Workshop Summary

Great Lakes Engineering With Nature® (EWN®) Natural and Nature-Based Features Playbook Workshop

Date: January 24 and 25, 2023

Location: USACE Chicago District, 231 S. LaSalle Street, Chicago, Illinois 60604

Speakers/Leads

Jeffrey King	USACE ERDC	Ram Mohan	Anchor QEA
Burton Suedel	USACE ERDC	Sean Burkholder	DRC/University of Pennsylvania
David Bucaro	USACE Chicago	Brian Majka	GEI
Steven Fischer	USACE Chicago	Enda Murphy	NRC Canada
Samantha Belcik	USACE Chicago	Scott Baker	NRC Canada
Jen Miller	USACE Chicago	Scudder Mackey	ODNR
Joe Miller	USACE Chicago	Debi Beck	ODNR
Josh Unghire	USACE Buffalo	Craig Taylor	LimnoTech
Jim Selegean	USACE Detroit	Adam Bechle	University of Wisconsin
Becky Nicodemus	NOAA		

Workshop agenda and the list of attendees can be found in Attachments 1 and 2. Summary slides from the workshop are available at the link below.

- Kick-Off: Developing the Great Lakes Natural and Nature-Based Features Playbook (https://ewn.erdc.dren.mil/?p=10820)

Goals and Objectives

The goal of this workshop was to facilitate discussion to inform a Great Lakes-specific guidance (i.e., Playbook) for strategic implementation of Natural and Nature-Based Features (NNBF) and Multiple Lines of Defense (MLD) to improve future coastal resiliency. This guide will help advance the understanding of NNBF and MLD emerging technologies in the Great Lakes Region and provide federal, state, and local agencies' solutions for adapting cost-effective NNBF and flood risk management (FRM) practices. General intended outcomes from development of the Playbook are as follows:

- Strengthen application and facilitate implementation of EWN and NNBF along Great Lakes coastlines.
- Review and advance specific project opportunities along the Great Lakes where EWN and NNBF principles can be applied and identify next steps to take projects from concept design to construction.

The key objective of the workshop is to integrate engineering with nature (EWN) concepts as part of the overall Great Lakes Coastal Resiliency Study (GLCRS), so that specific guidance and protocols can be provided to the practitioner by doing the following:

- Providing an opportunity for subject matter experts to share their ideas for designing and constructing Great Lakes coastal projects incorporating EWN/NNBF for maximizing FRM, economic, environmental, and social value.
- Working with partners to identify existing EWN/NNBF projects designed and constructed under a range of conditions in the Great Lakes.
- Determining next steps including follow-on opportunities to continue collaborative discussions to develop content for an EWN/NNBF Playbook for the Great Lakes.
- Developing a fact sheet summarizing the results of the workshop that discusses purpose, objectives, outcomes, and tangible next steps towards developing the Playbook.

Summary of Workshop Activities

The plenary session focused on "Setting the Stage" was held over two days with a variety of speakers to provide background information on the state of EWN in the Great Lakes from a variety of perspectives including federal, state, academia, international neighbors, and industry experts. As part of the workshop, three breakout sessions were held for smaller breakout group discussions focused on: 1) identifying EWN/NNBF priorities and the current state of practice, 2) understanding what exists to support EWN/NNBF and the associated challenges, and 3) prioritizing themes and identifying next steps. Each breakout session utilized key questions to facilitate discussion for each group. Overarching themes and highlights from those sessions are summarized below.

Breakout Session 1: Identifying EWN/NNBF Priorities and the Current State of Practice

1. What is our current state of understanding of EWN/NNBF principles?
2. What aspect of EWN/NNBF do you think requires more emphasis?
3. How do we apply EWN/NNBF to existing or new projects, and what, if any, limits us?
4. What specific conditions do you seek to improve using NNBF/EWN?

Summary of Key Points

Current State of EWN/NNBF: Principles and Goals

- The U.S. Army Corps of Engineers (USACE) has a goal to beneficially utilize 70% of material dredged by 2030 and is currently assessing how to integrate beneficial use (BU) of dredged material more effectively into navigation, habitat restoration, and FRM projects.
- The definitions of EWN and NNBF appears to vary between stakeholder groups.
  - Stakeholders and communities are generally supportive but apprehensive of what exactly EWN solutions mean and the effectiveness of those EWN solutions.

- Many projects are currently implemented on the scale of owner/user/individual project.
  - EWN solutions can be implemented on the smaller-scale but should be assessed and integrated in a larger, regional, and system-wide approach, which requires extensive stakeholder engagement and alignment of goals.
- Ownership and responsibility for the various phases of a project (from planning, engineering, and design through construction, and then through long-term maintenance, operation, and monitoring) appears to be segmented and misaligned between the various project stakeholders.
  - Lack of funding and resources for any phase of the project can impact adaptive management and development of lessons learned for EWN/NNBF projects, which ultimately may impact confidence in the success of such projects.
- From a regulatory standpoint, the USACE does not permit its own projects but does complete analysis required by the Clean Water Act for federal consistency.
  - Sometimes there is misalignment and disconnect between various agencies and stakeholders on the definition and measurement of the impacts and benefits of a project when compared to the overall net project benefits, which can result in what appears to be "mitigating for mitigation projects."
- The public trust doctrine protects the public's right to use the waters of the Great Lakes for purposes such as navigation, hunting, and fishing.
  - Interpretation and application of this doctrine lacks consistency in implementation as it pertains to EWN/NNBF projects across various jurisdictions.

Aspects of EWN/NNBF Requiring More Emphasis

- Demonstration of successful implementation of NNBF will be necessary for accomplishing the following:
  - Implementing USACE goal of BU of 70% of dredged material by 2030.
  - Promoting and supporting NNBF for years to come with monitoring and adaptive management.
- Consideration will need to be given to the economic impact of EWN projects balanced with the other social, ecological, and regional benefits.
- Project teams will need to work with state agencies and non-governmental organizations (NGOs) to build more NNBF projects based on existing successful ecosystems and projects, such as progress made in Lake Ontario.
- Early and often stakeholder and community engagement are not consistently emphasized during project development. Programmatic changes may be necessary at the local, state, and federal levels to integrate considerations from community engagement, regulators, and planners into all phases of the project development.
- Determination of project goals and success matrices will be important. Project teams will need to establish decision-making criteria in order to accomplish the following:
  - Address perceived issues early in project development (i.e., littoral drift, impact to bottom, etc.).

  - Consider criteria that quantifies and determines the success or effectiveness of a project.
- Consideration and establishment of the roles each agency and stakeholder will take in monitoring and implementation of performance standards will be necessary.
- Marketing and messaging of sediment as a resource (i.e., BU of dredged material) may be necessary to change the connotation and historic perceptions of the needs and opportunities in the region.
- Consistent messaging and unified ease of access to educational and implementation resources focused on NNBF solutions would help facilitate implementation on the individual project level for an overall regional impact.
- Identification of and connection to funding sources from the local, state, and federal level for EWN projects and NNBF would be helpful along with education on effective implementation and long-term benefits realization for EWN projects.

Application of EWN/NNBF to Existing or New Projects

- Existing maintenance projects may pose opportunity for short-term transition along the spectrum from grey to green infrastructure.
- Solutions may need to be a hybrid approach between conventional methods and EWN solutions to increase confidence in the "level of protection." Effective solutions in some scenarios may utilize MLD—marrying grey and green solutions.
- Consider system-wide and ecosystem-wide impacts and benefits for EWN solutions and the importance of the synergy and connectedness of how a project fits into a whole system.
- Regulatory frameworks at the local, state, and federal levels may need to be considered and adjusted to permit on the project level with consideration to system-wide solution impacts.
  - Breakout groups noted that a vast majority of the properties on the Great Lakes are private property, and it needs to be considered how smaller parcels can unify to put EWN solutions in place for a system-wide benefit.
  - Typology differences between urban and other landscapes can be very dramatic and will likely require MLD for effective implementation, which may have competing or conflicting regulatory requirements and project controls.
- Visual depiction of concepts and projects would be useful in conveying technical design concepts to all stakeholders.
- EWN often has a long-term net-benefit but can have a short-term economic impact. When funding becomes constrained, overall net-benefits of a project needs to be considered when reducing the project's scope and impact.

Factors to Improve EWN/NNBF

- Breakout groups suggested that the term "monitoring" should be replaced with "stewardship" as it implies long-term relationships and connections.
- Confidence in EWN/NNBF solutions will need to be built and maintained for application along the Great Lakes coastlines.

  - Breakout groups recommended compiling and developing a tool kit for stakeholders and communities, focusing on socioeconomics, resiliency, restoration, funding opportunities, design guidelines, etc., to build confidence in EWN solutions and providing a centralized location for information, education, and resources.
  - Connection to various funding sources, opportunities, and solutions are needed at the local, state, and federal levels for implementation of NNBF including education about the benefits of EWN. Potential funding options should be considered, identified, and distributed at the local, state, and federal project levels (i.e., possibly utilize Infrastructure Investment and Jobs Act [IIJA] funding to create opportunities for EWN implementation).
  - Existing funding streams and authorizations should be considered to pilot NNBF solutions including repair of existing federal projects requiring maintenance, which would emphasize opportunity for localized implementation of EWN solutions utilizing NNBF on a short-term scale and provide short-term successful demonstration projects that can be utilized for community engagement for long-term implementation.
- A system-wide assessment of resources and impacts may be necessary (e.g., how do individual projects impact littoral drift? Are sediments replenishing where necessary and sourced where sustainable?)
- Stakeholder alignment and engagement will be critical for successful EWN.
  - Project teams should meet early and often with stakeholders to enhance stewardship of the project in the long run for respectful engagement.
  - Engagement with the full suite of potential stakeholders will be necessary to establish effective project development and implementation teams.
  - Effective stakeholder engagement should occur locally where stakeholders exist.
  - Large-scale EWN workshops and information distribution would help socialize NNBF solutions.
  - Existing processes and protocols at all levels should be reviewed for effectiveness and impact on overall net-benefits (e.g., NNBF as part of National Environmental Policy Act [NEPA] process).
  - In terms of mitigation, these projects should be considered net positive projects, and there should be a shift in the regulations that currently require mitigation of dredged material. Consideration and definition for the measurement of project success will be critical. For example, one goal of the EWN solution may be based on parameters that can be measured such as water elevation or accretion of sediment, rather than fish colonization or other biological components that may be more easily influenced by factors beyond project control.
- Education and Promotion
  - Create materials for teaching purposes given the interest in EWN.
  - Better educational and decision tools are needed to help get more of these projects off the ground and with the explanation of all the different co-benefits.

- There will be a database solution and coastal practice 3-day course in Galveston in the beginning of June that will be focusing on EWN.
- Education is key with providing more knowledge at all levels from property owners to practitioners.
- Many universities are now developing curriculums for EWN. For example, Texas A&M has a new week-long summer short course on "Coastal Practice and Nature-Based Solutions," targeted for practitioners.
- EWN website has a wealth of information and access to continuation hours.
- In the same way that engineers are getting experience with planting plans and ecological restoration, there is interest in hearing about coursework/continuing education opportunities appropriate for ecologists/biologists who want to incorporate EWN into their work.

Breakout Session 2: Understanding What Exists to Support EWN/NNBF and Associated Challenges

1. What criteria do you use to measure the success of EWN/NNBF?
2. Should long-term monitoring and adaptive management be "presumed" in EWN/NNBF projects, and to what extent?
3. What is the trade-off between use of EWN/NNBF and protection from higher force natural events?
4. Are EWN/NNBF projects less protective than hard structures and how do we justify that?

Summary of Key Points

Various Criteria Used to Measure the Success of EWN/NNBF

- Clearly defined expectations will be necessary to determine success of EWN projects.
- Successful EWN projects will need to measure implementation and success differently than the traditional federal standard and consider engineering/FRM performance that balances economics, environmental, other social effects, and regional benefits.
- Metrics and means of determining success for the other social benefits of projects will need to be considered along with how those other social benefits will be maintained and enhanced. For example, successful projects may maintain public access, improving view scape, and provide human connection to coastal environments.
- Projects should, in some cases, re-establish coastal processes that have been impacted: for example, sediment transport.
- NY Coastal Management Program has a statewide shoreline monitoring framework, which was originally developed with significant regional stakeholder engagement and reviewed resilience performance relative to ecological systems, hazard mitigation, and socioeconomic benefits (broader community benefits). This is more holistic in terms of how the New York program defines success. However, the landowner will need to play a heavy role in defining success. This model could be considered and evaluated for wider implementation.
- Expectations (and priorities) will likely vary among different stakeholders or interested/affected groups.
- Designs that get implemented along the coast are heavily influenced by the available budget for construction. EWN solutions will need to consider the capital expenditures and operational expenditures required as part of the decision-making regime.
- The timeframe over which to assess the effectiveness and success of implemented projects will need to be considered (e.g., What does success look like in 5 years versus 50 years?)

Long-Term Monitoring and Adaptive Management in EWN/NNBF Projects

- Long-term stewardship should be the goal.
- Funding for monitoring and adaptive management needs to be built in from project conception and development, and not as an afterthought.

- Maintenance (which is different from adaptive management) needs to be considered in the decision-making regime including responsibility for maintenance. Regulations, guidance, or oversight may be required to ensure long-term monitoring and adaptive management are effectively incorporated into EWN projects.
- From a regulatory perspective, it seems when monitoring is required, it tends to focus primarily on ecological monitoring, but monitoring the success of projects may need to consider broader metrics.
- Long-term funding sources and options will be critical since monitoring, maintenance, and adaptive management currently tends to get postponed when funding is tight.
- Adaptive management of NNBF and EWN solutions may take a cultural shift in viewpoint of success. Some funding sources like National Fish and Wildlife Foundation (NFWF) have a separate monitoring/adaptive management category. It really helps normalize this need and contributes to the cultural shift.
- The use of biodegradable materials (woody debris, mats, coir logs, etc.) will require monitoring/replacement over time unless that degradation is incorporated into the design.

Trade-offs Between Use of EWN/NNBF and Protection from Higher Force Natural Events

- EWN solutions will need to balance economics, environmental stewardship, other social effects such as human health, and longer-term regional benefits.
- Phased solutions may be necessary to provide coastal resiliency while vegetation establishes and matures. Soft solutions should be considered as one phase of MLD (e.g., for higher energy wave environments).
- Often EWN requires a much larger footprint to provide similar level of protection (i.e., seawall vs. nearshore reef); lakebed fill is a trade-off since EWN solutions occupy more lake bottom than traditional solutions (i.e., a rock revetment).
- In some cases, hardened structures lead to displaced sediment and malnourished beach shorelines nearby whereas EWN solutions would reduce these impacts.
- MLD may be required for increased levels of FRM. Maintenance and adaptive management practices (AMPs) can increase the effectiveness of EWN projects.
- Working with nature and mimicking natural shorelines and coastal processes can increase natural resiliency. Strategic consideration for protection of manufactured assets, infrastructure, etc. may be required for long-term sustainability of systems.
- There are concrete examples from Hurricane Fiona, where beach nourishment schemes provided better protection than adjacent rock revetments.
- There is the timelapse between maximum protection when some of the protection comes from vegetation maturity/root protection as opposed to short-term/more immediate protection factor from hardened structures (from a site basis vs. from a watershed level protection).
- A change in mindset for lakeshore owners may be required since they are living in a dynamic environment.

- Planned retreat can be viewed as a nature-based solution. There are some case studies and insights on planned retreat in Canada in *Planned Retreat Approaches to Support Resilience to Climate Change in Canada* includes consideration of planned retreat at communities on Lake Erie.
  - Social justice may be a critical component of a strategic shoreline retreat that may need to include zoning, planning, and private property for vulnerable communities and unintended consequences of investment (e.g., eco-gentrification). The breakout groups expressed interest in future workshops that incorporate agencies involved in housing/zoning/etc.

Breakout Session 3: Prioritization of Team Ideas and Defining Next Steps for the Playbook

- What are the knowledge gaps that must be resolved for more frequent use of EWN/NNBF projects?
- What are the challenges/barriers to EWN project implementation?
- What are your thoughts on the potential use of EWN/NNBF in a non-habitat-focused project?
- Can EWN/NNBF principles be applied to modify 'grey' infrastructure projects (i.e., to benefit local ecology)?

Summary of Key Points

Data/Knowledge Gaps

- Defining criteria for multi-purpose, co-benefit projects (EWN/GLCRS) vs. Ecosystem Restoration projects
- National Oceanic and Atmospheric Administration (NOAA) National Centers for Coastal Ocean Science (NCCOS) as possible source for long-term monitoring
- Universities (e.g., University of Illinois)
- Obliques! Easy access to aerials, obliques, and system-wide information is limited.
- Engineers are focused on the solution and not the effects of implementing the solution or the process.
- Solutions are dependent on stakeholders' viewpoints. There is a social aspect to projects that needs to be captured. There needs to be social scientist input regarding eco-gentrification and environmental justice; projects have consequences.
- Not having consensus on whether to protect bluffs is a good thing. A task force to investigate it is needed.
- Are there any data on how ice effects EWN solutions in the great lakes?
  - Ice forces do need to be considered in some areas and are included in the design process. How are pristine conditions also affected by ice conditions? Ice can also be an estuary problem.

Barriers/Challenges Inhibiting Effective Implementation of EWN/NNBF Projects

- Lack of standards for design, implementation, and long-term effectiveness of EWM projects
- Data sharing between stakeholders, agencies, and project partners is often lacking.
- Proof of concepts (demo projects) are limited.
- Definition of monitoring and success is unclear.
- Funding and responsibility for maintenance and adaptive management is not well defined.
- Eco-gentrification:
  - NOAA has been working on this issue, but there is paper by Hope Shinn (2021; *Green Infrastructure and Gentrification: Bibliography*) on what can be done to discourage it. There will be a webinar on this as well soon.

- There is fallout from the "fastest, cheapest solution" approach. The federal laws (NEPA and related) allow too much wiggle room when considering the effect of implementation. Baseline and minimally acceptable should not be the standard. It is necessary to think more creatively about how cost systems are weighted.
- Plants need to be established at low water, when it is not needed, so that once the water rises again, the plants and root system will be established when needed.
  - More information on anti-displacement strategy can be found in the Rigolon and Christensen 2020, Pinter 2021, and New York Sea Grant 2022.
- There are not a lot of regulatory frameworks that put value on the cultural benefits that come from the EWN solutions. Additional specialists (i.e., social scientists) may need to be engaged to further assess the other social benefits of EWN projects.
- There needs to be serious consideration and assessment on the presence of invasive organics and contamination when determining sand eligibility for reuse, particularly when moving sand and sediments to other project locations.
  - On reservations, the greatest areas of invasive plant impacts are usually related to the area of development and what contractors brought in.

Current Opportunities for Advancing Use of EWN Approaches

- Indiana – identify restoration sites, citizen science input, coastal hazard mitigation; and restore national parks
  - Key stakeholders: local communities
- Michigan – IIJA projects, infrastructure, Grand Haven coal plant, Benton Harbor(?), Traverse City, Detroit River (large, decadal project)
  - Key stakeholders: NGOs, Council of Governments, Michigan Association of Planning
- New York – South shore of Lake Ontario and Lake Oswego dredging (BU)
  - Key stakeholders: The Nature Conservancy, Waterkeeper, Department of Environmental Conservation Great Lakes program, New York State Parks
- Illinois – Similar shoreline projects, maybe near Chicago brownfields/legacy sites
  - Key stakeholders: Illinois Department of Natural Resources (DNR), Shoreline Management Working Group (SMWG)
- NOAA funds restoration design across the Great Lakes region (e.g., National Coastal Resilience Fund [NCRF], Great Lakes Restoration Initiative [GLRI] funds)

EWN Support Tools

- We need an understanding of what tools are available and what the challenges are:
  - N-EWN (Network for EWN) and training
  - Factsheets
  - NOAA guidance docs
  - State guidance documents
  - QAPP for data collection for maintenance to ensure defensible, quality data

- A Natural Infrastructure Opportunities Tool (NIOT)-type regional tool would be useful.
  - A dedicated NIOT tool might be great, and this might be a prime time to get something like this up and running. The relationship can help foster this type of work within the great lake's region. Include colleagues in Canada in this conversation to help expediate this process.
- Develop input process to GLCRS project formulation (in the next 18 months).

Challenges and Barriers to EWN Implementation

- What is stopping us is not a lack of knowledge. There needs to be focus on:
  - Scalability—examples and opportunities for large/small scale implementation
  - Homeowner/property owner understanding
  - Lack of education and certification (skill sets needed) for practitioners
  - Regulatory issues
  - Risk tolerance
  - Environmental justice
  - Stewardship! Long-term ownership including operations and maintenance (O&M), monitoring, and adaptive management, and funding for these
  - Changing attitudes to own the projects
  - Funding strategies

Measuring Performance

- There is still somewhat of a data gap on how to measure performance.
- Need a "home" – EWN website to centralize information for distribution.
- Encouragement is needed to collect varying levels of data.
- How long are long-term maintenance and AMP needed and with what parameters?
- Post-storm monitoring to measure project evolution.
- Performance measures are important and difficult. The goals of the project should be defined from the beginning so that it can be properly monitored.
- Maybe process and performance are better things to track than structure and form.
- EWN is a long-term solution, which needs a change in perception. It may take more time to establish. However, there is a need for MLD, but not everything works everywhere.

Playbook Considerations

- Who is this playbook for? Practitioners or the public?
- Multiple volumes or technical information could be in a separate bibliography, keeping technical information available but separate.

Next Steps

- Need to know how to make the homeowner say "yes" to EWN projects for integration into larger scale and more regional ecosystem-wide EWN solutions.
- Ecologically enhanced hardened shorelines are the goal of EWN solutions, but a phased approach to retrofitting existing grey infrastructure could be utilized for MLD.
  - An analogy can be made to the pollinator garden.
  - Consider using modified grey infrastructure to help gain acceptance, especially when more comprehensive solutions are not accepted.
- There is a preference for projects that include internships, job training, apprenticeships for EWN for additional social benefits.
- Need a paradigm shift towards "healing" the lakes. Need to incentivize this shift by possibly driving the shift from the federal government.
- Address regulatory and policy issues.

Dream Projects Ideas

- Remove structures and soften shorelines where feasible.
- Restore legacy lands (e.g., steel mills).
- Add EWN to GLRI/Great Lakes National Program Office (GLNPO) areas of concern (AOC) restoration.
- Consider community-based EWN ideas on a regional scale.
- Reclaim/create shoreline parks (and retreat from existing grey infrastructure).
- Possibly create a wetland in Chicago to demonstrate urban implementation for maximum visibility.
- Restore waterways significantly impacted by industrial operations (e.g., Calumet Harbor).
- Develop projects to restore littoral drift on a regional scale.
- Wildest dream ideas:
  - Make a giant national park along the shoreline.
  - Consider land back programs like California's (return possession of land to the Indigenous peoples for them to manage).
  - Buy all the natural lakeshore for protection.
  - Note, wildest dreams may not be engineering solutions. Some the best ideas are "un-engineering" and letting nature be. EWN may be a bridge to get there. Land use is big issue to consider.
  - Create partnerships with affordable housing with EWN to address climate change impacts.
  - Ensure communities relate to nature.

Attachment 1
Workshop Agenda

AGENDA

Great Lakes Engineering With Nature® (EWN®) Natural and Nature-based Features Playbook Workshop

Date: 24-25 January 2023

Location: Central Standard Building
231 S La Salle St, Chicago, IL 60604
Basement Conference Center

Virtual Option: https://usace1.webex.com/meet/jennifer.miller
Join by phone
+1-844-800-2712 US Toll Free
+1-669-234-1177 US Toll
Access code: 2763 294 8822

Workshop Purpose:
The key objective of the workshop is to integrate engineering with nature (EWN) concepts as part of the overall Great Lakes Coastal Resiliency Study (GLCRS), so that specific guidance and protocols can be provided to the practitioner. Great Lakes communities along the Great Lakes coastline are experiencing increased frequency in coastal flooding and erosion, causing property damage, putting lives at risk, and disrupting local economies. Recent historic high lake levels illustrate the widespread vulnerabilities along the coast. Natural and Nature Based Features (NNBF) are measures and techniques that can be incorporated into shoreline protection to reduce flood risk and improve resilience of coastal and inland water systems. However, current understanding of NNBF and Multiple Lines of Defense (MLD) coastal resiliency measures is mostly limited to ocean coast, resulting in lack of confidence on the applicability and cost-benefit of these measures in the Great Lakes. Engagements and discussions with Great Lakes Communities revealed the need for NNBF guidance specific to the Great Lakes. Without greater understanding and guidance, a paradigm shift from traditional flood risk management (FRM) practices to NNBF will not occur. USACE also needs this guidance to confidently consider these types of measure as part of the GLCRS and related follow-on studies.

Workshop Outcomes:

- Strengthen application and facilitate implementation of EWN and NNBF along Great Lakes coastlines.

- Review and advance specific project opportunities along the Great Lakes where EWN/NNBF principles can be applied and identify next steps to take projects from concept design to construction.

Workshop Objectives:

- Provide an opportunity for subject matter experts to share their ideas for designing and constructing Great Lakes coastal projects incorporating EWN/NNBF for maximizing flood risk management (FRM), economic, environmental, and social value.
- Work with partners to identify existing EWN/NNBF projects designed and constructed under a range of conditions in the Great Lakes.
- Determine next steps including follow-on opportunities to continue collaborative discussions to develop content for an EWN/NNBF Playbook for the Great Lakes.
- Develop fact sheet summarizing the results of the workshop that discusses purpose, objectives, outcomes, and tangible next steps towards developing the Playbook.

Day 1

Time	Action	Lead or Speaker
8:00 – 8:30	Arrive & check in (Basement Conference Center)	All
8:30 – 8:45	Welcome/Quick Introductions	LTC Broderick, King/Suedel
8:45 – 9:15	Engineering with Nature (EWN) for Great Lakes Coastal Systems – Application to NNBF and development of the Playbook	King/Suedel
9:15 – 9:30	Initial Thoughts	All (Suedel facilitates)
Plenary Session Begins: Setting the Stage		
9:30 – 10:15	EWN Project Ideas Handbook - A Review of Process, Tools, and Lessons Learned	Ram Mohan (Anchor QEA) Sean Burkholder (DRC/U. Penn)
10:15 – 10:30	Break	
10:30 – 11:00	Overview of USACE Work with Linkages to EWN	Josh Unghire (Buffalo) Samantha Belcik (Chicago) Jim Selegean (Detroit)
11:00 – 11:15	Overview of EWN/NNBF projects around the Great Lakes (Survey 123 output)	Joe Miller
11:15 – 11:45	Discussion of EWN/NNBF project ideas	All (Ram Mohan & Sean Burkholder facilitates)
11:45 – 12:30	Lunch Catered by Naf Naf Grill	All
Plenary Session Continues: Setting the Stage with EWN Partners		
12:30 – 12:55	Applied Research to Guide Engineering with Nature on the Great Lakes	Enda Murphy/Scott Baker, NRC Canada
12:55 – 1:20	What Does Successful EWN in the Great Lakes Look Like?	Brian Majka, GEI
1:20 – 1:45	Examples of Nature-Based Solutions in Ohio; Regional Approaches – Projects, Education and Training	Scudder Mackey/Debi Beck, ODNR
1:45 – 2:10	Nature-based Shorelines on Wisconsin's Great Lakes Coasts	Adam Bechle, U Wisconsin
2:10 – 2:25	Break	
2:25 – 2:50	A Perspective on Great Lakes EWN	Craig Taylor, LimnoTech
2:50 – 3:15	Advancing Nature-based Solutions in the Great Lakes	Becky Nicodemus, NOAA

3:15 – 3:30	Plenary: Introduction of Breakout Group Process	Suedel
3:30 – 4:45	Breakout Session 1 – Identifying EWN/NNBF priorities and the current state of practice	All (Team POCs to lead)
4:45 – 5:00	Summarize and Adjourn Day 1	Suedel
Evening	Tentative no host social opportunity: Elephant and Castle, 111 W. Adams St. (one block north).	Bucaro to take an interest poll

Day 2

Time	Action	Lead or Speaker
8:00 – 8:30	Arrive	All
Breakout Session Begins: Focused Coastal Applications of EWN		
8:30 – 9:30	Plenary: Session 1 Report Out & Discussion of Results (10 mins per group including Q&A)	Suedel, Team POCs
9:30 – 10:30	Breakout Session 2 – Understanding what exists to support EWN/NNBF and associated challenges	All (Team POCs to lead)
10:30 – 10:45	Break	
10:45 – 11:45	Plenary: Session 2 Report Out & Discussion of Prioritization Results (10 mins per group including Q&A)	Suedel, Team POCs
11:45 – 12:00	Plenary: Instructions for Breakout Session 3	Suedel
12:00 – 2:30	Working Lunch (Catered by Giordano's) & Breakout Session 3 – Prioritization of team ideas and defining next steps for the Playbook	All (Team POCs to lead)
2:30 – 2:45	Break	
2:45 – 4:00	Plenary: Voting Exercise to Prioritize Proposed Projects & Day 2 Recap	Suedel, All
4:00 – 4:30	Closing Thoughts & Next Steps	Suedel
4:30	Meeting Adjourns (Dinner on your Own)	

Breakout Groups:

Team 1 – in person group
Facilitator – Burton Suedel
Notetaker – Alyssa Calomeni
Location – Large Conference Room

Team 2 – in person group
Facilitator – Ram Mohan
Notetaker – Sam Belcik
Location – Small conference room

Team 3 – Virtual group A
Facilitator – David Bucaro
Notetaker – Joe Miller
Location – Lobby

Team 4 – Virtual group B
Facilitator – Jen Miller
Notetaker - Anna Coval
Location – large conference room back corner

Breakout sessions

As part of the workshop, we will divide into three breakout sessions and focus on the following general themes:

- Breakout Session 1: Identifying EWN/NNBF priorities and the current state of practice
  - What is our current state of understanding of EWN/NNBF principles?
  - What aspect of EWN/NNBF do you think requires more emphasis?
  - How do we apply EWN/NNBF to existing or new projects, and what, if any, limits us?
  - What specific conditions do you seek to improve using NNBF/EWN?

- Breakout Session 2: Understanding what exists to support EWN/NNBF and associated challenges
  - What criteria do you use to measure the success of EWN/NNBF?
  - Should long-term monitoring and adaptive management be "presumed" in EWN/NNBF projects, and to what extent?
  - What is the trade-off between use of EWN/NNBF and protection from higher force natural events?
  - Are EWN/NNBF projects less protective than hard structures and how do we justify that?

- Breakout Session 3: Prioritization of team ideas and defining next steps for the Playbook
  - What are the knowledge gaps that must be resolved for more frequent use of EWN/NNBF projects?
  - What are the challenges/barriers to EWN project implementation?
  - What are your thoughts on the potential use of EWN/NNBF in a non-habitat-focused project?
  - Can EWN/NNBF principles be applied to modify 'grey' infrastructure projects (i.e., to benefit local ecology)?

Discussion Rules:

Please silence all WMDs (weapons of mass distraction)
Share the Air
Limit Acronyse (explain first time used)
Respect Time Allotments
Avoid Sidebar Conversations
Minimize "Bunny Trails", Stay Focused on Topic
Limit War Stories – Use Headline Version
Focus on the Quality Few versus the Mediocre Many
Disagree without being disagreeable
ELMO Empowerment (enough, let's move on)
Thumbs Voting for Quick Consensus, Dots for Other
OTRs (on time video rewards)

Have Some Fun!

Attachment 2
List of Attendees

Attachment 2
List of Attendees

Last Name	First Name	Organization
Agnew	Rory	Baird
Akina	Kaila	Gun Lake Tribe Tribal Historic Preservation Office
Baker*	Scott	National Research Council, Canada
Balasubramnayam	Vidya	Coastal States Organization
Bayers	Ania	Illinois Coastal Program
Beaver	W. Frank	Natural Resources Department, Little River Band of Ottawa Indians
Bechle*	Adam	Wisconsin Sea Grant
Beck*	Debi	Ohio Coastal Program
Belcik*	Samantha	U.S. Army Corps of Engineers (USACE) Chicago District
Bosche	Lauren	USACE Engineer Research and Development Center (ERDC) Cold Regions Research and Engineering Laboratory (CRREL)
Bradley	Doug	Electric Power Research Instititute
Brown	Bridget	Great Lakes and St. Lawrence Cities Initiative
Bucaro*	David	USACE Chicago District
Burkholder*	Sean	University of Pennsylvania
Calomeni	Alyssa	USACE ERDC Environmental Lab (EL)
Carrillo	Carra	USACE ERDC EL
Catcher	Karen	New York Natural Heritage Trust
Chlebus	Matthew	New York State Department of Environmental Conservation (NYSDEC)
Clarke	David	NYSDEC
Clohessy	Liz	NYSDEC
Cofrancesco	Alfred	USACE ERDC
Cousino	Brendan	LimnoTech
Coval	Anna	USACE Chicago District
Cox	Jack	Edgewater Resources
Crilly	Jennifer	Baird
Darnton	Ryan	National Oceanic and Atmospheric Administration (NOAA)
Davis	Brian	University of Virginia
Dey	Lauren	Tip of the Mitt Watershed Council
Donnell	T. Kevin	U.S. Environmental Protection Agency (USEPA) Great Lakes National Program Office (GLNPO)
Ellis	Eric	Great Lakes Commission
Eskew	Cody	Illinois Coastal Program
Exl	Joe	Indiana Department of Natural Resources (DNR)

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Fischer*	Steven	USACE Chicago District
Foley	Carolyn	Purdue University
Fraioli	Carolyn	New York Coastal Program
Gangai	Jeff	Dewberry
Geldard	Beth	NYSDEC
George	Libby	University of Windsor
Gere	Tanna	New York Coastal Program
Glandon	Hillary	University of Illinois
Greene	Steve	Federal Emergency Management Agency (FEMA)
Greer	Michael	USACE ERDC
Hackett	Tyler	Dewberry
Harewood	Greer	NOAA
Hayes	Kate	Credit Valley Conservation (CVC)
Henderson	Matt	Anchor QEA
Herleth-King	Shawna	USACE Chicago District
Herman	Brooke	USACE ERDC
Holmes	Rob	Auburn University
Jansen	Noah	Watershed council
Kaspar	Tyler	1854 Treaty Authority
King*	Jeff	USACE ERDC EL
Kirkpatrick	Emily	Michigan Department of Environment, Great Lakes, and Energy (EGLE)
Krumwiede	Brandon	NOAA Office for Coastal Management (OCM)
Laughlin	Kyle	Wisconsin DNR
Letosky	Melissa	Michigan EGLE
Lunardi	Brianna	University of Windsor
Mackey*	Scudder	Ohio DNR
Majka*	Brian	GEI Consultants
Malley	May	NYSDEC
Miller*	Jennifer	USACE ERDC EL
Miller*	Joe	USACE Buffalo District
Mitchell	Todd	USACE Buffalo District
Mohan*	Ram	Anchor QEA
Moran	Jenna	Association of State Floodplain Managers
Moser	Jennifer	USACE

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Murphy*	Enda	National Research Council (Canada)
Newcomb	Tammy	Michigan DNR
Nicodemus*	Rebecca	NOAA
Olinger	Diana	NOAA
Orsburn	Jenny	Illinois Coastal Program
Patterson	Noah	NYSDEC
Ren	Sarah	Watershed Center Grand Traverse Bay
Rhodd	Benjamin	Forest County Potawatomi
Ronge	Michael	Sokaogon Chippewa Community
Root	Emily	Buffalo Niagra Waterkeeper
Rosario	Mollie	FEMA
Russel	John	NYSDEC
Ruswick	Theresa	University of Pennsylvania
Salus	Lydia	Wisconsin DNR
Schrader	Beth	Lac Vieux Desert Band of Lake Superior Chippewa Indians
Selegean*	Jim	USACE Detroit District
Shannon	Danielle	USDA
Shively	Alina	Lac Vieux Desert Band of Lake Superior Chippewa Indians Tribal HPO
Simmons	Julie	NOAA Fisheries
Strelzoff	Audrey	USACE ERDC
Strevig	Mindy	Anchor QEA
Suedel*	Burton	USACE ERDC EL
Szabo	Sarah	Wisconsin DNR
Tatarevich	Stephany	NYSDEC
Taylor	Rachael	NOAA OCM
Taylor*	Craig	LimnoTech
Theuerkauf	Ethan	Michigan State University
Troy	Cary	Purdue University
Unghire*	Josh	USACE Buffalo District
Veraldi	Frank	USACE Chicago District
Widrig	Roy	New York Sea Grant
Wuycheck	Ronda	MI Coastal Program
Zomeren	Christine	USACE ERDC
Zuzek	Peter	Zuzek, Inc., Canada

Attachment 3
Project Development Breakout Group 1: Summary Work Products

Breakout #1

1-1

- Connecting Channels

- INDIANA SHORELINE.
  - OFFSHORE COBBLE BERMS.
  - OF LAKEPL system study.
  - ALL DUNES.
  - 6' over 7 years of change.

(NAT PARK AGENDAS)
"Marquette Plan"

NPS Comm./ Collab

- EASTERN OHIO/ LAKE ERIE
  - NO SEDIMENT SUPPLY
  - ALL HARDENED.
  - SEICHE EVENTS. up to 11'

- WESTERN ERIE
  - HABS/ Water Quality
  -

- LOW [redacted] ENERGY ENVIRONMENTS
  - LESS EROSION - MORE POLLUTION -

- "BARE CHANNEL CREATION"

- FORMER INDUSTRIAL AREAS

1-1

3 buckets.

- 🏘 · SOCIAL RISK
- · NATURAL ASSETS
- $ · MOST IMPACTED

"URBAN WATERFRONT"
HIGHLY ALTERED SYSTEM

1-2

- FEDERAL SCALE
  - · NAV · EDD · FRR · Water Ops ·

PILOT → LARGE SCALE. — BUT → "80% of the SHORELINE IS PRIVATE"

↓

THIS IS THE GOAL of the program.

- REGULATORY FRAMEWORKS / COORDINATION
- ALWAYS A FOOTPRINT QUESTION RE PUBLIC TRUST
  - PUBLIC TRUST TRANSLATION BY STATE INTERPRET
    - COULD VARY BY PERSON
- VERY SMALL COMMUNITY projects MIGHT BE NECESSARY SMALL COMMUNITIES (E.G. MICHIGAN)

Justify?

TOURISM ? BEACHES ARE AN OBVIOUS ATTRACTION (1-3)

BIRDS & FISH AESTHETICS ARE A REAL CONCERN

· "NATURE-APPROVED" - ISSUE W/ "NATURE DISNEYLAND"

· "SUSTAINABLE SMALL HARBORS program"
· "LAKE HURON FOREVER" — EXAMPLES OF SMALL communities working together.

· "LITTORAL SHEDS" - WE NEED MORE OF THESE

- GROUPS W/ SIMILAR ISSUES -

- NPS.

- MORE WORK ON "BEACH FILLS"

· MITIGATION BANK FOR SAND
· UPLAND SAND.
· OFFSHORE RESOURCES.
AT HEAD OF OLD SHORES.

- D.U.

- WILDLIFE REFUGES -

- COASTAL TARGETS FOR HOMEOWNERS / GRANT OPTIONS

* IN WORKING W/ FAILING / RETIRING INFRASTRUCTURE.

- EASIER TO FUND THAN TO PERMIT -
THIS IS AN OPPORTUNITY FOR INNOVATION.

(1-4)

- BREAKWATER "CHUNKS" ARE typically HOW THEY ARE DONE.
  - WORK WITH THE CHUNKS, WORK W/ EXISTING FOOTPRINT.

Overview/Summary

- NAV RELATES
- HOW to ADDRESS SOME PRIVATE LAND (most of the LAKES)
  - SOME KIND OF APPROVED PLAN
  - How to INCENTIVIZE IT?
  - LAND OWNER groups?
  - PERCEPTION ISSUES
  - PROVIDE EXPOSING SUPPORT
- PROJECT SCALE -
  - LITTORAL "SHEDS"
  - CURTAIN
  - DESIGN SHEDS.
- IN-WATER/PUBLIC TRUST REGULATIONS BY STATE.
- URBAN/POST INDUSTRIAL SITES
- WE NEED MORE SAND

Breakout Session #2

(1-5)

- Measuring EWN success
- What criteria do we use to measure success?

. Criteria
. Barriers
. Data Gaps

- CLEARLY ESTABLISHED GOALS w/ METRICS
- PHYSICAL, ECOLOGICAL, SOCIAL
- SUCCESS IS TIME BASED. OR EVENT BASED
  NOT YEARS ED.
- TRACKING LESSONS LEARNED.
- MAYBE FOCUS ON PROCESS & PERFORMANCE OVER STRUCTURE & FORM
- REF SITES OR METRICS — PERFORMANCE over time
- HOW BIG DO PROJECTS NEED TO BE? ... to "FUNCTION"

NOVEL PERFORMANCE. IN URBAN AREAS. THAT NEVER PERFORMED. (1-6)

- HOW DO WE EVALUATE SOCIAL (→ EXPERIENCE) / CULTURAL (→ ECONOMIC) BENEFITS? — CRITERIA OF OTHERS (TRIBAL NATIONS)
- NO REGULATORY FRAMEWORK to ENCOURAGE SOCIAL / CULTURAL PERFORMANCE.
- "ECOSYSTEM SERVICES" EVALUATION. COULD WORK
- HOW DO WE WEIGH THE FACTORS?
- OK. BREAKWATER REPAIR - CRITERIA? — OPS FUNDING. NO COST/BENEFIT.
  - $
  - SOCIAL
  - ECONOMIC
  - ECOSYSTEM BENEFITS

MAYBE JUST A GUIDE GOING THROUGH THE DESIGN OF ONE OF THESE FEATURES.

Gaps Resources / knowledge.

(1-7)

- Sand/sediment supplies.
- Micro habitats
- Geologic characteristics
- Short-time changes / long time changes
- Value of sand?
- Acceptable Level of Disturbance.
- OBLIQUES

Breakout #3
Playbook Priorities

(1-8)

- Audience of the Playbook?
- Selection of infrastructure type
  - breakwater
  - revetment

  > e.g., enhancing existing infrastructure

  > in relation to its surrounding environment
- Likelihood of opportunities (↑↑↑)
- Develop real world challenge that could inform the scope of the Playbook

Real world Challenge (Frankfurt Harbor MI) (F-9)

- USACE deep draft harbor
  - aging infrastructure breakwater
  - periodic maintenance dredging w/ BUDM opportunity
  - Impacts on littoral drift - nature
  - Coastal river + lake that enters Lake MI w/ wetlands + fish passage
  - Upstream bluff is severely eroding, posing risk to local community on the bluff
  - Connectivity to surrounding communities
    - both ecol + human
  - Existing beaches fully functioning as social + eng benefit
  - Stormwater infrastructure contributing to bluff erosion + instability
  - Two sources of BUDM: litoral drift sand + dredged sed in harbor

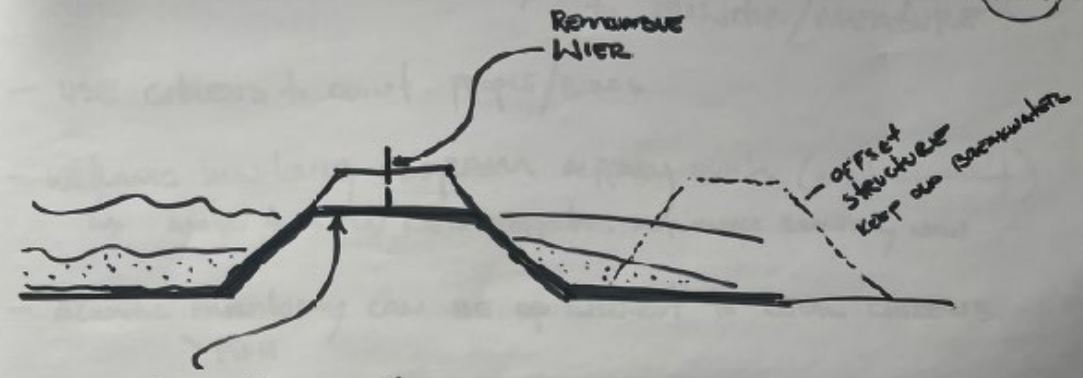
Real World Challenge Cont'd

(1-10)

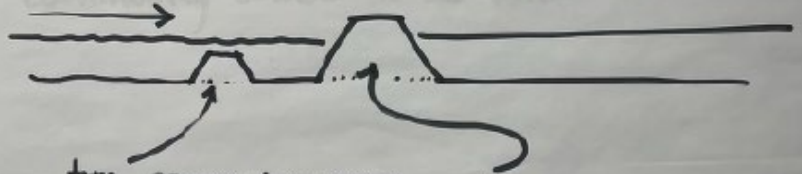
Project funding

- Construction prompts:
  - Degraded breakwater repair
  - Shoaled sed impedes safe navigation in harbor
  - Threat to bluff homeowners: beaches
    Combo of sand + cobble (natural shoreline) is the natural analog >> how to implement EWN on high energy open coast?
  - Increasing coarseness of beach would help reduce erosion + enhance bird habitat
  - offshore structures to reduce energy
  - Fed, state, local, tribal input required
  - Repurpose degraded, disused BW
  - SAFETY ON BREAKWATERS / STRUCTURAL CURRENTS KILL PEOPLE.
  - MANAGE BREAKWATER ACCESS? OPEN/CLOSE FENCE

(1-11)



CALIBRATED CREST DEPRESSION



THIS REDUCES THE HEIGHT OF THIS

- RECESSION RATES. EASY FOR THE COMMUNITY TO MONITOR/MEASURE (1-12)
- USE CITIZENS to count PEOPLE/BIRDS
- WETLANDS MONITORING PROGRAM ALREADY EXISTS (A BIT INCONSISTENT)
  ↳ ALIGN THESE W/ NEW PROJECTS. NOT MAKE SOMETHING NEW.
- ACOUSTIC MONITORING CAN BE OF INTEREST TO LOCAL CITIZENS.
  \ FISH
- SYNC WAVE ENVIRONMENTS W/ OBSERVATIONS
- COMMUNITY OWNED WAVE DATA

Attachment 4
Project Development Breakout Group 2: Summary Work Products

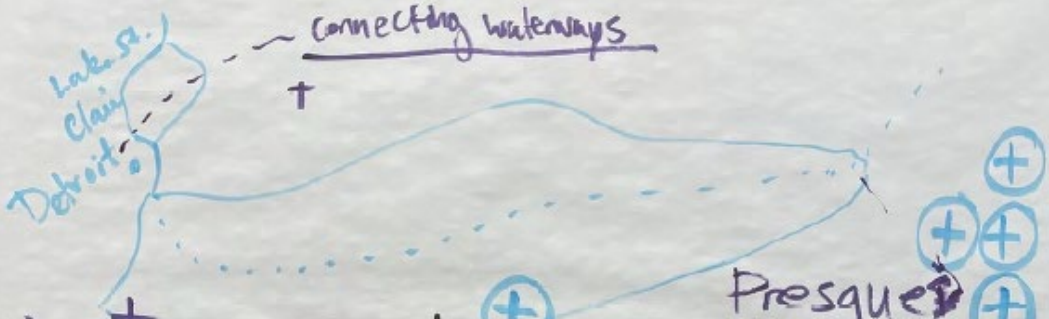
MACRO

need for <-
sediment budget + regional strategy
uncertainty re: how much data has been collected + what planning is underway...

+ littoral drift...
+ sediment bypassing — at harbors — dredge project
  [transfer plant?]
  - Waukegon
  - St. Joe
  - littoral drift/cells
  - RSM / sources + sinks
+ Dune Management
+ Bluff management [erosion — agency responsibility?]
+ Integrated infrastructure/shoreline Resiliency Plan
+ Creation of sub-aquatic habitat zones in or near dredge areas.
+ sensitive but important conversation — managed retreat, lake setbacks
  (local communities centered + driving conversations)

> low-water vs high-water OBLIQUES

ERIE



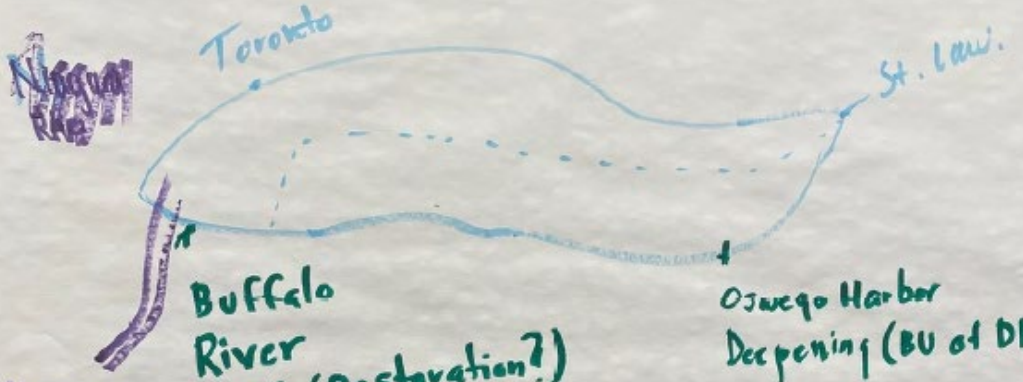
Maumee Bay/River
ACC
wetland creation—BU

Sandusky Bay
Wetland restoration

Cleveland CHEERS project
BU, wetland + island creation

Presque Isle
beach nourishment/dune project—state park, USACE breakwaters
losing sand

ONTARIO

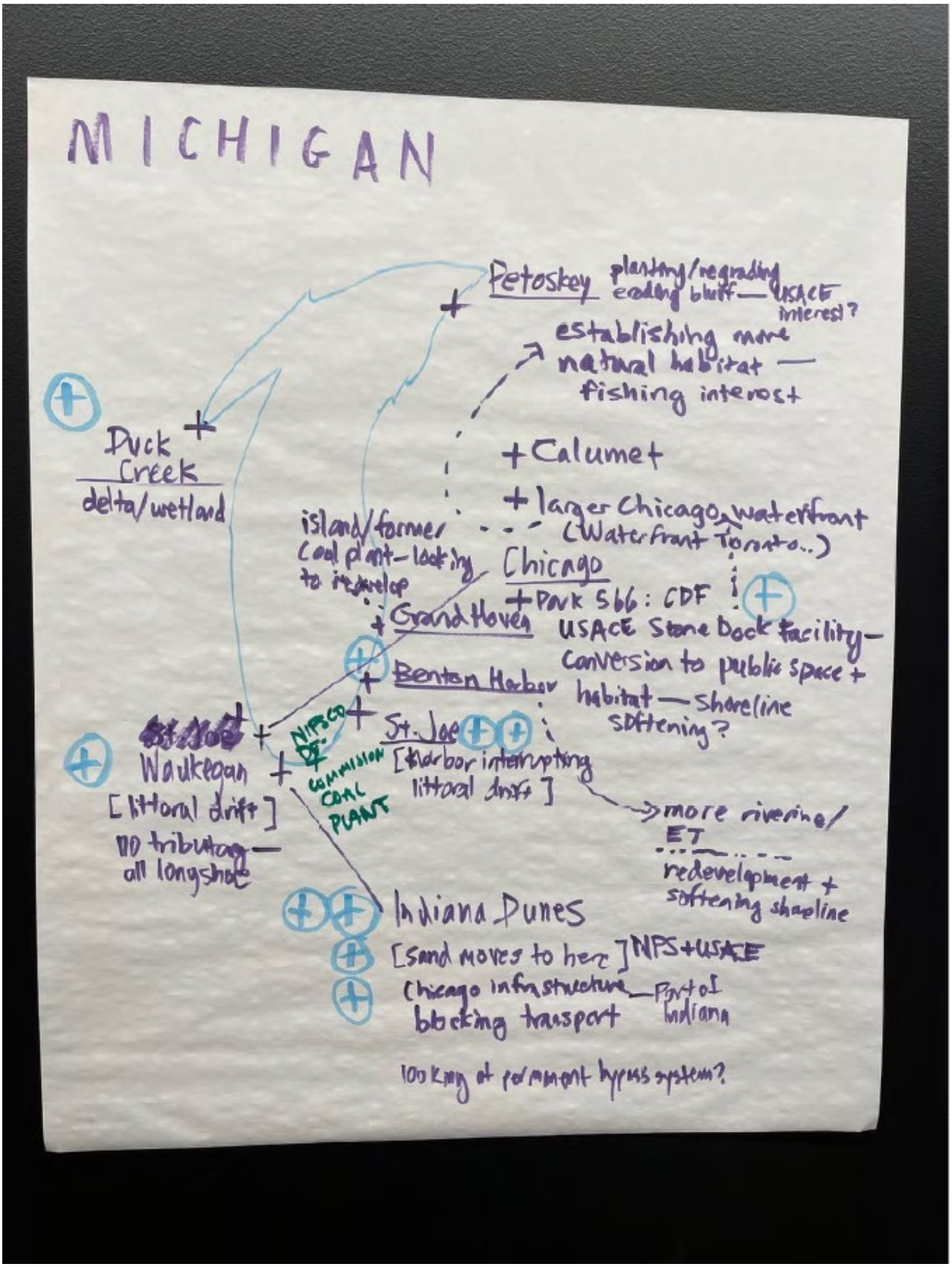


Buffalo River AOC (Restoration?)

Ojwego Harbor Deepening (BU of DM)

Niagara River erosion

NYS DEC_working on lake RSM for their Ontario shoreline


MICHIGAN
Petoskey
planting/regrading eroding bluff — USACE interest?
establishing more natural habitat — fishing interest
+ Calumet
+ larger Chicago waterfront (Waterfront Toronto...)
Duck Creek
delta/wetland
island/former coal plant — looking to redevelop
Chicago
+ Park 566 : CDF
USACE Stone Dock facility — conversion to public space + habitat — shoreline softening?
Grand Haven
Benton Harbor
St. Joe
[harbor interrupting littoral drift]
NIPSCO GENERATING COAL PLANT
Waukegan
[littoral drift]
no tributary — all longshore
more riverine/ ET
redevelopment + softening shoreline
Indiana Dunes
[sand moves to here]
NPS + USACE
Chicago infrastructure blocking transport
Part of Indiana
looking at permanent bypass system?

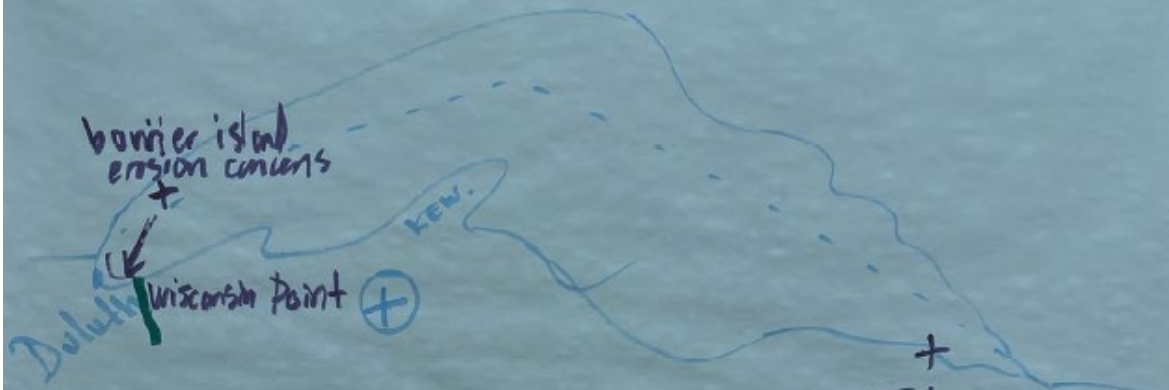
HURON

wetlands/B.U.
AOC

(+) Shiawassee NWR

failing berms — sediment + nutrient issues, flood management
river connection to S.B.
muskrats

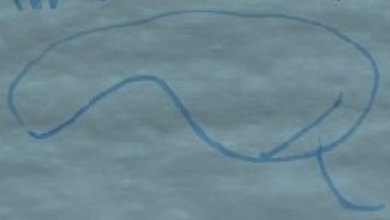
SUPERIOR

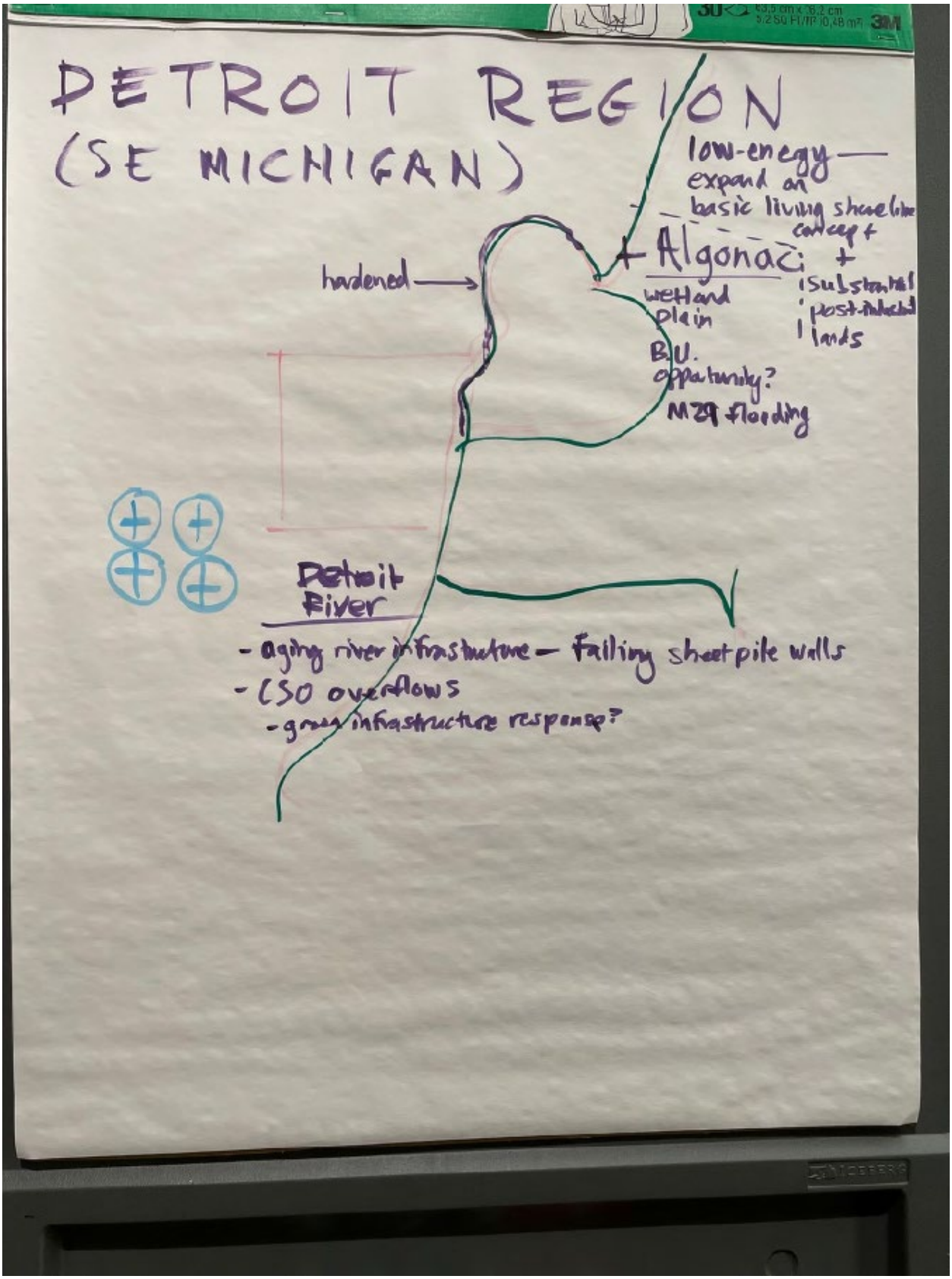


+ Duluth - sediment transport concern

+ Tahqamenon falls - river mouth - erosion, flooding
state park land w/ surface transportation

Lake of the Woods - Fo[illegible]mile Bay
Barrier Island
manageable scale




DETROIT REGION
(SE MICHIGAN)
low-energy —
expand on
basic living shoreline
concept +
Algonac
+ substantial
post-industrial
lands
hardened
wetland
plain
B.U.
opportunity?
M29 flooding
Detroit
River
- aging river infrastructure — failing sheetpile walls
- CSO overflows
- grey infrastructure response?

Attachment 5
Key References and Links from the Workshop Sessions

Key References and Links from the Sessions

Below are some links and references that came out the workshop.

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