessible during coastal flood events.

The Borough's OEM identified each stage of the process:

- Identify areas subject to coastal flooding and water levels that would trigger a high water response.
- Provide a means of alerting emergency dispatchers that flooding is occurring. This must be automated, accurate and reliable.
- Provide a simple way for emergency dispatchers to know if an address is in a flooded area. This must be simple, fast and part of the dispatchers' established routine.
- Provide a plan that encompasses the entire town and addresses flood levels from the minor coastal flood level up to a full-scale evacuation.

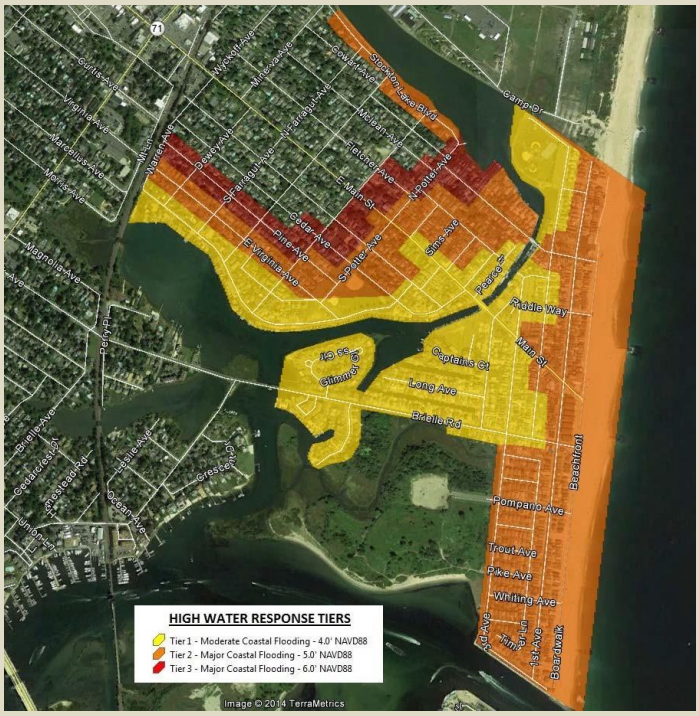
Flood Inundation Tiers:

A tiered response was developed in order to correlate geographic areas to water levels and trigger a high water response into those areas when appropriate.

Three tiers were developed with the following trigger heights:

- Tier 1 – 4.0' NAVD88
  (NWS moderate coastal flooding)
- Tier 2 – 5.0' NAVD88
  (NWS major coastal flooding)
- Tier 3 – 6.0' NAVD88
  (NWS major coastal flooding)

An area was included in each respective tier if the crown of the roadway was below the trigger height for each tier, or if access into that area would require traversing roads below the trigger elevation.



Flood Tiers for high-water response

USGS WaterAlert:

In order to know when areas were experiencing flooding, OEM officials utilized the USGS WaterAlert notification system. This is a reliable system with built-in redundancy that had been tested by OEM officials since installation of the USGS tide gage in 2013.

Several modes of receiving the USGS WaterAlerts were considered, however, the most reliable, cost effective and easiest to implement would be text alerts through a standard cell phone. The Borough acquired a new Android

Smartphone from Verizon Communications with a text messaging plan only. On the phone, an application called FireAlert was downloaded from the Google-play store which had the ability to provide customized visual and audible warnings based upon text messages received.

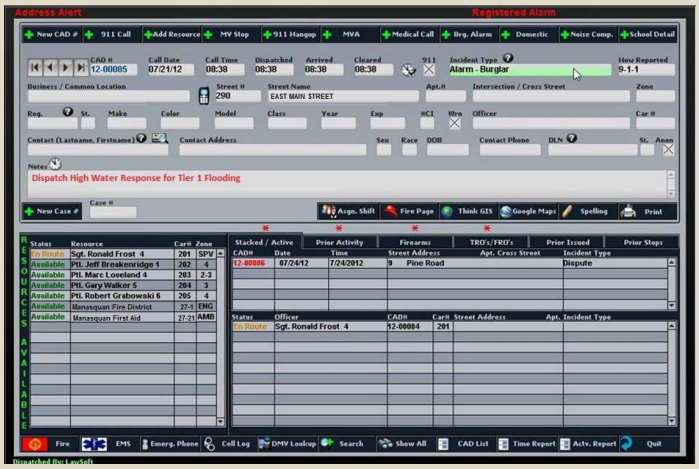
Since USGS WaterAlert only checks water levels once every hour, a built in factor of safety was added to the trigger elevation for each tier. For example, the USGS WaterAlert will check water levels every hour on the half hour. If water levels are just below trigger height when the gage reports, no alert will be given, and a WaterAlert will not report until an hour later. The water will be rising during this timeframe and may exceed an established tier up to 59 minutes before an alert would be issued. As such, after careful calibration, all trigger heights include a 0.5' safety buffer to account for these situations.

USGS WaterAlerts received via the FireAlert App

The FireAlert app on the phone was programmed to provide uniquely identifiable alerts based upon depth of flooding occurring. The app is programmed to keep the screen illuminated for 59 minutes after the WaterAlert is received and ring a distinct tone every 15 minutes. This way, the phone will continuously illuminate the WaterAlert until the alert expires or is replaced with a new alert one hour later. Each tiered alert is color coded and provides different tones for different flood tiers. This allows emergency dispatchers to know when a flood alert tier changes or when the alert expires.

Computer Aided Dispatch:

Every time an emergency call is received by dispatchers, the address is entered into the Computer Aided Dispatch System (CADS) in order to log the call and ascertain pertinent information about the address that may impact the emergency response. Since the Borough already had this system in place, OEM and Borough emergency dispatchers realized that they could use this system to identify what flood tier each address was located in.



CADS control and display dashboard

Over the next several months, OEM and emergency dispatchers identified every address located in each flood tier and meticulously entered over 1,000 addresses into the CADS system. Now when a call for help is received by emergency dispatchers, the dispatcher immediately logs the call and is alerted if the address is located in one of the three flood tiers.

High-Water Dispatch Policy:

Police, fire or first aid emergencies in areas inaccessible during flood conditions now automatically trigger a high water response by the municipal Fire Department's high water response team.

How the high-water dispatch system works…

- When flood levels exceed any of the flood tiers, emergency dispatchers are notified by USGS WaterAlert of the flood level and what tiers are affected throughout the duration of the flood.
- An emergency 911 call is received and dispatched as usual.
- The dispatcher logs the address into the Computer Aided Dispatch System (CADS) and is notified if the caller's address is located within a designated flood tier.
- If a 911 call is received for an address located in a flood tier and that tier is currently flooding, the dispatcher automatically dispatches a high-water response to that address.

The high water response will result in two high-water response vehicles each staffed by a driver and two water-rescue trained firefighters reporting to a preplanned staging area. Incoming police, fire & first aid units will report to the staging area and arrange for transport to the call location if roads

One of two converted surplus military cargo trucks used for high-water responses

are deemed impassable. The first high-water truck will transport police/fire/first aid units to the call location. The second high-water truck will stand by until transport of medics, additional units, manpower, etc. is required. If the primary staging area on Main & Potter becomes inaccessible, a fallback staging area at Borough Hall will be announced via Police Dispatch.

Dispatchers may also trigger a high water response to an emergency at any time based upon reports from field units, even if the high water alarm has not activated.

Implementation:

A pilot program of the high water dispatch policy was implemented on September 1st, 2014, just a week after the initial State of Emergency was declared following closure of the bridge. This was initially implemented for the area affected by the bridge closure only.

A full-scale exercise of the pilot program was conducted on September 9th, 2014. The entire system was tested, including the high water alarm, the emergency dispatch system, and response of the high water trucks to a pre-planned staging area, including appropriate police, fire and first aid units. The goal was to conduct a "dry run" and discover any changes to the policy that may make things run smoother.

The drill proceeded as planned and ran smoothly. Following the drill it was recommended by response personnel that the high-water trucks be equipped with floating "Stokes" rescue litters, similar to the ones the Coast Guard uses in their helicopters to remove victims. These have now been placed on the high water trucks and are available for immediate deployment when needed.

High-water response team in action during Hurricane Sandy

After several months of evaluation, and time to develop flood tiers and fine tune specific addresses included in each tier, on January 1st, 2015 the pilot program was expanded town-wide and was formally incorporated into the Borough's Emergency Operations Plan.

Conference Discount Deadlines

Full conference attendance prices go up $100 after May 15, 2015
Register Today

Special hotel room rates end after May 25, 2015
Reserve Your Room Today

NHWC Conference Rapidly Approaching

The June 15-18, 2015 National Hydrologic Warning Council (NHWC) Conference in Indianapolis is rapidly approaching.

The Conference is the largest of its kind in the United States, devoted specifically to real-time hydrologic warning systems and how these systems and associated technologies assist local officials with hydrologic hazard preparedness, emergency response, recovery, and mitigation. The extensive Conference Program is based on the theme "Advances in Hydrologic Warning – The Race to Save Lives".

To attend the Conference, here is some key information:

Early Registration discount – ends after this Friday (May 15, 2015), click here to register.

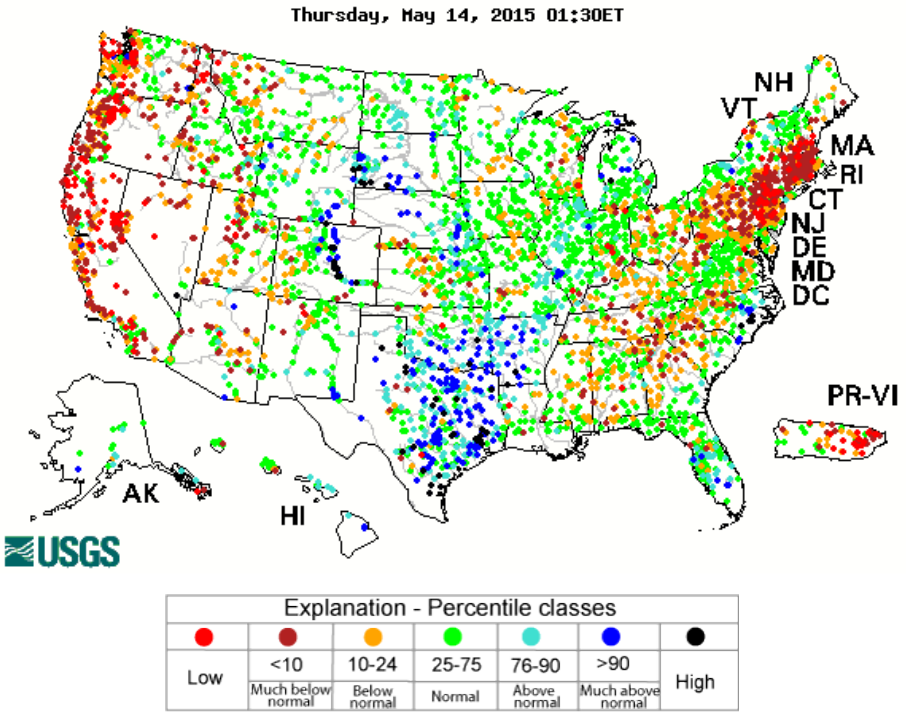
Special hotel room rates at the Crowne Plaza at Historic Union Station – the special attendee rate of $150.00 single or double is still available, but ends after May 25th, 2015. Reserve your room here.

Government rate rooms are still available – to request the special weblink to reserve a room at the government rate send an e-mail to governmentrooms@hydrologicwarning.org including the name of your organization. Presentation of valid identification is required upon check-in.

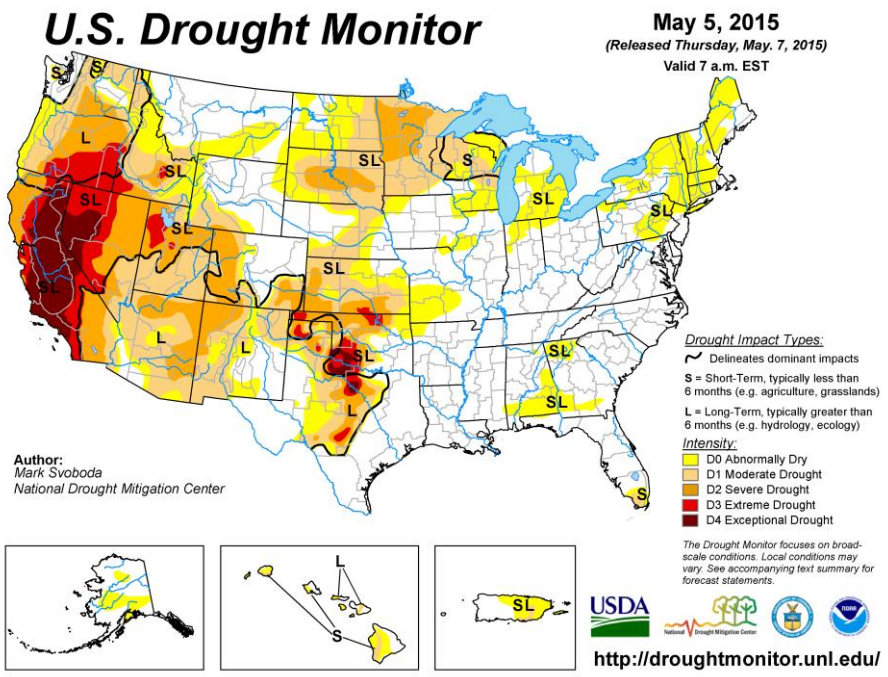
CFM Continuing Education Credits – ASFPM will offer 12 core continuing education credits to Certified Floodplain Managers attending the Conference.

If you need help with registration, contact April Krieg at:
april@aprilkrieg.com

Hydrologic Conditions in the United States
Through May 14 2015



Latest stream flow conditions in the United States. (courtesy USGS)



Latest drought conditions in the United States. (courtesy National Drought Mitigation Center)

June Newsletter Articles Focus:

Data Collection

The NHWC is requesting articles that focus on practices, technologies and tools used to gather and disseminate real-time hydro-meteorological data.

Please consider writing an article that highlights how your organization collects and disseminates real-time data.

Submit your article to:

editor@hydrologicwarning.org

June 5th is the deadline for inclusion in the June issue.

Future Newsletter Articles Focus

To give you more time to prepare articles, below is the article focus schedule for the next four months:

Jun - Data Collection
Jul - Hydrology
Aug - Hazard Communication & Public Awareness
Sep - Modeling/Analysis

Membership Renewal

It's not too late to renew your Annual NHWC Membership. New members are welcome. Click **here** to join/renew your membership.

NHWC Calendar

June 15-18, 2015 - NHWC 2015 Training Conference & Exposition, Indianapolis, Indiana

November 4-5, 2015 - NHWC Advanced Flood Warning Workshop, Albany, New York

General Interest Calendar

May 17-21, 2015 - World Environmental & Water Resources Congress, Austin, Texas

May 31-June 5, 2015 - Association of State Floodplain Managers (ASFPM) Annual National Conference, Atlanta, Georgia

July 19-22, 2015 - 40th Annual Natural Hazards Research and Applications Workshop, Broomfield, Colorado

(see the event calendar on the NHWC website for more information)

Parting Shot

Ellijay Watershed Control Structure No. 1

This siren station, installed in July, 2014 by Gilmer County, Georgia, is activated automatically when the reservoir's stage reaches a critical flood threat elevation.

photo courtesy High Sierra Electronics, Inc.