

R2R2R: A LIFE CYCLE APPROACH TO ECOSYSTEM SERVICES ASSESSMENTS AT CONTAMINATED SITES

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Remediation to Restoration to Revitalization (R2R2R)

To help transform remediation and restoration projects into sustainable revitalization of the surrounding community by maximizing the positive societal and environmental outcomes



Restoration & Revitalization



Managing Contamination

Partnering companies purchased a 19-acre parcel in Ashabula Township for a Sediment Consolidation Facility, where contaminated sediments from the riverbed would be stored. This facility was completed in 2006.

State and federal agencies implemented dredging of the Ashabula River between 2006 and 2011, removing over 700,000 cubic yards of contaminated sediment from the river and reopening it for commercial shipping and recreational boating. The contaminated material was pumped into a specifically designed landfill and isolated from the environment.



Restoring the River

Restoration of the Ashabula River began in 2008. About 2,500 feet of fish shelves and a total of 10.5 acres of river, wetland, and upland habitat were created, providing a home for mammals, birds, and fish.

Through the efforts of many, the Hah-tah-buh-lah River is returning to its former glory as a "river of many fish."

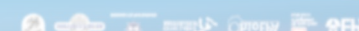


Using funds from the US EPA, US ACF, industry and the State of Ohio, approximately 700,000 cubic yards of contaminated sediment were removed from the river between 2006 and 2011, pumped up through a 2.5 mile pipeline to a upland sediment consolidation facility and into permeable ridges. Ridges that separate contaminated sediment from the river water.

The Ashabula River Partnership: A model approach to environmental cleanup



2011-2012 Great Lakes Restoration Initiative (GLRI) Grant

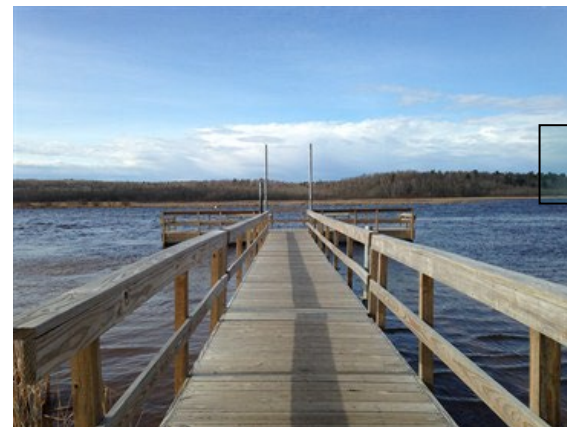


Bringing A Community Back to the Water

- By what means does coastal wetland restoration affect community health and well-being?
- How do we integrate our research and results into community-engagement and decision-making?



Restoration



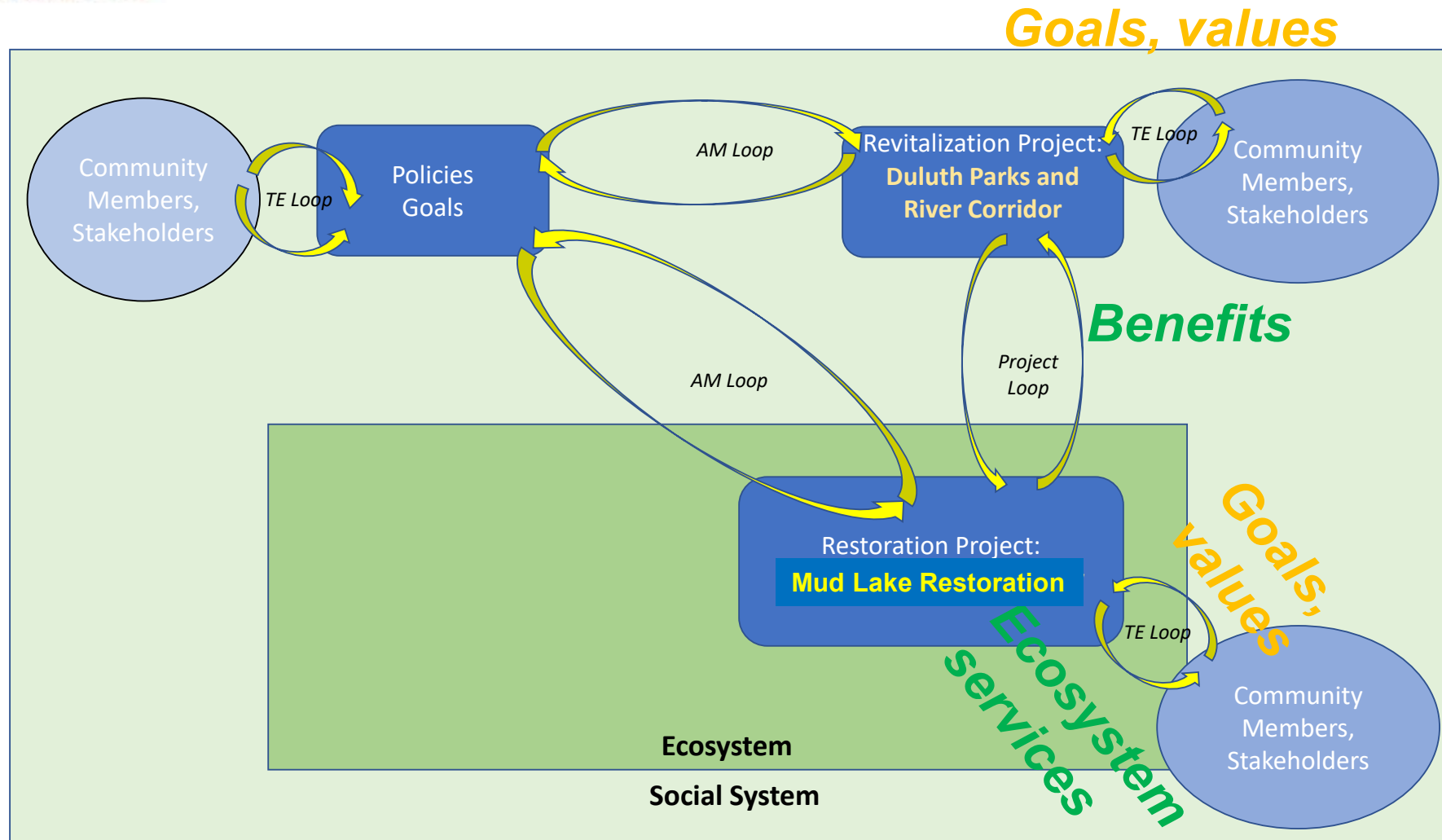
Amenities

Ecosystem Services



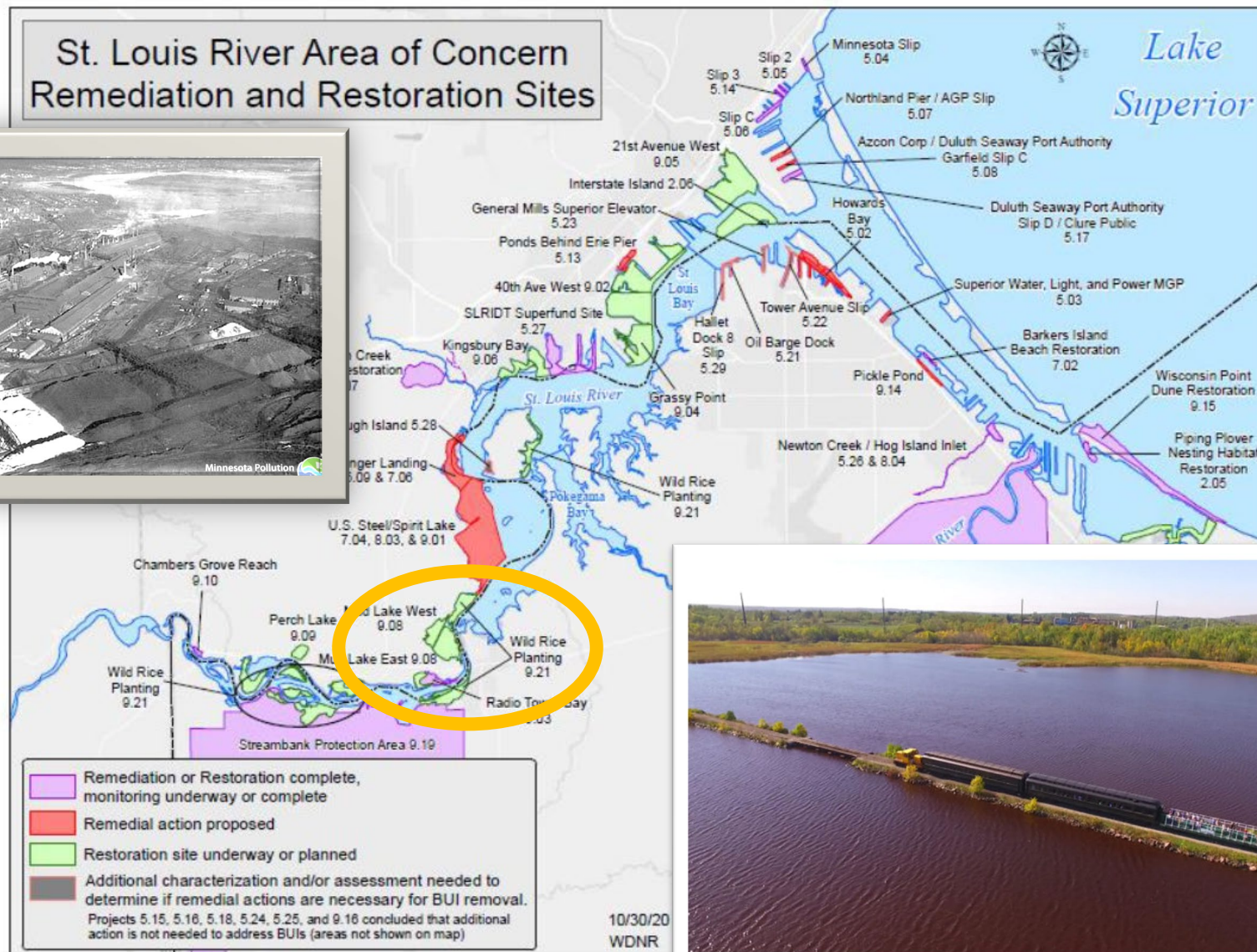
Wellbeing

R2R2R as Social-Ecological System



US Steel Superfund Site and Mud Lake

St. Louis River Area of Concern Remediation and Restoration Sites



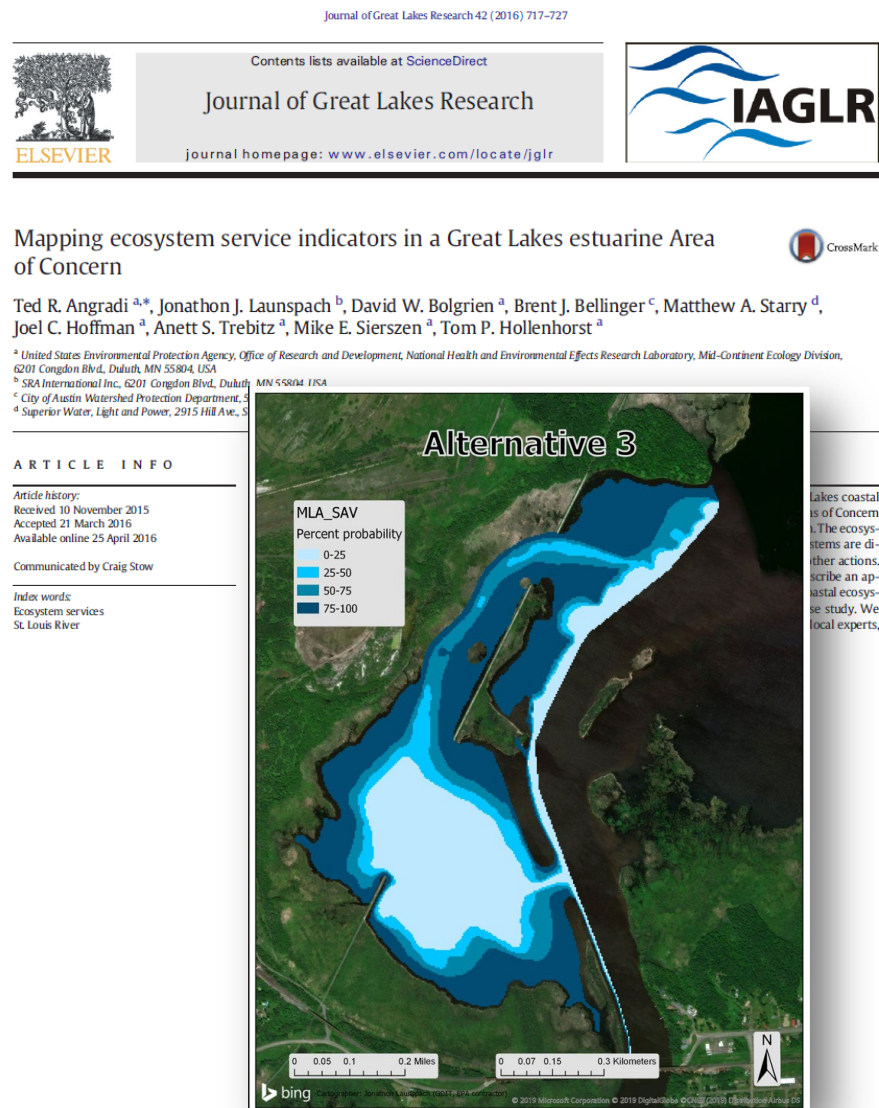
Methods: Decision Support

- Similar to Health Impact Assessment
- Scoping: Community Engagement
- Assessment: Compared six options based on ecosystem services and associated benefits
- Recommendations: Community feedback
- Reporting: Engagement and City-wide Meeting
- Monitoring and Evaluation: Future



ES Providing Areas

- Supporting ES (e.g., SAV)
- Proxies (e.g., Bald Eagle nesting)
- Ecosystem Services (e.g., boating, fishing)



Methods: Community Values Analysis

Participatory mapping

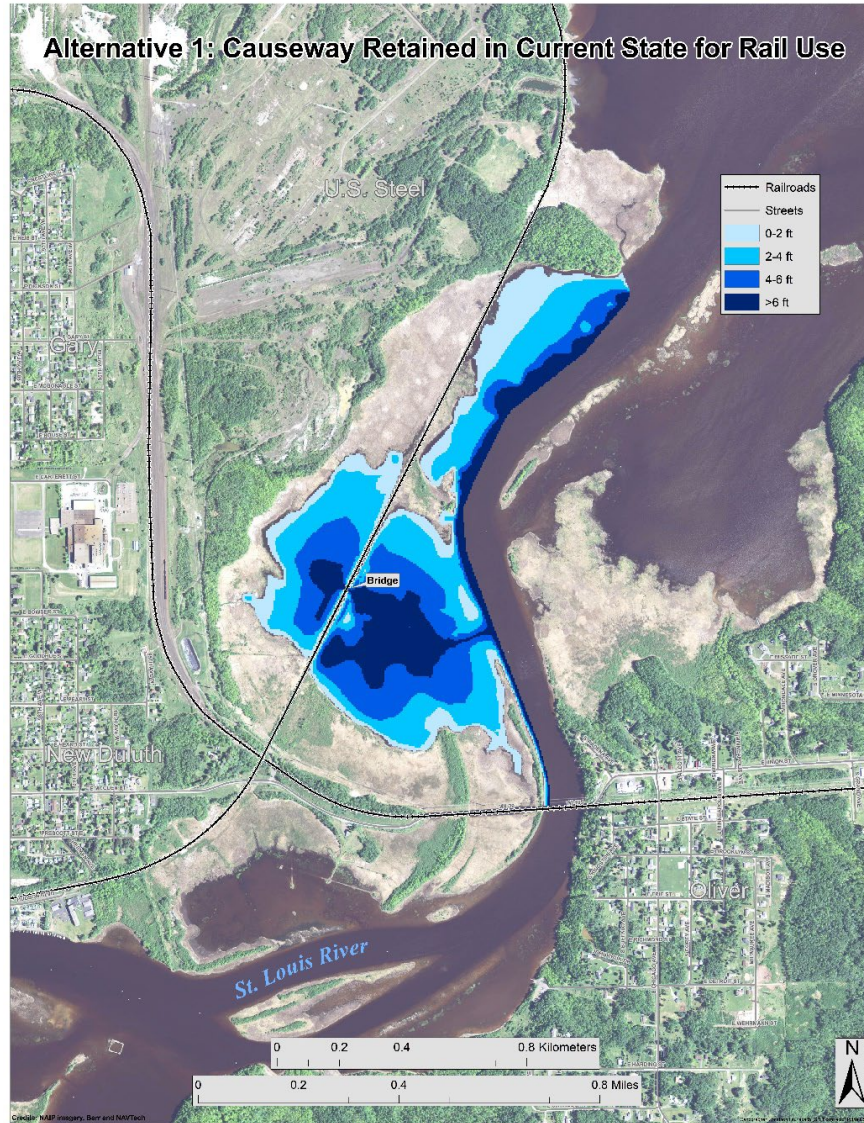
- Goal: capture different types of knowledge based on relationships to the ecosystem
- Conversation-based
- Geospatial
- Knowledge co-production
 - Traditional
 - Professional
 - Local
 - Scientific



Three benefit pathways

1. Cultural and Social
2. Recreation
3. Habitat and Water Quality

Results: Existing Conditions (Alternative1)



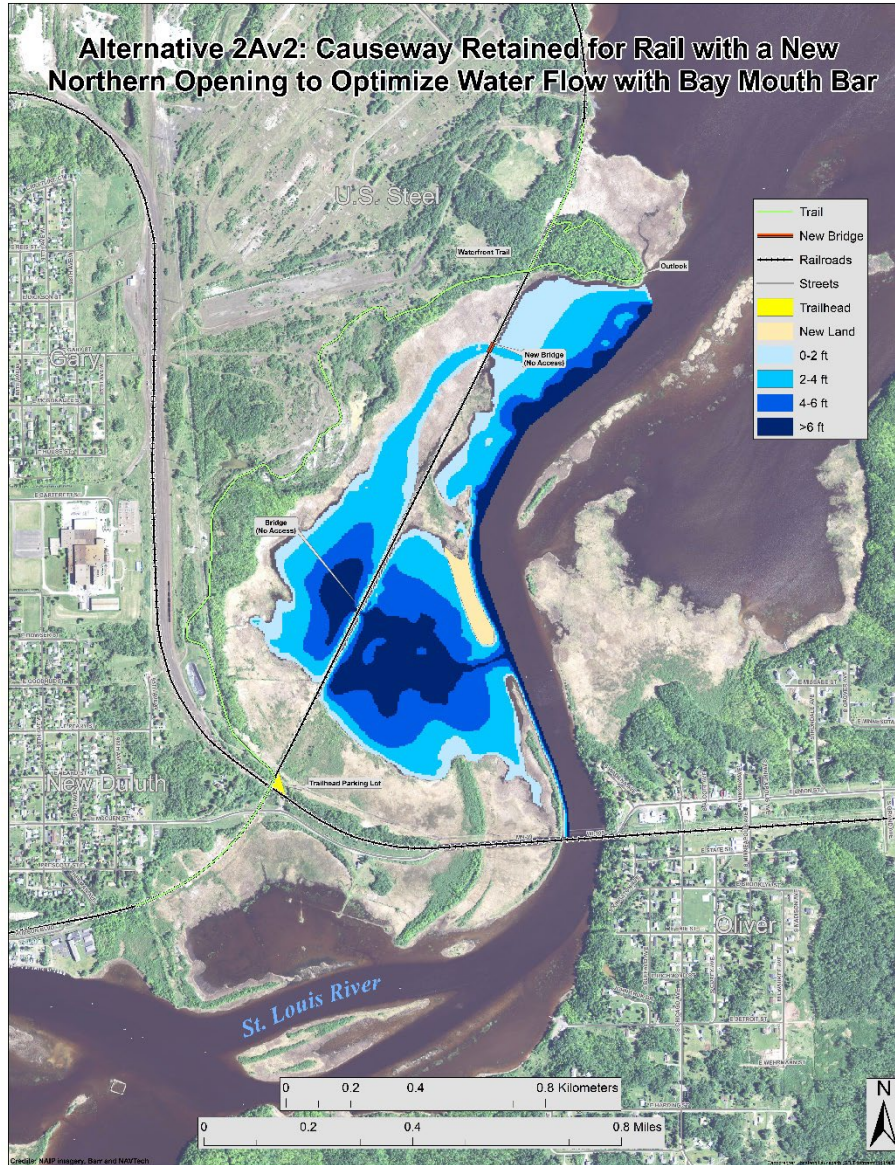
Existing recreational access:

- Lake Superior and Mississippi RR
- Causeway is an informal trail
- Parking lot (informal parking on private property)

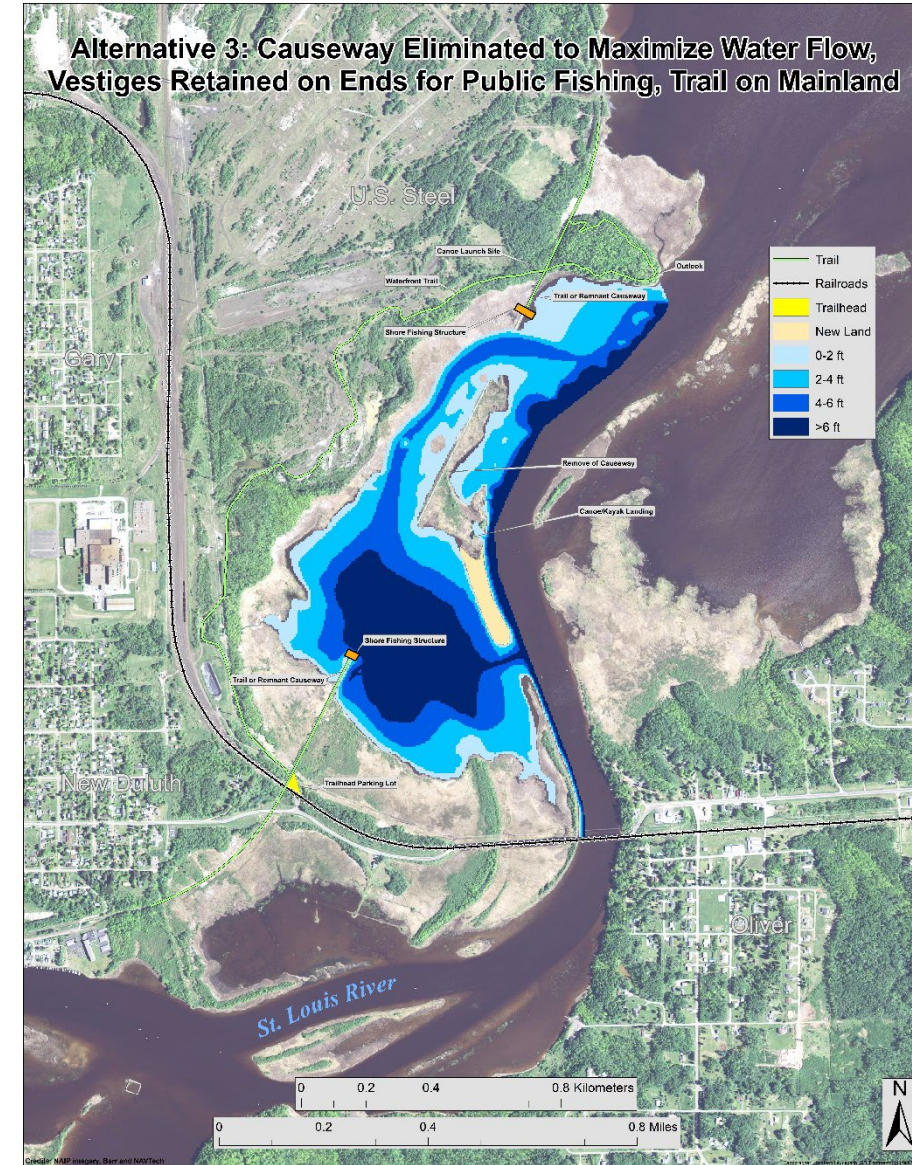
Existing uses:

- Bird and wildlife watching
- Kayaking
- Dog training
- Fishing

Alt 2: Keep Rail, Improve Flow, Shelter Bay*



Alt 4: Remove Causeway, Improve Flow, Shelter Bay



Results: ES Trade-Offs

ES Change | Ecosystem Change

Ecosystem Service (units)	Current Condition (Alt 1)	Retain Rail, North Opening (Alt 2A)	Retain Rail, North Opening, Bay Mouth Bar (Alt 2Av2)	Remove Causeway, North Opening, Bay Mouth Bar (Alt 3)
River greater than 6 feet deep (acres)	33.2	37.1	36.5	51.1
Highly-sheltered bay (acres)	23.4	26.5	30.9	9.8
Moderately-sheltered bay (acres)	29.8	28.2	42.6	21.0
Fill in public waters (lineal feet)	4894	4782	4782	3067
Protected shoreline (lineal feet)	4379	4107	4107	1302
75-100 percent probability of SAV occurrence (acres)	75.9	84.3	79.3	73.3
25-75 percent probability of SAV occurrence (acres)	42.7	40.5	40.4	46.2
50-100 percent probability (acres) of FLV occurrence (acres)	42.2	51.2	57.9	2.9
Power boating (acres)	75.9	75.9	75.9	110.9
Human-power boating (acres)	129.7	129.7	129.7	184.0
Esocid spawning (acres)	75.7	84.0	78.9	72.9
Designated shore fishing (acres)	0.0	0.0	0.0	1.2
Boat/ice fishing (acres)	144.6	153.5	149.2	160.6
Trapping (acres)	133.6	124.7	128.2	118.7

positive change

no change

negative change

Results: Social and Cultural Dimension

Identity and Place Attachment

- Personal, social, organizational perception of Mud Lake
 - Use
 - History
 - Meaning for community

- More comments coded to this category than any other

Train offers access to wildlife: swans, geese, turtles, eagles, egrets, muskrat, beaver, blackbirds, peregrine falcons, fish jumping.

[There is] a lot of history with the Radio Bay towers being in the area and the economic history.

Governance

- Decision made by the City of Duluth*
- Questions
- Many commenters thought change would negatively impact the resource

So the question is...is it possible to achieve your goals and leave the causeway and railway intact?

I think if you keep the track and causeway and make your water flow it's a win for everyone. We would like to see that as a viable proposal and we could say we can make that work and keep the railway running.



Recreation and Engagement with Nature Dimension

Accessibility

Train brings people to the river that wouldn't otherwise be there.

The train that crosses Mud Lake and provides access for all to see it.

Calm area for elderly and handicap people to view wildlife only by train access.

Sustainability

- User perceptions
- Current uses of the natural features of Mud Lake
- Users' relationship with Mud Lake

Berry trees offer great birding recreation and jelly making.

Let mother nature take its course, the site has healed itself.

[Mud Lake is an] unofficial trail for lower socioeconomic class- people using garage sale tackle. Volunteers keep up [the] costly care. [the site] is #1 for wildlife.

Alternative	Recreational Access	Uses
Alternative 1: No Change	<ul style="list-style-type: none"> • LSMR passenger train • Causeway is an informal trail • Parking lot (on private land) 	<ul style="list-style-type: none"> • Bird and wildlife watching • Kayaking • Jelly making (berry picking) • Dog training • Fishing • Trapping
Alternative 2 and Alternative 2 v2: Retain Rail	<ul style="list-style-type: none"> • LSMR passenger train • Trail on land • Parking lot • Designated outlook • New bridge 	<ul style="list-style-type: none"> • Bird and wildlife watching • Kayaking³ • Fishing • Trapping • Hiking and biking
Alternative 3 and Alternative 3 v2: Rail to Trail	<ul style="list-style-type: none"> • Trail on causeway • Parking lot • Designated outlook • New bridges with kayak and canoe access • Two new shore fishing structures 	<ul style="list-style-type: none"> • Bird and wildlife watching • Kayaking with canoe launch • Fishing • Trapping • Hiking and biking
Alternative 4: Remove Causeway	<ul style="list-style-type: none"> • Trail on land • Parking lot • Designated outlook • Fishing on causeway remnants and new fishing pier • Canoe launch and kayak landing 	<ul style="list-style-type: none"> • Bird and wildlife watching • Canoeing and kayaking • Fishing • Trapping • Hiking and biking • Power boating

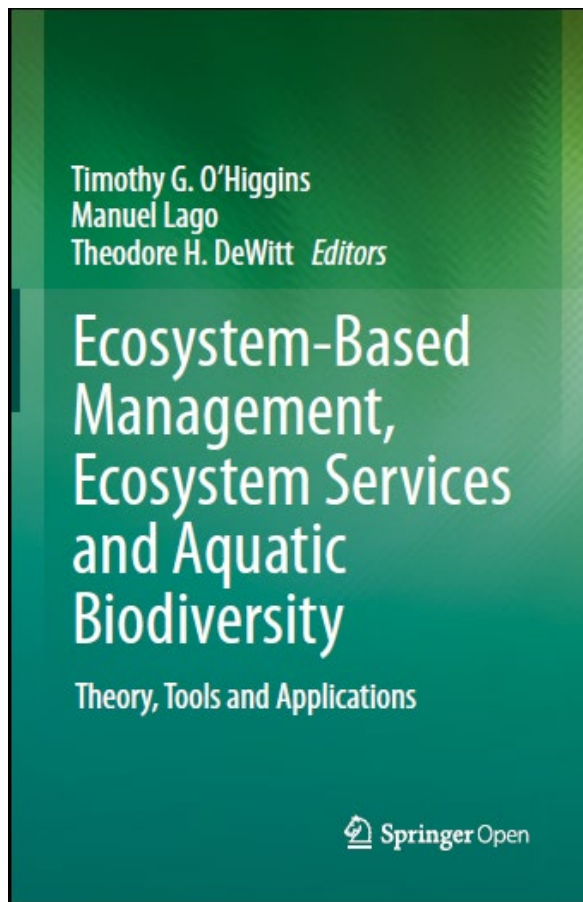
Alternative	Description of Impacts on Benefits	Impacts on Beneficiaries
Alternative 1: No Change	<ul style="list-style-type: none"> Baseline alternative No change to the health determinants Current users will continue current uses. (e.g. railroad, informal trail, bird and wildlife watching, kayaking, fishing, etc.) Least protective for water quality, negative impact on indigenous communities' rights <p>By definition, informal trails are NOT sanctioned</p>	<ul style="list-style-type: none"> Access would remain <u>limited</u>. Positive impact on health for current users Potential negative impacts to indigenous communities' rights
Alternative 2 and Alternative 2 v2: Retain Rail	<ul style="list-style-type: none"> Rail continues, along with other uses (bird and wildlife watching, kayaking, fishing, etc.) Potential to improve habitat <ul style="list-style-type: none"> Might positively bird and wildlife watchers, and anglers Will positively impact hikers and bikers through the addition of a trail on land 	<ul style="list-style-type: none"> Positive impact on most impacted populations LSMR, anglers, boaters, and trail users
Alternative 3 and Alternative 3 v2 ⁴ : Rail to Trail	<ul style="list-style-type: none"> Great loss for railroad organization (e.g., social cohesion and sense of purpose) and a loss for rail riders Potential to improve habitat, <ul style="list-style-type: none"> Might positively bird and wildlife watchers, and anglers Will positively impact hikers and bikers through the addition of a trail on land Tall bridge would provide improved access for kayakers and canoers to all of Mud Lake 	<ul style="list-style-type: none"> Positive impact on recreational users, anglers, and boaters Negative impact on LSMR and the neighborhood that identifies with train
Alternative 4: Remove Causeway	<ul style="list-style-type: none"> Great loss for railroad organization (e.g., social cohesion and sense of purpose) and a loss for rail riders. Most potential to improve habitat <ul style="list-style-type: none"> Creation of a high-quality coastal wetland, which will likely positively impact indigenous communities (especially for wild rice harvesting), bird and wildlife watchers, and anglers Positively impact hikers and bikers through the addition of the trail 	<ul style="list-style-type: none"> Positive impact on recreational users, indigenous communities' rights, anglers, and boaters Negative impact on LSMR and the neighborhood that identifies with train, and bird watchers

Conclusions

- **Decision Support:** build trust and incorporate equity
 - translation
 - two-way communication
 - formal decision-support
- **Process:**
 - Research was responsive to the project design and stakeholders
 - Trades-off impacts were beneficiary dependent
- **Impact:** A hybrid option was chosen to maximize ecological outcomes while preserving existing uses and benefits



Thank you!



Free book!!

Remediation to Restoration to Revitalization: Engaging Communities to Support Ecosystem-Based Management and Improve Human Wellbeing at Clean-up Sites



Kathleen C. Williams and Joel C. Hoffman

Abstract Remediation to Restoration to Revitalization (R2R2R) is a framework to identify ecological and policy-based relationships between large-scale aquatic sediment remediation projects, subsequent habitat restoration projects, and waterfront revitalization. A defining feature of R2R2R is that it possesses three essential feedback loops: a translational ecology feedback loop, an adaptive management feedback loop, and a project management feedback loop. The R2R2R framework builds on Ecosystem-Based Management (EBM) theory by addressing the role of humans through these feedback loops, and by recognizing the ability of communities to learn and make choices that improve the environment through translational science. In this framework, translating ecological changes from remediation and restoration projects to public benefits (e.g., swimmable water, potential for urban greenspace) using the concept of ecosystem services is critical to support decision-making. In practice, community perceptions and uses of the remediated and restored ecosystem or habitat are central to EBM. We use the Great Lakes Area of Concern program to illustrate how R2R2R exemplifies EBM for large, complex sediment remediation and aquatic habitat restoration projects.

Lessons Learned

- The Remediation to Restoration to Revitalization (R2R2R) framework is integrative of diverse interests through ongoing opportunities for engagement and a synthesis of input to inform research and project alternatives
- Consideration of translational ecology and adaptive management, in addition to the project, create distinct opportunities for engagement with the community, stakeholders, and project implementers

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