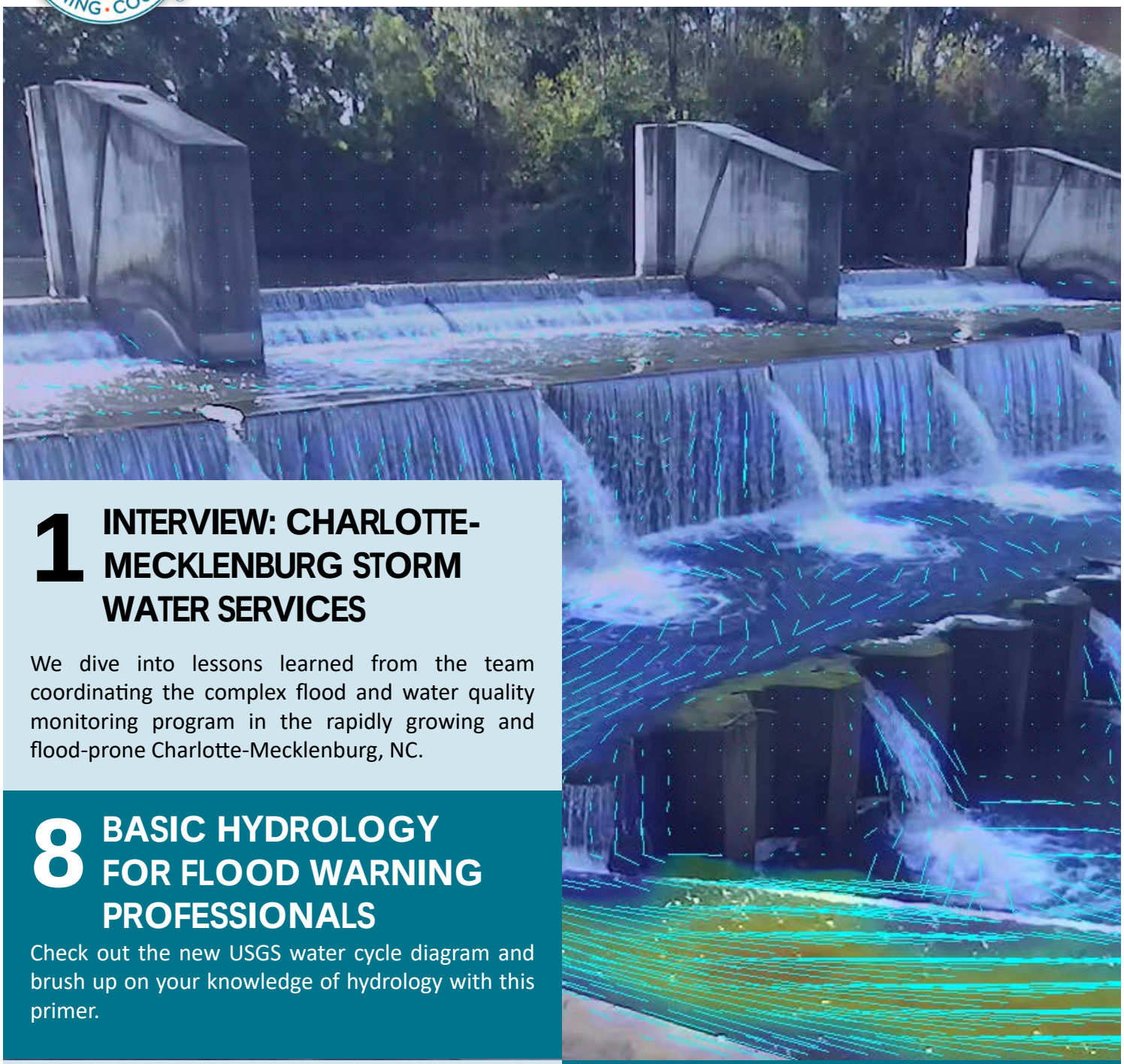
NHWC Transmission

Winter 2023



1 INTERVIEW: CHARLOTTE-MECKLENBURG STORM WATER SERVICES

We dive into lessons learned from the team coordinating the complex flood and water quality monitoring program in the rapidly growing and flood-prone Charlotte-Mecklenburg, NC.

8 BASIC HYDROLOGY FOR FLOOD WARNING PROFESSIONALS

Check out the new USGS water cycle diagram and brush up on your knowledge of hydrology with this primer.

13 APPLYING COMPUTER VISION APPROACHES TO STREAM GAUGING

Learn how an innovative remote sensing system allows users to develop accurate stage-discharge relationships in real-time.

16 NEWS, WEATHER, AND EVENTS

Get the scoop on upcoming NHWC events and opportunities and nationwide hydrologic conditions.

INTERVIEW: CHARLOTTE-MECKLENBURG STORM WATER SERVICES

with Josh McSwain, Senior Business Analyst & Ryan Spidel, Environmental Supervisor / Charlotte-Mecklenburg Storm Water Services

by Mike Zucosky / AEM Product Manager

Home to more than 60 streams and sitting at a hydrological divide, the Charlotte-Mecklenburg area of North Carolina contains a vast network of flood-prone headwaters. Pollution in those headwaters can impact water quality for many miles downstream. To help officials keep up with the county's flood and water quality issues, Charlotte-Mecklenburg Storm Water Services has steadily amassed a large network of different sensors, gages, and cameras.

However, to develop a fully mature flood and water quality monitoring program, they had to go through some growing pains. Many other environmental monitoring programs—whether publicly or privately operated—could learn a lot from the way this team has successfully handled its growing pains.

To understand the process they went through, I sat down with the officials who oversee flood and water quality management at Charlotte-Mecklenburg Storm Water Services. Josh McSwain oversees the county's Flood Information Notification Service (FINS), and Ryan Spidel supervises the surface water quality monitoring program, which is known as the Continuous Monitoring and Alert Notification Network (CMANN).

Josh and Ryan, you both work for Storm Water Services in the Charlotte-Mecklenburg County area. Maybe you could start us off, Josh. Give us some background about what that group does and your specific role.

Josh: The group I'm in within Stormwater Services, we are Flood Mitigation and Engineering. So, our responsibilities deal with stream restoration projects, FEMA…and then, obviously, flood warning is a component of our group. My primary role in this group is managing FINS, the flood warning system. It involves a lot of technology—anywhere from security to servers.

Josh McSwain is a Senior Business Analyst with Charlotte-Mecklenburg Storm Water Services. For the past 20 years, Josh's primary responsibility has been managing the County's Flood Information and Notification System (FINS). Josh served 10 years on the Board of Directors for NHWC representing the Eastern region of the United States.

Ryan Spidel is an Environmental Supervisor with Charlotte-Mecklenburg Storm Water Services' Water Quality Program. Ryan has been involved with the Water Quality Program's automated monitoring program for 10 years.

Mike Zucosky serves as AEM | OneRain's Product Manager for the Contrail® suite of products; he is responsible for the strategic vision and leads the development of Contrail.

Ryan, could you fill us in a little bit about your specific role and what your group does inside of Storm Water Services?

Ryan: Our group is a water quality program within Storm Water Services, and we're responsible for keeping up with water quality, pollution issues, and monitoring of all the streams in Mecklenburg County. One of the things here in Mecklenburg County is we are right in the middle of a hydrological divide where we have a lot of headwater streams. We have about 300 miles of monitorable streams that we look after. So, a pretty big job. Our automated monitoring program has 35 real-time units that are out in the field collecting the data, scattered across the county. And, then, we also help manage, in partnership with Josh's group, our low-cost flood sensor network; we have 65 units in the field for it.

Let's start off maybe on the flooding side. Josh, for those who aren't familiar with Mecklenburg County, can you share a bit about the historical challenges with flooding?

Josh: It wasn't until the '90s, and on towards today, that the impacts of flooding have increased significantly. And most of that came with growth. Charlotte has exploded growth-wise with development. In the '90s, '95 and '97 specifically, Charlotte experienced several 200-year flood events. It was the remnants of two tropical storms that came through. At that point in time, there was no such thing as a local flood warning system. We just relied on National Weather Service warnings. But across just two storms —the damage estimate was north of $65 million. That's in '90s money. And we had the loss of three lives during those storm events. So, flooding became more of a serious impact after the '90s into the 2000s.

Ryan, your focus is more on water quality, so could you tell us a little bit more about what kind of challenges you have to face around that?

Ryan: One of the things that we monitor routinely are new development projects, large development projects. We have partnerships with some of these

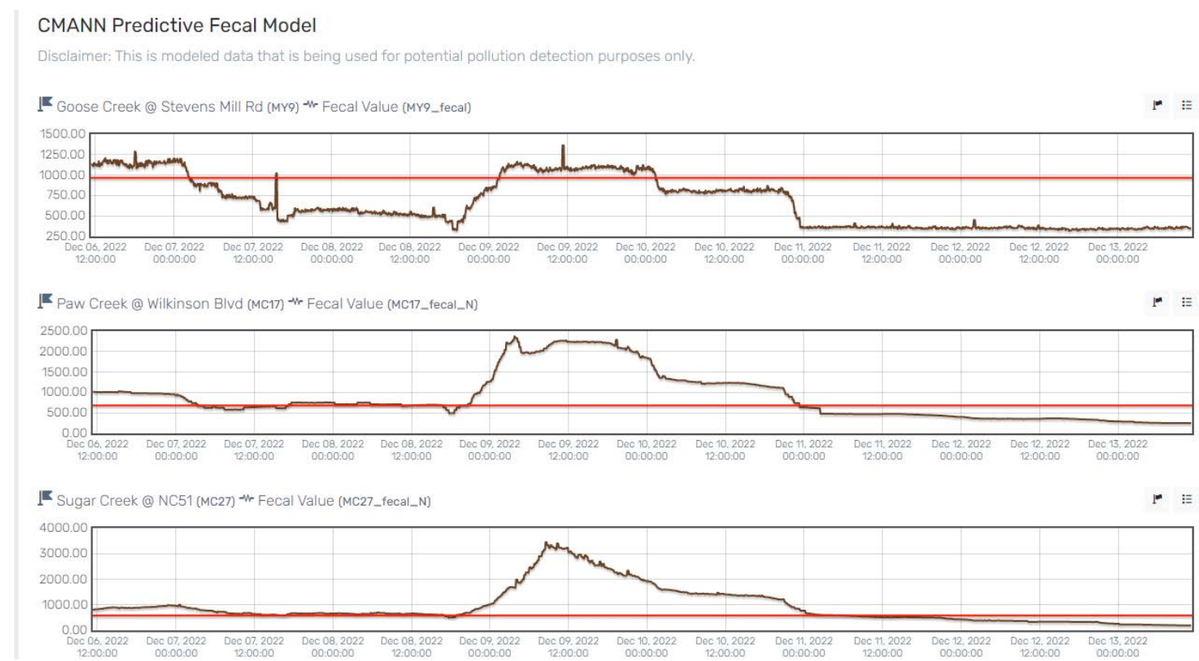


Figure 1 - Predictive fecal models used by the county to inspect water quality.

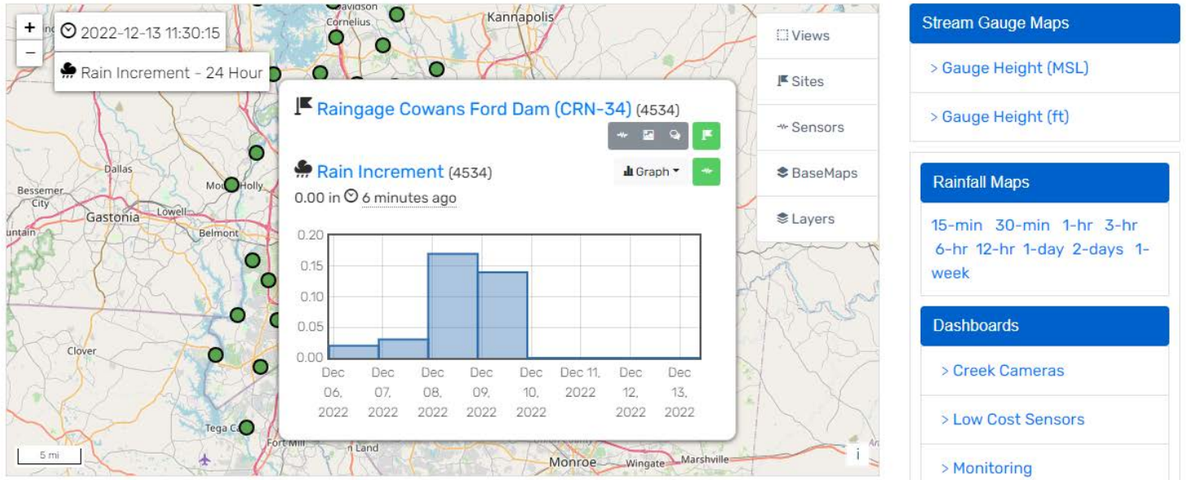


Figure 2 - Contrail interface for the Flood Information and Notification System (FINS).

large developers here in the county, where we put it into their re-zoning to monitor turbidity downstream of their projects to ensure that they're compliant with state water quality standards. And, then a lot of it is also going to our lakes, our drinking water reservoirs. So, we want to ensure that we're helping protect our lakes—our drinking water reservoirs—to keep them clean and ensure that we're not allowing excess turbidity levels into them.

We also have fecal predictive models. One of the challenges of being in a developing city is that a lot of our infrastructure dates back to the 1920s and earlier. So, a lot of our infrastructure is getting on in age and some of it fails from time to time, so we try to use our automated monitoring equipment to help find these issues and correct them and minimize the amount of pollution that we're introducing to our streams. So, between sediment and fecal bacteria (sewage), those are our largest two challenges that we deal with here in Mecklenburg County, which are a lot of the same challenges that people face around the country.

Based on what you were talking about, Josh, with the flooding issues you had in the '90s and early 2000s, was that the impetus for starting the FINS system? Can you talk a little bit about that early history?

Josh: FINS stands for Flood Information and Notification System. After the '97 flood, emergency management approached the engineering group in the county and asked about these USGS [U.S. Geological Survey] gages that they noticed in the creek. They asked if they could get some kind of early notification from these USGS gages. So, it was really a simple request at the time. And, that was the beginning of FINS. We got together with the USGS—actually became a cooperative partner with the USGS. So, we have an annual contract with the local USGS office to pay a percentage of operating cost of the network.

All USGS staff take care of all the gages that USGS owns. That includes stream gages, rain gages, and some of our creek cameras. Going back to the beginning when that request came in and we became a partner with USGS, there were only 12 stream gages in the entire county; there's 50 now. They had 14 rain gages, and I believe we have 72 rain gages now. So, considerable growth since the beginning.

Maybe you could explain what role Contrail® plays within your network and within your system?

Josh: When Contrail came on board, it was our one-stop toolbox, basically. Everything—all the alarming, dashboards—everything that we had in multiple locations before were now consumed into one toolbox. The frustration that we were experiencing prior to Contrail was having to build separate applications to view data, to edit. And it finally all came together when we installed Contrail.

We have alarms that monitor for rainfall intensity. So those are all built within Contrail and are monitored 24/7. Also, stream gage alarms based on threshold. So, once the stream level exceeds a certain threshold, the notification goes out via email and text.

One thing that Contrail offered that we didn't have in the past was being able to customize those notifications. So, you would get that email in the past, and it pretty much was just text—static. But with Contrail, you have some features to make it more of a dynamic message where it even has a link in the email that links you back to a dashboard that shows you the details, the gages in the area of where the flooding is taking place. That became a huge resource for emergency management staff. Those firemen and folks that are responding to the event, they have a snapshot there on the dashboard of what's going on upstream, as far as the gage rising or falling, and also with the rain. Then, of course, you can turn on radar and other layers. So, significant improvements as far as managing a flood event with Contrail.

Can you tell me a little about how you use and leverage Contrail to help manage your operations on the water quality side?

Ryan: On the water quality side, our automated water quality monitoring program is called CMANN, which is Continuous Monitoring and Alert Notification Network. As with any other government agency, we love acronyms! CMANN has been around about 20 years. It actually started out as a DOT [Department of Transportation] monitoring project for an interstate program around Mecklenburg County. From there, it evolved into monitoring all of our streams that exit Mecklenburg County.

So, we have 35 sites. The way Contrail helps us is that it basically gives us the visualization to see all of our data. It gives us our learning capabilities. We have all of our thresholds for the alerts set up at our state water quality standards. So, for oxygen, it's less than four milligrams per liter. If it's pH, outside of six to nine range. We've got different local thresholds that are set up for different parameters that give us an indication there might be pollution issues.

All of those come to us via email. And some of them—more important for potential pollution issues—to be more responsive for our technicians, are actually sent

Figure 3 - Contrail water quality sensors dashboard.

to them via text messaging as well. It really helps us to be able to respond and get notifications of what's going on in our creeks. Because with 35 stations recording 24 hours a day, it's a lot of data. So, it's hard to keep your pulse on it without those alerts.

We also have several other dashboards that we use. The dashboards are really helpful in the way we've developed them to give our technicians the capability to come in every morning, look at the data, look at what's going on with their sites, what they're responsible for, and see if there's anything that needs to be addressed first thing that day. Those are really beneficial and really helpful for our technicians.

One thing we didn't talk about before was some of the stakeholders who are involved in these systems and the type of data that you guys are collecting.

Josh: Our stakeholders include staff with the county and with the city. The city Department of Transportation, the city Public Works, Water, and Sewer. Obviously, the USGS. Emergency management, which is Fire and Police, and the National Weather Service. All of them have a stake in the FINS system on the flood side. Ryan, anything to add to that?

Ryan: From our side, we actually have several people. Local colleges here in the Mecklenburg County area that look at our data. Some of the biology programs. Actually, we've had several masters students and PhD students use some of our automated water quality network data. Some of the other partners that do it are our local river keepers. They're looking at our data all the time to look at what the lakes are doing, if there's any of the big construction site projects we talked about earlier. They like to keep an eye on them as well to make sure that our lakes are being protected. River keepers keep an eye on it. City and town partners, as well, will look into it, and see what the streams are doing.

So, how has Contrail allowed you to implement and utilize data from many different sources?

Josh: Contrail gives you the option or the ability to create a unique system where you're going to ingest data formats such as ALERT [Automated Local Evaluation in Real Time] 2, regular ALERT data, you maybe get USGS data coming in, or from satellite sources. Or, in the case of the low-cost sensors, they transmit via cellular, but they have their own vendor-specific coding to decode the message.

All of those come into a different system in Contrail. But once they're in that system, then it's almost like they become the same, so to speak, as in you can add them all to the same map if you want to, create custom views. At that point in time, the data value and the date stamp is associated. And, then you can plug it into all the different resources within Contrail.

In addition to the sensor and telemetry, that observational data, you guys are also using a lot of cameras and imagery to supplement your situational awareness. Talk a little bit about how you've integrated the camera images and how you use that.

Josh: When Contrail came along, now we've got the ability not only to add the cameras as widgets on a dashboard, but we can actually turn them on as a layer on the map, and you will see the locations of the cameras with the most recent image. And cameras—you can't automatically alarm using camera images; I know there is technology there to do that—but, you also don't have to spend a whole lot of time interpreting what you're seeing on a camera. So, for emergency managers in an EOC [Emergency Operations Center] environment, seeing a creek via a camera, there's very little interpolation that has to be done to understand what's going on out there. It's been nice to bring all that to one source—one location—inside of Contrail Camera. Ryan, do you want to add anything on what you're doing with the water quality cameras and Contrail Camera?

Ryan: A couple years ago, we worked with one of our partners to get a camera on one of our CMANN sites. Working with them, they set up the camera, using our data loggers that have scripting capabilities. We run the script on our data loggers to be able to capture the image, and then we send that image to the Contrail Camera servers to where it can be displayed on our site pages. And then we've also made some dashboards as well that show each of the cameras.

The whole reason we were wanting this was to reduce staff time in the field and verification of readings. Basically, we'd get an alarm for a high turbidity reading. Before, somebody would have to wait maybe a couple hours and see, "Okay, does turbidity go down, or was it a fish swimming around in the pond, or what?"

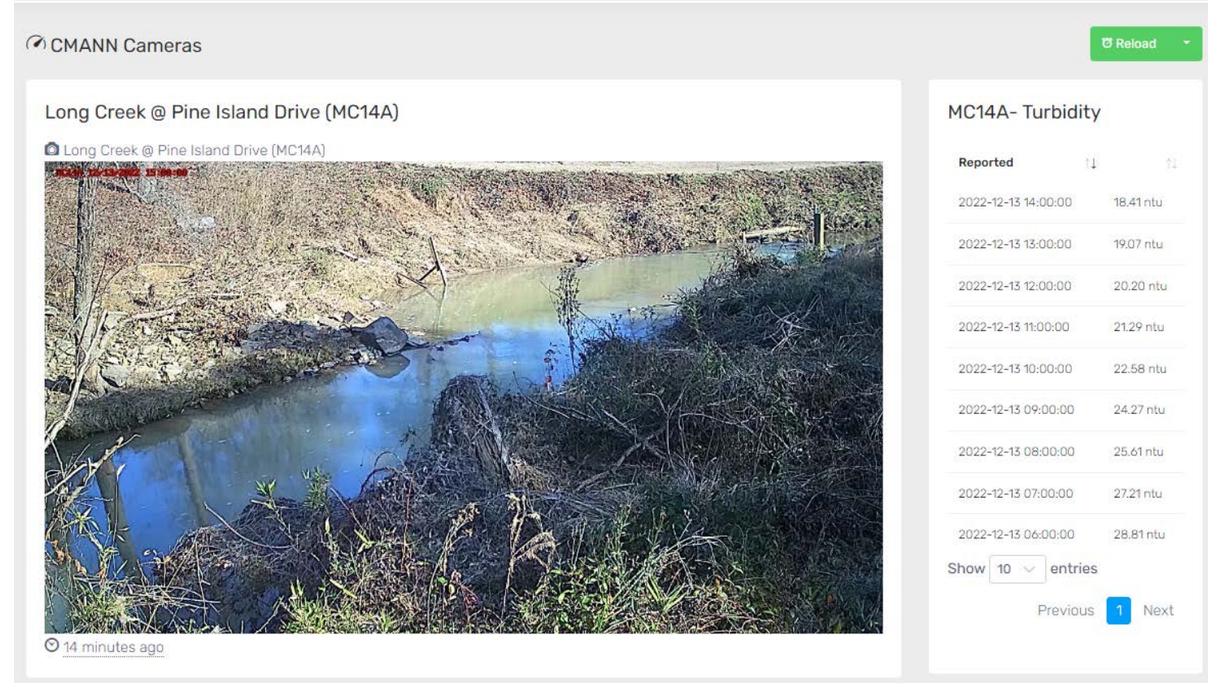


Figure 3 - Contrail water quality camera located at Long Creek.

The way we have it set up is we built the script so that every time the pond takes a reading, it takes a photo as well. And, that way, we can use that time-correlated photo along with our data to look back at the data—or look at the creek itself—and say, "Yeah, the creek is turbid; it's legit. Let's go check it out, figure out what's going on upstream, what's causing this source of pollution." Or, "No, the creek's crystal-clear. This must have been a crawfish, or some kind of debris, or something stuck at the bottom. We can clean it out when we get to it." Basically, we don't have to have that immediate response for some types of pollution in the creek.

Where do you think the county goes from here in regard to this network and the application? Do you have any plans moving forward to potentially expand beyond water quality and the FINS program?

Josh: We just recently adopted a strategic business plan for the next three to five years. And one of the specific items in that strategic business plan was to bring all the environmental monitoring efforts onto the same platform.

So, that could potentially include our air quality group, maybe groundwater. That'd be subsurface water.

We've all kind of been on our own until Contrail came along. And now we've got the FINS on there, obviously. And then the CMANN, so the water quality side. So, the goal in the next year or two would be to work with air quality and any other monitored programs within the county to see if we could potentially get them added as additional clients onto Contrail.

For More Information Visit:
https://charlottenc.gov/StormWater/

CALL FOR VOLUNTEERS

Help Make the NHWC a Success!

The NHWC is looking for new members to become active in the organization at all levels. Regardless of your experience, we encourage you to get involved!

We are in immediate need of help with:

Website

Webinars

Marketing & Membership

Newsletter Editing & Layout

Training & Professional Development Committee

Conference Planning

To learn more, contact the Vice President at:

brad.heilwagen@woodplc.com

BASIC HYDROLOGY FOR FLOOD WARNING PROFESSIONALS

by NHWC Transmission staff

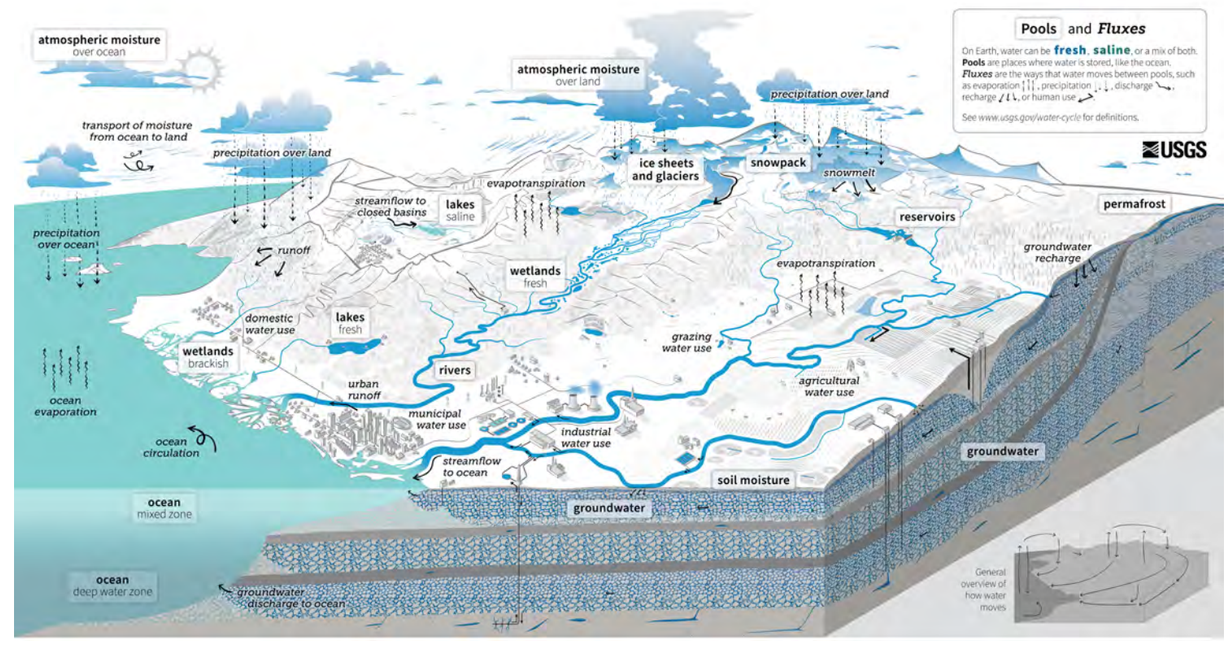


Figure 1 - New U.S. Geological Survey (USGS) water cycle diagram (Oct. 2022) reflecting the role of human activity in water availability. Click to explore the diagram in detail.

This article is adapted from the July 28, 2021, NHWC webinar, Basic Hydrology for Flood Warning Professionals, by Jeff East, USGS, available HERE.

No matter one's background or training, we can all play a part in protecting people, property, and the environment from flood impacts. This article presents an overview of the basic science of flooding.

The practical definition of hydrology is the study of water—its occurrence, movement, and distribution—on Earth. It closely relates to meteorology, soil science, and hydraulics, among other scientific fields.

Hydrologic Cycle

The *hydrologic cycle* is the continuous movement of water in the atmosphere as well as on and below the Earth's surface. Water moves between places it is stored, and it occurs in the form of a liquid, solid, or gas.

The sun rises over the ocean and starts to heat the water. Over time and with the right conditions, evaporation occurs. The liquid form of water becomes gas. Transpiration is a similar process, in which liquid water within a plant becomes gas. The moisture moves into the atmosphere and aggregates to form clouds.

As clouds move inland, changes in pressure and temperature cause precipitation, the process of atmospheric gas particles falling as rain, snow, sleet, or hail.

Infiltration occurs when rain seeps into the ground, below the surface. Rain may also puddle and be stored. Alternatively, rain water may flow or run off into a natural or human-created drainage system. Runoff is the amount of precipitation that does not infiltrate the ground. Runoff that enters the drainage system is known as streamflow (or discharge). Precipitation that neither infiltrates the ground nor gets diverted to storage becomes direct surface runoff, which may increase risk of flooding.

Warm temperatures cause snow (solid water) to become liquid; this snowmelt process can cause flooding, but it does not happen during or immediately after a precipitation event. Likewise, infiltration is a factor in flooding.

Using equipment to monitor key components of the hydrologic cycle—precipitation, snowmelt, evaporation, infiltration, runoff/streamflow—provides quantitative and qualitative information used to understand, manage risks and events, and forecast effects on the landscape and communities.

If we can identify where, when, and how much rain will fall and how the environment will react to that rain, we can better predict and provide advance notice of where, when, and how severe flooding will be.

Watershed Properties

Another critical aspect of basic flood warning science is understanding how precipitation interacts with the landscape. In general, a watershed or basin (or subbasin) is a topographic boundary defining an area in which rainfall drains to a single point. Rain that falls outside the boundary will drain to a different point.

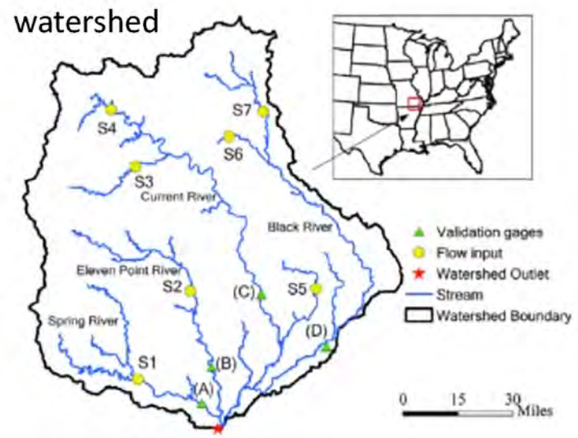


Figure 2 - Example watershed map.

Flood warning depends on collecting accurate and precise information about:

- Precipitation type (rain, snow, etc.)
- Total precipitation per event
- Rainfall intensity
- Spatial variation in precipitation

Putting data from one storm event into the context of the location with its particular annual precipitation amount or intensity will indicate whether the storm was significant or not. Information on topographic characteristics such as land cover and slope is also helpful for contextualizing runoff data.

Runoff/Streamflow

Within a defined basin, the capacity of a stream, river, or bayou can be determined using streamflow, which serve as a volumetric sample representing the overall capacity of the waterbody (see Figure 3).

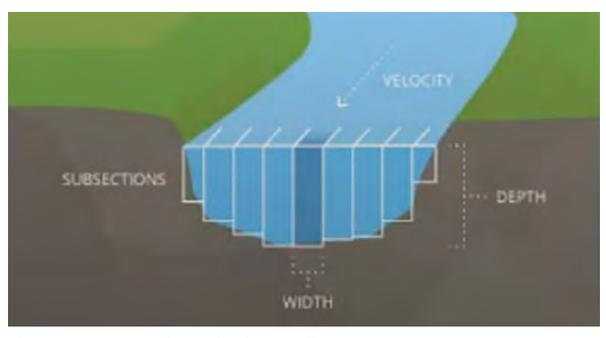


Figure 3 - Streamflow/discharge diagram.

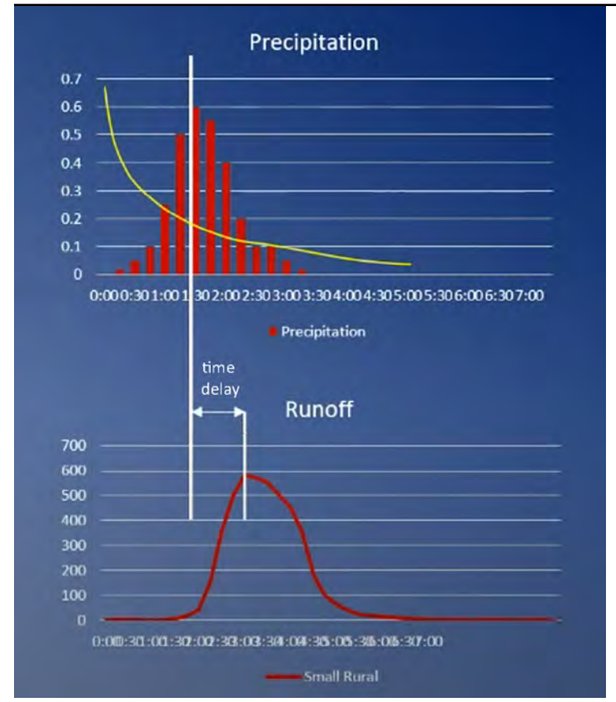


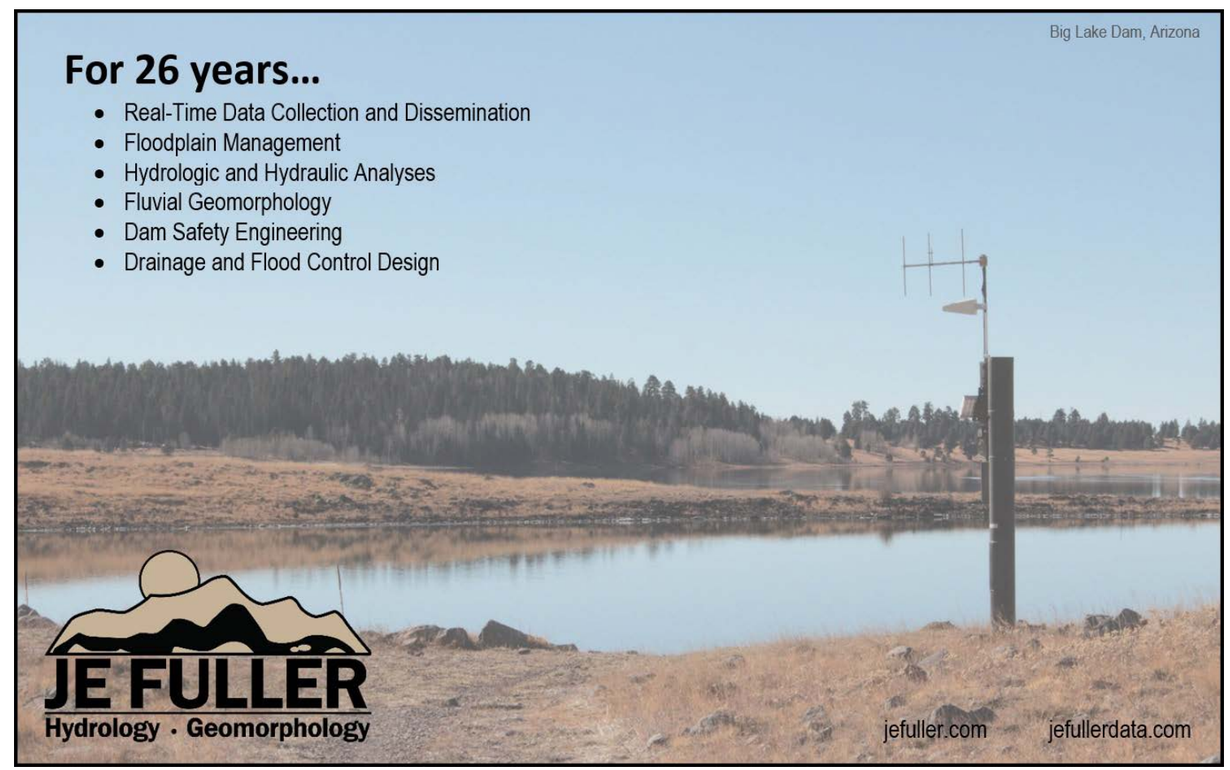
Figure 4 - Precipitation-runoff time series graph.

The volume is calculated by measuring the discharge or flow rate of water as it moves past a specific location in a specific period of time, measured in cubic feet per second (cfs) or cubic meters per second (m3/s).

The use of devices to monitor discharge and the calculated volume provides quantitative information to indicate when a stream overflows its banks. As shown in the graphs in Figure 4, time series created from such monitoring data reveal the relationship between precipitation and runoff.

In the top graph, the y-axis indicates the amount of rainfall, reported by rain gages, in red bars. The yellow curve represents the infiltration rate. At the beginning of the storm, the ground has the ability to absorb the water. Eventually, the amount and/or intensity of rainfall exceeds the amount that infiltrates the ground.

The excess rainfall becomes runoff. The length of the delay from the peak amount of precipitation to the peak discharge measurement depends on such factors as rainfall intensity, soil characteristics, land cover, slope, and watershed size.



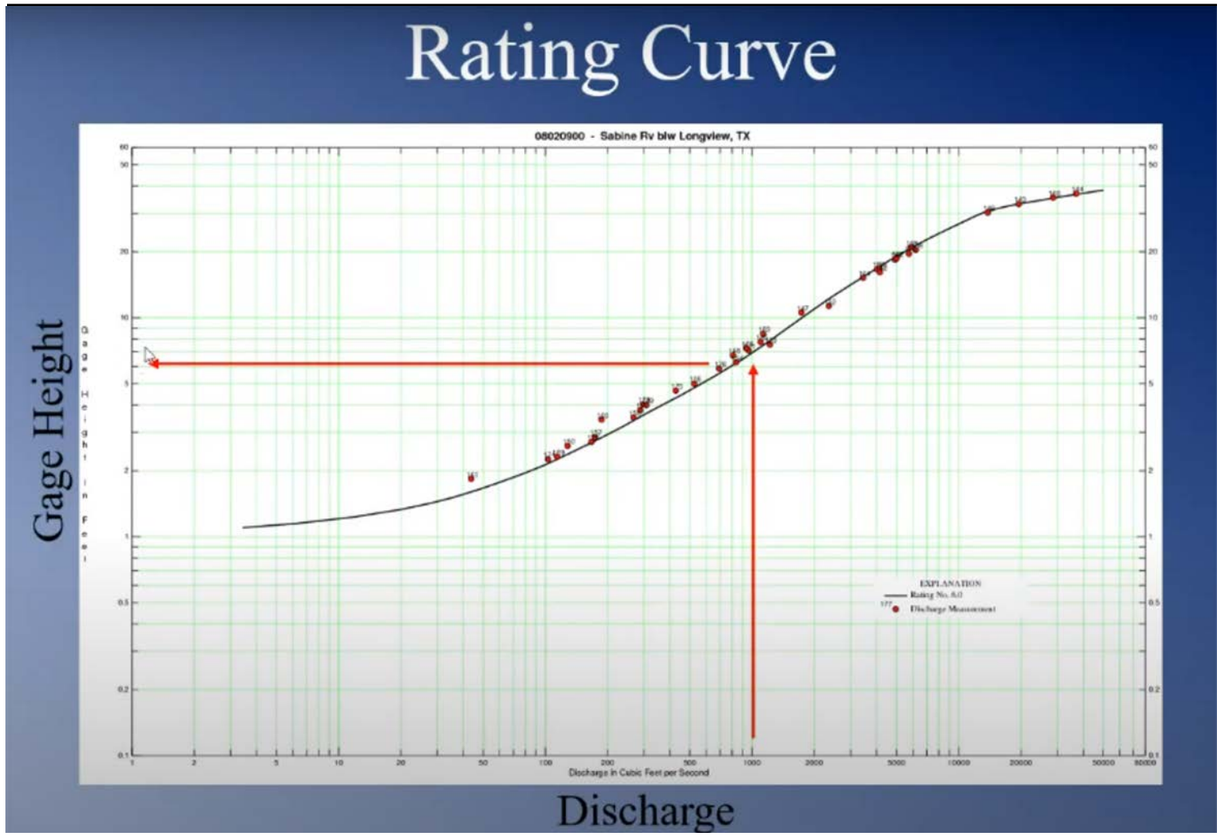


Figure 5 - Sample rating curve graph.

In the bottom graph, the y-axis indicates the magnitude of the runoff that will enter the drainage basin.

Understanding the timing and magnitude of flood drivers is critical for flood forecasting.

Applying Streamflow Data

In the absence of a direct measurement, discharge can be simulated using hydraulic theory, topography, and channel dimensions to convert the information to water elevation estimates. In turn, the estimated elevations can be used to generate flood inundation maps or forecast (timing and magnitude of) flooding.

A rating curve is a graph showing the relationship between discharge (in cfs) and stage or gage height (in feet) for a given point on a stream such as a gaging station, where discharge has typically (but not always!) been estimated across the channel based on measurements from a velocity meter.

The curve can serve as a predictable guide for estimating the stage when discharge is monitored before, during, and after a storm event.

In summary, qualitative information can be observed and obtained while monitoring a variety of particular components to improve understanding, forecasting, and risk management of floods in terms of timing and magnitude. Using both qualitative and quantitative information to protect life and property is the ultimate goal.

Jeff East is a Supervisory Hydrologist with the USGS Oklahoma-Texas Water Science Center in Shenandoah, Texas and conducted the webinar on which this article is based. Follow-up questions can be sent to jweast@usgs.gov. "If you only remember one thing, remember: water flows downhill!"

CLICK to explore the effects of precipitation intensity, watershed size, land cover, and slope on runoff magnitude and timing.

WEST CONSULTANTS
WATER | ENVIRONMENTAL | SEDIMENTATION | TECHNOLOGY

30+ YEARS OF SERVICE TO OUR INDUSTRY

Martin Teal
858-487-9378
mteal@westconsultants.com

David Curtis
916-932-7402
dcurtis@westconsultants.com

OUR SERVICES

Flood Warning Systems
Flood & Reservoir Modeling
Reservoir Operations & Control Plans
Forecast-Informed Reservoir Operations
Dam Failure Analysis
Hydrometeorolgy
Hydromet System
Software Training
Hydraulic Design
CFD Modeling
Geomorphology

www.westconsultants.com

CALL FOR ARTICLES

Data Collection

Communication and Education

Public Engagement

Hydrology & Hydraulics

Modeling & Analysis

Flood Warning Systems

If interested, please contact:
Editor@HydrologicWarning.org

APPLYING COMPUTER VISION APPROACHES TO STREAM GAUGING

by Daniel Wagenaar, Senior Hydrologist-Environmental Solutions, Xylem Water Solutions

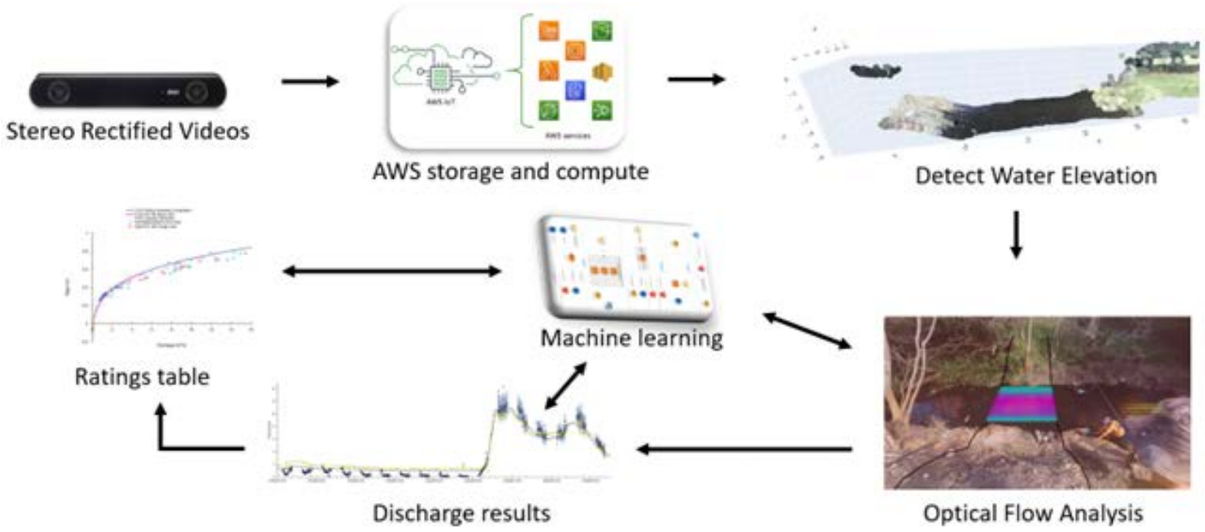


Figure 1 - Computer vision stream gauging (CVSG) system operation diagram.

Efficient flow monitoring networks are a fundamental component of water resource and flood risk management; this has become more evident with the impact of climate change and significant flood events experienced worldwide. The current water engineering solutions for establishing flow monitoring sites come from well-established methods that can provide accurate and reliable flow records over time. These solutions depend on many resources over a prolonged period to develop accurate stage-discharge relationships. The methodology for stage-discharge rating development is also not always suitable for rapid deployments during major events such as flooding and environmental releases.

Stage-discharge relationships based on stream flow measurements require a series of measurements over the stage range of interest at a monitoring site to accurately define the relationship. An initial stage-discharge relationship at a monitoring site is normally based on seven or more flow measurements performed over the entire stage range of interest. The stage-discharge relationship is then further developed over time by performing additional stream flow measurements, a process that can take several months to years. This process is highly dependent on available resources, catchment characteristics, rainfall events, monitoring site, and hydraulic conditions. Monitoring sites in remote areas prone to flash flooding typically have an insufficient quantity of flow measurements to develop an accurate stage-discharge relationship. The use of historic high flow measurements over consecutive stage-discharge rating curves is common due to the lack of high flow measurements to define the stage-discharge rating curve for less frequent flow events.

Figure 2 - Brisbane River at Centenary Bridge (Source: Google Earth).

The University of Queensland, in conjunction with Xylem Water Solutions Australia, developed a Computer Vision Stream Gauging (CVSG) system that enables stream flow gauging using stereo cameras for remote sensing of surface velocities and water level measurements within a channel reach (Hutley et al., 2022). The CVSG system integrates all components into a single enclosure for the non-contact development of adaptive stage-discharge rating curves for flow calculations, as outlined in Figure 1.

The real-time monitoring of surface velocity changes within a channel reach allows the CVSG system to develop an accurate stage-discharge relationship in a relatively short timeframe, especially if a single flow hydrograph spans the entire flow range at the monitoring site. The adaptive stage-discharge rating curve is continuously assessed from surface velocity and water level measurements over consecutive flow events to provide the most accurate flow record within the flow monitoring site and hydraulic conditions. The CVSG system includes onboard processing capability, application connectivity, and a cloud-based management system with a dashboard for operational monitoring, which can be particularly useful for rapid deployment during significant flow events.

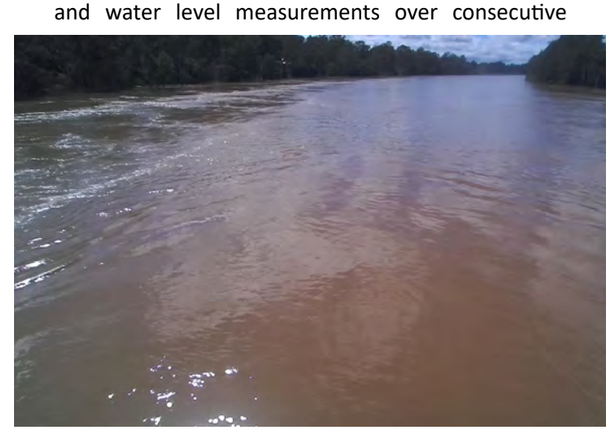


Figure 3 - CVSG System: field of view (9:57 am AEST 03/01/22).

As outlined in the published research paper (Hutley et al., 2022) ***(the full version of the paper can be downloaded from the following location: https://egusphere.copernicus.org/preprints/2022egusphere-2022-735/egusphere-2022-735.pdf),*** the methodology, algorithms, and hardware performance of the CVSG system were verified at a range of different site and hydraulic conditions in both artificial and natural channels. Criteria used to identify suitable testing sites included an operational flow monitoring site with well-developed stage-discharge rating, external water level measurements, and real-time telemetry. Operational flow monitoring sites from several key agencies in Tasmania, New South Wales, Queensland, the United States, and England formed part of the overall development process. Each flow monitoring site was evaluated against rigorous site selection requirements to determine the most optimal measurement location. The CVSG system was then deployed on a mast or other infrastructure and referenced to a cross sectional survey of the channel in line with the camera.

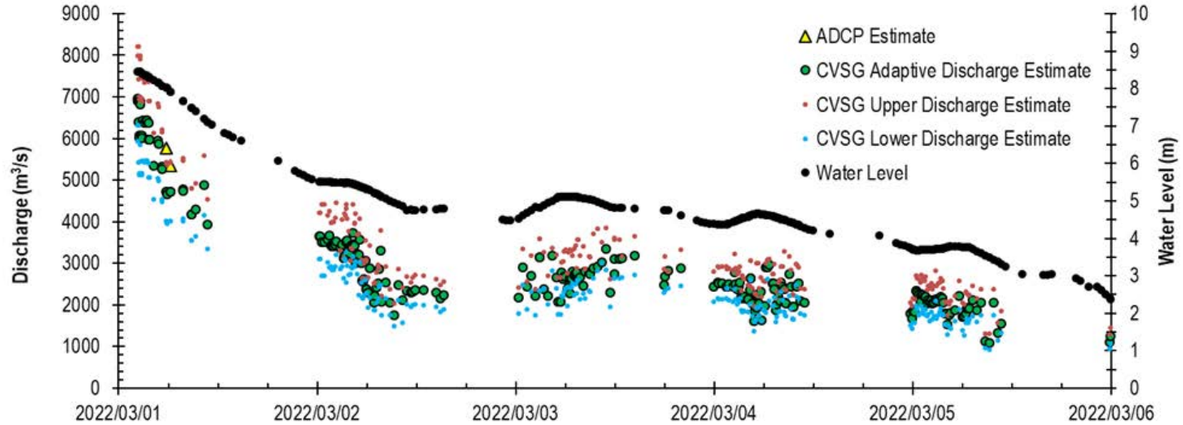


Figure 4 - CVSG – Centenary Bridge event discharge timeseries.

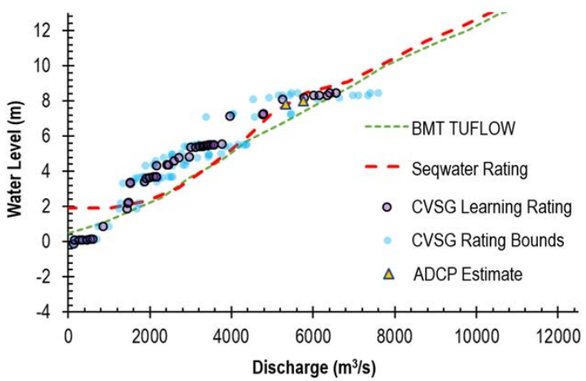


Figure 5 - Comparison of CVSG-produced and historical rating curves (dashed lines from "Data, Rating Curve and Historical Flood Review Report, Aurecon, Australasia).

On the Brisbane River, a CVSG system was deployed at Centenary Bridge (shown in Figures 2 and 3) over 10 days during the March 2022 floods to provide real-time monitoring of the flow conditions for local utility services.

A total of 1,400 videos were collected and analyzed, with a maximum velocity of 3.7 m/s and maximum discharge of 6,967 m3/s gauged during the event shown in Figure 4.

The velocity and discharge estimates from the CVSG system closely matched those estimated from an acoustic Doppler current profiler (ADCP), with the CVSG stage-discharge rating curve based on the receding limb of a single hydrograph (Figure 5). Comparing the historic stage-discharge rating curves based on a limited number of stream flow measurements shown in Figure 5 with the CVSG rating curve demonstrates a difference during medium flow conditions. This could be attributed to a controlling feature downstream in the Brisbane River or variable backwater conditions due to tidal influences. Furthermore, given that the 18 discharge measurements on which the rating curve is based were collected over a period of 120 years, it is reasonable to believe that changes in the cross section of this highly mobile bed in the Brisbane River estuary may have contributed to the difference during medium flows. The deployment of CVSG system at Centenary Bridge highlights the CVSG versatility and that it can be used for both long-term flow monitoring and rapid deployment during significant flow events.

A major drawback of traditional flow monitoring methods is the level of resources required, particularly in remote areas or catchments prone to flash flooding. The ability to develop stage-discharge relationships in real-time is a significant enhancement in water engineering.

References

Hutley, N.R., Beecroft, R., Wagenaar, D., Soutar, J., Edwards, B., Deering, N., Grinham, A., and Albert, S. (2022). Adaptively monitoring streamflow using a *stereo computer vision system.* EGUsphere [preprint]. https://doi.org/10.5194/egusphere-2022-735

Texas Water Development Board

Request for Information on Low-Cost Flood Warning Systems

The Texas Water Development Board (TWDB) is developing a guidance document that communities can use to help plan for the implementation of low-cost flood sensor (LCFS) flood warning systems (FWSs). As part of the research phase of this project, the TWDB is soliciting input from commercial vendors, universities, and public agencies regarding their development, application, and/or knowledge of LCFS FWSs.

The TWDB is interested in information about low-cost sensors (contact and non-contact) and associated data logging and telemetry systems that can provide real-time awareness of flood conditions at roadways. The guidance document will include information on FWSs that are less than approximately $10,000 but ideally less than a few thousand dollars in total cost.

If your organization has experience with LCFS FWSs that you believe would be useful to share, please reach out to the Texas Water Development Board at lcfs@twdb.texas.gov. Do not include email attachments as these will be blocked for security purposes. TWDB or their consultants will reach out for more detailed information if needed.

14TH BIENNIAL TRAINING CONFERENCE

JUNE 19-22, 2023 / **BEAVER RUN RESORT** / **Breckenridge, Colorado**

QUICK LINKS

Conference Website

Program

Hotel

Activities

REGISTER HERE

The 14th Biennial Conference & Exposition, will be held on June 19-22, 2023, at the Beaver Run Resort in Breckenridge, Colorado. Our planning committee is working feverishly to organize a memorable week of education, training, networking, and fun. "Gold Rush at the Great Divide" is our 2023 theme, reflecting both the long history of gold mining the region and its location at the headwaters of the largest river systems in the United States.

Training workshops and concurrent session tracks will follow this central theme. The program will include a wide range of keynote presentations, workshops, and detailed technical sessions that cover the needs of communities from those just getting started to those that already have advanced systems. Abstract submissions and online registration are now open! We are also planning several fun activities, such as a golf outing, fly fishing trip, field tours, casino night, and hospitality suite.

To stay up-to-date on all things conference related, please visit our website HERE.

NEWS & EVENTS

OFFICERS

Bruce Rindahl
President
Mile High Flood District

Brad Heilwagen
Vice President
WSP

June Wolfe
Secretary
Texas A&M AgriLife Research

Ben Pratt
Treasurer
Susquehanna River Basin Commission

DIRECTORS AT-LARGE

Jimmy Stuart
Climate Resilience

Mark Moore
Distinctive AFWS Designs

Rob Hartman
Robert K. Hartman Consulting Services

Matt Friedberg
Dona Ana County Flood Commission

Fritz Law
(AUG Appointee)
AEM

BOARD TRUSTEE

Kevin Stewart
Retired

Calendar

June 19-22	NHWC 14th Biennial Training Conference & Exposition Breckenridge, Colorado

Important Conference Dates

April 10	Early Bird Registration Discount DEADLINE
April 20	Exhibitor Registration DEADLINE
May 8	Sponsor Advertising DEADLINE
May 8	Speaker Change DEADLINE
May 29	Hotel Reservation Deadline

TRANSMISSION EDITORIAL TEAM

Brian Iserman, PE | JE Fuller
Co-Editor

Lee von Gynz-Guethle, PE, D.WRE, CFM | WEST Consultants, Inc.
Co-Editor

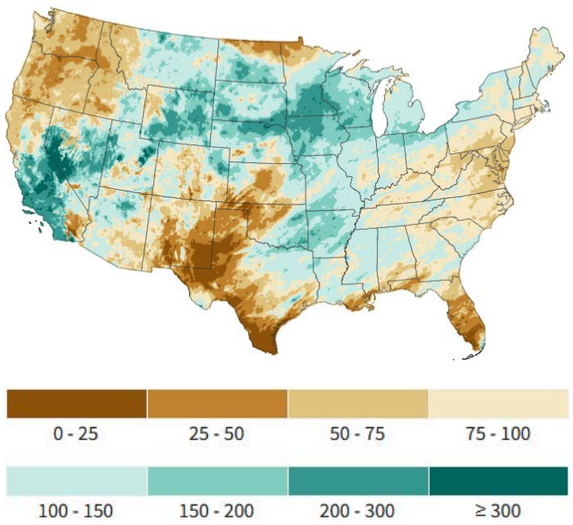
Cortnie Chaple | WEST Consultants, Inc.
Becca Emery | Kisters
Liberty Smith, Ph.D. | WEST Consultants, Inc.
Jenny Struzik | WEST Consultants, Inc.

SUBSCRIBE

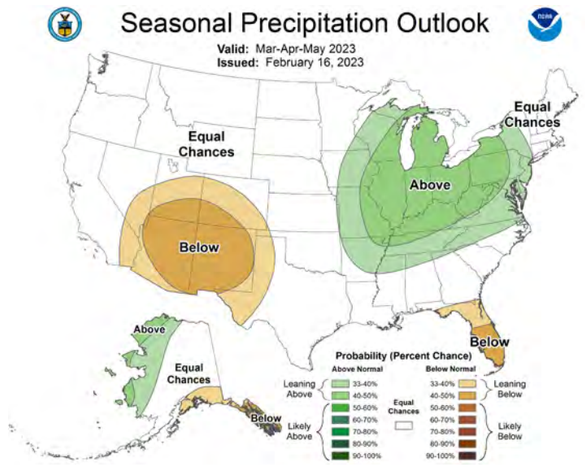
Subscribe to the Transmission today and consider recommending the Transmission to your colleagues. Non-members can access the latest issue and receive it in their inbox! Members receive access to all past issues.

HYDROLOGIC CONDITIONS

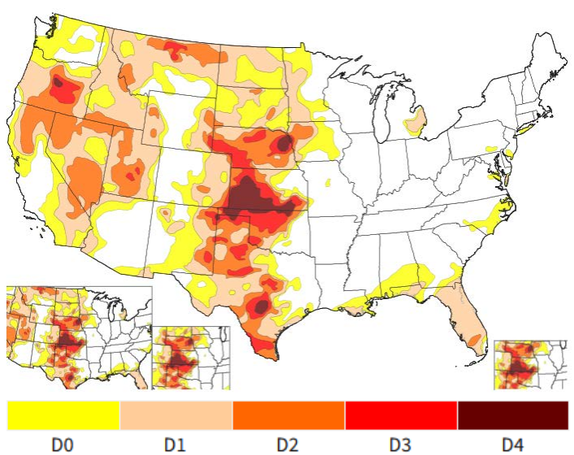
60-day % of Normal Precipitation
Last Updated 03/10/23



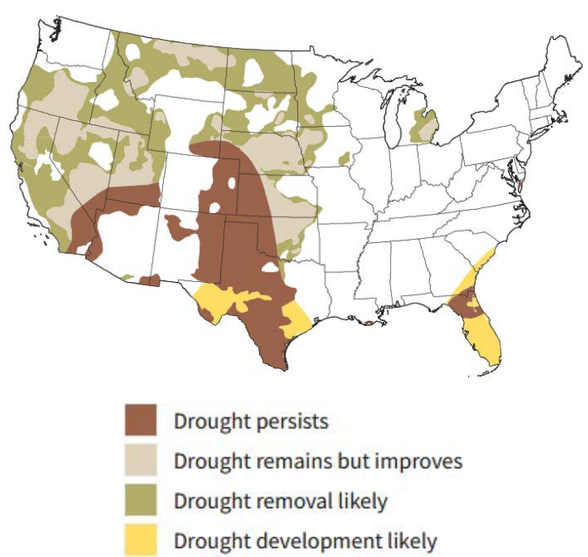
3-mo Precipitation Outlook
Last Updated 02/16/23



Current Drought Conditions
Last Updated 03/07/23



3-mo Drought Outlook
Last Updated 03/15/2023



Sources: https://www.drought.gov/forecasts
https://www.drought.gov/current-conditions
https://www.cpc.ncep.noaa.gov/

TRAINING AND PROFESSIONAL DEVELOPMENT COMMITTEE

WEBINAR TOPICS

- Overview of Flood Warning Systems
- Basic Hydrology
- Collecting Rainfall
- Collecting Stage
- Other Data Collection
- Batteries and Solar Panels
- Transmitting Data
- Data Evaluation
- Upgrades & Installation
- Flood Modeling & Forecasting
- Communicating Data

The Training & Professional Development Committee is hosting a monthly webinar series to provide an overview of Flood Warning Systems and the topics that are fundamental to planning, operating, and maintaining those systems. The Committee is also planning for potential workshops, training courses, and a Flood Warning System certification program. **All webinars are FREE!** Past webinars are also available on our website HERE. Our goal is to offer a library of videos covering flood warning systems and make these available to the industry. Of course, we hope viewers will become members, volunteers, and conference attendees!

Interested in Volunteering?

We need volunteers! If you are interested in the topics mentioned above, regardless of your experience, contact Mark Moore, Training and Professional Development Committee Chair at: mark.moore@distinctiveafwsdesigns.com. Consider sending around a request for volunteers within your organization as well.

Interested in Speaking?

We are always looking for speakers to contribute to the webinar series! Contact the Committee Chair if you are interested in speaking.

More information on the webinar schedule and registration is HERE.

PARTING SHOT

Pima County, Arizona / 31.90, -110.97 / DECEMBER 14, 2022

Photo by Brian Iserman, PE / Hydrologist / JE Fuller

The Pima County Regional Flood Control District, in cooperation with the Town of Sahuarita, Arizona, the USGS, and JE Fuller recently installed this camera station and ALERT precipitation/stream station just prior to the completion of the new Quail Crossing Bridge over the Santa Cruz River. Shown in the photo is Peter Acton (JEF) making final camera configuration adjustments while a USGS crew (background) installs conduit for the ALERT station's pressure transducer sensor. Data from the ALERT station and images from the camera can be viewed at https://alertmap.rfcd.pima.gov/Gmap/Gmap.html and https://pima.jefulleralert.com/jefmap/.

Send us your best shot!
Editor@HydrologicWarning.com