



technical BRIEF

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Mud Lake Future Alternatives Community Values and Health Impact Analysis

The goal of this analysis was to utilize elements of the systematic and science-based health impact assessment (HIA) methodology to conduct a community values analysis to compare the health impacts and ecosystem services associated with four different alternatives selected by the City of Duluth, Minnesota, for the restoration of habitat at Mud Lake on the St. Louis River.

This approach was chosen because the process objectively and transparently considers the best-available qualitative and quantitative evidence to identify potential direct and indirect health impacts and help assess the trade-offs inherent in the decision process.

Ecosystem Services

Ecosystem services are products of nature that when used, consumed, or experienced by people provide some sort of direct benefit (Boyd and Banzhaf 2007). In conjunction with this analysis, a separate ecosystem services analysis was conducted to compare the amount of ecosystem services associated with the alternatives under consideration (see Angradi and Hoffman 2019).

Health Impact Assessment

Community health and well-being are a product of one's environment and the social and environmental conditions that exist there. These social and environmental determinants of health (i.e., factors or conditions that can directly or indirectly influence human health) include access to public services and infrastructure; adequate living and working conditions; and social, economic, and political factors (Figure 1).



Figure 1. Determinants of health, from Human Impact Partners (2011)

HIA is a science-based approach that considers input from stakeholders and uses a variety of analytical tools and methods to determine the potential effects of a proposed project on the health of a population. An HIA is neutral to the decision result; its purpose is to advocate for health and wellness through the consideration of potential health impacts.

The HIA process is a systematic, six-step process that includes screening, scoping, assessment, recommendations, reporting, and monitoring and evaluation (Human Impact Partners 2011; National Research Council 2011).

Screening for an HIA

Decision context. The design alternatives focus on Mud Lake; however, the site is connected to overlapping decision contexts, including the:

- Comprehensive approach to the [St. Louis River Corridor](#)
- Options for extending the [Western Waterfront Trail](#) from its current terminus to Chambers Grove Park
- Initiatives to improve options for outdoor recreation and create or enhance regional amenities
- Other plans, including:
 - [St. Louis River Water Trail](#)
 - [Duluth Natural Areas Plan](#)
- [City of Duluth Comprehensive Plan](#)
 - Green space
 - Economic development
 - Housing
- [St. Louis River Area of Concern](#)
- [Habitat restoration plans](#)

Decision alternatives. The City of Duluth identified six potential alternatives for Mud Lake¹:

- Alternative 1 (Alt 1) – Causeway retained in current state for rail use
- Alternative 2 (Alt 2) – Causeway retained for rail with a southern opening and a new northern opening to optimize water flow. Trail located on the mainland.
 - Alternative 2 v2 (Alt 2 v2) –Causeway retained for rail with a southern opening and a new northern opening to optimize water flow, with an added levee. Trail located on the mainland. The alternative was considered for habitat metrics only.
- Alternative 3 (Alt 3) – Causeway retained for trail with a southern opening and a new northern opening to optimize water flow.
 - Alternative 3 v2 (Alt 3 v2) –Causeway retained for trail with a southern opening and a new northern opening to optimize water flow, with an added levee. The alternative was considered for habitat metrics only.
- Alternative 4 (Alt 4) – Causeway eliminated to maximize water flow, vestiges retained on ends for public fishing, and trail located on the mainland.

These alternatives focus on the section of the rail through Mud Lake, from Boat House Point to Boy Scout Landing.

Feasibility and Value of an HIA

EPA's Mid-Continent Ecology Division (MED) evaluated whether an HIA was feasible and would add value to the project. It was decided that elements of an HIA could be used to scope the problem, identify the social and environmental determinants of health and populations potentially impacted by the alternatives, and assess the impact of the decision alternatives on health, but not all six steps of the HIA process would be conducted.

To facilitate the analysis, the research team made several assumptions:

- It is feasible to remediate and restore Mud Lake to a standard that would allow people to safely use the area.

- The rail will continue to operate from their station near the Lake Superior Zoo to Boat House Point.
- If left in place, the railroad would continue to run and maintain the causeway and tracks to a working condition that meets operational standards.
- The City of Duluth would adequately maintain any infrastructure or features built as a result of the Western Waterfront Trail extension.

Scoping the Problem: Community Values, Pathways of Impact, and Impacted Populations

The scoping phase of the analysis included identifying the social and environmental determinants of health most important to the community, the pathways through which the decision could impact health, and the impacted populations.

Social and environmental determinants of health. A stakeholder meeting was held on March 4, 2019 at the Goodfellowship Community Center in the Morgan Park neighborhood to identify the social and environmental determinants of health most valued by the community. Twenty-nine people attended the meeting representing environmental nonprofit organizations, community groups, natural resource agencies, and businesses.

The comments collected through stakeholder input exercises were analyzed to identify what services Mud Lake provides to the participants and what Mud Lake means to them (Table 1). Several potential Mud Lake user groups were identified that were not in attendance at the meeting, including organized outdoor recreation groups. It was important to identify the values of this group of users because they too will be impacted by the City's decision.

To fill this gap, a content analysis was conducted of Duluth news articles related to outdoor recreation (Table 2).

Pathways of Impact. The dimensions identified as significant to the community represent three distinct pathways that were analyzed to understand how changes at Mud Lake will impact health (USEPA 2019):

- Social and Cultural
- Water Quality and Habitat
- Recreation, Aesthetics, and Engagement with Nature

¹ In the original stakeholder consultation exercise, there were six alternatives which were numbered differently. This reflects the current numbering and list of alternatives. The current

(old) alternatives are: Alternative 1 (same); Alternative 2 (2A/2Av2); Alternative 3 (2B/2Bv2); Alternative 4 (Alternative 3).

Impacted populations. The populations that will be impacted by decisions at Mud Lake are diverse and include residents, organizations, and other groups:

- Current users of Mud Lake area
- Train passengers
- Morgan Park residents
- Gary-New Duluth residents
- Indigenous community
- Businesses
- Others (i.e., user groups, including outdoor recreation groups)

A baseline health assessment for the impacted populations indicates that these populations have distinct connections to Mud Lake.

Current users. Some users volunteer to run a passenger train that travels to the Mud Lake area, while others forage, trap, fish and use it as a natural area. Mud Lake serves as a site for personal and organizational identity and has historical and cultural value. Furthermore, Mud Lake is a site important for social cohesion and historical preservation.

The rail on the causeway is a remnant of the Lake Superior and Mississippi Railroad (LSMR), which was completed in 1870 and provided the first transportation link between St. Paul and Duluth. It served as an important economic link to expand the mining, fishing, manufacturing, and timber industries. The rail is currently preserved by a nonprofit that provides historical information about the surrounding neighborhoods.

Train passengers. According to a brief analysis of social media about the LSMR passenger train, the train is valued because of the experience it provides. There was an emphasis on the scenic views, natural experience, and the dedication of the volunteers. Riders also noted the affordability and accessibility of the train.

Morgan Park and Gary-New Duluth residents. These are two of the neighborhoods surrounding the Mud Lake area that would be impacted by decisions made at the site. The health status of residents in the Morgan Park and Gary-New Duluth neighborhoods was examined in comparison to the health of residents in the City of Duluth as a whole:

- Residents in the adjacent neighborhoods report better well-being behaviors (i.e., >7 hours of sleep and leisure time activity) than the City of Duluth as a whole;

- Poverty in Morgan Park is higher than the City of Duluth, but in Gary-New Duluth is lower than the rate for the City as a whole;
- Rates of diabetes, high blood pressure, and obesity are higher in these neighborhoods than rates for the City of Duluth (CDC 2016).

Indigenous community. The St. Louis River estuary is the ancestral home of the Anishinaabe people. Spirit Island, just downstream from Mud Lake, is the sixth stopping place on their westward migration. It was the first place they encountered the food that grows on water – wild rice (Fond du Lac Band of Lake Superior Chippewa 2018). The St. Louis River is also an important place to exercise treaty rights (1854 Treaty Authority 2017). Maple sugar camps and burial grounds are found on Spirit Mountain, the hill that runs parallel to the St. Louis River.

The large hill that extends for several miles along the far western end of Duluth was called Manitouahgebik (Spirit Mountain) by the Ojibwe Indians. They believed that the Great Spirit resided within the forest at the top of Spirit Mountain (Turnstone Historical Research 2015, p. 49).

Businesses and other user groups. The scoping exercise revealed that other potentially impacted groups not present at the meeting include hikers, bikers, berry pickers, and nearby businesses. Moreover, this site was identified to be important for the extension of the Western Waterfront Trail and development of Duluth as an outdoor recreation destination and economic engine (Cities of Duluth and Superior 2017). A media analysis was conducted to better understand the general values of the outdoor recreation group (Table 2).

The outdoor recreation groups valued access to open spaces to pursue recreation and valued Duluth as a “real” outdoor recreation city (Chandler 2017). Social cohesion for this group of people means joining together to advocate in the City’s decision process to expand recreation in the city. The values analysis for this group suggests their interest is less about their relationship to a particular place, but generally access to green space.

Assessing the Health Impacts of the Decision Alternatives

A rapid analysis of the impact of each alternative on the three dimensions of health determinants – Social and Cultural; Water Quality and Habitat; and Recreation, Aesthetics, and Engagement with Nature – was conducted. Table 3 summarizes the connection between these dimensions and health; the full literature reviews documenting these connections can be found in the

background research for USEPA (2019), which was conducted in Duluth as well.

Impacts of the alternatives on Water Quality and Habitat are documented in Angradi and Hoffman (2019). Table 4 summarizes the potential impacts of the alternatives on the Social, Cultural, and Recreation dimensions and on health overall.

Discussion and Summary

The proposed project has the potential to impact the health of several populations – current users of Mud Lake and the LSMR, other user groups and the outdoor recreation community, Morgan Park and Gary-New Duluth neighborhoods, and the indigenous community. The Anishinaabe are the first inhabitants of the Mud Lake area. At the same time, this site has contributed greatly over the last 150 years to the current wealth and economic base of Duluth. There is a shared and linked history to this site and those around it; thus, all populations will be affected by the decision about the future of Mud Lake.

In addition to outdoor recreational opportunities, all alternatives have the potential to offer social, historical, and cultural opportunities (e.g., spaces for socialization, social capital through rail and/or trail volunteer opportunities, maintaining the sense of place and history, cultural expression, etc.). These social and cultural dimensions can result in more positive perceptions of health, particularly mental health and stress (Kitchen et al. 2012).

Improving cultural or historical amenities can contribute to community development. However, there are cautions, as some enhancements of cultural amenities and green spaces might lead to gentrification (Gunay and Dokmeci 2012; Smiley et al. 2016) and unequal distribution of benefits (Foster et al. 2016). Policy interventions and work with community groups is likely required to prevent displacement of low-income residents (Ellen 2018). Generally, inclusivity and shared benefits of environmental renewal are created through inclusive processes (Daigneau 2015).

This analysis demonstrates that every alternative produces a different mix of ecosystem services and benefits. The realization of positive health outcomes from the ecosystem services produced is less certain because it is dependent on individual behaviors and details not contained in the alternatives (e.g., the presence of gathering spaces to encourage diverse communities to utilize natural spaces).

Moreover, given uncertainty regarding water flow through Mud Lake under the various alternatives (Angradi and Hoffman 2019), the habitat and water quality improvements may not be extensive enough for the Anishinaabe people to adequately pursue treaty rights of fishing, hunting, and gathering.

The only group positively impacted in almost all alternatives is the outdoor recreation community. But, several alternatives have the potential to result in negative impacts to other groups, such as those associated with the LSMR and indigenous groups.

Recognizing that there is an attachment to place, as well as claims on the space by multiple groups, it would positively impact the mental health and social cohesion of all communities to participate in collaborative decision-making to ensure that health impacts are maximized for all communities. The City has already employed such a model in other St. Louis River Corridor projects (e.g., Quarry Park).

Limitations

This assessment is a rapid analysis of how the proposed Mud Lake future alternatives might impact the health of the community. The assessment is based on identifying the valued determinants of health and describing how those determinants will subsequently change for different populations.

The abbreviated timeframe limited the amount of community consultation. In a complete health impact assessment, considerable effort would be devoted to reaching out to community members to ensure participation. Outreach to the community was limited to a single stakeholder meeting. Despite this limitation, other impacted populations were identified and considered in the assessment through media analysis.

There were other limitations:

- Although the project alternatives do have impacts to personal and community economics, the project team did not have the time or resources to conduct an independent assessment of economic impacts. Given this limitation, we did not address several publicly-available economic studies about western Duluth, the train, or surveys conducted in relation to the expansion of the Western Waterfront Trail.
- We were unable to determine the feasibility of berry picking/jelly-making and dog training as potential uses in the future alternatives. It is plausible that the site

could continue to be used for these activities, but there is not enough information available in the alternatives to determine how the infrastructure and vegetative changes could impact the suitability of the site for these uses.

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Table 1. Dimensions or Themes Identified Through the Analysis of Input and Discussion Gathered at the Stakeholder Meeting on March 4, 2019
(The numbers in parenthesis indicate the number of comments received related to each theme. Many comments reflected more than one theme, so results should be interpreted as representing a pattern of the relative importance or significance of each theme for those stakeholders who participated.)

Social and Cultural (157)
<ul style="list-style-type: none"> • Identity and Place Attachment (Personal, social, and organizational attachment to Mud Lake. Most comments coded to this node than any other.) • Governance (Focus on decisions made by the City of Duluth about Mud Lake. Participants thought changes would impact the resource.) • Participation and Self-Determination (Desire to participate in the decision; advocating for a win-win or keep the causeway and build a trail) • Social Cohesion (Collective action taken by community; the collective “we”)
Water Quality and Habitat (80)
<ul style="list-style-type: none"> • Biophysical Environment (Observation and appreciation of wildlife; physical environment; movement of water) • Safety (Perception of contamination; fear removing causeway would release contamination into the river)
Recreation, Aesthetics and Engagement with Nature (48)
<ul style="list-style-type: none"> • Accessibility (Train provides access to Mud Lake) • Sustainability (Current uses of the natural features of Mud Lake: berry picking, kayaking, fishing) • Parks and Trails (Causeway currently serves as an unofficial trail) • Aesthetics (Beauty associated with Mud Lake; appreciation for Mud Lake as it is)

Table 2. Dimensions or Themes Identified Through an Analysis of Duluth Media Articles About the Organization of Stakeholder Groups and Development of an Outdoor Recreation Economy in Duluth

(The articles examined are related to the outdoor economy, not Mud Lake specifically. The numbers in parenthesis indicate the number of statements found related to each theme. Results should be interpreted as representing a pattern of the relative importance or significance of each theme.)

Social and Cultural (237)
<ul style="list-style-type: none"> • Identity and Place Attachment (Duluth as a “real” outdoor recreation city; the outdoor recreation economy; down-to-earth; enjoy outdoors) • Participation and Self-Determination (Actions and measures taken to influence decision-making; voice opinion on topics) • Social Cohesion (Groups or individuals coming together to advocate for a decision) • Governance (Decisions made by City of Duluth that impact the city and natural spaces)
Water Quality and Habitat (5)
<ul style="list-style-type: none"> • Biophysical Environment (Presence of green space in the environment; Feasibility of new mountain bike trails)
Recreation, Aesthetics, and Engagement with Nature (62)
<ul style="list-style-type: none"> • Parks and Trails (Parks trails and outdoor recreation; future outdoor recreation spots)

- Accessibility (Barriers to overcome: demographics, geographic proximity, income, ability, or other structural barrier)
- Sustainability (“To make citizens healthier and happier”)

Table 3. Description of Assessment Dimensions and How They Impact Health (Modified from USEPA, 2019)

Determinant of Health/Pathway	Connection to Health
Social and Cultural	Parks and green spaces provide space for socialization, which builds social capital and cohesion (the formation of social bonds and connections), spiritual reflection, and cultural resource use. The ability of the public to enjoy parks and green spaces in these capacities has been shown to improve health and well-being and reduce stress. The opportunity for public input during the planning of these spaces can also build social capital and lead to improved community health. Parks and green spaces are an important site for volunteering which can provide mental health benefits, including self-rated health, mental health, life satisfaction, social interaction, healthy behaviors and coping ability (Casiday et al. 2008; Jenkinson et al. 2013). Furthermore, people who are attached to a local area will volunteer to preserve it (Anton and Lawrence 2014).
Water Quality and Habitat	Improving water, sediment and habitat quality can potentially improve nutrition and decrease disease incidence in anglers, as well as decrease illness and skin and eye ailments in those who have contact with the water, including waders. However, at this time, it is uncertain how legacy contamination might impact fish, wildlife, or human health. Broadly, improving water quality can reduce stress, as well as improve social capital and recreational opportunities. Subsequent to improvements in water, sediment, and habitat quality, designated recreational amenities such as boat launches, canoe landings, and fishing piers can contribute to health by providing safe access to the river for the community.
Recreation, Aesthetics, and Engagement with Nature	Access to outdoor recreation areas is an important component to individual and community mental and physical well-being. Parks provide opportunities for physical activity, which is known to reduce stress, cardiovascular disease, obesity, and other chronic disease. Activities such as fishing can further impact health through consumption of the catch. Parks and aesthetically-pleasing green spaces also promote engagement with nature, which has been shown to reduce stress and improve mental and overall health and well-being. The value of these spaces can be a product of on-going contact with them.

Table 4. Health Impact Characterization Table Summarizing Potential Impacts to Health for Each Future Alternative

Alternative	Recreational Access	Uses	Description of Impacts	Impacts to Health
Alternative 1: No Change	<ul style="list-style-type: none"> • LSMR passenger train • Causeway is an informal trail² • Parking lot (on private land) 	<ul style="list-style-type: none"> • Bird and wildlife watching • Kayaking³ • Jelly making (berry picking) • Dog training • Fishing • Trapping 	<p>This is the baseline alternative. This alternative would result in no change to the health determinants. Current users will continue to enjoy running or riding the railroad, using the rail as an informal trail, and other uses (bird and wildlife watching, kayaking, fishing, etc.). This alternative is the least protective for water quality, which will impact indigenous communities who wish to exercise treaty rights.</p>	<p>The LSMR would continue to run and provide opportunities for social cohesion to its volunteers and cultural experiences for passengers. Existing opportunities for recreation and engagement with nature would continue for recreational users, bird and wildlife watchers, anglers, and others, although formal recreational access would remain <u>limited</u>. While these aspects would have a positive impact on health for current users, the habitat would remain impacted and could have potential negative impacts to birds, fish, and other wildlife (USEPA, 2019), as well as impact indigenous communities' rights.</p>
Alternative 2 and Alternative 2 v2⁴: 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 	<p>Current users will continue to enjoy running or riding the railroad and other uses (bird and wildlife watching, kayaking, fishing, etc.). These alternatives have the potential to improve habitat, which might positively impact bird and wildlife watchers, and anglers. The alternatives will also positively impact hikers and bikers through the addition of a trail on land.</p>	<p>These alternatives would have a positive impact on health for most impacted populations. The LSMR would continue to run and provide opportunities for social cohesion to its volunteers and cultural experiences for passengers. There would be potential improvements in water habitat and quality. Existing opportunities for recreation and engagement with nature would be preserved for recreational users, bird and wildlife watchers, and anglers, and additional recreational opportunities could be added through trail use.</p>

² An informal trail is by definition an unsanctioned use. We include it here not as an endorsement, but as input offered by participants.

³ Kayaking is limited. Stakeholders reported portaging over the tracks into West Mud Lake.

⁴ The levees in the v2 alternatives provide more sheltered bay habitat (Angradi and Hoffman 2019).

Alternative	Recreational Access	Uses	Description of Impacts	Impacts to Health
Alternative 3 and Alternative 3 v2 ⁴ : 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 	<p>These alternatives will result in great loss for the railroad organization in terms of social cohesion and sense of purpose and a loss for rail riders. These alternatives have the potential to improve habitat, which might positively impact bird and wildlife watchers and anglers. These alternatives will also positively impact hikers and bikers through the addition of a trail on land, and the addition of a tall bridge would provide improved access for kayakers and canoers to all of Mud Lake.</p>	<p>These alternatives would have a positive impact on health for recreational users, bird and wildlife watchers, and anglers through trail use and other added amenities, as well as potential improvements in water habitat and quality. They would have a negative impact on the social cohesion and place attachment for the LSMR, the neighborhood that identifies with the train, and train passengers.</p>
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 	<p>This alternative will result in great loss for the railroad organization in terms of social cohesion and sense of purpose. This alternative has the potential to improve habitat more than the other alternatives through the creation of a high-quality coastal wetland, which will likely positively impact indigenous communities who wish to exercise treaty rights, along with bird and wildlife watchers and anglers. The alternative will also positively impact hikers and bikers through the addition of the trail.</p>	<p>This alternative would have a positive impact on recreational users given the trail and other amenities; the Anishinaabe people as the bay is returned closer to its original state to allow for the exercise of treaty rights; anglers through more shore and boat fishing access; and boaters through more deep water. This alternative would have a negative impact on the social cohesion and place attachment for the LSMR, the neighborhood that identifies with the train, and train passengers, and bird watchers who will lose highly-sheltered shallow-water habitat and the access to the river that the causeway provides.</p>