Upper Mississippi River Basin Association

Water Quality Executive Committee and Water Quality Task Force Joint Meeting

June 8-9, 2021

Agenda

with
Background
and
Supporting Materials

UPPER MISSISSIPPI RIVER BASIN ASSOCIATION
WATER QUALITY EXECUTIVE COMMITTEE AND WATER QUALITY TASK FORCE
JOINT VIRTUAL MEETING

June 8-9, 2021

Agenda

Connection Information

- Web, video conferencing, click on the following link:
  - June 8: https://umrba.my.webex.com/umrba.my/j.php?MTID=mf50d9b4660dad31d59ae05683b75c007
  - June 9: https://umrba.my.webex.com/umrba.my/j.php?MTID=mcf40cdad0c262ecf02a5332d6a0d0389
- Dial-in number: (312) 535-8110
  - June 8 access code: 182 926 6546
  - June 9 access code: 182 165 6725
  - Passcode: 1234 (same for both days)

June 8, 2021

Time	Attachment	Topic	Presenter
1:00 p.m.		**Welcome and Introductions**	***Chris Wieberg,*** *MODNR*
1:05	**A1-12**	**Approval of the January 27, 2021 WQ Task Force Meeting Summary**	***All***
1:10		**UMRBA Meeting Review** • January 26, 2021 WQTF Technical Session • April 9 and 13, 2021 NRS Progress Tracking Workshops	***Lauren Salvato,*** *UMRBA*
1:25	**B1**	**TSS in the Upper Mississippi River**	***Pam Anderson,*** *MPCA*
1:50		**Nutrients** • State and Federal Updates	***All***
2:10		**Break**	
2:40	**C1-2**	**Soil Loss in the Corn Belt Region**	***Evan Thaler and Dr. Isaac Larsen,*** *U-Mass Amherst*
3:10	**D1**	**Hydraulic Connectivity for Sediment and Nutrient Sequestration in UMR Floodplains**	***Dr. Chuck Theiling,*** *MVD-ERDC*
3:40		**CWA Program Updates** • 305(b) and 303(d) Consultation • TMDL Updates	***All***
4:00 p.m.		**Adjourn for the Day**	

(Continued)

June 9, 2021

Time	Attachment	Topic	Presenter
9:00 a.m.		**Reflection**	***All***
9:05	**E1-4**	**Illinois River Basin NGWOS Science Plan**	***Jim Duncker,*** *USGS*
9:35		**How Clean is the River? Report Update**	***Lauren Salvato,*** *UMRBA*
9:50	**F1-4**	**The Impact of Drought on Arsenic Exposure in Private Wells**	***Dr. Melissa Lombard,*** *USGS*
10:20		**Administrative Items** • Election of Officers • Future Meeting Schedule	***All***
10:30 a.m.		**Adjourn**	

ATTACHMENT A

Draft Summary of the January 27, 2021 WQTF Virtual Meeting

(A-1 to A-12)

Upper Mississippi River Basin Association
Water Quality Task Force Virtual Meeting

January 27, 2021

Draft Highlights and Action Items Summary

September 22, 2020 WQTF Meeting Summary

The UMRBA Water Quality Task Force (WQTF) approved the September 22, 2020 draft highlights and action items summary pending an edit to Minnesota PCA's HAB update on page A-7.

UMRBA Meeting Review

Keys to the River Report

Kirsten Wallace reminded participants that the focal points of the Keys to the River report are the challenge of flooding and vulnerability to low water conditions in the river floodplain. The volume and rate in which sediment moves through the system has made it challenging for channel maintenance and maintaining the 9-foot navigation channel. UMRS stakeholders and Congress are committed to addressing these issues.

Currently, UMRBA is undergoing a targeted review of the draft Keys to the River report and the high leverage action items developed in the process. UMRBA wants to understand stakeholders' perspectives before handing the final version to the UMRBA Board for review. UMRBA staff will share the draft report to the WQTF. An earlier version was shared with the WQEC.

Communication to the Biden-Harris Administration

The Water Subcabinet Executive Order (EO) was an artifact of the Trump Administration. The EO sent an important signal of federal agencies priorities of nutrient reduction strategies (NRS) and work on the Mississippi River. In response, UMRBA sent a letter to the subcabinet that requested UMRBA be consulted with or used as a partner in an action plan.

A letter was sent to the Biden-Harris transition team with UMRBA's priorities. With the new Administration's emphasis on climate change, there may be opportunities to discuss NRS and other water quality work.

WQEC Strategic Planning

Wallace said the WQEC continues to engage in strategic planning. Thus far, the priorities of the WQEC have been confirmed, including the WQIA, NRS progress tracking workshop, engaging with the HTF, Reaches 8-9 pilot, HABs, emerging contaminants, and engaging in regional and national forums.

Strategic planning initiated when questions came up about the role of the WQ committees. Both the states and UMRBA have recently experienced staff turnover. This ultimately evolved into the idea of strategic planning, to take a step back and solidify what the WQ committees want to build towards. The last major strategic planning effort occurred in 2006, and the WQ committees accomplished the steps that

were laid out. Next steps are to build an interstate WQ monitoring program for the UMR. Wisconsin DNR has provided the WQEC with a staff facilitator, Dan Helsel.

In July 2020, at the first strategic planning session the meeting focused on the basic questions of what business should UMRBA be in and why. Those questions guided development of the mission and vision statement. Additional items discussed included aligning the states' work and managing the UMR as one river. This means using CWA to have shared designated uses, working on the NRS as an advocate, communicating, and bringing in resources. States asked UMRBA to augment their NRS programs, but what this looks like is still in development.

One of the working assumptions is that UMRBA remains as an association of states. In the October 2020 strategic planning session, the WQEC looked at the 2006 strategic planning table and discussed the types of services UMRBA provides. Marcia Willhite provided an overview of working with UMRBA and ORSANCO during her tenure with Illinois EPA. She said that the success of ORSANCO was in the shared agreement of the states to come together and decide how to use, manage, and protect the river. UMRBA does not necessarily need to be a compact to do those things and has the pieces to build the holistic management of the river.

In the November 2020 strategic planning session, the WQEC switched gears and used a product-action-issue-results (PAIR) assessment for its issue areas. Lauren Salvato presented on Interstate WQ Monitoring Program as an example and highlighted what would have to be done in the next five years to get to the point of full-scale implementation of UMR monitoring. The detail provided was helpful to understand the amount of work ahead. Gregg Good added that developing the recommended monitoring plan and other documents was such a small part of the entire picture. It is an incredible amount of work to implement and develop a 305(b) report. It is a 10-year effort, and not something that can be implemented next year.

UMR Water Quality Improvement Act

Wallace said that UMRBA staff has been engaged in outreach and is pleased to have increased support of the Act (e.g., agriculture, waste water, and drinking water groups). The goal of outreach is to build collaboration before proposing the Act to Congress.

Albert Ettinger asked if UMRBA staff talked to legislators about the WQIA and how that is going. Wallace replied that UMRBA has been working with legislators since 2018. Representative Ron Kind brought to the bill to UMRBA in 2017. UMRBA and the states are regularly talking with delegations about stakeholder perspectives and ensuring the Act reflects those stakeholder needs. In response to Ettinger's questions about the lead sponsors of the bill, Wallace said several members are willing to serve as lead across agriculture, transportation and infrastructure, and environment and public works committees. UMRBA staff were waiting to see if any changes would be made to committee assignments following the 2020 elections.

Shawn Giblin reiterated that it would be great to have a draft of the Keys to the River report, as he has received questions about the report.

Interstate Water Quality Monitoring

Reaches 8-9 Pilot Update

Dan Kendall provided an update on the Reaches 8-9 pilot project. As a reminder UMRBA, Missouri, Illinois, and Iowa agencies and laboratories are sampling 109 river miles from the Iowa River confluence

to L&D 21 (near Quincy, Illinois). Recent changes to the pilot include the pause of pilot sampling from March 2020 to October 2020. The original sample period was from December 2019 to December 2020, and the new sampling period is from December 2019 to March 2020 and October 2020 to September 2021.

After the pilot was restarted the Reaches 8-9 planning committee lost the participation of the PWS voluntarily sampling for the drinking water use assessment. Some of the reasons were due to reduced staff capacity and the monthly volume of samples requested of the PWS. The planning committee adjusted and incorporated drinking water parameters with fixed site sampling. The next update is that PFAS sampling was temporarily suspended due to laboratory contamination issues. Sampling resumed in January 2021 after USEPA Region 5 adjusted sampling protocols to combat the contamination issue. Finally, samples were lost by FedEx in January 2021, and have not been recovered.

Nutrients

Presentations

Reducing Legacy Nutrient with Wetlands and Wetlaculture™

Bill Mitsch said the motivation for his research has been to address excessive nitrogen and phosphorus loading to the Gulf of Mexico. Wetlaculture™ is sustainable agriculture combined with wetlands. Adding the wetlands adds a treatment process, step one, taking in the nutrients that agriculture may otherwise discharge into landscapes. It doesn't eliminate fertilizer application but reduces the need, as eventually the nutrients retained are returned back to the agriculture landscapes to grow crops. Step two is known as nutrient recycling from wetland to farmland.

Using mesocosm experiments in Ohio and Florida, Wetlaculture™ has demonstrated that agriculture crops (e.g., corn) can be produced with nutrients captured by wetlands rather than by conventional fertilizer application. This results in both a reduction in the application of fertilizers across agricultural landscapes and restoration of wetland habitats. The model is a sustainable approach as both farmers and investors can profit from using Wetlaculture™.

Ettinger observed that wetlands are recognized for nitrogen sequestration, but asked how long does it take before the wetland receives too much phosphorus and reduces oxygen to biota. Mitsch replied he can predict that the wetlands will work well for 25 years of operations but is unsure of the longevity after 100 years.

Wetlaculture™ can flip landscapes in crop production that can use the nutrients. Joe Summerlin asked Mitsch to elaborate on how the landscapes can be flipped. Mitsch detailed that the experimental mesocosm are 100-gallon experimental tubs. The size of the tubs allows for a plug to instantaneously change from wetland to dry land. This is all using the same plot of land. Mitsch and his team do not yet know the sequence of wetland and agriculture timing (e.g., 5 years for a wetland, 3 years for agriculture).

[Note: questions were emailed to Dr. Mitsch following the presentation and responses are included below].

Steve Schaff asked in Wetlaculture™, how much of the crop is harvested (e.g., corn only or corn stover as well). Mitsch responded that there are no horticultural rules in the approach to the crops. That is where we will benefit from the experience of the farmer or land owner. Like current agriculture, there will be practices and crops that will work better than others. Coreen Fallat asked what scale Wetlaculture™ will work. Is this work suggesting that a whole field could be converted to the system? Mitsch said his

research team has demonstrated Wetlaculture™ in 100-gallon tubs in experiments. Larger scale pilot-scale experiments at multi-acre scale and over a decade or more need to be the next step. His team also found that the mesocosm experiments growing crops in small containers are too small a scale to get repeatable results and deal with herbivory, for example.

Karen Hagerty asked how do you change the hydrology from wetland to crop land outside of mesocosms. Similarly, John Hoke asked whether the tile drains remain in place. In response to both questions, Mitsch said if the field has tile drainage to leave it in place. If you want a wetland, plug the tile outflow. If you want farmland, drain the land. This would be a major benefit for farmers to know that the drainage system stays in place. Micah Bennett observed that it seems like one of the big barriers to existing conservation programs is in getting farmers to give up use of the land. You end up getting marginal lands that they may not have farmed much anyway. How do you see overcoming this dynamic with Wetlaculture™ since it seems like it would need to involve giving up use of productive lands? Mitsch replied that more likely a farmer could use Wetlaculture™ even in marginal lands that are often a little wetter.

Mitsch agreed with Joe Summerlin's comment that the idea is that you use the existing farm tiles to "cork" the system when you need to convert to wetlands, and then you drain the wetlands to create arable land. Adam Schnieders shared that the Iowa Department of Agriculture and Land Stewardship received a grant a year or two ago for drainage water managements systems. One of the projects is capturing water from tile drainage in a lagoon, pond, or wetland for storage. This water can then be used for irrigation when needed. Maybe not the exact same of what is presented here, but seems to be a similar line of thinking. It will be interesting to see the results once it is in place. There may be an economic benefit to farming this way, but Schnieders thinks that is one of the areas that is being investigated as a part of the project. Mitsch commented that he is aware of the idea of using wetlands to store water for crop irrigation. This is different but similar in the concept that the landscape has wetlands and crops rotating.

Salvato asked how far is the Wetlaculture™ concept from being brought to market. Is the hope that this could be an accepted conservation practice? Mitsch replied that he has talked to investment specialists, who are working with a business college professor at Notre Dame, and presented this idea with enthusiastic reaction to investors in Florida. The business model is improving every year. This could be a win-win-win situation of using less fertilizer, having clean water downstream, farmers making income whether growing crops or clean water, and providing a crop that could be marketed at twice the cost as an ecological "crop." There is no question that it would have a market at Whole Foods and similar outlets.

Defining a Nuisance Algal Bloom

Mike Shupryt recalled that, at the September 2020 WQTF meeting, participants discussed the definition of a HAB. Wisconsin DNR has done some work on putting a quantitative value to the definition of a HAB, specific to recreation uses. The algae criterion is based on chlorophyll-a (chl-a), to protect recreation uses and use values for site specific criterion for phosphorus. This includes aesthetics and perception of swimming.

The data utilized were Wisconsin's Citizen Lake Monitoring Network. Citizen scientists collect chl-a, total phosphorus (TP), Secchi depth, and submit a user perception survey (i.e., how water quality is perceived). The perception survey includes levels 1 through 5, describing the presence or absence of aesthetic problems and ability to swim and boat. A rating of 1 equates to the perception that the waterbody is "beautiful, could not be nicer," while a rating of 5 means that "swimming and aesthetic enjoyment of the lake is substantially reduced because of algae levels."

Wisconsin DNR staff compared user perceptions with measured chl-a. The logistics regression revealed that Wisconsin user data supports the definition of "moderate algae" of 20 µg/L chl-a. This value was

determined by comparing the measured chl-a with the inflection point between levels 2 and 3 and levels 3 and 4.

The new proposal is that shallow lakes should not have "moderate algae levels" more than 25% of the days during the summer sampling period. Looking at site specific lake chl-a data, Wisconsin DNR staff found that the 75th percentile of lakes can meet the "moderate algae levels", i.e., 20 µg/L chl-a. A crossover from shallow lakes was made to large rivers, as the same type of recreation is done on both water bodies. There is a similar relationship between phosphorus and frequency of moderate algae levels. However, confounding factors in large rivers include size and slope, TSS, and upstream impoundments.

The implications of the proposal are the following:

— Reduces the frequency to no more than ¼ of summer days with "moderate algae levels" i.e., 20 µg/L.

— This equates to no more than 15 days in mid- to late-summer.

— A number of large rivers would be impaired for algae, but most are already exceeding TP criterion or under a TMDL (reservoir based end-points).

In response to a question from Hoke about the extent of user surveys, Kristi Minahan said over 10,000 user surveys were conducted beginning in 2003, which has resulted in two decades worth of data. Shupryt added that some of those surveys were repeated and they had to account for that in the analysis framework. Hoke said Missouri has considered how it would construct user surveys, but perhaps Missourians thinking similarly to Wisconsin and data in the region can be used. Pam Anderson commented that Minnesota used the exact same survey if Missouri wanted another example. Minahan said that Wisconsin's protocols were based directly off of Minnesota and Vermont's surveys developed in the 1980s.

Ettinger noted that a study in Florida revealed similar numbers, that people believe algal biomass is undesirable at about 20 mg/L. Good asked whether the numbers were generated as a statewide number for Wisconsin or have regional differences. Shupryt replied that yes, the value is state-wide. DNR staff looked at the split between north and south. The northern third of the State is pristine and the lower two thirds is mixed agriculture and urban uses. Minahan added that staff found some difference but not enough to warrant splitting the criterion into two different groups. DNR staff put together a technical support document, and while it has not yet been published, Minahan can share with the WQTF. Anderson said that Minnesota split values across eco regions.

Ettinger asked participants if anyone has looked at user perception of aquatic plants like Eurasian watermilfoil as opposed to chlorophyll-a. KathiJo Jankowski thought retired DNR staff John Sullivan worked on that topic for Wisconsin. Giblin clarified that it did not emphasize user perception. Minahan added that the topic was discussed in terms of quantifying aquatic biomass as it relates to impeding recreation.

Jason Daniels recalled that Iowa conducted a user perception survey around a decade ago. Kendall confirmed that Iowa State University did. One aspect that comes out is that users are happy post-restoration because the water is clear. Two years later they get weeds again (i.e., aquatic vegetation) that makes it hard to fish. Users want a swimming pool that they can boat and fish in. Salvato asked how the WQTF wanted to follow-up on this topic. Kendall replied that states can look over the surveys conducted in the region, and Minahan said she will send the technical support document.

State Updates

Minnesota – Anderson said NRS five-year update is posted on PCA's website. This includes an interactive BMP adoption page.

The waste water program has been working on WQ trading guidance. The state wanted to come up with a market strategy to facilitate trading between agriculture and municipalities. This multi sector group landed with developing a guidance document, establishing baselines for sellers and buyers, and talking about credit ratios. The guidance document was just updated in January 2021. Anderson can share with the WQTF and interested individuals.

With the Biden-Harris Administration's emphasis on climate change, Minnesota is trying to integrate NRS and multiple benefits into its climate change initiatives

Illinois– Good announced that Illinois EPA received a multipurpose HAB grant from USEPA. As part of the grant, the state is receiving HAB kits and sending the collection to a contractor to identify blue green algae. Another potential addition is monitoring sites for the ambient water quality network. Potential sites were identified on the Fox River.

The USGS Next Generation Water Observing System (NGWOS) on the Illinois River Basin will be evaluating HABs and nutrients in the basin. The basin runs from SW Chicago to the Mississippi River and borders portions of Wisconsin and Indiana. USGS' Jim Duncker has been tasked to work with USGS HQs on this. Upcoming meetings will solicit information from stakeholders and the states to see what existing information and research questions exist. Duncker appreciated Good's shoutout about the Illinois River Basin NGWOS. USGS is just getting started and staff reached out to UMRBA and other stakeholders to assist in setting up meetings to understand stakeholder's priority issues as USGS puts together a study plan.

Ettinger asked Good if Illinois EPA will use USGS data in 2020. Good responded that Illinois EPA is using USGS super gauge data and staff are working on data consolidation and analysis. There are millions and millions of records and it has been quite a process to figure out how to have attainment/ non-attainment for aquatic life use using DO, pH, and temperature data. Ultimately the data will be in the next assessments. Kendall seconded Good's comment about continuous monitoring data. It is a struggle to deal with massive datasets.

Gina LaLiberte suggested trying the jar test if the HAB identification question is for planktonic cyanotoxin versus other algae. LaLiberte instructed participants to shake up your green water sample, and let it sit to allow the planktonic cyanotoxins to form a floating scum. More information on the jar test can be found at the following link: https://www.pca.state.mn.us/sites/default/files/wq-swm1-04.pdf

Iowa – Schnieders said Iowa DNR continues to develop relationships with municipalities and farmers in priority watersheds. A lot of the work is based out of the Sand County Foundation, applying work in Wisconsin, Illinois, and Iowa. The outgrowth of that work results in a MOU to provide municipalities with regulatory certainty to recognize NDPES permitting purposes for investing in the watershed. Policy is evolving to allow for on-the-ground practices that reduce nutrients and provide other benefits such as source water protection and flood resiliency.

Regarding source water protection, the WQ bureau is reorganizing to better leverage NRCS funding and line up Iowa communities to take advantage of those resources.

The state and a group of organizations are also working with smaller communities to look at waste water treatment plant (WWTP) optimization opportunities, which is low hanging fruit to lower electricity used

and reduce greenhouse gas emissions. The engaged groups include the League of Cities, Iowa Power, Iowa State University, and Iowa Rural Water Association.

The state is also working on increasing cover crop production, and began to produce its own cover crop seed to give to wildlife managers where there are row crops planted. The state is looking to expand on that and is currently applying for grants from the USEPA Gulf of Mexico Program Office. The goal is to increase seed production to the 30,000 acres of state managed lands.

Salvato asked whether it is feasible for small municipalities to be involved in the Sand County Foundation work. In response, Schnieders noted that Storm Lake is a small community. It is a matter of having administrative capacity and awareness, and bigger cities are better equipped. The Sand County Foundation is trying to develop solutions to these potential barriers.

Wisconsin – Shupryt said monitoring is in progress for the Fox River TMDL. It will be complete in a couple years.

Shupryt reminded participants that Governor Evers' Administration declared 2019 the year of clean drinking water. This was initiated by the state's challenges with *E. Coli*, nitrate, PFAS, etc. There has been some departmental movement on nitrate in ground water. Wisconsin DNR now has a nine key element plan, in terms of well head protection for nitrate loading. The agency is collaborating with agriculture to figure out ways to tackle the issue of nonpoint source pollution.

Ettinger observed that the federal arsenic standard is low if its intention is to protect for fish consumption. He asked if states are using the federal criterion. Anderson replied that Minnesota has worked on assessments in the Red River Basin but believes it was drinking water focused. Ettinger recalled that the drinking water MCL is 10 micrograms per liter.

Clean Water Act (CWA) Program Updates

State Updates

Missouri – Hoke said Missouri DNR staff submitted its 303(d) list at the end of April 2020. USEPA Region 7 reviewed and acted upon it in November. The 2020 list represented the first where Missouri implemented its data age provision. In other words, if a waterbody was not already listed as impaired and data was more than 7 years old, DNR is required to collect additional data and place it in the 3b category. USEPA approved the vast majority of the list. However, there were 40 lakes for which USEPA did not agree with Missouri's data age provision. Data from the University of Minnesota was discovered after the list was submitted, as well as for other data missed on Missouri DNR's end. Currently the 40 lakes are back out for public notice until March 22, 2021.

Additionally, there is a push by USEPA to get all CWA submissions in on time in celebration of USEPA's 50th anniversary. Missouri DNR has vacancies in the Monitoring and Assessment Unit, and staff are trying to fill those slowly so DNR can meet the USEPA anniversary goal and complete field work.

On the 2020 list, the UMR *E. Coli* impairment was delisted as it was determined to no longer be impaired.

Hoke said that TMDLs are still being revised based on the consent decree, particularly where there is a nutrient impairment below a WWTP. The nutrient waste load allocations are being revised to be more

achievable with current technology. Thank you to USEPA Region 7 for reviewing the modeling for this revision.

DNR staff are also engaged in a reasonable potential analysis for lakes that are impaired on 2020 303(d) to make a determination whether nutrient limits are necessary for waterbodies in those new lakes in impairment watersheds. The TMDL modeling group is working with the BATHTUB model and decay over stream distance. Fortunately, there are not a lot of large lakes in the analysis, other than a larger reservoir in SW Missouri. There may be additional lakes listed as impaired at the end of 2020. Regarding CWA programs, DNR staff are waiting to proceed with 2019 triennial review once updates are made to WQ standards. Missouri has nutrient standards for aquatic life protection but wants to expand to recreation.

Ettinger asked if the reasonable potential analysis for impaired waters list is being conducted for lakes that have not yet been listed. Hoke replied that DNR is doing both, but prioritizing impaired lakes for permit review, and so permit holders can be aware of upgrades are coming.

Minnesota – Anderson said the Lake Pepin TMDL went on public notice in early 2021 and PCA hopes to get it wrapped up shortly and sent to USEPA for approval. The Des Moines River and Shell Rock River TMDLs generated contested hearing requests.

For 303(d), the sulfate standard for wild rice waters is still stuck in the Governor's office. As a reminder, Minnesota tribes request that eight waters be added to the list. In response to a question from Salvato, Anderson replied that the 10mg/L sulfate standard has been around for decades. PCA attempted to promulgate a standard for wild rice years ago, and there is now legislation that PCA cannot assess for wild rice. It is a matter of figuring out where a lawsuit will come from. The new standard is more protective of wild rice, according to the science, but it could not get through the legislative process. PCA may have to resort to using the old standard.

Anderson said that PCA is planning to sample seven or eight watersheds in 2021. The agency is working on 2020-2021 to be pulled together for the 2022 submittal. Anderson hopes to get an RFP out for building better data flow for ATTAINS submittal. If not, the submission process will be labor intensive again.

Wisconsin – Shupryt said things went smoothly for the 2020 CWA assessments. For the 2022 assessments, the state is on track.

Illinois – Good said Illinois EPA's integrated report 2018 was approved. Staff were successful inputting the data into ATTAINs. Once the 2018 assessment is approved, staff will populate the database with 2020 assessments, which are already complete.

There has been a big push from USEPA to submit 2022 assessment data for the upcoming 50th anniversary on April 22, 2022. States have been asked to work with regions to come up with a timeline for submission.

Iowa – Kendall said Iowa DNR's impaired water list went out for public comment in December 2020. Finishing the list in 2020 was a big accomplishment, and the goal moving forward is to get caught up on assessments. There were no major changes from last cycle, although a few assessments were phased out due to the age of the datasets. Another change is the basin level Iowa River TMDL. This is a big TMDL, as opposed to the agency's typical method of issuing TMDLs in shorter segments. Iowa DNR staff are finishing up responses to comments on assessments. Kendall said the agency received 110 comments this year, which is higher than the last cycle. He hopes to finalize responses to the comments in January 2021 and send everything off to USEPA R7.

Kendall said there are no major plans for TMDLs on the Mississippi River.

Federal Updates

USEPA Region 5 – Micah Bennett shared updates from USEPA Headquarters. The Biden-Harris Administration is reviewing the numeric lake criteria, and it will take several months to complete. Cyanotoxin implementation guidance is likely delayed until the summer. A financial capability guidance document was issued in early 2021 to provide more information on feasibility for a lot of different CWA programs. The update pertains to the Ohio River Basin, but a petition from the Sierra Club and others was filed for USEPA to establish numeric nutrient criteria in the Basin and develop a TMDL. This petition is similar to the one put out for the Mississippi River several years ago. Ettinger added he was one of the authors on the Ohio River petition.

USEPA Region 7 –Jason Daniels thanked the states for mentioning USEPA's 50th anniversary. More outreach will be done this year, including a timeline and plan for meeting the anniversary goals. It will be a heavy lift but hope everyone can work together.

USEPA received a recovery and mitigation order directing staff to designate a point of contact for recovery and mitigation of disasters. Daniels believes it will help streamline communication and coordination. There is a lot of crossover to WQ and hazard mitigation work.

The STORM Act was passed at the beginning of 2021 (information linked here). MRCTI was at the forefront of getting that passed. The Act includes a provision similar to a state revolving fund for clean water but focused on disaster and resilience projects. It is a FEMA program that will come online in 2022 or 2023, and the goal is that the program will eventually be self-sustaining. The STORM Act also includes language on flooding and habitat projects.

Daniels shared additional links:

- Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-protecting-public-health-and-environment-and-restoring-science-to-tackle-climate-crisis/

- Executive Order on Advancing Racial Equity and Support for Underserved Communities Through the Federal Government https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/20/executive-order-advancing-racial-equity-and-support-for-underserved-communities-through-the-federal-government/

UMRR Water Quality Status and Trends

Jankowski said the UMRR Status and Trends report is still in draft version. She is happy to gather feedback and add to the ongoing report development. The report broadly overviews the status and trends of the river, with a focus on habitat conditions (e.g., ecological health), discusses where the river is changing, highlights information to guide restoration and management, and provides implications for the future of the river. The status and trends report is in its third edition and is published by the UMRR Long Term Resource Monitoring element (LTRM) and includes over 25 years of data. The first report was published in 1998 and provided more descriptive information about the ecology of the river and less data. The second version was more quantitative, published in 2008, based on 10 years of data (1993-2003).

Jankowski presented on water quality indicators, which focused on habitat conditions, nutrient and light conditions, and indicators of eutrophication. The indicators are total suspended solids (SS) in the main channel; nutrients: total nitrogen (TN) and total phosphorus (TP) in the main channel; chlorophyll-a (chl-a) in the main channel and backwaters; and dissolved oxygen (DO) in the backwaters. The data were collected as part of LTRM's fixed and stratified random sampling design. LTRM staff used water quality criteria to assess the status of the river, but it was a challenge to find representative values for a large floodplain river. Ultimately, USEPA nutrient criteria were used, differentiated by eco-region. The statistical trend methods employed included linear vs. non-linear models for chl-a and DO. Trends in nutrients and suspended solids were analyzed two ways: linear trends were estimated for measured concentrations from stratified random sampling and modeled flow-normalized concentration and fluxes were generated using the WRTDS model from several main channel and fixed monitoring sites (SS, TN, and TP).

Jankowski reviewed the results for each WQ parameter. For suspended solids (SS), a longitudinal trend is apparent. In other words, turbidity increases as you move downstream, reflective of resuspension and inputs from the watershed. The lower pools are almost always above 30 mg/L. The main take home is that there are widespread declines in suspended solids, except for Pool 13, which was highly variable and showed no directional change. The tributaries also indicate a decrease in SS, with the exception of the Maquoketa River. This suggests that changes in the mainstem river reflect changes occurring in the watershed.

For total nitrogen (TN), most pools always exceeded the USEPA values, except for Pool 13, which had a higher criterion value than other reaches (3.26 mg/L). The highest values were observed in the La Grange reach of the Illinois Waterway (IWW). Trends in TN were mostly stable, except in Pool 13 which showed a significant increase and the La Grange reach of the IL River, which showed a significant decrease. These trends appear to be reflective of similar north-south trends in tributary inputs (increasing in northern reaches, decreasing in southern). These results also correspond to trends in nitrate evaluated from 2002-2012 by Crawford et al., (2019) who observed declines in nitrate loading in tributaries on the IWW and an increase in nitrate in and around Pool 13.

Total phosphorus (TP) follows an increasing north-south longitudinal pattern. In terms of the USEPA criteria, most of the river is in exceedance. In-river concentrations declined in Pool 4, but flow-normalized concentrations declined strongly in Upper Pool 4 through Pool 26. These decreases are believed, in part, to be due to WWTP improvements and reflect reduced loading from the watershed from some tributaries (e.g., Cannon and Chippewa Rivers). Flow-normalized TP increased in the La Grange reach, matching trends in the Sangamon and La Moine Rivers.

Chl-a was high and above water quality standards in nearly all years in all reaches. There are no significant differences in chl-a between the reaches (i.e., no longitudinal pattern or linear trends). Jankowski observed that some chl-a concentrations peaked around the 2006 to 2008 timeframe. Chl-a is highly responsive to discharge and concentrations were higher during periods of low flow. The chl-a trends could be linked to changes in TP, but Jankowski has yet to make further connections. In the La Grange reach, previous work by the Illinois Natural History Survey has shown that the reduction in biomass was correlated to the proliferation of Asian carp (De Boer et al., 2018). For backwater areas, concentrations are generally higher than the main channel. One exception is Pool 8, which may have something to do with its high aquatic vegetation density.

The dissolved oxygen (DO) criteria is 5mg/L. Jankowski stated that there was more frequent low DO occurrence in summer than winter (0-80% of sites in summer vs. 0-38% of sites in winter). Low DO was more common in the northern pools, which may be a function of the variable hydrologic connectivity between the main channel and back waters, prevalence of free-floating plants that block light, or decay of

aquatic vegetation, but mechanisms need further exploration. There was an increasing trend in the prevalence of low DO during summer in Upper Pool 4 and during winter in Lower Pool 4.

Jankowski reviewed the summary of water quality findings:

- Widespread declines in SS in mainstem and tributaries
- TN is above standards, but trends are mostly stable
- TP is above standards, but many reaches show declining concentrations
- Chl-a indicates eutrophic conditions, but has remained largely stable with some recent declines
- Backwater DO remains mostly stable
    - More prevalent in summer than winter
    - More prevalent in northern than southern reaches

Ongoing challenges include long term (legacy) nutrients in the watershed, climate change impacts, the potential for HABs, and backwater sedimentation and disconnection. Jankowski suggested that efforts to reduce point and nonpoint source SS and TS are improving conditions in the UMR. Additional opportunities include maintaining and enhancing gains in aquatic vegetation and maintaining and enhancing connectivity with backwater and floodplain habitats.

Anderson commented that the reduction in phosphorus in Upper Pool 4 is tied to WWTP improvements, however there are still high loads for nonpoint source coming out of Minnesota. Jeff Houser agreed with Anderson that the data correspond closely to changes at WWTPs, especially when you look at winter data. Hagerty asked if supersaturation was ever a problem, and Jankowski responded she will follow up on her question.

Salvato asked if Jankowski is involved in any additional research that can provide additional insight into the lack of chl-a trends. Jankowski said she has ongoing research looking at winter versus summer data. Biomass is high in winter in some of the lower reaches. One possible next step is to run the chl-a data through the WRTDS model and look at seasonality differences. Robert Voss asked Jankowski which flow gauge was used for above and below Lake Pepin, and she replied that the Prescott gage was used. It provided continuous enough flow, and there was not another option to use.

Good said he was surprised of the results that the water quality story highlights good news. Jankowski confirmed that yes, despite climate change, higher flows, some aspects of water quality on the river have improved. Good asked if he could share the presentation. Jennie Sauer asked that the presentation is not shared beyond this group, and hopes to have the status and trends report completed in April or May 2021. Sauer offered to help with graphics that Good may be interested in by using the LTRM graphical browser.

Administrative Items

Future Meetings

- The next WQTF meeting will be convened virtually June 8-9, 2021

Attendance

Anna Belyaeva	Illinois Environmental Protection Agency
Gregg Good	Illinois Environmental Protection Agency
Daniel Kendall	Iowa Department of Natural Resources
Adam Schnieders	Iowa Department of Natural Resources
Pam Anderson	Minnesota Pollution Control Agency
John Hoke	Missouri Department of Natural Resources
Erin Petty	Missouri Department of Natural Resources
Robert Voss	Missouri Department of Natural Resources
Shawn Giblin	Wisconsin Department of Natural Resources
Sally Jarosz	Wisconsin Department of Natural Resources
Gina LaLiberte	Wisconsin Department of Natural Resources
Kristi Minahan	Wisconsin Department of Natural Resources
Greg Searle	Wisconsin Department of Natural Resources
Mike Shupryt	Wisconsin Department of Natural Resources
Coreen Fallat	Wisconsin Department of Agriculture, Trade, and Consumer Protection
Karen Hagerty	U.S. Army Corps of Engineers, Rock Island District
Leo Keller	U.S. Army Corps of Engineers, Rock Island District
Micah Bennett	U.S. Environmental Protection Agency, Region 5
Tim Elkins	U.S. Environmental Protection Agency, Region 5
David Pfeifer	U.S. Environmental Protection Agency, Region 5
Kathryn Quesnell	U.S. Environmental Protection Agency, Region 5
Jason Daniels	U.S. Environmental Protection Agency, Region 7
Steve Schaff	U.S. Environmental Protection Agency, Region 7
Joe Summerlin	U.S. Environmental Protection Agency, Region 7
Josh Tapp	U.S. Environmental Protection Agency, Region 7
Amber Tilley	U.S. Environmental Protection Agency, Region 7
Jay Christiansen	U.S. Environmental Protection Agency, Office of Research and Development
Heather Golden	U.S. Environmental Protection Agency, Office of Research and Development
Aleisha Kenney	U.S. Fish and Wildlife Service, Iowa-Illinois Field Office
Jim Duncker	U.S. Geological Survey, Central Midwest Water Science Center
KathiJo Jankowski	U.S. Geological Survey, Upper Midwest Environmental Science Center
Jeff Houser	U.S. Geological Survey, Upper Midwest Environmental Science Center
Jennie Sauer	U.S. Geological Survey, Upper Midwest Environmental Science Center
Ted Kratschmer	National Great Rivers Research and Education Center
Albert Ettinger	Mississippi River Collaborative and Sierra Club
Ingrid Gronstal	Iowa Environmental Council
Bill Mitsch	Florida Gulf Coast University
Lauren Salvato	Upper Mississippi River Basin Association
Kirsten Wallace	Upper Mississippi River Basin Association

ATTACHMENT B

Upper Mississippi River
Total Suspended Solids TMDL Fact Sheet

(B-1)

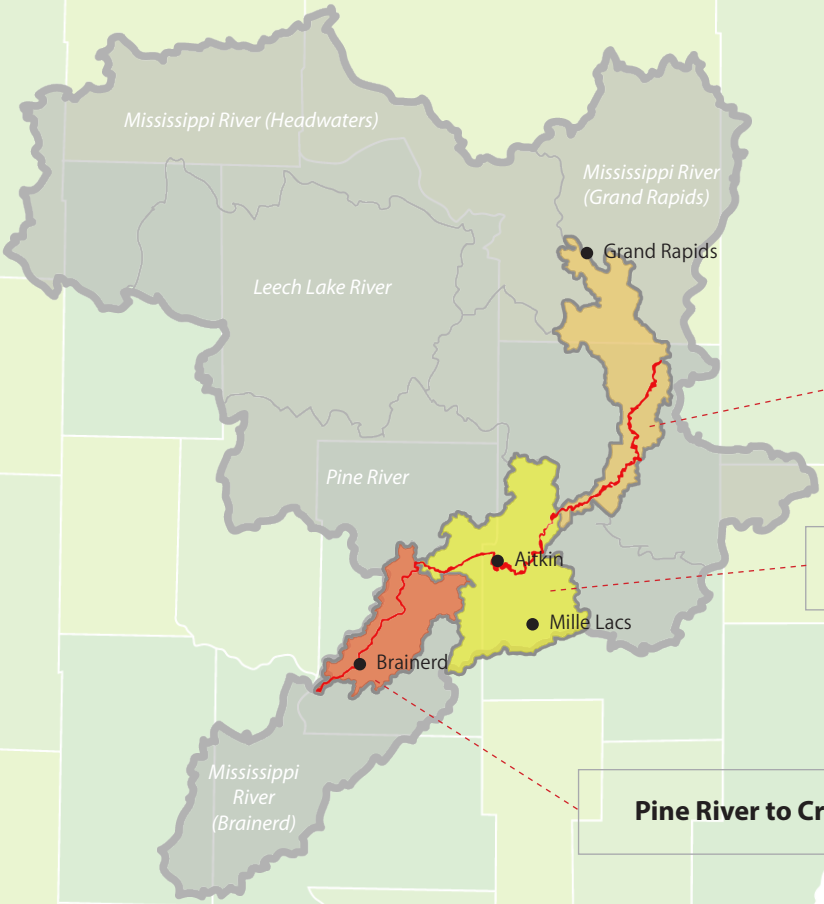
Upper Mississippi River TSS TMDL fact sheet

- **The report,** known as a total maximum daily load (TMDL), is specific to Total Suspended Solids (TSS) in three reaches of the Upper Mississippi River that are on Minnesota's 2018 list of impaired waters: from the Swan River to the Willow River; the Willow River to the Pine River; and the Pine River to the Crow Wing River.
- **Past monitoring efforts** identified TSS, or specifically sediment, impairments within these reaches of the river. This TMDL is a follow up study stemming from the Upper Mississippi River Monitoring and Assessment Report.
- **The dominant source of sediment** within this TMDL study area is nonpoint sources, in particular bed and bank erosion of the finely grained, easily erodible Glacial Lake Aitkin/Upham clay deposits. Past ditching in peatlands has resulted in a significant amount of altered watercourses in the study area.

Consequences of altered watercourses can include channel instability characterized by bank erosion and riverbed alteration, and increasing the amount of water in downstream reaches. Land use conversions near the river channel also contribute sediment through greater soil erosion from physical trampling of the banks from livestock, less stabilization of the soil from shallow rooted plants, more areas of exposed soil, and more concentrated runoff. Watershed runoff and regulated wastewater and stormwater sources contribute a small fraction of the total sediment to this part of the Upper Mississippi River.

This TMDL report will help guide local, state, and federal partnerships to develop and implement strategies to minimize sediment impairments, including:

- Land conservation through easements and acquisition.
- Working with landowners to exclude livestock from direct access to riverbanks.
- Riparian buffers and filter strips along riverbanks.
- Stormwater best management practices.



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ATTACHMENT C

Article: Corn Belt Farmland has Lost a Third of its Carbon-Rich Soil (2/15/2021)

(C-1 to C-2)

Corn belt farmland has lost a third of its carbon-rich soil

15 February 2021

Credit: CC0 Public Domain

More than one-third of the Corn Belt in the Midwest—nearly 100 million acres—has completely lost its carbon-rich topsoil, according to University of Massachusetts Amherst research that indicates the U.S. Department of Agricultural has significantly underestimated the true magnitude of farmland erosion.

In a paper published in the *Proceedings of the National Academy of Sciences,* researchers led by UMass Amherst graduate student Evan Thaler, along with professors Isaac Larsen and Qian Yu in the department of geosciences, developed a method using satellite imagery to map areas in agricultural fields in the Corn Belt of the Midwestern U.S. that have no remaining A-horizon soil. The A-horizon is the upper portion of the soil that is rich in organic matter, which is critical for plant growth because of its water and nutrient retention properties. The researchers then used high-resolution elevation data to extrapolate the satellite measurements across the Corn Belt and the true magnitude of erosion.

Productive agricultural soils are vital for producing food for a growing global population and for sustaining rural economies. However, degradation of soil quality by erosion reduces crop yields. Thaler and his colleagues estimate that erosion of the A-horizon has reduced corn and soybean yields by about 6%, leading to nearly $3 billion in annual economic losses for farmers across the Midwest.

The A-horizon has primarily been lost on hilltops and ridgelines, which indicates that tillage erosion—downslope movement of soil by repeated plowing—is a major driver of soil loss in the Midwest. Notably, tillage erosion is not included in national assessments of soil loss and the research highlights the urgent need to include tillage erosion in the soil erosion models that are used in the U.S. and to incentivize adoption of no-till farming methods.

Further, their research suggests erosion has removed nearly 1.5 petagrams of carbon from hillslopes. Restoration of organic carbon to the degraded soils by switching from intensive conventional agricultural practices to soil-regenerative practices, has potential to sequester carbon dioxide from the atmosphere while restoring soil productivity.

More information: Evan A. Thaler el al., "The extent of soil loss across the US Corn Belt," *PNAS* (2021). www.pnas.org/cgi/doi/10.1073/pnas.1922375118

Provided by University of Massachusetts Amherst

APA citation: Corn belt farmland has lost a third of its carbon-rich soil (2021, February 15) retrieved 18 May 2021 from https://phys.org/news/2021-02-corn-belt-farmland-lost-carbon-rich.html

ATTACHMENT D

Abstract: Managed Hydraulic Connectivity for Sediment and Nutrient Sequestration in the Upper Mississippi River Floodplains

(D-1)

Managed Hydraulic Connectivity for Sediment and Nutrient Sequestration in Upper Mississippi River Floodplains

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Upper Mississippi River (UMR) floodplains have a range of connectivity conditions and land use that greatly influence their sediment and nutrient sequestration capability. Undeveloped UMR watershed and floodplains provided effective natural filters but developed watersheds and floodplains do not deliver sufficient ecosystem services to provide clean water and abundant wildlife. Economic objectives have overridden ecosystem objectives through extensive watershed, floodplain, and river developments like upland drainage, floodplain levees and drainage, and navigation dams. Balance can be restored through managed floodplain connectivity in the form of ecosystem restoration, alternative crops, payment for flooding, and an UMR nutrient trading system.

UMRR HREPs provide several excellent examples of ecosystem restoration actions that manage connectivity to improve fish and wildlife habitat. LTRM, MNDNR, and WDNR have documented nutrient reduction potential to control algal blooms in specific sites, but nobody has extrapolated that potential for the entire UMR and Gulf of Mexico.

UMR leveed floodplains can also be considered through a wider lens of Integrated Water Resource Management (IWRM) to include sediment and nutrient sequestration services through minor modifications in water management and cropping and/or major alterations in floodplain connectivity. Incorporating hydroponic nutrient sequestration in wetlands and algal biomass systems within levee district infrastructure can grow new high value crops adjacent to traditional row crops. The biomass crops can drive value, but a UMR nutrient credit trading system could greatly enhance the value and provide capital requirements to initiate new ecosystem service markets.

Flood storage value can also be considered to optimize the use of floodplain infrastructure. Coordinated system-wide flood management based on IWRM principals could reduce risk, reduce damage, and increase value. The plan would allow for managed overtopping of levees based on the level of protection of their current design. Controlled spillways would reduce damage and a combination of crop insurance and payment for flooding and other ecosystem services could maintain revenue for landowners.

NESP provides two important foundations to enhance ecosystem service delivery. First, the entire plan was based on IWRM that integrates ecosystem and navigation system management. Second, it includes substantial authority and funding for floodplain management. Where land purchases and reconnecting floodplains were envisioned, the NESP could actually partner with levee districts to consider IWRM potential to increase ecosystem goods and services such as habitat provision, flood damage reduction, and water quality improvement.

ATTACHMENT E

USGS Next Generation Water Observing System

- **Program Overview Fact Sheet (8/2019)** *(E-1 to E-2)*
- **Illinois River Basin Fact Sheet** *(E-3 to E-4)*

USGS
science for a changing world

Water Priorities for the Nation—The U.S. Geological Survey Next Generation Water Observing System

The challenges of providing safe and sustainable water supplies for human and ecological uses and protecting lives and property during water emergencies are well recognized. The U.S. Geological Survey (USGS) plays an essential role in meeting these challenges through its observational networks and renowned water science and research activities (National Academies of Science, Engineering, and Medicine, 2018). Substantial advances in water science, together with emerging breakthroughs in technical and computational capabilities, have led the USGS to develop a **Next Generation Water Observing System (NGWOS)**. The NGWOS will provide real-time data on water quantity and quality in more affordable and rapid ways than previously possible, and in more locations. The data will be served through a modernized USGS National Water Information System that will be coupled to advanced modeling tools to inform daily water operations, decision-making during water emergencies (like floods, droughts, and contaminant spills), assessments of past trends in water quantity and quality, and forecasts of future water availability.

NGWOS Design Strategy

The USGS has a nearly 140-year history of providing reliable and relevant scientific information to decision makers. Today (2019), the USGS operates and maintains real-time, continuous monitoring networks nationwide consisting of more than 8,200 streamflow-gaging stations, 2,100 water-quality stations, 1,700 groundwater-level monitoring wells, and 1,000 precipitation stations. USGS hydrographers make tens of thousands of discrete water measurements each year. Requests for USGS data exceed 670 million annually. Yet, the current National Streamflow Network—although providing data at critical locations—covers less than 1 percent of the Nation's streams and rivers. This sampling density helps to inform current and past water conditions (see, for example, WaterWatch) but is not sufficient for predicting interactions between climate, surface water, groundwater and soil moisture across large watersheds.

It is not necessary or feasible to collect data at a high spatial density throughout all large watersheds and aquifers. A more practical approach is to develop intensive monitoring networks in a small number of medium-sized watersheds (10,000–20,000 square miles) and underlying aquifers that are representative of larger regions across the Nation. Data from these intensively monitored watersheds can then be used, alongside data from existing monitoring networks, to construct and reduce the uncertainty in advanced models to fill in data and knowledge gaps in regional and national water assessments and predictions. At present, it is anticipated that the NGWOS will include at least 10 intensively monitored medium-sized watersheds, selected with input from USGS stakeholders, to represent a wide range of environmental, hydrologic, and landscape settings across the Nation.

NGWOS monitoring networks will integrate fixed and mobile monitoring assets in the water, ground, and air, including innovative webcams and new ground- and space-based sensors. When fully implemented, the NGWOS will provide high temporal- and spatial-resolution data on (1) streamflow; (2) water-cycle components, including evapotranspiration, snowpack, and soil moisture; (3) a broad suite of water-quality constituents, including temperature, nutrients, salinity, and turbidity; (4) connections between groundwater and surface water; (5) stream velocity distribution; (6) sediment transport; and (7) water use.

Mapping river-water depth by using a drone-mounted ground-penetrating radar system (white equipment). Photograph by John Lane, U.S. Geological Survey.

Characteristics of a Next Generation Water Observing System

- State-of-the-art measurements
- Dense array of sensors at selected sites
- Increased spatial and temporal coverage
- New technology testing and implementation
- Improved operational efficiency
- Modernized and timely data storage and delivery

The USGS information systems for water-data management and delivery are being transformed and modernized as part of the NGWOS to accommodate new data and sensor networks, allow for integration with water data from multiple agencies and sectors, display observational data uncertainty, and enable data and analytical products to feed directly into models. Data telemetry systems also are being updated to allow for two-way communications and more frequent transmission of data to the internet.

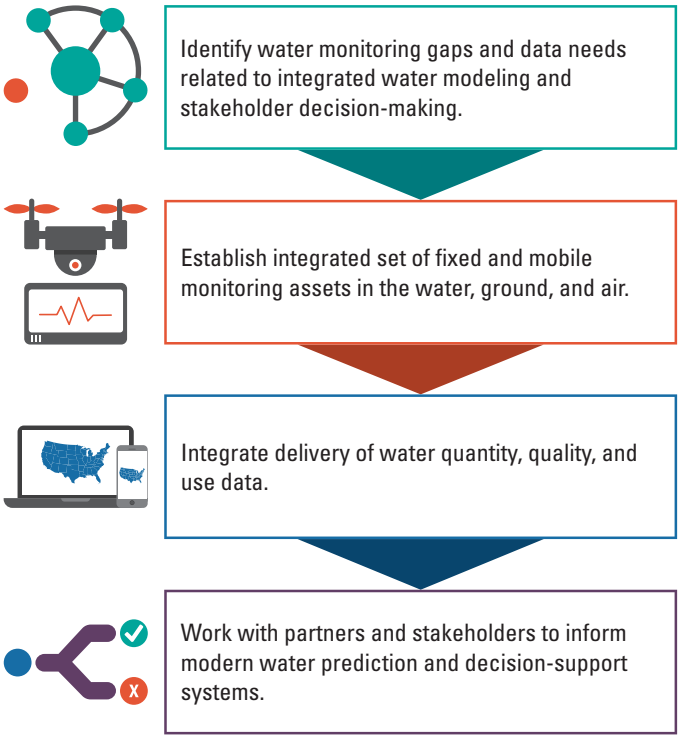
U.S. Department of the Interior
U.S. Geological Survey

Fact Sheet 2019–3046
August 2019

The USGS is advancing the use of large-scale particle-image velocimetry (LSPIV)—a method that uses innovative video analyzation techniques—to measure streamflow. Photograph by Mike Woodside, U.S. Geological Survey.

Emerging and Innovative Technologies

The NGWOS aims to foster innovation and development of monitoring technologies and methodologies to make data more affordable and more rapidly available. Monitoring innovations also are expected to lead to more types of data at higher temporal and spatial frequencies. Innovation testing sites will be identified on main-stem streams and small streams within NGWOS watersheds. These locations will provide a platform for rigorous, transparent, and reproducible testing of emerging and innovative monitoring technologies by the USGS and other entities. Technologies of interest include radar and image velocimetry for remotely sensing surface-water velocities, drone-mounted ground-penetrating radar for measuring bathymetry for improving flow estimates, new sensors for monitoring continuous water-quality and suspended sediment, and others. The application and benefits of these innovations will extend beyond the NGWOS watersheds and be incorporated into routine operation of USGS monitoring networks.



The USGS's NGWOS, when fully implemented, will provide real-time data on water quantity and quality. USGS partner and stakeholder needs are helping to inform the NGWOS design so that the data and information generated by the NGWOS will help them anticipate water shortages more accurately and react to water hazards more quickly.

Delaware River Basin Pilot

In 2018, the USGS began a pilot of the NGWOS in the Delaware River Basin. This pilot is providing an opportunity to demonstrate a water-observing system that will support innovative modern water prediction and decision-support systems in a nationally important, complex interstate river system. The following are some of the initial NGWOS activities in the Delaware River Basin:

- New streamgages addressing key monitoring gaps to better quantify the amount, temperature, and conductivity of water in headwater and tributary streams and to track the flux of salt water in the main stem of the Delaware River
- Webcams and drone-mounted sensors for operational and science applications
- Limited-scale soil moisture, snowpack, evapotranspiration, water-use, and groundwater/surface water interaction monitoring
- Enhanced two-way communication equipment at existing streamgages to enable remote operation and troubleshooting of monitoring equipment
- Cellular and satellite redundancy to ensure data are delivered during critical streamflow periods
- Innovation sites for testing a suite of new water-quality sensors and noncontact streamflow measurement technologies, and remote sensing of water quantity, quality, and use

Reference Cited

National Academies of Sciences, Engineering, and Medicine, 2018, Future water priorities for the Nation—Directions for the U.S. Geological Survey Water Mission Area: Washington, D.C., The National Academies Press, 96 p. [Also available at https://doi.org/10.17226/25134.]

For more information:

U.S. Geological Survey Water Resources Mission Area
Groundwater and Streamflow Information Program
https://www.usgs.gov/water-resources/groundwater-and-streamflow-information

Banner photograph by Jack Anstey, Unsplash, February 28, 2018.

By Sandra M. Eberts, Chad R. Wagner, and Michael D. Woodside

ISSN 2327-6932 (online)
https://doi.org/10.3133/fs20193046

Groundwater and Streamflow Information Program

Next Generation Water Observing System — the Illinois River Basin

Emergency managers and water resource managers rely on the USGS's water monitoring system and its associated water data delivery and instrument testing infrastructure to provide monitoring data to address complex water challenges involving too much, too little, or poor-quality water. Each year, floods, droughts, and water quality issues remind us of the vulnerability of our physical and socioeconomic well-being and the importance of monitoring our Nation's water. This monitoring system is currently functioning, but it was designed many decades ago to address 20th century challenges and needs major upgrades to meet the increasingly complex water challenges facing communities across the Nation. In fiscal year 2021, the USGS selected the Illinois River Basin as the third basin for implementing the Nation's next-generation integrated water observing system (NGWOS) to provide high-fidelity, real-time data on water quantity and quality necessary to support modern water prediction and decision support systems for water emergencies and daily water operations.

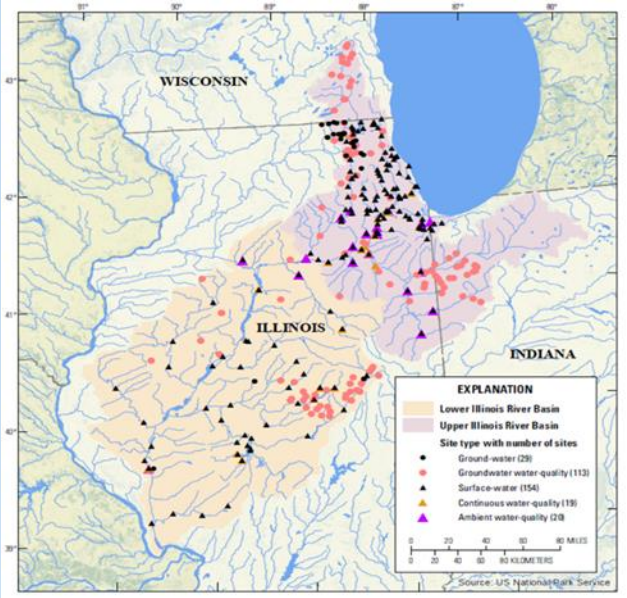
Substantial advances in water science, together with breakthroughs in technological and computational resources, have resulted in sophisticated new capabilities that can provide managers and decision support systems with the information, insights, and data needed to address today's water challenges. Modern models require high-density data describing the major hydrologic characteristics that the models represent, such as streamflow, evapotranspiration, water storage in snowpack, soil moisture, groundwater, and many others. However, these models and tools require more extensive observational data than the current hydrologic monitoring networks can provide.

When fully implemented, the USGS NGWOS will intensively monitor at least 10 medium-sized watersheds (10,000-20,000 square miles) and underlying aquifers that represent larger regions across the Nation. Data from this suite of watersheds will be used, alongside data from existing monitoring networks, to address data gaps that limit integrated water availability assessments and water prediction. This advanced observing system will provide quantitative information on streamflow, evapotranspiration, snowpack, soil moisture, a broad suite of water quality constituents (nutrients, salinity, turbidity, and wastewater indicators), connections between groundwater and surface water, and water use. It will be directly coupled with the National Water Model and other advanced modeling tools to provide state-of-the-art flood and drought forecasts, drive emergency and water-management decision support systems, and to provide data necessary to address difficult questions such as:

- What are the near-term and long-term risks of floods and droughts, and what scenarios change these risks?
- What factors affect water availability in basins that possess a complex mixture of urban and agricultural land use?
- How do nutrient loads influence harmful algal blooms (HABs)?
- What are the best ways to monitor for water supply contaminants such as perfluoroalkyl and polyfluoroalkyl substances (PFAS)?
- What are the best practices to inform federal state and local agencies about sediment loads in watersheds to facilitate planning of dredging operations that maintain navigable waters?

Next Generation Water Observing System in the Illinois River Basin

The USGS has selected the Illinois River Basin as its third NGWOS basin. This decision was based on rigorous quantitative ranking of US basins, input from USGS Regions and Science Centers, and feedback from targeted external stakeholders. Covering ~29,000 square miles that includes ~44% of Illinois and smaller parts of Wisconsin and Indiana, the Illinois River Basin ranked high among US basins because of its socioeconomic importance, ecological significance, and unique combination of mixed urban/rural land use. Principal economic drivers in the upper Illinois Basin are manufacturing/industry and a $7 billion sport fishing industry in the Great Lakes. The driver in the lower basin is agriculture (corn/soybean), with Illinois' agricultural commodities generating more than $19 billion annually. The Illinois River Basin likewise plays an important ecological role as the primary connection between the Great Lakes and the Mississippi River.



Long-term issues in the Illinois River Basin that could be informed by NGWOS include:

- **Nutrients** – The Illinois River Basin is one of the largest contributors of nitrogen and phosphorus loading to the Gulf of Mexico. While agricultural runoff from farms in the Illinois River Basin and other parts of the Mississippi River Basin is the main driver of the Gulf dead zone, urban wastewater discharges, such as those in the Illinois River Basin, are also a source of nitrogen and phosphorus delivered to the Gulf of Mexico.
- **Sediment** – Since the enactment of environmental regulations in the 1970s, water quality in the Illinois Waterway has steadily improved. However, erosion and sedimentation continue to degrade water quality in the basin and remain major issues. The US Army Corps of Engineers removes approximately 250,000 cubic yards of sediment from the Illinois Waterway each year for the operation and maintenance of the inland waterway navigation system which is essential to the economy of the Midwest and the Nation.
- **Harmful algal blooms (HABS)** – In Illinois, algal blooms typically occur during the warm-weather months of June through September. Blue-green algae are often present in Illinois lakes in small or moderate amounts, but can grow and proliferate quickly in warm, fresh water that is rich with nutrients. In recent years, extended periods of warm summer weather and a supply of nutrient-laden runoff have combined to produce an increasing number of reports of harmful algal blooms.
- **Water availability** – Water availability is an increasingly important issue within the Illinois River Basin. Population growth in northeastern Illinois and declining regional aquifer (Cambrian-Ordovician aquifer) levels and water quality (radium issues) have municipalities carefully planning water supplies for the future.
- **Urban flooding** – Development of improved water observing systems are needed to protect life and property during major flood events. Urban flooding causes a disproportionate amount of the total monetary damages related to flooding in the Illinois River Basin. New monitoring technology and deployments of relatively low cost and spatially dense arrays of sensors in urban watersheds are needed to further understand the causes and underpinnings of urban flooding as well as prepare for and respond to urban flooding.
- **Emerging contaminants** – The term “emerging contaminants” refers to many kinds of chemicals, including medicines, personal care or household cleaning products, lawn care, and agricultural products, among others. These chemicals enter our Nation's lakes and rivers and have a detrimental effect on fish and other aquatic species. The risk they pose to human health and the environment is not yet fully understood. Several cities within the Illinois River basin have reported perfluoroalkyl and polyfluoroalkyl substances (PFAS) detections within their municipal drinking water systems.

An integrated data-to-modeling approach in the Illinois River Basin will help improve regional water-availability assessments and water prediction in mixed urban/agricultural landscapes in the midwestern US and beyond. Planning and stakeholder engagement for the NGWOS in the Illinois River Basin will begin in fiscal year 2021.

For Additional Information:

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NGWOS Program Manager (acting)—Brian Pellerin, bpeller@usgs.gov
Groundwater and Streamflow Information Program Coordinator—Chad Wagner, cwagner@usgs.gov

Next Generation Water Observing System https://www.usgs.gov/NextGenWOS

ATTACHMENT F

USGS Press Release: Drought May Lead to Elevated Levels of Naturally Occurring Arsenic in Private Domestic Wells (5/12/2021)

(F-1 to F-4)

USGS
science for a changing world

Drought May Lead to Elevated Levels of Naturally Occurring Arsenic in Private Domestic Wells

Release Date: MARCH 18, 2021

An estimated 4.1 million people in the lower 48 states are potentially exposed to arsenic levels that exceed EPA's drinking water standards

A new U.S. Geological Survey study highlights the importance of homeowners testing their well water to ensure it is safe for consumption, particularly in drought-prone areas. The first-of-its-kind national-scale study of private well water, conducted in collaboration with the Centers for Disease Control and Prevention, showed that drought may lead to elevated levels of naturally occurring arsenic and that the longer a drought lasts, the higher the probability of arsenic concentrations exceeding U.S. Environmental Protection Agency's standard for drinking water.

Researchers estimate that during drought conditions, 4.1 million people in the lower 48 states who use private domestic wells are potentially exposed to unsafe levels of arsenic. This is an increase of 54% from the estimated 2.7 million people exposed to unhealthy arsenic levels in private wells during normal, non-drought conditions.

Jacks Pond in Hancock, New Hampshire. Groundwater from this area supplies nearby private wells. (Credit: Melissa Lombard, USGS. Public domain.)

Arsenic is a metal that can occur naturally in bedrock and sediments around the world and is commonly reported in drinking-water supply wells. However, chronic exposure to arsenic from drinking water is associated with an increased risk of several types of cancers, including bladder, lung, prostate and skin cancers. Other adverse effects include developmental impairments, cardiovascular disease, adverse birth outcomes and impacts on the immune and endocrine systems.

Contacts

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The study's findings can help public health officials and emergency managers notify well owners in areas potentially affected and further refine their strategies for addressing the issue. The EPA regulates public water supplies, but maintenance, testing and treatment of private water supplies are the responsibility of the homeowner. Private well owners can work with their local and state officials to determine the best way to test and, if necessary, treat their water supply.

"The population potentially exposed to arsenic levels exceeding the EPA standard during simulated drought conditions amounts to roughly one-tenth of the estimated 37.2 to 43.2 million people in the conterminous U.S. who use domestic wells for household water supply," said Melissa Lombard, a USGS hydrologist and lead author of this study.

This is the first national-scale study to assess the potential impact of drought on arsenic levels in private domestic wells. It is also the first to estimate the population of private well users who are potentially exposed during droughts to arsenic levels above EPA's limits, which are intended to protect human health.

The study also estimated that 2.7 million people are exposed to elevated arsenic levels above EPA standards under normal conditions. This is an increase from a 2017 study by the USGS and CDC that estimated 2.1 million people were exposed to elevated arsenic levels. The increase reflects new estimates of well locations and the population reliant on private wells.

The new study, which did not examine private domestic wells in Alaska or Hawaii, includes maps showing where simulated drought conditions are likely to increase the probability of high arsenic levels and the number of people potentially exposed.

The states with the largest populations facing elevated arsenic levels in private domestic well water during the simulated drought conditions are Ohio (approximately 374,000 people), Michigan (320,000 people), Indiana (267,000 people), Texas (200,000 people) and California (196,000 people).

Even without drought conditions, relatively large numbers of people are estimated to be exposed to elevated arsenic levels in private domestic well water. Under normal conditions, the largest populations potentially exposed to high levels of arsenic are in Ohio (approximately 241,000 people), Michigan (226,000 people), Indiana (162,000 people), California (157,000 people) and Maine (121,000 people).

This study is the first to explore the potential large-scale impact of drought on naturally occurring arsenic in private drinking water wells," said Lombard. "While the results suggest that drought will have a negative impact, the study cannot predict what might happen at an individual well, further highlighting the importance of testing."

The occurrence of arsenic in groundwater is due to a variety of complex interactions, added Lombard. The reasons for the increase in arsenic during drought and as drought persists could vary depending on changes to groundwater flow, alterations in water chemistry and other factors.

Further exacerbating these challenges, climate models predict increasing temperatures and decreasing precipitation in portions of North America during the 21st century. USGS findings suggest that as the duration of drought increases, the probability of arsenic concentrations greater than EPA's drinking water standard will also increase.

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This study used an existing USGS statistical model that predicts the probability for elevated arsenic concentrations in domestic well water. In the new research, scientists used the model to simulate drought conditions by changing precipitation and groundwater levels. The researchers also used data from the drought of 2012, one of the worst on record in the U.S., to investigate how drought duration can impact arsenic levels.

Read the study “Assessing the Impact of Drought on Arsenic Exposure from Private Domestic Wells in the Conterminous United States” published in *Environmental Science and Technology* at https://pubs.acs.org/doi/full/10.1021/acs.est.9b05835.

View from Hedgehog Hill in Deering, New Hampshire. Groundwater from this area supplies nearby private wells. (Credit: Melissa Lombard, USGS. Public domain.)

View from Thumb Mountain in Hancock, New Hampshire. Groundwater from this area supplies nearby private wells. (Credit: Melissa Lombard, USGS. Public domain.)