

Virtual Workshop Sessions: Improving Communication About Changing Lake Michigan Water Levels in the Chicago Metropolitan Area

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Background

In October 2020, Illinois-Indiana Sea Grant (IISG) hosted a series of four virtual workshops. The goals of the four workshops combined were to:

- 1) Present information on how well researchers can currently predict water levels in southwestern Lake Michigan;
- 2) Outline the known or predicted impacts of record high or record low water levels on southwestern Lake Michigan shorelines;
- 3) Identify existing data and products that can help local emergency responders, weather forecasters, parks department personnel, and other community leaders communicate the risks associated with changing water levels, including probable impacts to community members and shoreline property owners;
- 4) Develop a list of additional data sets or products that could help communicate the risk associated with changing water levels, including probable impacts to community members and shoreline property owners;
- 5) Identify which of these data sets or products IISG can help develop or otherwise support, for example by working with local researchers or extension personnel.

The workshops centered on southwestern Lake Michigan because of the complex interplay of human-shoreline dynamics along the Illinois and Indiana shoreline of the lake, which includes both the densely populated, heavily developed city of Chicago, industrialized areas south of Chicago and in Indiana, as well as unique stretches of precious coastal habitat such as the Chiwaukee Illinois Beach Lake Plain (designated a Ramsar Wetland of International Importance) and Indiana Dunes National Park, along with other state-protected natural areas. This region, along with all of the Great Lakes, has experienced extreme fluctuations in water levels in the past decade. Lake Michigan, which is hydrologically connected to Lake Huron, saw record low water levels in December 2012 through January 2013.¹ At the time, hydrologists, shoreline residents, and shipping industry experts were concerned that they may need to require ships to carry less weight as they navigated shallower waters; dredge additional channels or move sediment around the lakes to control flow; remove unsightly vegetation and detritus from the newly exposed, receding shoreline; and/or revise or improve access to the lake. Conversely, six years later, lake levels were among the highest on record.² Record and near-record high water levels in 2020 have led to increased flooding and erosion risks along shorelines and the opposite concerns of those expressed in 2013: namely, submerged docks, flooded transportation infrastructure such as Chicago's Lake Shore Drive, inundated coastal areas, and eroding shorelines, which may cause irreversible, lasting damage to the shoreline, associated structures, and loss of habitat.

These wide-ranging impacts affect the entire Chicago metropolitan area, which is home to more than 9.5 million people and is one of the most popular urban tourist destinations in the United States. The socioeconomic status of communities along the Illinois and Indiana shorelines is diverse; however, given their geographic distribution, lower-income communities are disproportionately affected by changing lake levels, urban flooding, and water quality issues. The physical and structural effects of rising and falling lake levels is interwoven with other economic and social challenges, and these must be considered in concert if mitigation or adaptation strategies are to be effective. With the recent designation of the Indiana Dunes National Lakeshore to a National Park and increased awareness

of the extremely rare coastal habitats at Illinois Beach State Park, travel to northwest Indiana and northeast Illinois has also increased and there is a strong desire to maintain the natural beauty of these parks along with the economic benefits and recreation and tourism opportunities these natural areas. Finally, the estimated economic activity of ports in southwestern Lake Michigan exceeds \$4.8 billion,^{3,4} but shipping and transportation in a given year is greatly influenced by the water levels.

While record high water levels are a current cause for concern in this important metropolitan area, many community members also remember recent record lows. Future projections show small decreases in the average water level on Lake Michigan over the 21st century.⁵ However, uncertainty remains around year-to-year variability and rates of change from very high to very low conditions or vice versa, such as the rapid change from record low water levels in 2012-2013 to current record or near-record high water levels. In addition to average water level and water level patterns changing as a result of climate change, projected increases in annual precipitation and decreases in winter ice cover for the Great Lakes region have the potential to amplify impacts.

Given the unprecedented nature of lake level change, stakeholders in the southwest Lake Michigan region expressed the need to come together to improve communication about this issue. It was decided that the first step would be to bring together key partners to convene a facilitated workshop to brainstorm ideas, catalyze collaboration, and prioritize which datasets, tools, and products would be most useful in tackling the many challenges associated with communication on changing lake levels. A planning committee of seven experts from six organizations other than IISG shaped the workshop (see [Appendix 1](#)). Four planning meetings were held prior to the workshop sessions, with representation from the Great Lakes Environmental Research Laboratory, Illinois Department of Natural Resources (DNR) Coastal Management Program, Indiana Lake Michigan Coastal Program, Midwestern Regional Climate Center, Prairie Research Institute, and U.S. Army Corps of Engineers. These experts provided valuable input on the content and topics to be included, the format and structure most suitable to a virtual environment, and who should be invited to participate in the workshops.

Each of the four 3-hour sessions (held October 20, 22, 27, and 29) was attended by 25–40 participants, though the exact attendee list varied from day-to-day. Participants included experts who provide water level-related information to community members, and scientists interested in physical and other effects of lake-level change ([Appendix 2](#)).

Information summarized in this report is meant to inform the development of products, tools, or datasets that help communicate the risks associated with water level changes, whether the lakes be high or low. Participant observations, input, and feedback will also help guide IISG research priorities and outreach programming. We also hope that by sharing information generated from these workshops, others will find this collection of material helpful to use in their work.

Summary of Workshops

The four workshops were a group effort; its success is largely due to the contributions of the planning committee and the workshop participants. The full agenda is included as [Appendix 3](#). An outline of each day, plus findings from the expert discussions held each day, are summarized below.

Workshop 1: Background information on Lake Michigan water levels, risks, and impacts

The first workshop began with an introductory presentation from the IISG team about the workshop background and goals, followed by overview presentations titled 1) Great Lakes Water Levels, 2) Improving Great Lakes Communication About Changing Lake Levels, 3) Improving Communication about Changing Lake Michigan Water Levels, 4) Regional Response to Rising Lakefront Water Levels, and 5) National Weather Service Lakeshore Flood Services. The presentation sequence aimed to progress from a regional perspective to a more localized one.

Summaries of each of the overview presentations are below. Readers can access a PDF of the presentations on the IISG website or contact each presenter for additional information

1) [*Great Lakes Water Levels*](#)

John Allis, chief of the Great Lakes Hydraulics & Hydrology Office from the [Detroit District of the U.S. Army Corps of Engineers \(USACE\)](#), began the overview presentations. Allis provided attendees with background information on the current state of water levels on the Great Lakes and also spoke about several USACE tools, products, and resources that provide historical information on water levels as well as forecasting tools.

2) [*Improving Great Lakes Communication About Changing Lake Levels*](#)

Laurie Smith-Kuypers, who is the division outreach specialist with the [Federal Emergency Management Agency \(FEMA\) Region V Mitigation Division](#), presented on mapping coastal hazards to reduce flood risk and the ongoing regional study to remap coastal flooding within the Great Lakes basin. Smith-Kuypers also shared information about several different FEMA resources, data, and funding sources.

3) [*Improving Communication About Changing Lake Michigan Water Levels: USACE Chicago District*](#)

Dave Handwerk from the [Chicago District of USACE](#) and chief of the Economic Formulation Section presented on the similarities and differences of the roles of USACE Chicago and Detroit districts. He also spoke to some local stories around erosion of the Lake Michigan shoreline, flooding events, and emergency response to these local challenges.

4) [*Regional Response to Rising Lakefront Water Levels*](#)

From [Cook County Emergency Management and Regional Security](#), Kimberly Nowicki spoke to the significant threat rising lake levels pose to residents and property along the Lake Michigan shoreline. Nowicki shared information about how Cook County monitors, communicates, coordinates and responds to hazards that threaten lakeshore communities, and future mitigation planning efforts.

5) [*National Weather Service Lakeshore Flood Services*](#)

The final overview presentation was delivered by Ricky Castro, a meteorologist with [National](#)

[Weather Service \(NWS\) Chicago](#). Castro presented on NWS lakeshore flood products, how lakeshore flooding is forecasted, recent examples of lakeshore flooding, and finally, beach hazards around the Chicago area of Lake Michigan.

Following these overview presentations were three brief, or so-called “lightning,” talks. All participants were invited to contribute 5-minute presentations focused on the groups they communicate with about changing lake levels, effective strategies, and major challenges that remain. Following the overview presentations, three lightning talks were given by four participants:

- Vidya Balasubramanyam of the Prairie Research Institute gave an overview of what she and her colleagues at the Illinois DNR Coastal Management Program can offer to support shoreline management.
- Mark Wagstaff and Margaret Boshek of Smithgroup, Inc., shared strategies they use to communicate lake level effects to local communities, including useful graphics.
- Luke Zoet of the University of Wisconsin-Madison shared findings from his research group, including publications and data visualizations.

Day 1 ended with round-robin introductions by all participants. At this time, each participant, in addition to sharing name and affiliation, was also asked to speak to something they hoped to learn during the workshops. Some of the common themes that were expressed among participants included:

- Applying information to long-term planning and management given the projections for increased water level variability.
- Learning the implications of variable lake levels for water safety.
- Continuing to learn about the best science available and experts in the field.

In addition, ideas were already beginning to be formulated about certain products that could be developed, such as a decision-tree of jurisdictions and a list of which organizations handle different types of issues in various locations.

This round-robin activity helped shape the discussions for the following workshops and inform the priority setting survey (see Day 4, [Appendix 4](#)).

Workshop 2: Short-term and local impacts of water level variability

The second workshop opened with two overview presentations focused on short-term and/or local impacts. These scales were roughly defined as actions that may be taken or effects that may occur on the scale of a few houses or a small community, or in the next few months to years.

- 1) [Great Lakes Water Levels: Short-term Impacts](#)
Deanna Apps with the [USACE Detroit District's](#) Hydraulics and Hydrology Office gave an over-view of the effects of recent near-record and record-high lake levels on Lake Michigan-Huron. Apps also shared information about several of the tools and resources USACE uses for fore-casting and assessing short-term impacts.
- 2) [High Lake Levels and the Illinois Coast: Some Insights from Illinois Beach State Park](#)
From the [Illinois State Geological Survey](#), C.R. Mattheus spoke about ongoing efforts to better understand shoreline dynamics at Illinois Beach State Park over the past few years, including

the recent rapid shift from low to high lake levels. Various products, tools, and datasets that are frequently used to understand the short-term and local impacts from high and varying lake levels were featured.

The two overview presentations aimed to not only share background information about recent and anticipated short-term and local impacts, but also highlight some tools, products, datasets, and additional resources that are available for use at these temporal and spatial scales. These presentations, plus the Q&A afterward, served as a springboard for discussion in smaller breakout groups.

Participants were assigned to their breakout group prior to this workshop session. During registration, participants were asked to self-identify the groups or communities they most often engage with as part of their work. The IISG team sorted the attendees into groups based on these responses, forming breakout groups of those working with similar stakeholders (i.e., parks and natural areas, residential or commercial property owners, critical infrastructure, government, permitting agencies). Four groups of 7–8 participants, including a moderator from the planning committee, were formed. The questions and topics provided for the breakout sessions were designed to encourage conversation; the primary goal of the breakout sessions was to provide ample time for thoughtful discussion rather than aiming to answer each question in a clear-cut or direct manner. The breakout session was divided into two, 40-minute sections, where each group used the following to guide discussion:

1) *How do you protect your shoreline?*

- a. What hazards are the groups you work with most concerned about when considering lake level change?
- b. What are people doing at a very local scale (i.e., a neighborhood, community, or individual municipality) or for immediate relief within the next 3-6 months?
- c. What is the biggest challenge in taking those actions?

2) *Identify datasets, tools & products and gaps & needs.*

- a. Identify data sets and tools/products that exist to help when communicating effects of lake level change on the short-term or hyperlocal issues.
- b. What do you like or not like about these available resources?
- c. What else is needed for addressing short-term or local issues?
- d. What are the preferred formats for data, tools, products, etc.?

After the two breakout sessions, everyone returned to the main room and each group quickly shared highlights from their discussion. Key points that emerged include:

- Erosion along the shoreline has caused a noticeable loss of public space and recreational resources.
- There is tension related to funding projects for the near and short term if they may not be the most beneficial approach in the long term.
- Permitting and permitting timelines can sometimes be big hurdles.

- Workshop participants prefer nature-based approaches to managing some of the effects of water levels and erosion.
- More gauges and geographically-precise forecasts would be useful since water level rise is not uniform.
- It would be good to increase availability of photos of the shoreline throughout the region, over both space and time.
- Similarly, more coastal aerial oblique photos from around the Great Lakes would be useful.
- Increased use of social media, e.g., creating short videos, would be a good way to share information.

Some key questions that arose were:

- How can neighbors, including property owners not immediately adjacent to each other, work together in a mutually beneficial way, especially for longer-term mitigation plans?
- How can we make it easier for everyone, including non-technical people, to understand where various resources exist, which agencies house these resources, and how to use those resources to better communicate about lake levels and related topics?
- How are hazards affecting our natural areas and those who participate in tourism and recreation activities on Lake Michigan, specifically with regards to erosion?

The summary discussion plus notes were used to inform the ranking priorities survey (see Day 4, [Appendix 4](#)).

Workshop 3: Long-term and regional impacts of water level variability

The third workshop began with overview presentations focused on long-term and/or regional impacts. These scales were roughly defined as actions that may be taken or effects that may occur on the scale of larger communities or the whole southern Lake Michigan region, or over years and decades.

1) *Great Lakes Hydrology*

Lauren Fry, a physical scientist with the National Oceanic and Atmospheric Administration (NOAA) [Great Lakes Environmental Research Laboratory](#), spoke about the observed long-term water level trends and variability and how water levels are monitored across the Great Lakes basin. Fry also highlighted some of the projected changes for the region's climate and the expected impacts.

2) *Understanding Long-Term Coastal Impacts Due to Water Level Changes in Lake Michigan*

From NOAA's [Office for Coastal Management](#), Brandon Krumwiede, a physical scientist and the Great Lakes regional geospatial coordinator, presented on coastal challenges for Lake Michigan, and the Great Lakes region as a whole. These challenges included the complexity of water

levels, physical impacts to shorelines, and economic and social impacts. Krumwiede also shared data and tools that he often uses to help understand regional impacts from changing lake levels.

These two presentations aimed to provide background information on historical lake level variability and trends as well as long-term future projections and impacts for the Great Lakes region. Each speaker also shared tools, products, datasets, and resources they use to better comprehend the challenges associated with understanding and communicating long-term and regional impacts.

Following these presentations and Q&A, participants were once again divided into breakout groups based on the groups and communities they identified during registration, which may have been different from the group they participated in during the second workshop. Three groups of 8–9 participants, including a moderator from the planning committee, were formed. The breakout session was again divided into two, 40-minute sections, where each group used the following to guide discussion:

- 1) *How do you protect your shoreline? Identify datasets, tools & products and gaps & needs.*
 - a. What actions can be taken more broadly (municipalities, communities, infrastructure that benefits everyone e.g., hospitals, transportation, schools, fire, police, etc.) to protect the shoreline in the longer term?
 - b. Identify data sets and tools/products that exist to help when communicating effects of lake level change in the long term or more regional issues.
 - c. What do you like or not like about these available resources?
 - d. Identify data gaps and needs for addressing long-term and/or more regional issues.

- 2) *Bigger challenges and wicked problems*
 - a. What are the challenges related to shifting thinking from short term to long term as well as the challenges of communicating and planning at both scales?
 - b. When asked by a constituent about the connection between lake levels and climate change, what answer do you give and what resources do you refer them to?
 - c. What difficult questions do you get in your role that you struggle with answering?
 - d. How do we better connect through communication as a network of various stakeholders interested in lake level change as well as communication with the many groups and communities we interact with in our roles?
 - e. The collection of data is central to us being able to understand current conditions and to predict and project future conditions. Who should be the one(s) collecting data? Academia? Agencies?
 - f. How do we dispel the misconceptions about why the lake levels are high?

While some questions were the same as those posed during Workshop 2, participants were asked to specifically address these duplicate questions in terms of long-term and regional impacts. The questions for the second breakout session were shaped by the planning committee between the second and third workshops, and were intended to spark conversation around difficult and challenging topics.

However, participants and moderators were encouraged to let the conversation naturally evolve.

As during Workshop 2, after the two breakout sessions, everyone returned to the main room and each group spent a few minutes sharing the highlights of their discussion. Major points from the third workshop included:

- There is not an ultimate high or low water level to expect since many factors impact lake levels, so we need to continue to talk about resilience and adapting to variability over time.
- In addition to variable and extreme lake levels, communities are greatly impacted by flooding and groundwater infiltration.
- How we define the time scale of “long-term” can be quite variable, ranging from 10–30 years to several generations.
- There are many misconceptions around homeowners’ flood insurance policies, and what funding may be available to install shoreline protection or recover from damage.
- It would be useful to better communicate to homeowners the benefits and drawbacks of various shoreline protection options by creating more educational resources about the range of available options.

Some key questions that arose were:

- How do we define the shoreline? Is it defined by where the shoreline has been, where it is now or where it may be in the future?
- How do we more effectively talk about the impacts of climate change as they relate to water level variability? How does this relate to ice cover, erosion, springtime flooding, etc. at a local level? How do we communicate a united message on the relationship between climate change and water levels?
- How can we better communicate the cyclic nature of the Great Lakes versus the gradual sea level rise that will be experienced on the salty coasts and that people are generally better informed about?
- Much of the country is aware of the extreme fire risk and events in the western U.S. but may not be aware of currently near-record high lake levels in the Great Lakes—even those who live nearby or rely on the lakes for drinking water, recreation, etc. How can we better communicate risk and impact and share more information about these extreme lake levels on a wider scale than only within the communities it is affecting?
- How can we better connect as a network of various stakeholders who have an interest in becoming better communicators about water level variability and impacts?

The summary discussion plus notes were used to inform the ranking priorities survey (see Day 4, [Appendix 4](#)).

Workshop 4: Summarize outcomes and look forward to improving communication on water level variability

During the fourth and final workshop, participants once again gathered to hear summaries of the previous three workshops and to help identify next steps. To begin, IISG personnel provided an overview presentation, highlighting all of the presenters and the abundance of information shared over the previous three sessions in both the full-group and breakout group discussions.

Based on discussion notes, the IISG team and members of the planning committee created a survey ([Appendix 4](#)) for participants to rank, in order of importance, the identified gaps and needs related to communicating effects of fluctuating lake levels in southwestern Lake Michigan. The needs and gaps were divided into four categories: reference lists; communication products; maps, tools, or datasets; and research priorities. Participants in this workshop were given approximately 15 minutes during the session to complete the survey. The survey link was sent to all participants who attended one or more of the previous three workshops, not just those who Workshop 4, and it remained open for approximately one week. Participants received one post-workshop reminder to complete it.

While IISG staff members were quickly compiling and summarizing initial findings of the survey, two final overview presentations rounded out the workshop. Both of these presentations focused on some bigger challenges and opportunities that are emerging around lake level change, impacts, and communication.

1) *Coastal Communications for Impact*

Cameron Davis, vice president of [GEI Consultants](#), spoke about the uniqueness of the recent seasonal cycle of water levels in the Lake Michigan-Huron basin. Davis then shared some of the communication challenges he encounters, as well as several communication opportunities and tips that are effective motivators for action.

2) *Coastal Resiliency Communication: Life at the Top/A Flipped Classroom Case Study in Process*

Mark Breederland, Northwest District Extension educator with [Michigan Sea Grant](#), provided the final presentation and told stories that featured just how extreme recent conditions on Lake Michigan-Huron have been. Breederland also shared information about a video series Michigan Sea Grant has been developing with partner institutions to engage, educate and connect communities around Michigan to plan for a resilient future.

Ranking Priorities Survey Results

Participants were asked to rank each of the following from most needed in the short term (highest priority) to least needed in the short term (lowest priority). Note that a lower ranking does not necessarily mean an item is not needed; rather, it was not identified as being most critical in the short term by respondents to this particular survey.

Reference Lists (n=19)

<i>Identified Need*</i>	<i>Rank</i>
A list of available resources (datasets, tools, graphics, etc.) for understanding/sharing impacts of lake level change	1

<i>Identified Need*</i>	<i>Rank</i>
A flowchart or list of which organization handles what types of issues in which locations, e.g., permitting, controlling lake levels: IJC, FEMA, USACE, local municipalities	2
A list of the full range of options for adapting to or mitigating effects of changing lake levels (for reference by homeowners, public land managers, marina or port managers)	3
A list of potential funding sources for adaptation/mitigation measures, e.g., grant opportunities for municipalities, options for homeowners	4
A record of uncertainty for the different tools/resources that are available, e.g., Lake Level Viewer, Shoreline Survey	5
A summary of how insurance coverage and disaster declarations work (for homeowner reference)	

Additional comments on reference lists shared via survey:

- Funding sources are probably the most sought-out information, especially from the public and municipal managers that don't deal with Lake Michigan every day.
- Video/graphics for understanding impacts of lake level change are one of the most needed items.
- Resources for the homeowner and public are most important. When high water first started, many wanted to point fingers, but as it has continued the response has been more of how do we deal with this. Providing resources will help all of us to better adapt to high and even low water in the future.
- Items that help address urgent concerns (like people's houses flooding or falling into the water) should have the highest priority, and actions that address longer-term solutions should come second (though they're still important of course!).
- The flowchart/guide to which agencies have jurisdiction over what will be helpful in guiding people to find the correct location from which to get more info/support, essentially finding the experts who can address questions that are also involved in the other list items we are ranking.
- Property owners need background information to better understand how to advocate themselves and get financial assistance.

Communication Products (n=19)

<i>Identified Need*</i>	<i>Rank</i>
Long term effectiveness of particular actions (e.g., shoreline hardening, beach nourishment; including cost estimates)	1
How actions taken locally will affect neighbors (e.g., erosion along other shorelines)	2
Local case studies of successful mitigation actions (e.g., traditional actions like shoreline hardening, beach nourishment, natural shorelines or relocation)	

<i>Identified Need*</i>	<i>Rank</i>
What affects lake levels, are they easy to control (e.g., relative contribution of natural processes versus human interventions such as regulating outflows)	4
How to install shoreline protections such that you minimize negative impacts on your neighbors	5
Why stakeholders can and should focus on variability in lake levels rather than long-term trends	6
How lake level changes affect different sectors (i.e., industrial, natural, recreational, privately owned areas), including how sectors and/or impacts are connected	7
How you define a shoreline can differ depending on your goals; show different ways people define a shoreline	8

Additional comments on communication products shared via survey:

- Local case studies would be most useful if they include how the actions will affect (or have affected) neighbors, and long-term effectiveness of the actions.
- General public may be most interested in learning WHAT they can do and HOW; and the actual science behind the lake levels comes second. (Although if there's a way to incorporate the science into products about shoreline protection actions, that would be great!).
- Property owners may need to understand how the watershed they are in is defined and what does or doesn't fall in the definition. They also need to learn what is causing the change in water levels before they can choose a direction of mitigation.

Maps, Tools, or Datasets (n=19)

<i>Identified Need*</i>	<i>Rank</i>
Location of highest risk areas under high or low water levels, including critical infrastructure and parks	1
Photos (with metadata, taken in consistent ways) or gauge data from more locations under more conditions so studies can examine trends over time and space; this could include historic information	2
Higher resolution models to predict very local changes under different scenarios (e.g., long-term forecasts, climate scenarios, modifying shorelines)	3
A comprehensive hydrologic model for the area	4
Location of different shoreline management strategies that can be updated in real-time	
Status of structures put in place in 1986 to mitigate effects of high lake levels	6
More and centralized data on groundwater	7

Additional comments on maps, tools, or datasets shared via survey:

- It would be difficult to examine trends using photos alone—photos could be paired with data collection (bathymetric, digital elevation models, etc.).
- Status of structures could be particularly interesting if it were coupled with shoreline conditions immediately next to the structure as well as down shore.
- Over the last year we have seen how photos and videos taken at different times are great tools for communicating change, failure, success and priority. Committing to collect a consistent set of these over the next 20 years as well as archiving existing material would be really helpful.

Research Priorities (n=18)

<i>Identified Need*</i>	<i>Rank</i>
What are the specific effects of high waves, stormwater surges, wave runup, and/or seiches on local shorelines under different water level scenarios?	1
What are the best strategies for managing dynamic shorelines given that we expect lake levels will change?	2
Is variability in water levels in southern Lake Michigan primarily attributable to changes in period of fluctuations, or magnitude of fluctuations? What may happen in the future?	3
What will be the economic impacts to different sectors under different scenarios (high lake levels, low lake levels, fluctuating back and forth on a shorter time scale)?	4
How does ice formation and duration affect shoreline erosion in southern Lake Michigan?	5
How can we best communicate that actions taken locally, right now, will have broad spatial and temporal impacts?	

Additional comments on research priorities shared via survey:

- The greatest need is for further understanding of how changing climate may impact future lake levels, including, but not limited to, extremes. Some are doing this work, but it needs more urgency.
- Adaptation measures and some of the actions taken so far during high water will provide us with feedback and monitoring these measures will better help us understand future impacts.
- Would be good to understand the value of beaches to coastal communities—tourism, cultural, etc.

*Though the survey listed “needs” identified during the workshop, what became apparent through conversations as a group was that some of these products and information already exist. Survey participants did a great job of sharing resources, and these will be compiled and made accessible to workshop participants. Some partner organizations already have central repositories for particular types of information, while other central repositories are potentially still needed.

After presentations concluded, IISG staff members shared initial survey results, which led into a group discussion about which items may be able to be completed relatively quickly versus those that may

require further work or follow-up discussions. Additional key thoughts shared via the survey include that:

- People are making decisions now given the impacts that are already being experienced due to the high lake levels. How best can they be supported in their decision making today with the imperfect information at hand while additional information, research, etc. is collected/conducted?
- All professionals should consider how to ensure equitable access to tools and datasets for all communities in southwestern Lake Michigan.

During the group discussion, participants further stated that justice, equity, diversity, and inclusion efforts merit further conversation. Attendees wanted to understand the types of information that are available to assess social vulnerability along southern Lake Michigan shorelines. However, they also wanted to know the types of specific data and information still needed to ensure that all work can benefit vulnerable communities and disproportionately impacted areas so that these communities are more resilient to changing lake levels and more frequent flooding events. To determine how we may prioritize our resources to assist vulnerable groups, non-traditional data sources and additional creative measures will need to be considered. Several attendees were very enthusiastic and determined to continue discussing these important topics, and IISG looks forward to supporting, participating in, and helping to sustain these dialogues moving forward.

Finally, participants were asked to share one take away from the workshops as well as one issue they still saw as a major challenge that could merit more discussion in the future. Combined with the thoughts and ideas collected throughout the series of workshops, this final round-robin reinforced the range of topics that had been covered as well as how many opportunities exist to expand and further develop the work.

Next Steps

It was clear from workshop activities that there is great interest in continuing efforts to improve communication about lake level change in southwestern Lake Michigan. Illinois-Indiana Sea Grant plans to consult with the workshop planning committee, as well as workshop participants, to continue to build on this effort. Some workshop participants have already indicated that they will be revising how they share information in response to thoughts shared during this workshop. In order to maximize utility of information, there is a need to review currently available regional tools and data viewers and potentially adapt them locally. There is also a need to pull together lists of resources or visualizations available for use by Lake Michigan shoreline communities, and ensure these are being equitably shared.

Illinois-Indiana Sea Grant will leverage broader Great Lakes Sea Grant Network activities, as well as partner institution activities, assist in this work. Specific initiatives to be led or supported by IISG over approximately the next year include:

- Compiling a list of available resources (datasets, tools, graphics, etc.) for understanding/sharing impacts of lake level change (see [Appendix 5](#)).
- Generating a flowchart or list of which organization handles what types of issues in which loca-

tions, e.g., permitting, controlling lake levels: IJC, FEMA, USACE, local municipalities).

- Creating 1–2 of the desired communication products
- Soliciting research proposals in any of the identified research priority areas, but in particular, those that could help: minimize shoreline flooding or erosion effects in lower income areas; understand costs and benefits of particular mitigation strategies; and/or identify the best ways to overcome barriers to implementation of strategies to minimize negative effects of lake level change.

Illinois-Indiana Sea Grant will also be creating a new place on the program website to house the products and initiatives developed in response to these workshops, including this summary report. Based on workshop discussions, IISG suggests that future workshops or training opportunities center on: the connection between lake level impacts and justice, equity, diversity, and inclusion; the potential for variable conditions in shoreline areas, including how local actions will affect near and far neighbors; and case studies that feature the full suite of possibilities for those who wish to implement adaptation or mitigation strategies.

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Appendix 1. Planning Committee Members

John Allis, Chief, Great Lakes Hydraulics and Hydrology Office, US Army Corps of Engineers – Detroit District

Vidya Balasubramanyam, Coastal Specialist – Prairie Research Institute, Illinois Coastal Management Program, Illinois Department of Natural Resources

Pat Charlebois, Interim Associate Director and Outreach Program Leader, Illinois-Indiana Sea Grant, University of Illinois

Veronica Fall, Climate Extension Specialist, Illinois-Indiana Sea Grant, University of Illinois

Carolyn Foley, Research Coordinator, Illinois-Indiana Sea Grant, Purdue University

Deb Jacobson, Operations Manager, Midwestern Regional Climate Center, Prairie Research Institute, University of Illinois

Jenny Orsburn, Program Manager, Lake Michigan Coastal Program, Indiana Department of Natural Resources

Casey Sebetto, Coastal Specialist, Prairie Research Institute, Illinois Coastal Management Program, Illinois Department of Natural Resources

Kathryn Vallis, Coastal Resources Planner, Lake Michigan Coastal Program, Indiana Department of Natural Resources

Chiara Zuccarino-Crowe, Great Lakes Outreach Specialist, Michigan Sea Grant, Michigan State University, NOAA Great Lakes Environmental Research Laboratory

Appendix 2. Workshop Attendees

Note: Attendees that attended one or more days are listed. A few cancelled at the last minute.

<i>Participant Name</i>	<i>Participant Affiliation</i>
Allison Voglesong Zejnati	International Joint Commission Great Lakes Regional Office
Cameron Davis	GEI Consultants
Carolyn Foley	Illinois-Indiana Sea Grant
Casey Sebetto	Prairie Research Institute, IDNR Coastal Management Program
Chelsea Volpano	University of Wisconsin - Madison
Cheryl Watson	Blacks in Green
Chiara Zuccarino-Crowe	Michigan Sea Grant
Cody Eskew	Illinois Coastal Management Program
Collin Roland	University of Wisconsin - Madison
David Handwerk	U.S. Army Corps of Engineers - Chicago District
Deanna Apps	U.S. Army Corps of Engineers – Detroit District
Deborah Stone	Cook County Department of Environment and Sustainability

<i>Participant Name</i>	<i>Participant Affiliation</i>
Debra Jacobson	University of Illinois – Prairie Research Institute
Don Wilson	
Doug Kluck	NOAA
Drew Phillips	Illinois State Geological Survey
Edith Makra	Metropolitan Mayors Caucus
Eric Anderson	NOAA – Great Lakes Environmental Research Laboratory
Frank Seglenieks	Environment and Climate Change Canada
Gabrielle Farina	NOAA
Jeff Kart	International Joint Commission
Jenny Orsburn	Indiana Lake Michigan Coastal Program
Jim Anderson	Lake County Forest Preserve
John Allis	US Army Corps of Engineers – Detroit District
John Sentell	Lake Forest Open Lands Association
Karsten Shein	University of Illinois, Illinois State Water Survey
Katherine Braun	Illinois State Geological Survey
Kathryn Vallis	Indiana DNR Lake Michigan Coastal Program
Kathy Luther	NIRPC
Kay Nelson	Northwest Indiana Forum
Lauren Fry	NOAA Great Lakes Environmental Research Laboratory
Laurie Smith-Kuypers	FEMA Region V
Lee Carlaw	National Weather Service Chicago
Leslie Thompson	Illinois-Indiana Sea Grant
Lucas Zoet	University of Wisconsin – Madison
Marcella Bondie Keenan	CNT
Margaret Boshek	SmithGroup
Mark Wagstaff	SmithGroup
Mark Breederland	Michigan Sea Grant Extension
Michael Rea	Indiana Dunes State Park
Patrice Charlebois	Illinois-Indiana Sea Grant
Rebecca Nicodemus	NOAA
Richard Castro	National Weather Service Chicago
Robin Mattheus	University of Illinois at Urbana-Champaign
Ryan London	Lake Forest Open Lands
Sarah White	Chicago Park District
Sean Bath	UCAR/NOAA Climate Program Office
Steve Davis	Indiana Department of Natural Resources
Tomas Höök	Illinois-Indiana Sea Grant

<i>Participant Name</i>	<i>Participant Affiliation</i>
Trent Ford	Illinois State Water Survey
Veronica Fall	Illinois-Indiana Sea Grant
Vidya Balasubramanyam	Illinois Coastal Management Program

Appendix 3. Workshop Agenda

Improving Communication About Changing Lake Michigan Water Levels in the Chicago Metropolitan Area

Webex was used throughout the workshop series to host the events. All times Central.

Day One – Tuesday, October 20 – Background of the Issue

<i>Time</i>	<i>Activity</i>
12:00 - 12:15	Review workshop goals – Veronica Fall, Carolyn Foley
12:15 – 1:10	Overview talks John Allis - USACE Detroit District (12:15 – 12:30) Laurie Smith-Kuypers - FEMA Region V (12:35-12:50) Dave Handwerk - USACE Chicago District (12:55-1:10)
1:15 – 1:20	Break
1:20 – 2:00	Overview talks Kimberly Nowicki – Cook County (1:20 – 1:35) Mike Bardou – NWS Chicago (1:40 – 1:55)
2:00 – 2:15	Lightning Talks
2:15 – 2:40	Participant introductions
2:40-2:55	Participant feedback on goals of the workshop
2:55 – 3:00	Wrap up – Veronica Fall
3:00 – 3:30	Room remains open for optional networking

Day Two – Thursday, October 22 – Short-term and/or Local Impacts

<i>Time</i>	<i>Activity</i>
12:00-12:05	Recap Day 1 – Veronica Fall
12:05 – 12:35	Overview Talks Deanna Apps – USACE Detroit District(12:05 – 12:20) Robin Mattheus – ISGS (12:20 – 12:35)
12:35 – 12:45	Prep for and move to breakout rooms
12:45 – 1:25	Breakout Session 1 – How do you protect your shoreline?
1:25 – 1:35	Break
1:35 – 2:15	Breakout Session 2 – Identify data sets/tools/products and gaps/needs

<i>Time</i>	<i>Activity</i>
2:15– 2:25	Break and return to main room
2:25 – 2:55	Large group report out and facilitated discussed related to Breakout Session 1 and 2
2:55 – 3:00	Wrap up – Veronica Fall
3:00 – 3:30	Room remains open for optional networking

Day Three – Tuesday, October 27 – Long-term and/or Regional Impacts

<i>Time</i>	<i>Activity</i>
12:00-12:05	Recap Days 1 and 2 – Veronica Fall
12:05 – 12:35	Overview Talks Lauren Fry – GLERL (12:05 – 12:20) Brandon Krumwiede – NOS (12:20 – 12:35)
12:35 – 12:45	Prep for and move to breakout rooms
12:45 – 1:25	Breakout Session 1 – How do you protect your shoreline? Identify data sets/tools/products and gaps/needs
1:25 – 1:35	Break
1:35 – 2:15	Breakout Session 2 – Bigger challenges and wicked problems
2:15– 2:25	Break and return to main room
2:25 – 2:55	Large group report out and facilitated discussed related to Breakout Session 1 and 2
2:55 – 3:00	Wrap up – Veronica Fall
3:00 – 3:30	Room remains open for optional networking

Day Four – Thursday, October 29 – Summarize Outcomes, Look Forward

<i>Time</i>	<i>Activity</i>
12:00 – 12:10	Recap of Days 1-3 – Veronica Fall
12:15 – 12:20	Introduce survey – Carolyn Foley
12:15 – 12:30	Participants complete survey and rank/prioritize the identified gaps needs from previous days (Qualtrics Survey)
12:35 – 1:15	Overview Talks Cam Davis – GEI Consultants (12:35 – 12:50) Mark Brederland – MISG (12:55 – 1:10)
1:15 – 1:20	Presentation of initial survey results – Carolyn Foley
1:20 – 2:00	Group discussion of survey results
2:00 – 2:10	Break

<i>Time</i>	<i>Activity</i>
2:10 – 2:50	Round robin where each participant answers One take away from the workshop One item you still see as a major challenge that we could potentially talk about in future sessions
2:50 – 3:00	Recap and adjourn
3:00 – 3:30	Room remains open for optional networking

Appendix 4. Survey to rank and prioritize the identified needs and gaps

Note: This survey was administered via Qualtrics. Priorities were presented to respondents in random order to minimize ranking bias.

The following pages list reference or communication products; maps, datasets, and tools; and potential research priorities. These lists are based on what was heard during the Improving Communication About Lake Levels in Southern Lake Michigan Virtual Workshop Series.

Please take your time ranking each set of priorities. You can rank something as high priority even if you believe it already exists.

These questions will ask you to drag-and-drop your priorities into order. If you have trouble with this, contact Carolyn Foley (cfoley@purdue.edu) or Veronica Fall (vfall@illinois.edu) who will provide you with a different ranking option.

- 1) Rank the following REFERENCE LISTS from 1 (most needed right now) to 6 (least needed right now). The goal would be to tailor these for southern Lake Michigan.
 - a. A list of available resources (datasets, tools, graphics, etc.) for understanding/sharing impacts of lake level change
 - b. A flowchart or list of which organization handles what types of issues in which locations, e.g., permitting, controlling lake levels; IJC, FEMA, USACE, local municipalities
 - c. A list of the full range of options for adapting to or mitigating effects of changing lake levels (for reference by homeowners, public land managers, marina or port managers)
 - d. A list of potential funding sources for adaptation/mitigation measures, e.g., grant opportunities for municipalities, options for homeowners
 - e. A record of uncertainty for the different tools/resources that are available, e.g., Lake Level Viewer, Shoreline Survey
 - f. A summary of how insurance coverage and disaster declarations work (for homeowner reference)

- 2) Rank the following COMMUNICATION PRODUCTS from 1 (most needed right now) to 8 (least needed right now). The goal would be to tailor these for southern Lake Michigan. They could be graphics, videos, and/or fact sheets, and the intent is for them to be widely available for use.
 - a. Long term effectiveness of particular actions (e.g., shoreline hardening, beach nourishment; including cost estimates)
 - b. How actions taken locally will affect neighbors (e.g., erosion along other shorelines)
 - c. How lake level changes affect different sectors (i.e., industrial, natural, recreational, privately owned areas), including how sectors and/or impacts are connected
 - d. How to install shoreline protections such that you minimize negative impacts on your neighbors
 - e. Why stakeholders can and should focus on variability in lake levels rather than long-term trends
 - f. What affects lake levels, are they easy to control (e.g., relative contribution of natural processes versus human interventions such as regulating outflows)
 - g. How you define a shoreline can differ depending on your goals; show different ways people define a shoreline
 - h. Local case studies of successful mitigation actions (e.g., traditional actions like shoreline hardening, beach nourishment, natural shorelines or relocation)

- 3) Rank the following MAPS, TOOLS, or DATASETS from 1 (most needed right now) to 7 (least needed right now). The goal would be to tailor these for southern Lake Michigan.
 - a. Location of highest risk areas under high or low water levels, including critical infrastructure and parks
 - b. Location of different shoreline management strategies that can be updated in real-time
 - c. Photos (with metadata, taken in consistent ways) or gauge data from more locations under more conditions so studies can examine trends over time and space; this could include historic information
 - d. Higher resolution models to predict very local changes under different scenarios (e.g., long-term forecasts, climate scenarios, modifying shorelines)
 - e. More and centralized data on groundwater
 - f. A comprehensive hydrologic model for the area
 - g. Status of structures put in place in 1986 to mitigate effects of high lake levels

- 4) Rank the following RESEARCH PRIORITIES from 1 (most needed in the short term) to 6 (least needed in the short term). The goal would be to tailor these for southern Lake Michigan.
- a. What will be the economic impacts to different sectors under different scenarios (high lake levels, low lake levels, fluctuating back and forth on a shorter time scale)?
 - b. How does ice formation and duration affect shoreline erosion in southern Lake Michigan?
 - c. How can we best communicate that actions taken locally, right now, will have broad spatial and temporal impacts?
 - d. What are the best strategies for managing dynamic shorelines given that we expect lake levels will change?
 - e. Is variability in water levels in southern Lake Michigan primarily attributable to changes in period of fluctuations, or magnitude of fluctuations? What may happen in the future?
 - f. What are the specific effects of high waves, stormwater surges, wave runup, and/or seiches on local shorelines under different water level scenarios?

Appendix 5. Resource List

The resources below represent a non-exhaustive list of various tools, products, data sets, etc. that were presented, discussed, shared or otherwise mentioned throughout the series of workshops posted by Illinois-Indiana Sea Grant.

- 1) [Environmental Law & Policy Center](#)
 - a. [The Impacts of Climate Change on the Great Lakes](#)
- 2) [Federal Emergency Management Agency](#)
 - a. [Video: Mapping Flood Risk Along the Great Lakes](#)
 - b. [Coastal Flood Insurance Rate Maps](#)
 - c. [FEMA Mapping Information Platform](#)
 - d. [FEMA Flood Map Products](#)
 - e. [FEMA Map Service Center](#)
 - f. [Flood Insurance Center \(1\)](#)
 - g. [Flood Insurance Center \(2\)](#)
 - h. [Flood Risk Study Engineering Library](#)
 - i. [Flood Study Data Request Form](#)
 - j. [National Mitigation Investment Strategy](#)
- 3) [GEI Consultants](#)
- 4) [Great Lakes Coast](#)
 - a. [Technical Resources](#)
- 5) [Great Lakes Integrated Sciences and Assessments](#)
 - a. [NCA3 Great Lakes Regional Climate Change Maps](#)
- 6) [Great Lakes Observing System](#)
- 7) [Great Lakes Sea Grant Network](#)
- 8) [Illinois Department of Natural Resources](#)
 - a. [Coastal Management Program](#)
 - b. [Sand Management Working Group](#)

- 9) [Illinois State Geological Survey](#)
 - a. [StoryMap: Illinois Beach State Park: A Dynamic Shoreline](#)
 - b. [StoryMap: A Vanishing Coast](#)
- 10) [Indiana Department of Natural Resources](#)
 - a. [Lake Michigan Coastal Program](#)
- 11) [International Joint Commission](#)
 - a. [Great Lakes-St. Lawrence River Adaptive Management Committee](#)
- 12) [Michigan Sea Grant](#)
- 13) [Midwestern Regional Climate Center](#)
 - a. [Great Lakes Region: Climate Impacts and Outlook Reports](#)
- 14) [National Ground-Water Monitoring Network](#)
- 15) [National Weather Service](#)
 - a. [Climate Prediction Center](#)
- 16) [NOAA Great Lakes Environmental Research Laboratory](#)
- 17) [NOAA National Centers for Environmental Information](#)
 - a. [Climate at a Glance](#)
- 18) [NOAA National Data Buoy Center](#)
- 19) [NOAA Office for Coastal Management](#)
 - a. [U.S. Great Lakes Hardened Shorelines Classification 2019 Dataset](#)
 - b. [Lake Level Viewer](#)
 - c. [Digital Coast](#)
- 20) [NOAA Tides & Currents](#)
 - a. [Water Levels — Station Selection](#)
- 21) [Purdue Climate Change Research Center](#)
- 22) [SmithGroup](#)

23) [University of Wisconsin – Madison: Department of Geography](#)

- a. [Bluff Erosion Visualization](#)

24) [US Army Corps of Engineers Detroit District](#)

- a. [Water Level Forecasts](#)
- b. [Water Level Observations](#)
- c. [Basin Conditions and Other Great Lakes Information](#)
- d. [Living on the Coast](#)

25) [Wisconsin Coastal Management Program](#)

26) [Wisconsin Department of Natural Resources](#)

27) [Wisconsin Geological and Natural History Survey](#)

28) [Wisconsin Sea Grant](#)

29) Other — Books

- a. The Death & Life of the Great Lakes — Dan Egan
- b. The Great Lakes Water Wars — Peter Annin
- c. Sinking Chicago: Climate Change and the Remaking of a Flood-Prone Environment — Harold L. Platt