

The Ohio Water Table

A Publication of the Water Management Association of Ohio

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Near Real-Time Recreational Water-Quality Predictions for the Cuyahoga River

Amie M.G. Brady, U.S. Geological Survey, Ohio Water Science Center

The Cuyahoga Valley National Park (CVNP) encompasses 33,000 acres along the Cuyahoga River between Cleveland and Akron, Ohio. Over 2.8 million people visit CVNP annually to enjoy the Park's historical, cultural, natural, and recreational activities all in one setting. Because of elevated concentrations of *Escherichia coli* (*E. coli*), a fecal indicator bacterium, the Cuyahoga River within the Park does not often meet the Ohio water quality standard (WQS) for primary contact recreational use. Sections of the river, including the 22 miles that flow through the Park, have been designated by the U.S. Environmental Protection Agency as one of the Great Lakes Areas of Concern because of beneficial-use impairments, including impairments caused by bacterial contamination.

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Cuyahoga Valley National Park

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Geothermal Heating and Cooling - The Role of Groundwater

R.A. Sheets and E.R. Burns, U.S. Geological Survey

The geothermal storage capacity of the earth often is utilized for the generation of electricity and heating and cooling of homes, businesses, and other manmade structures. Geothermal energy can be subdivided into two main categories—low grade and high grade. While high grade geothermal-source electricity is currently only economical under a limited set of conditions (for example Figure 3 of

[Williams and others \(2008\)](#)), low grade or shallow, geothermal heating and cooling is viable in most US locations. At a few tens of meters below land surface, the shallow subsurface temperature is typically near the average annual air temperature; below this depth, temperatures commonly increase with increasing depth at a rate of about 2.5 °C per 100 meters (for continental crust worldwide, Duffield and Sass (2003)). These characteristics allow the subsurface to be a heat sink during warm summer months and a heat source during cold winter months.

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Points of Interest:

- November 18th & 19th - WMAO 2014 Conference.
- Captina Conservancy protects over 1,000 acres.
- Recommendations made to reduce phosphorus loading and protect against Harmful Algal Blooms.
- A coal-washing chemical leaked into the Elk River near Cincinnati, January 9, 2014.

President's Column



Boris E. Slogar, P.E.

I just read an interesting article online projecting that by 2210 the world's population will be 11.3 billion. It went on to state that 87% of the population will be living in urban areas and this will require existing cities to expand 6-fold in size. A mention was also made regarding the expected adverse impact this population may have upon air and water in the form of pollution. I couldn't help but think of

the impact this would have on water resources – not just from a pollution stand point, but in terms of managing a finite supply. I find it mind-numbing when thinking about the challenges of dealing with our aging infrastructure. I can't imagine the level of effort required to expand infrastructure to meet the needs of the future.

I'm reminded of images I have seen of Lake Mead behind Hoover Dam showing a significant loss of storage in that massive reservoir. I can't help but wonder if the decades-long migration from the water-rich "rust belt" southward and westward will slow and perhaps even reverse itself. We spend millions around here to deal with excess water in the form of flood control projects. What a different world it is down south and out west.

I can't help but to acknowledge and appreciate the great work many of our WMAO members have done with regards to protecting our water resources through efforts with the Great Lakes Compact and through preliminary discussions aimed at protecting the Ohio River Basin's water resources - just to name a few. Over the years, WMAO has provided numerous forums through our annual conference, division conferences, water luncheon seminars, and other collaborative events to learn more about these efforts and to encourage an open discussion and exchange of ideas. Attention-grabbing headlines and banners are one thing, working towards solving these problems is entirely another...and this is what we do. How cool is that?

Looking towards the future makes me think about the next generation of water resource professionals and how imperative it is that we double our efforts in getting students engaged in our profession. I sure tried to get both of my teenage daughters to embrace engineering, but unfortunately, having two parents as engineers has somehow - beyond my comprehension - completely shut the door to this career path. I have no idea where my wife and I went wrong...but for the rest of the youth out there, there is hope! If you know of a college student in a water resource related profession, encourage them to apply for our WMAO scholarship – just send them to our website at <http://wmao.org/wmao-scholarship/> for details or have them contact any board member.

"Ralph Haefner, long-time WMAO board member and USGS employee, has accepted a new position as Deputy Director of the USGS Michigan Water Science Center...."

In wrapping up, a long-time water resource professional that has spent many years serving WMAO (he's a water buffalo), is leaving our herd and heading north. Ralph Haefner, long-time WMAO board member and USGS employee has accepted a new position as Deputy Director of the USGS Michigan Water Science Center in Lansing, Michigan. Though he will occasionally have to travel through that successfully-challenged region known as Ann Arbor, we wish him the best in serving the rest of that great state to the north and thank him for his many years of service – not to mention his penchant for reminding us that groundwater does in fact exist. Thanks Ralph...and congrats and good luck in your new position!

WMAO Conference Theme Contest

Alex Covert, Chair, WMAO Conference Planning Committee

The Water Management Association of Ohio would like to thank all of the people who contributed an idea towards the WMAO Conference Theme Contest! We received 30 submissions that sparked a lengthy and interesting discussion about WMAO's 2014 Conference theme. In the

end, however, we did not pick a specific theme submission but, instead, combined a few ideas to come up with: **VALUING WATER: Exploring the interactions between people, markets, and water.** Thank you for your interest and participation in the Water Management Association of Ohio! We'll see you in November.

Save the Date!

WMAO 43rd Annual Meeting and Symposium

VALUING WATER: Exploring the interactions between people, markets, and water

November 18 & 19, 2014

Doubletree Hotel - Columbus Worthington,
175 Hurchinson Ave., Columbus, OH 43235

Near Real-Time Recreational Water-Quality Prediction for the Cuyahoga River

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In response to these concerns, the U.S. Geological Survey and the National Park Service have collaborated to develop a method to provide more timely results to Park visitors regarding the condition of the recreational water quality of the river.

“...provide more timely results to Park visitors regarding the condition of the recreational water quality of the (Cuyahoga) River.”

Traditional methods for determining the concentration of *E. coli* in a water sample take at least 18 hours until results are available.

Therefore, the results from the previous day's

sample are often used to determine the recreational water quality for the current day. In previous research at CVNP, a predictive model, using turbidity as measured in the lab for samples collected in the field and rainfall from a local NOAA weather station, was used to accurately predict water-quality conditions (in terms of exceedances or non-exceedances of the WQS) at one site on the river for over 80 percent of the samples collected. The traditional method of using the previous day's bacteria concentration consistently was not as accurate as the predictive model.

To decrease demand on staff time for field data collection, an in-stream turbidity sensor (with telemetry) was installed in May 2012. Data were collected during 2012 to calibrate the predictive model to the measurements from the in-stream turbidity sensor (in comparison to the turbidity

measurements made in the lab during previous research). Computer scripts were developed to automatically retrieve the appropriate data, calculate the predicted *E. coli* concentration, and post the results to Ohio Nowcast, a publicly accessible website (<http://www.OhioNowcast.info>). This automated approach was created to consistently post the results to the website each day prior to 9 a.m. During 2013, the Ohio Nowcast Web site was actively used from May through October, and 139 daily model predictions were posted to provide Park visitors with information to assess recreational water-quality risks. On 37 of these days, samples were taken to check nowcast results. The nowcast was able to provide more correct responses than the use of the traditional method – 89.1 percent compared to 77.8 percent. Additional statistics that measure how often the methods correctly predicted exceedances (sensitivity) and non-exceedances (specificity) of the RWQ were also higher for the predictive model as compared to the traditional method.

Signage at Park trailheads along the river have been used to raise public awareness of water-quality issues and referenced the Ohio Nowcast website. During 2013, there were more than 3,300 site visits to the Cuyahoga River web page during the period of time the website was in active use. Because the Ohio Nowcast website is not specific to the Cuyahoga River, visits to the home page were not tallied. Therefore, this count demonstrates the number of visitors interested in more detailed information on the water quality of the river and may be an under estimate of the actual use of the website for this purpose.

Continued monitoring of the Cuyahoga River is planned for 2014. The Ohio Nowcast website will be used to provide the public with daily, near-real-time information about the water quality in the river.

Geothermal Heating and Cooling - The Role of Groundwater

Continued from Page 1

In the past couple of decades, shallow geothermal energy has become a very popular and ubiquitous alternative energy solution across the world. Shallow geothermal energy is usually accessed by boreholes drilled vertically into the ground, but can be accessed horizontally from shallow (<2 m) ditches or ponds/lakes. There are several types of systems used to access the shallow geothermal energy, some of which are designed to store or remove heat energy in the ground for future use as a heat source or sink, and some use natural thermal conditions as the heat source/sink, depending upon the needs for heating and cooling.

By far, the most popular method to access shallow geothermal energy is by use of artificial circulation of fluids using a borehole heat exchanger (BHE) system. These systems utilize closed-circuit (or 'closed-loop') piping that contains a carrier fluid (a solution of anti-freeze). The piping is usually placed in multiple boreholes that typically are backfilled with grout to isolate the piping containing the antifreeze solution from potable groundwater supplies and to improve thermal contact and efficient heat exchange. The carrier fluid is circulated by a pump to exchange heat between the subsurface and the heat exchanger that is used to heat or cool the manmade structure. In Ohio and similar latitudes, these systems typically alternate between heating and cooling resulting in the alternating cooling and heating of the earth materials in which the wells are placed. In the summer, heat goes into the ground and in the winter, heat comes out of the ground. With balanced thermal loading, as much heat enters the ground as comes out.

To account for unequal thermal loads over time, a measure of cumulative heat load (heating degree days) is used. In central Ohio, there are about twice as many heating degree days as there are cooling degree days which would seem to indicate that the energy load would be unbalanced toward cooling the subsurface. However, the thermal load is not balanced between these two periods, with summer thermal loads being comparatively larger than winter thermal loads. For example, in the summer, the ambient subsurface temperature may be 13 °C, while the summertime temperature of the carrier fluid when it leaves the building (leaving water temperature (LWT)) is close to 30 °C, a difference of 17 °C. In the winter, the LWT is around 5 °C, a difference of just 8 °C. Heating degree days can also vary depending on the purpose of the structure being heated/cooled. For example, large institutional geothermal systems where occupancy is high or that contain a significant amount of heat generating equipment (e.g., computers) will require less heating in the winter and more cooling in the summer,

becoming a larger heat source for the subsurface. Institutional geothermal well fields at Ball State University (Indiana) and Stockton University (New Jersey) have documented thermal buildup of about 1 °C increase/year (Epstein and Sowers, 2006; Dunn, 2013). This thermal buildup can reduce system efficiency over time.

A primary control on heat removal in the subsurface is groundwater flow (advective heat transport). If the flow of groundwater is negligible, then the subsurface system is heat-conduction dominated, and the amount of heat stored and removed depends only on the rate at which heat conducts through the geologic media. For systems located where there is a large amount of groundwater flow, heat removal via conduction can be negligibly small because heat is rapidly carried away with the groundwater. However, many natural systems will remove heat with a combination of advection and conduction. Groundwater flow can improve geothermal heating/cooling system efficiency, but thermal loads carried with groundwater can have unintended consequences.

So what does this mean and who should care? Three things come to mind – 1.) The long-term efficacy of geothermal systems realistically depends on balanced systems where similar amount of heating and cooling of the earth materials occur or where systems can be balanced by forced cooling in the winter or heating in the summer, so that the efficiency of the system remains about the same over time. If not, engineering measures have to be taken later to maintain the same levels of efficiency, which relates to long-term cost of operation of the geothermal well fields; 2.) Because groundwater flow can carry the thermal plume created by the geothermal field down gradient, wells in the system that are downgradient can be less efficient than upgradient wells. Since groundwater flow is not usually accounted for in the design, later engineering measures to ameliorate this issue can also be costly, and 3.) The nearby receptors of groundwater (for example, streams, ponds, withdrawal wells, other geothermal systems) can be adversely affected by increases (or decreases) in temperature. For relatively short groundwater travel times to streams, geothermal heating/cooling systems could make summer baseflow to these streams warmer and, in some areas, winter baseflow cooler. More generally, the advective heat-transport travel time will lag the thermal loading. Some biota living in potential receptor surface-water bodies are particularly sensitive to temperature at different life stages. Groundwater biota may also be affected by the increases in temperature as some studies suggest (York et al., 1998).

Groundwater pumping wells and geothermal wells both affect the subsurface. When a new large-scale groundwater pumping system is installed, typically monitoring wells are installed to monitor the short- and long-term impacts of pumping. But this is not generally the case for geothermal well fields and there is a need for long-term monitoring of heat (and groundwater) flow. The USGS, in collaboration with geologists at Antioch College at Yellow Springs Ohio, have developed a

groundwater and heat-flow model which has helped design placement of monitoring systems at the site and the hope is to monitor this system so that we can calibrate the model and better predict the possible impact on downgradient receptors and help better design operation of the system. Because the factors that affect groundwater and heat flow vary widely with hydrogeology, monitoring at a wide variety of sites is needed to help this research.

Geothermal References

For a description of geothermal systems and for guidance and recommendations to ensure geothermal system installation protects Ohio's water resources, see a recent publication by the Ohio Water Resources Council/State Coordinating Committee on Ground Water (2012):

Duffield, W.A., and Sass, J.H., 2003, Geothermal energy—clean power from the Earth's heat, U.S. Geological Survey Circular 1249, 36 p. <http://pubs.usgs.gov/circ/2004/c1249/>

Dunn, M.A., 2013, Effects of ground-coupled heat pumps on hydrogeologic systems, Ball State University: Master Thesis http://cardinalscholar.bsu.edu/bitstream/123456789/197422/1/DunnM_2013-3_BODY.pdf -- accessed 1/22/2014/

Epstein, C., Skinner, W., Stiles, L., Taylor, H., Sowers, L., and Pal, S. 1996. "Geothermal Heating on a Very Large Scale: the Stockton College Facility." *Well Water Journal*, 9: 38-41.

Epstein, C. and Sowers, L., 2006. "The Continued Warming of the Stockton Geothermal Well Field." Proceedings of Ecstock 2006, the 10th International Conference on Thermal Energy storage. The Richard Stockton College of New Jersey. http://talon.stockton.edu/evos/energy_studies/content/docs/FINAL_PAPERS/4A-6.pdf -- accessed 1/22/2014

Ohio Water Resources Council/State Coordinating Committee on Ground Water, 2012, Recommendations for Geothermal Heating and Cooling Systems--Guidance for Protecting Ohio's Water Resources. State of Ohio, February 2012. <http://wwwapp.epa.ohio.gov/ddagw/SCCGW/Documents/GHCS.pdf>.

Williams, Colin F., Reed, Marshall J., Mariner, Robert H., DeAngelo, Jacob, Galanis, S. Peter, Jr., 2008, Assessment of moderate- and high-temperature geothermal resources of the United States: U.S. Geological Survey Fact Sheet 2008-3082, 4 p. <http://pubs.usgs.gov/fs/2008/3082/>

River Rat Revelry on the Cuyahoga River

Friends of the Crooked River will hold its annual River Rat Revelry on Thursday April 10, 6:30 – 9:00 PM, at Lion's Lodge, 641 Silver Lake Ave., Cuyahoga Falls.

The program, , *Tales of the Trail: A 2014 River Odyssey , Progress and Challenges in Developing the Cuyahoga River Water Trail* will feature presentations by Andrew Lepp, PhD, Kent State University who will report on *Perceptions of Cuyahoga River Paddlers*. by Ed Stewart, Director Parks & Recreation, City of Cuyahoga Falls, who will discuss *The Dams are Down; What's Next in the Falls* and by John Cardwell, Sr. Landscape Architect, Cleveland Metroparks, who will talk about *Rivergate Park and Public Access in the Navigation Channel*. Also, attendees will hear updates on other Cuyahoga River news, including the City of Akron's Long Term Control Plan for their combined sewers, plans for dams in the Gorge and in Brecksville and progress on the Cuyahoga River Water Trail.

Program will start at 7:00 PM.

Light refreshments will be served. Music by **RiverFall**. Public welcome.

For more information contact 330-666-4026 or ohgreenway@gmail.com



A Water Luncheon Seminar



Presented by:
The Water Management Association of Ohio
and
The Ohio Water Resources Center

April 16, 2014; 11:30 a.m. - 1:00 p.m.

Wilma H. Schiermeier Olentangy River Wetland Research Park,
The Heffner Building, 352 Dodridge St. Columbus, OH 43202



Assessing the Impact of Increased Climate Variability and Land Use Change on the Water and Nutrient Budget of the Upper Walnut Creek: Downscaling Climate Models to Drive Watershed Models

Gaj Sivandran, Assistant Professor, Civil, Environmental and Geodetic Engineering, The Ohio State University; <http://ecohydrology.wordpress.com/>

Non-point source pollution causes millions of dollars each year in impairment to surface waters in the United States, the largest contributing source being from agricultural runoff. Due to the complex coupled process interactions within the biogeochemical and hydrologic cycles, the spatial and temporal extent of non-point source pollution can be difficult to assess and quantify. With predicted changes in climate variability and land use change, numerical models of these watersheds offer a framework through which the impact of these changes can be quantified and managed. The Soil Water Assessment Tool model was calibrated and validated for the Upper Big Walnut Creek watershed, which serves as the primary drinking water source for 600,000 Columbus residents, to assess the effects of climate and land use change. Climate change scenarios from the Fifth Assessment Report from the Intergovernmental Panel on Climate Change were downscaled to drive the SWAT model to evaluate the potential changes to the water and nutrient budgets within the watershed.

Please register by April 9, 2014. Late or on-site registrations cost \$5 extra and are not guaranteed a meal. For registered engineers who need Professional Development Hours (PDHs), this presentation offers 1 PDH.

WMAO Member (\$10) Nonmember (\$15) Student (\$7) Special meal? _____

Name _____

Organization _____

Address _____

City _____ State _____ Zip _____

Phone _____ Email _____

Please send form and check to: WMAO-Luncheon, 8440 E. Washington St. #206, Chagrin Falls OH 44023.

OR, register online with a credit card at: www.wmao.org

Proceeds from the luncheon benefit the continued operation of WMAO and our scholarships. Sponsorship opportunities are available for those interested in providing extra support. More information on sponsorship is available at www.wmao.org.

BioBlitz to Celebrate the Largest Natural Area Conservation Easement in Ohio History

Join the Captina Conservancy for a BioBlitz of over 1,000 acres at Raven Rocks, in the Captina Creek Watershed! A BioBlitz is an intense period of biological surveying to record an inventory of plants and animals inhabiting an area. Professional biologists will be surveying the Raven Rocks property on May 8th and 9th. The public is invited to join us on Saturday, May 10th between 10:00 AM – 4:00 PM to explore the flora and fauna of Raven Rocks and see what the biologists have found. Be sure to bring your camera and a picnic lunch. Share your best photo on the Friends of Captina Creek Facebook page and your photo may be featured in the next Captina Conservancy newsletter!

Raven Rocks is located in Belmont County's Wayne Township, within Ohio's Appalachian Plateau. The property is a magnificent area with natural, historical and archeological significance. The series of ravines, sandstone cliffs, extensive rock overhangs, and miniature waterfalls is unusual in the eastern Ohio hills. Raven Rocks has been recently placed into a conservation easement with the support of the Clean Ohio Fund, making it the largest natural area conservation easement in Ohio history. Participants of the BioBlitz should come to the parking lot at Raven Rocks, located at 54061 Crum Road (Wayne Twp. Rd.

804), Beallsville, Ohio 43716. Coordinates for this location are 39° 52' 40.57"N and 81° 02' 19.12" W (39.87794; -81.03865).

The Captina Conservancy is a nonprofit land trust that was created in 2010 with a startup grant from the Columbus Zoo and Aquarium's Conservation Fund. The Conservancy works to conserve natural and agricultural lands in Belmont County, Ohio by undertaking or assisting in land or conservation easement acquisition and through the stewardship of such land and/or easements. For questions or to learn more about the Captina Conservancy, please visit www.captina.org.



Raven Rocks, Captina Creek Watershed, Wayne Township.

Members of the press who would like to cover this event, or those with additional questions about the BioBlitz, should contact Ron Preston, the BioBlitz Coordinator, at 740-425-1889. We hope to see you at Raven Rocks!

OFMA Award Nominees and Local Floodplain Manager Scholarship Candidates Welcome!

An exciting part of each year's annual conference is the Ohio Floodplain Management Association presentation of awards. **OFMA counts on the membership for nominations of deserving peers, communities and projects.** The awards program was initiated in 2000 with the first statewide floodplain management conference. The categories are: Floodplain Administrator of the Year; Innovation in Floodplain Management; Peter G. Finke – Most Valuable Contribution to Floodplain Management; and Distinguished Member Service. The nominees and brief supporting information are reviewed by the OFMA Awards and Scholarship Committee and the awards are presented at the conference.

The **Floodplain Administrator of the Year** is designed to honor an individual who is a role model and inspiration because of their contributions to an outstanding local program for comprehensive floodplain management.

The **Innovation in Floodplain Management** is awarded to those demonstrating creative approaches for achieving flood loss reduction, stewardship of floodplain resources and functions, resiliency in the face of disasters in their communities or the state.

The **Most Valuable Contribution to Floodplain Management** is a tribute to Peter G. Finke for his distinguished service and leadership in the formation of Ohio's Floodplain Management Program. It is considered for those who have extensive service (over the course of a career) and have improved the quality of life for all Ohioans through better water resource management. Consideration may be given to individuals working in floodplain management, stormwater management, coastal management or the natural benefit and function of floodplains.

OFMA is relying on you to please nominate deserving candidates! Nomination is a fairly simple process. Basic information about the nominees merit and accomplishments, their contact information, and your relationship/perspective (concerning the nominee's worthiness) are generally what is needed. Brief supporting material is acceptable and will help the Committee to select if there are multiple nominees for an award.

In addition to recognizing deserving peers, the Ohio Floodplain Management Association (OFMA) is focused on providing local floodplain managers with knowledge and skills to do their jobs

and in promoting professional growth. For over a decade, OFMA has been an active partner in the annual statewide floodplain management conference. The conference is primary to delivery of training, education and networking opportunities.

OFMA's Managing Board has approved the granting of scholarships for attendance at the annual conference to ensure that local floodplain managers have a chance to develop and grow their professional expertise. Four (4) scholarships may be earmarked for the recipients of the OFMA awards; however, most years there are **6 to 8 scholarships available for community floodplain managers**.

Scholarships cover the cost of registration and may include one night's lodging for floodplain managers who work and live in communities located outside of Franklin and the contiguous counties. Scholarships will not be awarded to Federal or state agency representative or a private sector consultant. Repeat scholarship applicants will have a lower priority in selection than first time (applicant or community) applicants.

Requests for a scholarship must be submitted on the local government letterhead, and specifically address what service the recipient is willing to provide (supported by their community) in exchange for the financial assistance to attend the annual conference. Scholarship recipients must agree to at least one of the following service commitments:

- *Host a local floodplain management workshop or training event (within one year of scholarship award) that includes securing a facility, inviting attendees, and coordinating the agenda with OFMA and ODNR;

- *Actively participate on the annual conference planning committee for the year following the award of a scholarship (may involve 2-3 one-day coordination meetings in Columbus, Ohio);
- *Serve the organization in a position of leadership (committee lead, officer, special project support) for at least one term or completion of a project.

Your request for scholarship consideration should be on your local government letterhead and may be submitted now through the conference deadline (see next paragraph). Scholarship recipients will be notified in writing and provided with a Scholarship Contract (available for review on the OFMA web site) at www.ofma.org. ODNR will coordinate the payment of conference registration upon receipt of a signed (OFMA President, recipient and recipient's supervisor) Scholarship Contract.

Your award nominees can be submitted now through the conference deadline. The nomination form and information on where to submit are available from the OFMA web site at www.ofma.org. **Nomination and scholarship request DEADLINE for this year's conference is July 31, 2014!** Please submit information and direct any questions or suggestions to:

Cindy Crecelius,
OFMA Awards and Scholarship Committee Lead
179 Baranof East
Westerville, Ohio 43081
Phone: (614) 891-1595
ccconsults.cic@gmail.com

THANK YOU for your time and consideration of the deserving individuals, agencies, organizations and programs working to achieve the best practical water resource management across Ohio.

The International Joint Commission Releases Lake Erie Report

Larry Antosch, Ohio Farm Bureau Federation

In late February 2014, the International Joint Commission (IJC) released a 100 page report titled "A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms". The report is the product of a bi-national cooperative effort of dozens of scientists, engineers, planners and technical experts. It provides scientific and policy advice to United States and Canadian governments as they move to implement plans in response to the emerging Lake Erie water quality challenges – particularly harmful algal blooms.

Over the past decade, Lake Erie water quality has declined, impacting ecosystem health, drinking water supplies, fisheries, recreation, tourism and property values. To positively impact Lake Erie water quality, the IJC made 16 specific recommendations to assist

governments in setting phosphorus reduction targets, reducing phosphorus loads from both agricultural and urban sources, and strengthening monitoring and research.

Phosphorus Reduction Targets

Current knowledge is sufficient to justify implementing immediate efforts to reduce the external loading of nutrients to Lake Erie. In particular, dissolved reactive phosphorus (DRP) was identified as the primary constituent of concern with the Maumee River watershed targeted as the highest priority for remedial action. A 37 percent reduction in the spring-time (March-June) DRP load was recommended (as compared to the 2007-2012 average). It was also recommended that Ohio and Michigan formally place western Lake Erie on an impaired waters list, triggering a phosphorus based Total Maximum Daily Load (TMDL) plan for the western Lake Erie Basin that

would include Indiana and be overseen by the U.S. Environmental Protection Agency. In addition, a plan incorporating regulatory and non-regulatory measures to reduce loadings from Ontario watersheds was also recommended.

Agricultural Sources

Monitoring data indicate that nonpoint sources are a major contributor of the phosphorus loadings to Lake Erie. Due to the major land use in the basin, initial attention is directed to agricultural operations. It is recommended that governments throughout the watershed focus current agricultural management programs to explicitly address DRP. Emphasis on management practices that address the rate, time, placement and form of phosphorus applied to fields, and reducing runoff from those fields will most likely reduce off site DRP transport. The nutrient management initiatives should focus on reducing the load delivered during the spring and on priority sub-watersheds that are delivering the most phosphorus to the lake. Additional recommendations address expansion of the scale and intensity of programs that have been shown to reduce nutrient runoff, while strengthening and increasing the use of regulatory mechanisms including linking crop insurance with conservation performance. The IJC also recommended that Ontario, Michigan, New York, Ohio, Pennsylvania and Indiana ban the application of manure, biosolids and commercial fertilizer containing phosphorus on frozen ground or ground covered by snow.

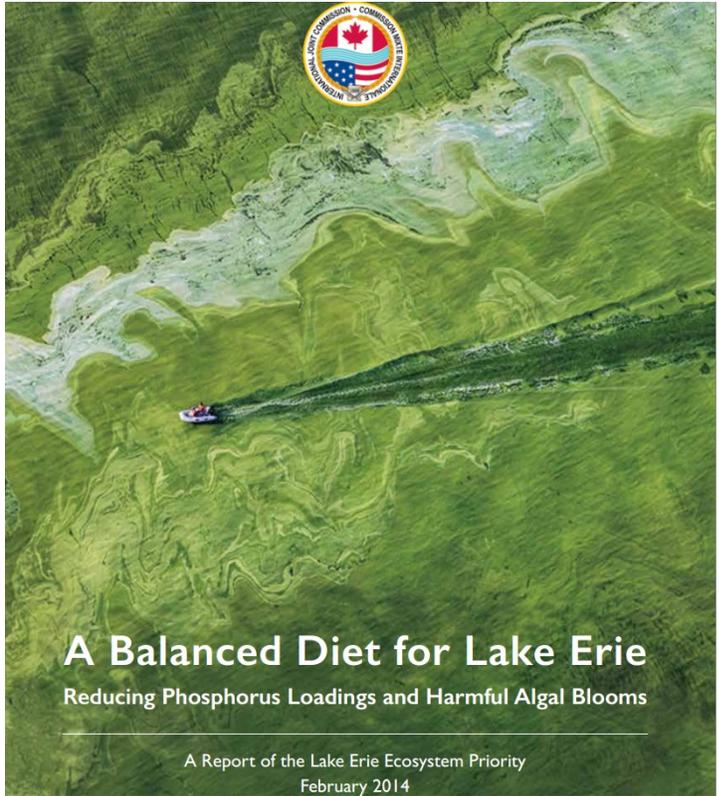
Urban Sources

The IJC recommends that federal, state and provincial governments work with municipalities to accelerate the use of "green infrastructure" in urban storm water management. Regulatory direction and technical support to municipalities for projects that are an alternative to the traditional more expensive storm water controls should be supported and pursued. In addition, it is recommended that Ontario, Ohio and Pennsylvania prohibit the sale and use of phosphorus fertilizers for lawn care, with the exception of the establishment of new lawns during the first growing season or in cases where soil testing indicates a need for phosphorus.

"...recommendations to assist governments in setting phosphorus reduction targets...and strengthening monitoring and research."

Restoring Wetlands

Lake Erie has lost more than 80% of its pre-settlement coastal wetlands, significantly affecting water quality as well as habitat. Coastal wetlands support biodiversity and



filter pollutants. The IJC recommended that federal, state and provincial governments, and nongovernment partners, commit to and fund a goal of a 10% increase (2,600 acres) beyond current levels in coastal wetland areas in the western basin of Lake Erie by 2030. A science-based goal for protection of wetlands inland of the coastal zone should also be established.

Strengthening Monitoring and Research

A number of significant knowledge gaps were identified that need to be filled to insure that governments have adequate information to make decisions. The IJC recommended enhancing current monitoring networks throughout the Lake Erie basin, including the establishment of a monitoring system at the outlet of the Detroit River to measure critical nutrient parameters. Further research was also recommended to improve understanding of the cumulative effectiveness of both rural and urban management practices.

Citation

International Joint Commission (2014). A Balanced Diet for Lake Erie: Reducing Phosphorus Loadings and Harmful Algal Blooms. Report of the Lake Erie Ecosystem Priority.

A copy of the report can be obtained at the following web site: www.ijc.org/files/publications/2014%20IJC%20LEEP%20REPORT.pdf

Research Highlights from State of Ohio Water Resources Center

The Ohio Water Resources Center is a federally authorized center situated at The Ohio State University. We fund State relevant water related research. Below are highlights from a recently completed project conducted by Dr. Paula Mouser and Dr. Gil Bohrer at the Ohio State University. If you are interested learning more about our research projects see the Ohio Water Resources Center webpage at wrc.osu.edu

The project entitled “**The Constructed Wetland Dilemma: Nitrogen Removal at the Expense of Methane Generation?**” evaluated which environmental conditions lead to nitrogen removal in wetlands without generating excessive greenhouse gas emissions.



Figure 1. Graduate student Mike Brooker on the site sampling wetland sediments for laboratory microcosms experiments.

This project used laboratory experiments and field measurements of gas flux for differing wetland habitats within OSU’s Olentangy River Wetland Research Center (see Figure 1). Mike Brooker, the graduate student, has conducted several experiments measuring gas production potential from distinct soil ecosystems. These included vegetated and unvegetated wetland zones as well as upland sites. The project’s findings suggest that wetland biome and soil depth greatly influence the methane flux potential at higher temperatures due to the availability of labile carbon substances and the presence of methanogenic archaea (Figure 2). While all biomes efficiently removed nitrogen, the shallow, open water sediments produced the greatest amount of methane while deeper vegetated sites produced the least. The prevalence of methanogens at the open water site and its ability to thrive under cooler and warmer temperatures suggest that designing wetlands with open water areas may contribute a larger greenhouse gas footprint than wetlands designed with more vegetated areas. Deeper sediments lacked either the microbial community producing labile carbon (e.g. acetate) or the appropriate carbon substrate for methanogenesis to occur (Figure 2).

Researcher: Dr Mouser is investigating the role that microorganisms play in mediating biochemical reactions in environmental systems using biotechnology methods. Her focus has been on deciphering the complex relationship between bio-physio-chemical processes in subsurface environments impacted by waste disposal activities and industrial processes. Applications of such research include improving detection and remediation strategies for the protection of water resources, and optimizing restoration activities for contaminated sites.

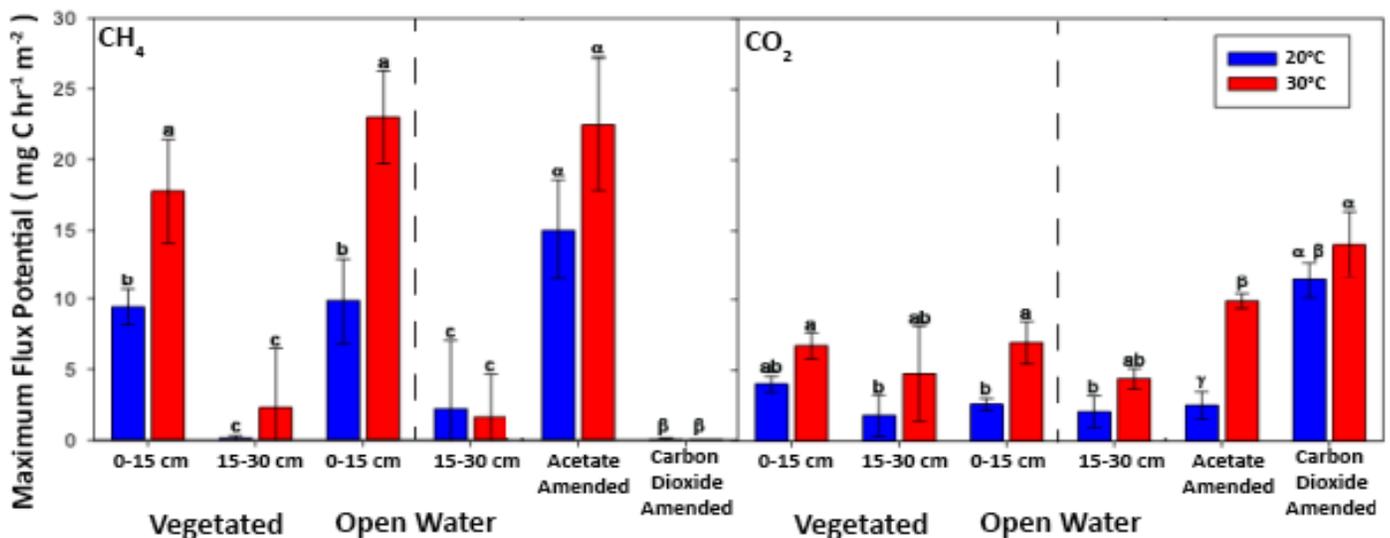


Figure 2. Methane and carbon dioxide flux potential of sediments collected from different zones. Amendments were added to the open water, 15-30 cm site. Significant differences are identified by letters above the bars.

Ohio's Response to Elk River Contamination Spill

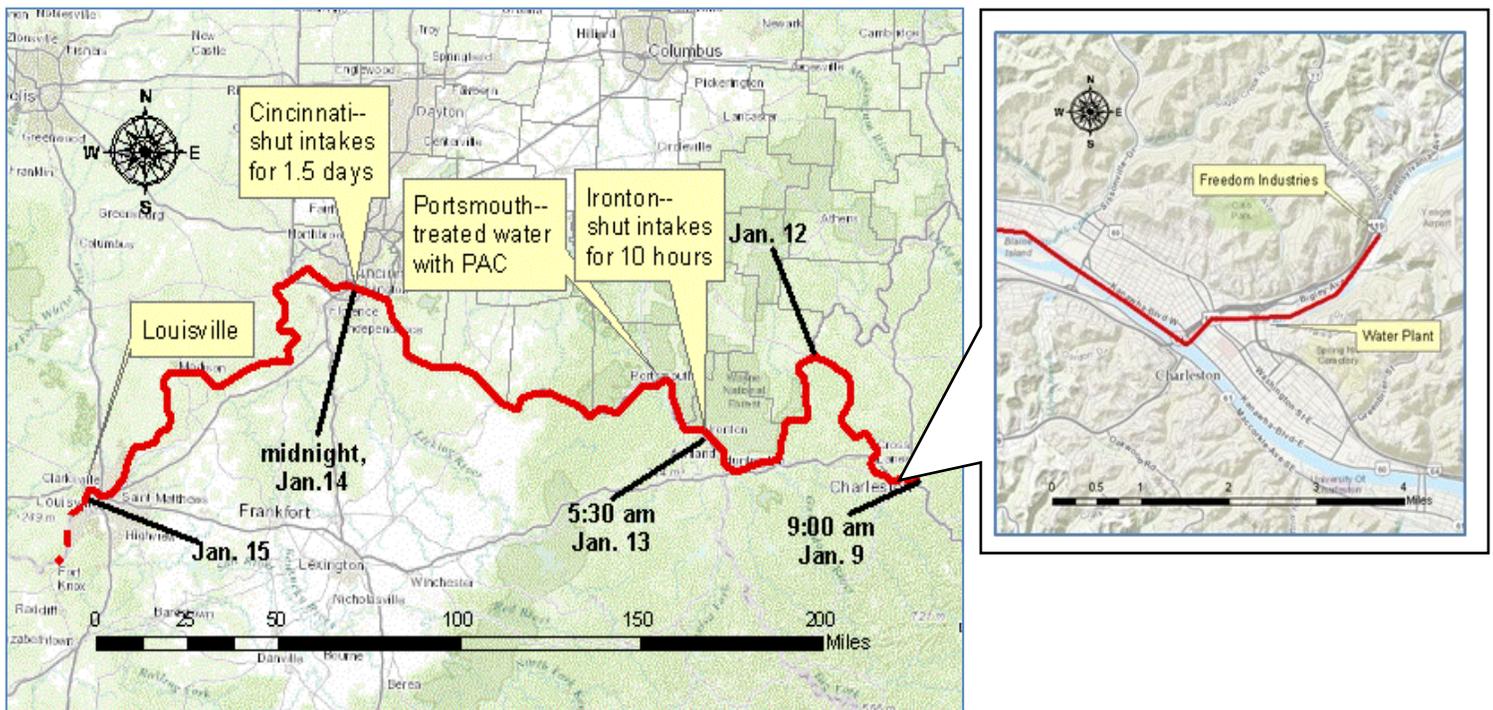
Barb Lubberger, Ohio EPA Source Water Assessment and Protection Program

On January 9, 2014, a coal-washing chemical (4-methylcyclohexylmethanol, or MCHM) was found to be leaking from a one-inch hole in a 40,000-gallon above-ground storage tank at Freedom Industries' facility in Charleston, West Virginia. Approximately 7,500 gallons was released, much of which made its way through a concrete block containment dike into the Elk River, a tributary to the Kanawha River, which flows to the Ohio River. West Virginia American Water has an intake on the Elk River about 1.5 miles downstream. They were notified of the spill by the National Response Center around noon, but assumed their carbon filters could treat it. However, the chemical began to break through the filters, and at 5:45 pm they instructed their customers to stop using tap water. About 300,000 West Virginia residents were affected, obliged to use bottled or trucked-in water for over a week, while West Virginia American Water struggled to flush out the entire distribution system.

Three days later, on January 12, the spill was detected in the Ohio River at Gallipolis, over 50 miles away from the spill site. From there it traveled more rapidly, being detected at Huntington, West Virginia on January 13 and at Cincinnati on January 14. It was last detected at Louisville, Kentucky

on January 15. Throughout this incident, the Ohio River Valley Water Sanitation Commission (ORSANCO) communicated the plume's progress to all public water systems using Ohio River water, and coordinated sampling of river water using its organics detection system (ODS), a network of 15 gas chromatographs situated at public water systems along the Ohio River from above Pittsburgh, Pennsylvania to Cairo, Illinois. ORSANCO staff quickly obtained a sample of the Elk River MCHM and calculated standards for it, so the staff at the ODS stations would be able to positively identify and quantify it. ORSANCO staff also modeled the plume using a time-of-travel computer model. This model proved highly accurate, predicting arrival times at specific points that were generally correct within an hour. Based on this model, it was predicted that the remnants of the plume reached the Mississippi River by January 23, 2014.

Ohio has six public water systems that use Ohio River water, three of them in the path of the plume: Ironton, Portsmouth, and Cincinnati. Portsmouth and Cincinnati are also ODS stations, and monitored the river water many times each day to check MCHM levels. Cincinnati and Ironton shut down their intakes while the plume passed by; Portsmouth treated their water with powdered activated carbon to ensure no trace of MCHM would enter the distribution system. Thanks to all these efforts, no communities in Ohio suffered any loss of water service.



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The Water Management Association of Ohio (WMAO) is the one organization dedicated to all of Ohio's water resources.

VISION: The Water Management Association of Ohio will be the most effective and respected independent water resources organization in Ohio.

MISSION: The Water Management Association of Ohio promotes the comprehensive understanding, conservation and multifaceted use of Ohio's water resources.

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