The NHWC Transmission

August 2017

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Addressing the needs of users of flood warnings – perspective from the UK

Murray Dale, CH2M and
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Effective flood warnings are those which result in people knowing what to do and taking appropriate action. 'Appropriate action' can be defined as activities that that reduce the flood impact – reducing risk to life, damage to property and businesses - while being proportionate to the level of flood risk. A flood warning also has the potential to reduce the mental health impacts of flooding[1]. Sounds simple, doesn't it? A few factors mean that it's not all that simple. Firstly, flood forecasts and warnings are uncertain – despite our best forecasting models we never truly know exactly what will happen, where the rain will land, how much will fall, where flood flows might go. Secondly, the information people want ahead of a flood is simple, non-technical messaging that tells them what to do, without uncertainty.

In the UK we have been addressing this issue for many years. A recent research project for the Environment Agency of England[2] that consulted many at-risk public groups drew out some interesting opinions and desires, including:

- Don't assume a little bit of information will scare people – telling the truth about risk and impacts is more likely to lead to action.
- Be really clear with people on what is happening before, during and after a flood, and what actions they should take
- Focus on making information local
- Stop talking about probability and risk in mathematical language as it means very little to a lot of people.

Professional partners (e.g. first responders, city authorities) have other requirements to the public and need to know basic facts such as when will the flood start?, when will it end?, how bad will it be?, and what important places will be affected?

Effective flood warnings allow people to take preventative action

Alongside these user needs, we also should consider what is possible and practical from the perspective of forecasting and warning professionals. For example, we can forecast a 60% probability of a levee being overtopped between 2 and 4pm tomorrow, or a 20% probability of a 2-foot-

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deep, fast-flowing flood affecting over 300 properties, but how do we turn these technical forecasts into meaningful warnings for both public and professional partners?

In a research project that CH2M is leading for the Environment Agency of England, the objective is to develop flood warning improvement opportunities to address user need, while making the job of those who produce the warnings easier. Initial research has shown that the improvement opportunities need to address warning message consistency, communicating flood impacts locally, using consistent language on uncertainty, and varying message content for different users. This project is proposing a range of options that use tools and processes to achieve these aims. Key to delivering these options is involvement of both warning recipients and warning producers at each stage of the process – consultation with these groups is vital and being carried out iteratively to ensure our proposals are tested at different stages as the project evolves. CH2M is also drawing on two expert groups to deliver the project: the Flood Hazard Research Centre at Middlesex University and the National Flood Forum. These groups bring great experience of flood impact research and in connecting with thousands of people who have been flooded in recent years.

There is applicability of this project to flood hazard communication and public awareness in the US. While flood types and watersheds may differ, the principles of warning communication are very similar. Coming back to the concept of effective flood warnings, it is true anywhere that a perfect flood forecast will be useless if it does not result in actions being taken to reduce the flood risk. Warning dissemination technologies can differ (many multimedia approaches are emerging in the US and globally), though a consistent feature is the choice of language used and the way warnings 'speak to people' – are they understood?, do they make sense?, will they encourage the recipient to do anything / the right thing? Clearly there are major challenges in getting this right. Exciting, though, is that learning lessons from research can benefit flood forecasting and warning approaches right across the world.

[1] Munro et al (2017) Effect of evacuation and displacement on the association between flooding and mental health outcomes: a cross-sectional analysis of UK survey data. The Lancet Planetary Health. Vol 1(4) e134-e141. http://www.thelancet.com/journals/lanplh/article/PIIS2542-5196(17)30047-5/fulltext

[2] Flood Risk Communications Public Dialogue (SC120010), Environment Agency, available at: https://www.gov.uk/government/publications/public-dialogues-on-flood-risk-communication

Real-time dam safety monitoring and communication at the Bureau of Indian Affairs

Lee Mauney, Bureau of Indian Affairs

Introduction

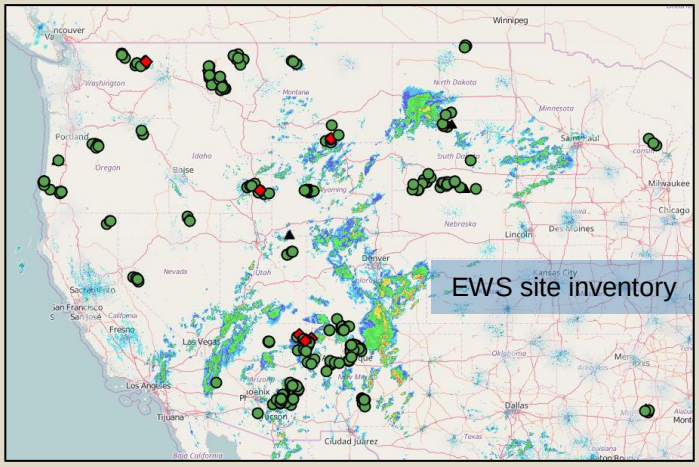
The U.S. Bureau of Indian Affairs (BIA) relies on a network of Early Warning System (EWS) stations to reduce risk at nearly 140 high hazard dams located across the United States. Monitoring lake levels, discharge from dams, rainfall and various other parameters on remote Indian Reservations presents unique challenges. Concurrently, the BIA must address challenges that commonly face dam owners, including hazard creep due to development at and below dams, implications of climate change to operations and dam safety, and underfunding – leading to deferred maintenance and potential conflicts between maximizing resources and maintaining safety. As is the case with much of the infrastructure in the U.S., many dams have not received necessary care over the years, as highlighted by the 2017 ASCE Infrastructure Report Card which gives dams a grade of 'D' [ASCE]. With the heyday of dam construction from 1950 to 1980, it is estimated that by 2020, 70% of the dams in the US will be more than 50 years old [NYT]. The BIA has an estimated deferred dam maintenance budget of over $500M and growing.

One cost effective way the BIA carries out its dam safety mission - to reduce loss of human life and property damage caused by a potential dam

failure by making BIA dams as safe as practically possible – is to harness the capabilities of real-time remote monitoring EWSs. It is well documented from historical dam failures and hazardous flood events that loss-of-life due to flooding is highly dependent on the amount of warning time received and the warning message provided to downstream communities.

Monitoring Solution

The BIA dam inventory is spread across 16 states and 43 Indian Reservations, from Mississippi to Alaska. With very few on-site dam tenders and unreliable cellular coverage on Tribal Lands, most BIA facilities are located in rural mountainous areas with limited access. Thus, power needs must be kept to a minimum while providing real-time telemetry and system redundancy.



EWS site inventory

The current BIA solution utilizes commercial satellite telemetry to transmit EWS data to an online server with latency usually less than 30 seconds per transmission. System redundancy is achieved by measuring reservoir level with a pressure transducer while also installing float switches at relevant levels to send notification on depths specified in a dam's Emergency Action Plan. Tipping bucket rain gauges measure precipitation and relay notifications tied to precipitation-frequency thresholds that could be hazardous to the dam.

Equipment is housed in enclosures either attached to constructed traffic poles or inside a gatehouse on the dam. Transmissions are programmed for certain time intervals with thresholds built in to increase frequency of measurement during predetermined changes of reservoir level, increased discharge from the dam, or intense precipitation. Though not necessarily a dam safety concern, anytime water is released over a spillway, downstream communities are typically notified. EWS sites are powered almost exclusively with two 12-volt batteries recharged by a small solar panel.


EWS site at Rosebud, South Dakota

Data collected by the remote sensor stations are recorded and monitored with Contrail®, OneRain's hydrologic monitoring and flood warning system software. The software generates automated dam-specific warning messages which are sent out via emails, text messages, and telephone from the BIA National Monitoring Center (NMC).

Communicating Risk

Detecting a potential dam failure or major flood event is only one part of an effective EWS. Notifying the correct staff and emergency responders of the need to verify the situation and/or inspect a dam are equally essential. While emails and text messages get important information out quickly and in a clear, straightforward manner, a human element to warning messages has been shown to improve effective response of the public during emergencies.

When a specified condition is detected based on EWS data, the NMC makes person-to-person phone calls to local Tribal staff. The NMC is located on the Flathead Indian Reservation in Ronan, Montana, about twelve miles south of Flathead Lake. The NMC is staffed 24 hours per day, seven days a week, by personnel from the Confederated Salish and Kootenai Tribes of the Flathead Nation. The NMC is unique to the BIA EWS Program with call lists setup to identify local personnel who are trained to respond to an emergency at each Program facility. Multiple users have reported that hearing the human voice on the other end of the line can make the difference between them heeding a warning or them ignoring

an issue that could place lives in danger.

Conclusion

Dams are a significant part of the water resources infrastructure and trust assets of many Tribes in the United States. While these facilities provide benefits such as irrigation, recreation, flood control, water supply, and fire protection like many other dams familiar to the water resources profession, dams on Tribal Lands can have great historic significance not easily described in simple engineering terms. Protecting these cultural resources and the downstream communities is a task not taken lightly, and an effective EWS can be instrumental in increasing available warning time to communities that may be at risk downstream of Program dams. The EWS Program relies heavily on all its partners, which includes Local Tribal Staff, the National Monitoring Center,

Pasture Canyon Dam, Arizona

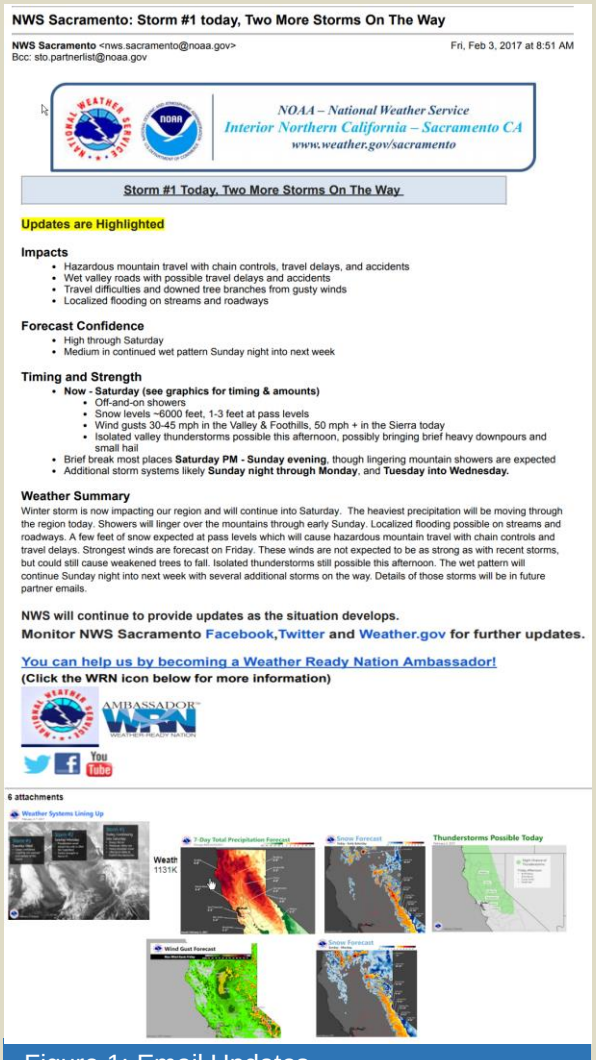
OneRain, and BIA staff, and through the effective cooperation of these partners, the EWS Program is able to promote the BIA's dam safety mission on Indian Lands.

Operational perspective and lessons learned about forecasting and communicating extreme precipitation events in Northern California during the 2016-2017 Winter Season

Michelle Mead, NWS Sacramento, CA

The National Weather Service (NWS) has always been in the business of forecasting the weather and issuing warnings for the protection of life and property and enhancement of the national economy. However, over the past several years, our mission has grown to include improved partner relations to increase clarity in our communications to the public and partners on impacts and preparedness when hazardous weather threatens.

Through our public and partner interactions, we realized that our traditional means of communicating with ALL CAPS TEXT forecasts and storm headlines wasn't communicating the impacts or sense of urgency needed to get partners and public to prepare. The NWS Sacramento took this vision to heart. A few years back, we decided to make a concerted effort to apply the adage, "A picture is worth a thousand words" and experiment with another communication avenue. Our office has since created a no weather geek worded email that communicates weather events in a non-jargon manner (Figure 1). We've developed numerous templates that create easy to understand graphics to illustrate "what this means to me" and "how long do I have to prepare" before the storm(s) get here (Figures 2, 3 and 4). We host webinars with emergency response partners to present timing, confidence and impacts of significant storms to aid decision making and preparations (Figure 5).



NWS Sacramento: Storm #1 today, Two More Storms On The Way

NWS Sacramento <nws.sacramento@noaa.gov> Fri, Feb 3, 2017 at 8:51 AM
Bcc: sto.partnerlist@noaa.gov

NOAA – National Weather Service
Interior Northern California – Sacramento CA
www.weather.gov/sacramento

Storm #1 Today, Two More Storms On The Way

Updates are Highlighted

Impacts
- Hazardous mountain travel with chain controls, travel delays, and accidents
- Wet valley roads with possible travel delays and accidents
- Travel difficulties and downed tree branches from gusty winds
- Localized flooding on streams and roadways

Forecast Confidence
- High through Saturday
- Medium in continued wet pattern Sunday night into next week

Timing and Strength
- **Now - Saturday (see graphics for timing & amounts)**
  - Off-and-on showers
  - Snow levels ~6000 feet, 1-3 feet at pass levels
  - Wind gusts 30-45 mph in the Valley & Foothills, 50 mph + in the Sierra today
  - Isolated valley thunderstorms possible this afternoon, possibly bringing brief heavy downpours and small hail
- Brief break most places **Saturday PM - Sunday evening**, though lingering mountain showers are expected
- Additional storm systems likely **Sunday night through Monday**, and **Tuesday into Wednesday**.

Weather Summary

Winter storm is now impacting our region and will continue into Saturday. The heaviest precipitation will be moving through the region today. Showers will linger over the mountains through early Sunday. Localized flooding possible on streams and roadways. A few feet of snow expected at pass levels which will cause hazardous mountain travel with chain controls and travel delays. Strongest winds are forecast on Friday. These winds are not expected to be as strong as with recent storms, but could still cause weakened trees to fall. Isolated thunderstorms still possible this afternoon. The wet pattern will continue Sunday night into next week with several additional storms on the way. Details of those storms will be in future partner emails.

NWS will continue to provide updates as the situation develops.
Monitor NWS Sacramento Facebook,Twitter and Weather.gov for further updates.

You can help us by becoming a Weather Ready Nation Ambassador!
(Click the WRN icon below for more information)

6 attachments

Figure 1: Email Updates

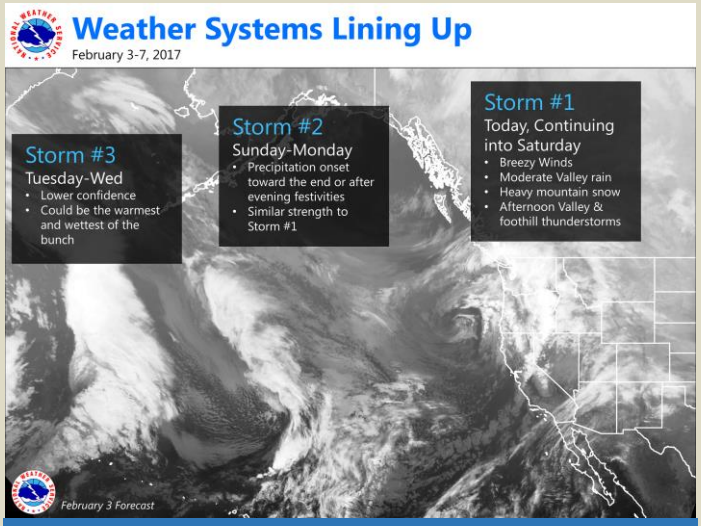


Figure 2: Simple Graphics

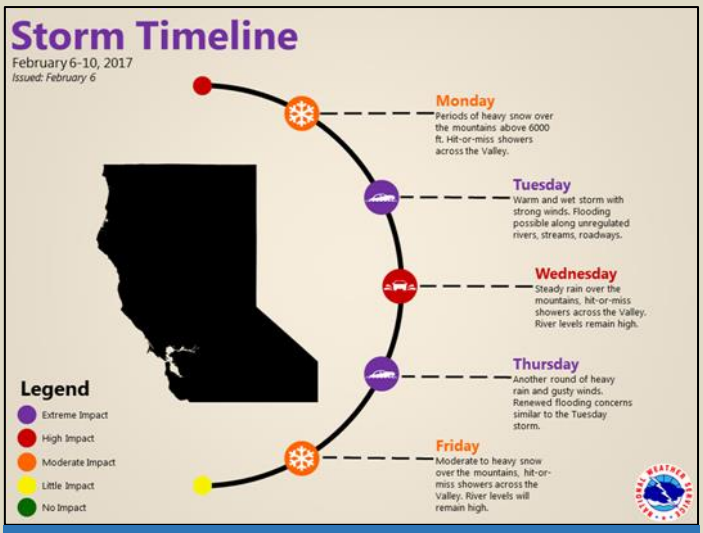


Figure 3: Color Coding

Figure 4: Emotional connection achieved via return interval and historical comparisons

We utilize Social Media (SM) venues to help spread the message. We had a strong Facebook and Twitter following before the winter of 2016-2017, but this active winter helped us double our followers (Figure 6). Note: SM is NOT something you can just stand up during an event. You need to build a base community so that they can help be message multipliers leading up to and during an event to spread the word. Trust needs to be established before an event occurs to be most effective.

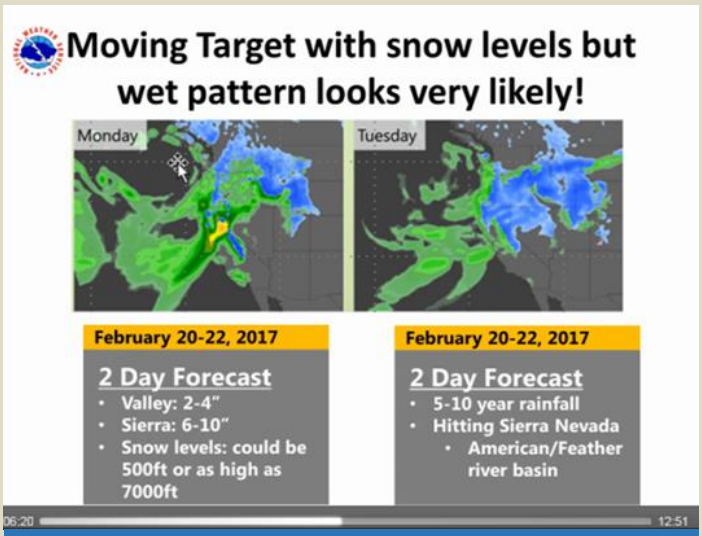


Figure 5: Live webinars for decision makers

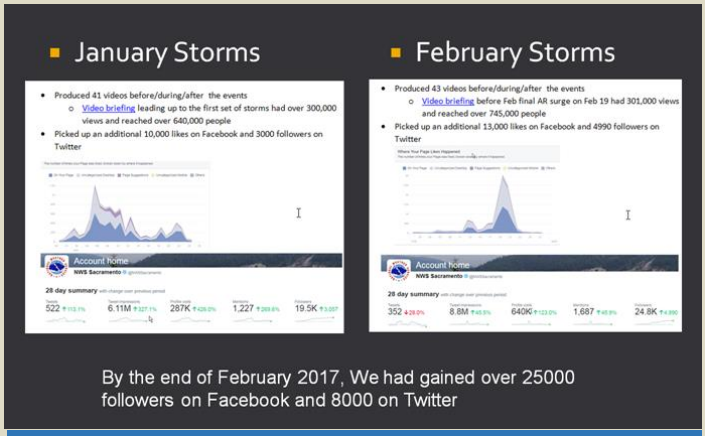


Figure 6: Increased effectiveness using social media

The lessons learned for our office from the 2016-2017 winter season were as follows:

- Constant Communication is a must
- Simple easy to understand information (make sure your mom or family members can understand it)
- Appealing and easy to understand graphics
- Being proactive and anticipate needs
- Strong and consistent interaction with media core partners, and the pubic using social media

If we continue to listen to our public and partner needs and effectively apply them to our operations, we'll build a true weather ready nation!

Save The Date

National Hydrologic Warning Council

9th Annual Texas Workshop

November 8-9, 2017

This 2-day interactive workshop will focus on hydrologic warning programs and systems in Texas, including flood warning system performance, flood forecasts and warnings, flood impacts, public communication, reservoir operations, and post flood activities. Other topics will include radio frequency encroachment, NOAA Atlas 14, and ALERT2 implementation.

The venue for this years' workshop will be the historic Menger Hotel located at 204 Alamo Plaza in San Antonio, Texas.

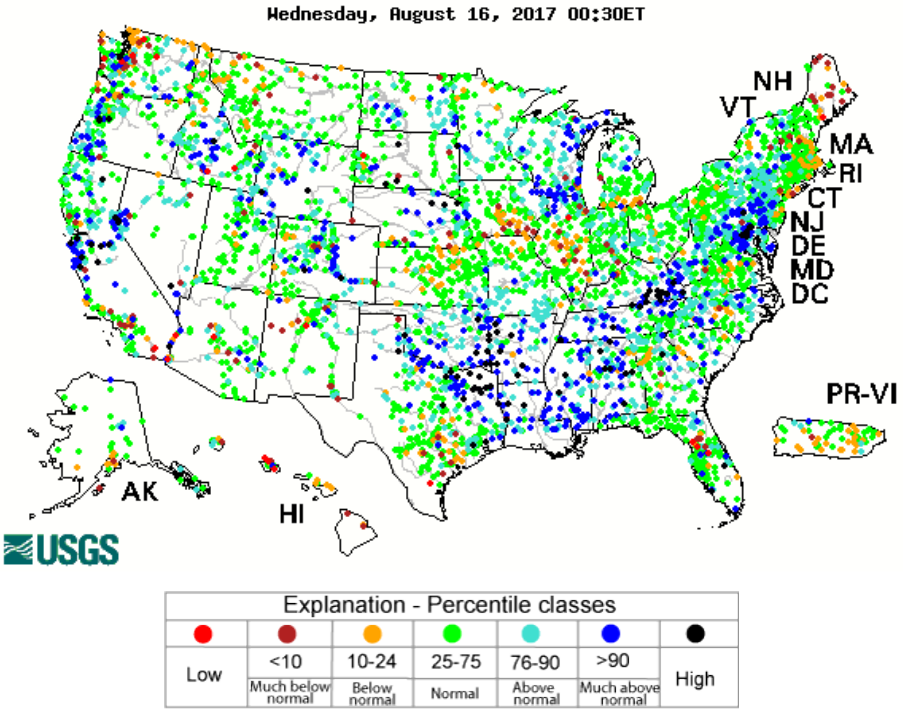
THE HISTORIC MENGER HOTEL

Visit the **NHWC** website to register.

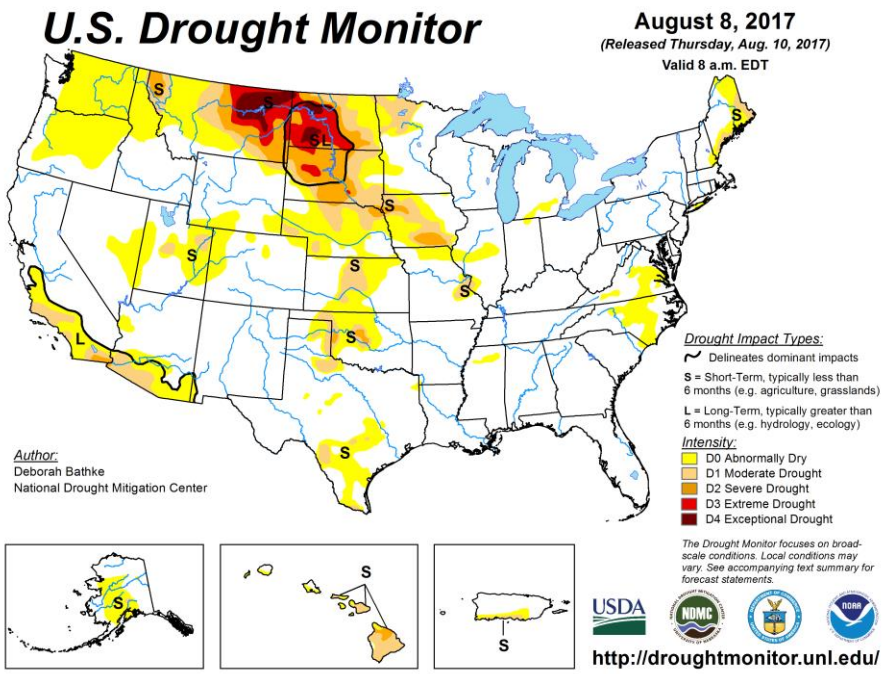
NATIONAL HYDROLOGIC WARNING COUNCIL

HARRIS COUNTY FLOOD CONTROL DISTRICT

Hydrologic Conditions in the United States
Through August 8, 2017



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



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

September Newsletter Articles Focus:

Modeling & Analysis

The NHWC is requesting articles that focus on practices, technologies and tools used to model, predict and analyze hydro-meteorological events and to support decision making for emergency response and floodplain management.

Submit your article to:

editor@hydrologicwarning.org

September 7th is the deadline for inclusion in the September issue.

Future Newsletter Articles Focus

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

Sep - Modeling/Analysis
Oct - Data Collection
Nov - Hydrology
Dec - Hazard Communication & Public Awareness

NHWC Calendar

November 8-9, 2017 - 9th Annual Texas Workshop, San Antonio, TX

General Interest Calendar

September 10-14, 2017 – ASDSO 2017, San Antonio, Texas

October 19, 2017 – The ALERT Users Group Fall Meeting & Workshop, Sacramento, California

November 5-9, 2017 – AWRA Annual Conference, Portland Oregon

April 17-20, 2018 – The ALERT User's Group Training Conference and Exposition, Ventura, California

Jun 4-7, 2018 – 2018 ASCE Environment and Water Resources Institute International Congress, Minneapolis, Minnesota

Parting Shot

Frye Fire RAWS Station (HGPA3), Heliograph Peak, Arizona

This temporary RAWS station was recently installed following the Frye Fire which burned over 48,000 acres in the Pinaleño Mountains of Arizona.

Photo by **Brian Iserman**, JE Fuller/Hydrology & Geomorphology, Inc.