



The NHWC Transmission

June 2016

CONTENTS

NC Gage Data Network 1
Consequence Management ... 3
NHWC Workshop 4
US Hydrologic Conditions 4
Calendar of Events 5
July Focus 5
Parting Shot 5

Click on hyperlinks located throughout this newsletter for more information.

NHWC 2015-17 Officers and Directors

Steve Fitzgerald

President
Harris County FCD

Joshua McSwain

Vice President
Charlotte-Mecklenburg
Stormwater Services

Brad Heilwagen

Secretary
Amec Foster Wheeler

Chris Crompton

Treasurer
County of Orange

David Curtis

Past President
WEST Consultants, Inc.

Bruce Rindahl

AUG Representative
Ventura County Watershed
Protection District

Directors At-Large

Ben Pratt

Susquehanna River Basin
Commission

Andrew Rooke

AMR Consults, LLC

Kevin Stewart

Urban Drainage and FCD



North Carolina's Gage Data Network

David Herlong, North Carolina Emergency Management

The Risk Management Section (RMS) of the NC Division of Emergency Management (NCEM) gathers data from over 530 gages across the state. From the Blue Ridge Mountains to the Outer Banks the network covers the entire 500-mile length of the state. As with most gage data networks ours was created at various times since the 1980s and is evolving in size and capability as finances and technology allow.

We also receive data from gages located in the nearby coastal areas of Virginia and South Carolina. Not all the gages being monitored are operated by NCEM. Three other agencies operate ALERT gages on our network:

City of Asheville – 11	NCEM – 152
Duke Energy – 14	NOAA Ocean Service – 11 (6 in NC)
Lake Lure, NC – 3	USGS – 332

All data is received by a Contrail Base Station located at the NCEM Emergency Operations Center (EOC) in Raleigh, North Carolina. It is viewable in Contrail as well as the FIMAN (<https://fiman.nc.gov/fiman/>) flood inundation mapping web site. Data from the all non USGS and NOAA gages is sent to the National Weather Service.

NCEM Gage Network History

During the 1980s and 90s seventeen counties in Western North Carolina received the first gages, mostly rain gages, through the NWS IFLOWS program. These gages utilize ALERT technology to transmit data either directly or via eleven mountain top repeaters to receiving stations.

In 1999 Hurricanes Dennis and Floyd brought record flooding to much of Eastern NC. As a result North Carolina became a FEMA Cooperating Technical State and created the NC Floodplain Mapping Program (now Risk Management Section). The primary task was to modernize the floodplain maps for the entire state which is now completed. In addition the NC Flood Warning Program was established to install additional gages and create inundation maps at selected gage sites in Eastern North Carolina.



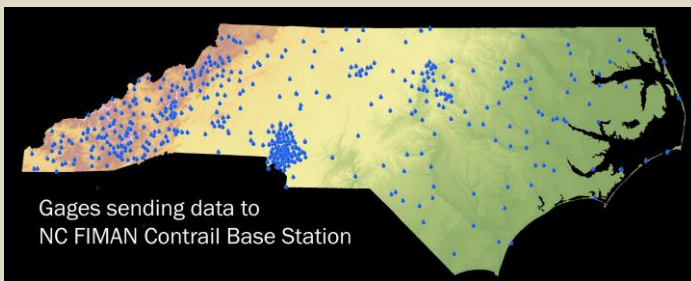
ALERT rain gage in Boone, North Carolina (Watauga County). ➔

After severe flooding from Hurricanes Francis and Ivan in 2004, 46 additional ALERT rain and stream gage sites were added in the mountains of the state. Inundation maps were also added for 36 sites in Western North Carolina.

Recovery efforts from Hurricane Irene in 2011 included installing seven gages on the Albemarle – Pamlico Sound to monitor flooding in populated areas along the low-lying shoreline. These were added to the twelve NCEM GOES gages installed further inland on the Coastal Plain. Future sound and ocean gage sites are continually being evaluated.

Gage Data Transmission and Receiving

Data from all gages are received by the Conrail Base Station at the NCEM Emergency Operations Center in Raleigh, North Carolina. For NCEM gages the geographical diversity of the state – from 6,000 ft. elevation to sea level – requires us to use two data transmission methods.



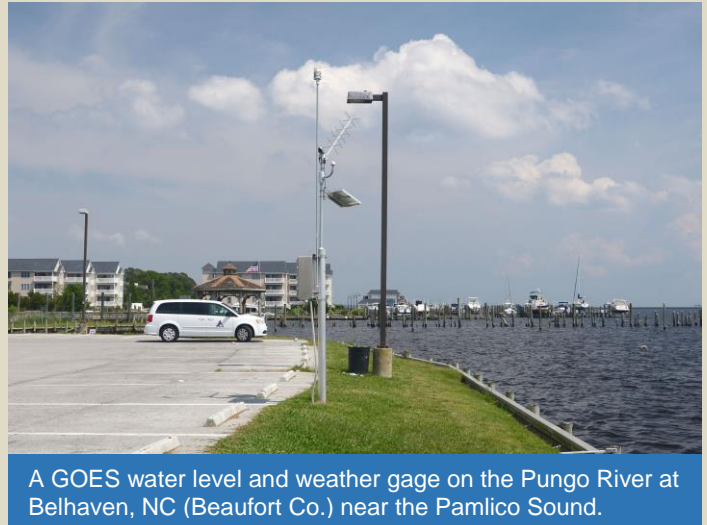
From the mountains to the sea data from over 530 gages is received into NC FIMAN Conrail Base Station from six different agencies. The large numbers of gages in the Charlotte, NC area are part of [FINS - Flood Information and Notification System](#) for Charlotte-Mecklenburg Co.

Sites in the western part of the state use ALERT and a network of repeaters to send data to four receiving sites on three mountain tops. Redundancy is achieved by having data received by two or more receivers. Only a very few sites have a single pathway.



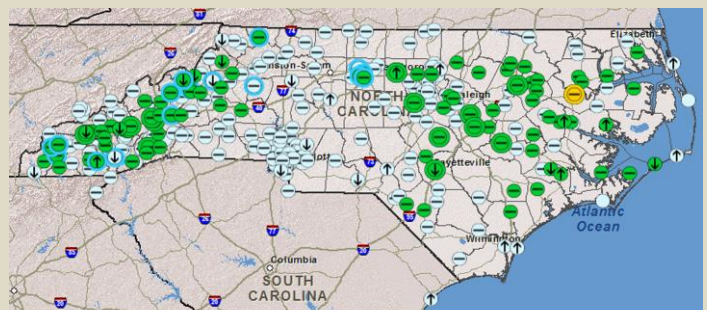
A radar water level sensor and rain gage at Bat Cave on the Broad River in Henderson Co, North Carolina

The mountain top receivers convert the analog data to digital data which is sent to Raleigh via the North Carolina Highway Patrol secure data network. We currently have no ALERT2 compatible hardware.



A GOES water level and weather gage on the Pungo River at Belhaven, NC (Beaufort Co.) near the Pamlico Sound.

The gages in Eastern NC are spread across the broad flat Coastal Plain and Sounds. These gages transmit data via GOES since there are fewer of them and they are widely distributed making terrestrial RF technology financially prohibitive. A satellite receiver was installed at the EOC in Raleigh to receive the data with an internet backup connection to Wallops Island. USGS and NOAA gage data are collected through a web service directly into Conrail.



Stream and Water Level Gages in FIMAN

The Flood Inundation Mapping and Alert Network (FIMAN) receives data from 322 stream gages and coastal water level gages. Sites in green are risk-rated and most of them have inundation map libraries. The arrows and dashes inside the icons indicate rising, falling or no change in recent water elevations

The central region of the state has no NCEM gages to date. Potential sites are being evaluated using risk-based assessments but installation will have to wait on further funding. Once sites are identified, ALERT, ALERT2 or GOES will be used based on geography and density of new gage sites.

Risk Management through Consequence Management

Woodrow Fields, USACE Hydrologic Engineering Center

Decisions within the USACE (U.S. Corps of Engineers) Dam and Levee Safety programs follow a risk-informed management process where life safety is held paramount. Understanding and making informed decisions related to life safety risk not only requires a clear understanding of the engineering aspects of USACE's flood defense infrastructure, but also the human aspects (Figure 1). To that end, USACE engaged with well-respected social scientists in the areas of warning and evacuation to better understand how flood warnings spread through a community and what causes an individual to delay their decision to take a protective action based on those warnings. This understanding will not only allow USACE to better assess the existing risk associated with USACE infrastructure and prioritize remediation investments accordingly, but also provide USACE with important insights regarding implementing or recommending efficient and effective risk reduction measures.



Figure 1 - Hurricane Katrina - People waiting to be rescued

Dr. Dennis Mileti (Professor Emeritus of Sociology, University of Colorado at Boulder) and Dr. John Sorenson (Researcher Emeritus, Oak Ridge National Laboratory, Oak Ridge, TN), both renowned social scientists in the areas of emergency warning and evacuation, wrote three white papers that cover the areas of warning issuance delay, warning diffusion, and protective action initiation delay (Figure 2). These papers, which are a culmination of existing social science research on the topic, discuss the primary factors that influence each aspect, and also provide guidance on how to develop inputs to USACE life loss modeling products. In addition, the

professors developed a facilitator guide that describes how to interview local emergency managers and gain an understanding of the existing evacuation potential in their area in the event of a major flood event.

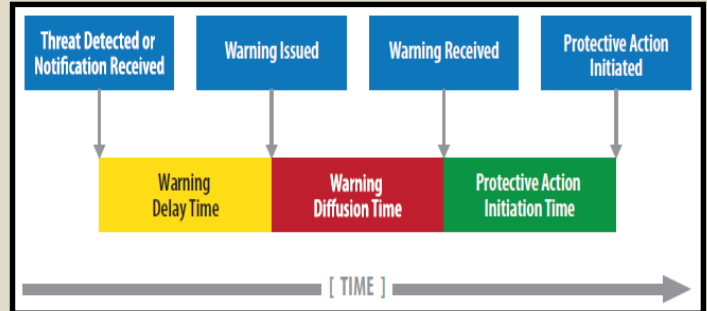
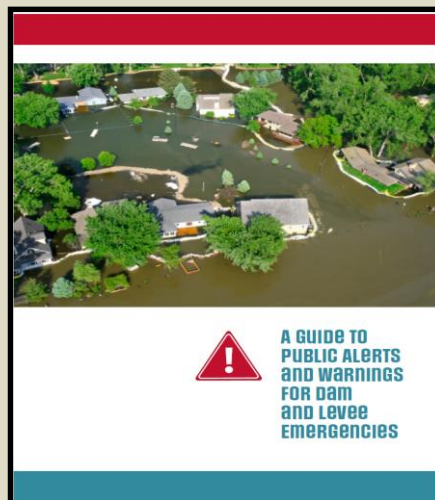


Figure 2

Finally, and perhaps most importantly, Drs. Mileti and Sorenson have developed a document titled "A Guide to Public Alerts & Warnings for Dam and Levee Emergencies". The purpose of the guidebook (Figure 3) is to assist those involved with emergency management in issuing more timely and effective public alert and warning messages for floods caused by dam breaches, controlled dam releases, and levee breaches or overtopping. The guidebook is based on findings from decades of research on disaster warnings and presents best practices derived from these findings. Finally, while the guidebook is targeted toward dam and levee safety emergencies, the



principals presented in this document can be used to prepare a plan in such a way that promotes successful implementation of emergency message communication for a wide range of emergencies.

Figure 3 - A Guide to Public Alerts & Warning for Dam & Levee Emergencies. To download go to:

http://silverjackets.nfrmp.us/Portals/0/doc/WarningGuidebook_USACE.pdf?ver=2015-08-10-213008-520

Save the Date.

2017 National Hydrologic Warning Council Training Conference & Exposition

June 5-8, 2017
Squaw Valley, California

The 2017 NHWC Training Conference & Exposition will be held on June 5-8, 2017 at the Resort at Squaw Creek near Olympic Valley, California.

Watch this [link](#) for more information and updates.

Registration is Open for NHWC Northeast Regional Workshop

The National Hydrologic Warning Council is presenting

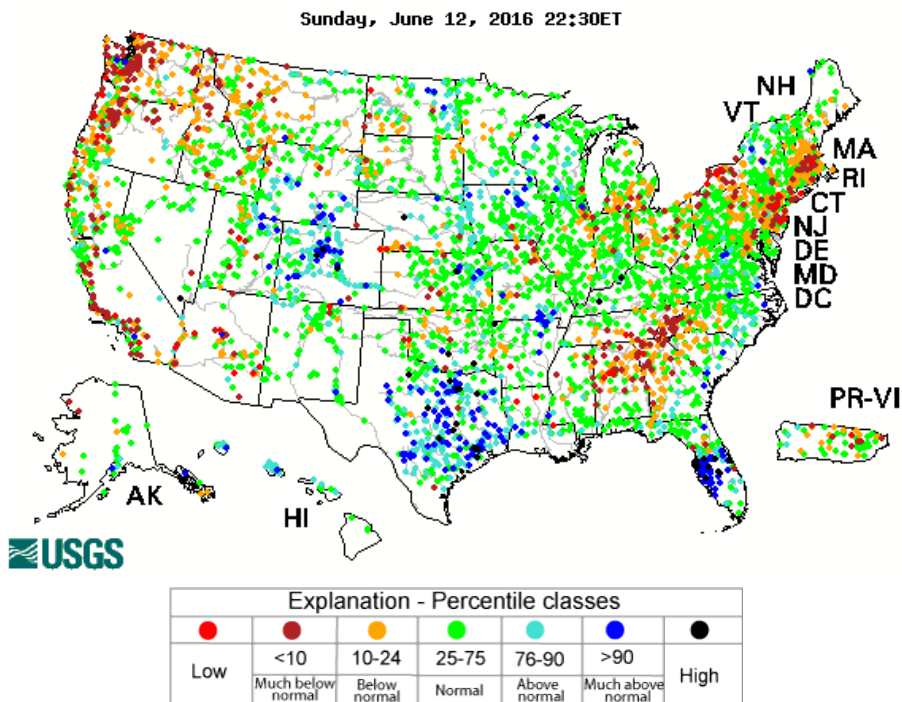
“Prepare to Protect, Advancing Community-Based Flood Warning”

at the Desmond Hotel and Conference Center in Albany, New York, September 20 – 21, 2016

This will be the NHWC’s first workshop or conference in the Northeast US. The workshop is intended for flood warning practitioners, owners and operators of existing or proposed hydrologic warning systems, emergency managers, public works officials, owners and operators of high hazard dams and levees, decision makers, and river authorities.

The 2-day workshop has a low registration fee of just \$75 for NHWC members and \$100 for non-members. Exhibiting and sponsorship opportunities are also available. Don’t miss this opportunity. Keep watch at this [location](#) for the latest information and to register use this [link](#).

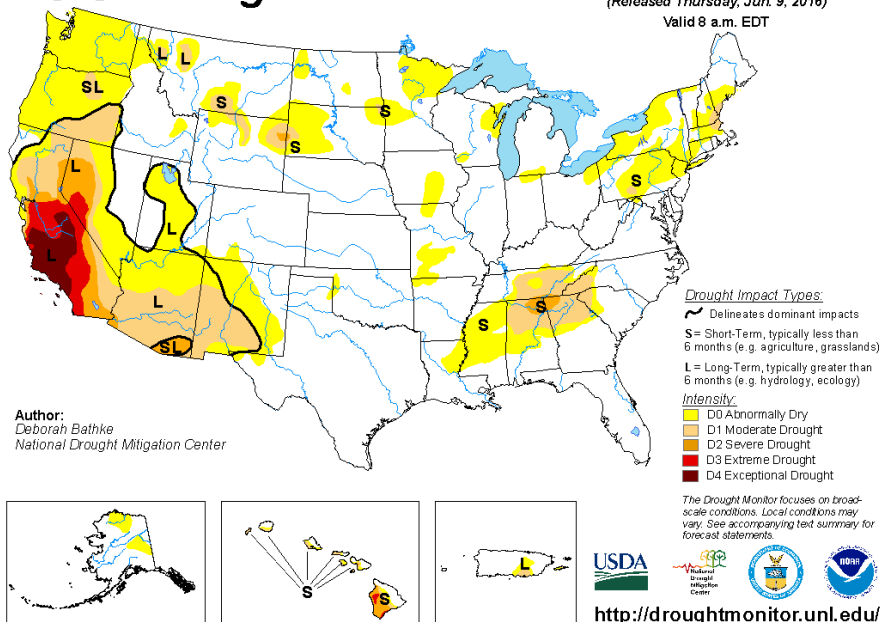
Hydrologic Conditions in the United States Through June 7, 2016



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

U.S. Drought Monitor

June 7, 2016
(Released Thursday, Jun. 9, 2016)
Valid 8 a.m. EDT



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

July Newsletter Articles Focus: Hydrology

The NHWC is requesting articles that focus on hydrology - the science behind the work we do.

Please consider preparing a short article about new methods, research, or discoveries in hydrology or a recent significant hydrologic event.

Submit your article to:

editor@hydrologicwarning.org

July 8th is the deadline for inclusion in the July issue.

Future Newsletter Articles Focus

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

Jul - Hydrology

Aug - Hazard

Communication &
Public Awareness

Sep - Modeling/Analysis

Oct - Data Collection

NHWC Calendar

September 20-21, 2016 - [NHWC Northeast Regional Workshop](#), Albany, New York

June 5-8, 2017 – [NHWC 2017 Training Conference & Exposition](#), Squaw Valley, California

General Interest Calendar

June 19-24, 2016 - [ASFPM 2016 40th Annual National Conference](#), Grand Rapids, Michigan

August 8-11, 2016 – [2016 International Atmospheric Rivers Conference](#), La Jolla, California

August 22-25, 2016 – [National Association of Flood & Stormwater Management Agencies Annual Meeting](#), Portland, Oregon

(See the *event calendar* on the NHWC website for more information.)

Parting Shot



Hydro-Meteorological data collection systems come on many platforms. Here are two nice examples from West Palm Beach, Florida.

Photo by David Curtis, WEST Consultants
NHWC Past President

^{id} National Hydrologic Warning Council

Providing Timely, Quality Hydrologic Information to Protect Lives,
Property, and the Environment

<http://www.hydrologicwarning.org>