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Kingsbury Bay-Grassy Point Habitat Restoration Health Impact Assessment

Duluth, Minnesota

Summary Report of Main Findings and Recommendations

Office of Research and Development
U.S. Environmental Protection Agency

Notice

The Kingsbury Bay-Grassy Point Habitat Restoration Health Impact Assessment (HIA) was led by U.S. Environmental Protection Agency (EPA) staff and contractors. EPA's Sustainable and Healthy Communities (SHC) research program and existing contracts within its Office of Research and Development (ORD) partially funded and provided personnel for the research described here. Members of state and local government; non-government organizations; and community residents also provided input for this report. The contents of this report are solely the responsibility of the authors and do not necessarily represent the views or policies of EPA. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise, does not necessarily constitute or imply its endorsement, recommendation, or favoring by EPA. The report was subjected to the Agency's review process and approved for publication as an EPA document.

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Acronyms and Abbreviations

A Assumption

L Limitation

 Ecosystem Service

AADT	Annual average daily traffic
AOC	Area of Concern
AQS	Ambient quality standard
ATSDR	Agency for Toxic Substances and Disease Registry
BSAF	Biota-sediment accumulation factor
CDC	Centers for Disease Control and Prevention
C-FERST	Community-Focused Exposure and Risk Screening Tool
CONUS	Continental United States
CPTED	Crime Prevention Through Environmental Design
dBA	A-weighted decibels
DWP	Duluth-Winnipeg-Pacific
EAW	Environmental Assessment Worksheet
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
FWS	United States Fish and Wildlife Service
GIS	Geographic information systems
GLWQA	Great Lakes Water Quality Assessment
HIA	Health Impact Assessment
IBI	Index of biological integrity
IPCC	Irving Park Community Club
LAEQ	24-hour equivalent sound levels
LOS	Level of service
MIC	Duluth-Superior Metropolitan Interstate Council
MDH	Minnesota Department of Health
MNDNR	Minnesota Department of Natural Resources
MNDOT	Minnesota Department of Transportation
MPCA	Minnesota Pollution Control Agency
MPO	Metropolitan planning organization
NAAQS	National Ambient Air Quality Standard
NAC	Noise area classification
NATA	National Scale Air Toxics Assessment
NHTSA	National Highway Transportation Safety Administration
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanic and Atmospheric Administration
NPCC	Norton Park Community Club
NRPA	National Parks and Recreation Association
ORD	Office of Research and Development
OSHA	Occupational Safety and Hygiene Administration
PCB	Polychlorinated biphenyl
PM	Particulate matter

REL	Reference exposure level
ROD	Record of Decision
SAV	Submerged aquatic vegetation
SHC	Sustainable and Healthy Communities
TSP	Total suspended particulates
VOC	Volatile organic compounds
WDNR	Wisconsin Department of Natural Resources
WHO	World Health Organization
WWFT	Western Waterfront Trail (now known as Waabizheshikana or "The Marten Trail")

Background

This summary report documents the main findings and recommendations of the Kingsbury Bay-Grassy Point Habitat Restoration Health Impact Assessment (HIA).

What is this HIA about?

This U.S. Environmental Protection Agency (EPA)-led HIA assessed a Great Lakes Area of Concern (AOC) habitat restoration project being implemented by the Minnesota Department of Natural Resources (MNDNR) at two sites along the St. Louis River in Duluth, Minnesota – Kingsbury Bay and Grassy Point. The HIA examined the potential public health implications of the restoration project, including the MNDNR restoration work itself, and how people will access and utilize the project sites following restoration. The HIA was conducted to provide voluntary, evidence-based recommendations to MNDNR and the City of Duluth, MN (who is responsible for any post-restoration park improvement work at these sites) to address any disproportionate health impacts (i.e., unequal sharing of health burdens and benefits), mitigate potential adverse health impacts, and enhance potential health benefits of the projects.

Great Lakes Areas of Concern (AOCs)

Forty-three (43) geographic areas in the Great Lakes were designated Areas of Concern in the Great Lakes Water Quality Agreement (GLWQA) because they had experienced environmental degradation "and significant impairment of beneficial uses… as a result of human activities at the local level." The GLWQA is a commitment between the U.S. and Canada, first signed in 1972 (and subsequently amended in 1983 and 1987), to restore and protect the Great Lakes, a series of interconnected freshwater lakes on the U.S.-Canada border. EPA and other federal and state agencies are working to restore the 27 remaining U.S. AOCs in the Great Lakes basin.

The Kingsbury Bay-Grassy Point Habitat Restoration is one of several projects that will restore lost habitat and restore beneficial uses of the Great Lakes ecosystem, contributing to the "delisting" of the St. Louis River AOC, one of the 27 remaining U.S. Great Lakes AOCs named in the Great Lakes Water Quality Agreement—a commitment between the U.S. and Canada to restore and protect the waters of the Great Lakes

The St. Louis River was named an AOC because of historical industrial and municipal wastewater discharges, contamination of river sediments, disposal of legacy debris, and habitat losses that impaired the beneficial uses of the St. Louis River ecosystem. Based on sediment testing, fish tissue analysis, macroinvertebrate sampling, and other studies at Kingsbury Bay and Grassy Point, remediation of the sites was generally not necessary; however, it was determined that restoration actions at these sites should consider the presence of contaminants.

The St. Louis River drains 3,634 square miles and enters the southwest corner of Lake Superior between Duluth, Minnesota and Superior, Wisconsin. Kingsbury Bay and Grassy Point are two of fifteen aquatic habitat restoration sites in the St. Louis Rive AOC (Figure 1).

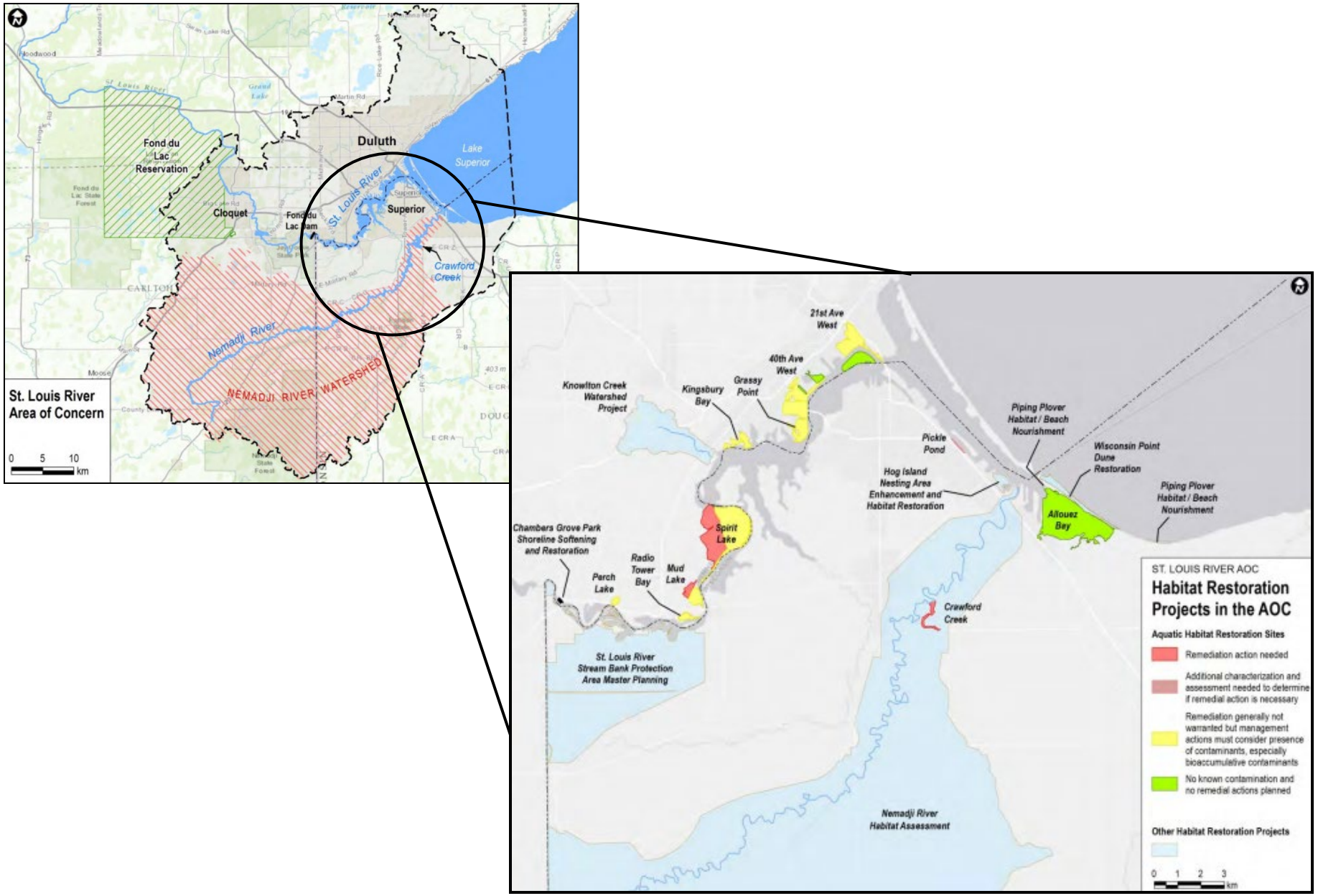

Figure 1. St. Louis River Area of Concern aquatic habitat restoration sites, including Kingsbury Bay and Grassy Point.

In addition to the MNDNR habitat restoration work, the City of Duluth has been implementing an extensive effort to enhance recreational amenities along the St. Louis River, including at Kingsbury Bay. Kingsbury Bay sits at the mouth of Kingsbury Creek, downstream from the Lake Superior Zoo, one of the City of Duluth's targets for renewal as part of the St. Louis Corridor Initiative. Kingsbury Bay is public land that connects three important public facilities – the Lake Superior Zoo, IndianPoint Campground, and the Western Waterfront Trail (now known as Waabizheshikana or "The Marten Trail"). Nearby Grassy Point is a natural area with amenities to support outdoor recreation at the northern end of an extended Western Waterfront Trail and the only public river access in the Irving Neighborhood of Duluth. The City of Duluth will be enhancing public access to these sites through the development of enhanced recreational amenities and park improvements following completion of the habitat restoration.

Western Waterfront Trail

Throughout this HIA, there will be mention of the Western Waterfront Trail; this was the name of the trail at the time of the HIA analysis. Since that time, the trail was renamed to Waabizheshikana (waa-bah-zhay-shay- kuh-nuh) or "The Marten Trail" in Anishinaabe, in honor of the Marten Clanthat settled in this part of the St. Louis River. The Western Waterfront Trail/ Waabizheshikana is a hiking and biking trail system along the St. Louis River from Grassy Point to beyond Kingsbury Bay and provides access to the river.

Why was an HIA performed?

EPA has identified HIA as a decision-support tool that can provide science-based resources and information for community-driven initiatives and promote sustainable and healthy communities. Several proposed St. Louis River AOC sediment remediation and habitat restoration projects were evaluated as potential HIA projects by EPA, and it was determined that the proposed habitat restoration project at Kingsbury Bay and Grassy Point and the subsequent park improvement projects at each site could benefit from an HIA. It was determined that the HIA would add value to the decision-making process, was timely, and achievable. Importantly, the HIA would facilitate the consideration of public health and well-being in the design of the project. The Kingsbury Bay-Grassy Point Habitat Restoration Project was timely because the project was funded and moving into the design phase, so input on the proposed path forward was well-timed. Furthermore, the Kingsbury Bay-Grassy Point Project was near the Irving and Fairmount neighborhoods, which were undergoing a revitalization planning process by the City of Duluth. The hope was that these two processes would inform and complement each other, through intentional inclusion of City representatives and stakeholders, and that the HIA would provide information to the decision-makers, stakeholders, and the public about the potential beneficial and adverse impacts to health that may result from the Kingsbury Bay-Grassy Point Habitat Restoration Project.

Based on this information, EPA agreed to lead an HIA to evaluate this habitat restoration project from a health-focused perspective. As an EPA-led HIA Case Study, the HIA was conducted from a neutral position (i.e., not advocating for or against the proposed project), with an emphasis on identifying and explaining the relationships between ecosystem services provided by the two sites and public health.

Who performed this HIA?

Staff in EPA led the HIA. They established the HIA Project Team, which consisted of EPA staff, contractors, and research fellows, along with local professional stakeholders (e.g., individuals from academia; community organizations; local, county and state government agencies; and environmental organizations). Members of the

HIA Project Team served on the HIA Leadership Team, HIA Research Team, or both. The HIA Project Team conducted the HIA with input and guidance from an HIA Advisory Committee, made up of technical experts and representatives from several stakeholder groups.

What methods were used in this HIA?

HIA is "a systematic process that uses an array of data sources and analytical methods and considers input from stakeholders to determine the potential effects of a proposed policy, plan, program or project on the health of a population and the distribution of those impacts within the population. HIA provides recommendations on monitoring and managing those effects" (National Research Council, 2011). The HIA process includes six steps – S*creening, Scoping, Assessment, Recommendations, Reporting,* and *Monitoring and Evaluation*.

This HIA utilized a mixed-methods approach to inform the assessment of health impacts, including the methods listed below.

- ✓ Analysis of pre-existing and publicly-available data
- ✓ Geographic information systems (GIS) mapping and spatial analyses
- ✓ Modeling and ecosystem services mapping
- ✓ Systematic review of the literature
- ✓ Stakeholder engagement and participatory mapping exercise to gather input from community members;tribal, professional, and scientific experts; and other stakeholders
- ✓ Statistical and graphical analysis
- ✓ Measurable (quantitative) and relative (qualitative) characterization of impacts

What was the scope of this HIA?

This HIA assessed the potential health impacts of the "85%-complete" habitat restoration design and concept plans for park improvements detailed in the Draft Environmental Assessment Worksheet (EAW) developed by MNDNR[1] and subsequent revisions made to that design to address some of the preliminary results and recommendations of the draft HIA, concerns raised during the design process, and input from the Minnesota Pollution Control Agency (the permitting agency). The revised design received from MNDNR and assessed in this HIA was chosen as the preferred project alternative in January 2018 and is detailed in the Final EAW (MNDNR, 2018)[2]. At the time of the HIA, the City's recreational and park improvement plans for the two sites had not yet been finalized. The HIA had an opportunity to inform that design process and communicate the desires and concerns of the community for these park sites.

Based on input from stakeholders, including community members, scientific experts, and decision-makers, the HIA Project Team identified "pathways" through which the proposed habitat restoration and park improvements could potentially impact health. Seven pathways were identified for assessment in the HIA. These pathways

[1] As the responsible party for the review of the project, MNDNR developed an EAW to describe the environmental effects associated with the Kingsbury Bay-Grassy Point Habitat Restoration Project.

[2] The Final EAW was issued for public comment in March 2018, following completion of the HIA analysis and communication of the HIA findings and recommendations to stakeholders and the community. MNDNR determined that an Environmental Impact Statement (EIS) was not required for the project and issued a Record of Decision (ROD) on May 30, 2018, concluding the state environmental review process for the project (https://www.dnr.state.mn.us/input/environmentalreview/kingsbury-grassy/index.html).

encompass well-established social determinants of health (i.e., conditions in the physical and social environment that shape opportunities to be healthy). In many cases, these pathways also include impacts on nature and the benefits and services nature provides, also known as ecosystem services:

- Water Habitat and Quality;
- Equipment Operation, Traffic, and Transport;
- Air Quality;
- Noise and Light Pollution;
- Crime and Personal Safety;
- Recreation, Aesthetics, and Engagement with Nature; and
- Social and Cultural.

The HIA assessed each of these pathways by addressing four questions: What are the current conditions?; How will habitat restoration and park improvements impact the current conditions?; What is the connection of the pathway to health?; and How might health be impacted by habitat restoration and park improvements?

Main Findings and Recommendations of the HIA

Kingsbury Bay and Grassy Point

The proposed project will restore approximately 240 total acres of aquatic habitat at the Kingsbury Bay and Grassy Point sites. At Kingsbury Bay, the project will restore the wetland complex at the mouth of Kingsbury Creek by dredging up to 170,000 cubic-yards of sediment, including a delta dominated by invasive narrow-leaf cattails. The project will create open water habitat and increase the diversity of native aquatic vegetation. In addition to restored habitat, the project will provide ecosystem benefits including recreational boating and fishing opportunities.

Legacy wood waste impairs the habitat at Grassy Point. The site was home to two turn-of-the-century sawmills that deposited wood waste up to 20 feet deep in the river over time. Grassy Point is an existing natural area that is located adjacent to an industrial site. Currently, amenities at Grassy Point include a parking area, a carry-in canoe landing, and a boardwalk. The boardwalk is presently in disrepair from vandalism and lack of maintenance and is not accessible to individuals with mobile disabilities. Restoration will create a shallow sheltered bay, an island to shelter the bay, and will improve the Keene Creek channel. Sediment dredged from Kingsbury Bay will be reused for island creation and habitat restoration at Grassy Point. Ecosystem benefits that will result from the restoration at Grassy Point include improved boating, walking, shore angling, birding, and scenic views.

At the time of the HIA, the City's recreational and park improvement plans for these two sites had not yet been finalized. The City was looking to undertake a park planning process to update the mini-master plan developed previously for Grassy Point and develop a plan for Kingsbury Bay. The HIA assessed concept plans for park improvements detailed in the Draft Environmental Assessment Worksheet (EAW) and had an opportunity to inform the park design process and communicate the desires and concerns of the community for these park sites.

The HIA study area, including the Kingsbury Bay and Grassy Point sites, surrounding neighborhoods, and Census tracts examined in the HIA analysis (Tracts 33, 34, and 36) are shown in Figure 2.

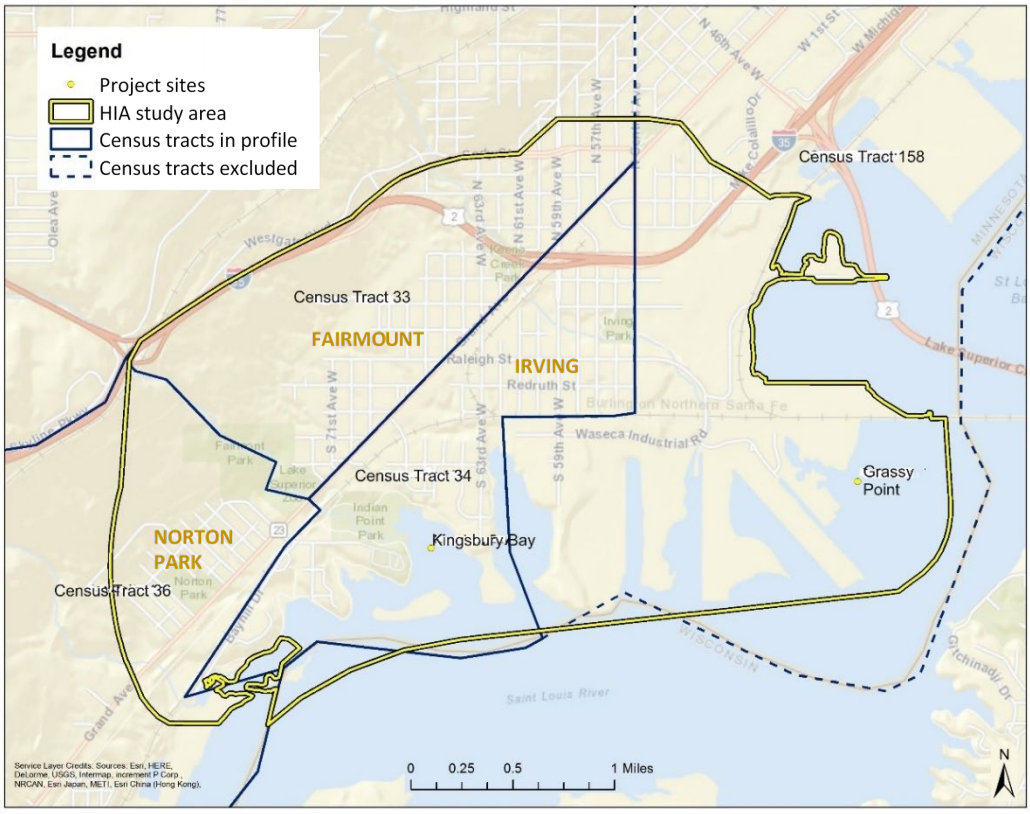

Figure 2. HIA study area.

Potential Health Impacts of the Proposed Habitat Restoration and Park Improvements

The HIA demonstrated that the proposed habitat restoration and park improvements work at Kingsbury Bay and Grassy Point could have both positive and negative impacts on health through a number of health determinants (i.e., factors known to directly or indirectly impact human health; Figures 3 and 4).

The majority of the negative health impacts potentially associated with the projects are expected to be short-term and to primarily impact residents and recreational users in the vicinity of the project sites and along the transportation routes during the habitat restoration and park improvements construction work. Potential negative impacts to health include pollution and noise impacts related to the operation of construction equipment, increased traffic, road damage, disruptions to recreational users, damage to aquatic habitat and wildlife, and material transport impacts.

In the longer term, the potential health impacts of habitat restoration and park improvements are expected to be positive and to improve the health of residents and recreational users in the surrounding communities of Duluth, as long as the sites are maintained and upkeep performed, as needed. Potential health benefits include decreased water, sediment, and biota pollutant levels; decreased fish tissue contamination; improved aquatic habitat; increased public green space; reductions in crime, as a result of beautification and on-going maintenance of the sites; and new and improved opportunities for outdoor recreation, social interaction, and cultural and spiritual experiences.

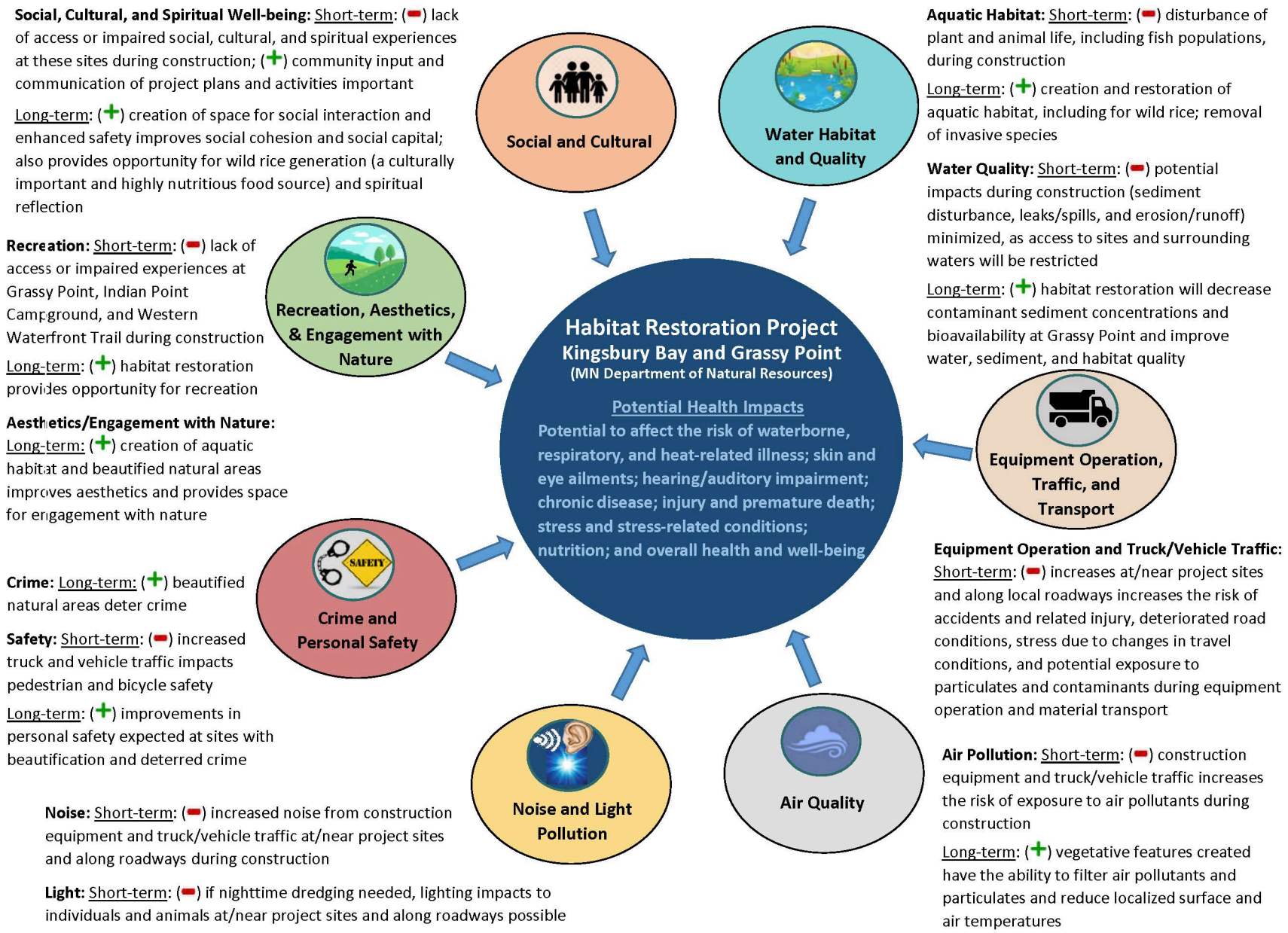

Figure 3. Potential impacts of the proposed habitat restoration on health and health determinants through seven pathways examined in the HIA. Negative impacts are denoted by (−); positive impacts are denoted by (+).

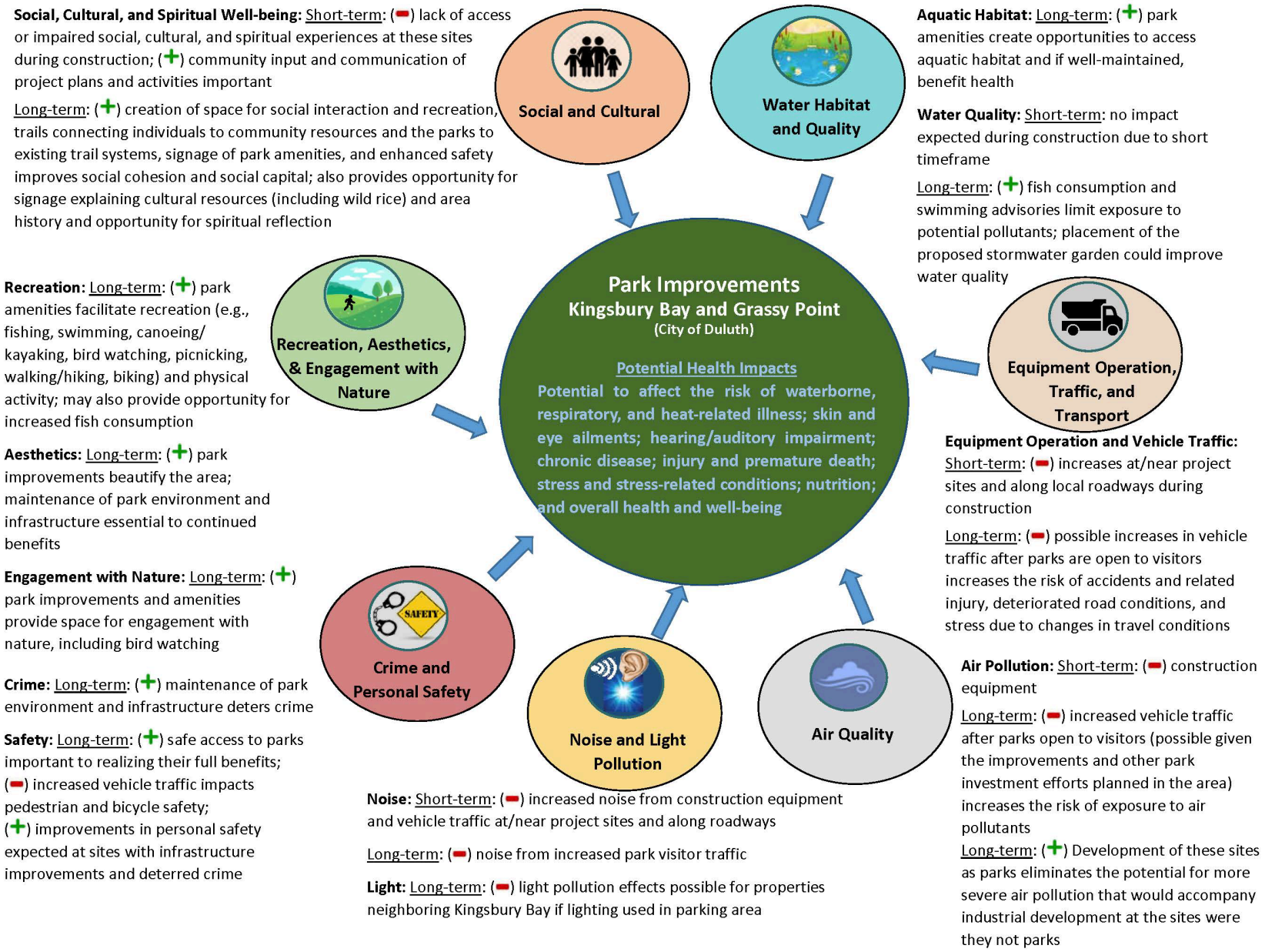

Figure 4. Potential impacts of the proposed park improvements on health and health determinants through seven pathways examined in the HIA. Negative impacts aredenoted by (−); positive impacts are denoted by (+).

The HIA results suggest that there might be unequal sharing of the burdens and benefits of the proposed habitat restoration and park improvements within the population. Some groups of people within the community may be more sensitive to or more affected by the changes in the physical and natural environment, social environment, and economic environment as a result of the project, including:

- outdoor recreation users,
- fishermen/anglers,
- members of low-income households,
- minority and indigenous peoples,
- people that live near Kingsbury Bay and along truck transport routes,
- pedestrians and bicyclists,
- the elderly (age 65 or older) and physically disabled,
- children, and
- people with pre-existing health conditions.

As mentioned previously, the HIA was also interested in examining how ecosystem services would be impacted through habitat restoration and park improvements. To do this, it was first necessary to make a connection between the things in the physical environment that will be changed due to the habitat restoration and park improvements projects (both in the short-term and long-term) and their associated ecosystem service or services. These ecosystem services connections and impacts are denoted throughout this report using a leaf icon. For each pathway, we then determined who would benefit from those services and identified any health determinant(s) or health outcome(s) associated with those ecosystem services (Table 1).

Table 1. Ecosystem Services Affected by the Habitat Restoration and Park Improvements Projects and the Associated Health Impacts

Ecosystem Services - Component	Ecosystem Services	Associated Beneficiaries	Associated Health Determinant/ Health Outcome
Wetland habitat	Habitat for marsh birds, wading birds, and migratory waterfowl	Recreational birdwatchers	Outdoor recreation, such as birdwatching, can provide opportunities to engage with nature, reduce stress, and provide opportunities for social cohesion
Shallow aquatic habitat	Production of wild rice	Indigenous community, recreational harvesters	Production of wild rice can provide opportunity for food gathering, nutrition, social cohesion, identity, place attachment, and cultural fulfillment
Deep aquatic habitat	Habitat for human powered-boating (canoes and kayaks)	Recreational users, such as boaters	Outdoor recreation, such as human-powered boating, can provide opportunities to engage with nature; reduce stress, cardiovascular disease, obesity, and other chronic disease; and provide opportunities for social cohesion

Ecosystem Services - Component	Ecosystem Services	Associated Beneficiaries	Associated Health Determinant/ Health Outcome
Deep aquatic habitat	Habitat for motor-powered recreational boating, and winter fishing	Recreational users, such as boaters and winter anglers	Outdoor recreation, such as boating and fishing, can provide opportunities to engage with nature, reduce stress, and provide opportunities for social cohesion
Submerged aquatic vegetation	Habitat for gamefish	Subsistence and recreational anglers	Outdoor recreation, such as fishing, can provide opportunities to engage with nature; reduce stress, cardiovascular disease, obesity, and other chronic disease; improve impact nutrition (if fish are consumed); and provide opportunities for social cohesion
Aquatic vegetation and reduced sediment contamination	Improved water quality	Recreational users, such as swimmers, human-powered boaters	Improved water quality can reduce water contact-related risks, such as skin and eye ailments
Reduced sediment contamination and improved water quality	Improved habitat for resident fish	People who consume fish from the river, including subsistence and recreational anglers	Improving water and sediment quality can decrease contaminant bioaccumulation, improve nutrition, and decrease chronic disease incidence due to consumption of contaminated fish
Clean sediment, water, and habitat	Scenic views, sights and smells	Indigenous community, park visitors, hikers on adjacent trails, neighbors	Improved aesthetics can deepen place attachment and identity; decrease crime; provide opportunities for physical activity, spiritual reflection, cultural fulfillment, engagement with nature, and social cohesion; reduce stress; and improve mental and overall health and well-being
Upland habitat (trees and other vegetation)	Shade, localized filtering of air pollutants, and regulation of air and surface temperatures	Park visitors, hikers	Shade and decreases localized air and surface temperatures can reduce the risk of heat-related illness, and improved air quality can reduce the risk of respiratory illness and other chronic disease related to air pollutants
Natural area and green space	Accessible natural areas	Park visitors, hikers on adjacent trails	Green spaces can decrease crime; provide opportunities for physical activity, spiritual reflection, cultural fulfillment, engagement with nature, and social cohesion; reduce stress, and improve mental and overall health and well-being

Recommendations to Manage These Impacts

The HIA Project Team identified evidence-based recommendations to maximize the potential positive health impacts (e.g., improved water habitat and quality; opportunities for outdoor recreation, social interaction, and cultural resources; etc.), minimize or avoid the potential negative health impacts (e.g., air pollution; noise and light pollution; impacts to residents and recreational users; etc.), and offer decision alternatives and health supportive measures. The final recommendations provided by the HIA incorporate input received from the community and stakeholders during the Final HIA Community and Stakeholder Meetings (documented in the full HIA Report). Adoption of any of these recommendations is at the discretion of the decision makers (MNDNR and the City of Duluth). Recommendations were related to:

- water, sediment, and biota management;
- aquatic and terrestrial habitat plans;
- equipment operation, traffic, and transport of materials;
- mitigation of air, noise, and light pollution;
- crime and safety;
- park access and amenities;
- cultural and social resources;
- communication and informational signage; and
- health supportive measures, such as creel surveys focused on fishing within the AOC, means for resident and stakeholder engagement and feedback throughout the process, and consideration of co-management models for the created parks.

The pages that follow summarize the main findings and recommendations for each of the seven pathways assessed in the HIA. For supporting information, including literature and community and stakeholder input, documentation of the HIA process and methodologies, a profile of the population affected by the proposed habitat restoration and park improvements, the complete HIA analysis, and a compilation of all 78 HIA recommendations, see the full HIA Report (EPA/600/R-21/XXX), available online at the EPA HIA Case Studies web page (https://www.epa.gov/healthresearch/epa-health-impact-assessment-case-studies).

Water Habitat and Quality

Water resources, such as the St. Louis River, provide invaluable ecosystem services, including a medium for transportation, food, habitat for wildlife, opportunities for recreation and tourism, viewscapes and opportunities to engage with nature, social/cultural benefits, and more. The quality of these water resources can affect both ecosystem health and human health. The habitat and water quality present in recreational and fishing waters, like the St. Louis River, can impact human health directly through fish consumption and water contact, but can also impact social, recreational, and cultural aspects of life.

Improving water, sediment, and habitat quality through habitat restoration can enhance nutrition and decrease chronic and waterborne disease incidence in anglers and decrease waterborne illness and skin and eye ailments in swimmers and recreational water users. Improvements to water and habitat quality can also reduce stress and stress-related conditions by enhancing aesthetics and reducing the risk (actual or perceived) of pollutant exposures. These improvements can also impact social capital and recreational opportunities, as well. Park improvements can contribute to health through the provision of features and amenities that help control stormwater, erosion, and runoff and that provide safe access to the river for the community.

Existing Conditions

Water Quality

The St. Louis River is a popular fishing destination for anglers from throughout the region (Lindgren, 2004). The St. Louis River estuary provides productive habitat for migratory gamefish, including Lake Sturgeon and Walleye, as well as resident gamefish, including Yellow Perch, Black Crappie, Smallmouth Bass, sunfishes (such as Bluegills), and Northern Pike. St. Louis River anglers primarily target Black Crappie, Yellow Perch, sunfishes, Northern Pike, and Walleye for consumption (Lindgren, 2004; Figure 5). Although less common in the harvest than Yellow Perch or Black Crappie, during the most recent creel survey, it is notable that Walleye and Northern Pike have high concentrations of bioaccumulative polychlorinated biphenyls (PCBs), dioxins, and mercury because they are top predators and occupy a higher position in the food web.

Figure 5. The St. Louis River provides habitat for various species of fish.

Sediment at the project sites is contaminated by mercury, PCBs, and dioxins. Contaminant concentrations are not high enough to pose a human health risk from physical contact with river sediments. However, these contaminants accumulate and magnify through food webs and thereby, can present a major human health concern when consumed in fish, especially larger predatory species. Both resident and migratory fish are subject to Minnesota and Wisconsin fish consumption advisories related to elevated concentrations of mercury (a neurotoxin) and PCBs (a carcinogen; WDNR, 2013). Global, regional, and local mercury sources contribute to mercury in the St. Louis River (Cohen et al., 2004). Given the observed patterns in the Great Lakes, it is likely that both regional and local mercury sources contribute to mercury in the

tissues of resident fish at the Kingsbury Bay and Grassy Point sites (Lepak et al., 2018). Given that many of these sources are from outside the basin, there is great uncertainty whether mercury in the project area sediments substantially contribute to mercury in the tissues of resident fish at the sites. In contrast, elevated PCBs concentrations in fish are strongly correlated to PCBs in sediment; PCBs are passed from sediments through the local food web and into fish through their diet. Dioxins, which (like PCBs) are a potent carcinogen that is primarily passed to fish from the sediment and up through the food web, are also of concern in the project area.

A

Based on mercury levels, many of the gamefishes in the St. Louis River should not be eaten more than once per month (WDNR, 2013). To assess the PCB- and dioxin-related toxicity of resident fish feeding in the project area, we used a species-specific and compound-specific biota-sediment accumulation factor (BSAF) model to predict fish tissue residues based on sediment contaminant and organic carbon concentrations (Ankley et al., 1992). The model outputs indicate that the potential for legacy sediment contamination to contribute to PCBs or dioxins and PCB-like dioxins in game fish in the vicinity of Kingsbury Bay is negligible, whereas in the vicinity of Grassy Point the potential is small, though higher than at Kingsbury Bay (see full HIA Report for model outputs).

Based on this evidence, routinely consuming fish from the project area presents a human health risk; the risk depends on consumption frequency, serving size, and fish species. Efforts to limit fish consumption where it presents a health risk, include signs posted at landings and fishing piers with updated waterbody-specific consumption advisory information. The effectiveness of these efforts on the St. Louis River is not known. If not communicated properly, health warnings may not reduce fish consumption among anglers that value the perceived general health benefits of fish consumption (Chess et al., 2005; Lin et al., 2014). However, populations that choose to reduce consumption of the most contaminated fish in favor of less contaminated fish can lower their mercury body burden (Xue et al., 2015). The most recent creel survey conducted on the St. Louis River estuary in winter of 2002-2003 and summer of 2003, found that about half (52%) of summer anglers and most winter anglers (90%) were either unaware of or did not heed fish consumption advisories (Lindgren, 2004).

Pathogens are also a problem in the St. Louis River, as indicated by counts of the bacteria *Escherichia coli* (*E. coli*), which episodically exceed water quality criteria in the St. Louis River. The source of pathogens to surface waters is typically improperly treated animal waste, which may come from malfunctioning septic systems, sewage system overflows, stormwater runoff, or direct water contact by wildlife. Exposure to waterborne pathogens can cause gastrointestinal illness (e.g., nausea, diarrhea, vomiting, and abdominal pain), respiratory illness, and illness of the eyes, ears, and skin, but can become more severe (EPA, 2012a; Fewtrell & Kay, 2015; Mannocci et al., 2016). Gastrointestinal illness is the most common outcome of exposure to waterborne pathogens, and due to the generality of the symptoms, often goes unreported (Fewtrell & Kay, 2015).

Habitat Quality

The aquatic habitat is degraded by woody debris deposited on the river bottom at Grassy Point, excess sediment at Kingsbury Bay, and non-native plants at both sites. These impairments have resulted in the loss of aquatic habitat, reduced aquatic vegetation coverage and diversity, and in some areas, degraded aquatic communities. Based on vegetation surveys, at Grassy Point, most of the aquatic habitat (~66% by area) is suitable for submerged aquatic vegetation and mixed aquatic vegetation (Table 2). At Kingsbury Bay, most of the aquatic habitat (~81% by area) is suitable for mixed aquatic vegetation and emergent vegetation.

Table 2. Existing Area of Suitable Aquatic Habitat at Kingsbury Bay and Grassy Point

Site	Aquatic Vegetation Habitat (acres)[a]				
	Total	Emergent	Mixed	SAV	Deep
Kingsbury Bay	101.6	31.5	50.3	5.6	14.2
Grassy Point	140.9	20.0	41.1	52.1	27.7

[a] Aquatic vegetation habitat total and divided into four depth-specific aquatic vegetation habitat types: emergent (<2 ft depth), mixed (2-4 ft depth), submerged aquatic vegetation (SAV; 4-6' depth), and deep (>6 ft depth).

Grassy Point has 1.3 acres of invasive common reed (*Phragmites australis*) and 26.8 acres of invasive narrow-leaved cattail (*Typha angustifolia*), and Kingsbury Bay has 10.4 acres of invasive narrow-leaved cattail. Current habitat area suitable at each site for three different aquatic plant categories were mapped based on available habitat suitability models (Angradi et al., 2013; Angradi et al., 2015). An important caveat is that the models did not account for woody debris; therefore, the models overestimate suitable habitat in the current conditions. The three plant categories were wild rice (*Zizania* spp.), floating leaf vegetation (typically pondweeds *Potomageton* spp. and water lilies family: Nymphaeaceae), and submerged aquatic vegetation (generally wild celery, *Valisneria americana,* in the St. Louis River; Table 3). Based on these estimates, Grassy Point has about 34 acres of habitat suitable for wild rice. For floating leaf plants, Grassy Point is more suitable for spare vegetation stands (<50% cover) than thick stands (>50% cover). For submerged aquatic vegetation, the Grassy Point habitat is similarly suitable for thick stands (>75% cover) and mid-density stands (25-50% cover), and slightly less suitable for spare stands (<25% cover). In comparison, Kingsbury Bay has 79.5 acres of habitat suitable for wild rice. Similar to Grassy Point, the habitat for floating leaf plants at Kingsbury Bay is more suitable for spare vegetation stands than thick stands. For submerged aquatic vegetation, Kingsbury Bay is most suitable for thick vegetation stands, and much less so for mid-density or spare stands. Further, at Kingsbury Bay, the Kingsbury Creek delta limits the aquatic habitat area.

Table3. Predicted Area of Suitable Habitat for Wild Rice and Aquatic Vegetation Types at Kingsbury Bay and Grassy Point Currently[a]

Site	Wild Rice (acres)	Floating Leaf Vegetation [b] (acres)		Submerged Aquatic Vegetation [b] (acres)		
		0-50%	>50%	0-25%	25-75%	>75%
Kingsbury Bay	79.5	65.8	35.8	18.1	9.9	73.6
Grassy Point	34.4	123.6	17.6	40.4	50.1	50.8

[a] Percent values are predicted percent cover based on models.

[b] Aquatic vegetation areas are given by the corresponding probability of occurrence (analogous to percent cover). Estimates do not account for woody debris and therefore, overestimate suitable habitat.

Potential Impacts to Water Habitat and Quality

Habitat Restoration

Water Quality

In the short term, it is possible that habitat restoration will reduce water quality by increasing water turbidity as a result of woody debris removal, sediment dredging, dredge material placement, and by potential leaks (e.g.,

oil, fuel) from construction equipment. Mitigation activities, including silt curtains and spill containment at sediment transfer points, are required by the permit. Turbidity will be monitored on-site and adjustments will be made if suspended sediment levels above permit requirements are detected. It is not likely that there will be long-term ecological effects from the short-term increases in turbidity that may occur during dredge material removal or placement.

In the long term, habitat restoration will likely improve water quality at Kingsbury Bay and Grassy Point but have little impact on waterborne pathogens, because the project will not affect the regional stormwater or sanitary sewer system, two potential source of contamination and waterborne pathogens. However, the habitat restoration is increasing the area of wetlands at the mouth of two urban creeks (Kingsbury Creek and Keene Creek), and these wetlands may help to filter excess nutrients, sediments, and pollutants often carried by stormwater runoff, if designed to directly intercept the stormwater.

Habitat restoration will decrease surface sediment concentrations of PCBs and dioxins in the project area, particularly by adding clean sediment to the Grassy Point project area, especially north of the C. Reiss facility, where dioxin concentrations are elevated compared to the rest of the project area. Moving sediment from Kingsbury Bay to Grassy Point is likely to reduce sediment concentrations of PCBs and dioxins, because the dredged material is presumed to be largely comprised of clean, upland sediment. Habitat restoration could also decrease the bioavailability of PCBs and dioxins in the project area by increasing wetland habitat, which reduce bioavailability of contaminants by increasing the carbon content of sediments.

Over time, the changes in PCBs and dioxins in the study area will result in a moderate, but unknown reduction in the concentrations and bioavailability of these contaminants in the tissue of resident fish, such as Yellow Perch and sunfish (Meier et al., 2015). Larger, older fish that people often target for consumption will respond more slowly than smaller, younger fish (Meier et al., 2015). The St. Louis River is a popular fishing destination for anglers from throughout the region, so improvement in the safety of fish for consumption would potentially impact thousands of people (Lindgren, 2004). Habitat restoration will have low impact on dioxin and PCB concentrations in other resident fish, such as Walleye, and migratory fish that feed throughout the river where these pollutants remain a problem. The greatest contamination close to the project area lies just outside the Grassy Point project area, between the eastern edge of the project boundary and the navigation channel.

L

Changes in mercury methylation or mercury bioavailability levels in the project area as a result of habitat restoration are not known.

Habitat Quality

Habitat restoration is highly likely to substantially improve the aquatic habitat quality (Table 4) at both sites. Overall, there will be a net gain of 12 acres of aquatic habitat (-1 acres at Grassy Point, +13 acres at Kingsbury Bay), the result of removing the Kingsbury Creek delta. Broadly, the site will become deeper and more suitable for submerged aquatic vegetation with more deep refuge habitat for fish. Habitat greater than 4-6 feet deep (suitable for submerged aquatic vegetation) will increase by 23.3 acres, and habitat greater than 6 feet deep will increase by 4.2 acres. Consequently, there will be a 14.2 acre loss of emergent vegetation habitat (0-2 feet deep). The habitat is highly likely to improve as a result of removing 25.1 acres of invasive common reed and narrow-leaved cattail. MNDNR plans to remove all the invasive common reed (1.3 acres) at Grassy Point, as well as all the narrow-leaved cattail in Kingsbury Bay and half of the inhabited area on Grassy Point (goal of 23.8 acres removal).

Table 4. Area of Aquatic Habitat at Kingsbury Bay and Grassy Point Currently (Existing) and in the Future (Post Restoration)

Aquatic Vegetation Habitat Type [a]	Aquatic Habitat (acres)					
	Kingsbury Bay Existing	Kingsbury Bay Post Restoration	Kingsbury Bay Change	Grassy Point Existing	Grassy Point Post Restoration	Grassy Point Change
Total Aquatic	101.6	114.4	12.8	140.9	140.2	-0.7
Emergent	31.5	26.3	-5.3	20.0	11.0	-8.9
Mixed	50.3	46.9	-3.3	41.1	43.2	2.1
SAV	5.6	23.8	18.2	52.1	57.1	5.1
Deep	14.2	17.4	3.2	27.7	28.8	1.0

[a] Aquatic vegetation habitat total and divided into four depth-specific aquatic vegetation habitat types: emergent (<2 ft depth), mixed (2-4 ft depth), submerged aquatic vegetation (SAV; 4-6' depth), and deep (>6 ft depth).

Overall, the project will increase mid-density submerged aquatic vegetation (25% - 75% cover), with a net gain of 26 acres between the two project sites (Table 5). This is important because many of the desirable game fishes, including Northern Pike and Yellow Perch, prefer moderate or patchy vegetation cover (Inskip, 1982; Krieger et al., 1983). Areas suitable for dense floating leaf vegetation (>50% probability of occurrence) is not likely to be changed overall, because gains at Grassy Point resulting from creation of the large island (to create a shallow, sheltered bay) are offset by decreases due to the deepening of Kingsbury Bay.

Table 5. Predicted Area Suitable for Wild Rice and Aquatic Vegetation at Kingsbury Bay and Grassy Point Currently (Existing) and in the Future (Post Restoration)

Aquatic Vegetation Type [a]	Aquatic Vegetation Area (acres)					
	Kingsbury Bay Existing	Kingsbury Bay Post Restoration	Kingsbury Bay Change	Grassy Point Existing	Grassy Point Post Restoration	Grassy Point Change
Wild Rice	79.5	75.7	-3.8	34.4	37.3	2.9
Floating Leaf: 0-50%	65.8	83.2	17.4	123.6	117.3	-6.3
Floating Leaf: >50%	35.8	31.2	-4.5	17.6	23.1	5.5
Submerged Aquatic Vegetation: 0-25%	18.1	24.0	6.0	40.4	42.3	2.0
Submerged Aquatic Vegetation: 25-75%	9.9	28.9	19.0	50.1	57.1	7.0
Submerged Aquatic Vegetation: >75%	73.6	61.5	-12.1	50.8	41.1	-9.7

[a] The aquatic vegetation areas are given by the corresponding probability of occurrence (analogous to percent cover). Estimates do not account for woody debris and therefore, overestimate suitable habitat.

Removing the Kingsbury Creek delta, which is currently dominated by invasive cattails, is likely to increase conditions suitable for wild rice; however, there will be little change in the total suitable wild rice habitat area because deepening both Grassy Point and Kingsbury Bay will offset the gain from removing the Kingsbury Creek delta (Table 5). At present, there is little wild rice at these locations, despite the physical suitability of both sites, presumably due to woody debris. Post habitat restoration, wild rice restoration efforts (i.e., spreading wild rice seed) at both sites should increase the amount of wild rice within the project area.

Restoration of Kingsbury Bay will likely provide habitat suitable for Black Crappie and Bluegills and will create open-water shore fishery and winter ice fishing opportunities. Grassy Point is close to the main river channel, and the restored habitat may offer a shore fishery for Walleye, particularly during spring and early summer. Habitat restoration is highly likely to increase aquatic habitat for migratory waterfowl. Habitat restoration may also increase nesting habitat for some species, depending on the riparian vegetation that develops post-restoration.

Park Improvements

Park Construction

Potential impacts to water quality and existing wetlands during trail and amenity construction will be evaluated and mitigation actions determined during the park improvements process. Based on the concept plans, any potential negative impacts on water quality and habitat are expected to be short-term, restricted to the construction period. In the long-term, park improvements can contribute to improvements in water quality through the selection of features and vegetation that help control stormwater, erosion, and runoff and can provide safe access to the river for the community. In addition to fishing piers and other amenities that will provide access to the river, the City of Duluth is proposing to build a new swimming beach at Indian Point Campground, near the mouth of Kingsbury Bay, after habitat restoration is complete.

Park Operations and Maintenance

Park improvements will increase access for both shore fishing and boat fishing, providing greater opportunity to catch both resident and migratory gamefish species. Multiple factors will affect the use of the project area by neighborhood residents from Irving and Fairmount for fishing. These factors include proximity to the project area, improved trail systems, new fishing docks, and improvements in other infrastructure, as well as greater abundance of desirable game fish owing to the deepened habitat. Improved fishing conditions may also draw anglers who currently fish at other locations along the river. The concept plan includes four new shore fishing locations at Grassy Point, including a fishing pier on the large island with access to deep water. To improve fishing, the existing pier at Indian Point Campground will be moved to the inside of the bay, close to the deep hole that will be created at the mouth of Kingsbury Bay. Improving fishing access is highly likely to generate more angler activity at the sites. Because other parts of the river will remain contaminated with PCBs, fish consumption advisories will remain after project completion. It is possible that visible improvement in habitat quality at Kingsbury Bay and Grassy Point could lead to the perception that the fish are safe to eat despite posted consumption advisories. Without improvements in public communication regarding the risk of fish consumption, some anglers will be unaware of or else ignore fish consumption advisories and consume more fish from the project areas than advised, potentially resulting in negative health impacts.

The area suitable for boating is also highly likely to increase (Table 6). We predict that there will be a net gain of 12 acres suitable for human-powered boating and a net gain of 46 acres suitable for recreational boating.

Table 6. Predicted Area (acres) of Kingsbury Bay and Grassy Point Suitable for Shore-based Fishing, Human-powered Boating, and Recreational Boating

Recreation Scenario [a]	Kingsbury Bay Existing	Kingsbury Bay Post Restoration	Kingsbury Bay Change	Grassy Point Existing	Grassy Point Post Restoration	Grassy Point Change
Shore Fishing	5.2	3.5	-1.7	2.4	18.3	16
Human-powered Boating	101.1	113.9	12.8	140.3	139.9	-0.4
Recreational Boating	27.8	58.2	30.4	95.6	111.3	15.7

[a] Area suitable for shore fishing based on fishing piers proposed in the concept plan. Human-powered boating includes kayaking and canoeing, and recreational boating includes motorized watercraft.

The new swimming beach within Indian Point Campground at the mouth of Kingsbury Bay will provide new opportunities to access the river. At present, there is not a swimming beach along this part of the river; the closest designated swimming beach along the river is on Park Point (over 10 miles from the project sites). This improved access will disproportionately benefit the Irving, Fairmount, and Spirit Valley neighborhoods, which have no other access to local, safe swimming along the St. Louis River.

Potential Health Impacts Related to Changes in Water Habitat and Quality

Habitat Restoration – Construction and Operation

Sediment contamination within the project area does not pose a health risk from physical contact, but there is a risk associated with eating contaminated fish from the project area. Covering the area of greatest contamination at Grassy Point with clean sediment is highly likely to reduce PCBs and dioxins concentrations in sediment, recognizing the concentrations are low. Further, improving wetland extent will likely reduce the bioavailability of PCBs and dioxins, and subsequently bioaccumulation in fish. As a result, it is **highly likely** that the habitat restoration will have a positive impact on the risk of disease from fish consumption and **benefit health**, because the restoration is likely to decrease contaminant sediment concentration and bioavailability in the project area. The incremental improvement will be relatively small because the current risk is low. Nevertheless, this will positively impact the overall health of anglers and those who consume resident fish caught in the project area, especially those who are most vulnerable, including infants, children, and ethnic and racial minorities. It is also **highly likely** that the project would **benefit health** by reducing the risk of sediment-contact related risks, such as skin and eye ailments, from contaminants. This would most benefit people wading at Grassy Point, who are most likely to be recreational users launching canoes or kayaks.

It is also **possible** that improving water and habitat quality will **benefit health** by reducing stress associated with actual and perceived contamination in the project area, benefitting mental health and increasing neighborhood satisfaction (Schwarzenbach et al, 2010; Saad, 2009; Leslie & Cerin, 2008). Improving the water and habitat quality at these sites can also improve social capital and recreational, spiritual, and cultural opportunities, all of which have associated health benefits (see related pathways). It is **possible** that the restoration will improve local water quality because wetlands can filter excess nutrients and sediments from tributaries. In turn, this might reduce the risk of waterborne illness, **benefitting health**. Any reduction in risk would most benefit Irving and Fairmount Park residents, especially youth, and Indian Point campground users who are likely to utilize the new swimming beach.

Park Improvements – Construction and Operation

Park construction is **highly likely** to have **no impact** on health related to water and habitat quality owing to its short-term nature. Park improvements can **benefit health** by providing amenities such as boat launches, fishing piers, and swimming beaches to encourage safe access to and use of the river and by selecting features and vegetation that help control stormwater, erosion, and runoff. The park improvement is **highly likely** to **benefit health** and have a positive impact on the risk of disease because it will provide improved shore fishing access to the restored habitat, with decreased contaminant sediment concentrations. The benefit will be greatest for anglers who fish from shore, as well as their family and friends with whom they share the fish. While improving fishing access is **highly likely** to generate more angler activity at the sites, without improvements in public communication regarding the risk of fish consumptions, some anglers will be unaware of or else ignore fish consumption advisories and consume more fish from the project areas than advised, potentially **detracting from health**.

Park improvements are also **highly likely** to have a positive impact on stress and stress-related conditions, **detracting from health**, because people will be able to experience the restored habitat, which will alleviate concerns regarding water and habitat quality. The benefit will be greatest to those who use the project area, including Irving, Fairmount, and Norton Park residents and recreational users of Indian Point campground, the Western Waterfront Trail, and the project area. Park operations are also **highly likely** to **benefit health** by having a positive impact on the risk to swimmers of waterborne illness. However, this assumes that the swimming beach to be built at Indian Point campground will be routinely monitored for water quality and officially closed when necessary to protect public health. If it is not managed on the basis of water quality, the operations are **highly likely** to **detract from health** because swimmers might use the swimming beach when conditions present a risk to health. The impact would be greatest for Irving, Fairmount, and Norton Park residents, especially youth, and Indian Point campground users, who would swim at the new swimming beach.

Main Findings and Recommendations Related to Water and Habitat Quality

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding

The project will likely improve water quality at both sites, but have little impact on waterborne pathogens. Adding a swimming beach to the area potentially increases exposure to waterborne illness, but also will provide a variety of health benefits.

- Follow best practices for stormwater management, erosion and runoff, and equipment leaks during the construction phases and implement mitigations, as necessary
- Identify regional stormwater outfalls or other sources of *Escherichia coli* and implement additional best management practices to improve water quality at the future swimming beach at Kingsbury Bay
- Design the stormwater pond identified in the concept plan to intercept stormwater to maximize its ability to protect Kingsbury Bay water quality
- Implement routine beach monitoring at the future Kingsbury Bay swimming beach

Main Finding

Adding clean sediment and increasing wetland extent will likely cause the health risk of eating resident fish from the project area to improve. Improving fishing access will likely result in increased consumption of fish from the project area.

- Develop a sediment remediation target protective of human health based on surface-weighted area contaminant concentration, particularly for dioxins
- For a future project, cap or remove sediments to the east of the Grassy Point project area (currently outside the project area) to reduce bioavailability of dioxins
- Implement a fish monitoring program that includes mercury, dioxins, and PCBs, and targets both resident and migratory fish species
- Conduct creel surveys focused on fishing within the AOC, and include information on race, ethnicity, location of residence, age, and fish consumption habits
- Provide ethnically-appropriate communication on consumption-related risk that addresses specific-contaminant risk as well as fish species and size
- Should contaminant concentrations of certain fish species or sizes at the project sites meet human health guidelines, promote the consumption of local fish due to its health benefits

Main Finding

The project will substantially increase aquatic habitat and restore native aquatic plants. The project will have the greatest benefit for submerged aquatic vegetation and fish that prefer either vegetated or deep-water habitat.

- Develop a long-term, non-native species management plan for both Grassy Point and Kingsbury Bay
- Develop habitat plans for marsh birds, wading birds, and migratory waterfowl
- Where compatible with project goals, protect existing high-quality aquatic plants at Kingsbury Bay
- Identify upland habitats within the site suitable for trees, and develop goals for the upland plant community that take into account future changes in invasive species, water level, and climate, as well as crime prevention and safety guidelines (e.g., Crime Prevention through Environmental Design guidelines)
- To sustain the ecological integrity of the site, provide interpretative signage that provides information on wetland habitat types and the benefits each habitat provides for fish, reptiles, birds, and people

Equipment Operation, Traffic, and Transport

Habitat restoration and park improvements both require the use of heavy equipment and other construction-related equipment. Construction is a high hazard industry that can expose workers to hazards, such as moving machinery and equipment; electrocutions; slips, trips, and falls; noise; cold and heat stress; respiratory and contact exposures; musculoskeletal disorders; and others (OSHA, n.d.-b; CPWR, 2018; NIOSH, 2018a).

Construction equipment, trucks, and vehicles are all sources of noise, light, and air pollution and have the potential for spills and leaks. Excavation and transportation of material (sediment and wood waste) increases the risk of exposure to particulate matter and contaminants, which can cause cardiovascular and pulmonary disease, cancer, and other chronic disease. Increased local truck and vehicle traffic can lead to congestion and increased time spent in traffic, and in the case of truck and heavy equipment traffic, the potential to damage roadways, all of which may be a source of stress for local residents and commuters. Equipment operation and increased traffic also present the potential for accidents, which can result in injury and even death.

Existing Conditions

Equipment Operation

The only existing equipment operation associated with the two project sites is the use of equipment for park maintenance, such as mowers to mow edges of trails and smaller equipment used for trail maintenance.

Traffic and Transport

In the study area, there are several main roadways:

- Grand Avenue/Highway 23 Corridor – an arterial route into Duluth that provides access to land uses along the St. Louis River and links neighborhoods in West Duluth to the rest of the city
- 63rd Avenue, 59th Avenue, and Central Avenue – north-south collector routes
- Raleigh Street – the only east-west collector roadway in the study area.

Grand Avenue, 59th Avenue, Central Avenue, Raleigh Street, and Waseca Industrial North Road all currently serve as truck routes. Daily traffic volumes and measures of flow and congestion on some of these truck routes are shown in Table 7. The City of Duluth has a proposal to extend Waseca Industrial to Grand Avenue, which would allow trucks to be prohibited in the neighborhood all together; however, this is a new road project proposal and may not occur until after habitat restoration is complete.

Table 7. Annual Average Daily Traffic and Levels of Service for Major Streets That Could Potentially Be Used for Truck Transport

Street	AADT*	Motorized Travel LOS Description†
Grand Avenue	8,300-15,300 (2017)	LOS B - Virtually no congestion
Central Avenue	5,800-10,900 (2017)	LOS C - Slight delays during peak hours
Raleigh Street	1,300 (2017)	LOS A - No congestion
Waseca Industrial Road	810-1450 (2018)	LOS A - No congestion

* Annual Average Daily Traffic (AADT) = traffic volume in vehicles per day (MNDOT Traffic Mapping Application, https://www.dot.state.mn.us/traffic/data/tma.html)

† Level of Service (LOS) indicates flow and congestion of motorized traffic (Toole Design Group, 2016). LOS C, D, E and F are associated with declines in convenience and comfort.

The Duluth-Superior Metropolitan Interstate Council (MIC) – the bistate (Minnesota-Wisconsin) metropolitan planning organization (MPO) for the Duluth-Superior metropolitan planning area – conducted a study of the Grand Avenue/Highway 23 corridor (Duluth-Superior MIC, 2013). In the western portion of the HIA study area, the land use along Grand Avenue from 72nd Avenue West to Raleigh Street is considered "low-density urban" (Figure 6). There is very little residential development along the highway in this area and building setbacks vary from 10 feet to over 100 feet. Heading east along Grand Avenue from Raleigh Street to 62nd Street, land use in this area is considered "higher-density urban," with a dense mix of single- and multi-family residential development along the north side of the highway. Buildings on this portion of the corridor are adjacent to the road and only set back 9-15 feet (Duluth-Superior MIC, 2013).

Figure 6. Grand Avenue from 72nd Ave W to Raleigh St (top) and from Raleigh St to 62nd Street (bottom). Source: Duluth-Superior Metropolitan Interstate Council (MIC) 2013.

In addition to connecting many of the neighborhoods in the West Duluth area and serving as a local route for commuters, Grand Avenue also serves as a regional thoroughfare for individuals trying to access recreational amenities in the area and for trucks hauling freight. According to the Minnesota Department of Transportation (MNDOT), trucks account for approximately 4% of the current daily traffic on Grand Avenue, and due to less stringent weight restrictions, is often used by heavy haul trucks. In thewestern portion of the corridor, Grand Avenue is also in close proximity to a rail line that provides the opportunity for intermodal transfers.

Accidents

Between 2005 and 2014, 210 vehicle crashes occurred in the Western Port Area Neighborhood study area (similar to the HIA study area, but excludes Grand from Pulaski to South 67th Avenue W); the majority of these involved vehicles striking another parked or moving vehicle (Toole Design Group, 2016). Of the 210 crashes, 82 occurred on Grand Avenue. Of these, 31 were rear-end crashes (37%), 22 were sideswipe crashes (27%), and 15 were right-angle crashes (18%) (Toole Design Group, 2016).

No accidents are known to have occurred during equipment operation maintaining Grassy Point.

Potential Impacts to Equipment Operation, Traffic, and Transport

The habitat restoration and park improvement projects will increase equipment operation and truck and vehicle traffic at and near the project sites and along the material transport routes in the short-term (during habitat restoration and the construction phase of park improvements). In the long term (post-construction), there may be increased traffic at and around the sites due to the park improvements and other park investment efforts currently planned in the study area as part of the St. Louis River Corridor Initiative (https://duluthmn.gov/parks/parks-planning/st-louis-river-corridor/).

Increases in equipment operation and truck and vehicle traffic will be experienced disproportionately by those living, working, going to school, or recreating at or near the project sites and along the material transport routes. The magnitude of the population affected will depend greatly on the material transport route chosen, as well as the timing of construction earthwork activities at Kingsbury Bay and any increases in park visitor traffic.

Habitat Restoration

The habitat restoration work was originally planned to occur over a two year period, targeted to begin in June 2019 with equipment mobilization and staging and is anticipated to end during the winter of 2020, although the contract was not scheduled to end until September 2021 (MNDNR, 2019). Due to a number of variables, habitat restoration is now scheduled to be complete in summer 2022. Excavation of the Kingsbury Bay delta is planned to occur by mechanical dredging during the winter months and by hydraulic dredging during the summer months, although some mechanical dredging may also be required during the summer months. At Grassy Point, mechanical excavation of wood waste and placement of Kingsbury Bay sediment will take place during the winter and water-based mechanical and hydraulic dredging during the summer (MNDNR, 2018). Due to the projected duration of the project, equipment will operate between 7 am - 7 pm Monday through Saturday, with exception of the hydraulic dredging (MNDNR, 2019). Dredge and barge crews may work 24 hours a day, 7 days a week, if needed; however, no truck hauling will occur after 7 pm (MNDNR, 2019). Per the MNDNR Public Information Meeting conducted on May 21, 2019 (MNDNR, 2019), “advance notice of any schedule change, and other project updates are posted on the project website” (https://www.dnr.state.mn.us/st-louis-river-restoration/index.html). There is also a place on the project website for individuals to sign up for email updates regarding the project.

Construction and Operations Equipment

The habitat restoration work will require a fleet of equipment at both project sites, trucks and construction vehicles on local roads, and boats and barges on the St. Louis River. A full listing of the equipment, truck and vehicle traffic is expected during the habitat restoration work can be found in the full HIA report.

Traffic and Material Transport

Kingsbury Bay

Approximately 80,200 cy of material will be mechanically-dredged from Kingsbury Bay during the winter (preferred) or summer. This sediment from Kingsbury Bay will be transported to Grassy Point (and potentially two other site St. Louis River locations – 21st Avenue W and 40th Avenue W). Given that 80,200 cy are estimated to be mechanically dredged, and assuming dump trucks with a 10-cy capacity, approximately 8,020 truckloads will be needed to transport the sediment by truck; this is an increase from the 6,500 truckloads originally

estimated. Transport by truck would result in a maximum of 20 trucks/hour, seven days a week for approximately three months.

For the sediment moved by truck, MNDNR will work with the City of Duluth to determine the truck route. Information about the truck routes and the duration of use will be posted to the MNDNR project website (https://www.dnr.state.mn.us/st-louis-river-restoration/index.html), once they are determined and approved by the City of Duluth. There are currently two possible truck routes for transporting the mechanically-dredged cattail-free material (22,953 cy) from Kingsbury Bay to Grassy Point (Figure 7); transport may also occur by barge:

- Kingsbury Bay to Pulaski Street to Grand Avenue to North Central Avenue to Waseca Industrial Road to Lesure Street. [This is the route that has been proposed to date and is approximately 4 miles long. Note the acute angle needed for trucks to make the turn at Grand and North Central.]

- Kingsbury Bay to Pulaski Street to Grand Avenue to Raleigh Street to Waseca Industrial Road to Lesure Street. [This is another possible truck route identified by the HIA Team, but the City of Duluth has voiced concerns over sending trucks through the Irving neighborhood. This route is approximately 1 mile shorter than the proposed route.]

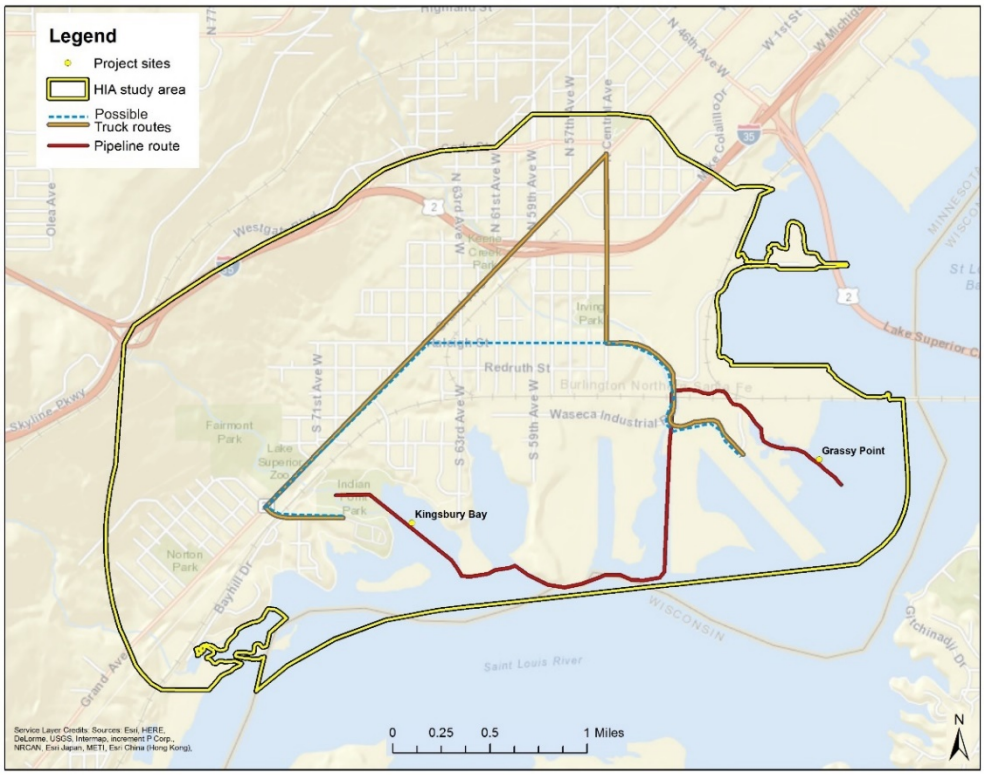

Figure 7. Truck and pipeline routes for movement of material from Kingsbury Bay to Grassy Point.

Note: The City of Duluth has also proposed to extend Waseca Industrial Road to Grand Avenue, which would allow the trucks to avoid the neighborhood all together; however this is a new road project proposal and the road work may not occur until after the habitat restoration work is complete.

Regardless of the truck route chosen, trucks will enter and exit Kingsbury Bay via Pulaski Street, which also services Indian Point Campground (i.e., a Duluth campground with river access) and a parking lot at the trailhead of the Western Waterfront Trail (i.e., WWFT; a trail that runs along the St. Louis River shoreline from Grassy Point past Kingsbury Bay to Riverside and provides hiking, biking, birding, and access to the river). Also nearby is a trailhead of the Willard Munger State Trail (i.e., an extensive multi-use trail that offers hiking, biking, in-line skating, cross-country skiing, and snowmobiling). Trucks will have to cross the WWFT in order to gain access to Kingsbury Bay shoreline, so mechanical dredging will likely result in closures to both the WWFT and the trailhead parking lot. Access and staging areas will be chosen to minimize the impacts to the WWFT. In the May 2019 MNDNR Public Information Meeting, the public was notified of these closures (MNDNR, 2019). The handout from this meeting noted that "the Western Waterfront Trail (WWFT) will be closed at Kingsbury Bay (there will be closure and rerouting signs), the Kingsbury Bay parking lot will be used to stage equipment, alternate parking for WWFT access will be established on Spring Street, and the Kingsbury Bay snowmobile trail will be closed" (MNDNR, 2019).

The remaining sediment from Kingsbury Bay will be hydraulically dredged (93,400 cy) and moved by pipeline or barge to Grassy Point in the summer. It is proposed that the hydraulic dredging pipeline will extend across the water, following the shoreline, to the former XLK Superfund site, through an abandoned storm sewer at the head of the XLK site, and then into Grassy Point – a distance of approximately 3 miles; alternatively, the pipeline may be routed in the water around the C. Reiss dock and into Grassy Point (Figure 7). The pipeline and hydraulic dredging equipment may interfere with recreational boating in the area and should be properly marked to prevent accident and injury. In addition to transport to Grassy Point, some sandy material from Kingsbury Bay may be placed along the Indian Point Campground shore in support of the future swimming beach planned by the City.

Note in Figure 7 that there is also an active rail line south of the Irving neighborhood that runs between the two sites. This represents an additional transport method not previously considered for the project – transport by rail. This transport method would greatly minimize the road and water traffic associated with the habitat restoration work.

Grassy Point

Transport of material from Grassy Point will include movement of excess sediment to 40th Avenue West (19,000 cy), excess wood waste transported to the incinerator or other locale (up to 5,000 cy), and debris (8,849 cy). There is no longer any excavation and transport of contaminated material proposed and almost all wood waste will be re-used at Grassy Point. No details were available about transport of these materials from Grassy Point;it is assumed the material will be transported by truck, but possible routes are unknown. Of particular concernis transport of the wood waste.

L

Exposure Risk

While remediation of Kingsbury Bay and Grassy Point was generally not required, it was determined that restoration of the sites could proceed, but should consider the presence of contaminants. The risk of exposureto contaminants during habitat restoration would be via the sediment or wood waste dredged from the sites and equipment and vehicle spills and leaks (e.g., fuel, oil, etc). There would be a potential risk for workers and recreational water users during excavation of the material and for workers, residents, commuters, and recreational users during material transport.

The main truck routes to and from Kingsbury Bay and Grassy Point (Figure 7) are in close proximity to multi-unit, single-unit, and low income or public housing; senior centers and care facilities; schools; businesses; and parks and trails:

- Grand Avenue to Central Avenue – 1392 residences (of which 37 are public housing, housing authority or low-income housing), 2 schools, 5 senior centers or care facilities, and numerous parks and trails
- Grand Avenue to Raleigh Street – 745 residences (of which 20 are public housing, housing authority or low-income housing), 1 school, 2 senior centers or care facilities, and numerous parks and trails

The setback of buildings from the street varies along the possible truckroutes, but in many areas, the building setback is minimal (Figure 8). In some areas along Grand Avenue northeast of Raleigh Street, the building setback is only 9-15 feet. Building setback along Raleigh Street is also minimal, and many of the streets also serve as on-street bike routes.

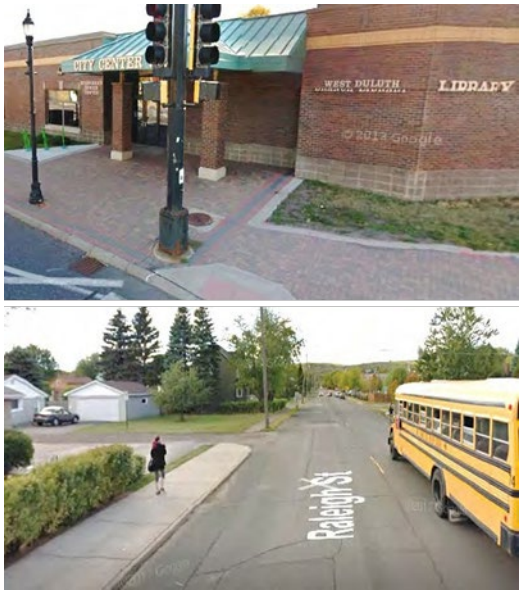

Figure 8. Building setback along the possible truck routes varies but in some areas is minimal.

The timing of the excavation and transport will be at the discretion of the construction contractor. MNDNR prefers that transport of Kingsbury Bay sediment by truck be done during winter to minimize exposure, as soil would be frozen and it is assumed that residents would be indoors more.

However, an analysis of photos taken outdoors in the study area from December through March and then posted to Panoramio, Instagram, or Flickr (n=124) indicates that there are still recreational users during the winter months in the study area. Foot traffic in the Spirit Valley business district at Grand Avenue and Central Avenue is also expected to continue through the winter months, as well as foot traffic to schools, libraries, and other amenities and businesses along the truck routes.

Park Improvements

L
A

Park improvements construction is at a much smaller scale than the habitat restoration work. The park improvements schedule and plans were not detailed at the time of the HIA, but it was assumed that no night-time work would occur with this phase of the project – either during construction activities or during operation and maintenance activities following completion of the park improvements. In addition to this assumption, the following assumptions were made about the types and equipment that will be needed for the park improvements work.

Construction and Operations/Maintenance Equipment

Construction

A

Equipment needed at Grassy Point would be relatively light duty (e.g., equipment needed to build a path or board walk and perhaps upgrade the parking lot). At Kingsbury Bay, there are a number of amenities that would require earth movement (e.g., the swimming beach and stormwater retention pond), so presumably excavators,

front loaders, and dump trucks would be required, at a minimum.

L

Quantities of construction-related equipment and trucks, as well as the duration of park improvements construction is unknown, but will be at a smaller scale than the habitat restoration work.

Operations and Maintenance

A

Equipment used for park maintenance, such as mowers to mow edges of trails and smaller equipment used for trail compaction or regrading would be utilized during operations and maintenance of the parks.

Traffic and Transport

L

Quantities and routes of construction-related traffic is unknown, but will be at a much smaller scale than habitat restoration work. No data was available on park-related vehicle traffic, but it is assumed the vehicle traffic will

A

increase in the vicinity of the parks, given the improvements at the project sites and other park investment efforts being undertaken in the study area.

Potential Health Impacts Related to Changes in Equipment Operation, Traffic, and Transport

Habitat Restoration and Park Improvements

The project is **highly likely** to increase equipment operation and truck and vehicle traffic at/near the project sites and material transport routes in the short-term (during the construction phases of habitat restoration and park improvements). In the long term, there may be increased traffic at and around the sites given the improvements at these sites and other park investment efforts currently planned in the study area as part of the St. Louis River Corridor Initiative. Increased equipment operation, traffic, and transport in the study area will **detract from health** because it increases the risk of accidents and related injury, stress due to changes in travel conditions, and exposure to particulates and contaminants during equipment operation and material transport.

Equipment operation, traffic, and transport impacts will be experienced **disproportionately** by those living, working, going to school, or recreating at or near the project sites and material transport routes. Construction crews, pedestrians, motor vehicle operators, and recreational users in the area will be more vulnerable to these impacts. The magnitude of the population affected will depend greatly on the material transport route chosen, as well as the timing of earthwork activities at Kingsbury Bay and any increases in park visitor traffic.

The health impacts of these changes can be minor (annoyance and stress) to severe (injury, illness, and death) and will likely be experienced immediately. During construction, the traffic and transport impacts will be short-term (limited to the duration of construction), but during operation and maintenance of the parks the impacts will be long-lasting. There is strong evidence supporting the link between both equipment operation and traffic/transportation and injury and death. The link between exposure to material in transport and chronic diseases, such as cardiovascular and pulmonary disease and cancer, is limited.

Main Findings and Preliminary Recommendations Related to Equipment Operation,Traffic and Transport

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding

Equipment operation and transport of sediment and other materials to and from the project sites will impact roadway and water traffic and have the potential to result in traffic accidents and injury to construction crews, residents, and recreational users.

- Clearly communicate the project, its duration, project updates (including issues and concerns), and expected roadway and water traffic impacts, air pollution levels, and noise levels to residents, schools and daycare centers, senior centers and care facilities, businesses, and recreational users in the project area and along the transport route
- Provide a means for residents and other affected populations to provide feedback, questions and/or lodge complaints about general construction activities and excess traffic, air, and noise impacts
- Hire companies with a proven safety record; local companies given priority in hiring can benefit the local economy
- Route trucks, other equipment and vehicle traffic away from neighborhoods, schools and daycare centers, senior centers and care facilities, and recreation areas to the extent possible to minimize the risk of traffic impacts and exposure to noise and air pollution
- Take additional safety measures and/or limit the amount of truck traffic at the start and end of the school day to create safe routes to and from school for children
- Take into account traffic patterns, road geometry, and frequency and timing of trips to minimize traffic disturbance and congestion
- Repair damage to roadways caused by construction vehicles and transport (e.g., potholes, broken curbs, collapsed manholes, rail crossing damage)
- Consider the use of rail or barge to transport sediment between the two sites, as these routes would avoid residential areas, minimize roadway traffic impacts, likely reduce the number of trips (given the larger capacity of rail cars and barges), and minimize traffic-related air pollutants in the residential areas
- Minimize impacts of the hydraulic pipeline and project-related barge traffic on recreational boaters and the navigation channel of the St. Louis River by using signs, markings, and warnings
- Implement traffic calming measures (such as speed humps, raised crosswalks/ intersections, traffic circles, medians, curb extensions or bump-outs, and signage or pavement markings) and bikeway improvements (such as clear painted bike lane markings and signage to already designated bike routes) to improve safe access to the parks and minimize the risk for increased accidents should the parks and other nearby enhancements increase the amount of traffic in the area post-construction

Main Finding

Excavation and transport of sediment and other materials to and from the project sites have the potential to increase exposure to particulate matter and contaminants.

- Route material transport traffic away from neighborhoods, schools and daycare centers, senior centers and care facilities, and recreation areas to minimize the risk of exposure to particulate matter and contaminants in excavated material
- Minimize exposure to material in transport by covering transport vehicles and implementing other fugitive dust measures, including watering access routes, and covering exposed soils/ stockpiles

Air Quality

Air quality is often described by the presence of and risk of exposure to harmful pollutants. Both natural and human activities influence outdoor air quality. Air pollutants can have natural sources such as plants releasing pollen or wildfires, or may originate in human activity including burning fossil fuels, industrial emissions, spills, or accidents (EPA, 2019b). Combustion of diesel fuel in construction equipment and truck and vehicle traffic release pollutants such as fine particulate matter (PM2.5), particulates, ozone, and other toxics. Exposure to outdoor air pollutants and particulates can impact an individual's willingness to spend time outdoors, exacerbate asthma conditions, cause respiratory illness or disease, exacerbate heat-related illnesses and chronic disease (such as cardiovascular disease, hypertension, stroke, and cancer), and can cause premature death. Children, the elderly, and people with pre-existing health conditions are more vulnerable to health impacts of poor air quality.

Existing Conditions

Industry

EPA regulates air quality by the authority outlined in the Clean Air Act. However, state and local governments perform most air quality monitoring (i.e., air sampling and data analysis). Facilities in the area that are regulated for air emissions include the C. Reiss Coal Company, Minnesota Power Inc - Hibbard Renewable Energy Ctr (2 locations), Verso Minnesota Wisconsin LLC -Duluth Paper Mill, and Hallett Dock Co - Dock 6. Only the C. Reiss Coal Company has had a noncompliance quarter in the last 3 years or a formal enforcement action in the last 5 years.

The C. Reiss Coal Company operates a bulk solid material handling facility directly adjacent to Grassy Point to the west. Materials such as coal, limestone, petroleum coke, salt, and other bulk solid fuels and bulk material commodities are unloaded onto a 19.5-acre storage pad area until they are loaded for final shipment. Dust emissions are controlled on-site with water when temperatures allow; other dust suppressants are used in freezing conditions. The facility was last inspected on February 4, 2020 with no violation observed.

Traffic

In Census tracts 33 and 34, over 5% and 2% of the population, respectively, live within 300 meters (984 feet) of roadways, making them at higher risk of exposure to diesel particulate matter (PM). As discussed in the Equipment Operation, Traffic, and Transport pathway, several of the main roads in the study area are heavily traveled by both motor vehicle and truck traffic, and in some portions of the study area, building setbacks are minimal. GIS analysis shows some of the existing land uses within a 300-m buffer of the two possible truck routes for transporting material from Kingsbury Bay to Grassy Point – Grand Avenue to Central Avenue or Grand Avenue to Raleigh Street (Figure 9) – including residences, schools, senior centers and care facilities, and parks and trails. The percent tree canopy within 26 meters of the two possible truck routes is 20.82% and 25.24%, respectively; trees have the ability to filter air pollutants.

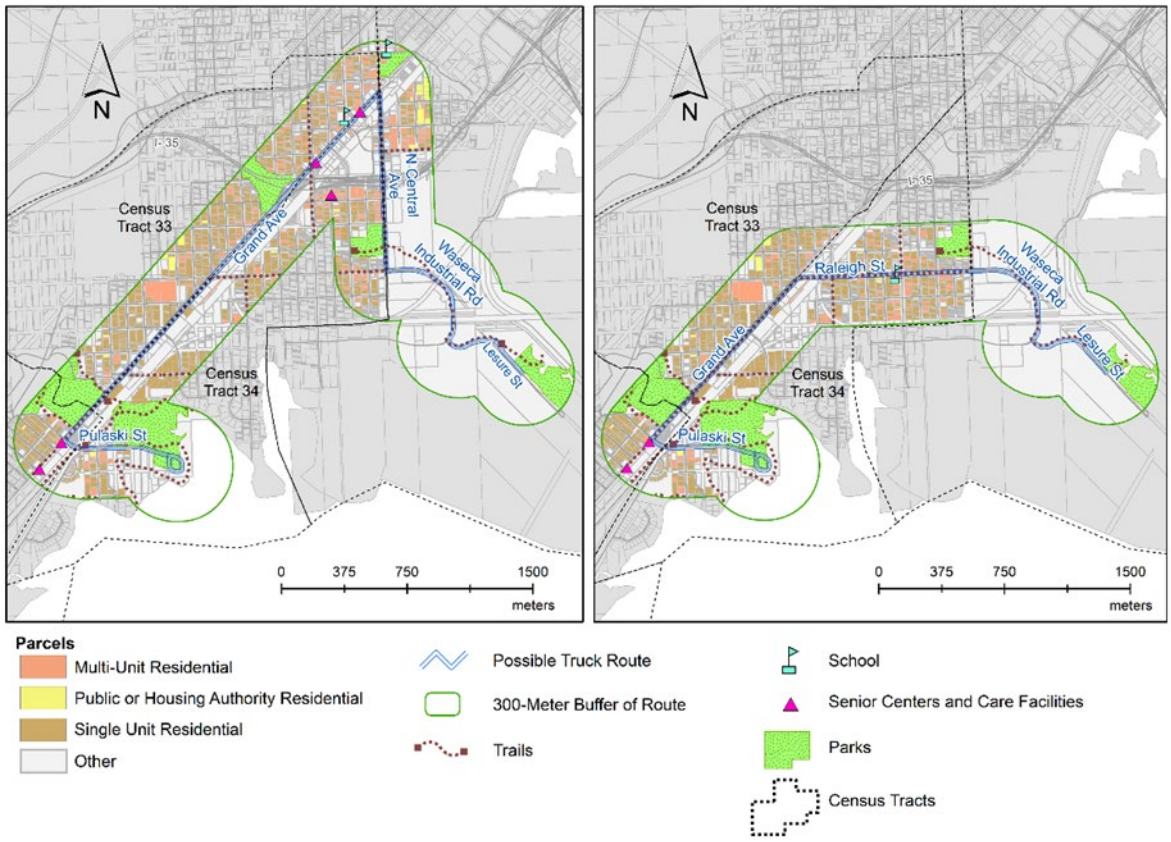

Figure 9. Select land uses within 300 meters of the possible truck transport routes - Grand Avenue to Central Avenue (left) and Grand Avenue to Raleigh Street (right).

Air Monitoring

There is one air quality monitoring site located off Waseca Industrial Road in the eastern part of the study area (AQS Site ID: 27-137-7555, MPCA Site ID: 7555) to monitor fugitive emissions from a variety of industrial and shipping facilities (Figure 10). This site, established in 2001, monitors every six days for total suspended particulates (TSP) and metals. Residential neighborhoods are located approximately 400 meters west of the site (MPCA, 2019). MPCA reports that metals did not exceed the lowest health benchmark at this monitor from 2010-2017 (https://www.pca.state.mn.us/air/air-toxics-data-explorer); however, TSP did exceed this standard. Figure 11 shows daily and annual TSP monitoring results from 2010-2018.

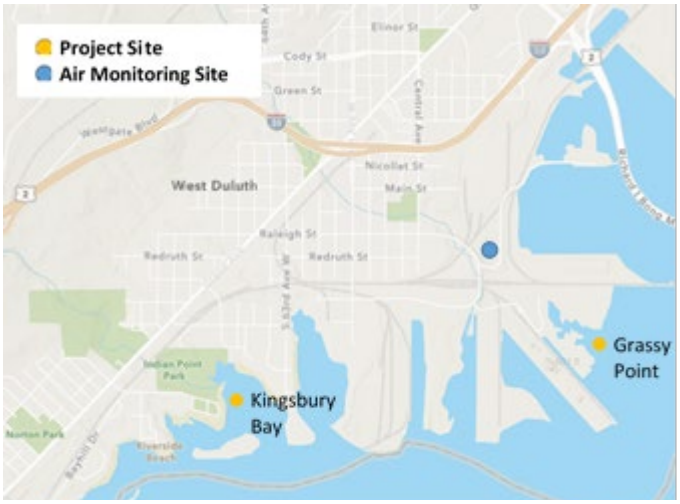

Figure 10. Location of air quality monitoring site in study area.

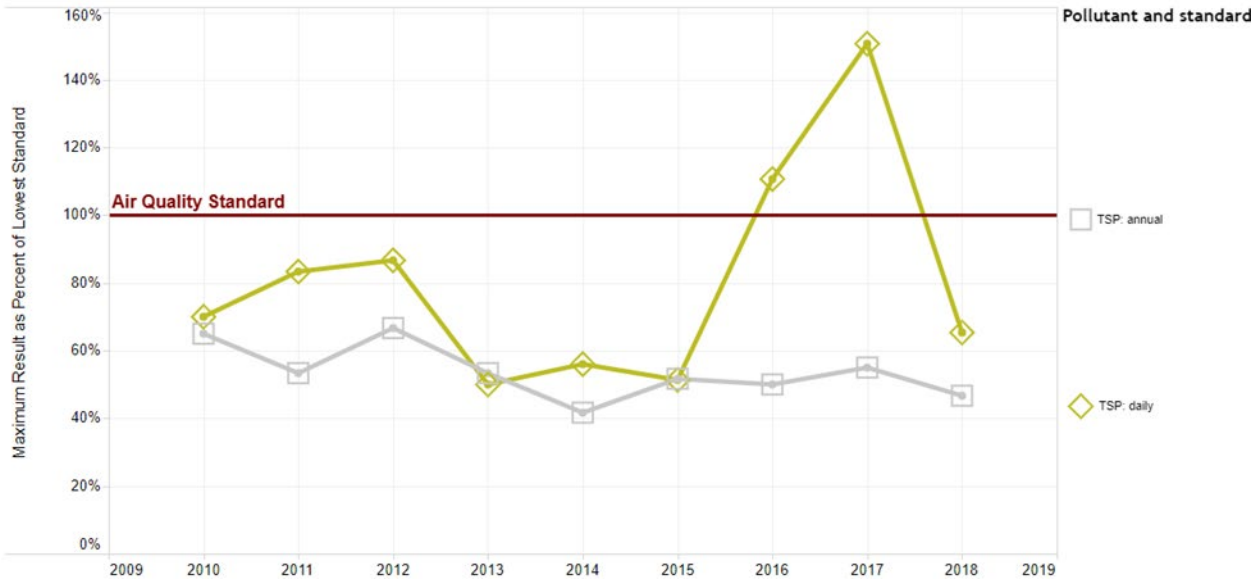

Figure 11. Total suspended particulate results from air monitor on Waseca Industrial Road, 2010-2018.(Source: https://www.pca.state.mn.us/air/criteria-pollutant-data-explorer)

Table 8 shows that diesel PM environmental concentrations, human exposure estimates, and air toxics health risk estimates are higher in the Census tracts in which the sites are located compared to estimates for the county and state.

Table 8. Existing Air Quality-Related Conditions in the Study Area, As Compared to the County and State[a]

Existing Conditions	Tract 33	Tract 34	St. Louis County	MN
% population within 300-m of roadway	5.4	2.4	--	--
Outdoor Air – Diesel PM (µg/m^3)	1.3	1.1	0.3	0.4
Outdoor Air – Diesel PM Human Exposure Estimate (µg/m^3 annual average in human breathing zones)	0.6	0.5	0.2	0.4
Outdoor Air – Diesel PM Non-Cancer Respiratory Risk (Hazard Quotient[b])	0.12	0.11	0.04	0.08
Cumulative Air Toxics Cancer Risk[c] (risk per one million persons)	33.5	33.8	27.6	35.6
Cumulative Air Toxics Non-Cancer Respiratory Risk (Hazard Quotient[b])	1.98	1.73	1.03	2.20

[a] Source: EPA's Community-Focused Exposure and Risk Screening Tool (C-FERST), accessed 11/9/2017; air toxics data from the 2011 National-Scale Air Toxics Assessment (NATA).

[b] Hazard Quotient - the ratio of the potential exposure to a substance and the level at which no adverse effects are expected (calculated as the exposure divided by the appropriate chronic or acute value). A hazard quotient of 1 or lower means adverse noncancer effects are unlikely, and thus can be considered to have negligible hazard. For HQs greater than 1, the potential for adverse effects increases, but we do not know by how much.

[c] Cancer Risk - The probability of contracting cancer over the course of a lifetime, assuming continuous exposure (assumed in NATA to be 70 years).

Potential Impacts to Air Quality

Equipment operation and truck and vehicle traffic will increase air pollution in the study area and have the potential of placing construction crews, residents, and recreational users at increased risk of exposure to air pollutants (fumes, particulate matter, fuel combustion pollutants, dust, etc.) and their adverse health impacts. One of the largest sources of air pollution during the construction phase will be from the burning of diesel fuel in construction equipment, and during the transportation of sediment (via truck, rail, or barge). The particles from diesel fuel combustion are very small and are able to travel deep into the lungs and cardiovascular system. The health effects from air pollution are more serious for sensitive populations including children, elderly, and those with existing chronic lung or heart problems and diseases.

Emissions

Equipment Operation

Exhaust emissions measured from 18 different pieces of diesel-powered equipment used in earthmoving activities, included:

- carbon dioxide (2608-2672 g/L);
- nitrogen oxide (3.5-63.1 g/L);
- hydrocarbons (0.5-16.3 g/L); and
- carbon monoxide (0.4-54.3 g/L) (Heidari & Marr, 2015).

Per the EAW, idling time for inactive equipment will be limited to 15 minutes, which will reduce the impact of equipment operation on air quality emissions. Air quality impacts of equipment operation during hydraulic dredging and earthwork activities at Kingsbury Bay during park improvements (e.g., building the beach and stormwater retention pond) have the potential to impact residents and recreational users due to the close proximity of these activities to residences and Indian Point Campground. It is assumed that equipment needed at Grassy Point will be relatively light duty and will not be a major air pollutant contributor. Air pollution from equipment used for park maintenance could impact recreational users, but is expected to be minor.

A

Truck Traffic

Construction traffic during habitat restoration and park improvements construction can increase congestion and disrupt road traffic and waterway navigation. Not only does this result in increased travel times, but also leads to greater fuel consumption and exhaust emissions. With increased idling and stop-and-go traffic, air emissions increase (Levy et al., 2010). Harmful air pollutants in these emissions, such as airborne particles, nitrogen dioxide, and carbon monoxide, are found in high concentrations along busy roadways and can persist as much as 300 meters or more from the road edge (EPA, 2015), impacting those living, working, and playing in this near-road zone. Increases in air pollution (actual or perceived) can impact an individual's desire to spend time outdoors.

The land use analysis shown in Figure 9 identifies the existing land uses within a 300-m buffer of the two possible truck routes for transporting material from Kingsbury Bay to Grassy Point, including residences, schools, senior centers and care facilities, and parks and trails:

- Grand Avenue to Central Avenue – 1392 residences (of which 37 are public housing, housing authority or low-income housing), 2 schools, 5 senior centers or care facilities, and numerous parksand trails
- Grand Avenue to Raleigh Street – 745 residences (of which 20 are public housing, housing authorityor low-income housing), 1 school, 2 senior centers or care facilities, and numerous parks and trails

A larger number of individuals are within the near-roadway zone of the Grand Avenue to Central Avenue truck route; these individuals also experience greater exposure to air pollution from Interstate 35 (I-35).

Impacts to air quality can be expected from transport of material from Grassy Point, however, no details on traffic, equipment, or routes were provided for park improvements work. It is assumed that a low to moderate number of individuals could be impacted during the construction phase of park improvements depending on the transport route chosen.

Vehicle Traffic

Vehicle traffic will likely increase in the vicinity of the parks post-park improvements, given the improvements at the project sites and other nearby park investment efforts currently planned as part of the St. Louis River Corridor Initiative. Increases in traffic will result in increased traffic-related air pollutants.

Fugitive Dust

Habitat restoration and park improvements construction may create temporary fugitive dust during handling, removal, and stockpiling of debris and sediment; truck and heavy equipment tracking and stirring up dust from the construction sites; and travel of trucks and cars in the vicinity of the sites, stirring up dust tracked to roadways. Fugitive dust is dust that is suspended in the air by wind or human activities and does not come out of a stack. Per the EAW, the contractor will be required to follow best management practices to reduce dust during habitat restoration, including covering loads, watering access routes, and placing temporary covers on exposed areas and stockpiles.

Vegetation, Air Quality, and Urban Heat Island Effects

Warmer conditions and more frequent and intense storms are predicted for the Great Lakes (MN Sea Grant, 2016). Planting trees, bushes, and greenery as part of habitat restoration and park improvements can reduce ambient air pollutants by absorbing pollutants, including greenhouse gases, and trapping the airborne particulates on their leaves. Increasing trees and vegetation through the habitat restoration and park improvements can combat urban heat island effects by reducing localized surface and air temperatures through shading and evapotranspiration.

Potential Health Impacts Related to Changes in Air Quality

Habitat Restoration and Park Improvements

The project is **highly likely** to increase equipment and truck and vehicle-related air pollution at and near the project sites and along material transport routes in the short term (during habitat restoration and the construction phase of park improvements). In the long term (post-construction), it is **possible** there will be increased traffic and traffic-related air pollution at and around the sites given the improvements at these sites and other park investment efforts currently planned in the study area as part of the St. Louis River Corridor

Initiative. However, the vegetative features created by the habitat restoration and park improvements can filter air pollutants and particulates and reduce localized surface and air temperatures. In addition to the vegetative features created by habitat restoration and park improvements, **development of these sites as parks eliminates the potential for more severe air pollution that would accompany future industrial development at the sites were they not parks.**

Increased air pollution in the study area during habitat restoration and park improvements construction, as well as any traffic-related air pollution post-park improvements may **detract from health** for some individuals because exposure to air pollutants and particulates can exacerbate asthma conditions and cause respiratory illness or disease, heat-related illness, chronic disease (such as cardiovascular disease, hypertension, stroke, and cancer), and premature death. These impacts will be experienced **disproportionately** by those living, working, going to school, or recreating at or near the project sites and material transport routes. Children, the elderly, and those with pre-existing health conditions are more vulnerable to these impacts. The magnitude of the population affected will depend greatly on the material transport route chosen, as well as the timing of earthwork activities at Kingsbury Bay and any post-project increases in park visitor traffic. The vegetative features created by these projects in the long term can **benefit health**, by improving air quality and reducing surface and air temperatures.

Main Findings and Preliminary Recommendations Related to Air Quality

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding

Equipment operation and truck and vehicle traffic will increase air pollution in the study area and have the potential of placing construction crews, residents, and recreational users at increased risk of exposure to air pollutants (fumes, particulate matter, fuel combustion pollutants, dust, etc.) and their adverse health impacts.

- Clearly communicate the project, its duration, project updates (including issues and concerns), and expected roadway and water traffic impacts, air pollution levels, and noise levels to residents, schools and daycare centers, senior centers and care facilities, businesses, and recreational users in the project area and along the transport route
- Provide a means for residents and other affected populations to provide feedback, questions and/or lodge complaints about general construction activities and excess traffic, air, and noise impacts
- Include mitigation specifications in the contract (reduced idling and requirements for equipment fitted with catalysts and filters) and incentives for contractors with idle reduction policies, and newer or retrofitted equipment
- Route trucks, other equipment and vehicle traffic away from neighborhoods, schools and daycare centers, senior centers and care facilities, and recreation areas to the extent possible to minimize the risk of traffic impacts and exposure to noise and air pollution
- Consider the use of rail or barge to transport sediment between the two sites, as these routes would avoid residential areas, minimize roadway traffic impacts, likely reduce the number of trips (given the larger capacity of rail cars and barges), and minimize traffic-related air pollutants in the residential areas
- Minimize exposure to material in transport by covering transport vehicles and implementing other fugitive dust measures, including watering access routes, and covering exposed soils/ stockpiles

Main Finding The vegetative features created by the habitat restoration and park improvements will have the ability to filter air pollutants and particulates and reduce surface and air temperatures.

- Select native trees and plants for planting that will do well in warming climate. Trees have the greatest potential to filter air pollutants, followed by shrubs, and then grasses
- Select trees that have tall, broad canopies for increased shading and place in areas where people may congregate

and

Noise and Light Pollution

Noise and light pollution are unwanted or obtrusive sound or light that interferes with normal activities, diminishes quality of life, and has adverse effects on human health and ecosystem function (Seidman & Standring, 2010). Operating construction equipment, trucks, and vehicles all produce noise and when operating at nighttime, may produce excessive or misdirected light. Both noise and light pollution can cause sleep disturbance, impaired task or functional performance (which may lead to injury), stress, cardiovascular disease and hypertension, and affect ecosystem function, particularly in fauna. Noise pollution also has the potential to cause hearing impairment and has been associated with lowered cognitive performance among school-aged children.

Existing Conditions

Noise

Baseline noise levels for the area are not known. Grassy Point is surrounded by industry and the railroad runs in close proximity to both sites, so background noise levels near the sites may be higher than a typical suburban neighborhood. There are also several major road thoroughfares in the area that contribute to the baseline noise levels. In Figure 12, you can see the 24-hour equivalent sound levels (LAEQ) in dBA from motor vehicle traffic for the major roadways in the HIA study area.

For noise to be considered a nuisance, it must significantly interfere with an individual's enjoyment of life and property. Slight or occasional noises are typically not sufficient to create a nuisance condition. In Minnesota, the Minnesota Pollution Control Agency (MPCA) has established noise standards to protect human health. Although MPCA has statewide authority, many cities in Minnesota also have local noise ordinances to help address community concerns (League of Minnesota Cities, 2017). For instance, the City of Duluth has noise ordinances covering nuisance events that disturb the peace (e.g., loud and boisterous conduct, noises, music and activities) and vehicle noise, including the use of truck engine retarding brakes (Duluth Legislative Code § 40: Police and § 34-23: Vehicle Noise Limits); truck engine retarding brakes are not allowed in Duluth, except in case of emergency.

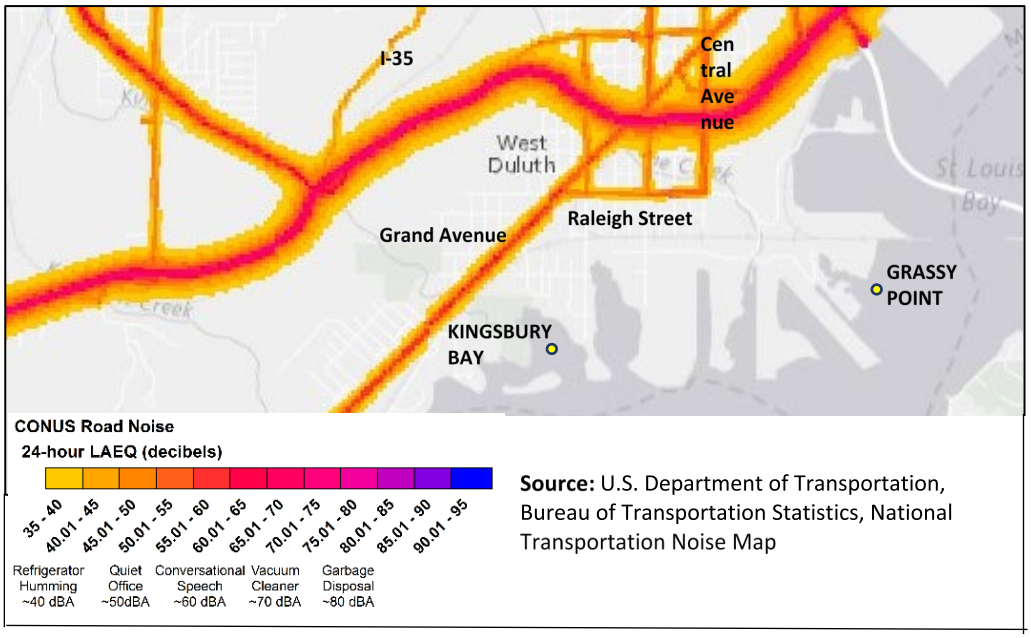

Figure 12. Continental U.S. (CONUS) Road Noise levels for major roadways in the HIA study area. L_{AEQ} is the 24 hour equivalent sound levels in DbA.

Light

Baseline nighttime light levels for the area can generally be estimated by the amount of skyglow in the area. While not as bright as downtown Duluth, the HIA study area has a fairly bright skyglow (Figure 13).

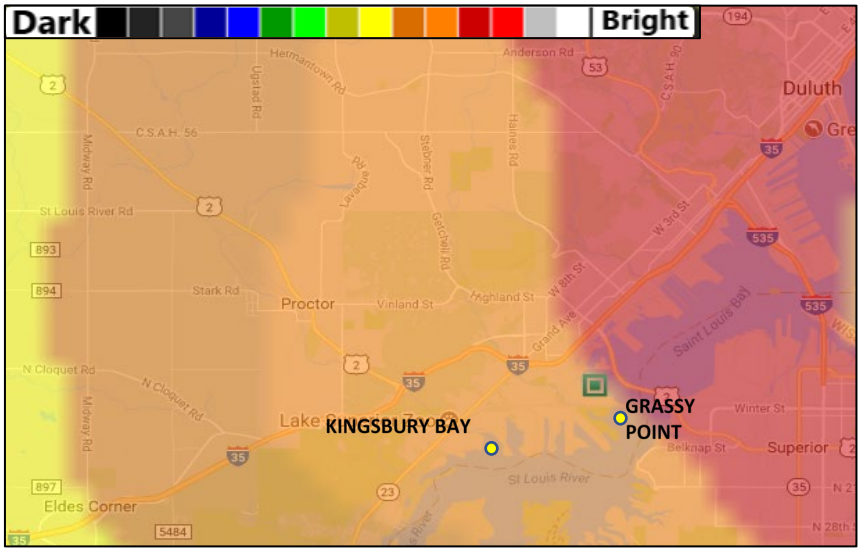

Figure 13. Sky glow in Duluth and the surrounding areas. Source: Light Pollution Atlas 2006

Potential Impacts to Noise and Light Pollution

Equipment and Traffic-Related Noise

Several common characteristics of noise can be associated with construction activities, like those that will occur during habitat restoration and park improvements construction. “Construction noise can be perceived or considered to be too loud, impulsive, uncontrollable, contain annoying pure tones, occur unexpectedly, occur at undesirable times of day, and/or interrupt people's activities” (FHWA, 2006).

Equipment operation and truck and vehicle traffic will increase noise pollution in the study area and have the potential of placing construction crews, residents, and recreational users in the study area at increased risk of adverse health impacts from noise exposure. **The adverse health impacts of noise pollution are related to <u>total noise exposure</u> from all sources; this includes existing noise (e.g., roadway, industry, etc.) plus noise related to the habitat restoration and park improvements work**.

Nighttime construction activity is not anticipated with exception of hydraulic dredging; however, sound travels further at night and nighttime noise and light pollution can cause sleep disturbance and other adverse health effects.

Noise Standards

In Minnesota, MPCA has established noise standards based on the land use at the location of the person that hears the noise. The standards are stated as the noise level in decibels over 10% or 50% of an hour - L_{10} or 6 minutes/hour and L_{50} or 30 minutes/hour, respectively; Table 9).

Table 9. Minnesota Pollution Control Agency Noise Standards by Land Use.[a] Source: Minnesota Administrative Rule §70300.0040: Noise Standards

Noise Area Classification (NAC)	Daytime 7:00 am-10:00 pm (dBA)		Nighttime 10:00 pm-7:00 am (dBA)	
	L_{10}	L_{50}	L_{10}	L_{50}
1 -Residential, Religious & Camping	65	60	55	50
2 -Commercial & Recreational	70	65	70	65
3- Manufacturing and Industrial	80	75	80	75

[a] L_{10} – noise level that can’t be exceeded for more than 10% of the time for one hour (6 minutes/hour) in A-weighted decibels (dBA); L_{50} – noise levels that can’t be exceeded for more than 50% of the time for one hour (30 minutes/hour) in dBA.

Equipment Noise

Sound levels associated with heavy construction equipment range from 80 to 120 dB(A) and power tools commonly used in construction produce sound levels up to 115 dB(A). Average noise level at 50 feet from a diesel-powered piece of construction equipment, including trucks, is 85 A-weighted decibels (dBA) and decreases by 6 dBA as the distance from the point source is doubled (Table 10; FHWA, 2006; MPCA, 2015). Doubling the number of pieces of equipment increases the decibels by 3. So, 4 pieces of equipment running at the same timewould be 91 dBA at 50 feet.

Table 10. Noise Levels by Distance from Diesel-powered Construction Equipment (FHWA, 2006; MPCA, 2015)

Distance from Source (Feet)	Noise Level (dBA)
50	85
100	79
200	73
400	67
800	61

The levels of noise from a dredge depend in part on the type of dredge to be used, as different style dredges consist of different components. One study showed noise from a pipeline cutterhead is 172-185 dBA at 1 meter (3 ft); another showed cutterhead sounds peaked at 100-110 dBA and were inaudible at ~500 m (1640 ft) from the source (CEDA, 2011; Clarke 2002). The EAW stated that hydraulic dredging operations may be conducted at night; it should be noted that sound travels further at nighttime and nighttime noise can have adverse health effects.

Habitat Restoration Equipment Noise

The EAW states during habitat restoration, equipment would be operated during daylight hours (7 am-9 pm) in accordance with the City of Duluth's noise ordinance, with *exception* of hydraulic dredging. Noise will include equipment operation, back-up beepers, and material handling and hauling.

According to the EAW, both Kingsbury Bay and Grassy Point are considered NAC 2 (Commercial and Recreational), which means the daytime noise standards in place would be an L_{10} of 70 dBA and L_{50} of 65 dBA[3]. One piece of diesel-powered equipment exceeds these standards even at a distance of 400 ft. As discussed previously, there will be numerous pieces of mechanical and hydraulic construction equipment running during the habitat restoration work, including excavators, dredges, generators, pumps, dump trucks, and more. Resident access to the sites will be prohibited during the habitat restoration work, mitigating the noise impacts, but the impact of the noise on nearby recreational users and residents should not be ignored.

During habitat restoration work, there is "an NAC 1 area (Residential, Religious, and Camping) 200 feet from the nearest excavation point at Kingsbury Bay (although most excavation will occur 400 ft from residences) and 0.5-1 mile from the Grassy Point construction zone." In addition to the excavation work, the use of the Pulaski Street parking lot as a staging area for this work will create noise pollution for neighbors in the Riverside neighborhood, residents adjacent to Pulaski Street, and those at Indian Point Campground. An NAC 1 area has a daytime L_{10} of 65 dBA and L_{50} of 60 dBA and a nighttime L_{10} of 55 dBA and L_{50} of 50 dBA. One piece of diesel-powered equipment running exceeds these standards, even at a distance of 400 ft. As discussed previously, there will be numerous pieces of construction equipment running during the habitat restoration work, including excavators, dredges, barges, dump trucks, and more.

[3] L_{10} – noise level that can't be exceeded for more than 10% of the time for one hour (6 minutes/hour) in A-weighted decibels (dBA); L_{50} – noise levels that can't be exceeded for more than 50% of the time for one hour (30 minutes/hour) in dBA

Given the amount of equipment that will be in operation and the proximity of residences and recreational trails and water areas to the habitat restoration work (both mechanical and hydraulic dredging equipment), noise levels at Kingsbury Bay will exceed the noise standards shown in Table 9 for nearby residents and possibly recreational users and will require mitigation. It should also be noted that there are a large number of shift workers in the vicinity of Kingsbury Bay who could be at increased risk of sleep-related disorders or potentially impacted by sleep disruption due to daytime construction activities in the study area. Noise from habitat restoration work at Grassy Point is not expected to be an impact to residents, as the surrounding area is deemed a NAC3 area (Manufacturing and Industrial) and per the EAW, the nearest residential property is approximately 2,000 feet fromthe closest point of excavation.

Noise Impacts to Fauna and the Zoo

- Noise levels during habitat restoration or park improvements construction could impact animal behavior and affect animal health, habitat use, reproduction, survival, and more. For example:
  - the underwater sound from dredging, barges, and boats could impact functioning of aquatic organisms, including echolocation to locate a mate or prey, detection of predators, navigation, etc.
  - declines could be witnessed in the numbers and breeding of birds at both sites due to the noise; this impacts not only the birds, but also the birdwatching pastime common at these sites).
- Due to its close proximity, equipment noise could also have an impact on zoo animals, zoo goers, and zoo staff.

Mitigation of Noise Impacts During Habitat Restoration - Perthe EAW, the MNDNR is undertaking several steps to help mitigate the potential impacts of noise and light, including:

- contacting the nearest residents along the St. Louis River shoreline to inform them of the project and potential for noise levels exceeding NAC Level 1 standards,
- restricting equipment operation only during daylight hours (7am – 9pm),
- requiring all equipment to have properly operating muffler systems,
- restricting idling time for inactive equipment to 15 minutes,
- notifying adjacent landowners and businesses about the intent of the project, duration, expected noise levels and complaint procedures, and
- informing construction operators of the nearby residential area and scheduling loud operations for mid-day.[4]

Park Improvements Construction Equipment Noise

A

The park construction plans are not detailed at this point in time, but it is assumed the equipment needed at Grassy Point would be relatively light duty and the noise would not impact nearby residents. At Kingsbury Bay, there are many amenities, a number of which that would require earth movement (e.g., building a swimming beach and the stormwater demonstration project) in areas in close proximity to residences and Indian Point campground. Per the EAW, creation of the swimming beach will be in an NAC 1 area and creation of the stormwater retention pond will be in close proximity to an NAC 1 area. Given the equipment that will be in operation and the proximity of residences and recreational trails and water areas to the construction work at

[4] During the final HIA meetings, stakeholders raised a concern about scheduling loud operations for mid-day, because there is a lot of shift work in the neighborhoods surrounding Kingsbury Bay and loud operations at this time of the day could interrupt the sleep of shift workers.

Kingsbury Bay, it is likely for the noise levels to exceed the noise standards shown in Table 9 for nearby residents and possibly recreational users and require mitigation. Noise from construction at Grassy Point is not expected to be an impact.

Park Improvements Operations and Maintenance Equipment Noise

Noise from equipment used for park maintenance could impact recreational users, but is expected to be minor. In addition to noise impacts to residents and recreational users during habitat restoration and park improvements construction, it is also important to recognize and mitigate the impact of noise on the construction workers themselves (Figure 14). The U.S. Occupational Safety and Health Administration (OSHA) has set a legally-allowable exposure limit for construction noise (i.e., the permissible exposure limit) of 90 dBA over an eight-hour period (29 CFR 1926.52). But, noise induced hearing loss can result from unprotected exposure to noise overan extended period of time at levels below 90 dbA. Therefore, NIOSH has established a recommended exposure limit for occupational noise at85 dBA for an eight-hour time-weighted period (NIOSH, 2018c). The Center for Construction Research and Training (CPWR, 2018) has shown that 73% of the time, construction workers are exposed to noise over the NIOSH recommended exposure limit. Noise mitigation, hearing protection, and operations schedules can be instituted to avoid exposure of construction workers to noise aboveNIOSH recommended exposure limits.

Figure 14. Construction workers may be subjected to noise over an extended period of time.

Traffic Noise

Habitat Restoration

Existing traffic noise along the two potential truck transport routes from Kingsbury Bay to Grassy Point was analyzed. In addition to traffic noise, the number of residences, facilities occupied by populations more sensitive to noise (i.e., schools and senior centers and care facilities), and recreation areas (i.e., parks and trails) within 300 feet of the potential truck routes was calculated to determine the populations potentially impacted by habitat restoration traffic noise (Figure 15). Also considered in analysis was the poverty rate in the two Census tracts along the routes to determine the potential for any disparate health impacts. Census tract 33 (north of Grand Avenue) has 19.4% of residents in poverty and Census tract 34 (south of Grand Avenue) has a poverty rateof 8.4%.

Analysis showed higher existing road noise and slightly more residences, facilities occupied by populations sensitive to noise, and parks and trails within 300 feet of the proposed truck route from Grand Avenue to Central Avenue (Figure 15a) compared to the alternate route from Grand Avenue to Raleigh Street (Figure 15b):

- Grand Avenue to Central Avenue – 309 residences (of which 5 are public housing, housing authority or low-income housing), 1 school, 3 senior centers or care facilities, and numerousparks and trails; it should also be noted that a portion of the population along the northeastend of the route from Grand Avenue to Central Avenue also experience greater exposure tonoise pollution from I-35.
- Grand Avenue to Raleigh Street – 306 residences (of which 8 are public housing or housingauthority), 1 school, 1 senior care facility, and numerous parks and trails

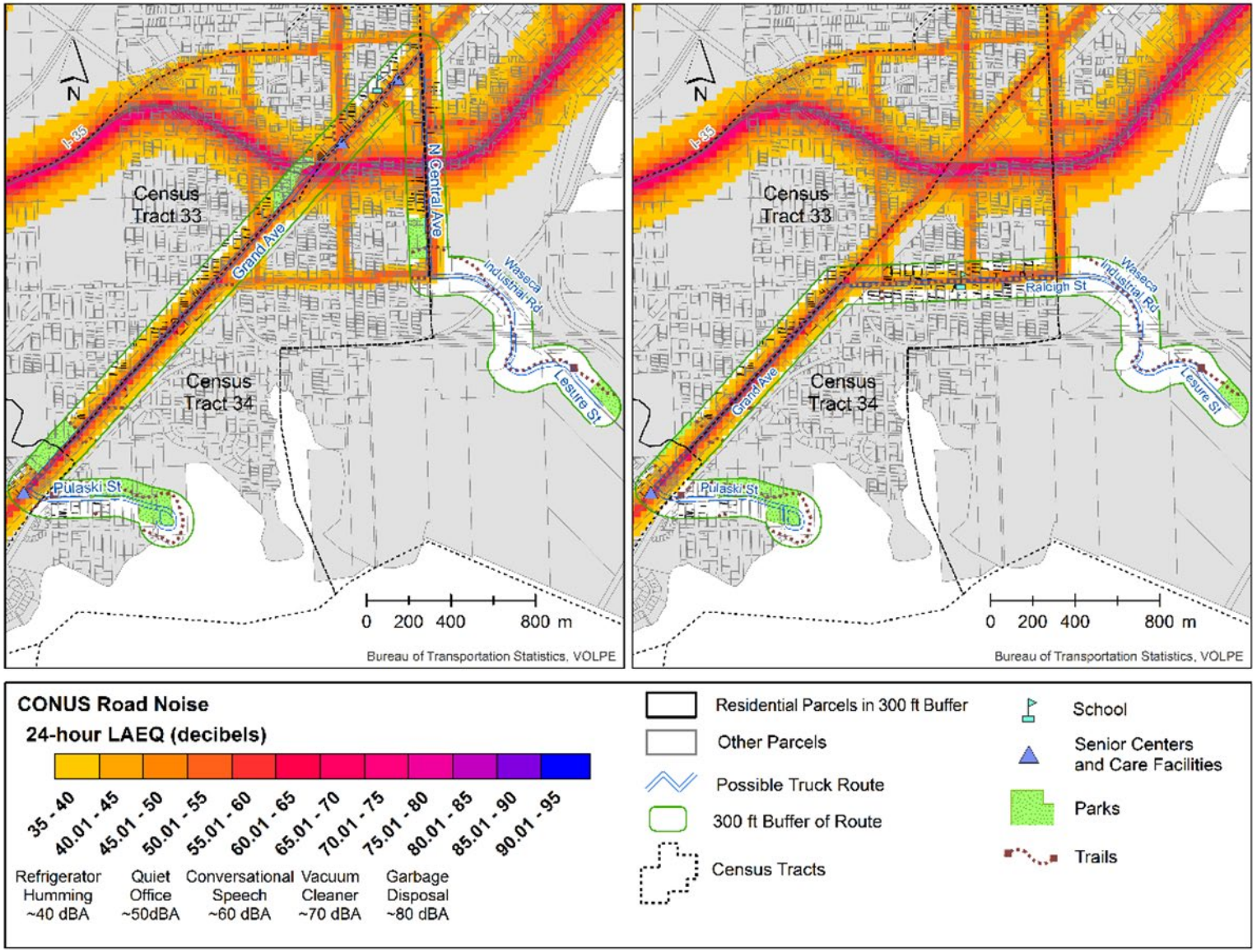

Figure 15. Continental U.S. (CONUS) road noise and populations within 300 feet of potential truck transport routes – a) Grand Avenue to Central Avenue and b) Grand Avenue to Raleigh Street.

Not only are there a large number of residences and facilities with sensitive populations within 300 feet of both routes, but as discussed previously, the building setback along areas of both Grand Avenue and Raleigh Street is minimal; many of the streets also serve as on-street bike routes. As stated previously, traffic noise has been found to impact the number of residents reporting frequent annoyance and sometimes or frequent sleep disturbance at noise levels above 50 decibels, and the desire to stay outdoors above 48 decibels; these thresholds are exceeded in several places along both potential transport routes (Figure 15). Exposure to constant ambient noise or periodic levels of noise above 55 decibels have been associated with changes in behavioral and mental activities, as well as lowered cognitive performance among school-aged children.

L

Noise is also expected from transport of material from Grassy Point, however, the HIA was unable to quantify the population affected, because no details on traffic, equipment, or routes were provided. A low to moderate number of individuals are expected to be impacted depending on the transport route.

Park Improvements

A

Noise is also expected from park improvements construction activities, and any increase in park vehicle traffic post-construction. It is assumed that vehicle traffic will increase in the vicinity of the parks, given the improvements at the project sites and other park investment efforts currently planned in the study area as part of the St. Louis River Corridor Initiative, which would result in increased near-roadway noise.

Equipment and Traffic-Related Light

The EAW states that during habitat restoration, equipment would be operated during daylight hours (7 am-9 pm) only, with *exception* of hydraulic dredging. During winter, sunset is between 4:30 and 7:30 pm (much earlier than 9:00 pm), but nonetheless, the potential for light-at-night impacts to residents seems to be minimal except during periods of nighttime hydraulic dredging. During periods of nighttime dredging, light-at-night impacts will require mitigation. During park improvements construction and operations and maintenance, no night-time work is anticipated.

Light at Night Impacts to Flora and Fauna

Light pollution at night during habitat restoration could affect the biological and ecological processes of both plants and animals, including photosynthesis of nearby trees and circadian rhythms, physiological activities, breeding, and behaviors in birds, fish, amphibians, turtles, reptiles, and other wildlife.

Park Operations and Maintenance Impacts on Light

If lighting is installed at the Kingsbury Bay entrance/parking lot, there is the potential for light trespass to nearby residences if not properly placed.

Potential Health Impacts Related to Changes in Noise and Light Pollution

Habitat Restoration and Park Improvements

The project is **highly likely** to increase equipment and truck and vehicle-related noise pollution and **possibly** light pollution (if nighttime activity occurs) at and near the project sites and material transport routes in the short-term during habitat restoration and the construction phase of park improvements. In the long-term (during park improvements operation and maintenance), it is **possible** there will be increased traffic and traffic-related noise pollution at and around the sites given the improvements at these sites and other park investment efforts

currently planned in the study area as part of the St. Louis River Corridor Initiative.

Increased noise and light pollution in the study area may **detract from health** because both can cause sleep disturbance; impaired task, functional, and cognitive performance (which may lead to unintentional injury); stress; cardiovascular disease and hypertension; and affect ecosystem function, particularly in fauna. Noise pollution also has the potential to cause hearing impairment and can also increase the risk of injury in occupational settings (Masterson, Themann, Luckhaupt, Li, & Calvert, 2016). The adverse health impacts of noise pollution are related to total noise exposure from all sources and can vary widely (Table 11).

Table 11. Adverse Health Impacts of Noise Exposure[a]

Effect	Exposure Type	Measure[b]	dBA	Location of Assessment
Hearing Impairment	Environmental	L_{aeq} (24 hr average)	70	Indoors
	Occupational		75	
Hypertension	Environmental	L_{dn} (24 hr average)	70	Outdoors
	Occupational	L_{aeq} (24 hr average)	<85	Indoors
Ishchemic Heart Disease	Environmental	L_{aeq} (24 hr average)	70	Outdoors
Annoyance	Environmental	L_{dn} (24 hr average)	42 30 (impulse noises)[c]	Outdoors
	Occupational	L_{aeq} (24 hr average)	Industry <85 Office <55	Indoors
Performance	School	L_{aeq} (average during school day)	70	Outdoors
	Occupational		70	
Disturbance of Sleep Pattern	Sleep	L_{aeq} (overnight average)	<60	Outdoors
Awakening	Sleep	SEL	55	Indoors
Sleep Quality	Sleep	L_{aeq} (overnight average)	40	Outdoors
Mood Next Day (sleep disturbance)	Sleep	L_{aeq} (overnight average)	<60	Outdoors

[a] Adapted from Passchier-Vermeer & Passchier (2000)

[b] L_{aeq} = equivalent sound level measured over a period of time; L_{dn} = day-night levels (i.e., sound level measured over 24 hours with sound level measured during the night); SEL = sound exposure level (i.e., equivalent sound level of an event measured over 1 second)

[c] Impulse noise is instantaneous, sharp sounds.

These noise impacts will be experienced **disproportionately** by those living, working, going to school, or recreating at or near the project sites and material transport routes. In addition, children, the elderly, and those with pre-existing health conditions will be more vulnerable to the health impacts. The magnitude of the population affected will depend greatly on the material transport route chosen, as well as the timing of earthwork activities at Kingsbury Bay and any increases in park visitor traffic.

It should be noted, while habitat restoration and park improvements can contribute to noise and light pollution, development of these sites as parks eliminates the potential for more severe noise and light pollution that would accompany future industrial development at the sites were they not parks.

Main Findings and Preliminary Recommendations Related to Noise and Light Pollution

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding

Equipment operation and truck and vehicle traffic will increase noise pollution in the study area and have the potential of placing construction crews, residents, and recreational users in the study area at increased risk of adverse health impacts from noise exposure. The adverse health impacts of noise pollution are related to total noise exposure from all sources.

- Clearly communicate the project, its duration, project updates (including issues and concerns), and expected roadway and water traffic impacts, air pollution levels, and noise levels to residents, schools and daycare centers, senior centers and care facilities, businesses, and recreational users in the project area and along the transport route
- Provide a means for residents and other affected populations to provide feedback, questions and/or lodge complaints about general construction activities and excess traffic, air, and noise impacts
- Include noise mitigation criteria/ specifications in the contract (e.g., absolute noise criterion for equipment, restricted idling, and use of mufflers, dampeners, shieldings, and enclosures)
- Include incentives or priority in hiring for contractors who have established noise mitigation programs/policies and/or newer fleets
- Implement noise monitoring in the vicinity of both sites to assess overall noise levels (i.e., baseline noise plus project noise) and implement mitigation measures, as necessary, to minimize impacts
- Limit construction activities to daylight hours or the hours specified in the Duluth noise ordinance (7 am – 9 pm), whichever is more restrictive (i.e., sunset December-March is between 4:30 and 7:30 pm). Limit noisy operations to non-sensitive time periods (e.g., mid-day)
- Position stationary noise sources as far away as possible from noise sensitive areas (areas where a quiet setting is a generally recognized feature or attribute, such as residential areas, parks, recreational and wilderness areas, and cultural and historical sites)
- Implement hearing protection and operations schedules to avoid exposure of construction workers to noise above NIOSH recommended exposure limits (73% of the time construction workers are exposed over the recommended exposure limits)
- Route trucks, other equipment and vehicle traffic away from neighborhoods, schools and daycare centers, senior centers and care facilities, and recreation areas to the extent possible to minimize the risk of traffic impacts and exposure to noise and air pollution
- Prohibit the use of truck engine brakes, unless in case of emergency

Main Finding	Nighttime construction activity is not anticipated with exception of hydraulic dredging; however, sound travels further at nighttime and nighttime noise and light pollution can cause sleep disturbance and other adverse health effects.

- Avoid nighttime construction activity to the extent possible. During winter, sunset is between 4:30 and 7:30 pm (much earlier than 9:00 pm). When necessary, implement measures to minimize light illumination impacts on nearby residences
- Ensure any lighting used in the parks are intelligently-designed, low glare, efficient outdoor lighting fixtures that direct illumination toward the ground (rather than upward) and evaluate the potential for motion sensors on lighting in certain areas of the parks or parking lots to minimize over-illumination

Crime and Personal Safety

Restoration of damaged habitats and improvements to the landscape at these sites can provide benefits to both environment and human health. An established body of research suggest that these benefits can often shape community attitudes and behaviors towards crime and safety. The amount of greenness in an urban community has also been linked to decreased aggression and violence, lower mental fatigue, higher resiliency to stressful life events, and increased social interaction and communication. These changes can improve community resiliency, social cohesion, and perceived safety and security. While it's not difficult to support the idea of crime as a threat to the health of individuals, negative perceptions of the natural environment can often translate directly to poorer health outcomes, such as decreased physical activity, poorer mental health, and increased risk of cardiovascular and chronic disease.

Existing Conditions

Current Rates of Crime

The City of Duluth provided raw crime data of all calls for service in the HIA study area for the years 2010 through 2017. The reported crimes were coded into four categories: personal safety (e.g., drug incidents, suspicious activities, etc.); violent person-to-person (e.g., assault, physical harm to others, etc.); person-to-property (e.g., burglary, vandalism, etc.); and other (e.g., domestic disturbances). The raw data were filtered to remove service calls for which the nature of the incident could not be fully ascertained (e.g., traffic stop) and incidents not relevant to the HIA (e.g., water main break). The locations of the remaining incidents were mapped by category from 2010 – 2017 within the HIA study area (Figure 16).

Crime incidence rate is used to describe the prevalence of crime in a community and can be used as a basis for comparison to other communities and benchmarks. From 2010 to 2017, there were 7,919 reported crime incidents in the study area (Census tracts 33, 34 and 36). **The crime rate was calculated as 171.3 cases for every 1,000 people per year in the HIA study area**.

$$\left[Crimes\ reported\ (n = 7{,}919) \Big/ Total\ Population\ (5{,}778)\right] * 1{,}000\ people * \frac{1}{8}\ years$$

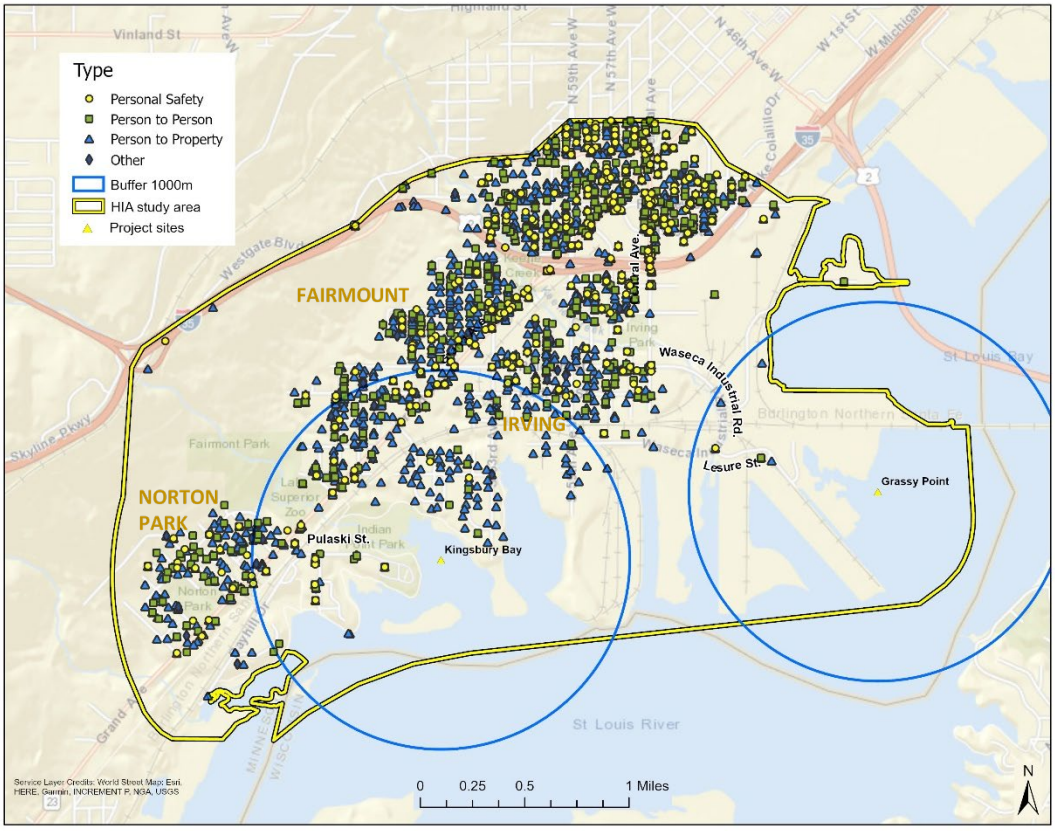

Figure 16. Map of crime type within 1000 meters of project sites for years 2010 - 2017. Person-to-person (e.g., assault, physical harm to others, etc.); personal safety (e.g., drug incidents, suspicious activities, etc.); person-to-property (e.g., burglary, vandalism, etc.); and other (e.g., animal disturbances)

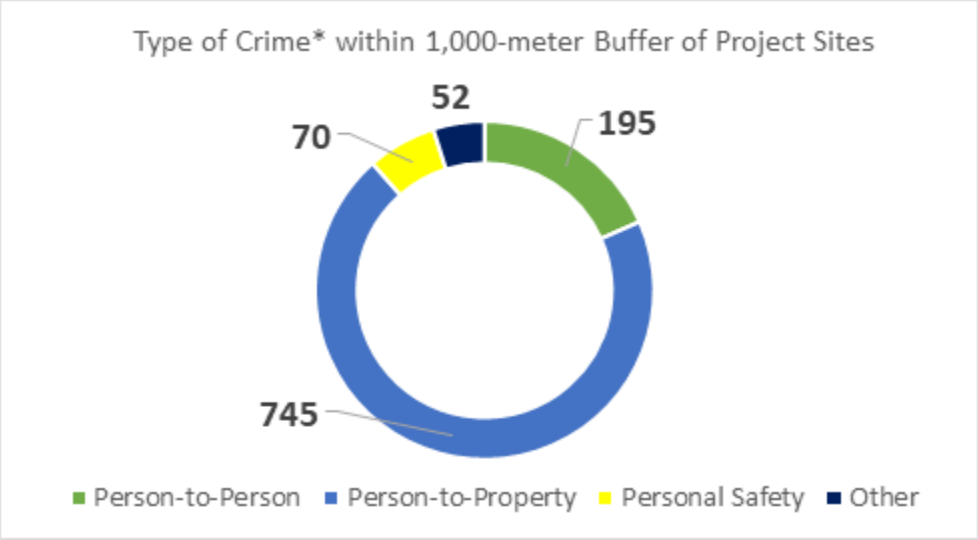

Figure 17. Types of crime within 1,000-meter buffer zone of the project sites for years 2010 -2017.
*** Person-to-person (e.g., assault, physical harm to others, etc.); personal safety (e.g., drug incidents, suspicious activities, etc.); person-to-property (e.g., burglary, vandalism, etc.); and other (e.g., animal disturbances)**

Pedestrian and Bicycle Safety and Access

Walk Score is an on-line tool that measures the walkability of a location based on the distance to nearby places, as well as pedestrian friendliness. West Duluth has a Walk Score of 29/100 (indicating it is car dependent; most errands require a car) and a Transit Score of 36/100 (indicating few nearby public transportation options). The neighborhood of Irving between Kingsbury Bay and Grassy Point is also car-dependent (Walk Score of 35/100) and has few nearby public transportation options (Transit Score of 30/100). Yet the population closest in proximity to both sites (Census tract 34, which includes the Irving neighborhood) has the highest prevalence of households with no vehicle available (19.8 ± 9.9%) (CDC, 2017), indicating that a higher percentage of individuals would likely be accessing the sites by foot or bicycle.

In an analysis of existing transportation and infrastructure conditions in the Western Port Area Neighborhoods in Duluth, there are three designated on-street bike routes in the study area – Grand Avenue, Central Avenue, and Raleigh Street (Toole Design Group, 2016). In addition, a portion of the Grassy Point Trail has an on-street segment along Waseca Industrial Road that has paved markings and signage for a designated bike lane (Figure 18). The bike routes along Raleigh Street and Central Avenue lack painted bike lane markings or signage, a safety issue which likely discourages use. The study identified a lack of a direct bicycle connection to the Willard Munger State Trail. Currently, bicyclists from the Irving Neighborhood would need to travel on-road along Grand Avenue to access the State Trail which may pose issues given the high traffic volumes and speeds along Grand Avenue.

Figure 18. Some bike routes are less than ideal, with bicyclists traveling on busy streets, such as Grand Avenue (top), or roads with industrial traffic, such as Waseca Industrial (bottom).

According Minnesota's Department of Transportation's Crash identified only two incidents where a pedestrian was struck (both in 2009) and two incidents where a cyclist was struck in the study area from 2005 to 2014. The report did not identify readily apparent clusters of crashes or locations that demonstrated an unusual crash history.

Community Perceptions of Project Sites

At the HIA kick-off meetings, community members and other stakeholders provided input on the current state and uses of both sites. Residents explained that Kingsbury Bay is poorly maintained, citing mudflats, thistles, cockleburs, and cattails. One local resident reported that people defecate in the park. At Grassy Point (described as"Junkie World" by one person), residents expressed fear of the people there and of the condition of the trail, highlighting the neglect, vandalism, and an unsafe environment where "seedy characters" may spend time (in the words of a community member). The neglect included broken boardwalks, vandalism, hypodermic needles, and debris, including discarded tires, shopping carts and garbage. Residents also felt that the Grassy Point area had "safety and traffic hazards" and that there were "no safe routes going to the park." Residents did not feel safe walking from the community of Irving to Grassy Point, "where [there] are a number of barriers, including a small under-road tunnel area that would need to be passed through" and the "unkempt nature of existing walking paths," which deterred people from access. Accessing the sites from the Fairmount and Norton Park neighborhoods, carry the added risk of crossing Grand Avenue, which is characterized by high traffic volumesand speeds.

Overall, community members expressed a lack of safety overall at the Grassy Point site, and in some cases, fear. One resident stated, “Fear. I feel fear when walking on the G[rassy] P[oint] trail - fear of people there and of the condition of the trail.” Numerous studies have demonstrated that poorly maintained natural spaces negatively affect residents’ sense of security and heightens perceptions (and possibly the incidence) of crime.

Potential Impacts to Crime and Personal Safety

Habitat Restoration

The Kingsbury Bay and Grassy Point project areas are currently inaccessible via larger boats due to shallow waters and at Grassy Point, the presence of woody debris. However, small boats and recreational watercraft such as canoes and kayaks can access the sites. During the construction phase of the restoration effort, stationary equipment such as floating pipelines and pumps will be installed along the edge of the main navigation channel of the St. Louis River. These pipelines will be buoyant and visible on the water surface and along with the associated dredging equipment may impact recreational boating activities. Plans to minimize water safety hazards are detailed in the EAW and MNDNR public waters permit, namely by positioning the pipeline near the shoreline; marking the pipelines with buoys and signage; and increasing visibility of the construction equipment with lights.

The habitat restoration work is also in close proximity to trails and other recreational outlets and has the potential to impact the personal safety of recreational users. Trucks will enter and exit Kingsbury Bay via Pulaski Street, which also services Indian Point Campground (i.e., a Duluth campground with river access) and a parking lot at the trailhead of the Western Waterfront Trail (i.e., a trail that runs along the St. Louis River shoreline from Grassy Point past Kingsbury Bay to Riverside and provides hiking, biking, birding, and access to the river). Also nearby is a trailhead of the Willard Munger State Trail (i.e., an extensive multi-use trail that offers hiking, biking, in-line skating, cross-country skiing, and snowmobiling). Increased truck traffic in this area poses a safety risk to pedestrians and recreational users in the area.

After restoration efforts are complete, the project sites will provide greatly enhanced recreational fishing and boating activities as a result of more open, vegetation-free channels and increased water depths (MNDNR, 2018). While the opportunities for public access and recreational use of the waters will be enhanced, the project currently does not plan to provide facilities or resources to facilitate watercraft use, such as marinas or boat docks. The enhanced opportunities for recreational boating in the bay brings along added risk for personal injury, loss of life, and property damage. While data on boating safety were not available for the project areas, this information can be inferred from the United States Coast Guard (USCG, 2016) who compiles national statistics on recreational boating safety. In 2016, the USCG reported 4,463 recreational boating accidents in the U.S. The most common vessel types involved in reported accidents were open motorboats (47%), personal watercraft (18%), and cabin motorboats (15%). In addition, the vessel types with the highest percentage of deaths were open motorboats (47%), kayaks (13%), and canoes (9%).

Restoration efforts are expected to improve the aesthetics of the project sites as accumulated wood waste and invasive plant species are removed and wetland habitats restored to a more diverse and natural condition. A number of empirical studies provide evidence that contact with natural environments improves the quality of people’s social and community interactions, thereby lowering incidences of crime and increasing the perception of safety (Weinstein et al., 2015). While some studies have associated natural and vegetated areas with greater perceptions of the possibility of crime (Nasar, 1982), the growing body of literature predominantly suggests that

more natural surroundings are negatively associated with crime, as nature facilitates residents spending more time outdoors and monitoring their environment (Kuo and Sullivan, 2001a,b).

Improvements to the project sites may influence the incidence rate for specific types of crime. In particular, enhancing the presence of green and natural space can potentially facilitate decreases in person-to-property crime (e.g., burglary, larceny, theft, arson, and vandalism). This is especially important for Kingsbury Bay and Grassy Point as person-to-property crime are highest around these sites.

Park Improvements

A number of post-restoration projects are being planned to improve and expand the trail systems that will ultimately provide greater public access and enhanced scenic views of natural St. Louis River habitats and wildlife. Currently, the Western Waterfront Trail (WWFT) borders Kingsbury Bay and provides nearly five miles of public waterfront access. The trail also connects the riverside neighborhood to the Lake Superior Zoo. The Duluth Cross City Trail Mini Master Plan (Hosington Koegler Group Inc., 2017) envisions a 10.3-mile multi-purpose, non-motorized paved trail system connecting downtown Duluth and the WWFT to the Willard Munger Trail, which would connect the project area to communities south of Duluth.

Conceptual park designs identified by the City promote additional recreational and development opportunities within and along the St. Louis River Corridor. For these future projects, improvements to aesthetics and existing infrastructure can facilitate a reduction in crime and offer improvements in perceived safety and security.

However, studies have indicated that improvements to natural and green space must include a plan for maintenance to promote use and positive perceptions of park safety. Crime Prevention through Environmental Design (CPTED) outlines proper design and effective use of the built environment that can lead to a reduction in the fear and incidence of crime (Crowe, 2000). CPTED principles can provide park users a comforting feeling while discouraging potential criminals, thereby reducing crime proactively and unobtrusively. Recreational users must also be able to safely access the parks from the surrounding neighborhoods.

Potential Health Impacts Related to Changes in Crime and Personal Safety

Habitat Restoration

Ecological restoration of the coastal wetlands may **detract from health** during construction due to physical hazards posed on recreational boaters but will **not be likely** due to the stated mitigation measures and relatively small number of users**.** Post-restoration operations will **benefit health** because conditions will ultimately improve attitudes and behaviors and help reduce the risk of crime related injury and stress. It is **possible** that revitalization of land (Kingsbury Bay) and addition of wetlands, deep water/streams, and wooded plants (Grassy Point) will deter crime and promote positive perceptions of the project sites. Changes in crime and personal safety will only affect a **low** number of people due to the availability of public access points and size of residential zones surrounding the sites. Improving crime and personal safety will benefit vulnerable populations such as youths, the elderly, and individuals in poor physical health. The health impacts from crime and decreased personal safety can be minor to moderate, depending on the nature of the crime. Building positive perceptions of the safety of the project sites will likely take a long time to take effect and can be easily reversed if conditions are allowed to deteriorate. There is limited evidence supporting positive changes in crime and personal safety through habitat restoration efforts.

Park Improvements

The trails and parks in the study area are perceived by some people as poorly maintained and unsafe. Construction-related activities may further **detract from health.** However, improving and maintaining park commodities will ultimately **benefit health** because it will support healthy behaviors, improve mental health, and reduce the risk of cardiovascular disease and related conditions. It is **possible** that increasing safe public access points, maintenance of park commodities, and availability of lighting on the trails will enhance perceived security and reduce the risk of crime related injury, stress, and stress-related illness. If they are well maintained, improvements to public perceptions of the safety of the parks will affect a moderate number. Improving crime and personal safety will benefit vulnerable populations, such as youths, the elderly, and individuals in poor physical health. The health impacts from crime and decreased personal safety can be minor to moderate, depending on the nature of the crime. Building positive perceptions on the safety of the park sites will likely take a long time to take effect and can be easily reversed if conditions are allowed to deteriorate. There is limited evidence (numerous but sometimes conflicting studies; vast majority of studies are cross-sectional and not representative of changes over time) supporting positive changes in crime and personal safety through park improvements.

Main Findings and Preliminary Recommendations Related to Crime and Personal Safety

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding	Design and maintenance of green spaces and natural elements can facilitate a reduction in crime and improvements in perceived safety and/or security. Improvements to aesthetics and existing infrastructure at Grassy Point will improve personal safety and perception of safety and/or security, as well.

- Clearly communicate the improvements being made to Grassy Point to alleviate existing perceptions of crime and personal safety issues and encourage utilization of the space post-restoration
- Follow Crime Prevention through Environmental Design (CPTED) guidelines, including lighting and planting configurations. Where possible, reduce dense planting and shrubs around narrow pedestrian paths
- Construction activities that alter existing routes and access points should have clear signs and barriers to minimize the potential for trespassers
- Lighting should be improved and police surveillance considered to reduce crime and the perception of risk at these sites
- Provide clear signage and maps for pedestrian and bicyclist access to the parks. Important elements of access and design include effective wayfinding systems such as the use of landmarks, signage, distance to destination markers, and interest points to assist in navigating the routes easily
- After improvements of parks begin, increase enforcement or police presence to “set the tone.” Communicate to police department that their presence is important in the beginning to deter bad behavior and reduce crime. This is especially true at Grassy Point where it is more secluded and thereby,

necessitates more formal surveillance. Delegation of those resources should be determined by the number of visitors and the expected frequency of crimes

Main Finding

The new parks and amenities need to be safely accessible by pedestrians and bicyclists, and access routes should be Americans with Disability Act (ADA)-compliant.

- Consider using the National Highway Transportation Safety Administration's (NHTSA's) Walkability and Bikeability Checklists to inform design of trails within the parks and leading to the parks
- Improve pedestrian and bicycle access to Grassy Point from the Irving neighborhood; current access is by footpath or walking/biking along Waseca Industrial Road
- Implement traffic calming measures (such as speed humps, raised crosswalks/ intersections, traffic circles, medians, curb extensions or bump-outs, and signage or pavement markings) and bikeway improvements (such as clear painted bike lane markings and signage to already designated bike routes) to improve safe access to the parks and minimize the risk for increased accidents should the parks and other nearby enhancements increase the amount of traffic in the area post-construction

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 pleasant green space 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 ongoing contact with them.

Existing Conditions

Park Conditions in HIA Study Area

Duluth has approximately three times more green space than most other U.S. cities of similar size (Kreag, 2002). The City of Duluth contains 129 parks (6,834 acres), 11,000 acres of green space, 12 miles of paved trails, 85 miles of unpaved bike-optimized multi-use trails, and 150 miles of unpaved hiking trails (Figure 19). There are 235 acres of parkland in nine parks and special use areas located in the HIA study area. Their sizes and uses are described in more detail below.

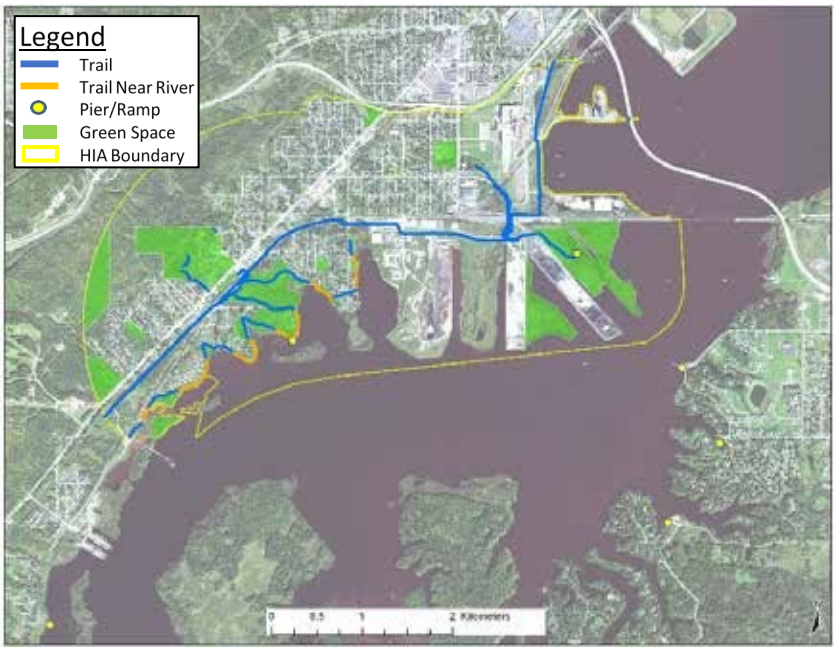

Figure 19. Map of the Kingsbury Bay-Grassy Point project area showing existing green space, trail, piers and boat ramps within and near the project area boundary.

Neighborhood Parks[5]

- **Irving Park** (9 acres): The park contains ball and soccer fields, playground equipment, a basketball court, and a trailhead for the Grassy Point Trail. Keene Creek runs along the southern edge of the park. Irving Park was severely damaged in the 2012 flood; the community center was a total loss, and fencing was damaged. The City of Duluth approved the Irving Park Mini-Master Plan in October 2015 (City of Duluth, 2015). The first phase of improvements for Irving Park were completed during the summer of 2018.
- **Keene Creek Park** (13 acres): I-35 passes over the park. It contains a dog park, children's play area, and skate park. The Mini-Master Plan for Keene Creek Park (City of Duluth, 2016b) includes upgrades to lighting, trails, play areas, and riparian zone restoration.
- **Norton Park** (3 acres): The park includes a play area, little free library, community center, and ball fields. The Mini-Master Plan for Norton Park (City of Duluth, 2016b) includes upgrades for the existing facilities and extensive streambank stabilization.
- **Memorial Park** (3 acres): The park is located on Grand Avenue and contains ball fields and courts, picnic shelter and tables, and BBQ grills. It is adjacent to Laura MacArthur School.

Three of the four neighborhood parks in the HIA study area were heavily damaged in a devastating flood in 2012. Many of the planned neighborhood park upgrades will address some of the unrepaired facilities, whichwill contribute to community resilience. Upgrades or planned projects for the parks include stream bank stabilization, athletic field repair, new lighting, and benches.

Regional Park[6]

- **Fairmount Park** (56 acres): The park is located adjacent to the Lake Superior Zoo. There are playground facilities, picnic areas, permanent restrooms, and a trailhead for the Superior Hiking Trail and connection to the Duluth-Winnipeg-Pacific (DWP) trail (Figure 20).

Figure 20. Fairmount Park includes a playground, picnic area, and a connection to the Superior Hiking Trail.

[5] The park categories used by the City of Duluth are based on the National Recreation and Parks Association (NRPA) classification system (NRPA, 1996). Neighborhood parks in Duluth are those that serve a 0.25- to 0.50-mile radius and 1,000 to 5,000 persons, are 4-8 acres, and suited for intense development. Most neighborhood parks have amenities like play equipment, ball or soccer fields, winter ice activities, and community centers. A Mini-Master planning process was conducted for 11 neighborhoods parks in the St. Louis River Corridor in 2015-2016 (City of Duluth, 2016b).

[6] Regional parks are the largest parks in the City of Duluth park classification system based on NRPA (1996). They are 50-100 acres in size, serve the entire city, and the service radius is about a 30-minute drive. Regional parks are a mix of recreation, as well as natural and open spaces.

Special Use Areas[7]

- **Indian Point Campground** (27 acres): This campground at Kingsbury Bay features 70 campsites, a permanent bathroom building, picnic shelter, grills, trash cans, a non-motorized boat landing, (Figure 21) and a fishing pier (Figure 23). The campground is adjacent to the Western Waterfront Trail. On-site amenities include RV hook-up, electric camp sites, internet connection, showers, laundry, ice machines, canoe and bicycle rental, and dock space with mooring buoys. According to campground policy, the accommodations are open to the public.

Figure 21. Non-motorized boat landing at Indian Point Campground also provides fishing access.

- **Grassy Point Park** (71 acres): This linear park is located in the Irving neighborhood of Duluth and is partly adjacent to industrial properties. Currently, amenities at Grassy Point are limited to a parking lot, a carry-in canoe landing, and boardwalk (Figure 22). The boardwalk is presently in serious disrepair from flooding and vandalism and lacks accessibility for individuals with mobile disabilities (Figure 22).

Figure 22. Signage at the entrance to Grassy Point Park (left). Grassy Point Trail boardwalk (middle). Current condition of the Grassy Point boardwalk near the observation platforms (right).

- **Western Waterfront Trail** (5 miles, 40 acres): This gravel trail is a linear park that runs along the St. Louis River shoreline through the HIA study area (Figure 23). There are portable bathrooms, trash cans, and several trailhead parking areas.

[7] Special use areas are intended to serve both residents and visitors with unique experiences and specialized facilities.

Figure 23. Western Waterfront Trail near Indian Point Campground (left). Fishing Pier at Indian Point Campground along the Western Waterfront Trail (right).

Current Use of and Perceptions of the Parks

The Duluth Parks Department does not currently track park use. However, an analysis of geotagged social media photos provides some insight on how parks are used in the HIA study area. A photo density analysis of Panoramio, Flickr and Instagram[8] photos suggest there is variable activity among parks. The local "hotspots" of activity are the Lake Superior Zoo, Keene Creek Park, Grassy Point, and both the Western Waterfront and Superior Hiking Trails.

The site with the most photos on all three platforms was the Lake Superior Zoo. The second-most popular site varied amongst the three platforms. Grassy Point was the second-most popular site on Flickr and contained many photos of birds. In contrast, the second-most popular site on Instagram was Keene Creek Park, home to a popular dog park, which was well represented among the posted photos.

In addition to the photo analysis, public and stakeholder meetings were structured to capture data regarding park use. During the public and stakeholder meetings, attendees shared ideas about the potential for habitat and park improvements at Kingsbury Bay and Grassy Point. Resident and stakeholder comments reflected past and current insight and experience, as well as historical knowledge. In general, the residents and stakeholders raised concerns about park maintenance and condition, and described current and desired park uses.

Concerns about park maintenance included:

- "The City already doesn't take care of the Western [Duluth] parks that it has and now they are going to add two more?"
- "Volunteers are the ones often left responsible for helping to keep the parks maintained."
- Many concerns about maintenance were directed towards Grassy Point. Residents shared that they feel unsafe there because of loitering and the poor condition of the boardwalk. Several residents felt that drug use and garbage dumping were currently problems at Grassy Point.

[8] The set of photos was extracted from a larger set of photos related to Area of Concern research. Panoramio is largely a landscape photo-sharing platform where photos were taken on cameras and uploaded to the site, Flickr users typically upload photos from both cameras and phones, and Instagram users most often upload photos from their phones or take photos in the app.

One resident stated, “Fear. I feel fear when walking on the G[rassy] P[oint] trail - fear of people there and of the condition of the trail.” Not all comments about present conditions were negative, as many stakeholders and residents feel positively about the area and the current amenities:

- “Please keep the waterfront trail open during construction.”
- Grassy Point was noted as a bird watching “hotspot.”
- There were several comments asking that camping be preserved at Indian Point Campground, including “(what are the) plans for Indian Point? Continue/improve camping? – [The} city seems short on camping opportunities.”

Several people expressed a hope for more fishing access at both Kingsbury Bay and Grassy Point. An overarching theme in the comments was that participants seemed to appreciate the current park amenities, even though many were concerned about maintenance or condition. It is important to recognize that the habitat restoration at Kingsbury Bay and Grassy Point are unfolding alongside the city of Duluth’s St. Louis River Corridor initiative, which entails the creation of new park and trail amenities, along with the improvement of the existing parks. What stakeholders seem to fear is duplication of existing resources. Two comments speak to this concern:

- *“Keep it simple. Fairmont is a few hundred feet away. Don't duplicate what is there. Duluth lacks money and staff to adequately maintain existing parks and trails. How can this additional park and trail be maintained? Attention to this new park (adding new parks at Fairmont and Quarry) will leave even less money and staff for existing parks and trails. Neglected and poorly maintained parks and trails are a greater negative than positive for health, wellness and happiness. There are multiple other nearby parks people use and enjoy.”*
- *“Nearby current parks are not adequately maintained and have 5-6-foot-tall thistles and cockleburs, yet there is planning to create brand new parks [which] makes users of existing nearby, neglected parks feel bad, frustrated, not important, yes – jealous.”*

Finally, two submitted comments at the stakeholder meeting indicated that resource availability for the maintenance of new park amenities may be a concern for the City of Duluth, especially at Grassy Point:

- *“It will be expensive for the City to develop permanent connection to the island - what does it mean to not have access to the island by foot (only access by water)?”*
- *“City not interested in a peninsula vs. island at Grassy Point (more material, Keene Creek outlet).*”

Current Conditions for Recreational Fishing

The area has been noted for recreational fishing, although agency-based and academic experts have reported that the fishery is impaired by wood debris and lacks high-quality sediment for macroinvertebrates. Within the project area, there are two public fishing piers: on the Grassy Point Trail and at Indian Point Campground. Facilities at both locations are restricted to the piers. The pier at Indian Point Campground has about 225 feet of usable perimeter. The pier at Grassy Point has about 75 feet of usable perimeter (distances from Google Earth). The pier and boardwalk at Grassy Point are currently not in usable condition due to vandalism and lack of maintenance. There are about 5,000 feet of public trail adjacent (<16 feet from shoreline) to open water in the project area that could be used to access the shoreline for fishing. The level of use of trail-adjacent access points for shore fishing is unknown.

There is a public landing for non-motorized boats at the Indian Point Campground and a picnic pavilion at Indian Point Campground, located about 600 feet from the fishing pier, which can be reserved for private use. Several recreational fishing access amenities can be found within one mile of the Kingsbury Bay - Grassy Point project area. A boat ramp, rest rooms, parking, and fishing pier with about 220 feet of usable perimeter at Clyde Avenue provide fishing opportunities directly upriver of the project on the Minnesota side of the river. A double boat ramp, rest rooms, parking, and fishing pier with about 450 feet of usable perimeter are located across the river from Grassy Point off Belknap Street in Superior, Wisconsin. Furthermore, there is a boat ramp with parking in the first bay upriver from Belknap Street facility and a more sheltered location that may be used more frequently for launching non-motorized boats. Additionally, an unimproved access off Billings Drive is used to launch small boats and for ice access.

Finally, both Kingsbury and Keene Creeks are recognized trout streams, meaning that they have cool water and coarse stream beds. There is currently no developed shore fishing access for Kingsbury Creek or Bay.

Potential Impacts to Recreation, Aesthetics, and Engagement with Nature

Natural Areas and Green space

Once construction is complete, Kingsbury Bay and Grassy Point will provide natural areas and multi-use green space. Grassy Point and Kingsbury Bay are already sites where people enjoy hiking, birding, camping, and some fishing. In addition, biking, skiing, and other hiking opportunities are located nearby. The proposed concept plans contain both habitat restoration and potential new amenities. Potential changes include a new swimming beach at Kingsbury Bay located along the Western Waterfront Trail near Indian Point campground. The beach will add a new amenity, but might also impact the use of or access to Indian Point Campground. Table 12 outlines the changes in fishing and swimming access based on the site concept plans.

Table 12. Summary of the Projected Impacts of Habitat Restoration and Park Improvements on Recreation, Aesthetics, and Engagement with Nature.[a]

Changes in swimming and fishing access	Impact on existing resources
New swimming beach at the mouth of Kingsbury Bay.	Swimming beach will be located along the Western Waterfront Trail and Indian Point Campground, which may impact the current use of or access to Indian Point Campground.
Four new shore fishing locations at Grassy Point (one with deep water access).	Additional fishing opportunities at Grassy Point, boardwalks, and trails will facilitate access to Big Island and the pier. Increased depth at Kingsbury Bay will improve winter fishing.
The existing pier at Kingsbury Bay will be relocated in the bay on the other side of Indian Point Campground.	The current fishing pier will move from the western edge of Indian Point Campground to the tip of the point.
Net gain of 12 acres of kayak and canoe access.	Removing the delta in Kingsbury Bay and deepening channels at Grassy Point will create human-powered boat access and additional launches. Caution should be taken to reduce potential conflicts between recreational and human-powered boat users.

Changes in swimming and fishing access	Impact on existing resources
Net gain of 46 acres of recreational boating access.	Removing the delta in Kingsbury Bay and deepening channels at Grassy Point will create deeper water for other types of boats. Care should be taken to reduce conflicts between recreational boaters and residents along Kingsbury Bay.

[a] Projected impacts based on concept plans.

Beautification and Aesthetics

Public perception of the quality of an environment is an indicator of the aesthetic quality and potential use of a natural space. While Kingsbury Bay and Grassy Point are under construction, the reduced environmental quality caused by the disturbance will result in decreased aesthetics and quality, likely leading to less enjoyment by the public. After construction, the operation and maintenance of the restored habitat will contribute to the beautification and aesthetics of the natural spaces. Sustained maintenance will be especially important for Grassy Point, where there is a perception that the space is not well maintained and is therefore unsafe.

These spaces, especially Grassy Point, have the potential to connect the HIA study area to the St. Louis River and City of Duluth economic development. For example, the creation of Big Island will enhance access to the St. Louis River for aesthetic appreciation and fishing. The proposed changes at both Kingsbury Bay and Grassy Pointwill occur in the context of the larger revitalization of the St. Louis River Corridor, including the St. Louis River National Water Trail.

Engagement with Nature

Visitors to Kingsbury Bay and Grassy Point habitat restoration sites can engage with nature through recreation. There is expected to be a net gain of 12 acres of open water suitable for kayaks and canoes, and 46 acres of open water suitable for recreational boats (Table 12), resulting from the removal of the delta at Kingsbury Bay and deepening channels at Grassy Point (as detailed in the *Water Quality and Habitat* pathway). One expected result of the habitat restoration at Grassy Point is improved native vegetation and natural substrates, which will enhance the paddling experience. Also, the creation of Big Island will enhance bird habitat and provide bird watching sites.

Because of restricted access and perception of reduced environmental quality during habitat restoration and park improvement construction, opportunities and quality of engagement with nature may be temporarily limited. Construction activities may result in the displacement of wildlife in the project area resulting in reduced bird watching quality. In the May 2019 MNDNR Public Information Meeting, the public was notified of closures related to habitat restoration activities. The handout from this meeting stated that “the Western Waterfront Trail (WWFT) will be closed at Kingsbury Bay (there will be closure and rerouting signs), the Kingsbury Bay parking lot will be used to stage equipment, alternate parking for WWFT access will be established on Spring Street, and the Kingsbury Bay snowmobile trail will be closed” (MNDNR, 2019). Similarly, during habitat restoration and park improvements the area may also be inaccessible for boaters.

Recreational Fishing

Opportunities for recreational fishing will be changed or enhanced at Kingsbury Bay and Grassy Point as a result

of the habitat restoration and park improvements work. For example, there are potentially four new fishing locations at Grassy Point (including one with deep water access). Access to the fishing piers will be facilitated by the addition of trail and boardwalk access to Big Island. At Kingsbury Bay, the existing fishing pier will move to the other side of Indian Point Campground, which will change the view of the St. Louis River. During the construction phases, however, because of restricted access and perception of reduced environmental quality, opportunities for and quality of recreational fishing may be limited. Construction activities may result in the temporary displacement of fish in the project area resulting in reduced fishing quality.

Potential Health Impacts Related to Changes in Recreation, Aesthetics, and Engagement with Nature

Habitat Restoration and Park Improvements

It is **highly likely** that habitat restoration and park improvements construction will **detract from health** because there will be fewer opportunities for physical activity. The impact will be **moderate** because the public will be impacted in their ability to use the space, be affected by recreational amenity changes, and by the construction that will be occurring through the surrounding neighborhood. It is **highly likely** that stress will be increased during habitat restoration and park improvements construction for two reasons: because of disruption during construction and because landscape change may impact place identity and attachment, including reduced opportunities for birding at both Kingsbury Bay and Grassy Point. Populations impacted include nearby residents, birders, recreational users of the Western Waterfront Trail, campers at Indian Point Campground, and subsistence fishers. Effects will be disproportionately felt by those who most use and are attached to the sites

It is **highly likely** that habitat restoration and park improvements will **benefit health**, as they will improve the aesthetics of the sites, increase the public's ability to utilize the green space for recreation and engagement with nature, and increase amounts of green space that provide additional opportunities for physical activity. Impacted populations include nearby residents, birders, recreational users of the Western Waterfront Trail, and campers at Indian Point Campground.

The impacts on stress and overall health and well-being in the long-term (post habitat restoration and park improvements) will be positive as biodiversity increases and the landscape becomes more familiar. The negative effects of stress will be felt **disproportionately** on those who are most attached to the current sites because there is high value placed on the existing amenities and changing them could cause distress. Furthermore, residents fear duplication of services and the subsequent neglect of existing parks.

It is **somewhat likely** the projects will **benefit health** and have a positive impact on nutrition as a result of improved natural resources and access and increased opportunity for fishing because of more fish habitat. The impact will be moderate because of the diversity of the public that will benefit from the restoration and park amenities. The groups that are most likely to be impacted include those who participate or depend on subsistence fishing for fulfilling their nutritional needs.

Main Findings and Preliminary Recommendations Related to Recreation, Aesthetics, and Engagement with Nature

Based on the main Assessment findings of this pathway, these recommendations were developed for promoting the positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding	Well-maintained spaces with diverse recreational options will enhance opportunities for recreation and overall health. *In spite of perceived condition, the recreational spaces around Grassy Point and Kingsbury Bay are well utilized for hiking, birding, and camping.*
Main Finding	Recreational fishing improves nutrition and overall health. Different populations fish for different reasons: subsistence, recreation, and as a social activity. *However, there are currently limited opportunities for shore and boat-based fishing in the study area.*

- Recommend that the City solicit deliberative community and stakeholder engagement and examine the pathways through which the park efforts could impact health to help inform the park improvements design and implementation
- Offer diverse opportunities for recreation at both sites, including publicly-accessible gathering spaces, fishing piers, birding platforms, access to the water for water-based recreation, and trails, considering maintenance requirements of installed features
- Preserve and enhance fishing opportunities, with more formal locations (e.g., piers) and social gathering opportunities adjacent to those locations. The creation of Big Island at Grassy Point would provide an opportunity for a fishing pier and access to a fishery with more biodiversity; a bridge would be needed to access Big Island
- Create a higher upland area on Big Island to form a more sheltered bay, providing safer harbor for kayaks and canoes
- Areas that support both human-powered and motorized boats should include measures to enhance safety and minimize potential for user conflict
- All swimming areas should include measures to enhance safety and minimize potential for user conflict. Measures should include signage about the availability of lifeguards and current water quality status. Buoys should separate swimming and boating areas
- In advance of construction and in all project phases, clearly communicate to recreational and water users, through multiple media sources, reliable and timely information about the construction periods, disruptions to the Western Waterfront Trail and walkability and accessibility to both project sites, and the planned changes at both sites so that users can anticipate the improved resources and plan to visit
- Provide additional parking to increase access to and utilization of the restored Kingsbury Bay and Grassy Point sites, using caution to minimize any potential environmental impacts of the added parking
- Perform wetland restoration at the mouth of Kingsbury Creek to preserve the cold-water habitat for trout and provide deeper water for kayak and canoe access
- The planners should strive to create natural spaces for social interaction and opportunities for social gatherings near the additional planned fishing piers, especially at Grassy Point, similar to the improvements at Chambers Grove Park
- Because recreational amenities are enjoyed by residents, any plans for future changes should include recognition of the value placed by residents who use the resources frequently

- Preserve and upgrade current birding locations, as well as enhance access to newly created birding habitat. Signage, raised platforms, and telescopes are all potential amenities. Upland plant communities should be restored to maximize potential for pollinator, including bird, habitat
- Recognizing the value placed on the existing resources, any changes to park amenities could add new features to existing parks and green space
- Create a water trail to serve as a by-way for kayaks, which can be nominated as a nationally designated water trail, and may provide opportunities for recognition and funding

Main Finding

Well-maintained spaces with diverse recreational options will enhance opportunities for recreation and overall health. *Partnerships with volunteer organizations may help support park maintenance.*

- Research and develop co-management models, where neighborhood organizations have more formal responsibility for park management. Co-management arrangements could empower the neighborhood and ease the maintenance burden on the city of Duluth
- The City should provide a means for assessing park usage and the ends to which the sites are being used (e.g., for social cohesion, spiritual reflection, and access to cultural resources). This could include reaching out to the University of Minnesota-Duluth Environmental and Outdoor Education program or other local organizations to create a service learning or citizen science project that monitors, through a 5-year monitoring and evaluation timeline, the use of the parks for these means or providing signage at the sites that includes a description of how to report usage of the park, including a QR code that sends them directly to a feedback form
- Explore partnerships with organizations to facilitate access, education, and equipment sharing, additional recreational opportunities and leadership capacity building for underrepresented communities

Social and Cultural

The ability of the public to enjoy green spaces, engage with nature, and have opportunities for recreation and social interaction in nature has impacts to individual's overall health and well-being. Nature and green space that provide opportunities for socialization and trails to connect individuals to community resources help build social capital and social cohesion. Social cohesion, or levels of trust, feelings of belonging, or willingness to participate and help (Chan, To, & Chan, 2006), is an important factor in a person's overall well-being. A lack of social cohesion may be linked to reduced time spent outside, as the public may spend more time indoors, isolated from their community. This social isolation is related to increased risks to health and mental well-being, both for the socialization benefits, the benefits of being outdoors and the opportunity for exercise (Cloete, 2014). In order for communities to have social cohesion, they must create social capital, by building networks and relationships between people and places (Cloete, 2014). Green space, nature, and park amenities can also provide opportunities for spiritual reflection and cultural resources important to individuals in the community and the history of the area.

Existing Conditions

Use of the Area as Green space

The citizens of Duluth find green space to be very valuable and consider engagement with nature to be a defining characteristic of Duluth (Kreag, 2002). Duluth has approximately three times more green space than other cities of similar size (Kreag, 2002). This means that Duluth residents already have multiple green space options to choose from. When citizens were asked about the amount of green space in Duluth, most residents felt there were already enough parks in the city (Kreag, 2002). The Minnesota Sea Grant found in a survey of eastern, central and western Duluth, that the majority of residents feel green space provides recreational opportunities and connects the community to nature (Kreag, 2002). There are different types of amenities and features that promote public usage. Walkways, beach and shoreline views, and fishing and boating access are three types of features and amenities that attract Duluth residents (Kreag, 2002).

Additionally, when citizens were asked to prioritize government functions, police protection and public safety were among the highest priorities to Duluth residents (Kreag, 2002). To ensure that residents use and benefit from Kingsbury Bay and Grassy Point, a sense of safety needs to be created in these parks.

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The abbreviated timeline and resources available for this HIA limited the opportunity to conduct interviews and other forms of stakeholder engagement that might have provided a more complete picture of the value of these green spaces to the residents of Duluth. However, during the community engagement meetings for the HIA, the public described their perception of the parks and their uses. Residents described the neglect and poorly maintained nature of the sites, but also discussed the beauty of these parks and what activities draw them to use the parks. The Western Waterfront Trail attracts hikers, walkers, and bikers, and Kingsbury Bay serves as a birding area with blue herons and other wading birds, spring warblers, and other birds. Grassy Point and Kingsbury Bay were both referred to as beautiful and were considered important access points to the river and

nature. These parks are also used for kayaking, recreational and subsistence fishing, canoeing, snowmobiling,camping, and exercise.

Use of the Area for Civic Engagement, Social Cohesion, and Social Capital

The parks in the HIA study area serve as a focal point for social relations and opportunities to build social capital. Both Irving Park and Norton Park have community clubs that support the parks (City of Duluth, 2013). The Irving Park Community Club (IPCC) is a neighborhood anchor institution and is a "voice of the Irving Neighborhood in West Duluth" (Irving Community Club, 2017). The IPCC supports organizations in West Duluth, like Valley Youth Centers and the Lake Superior Zoo (City of Duluth, 2016a). Valley Youth Centers in West Duluth provides youth programming and a "positive, safe, stable, and trusting environment where kids can grow" (Valley Youth Centersof Duluth, 2017). There are numerous sports-oriented community groups as well (City of Duluth, 2016a).

On the other side of Grand Avenue, Norton Park Community Club (NPCC) focuses its attention on the Norton Park neighborhood. The recent activities of the club include a garage sale to support the upgrades necessary tomake the community center ADA accessible (Norton Park Community Club, 2017). This type of community support is important because the City of Duluth has asked that community organizations "co-create and co- manage outdoor recreation experiences in the neighborhood parks" in the corridor (City of Duluth, 2017). Co- creation and co-management require that community groups contribute to the project funding at a 9:1 (city: community group) ratio.

Chambers Grove Park located upriver and outside the study area contributes to social cohesion through restored river habitat and public river access facilities created as a result of habitat restoration and park improvement efforts. In 2012, MNDNR provided a $1 million grant to restore the Chambers Grove Park after itwas damaged by a June 2012 flood. In fall 2015, the shoreline of the St. Louis River at Chambers Grove Park was reinforced with rock weirs, and public river access points were created. The habitat improvements also include spawning habitat for lake sturgeon and other fish (Myers, 2015). Restoration of the park itself began after the habitat restoration project was completed, and included the addition of an ADA-compliant restroom and playground, improved parking, improved road access and park infrastructure, an access and wet meadow nature area (City of Duluth, 2016a). In fall 2017, the Minnesota Land Trust hosted a fishing tournament at the park to celebrate the restored fish habitat and improvements in fish population (StarTribune, 2017).

Use of the Area as Spiritual and Cultural Experience

The Kingsbury Bay and Grassy Point natural areas have traditionally provided space for spiritual reflection and other tribal uses for the Native American communities in the area (Restoration Plan and Environmental Assessment Saint Louis River Interlake/Duluth Tar Site, draft, 2017). Subsistence fishing (i.e., fishing by individuals who derive a significant part of their diet from fish)is an inter-generational cultural and spiritual experience that takes place, often by minorities. The Anishinaabe People

Figure 24. The thunderbird is a symbol of the Anishinaabe people.

(Figure 24) are the indigenous people that are most likely to use and access the sites. The Anishinaabe People have a protected legal right to fish as a result of the Treaty of 1854 (1854 Treaty, Fond du Lac Band of Lake Superior Chippewa, MNDNR, MPCA, NOAA, FWS, BIA, WDNR, 2017), and the St. Louis River is a popular place for fishing. In addition to fishing, the tribes also have a legal right to hunt and gather natural resources in this area. These material uses, in addition tothe spiritual uses, are impacted by "mercury in fish, PCBs in fish, E. coli, and chloride" (Restoration Plan and Environmental Assessment Saint Louis River Interlake/Duluth Tar Site, draft, 2017, p. 38). The Native American community faces disproportionately high rates of poverty and food insecurity (69% of American Indian households surveyed in Duluth reported experiencing poverty), and subsistence fishing and hunting are significant as sources of food for many families (Community Action Duluth, 2017). This means that if the fish are contaminated or are limited in quality or quantity, these populations will face a disproportionate impact on theirdiet and health (Burger, Pflugh, Luring, Von Hagen, & Von Hagen, 1999).

Like Native Americans, African American families in Duluth also reported a high rate of poverty (55%), and bothNative American and African American communities in the area are more likely to lack health insurance (52% reported lacking insurance) (Community Action Duluth, 2017). Poverty contributes to food insecurity, as households living in poverty are often unable to afford healthy food. Duluth has a much higher food insecurity rate (41%) than St. Louis County and Minnesota (12% and 10%, respectively), and this high rate suggests that subsistence activities such as fishing, ricing, and hunting are even more important to these communities (Community Action Duluth, 2017). Access to natural environments and green space contribute to a healthier lifestyle (University of Wisconsin HIA Graduate Class, 2012), and with such high rates of uninsured populations,these communities stand to benefit from greater access to green spaces from a health perspective.

As an ancestral home of the Anishinaabe people, the western end of Duluth contains many culturally-significant sites. Spirit Island, a short distance upstream from Kingsbury Bay and Grassy Point was the sixth and last stopping place on their westward migration. It was the first place where they encountered the prophesized wild rice, or "the food that grows on water." Historically, Native American maple sugar camps and burial grounds were found on Spirit Mountain, which spans much of western Duluth parallel to the St. Louis River and overlooksthe HIA study area. The Anishinaabe feel that important places are alive, that they have "animacy," and "are strong enough to survive time" (Turnstone Historical Research, 2015).

Listed below are several important sites in the HIA study area (Turnstone Historical Research, 2015), in additionto the likely many unnamed sites:

Aaron Crosier Point: *There was once an Indian camp located on what would later become known as Aaron Crosier Point, near the St. Louis River at South 62nd Avenue West. The site served as a stop along an old Indiantrail that was located between Minnesota Point and Duluth's Fond du Lac Neighborhood. The camp was apparently abandoned sometime prior to the mid 1850's, before Crosier owned the property.* (p. 48)

Indian Point Campground (adjacent to Kingsbury Bay): *This site was the home of an early Ojibwe Indian camp.It is located along the St. Louis River at the very end of Pulaski Street in Duluth. The property is*

currently ownedby the City of Duluth and is used as an RV park and campground. (p. 50)

Spirit Mountain: *The large hill that extends for several miles along the far western end of Duluth was called Manitouahgebik (Spirit Mountain) by theOjibwe Indians. They believed that the Great Spirit resided within the forestat the top of Spirit Mountain. The first known recorded reference to the areawas on a map dated 1762. Famous English geographer, Thomas Jefferys, created the map for the use of fur traders who made deals with the local Ojibwe Indians*. (p. 49).

Spirit Mountain is also significant because of the vista it provides of Spirit Islandand Spirit Lake (Figure 25), which are central to the creation story of the OjibweIndians, an Anishinaabe nation (Hollingsworth, 2011).

Figure 25. Spirit Lake.

Participants in the HIA have indicated that the river and the area are still culturally significant. Two comments in particular indicate the continued use of the river by the Ojibwe. One person indicated that he has seen spirit houses (Figure 26) near Indian Point Campground. Spirit houses are small houses placed over a burial site, with an opening facing west so the spirit canstart its journey and where offerings may be left (Kisor, 2009). Another participant mentioned that "it is important to have healthy resources (water,fish, wildlife, and plants) and available access to these resources – necessary for exercise of treaty rights – also recreation." It is important to also identify the "adventure gap" that exists between the white and non-white communities in Duluth. Duluth community members cited this as a barrier to the true enjoyment of these spaces as sites for cultural significance for all members.

Figure 26. Spirit houses placed over burial sites

Founded in 2016, Youth Outdoors-Duluth, in partnership with Neighborhood Youth Services, has been bringing youth from all backgrounds out to the waterways and trails of Duluth to bridge the "adventure gap" in the city (Figure 27) (Kaczke, 2017). Youth Outdoors-Duluth, led by the Duluth Area Family YMCA, was created by the Bridging the Adventure Gap work group, a partnership of the Minnesota Land Trust, Northland Foundation, the City of Duluth, the Duluth school district, and nearly two dozen outdoor groups. Their Youth Adventure Series includes fishing, rock climbing, archery, paddling, and nature backpacking, as well as a gear and curriculum library. Over 1,129 children haveparticipated in their programming since their founding (Youth Outdoors - Duluth, 2016). Local partnerships like this can make the difference in ensuring the sites are used by a diverse and representative number of citizens.

Figure 27. Youth enjoying the outdoors as part of Youth Outdoors-Duluth.

Potential Impacts to Social and Cultural

The potential impacts of the habitat restoration and park improvements work on social and cultural well-being are similar to those assessed in the HIA for a Lower Duwamish Waterway cleanup project in South Seattle, Washington (University of Wisconsin HIA Graduate Class, 2012):

- Providing the opportunity for increased physical activity and therefore reducing stress and increasingmental well-being (Sallis, Millstein, & Carlson, 2011)
- Increasing a sense of community (Sullivan, Kuo, & Depooter, 2004)
- Strengthening neighborhood social ties (Coley, Sullivan, & Kuo, 1997)
- Decreasing crime and fear (Kuo & Sullivan, 2001b)
- Assisting in mental fatigue recovery (Kuo & Sullivan, 2001a)

As noted previously, one of the most effective ways to foster community engagement and social cohesion is by involving the surrounding neighborhoods in the development of green space (Hale, et al., 2011). A participatory process should be undertaken in habitat restoration and park improvements planning to engage the public, increase civic engagement, and promote community ownership of the space (Hale, et al., 2011). Also important to the utility of the green spaces and their contribution to social cohesion is the availability of amenities and features that are culturally appropriate and foster a sense of belonging. Involving the public in planning the future of these sites can create a greater sense of understanding among residents of the collective value placed on these spaces.

Habitat Restoration and Park Improvements

Habitat restoration and park improvements construction may temporarily limit the public's access to natural space for social interaction, spiritual reflection, and cultural uses because the sites will be closed to the public at times. As noted in other pathways, the construction periods will also cause traffic, noise, and air pollution. These factors may further lead to a reduction in the public's access to natural space for social interaction, spiritual reflection, and cultural uses because they would reduce the value of the site for these contemplative activities.

Water Habitat and Vegetation

During the habitat restoration work, the water habitat in the Kingsbury Bay and Grassy Point areas may become turbid, decreasing water clarity. This could have a negative impact on the public's perception of the natural spaces for social interaction, spiritual reflection, and cultural uses. Research has shown that higher rates of water clarity is positively related to public perception of the water body (Dobbie & Green, 2013; Angradi, Ringhold, & Hall, 2018). In the long term, the improved water quality and riparian and upland vegetation will have a positive impact on the public's perception and use of natural space for social interaction, spiritual reflection, and cultural uses (including subsistence food gathering). The HIA Project Team recognizes that the Grassy Point is located in an industrial area, which may affect the area's potential as a quiet space for spiritual reflection and social interaction and the industrial pollution may affect the ecosystem's ability to support cultural natural resources, such as wild rice.

Natural Areas and Green space

The public has a greater appreciation for natural areas where they expect to have nature, and when a place is more green and more natural, their appreciation increases (Nassauer, 2004). Use of natural space for social interaction, spiritual reflection, and cultural practices is related to the perceived naturalness of the site, which is strongly linked to the amount and quality of green space present (Andersson, Tengo, McPhearson, & Kremer, 2015). Use of natural space for social interaction, spiritual reflection, and cultural uses may decrease during construction because the sites will be changed so extremely due to dredging and other construction activities. The public will have limited access to the site and further, the construction will make it seem less natural andwill not provide a tranquil place to reflect.

However, the improvements to the environment through the habitat restoration and park improvements work has the potential to improve the natural environment and result in long-term increases in the amount and quality of green space for social interaction, spiritual reflection, and cultural uses. Green space is shown to reduce stress (Kahn, 1999). The benefits of exposure to natural environments and green space that promote good health, according to Mitchell and Popham (2008) and their analysis of the population of England below retirement age (n=40,813,236), include reduced socio-economic health inequalities.

Beautification and Aesthetics

Public perception of the quality of an environment is a great indicator of their likelihood to use a natural space, regardless of the objective scientific quality. While Kingsbury Bay and Grassy Point are under construction, the reduced environmental quality caused by the construction will cause aesthetics to decrease and this will lead to less enjoyment by the public. Further, this will limit their access to natural space for social interaction, spiritual reflection, and cultural uses, as a less enjoyable environment means a less pleasant experience. Habitat restoration and park improvements will contribute to the beautification and aesthetics of the natural spaces. Combined with maintenance of the restored habitats, the public's access to natural spaces for social interaction, spiritual reflection, and cultural uses will increase.

Cultural Resources

Relying first on the existing ethnographic survey (Turnstone Historical Research, 2015) and working with local experts, like the Indigenous Commission for the City of Duluth, an assessment should be conducted to establish a baseline of the cultural heritage conditions, and should include but not be limited to the cultural significance ofthe parks to Ojibwe residents and other ethnicities in the area, including African Americans, Latinos, Asian and Pacific Islanders, as well as those of Scandinavian and other European descent (Zenith City Press, n.d.).

The tribes are active managers of the aquatic resources in the St. LouisRiver. During habitat restoration and park improvements construction,tribal resource managers will work with other agencies, including the MNDNR, USFWS, and St. Louis River Alliance, to restore wild rice and other aquatic habitat on the river. Wild rice is only one culturally- significant plant of many in the area (although it may not be currently growing in the HIA study area; Figure 28). The restored habitat and water quality will have a positive impact on the ability of medicinal andutilitarian plants to grow, and park improvement will create safer and more official access to the plants. The restored habitat at the sites could support many culturally-significant plants (see the full HIA Report for a list of these culturally-significant plants).

Figure 28. Wild rice harvest.

During park improvements construction, there is also the opportunity to install educational signage highlighting the history and cultural resources present at the sites to create a sense of belonging and inclusion, as well as greater understanding of the significance of the sites.

Park Improvements Operation and Maintenance

Once construction is complete, the natural space will provide an opportunity for the public to engage in all of the activities included in this pathway that contribute to health. While some residents may have limited funding for extracurricular activities (Community Action Duluth, 2017), these natural areas will provide a space where the public can gather to socialize and enjoy the outdoors without additional cost. As a result of the restoration of wild rice and other medicinal plants, some members of the public will be able to enjoy the area as a site for social interaction and recreation, spiritual reflection, and cultural practices. The high value placed on green space by the Duluth community suggests that Kingsbury Bay and Grassy Point will be utilized by citizens after thehabitat restoration and park improvements are complete. To ensure that residents will use Kingsbury Bay and Grassy Point, a sense of safety will need to be created in the parks; the habitat restoration and new park facilities have the potential to help increase the sense of public safety and promote park usage.

Aquatic Habitat/Vegetation and Beautification and Aesthetics

The aquatic habitat and vegetation will be greatly improved as a result of the habitat restoration. The restored environment will promote greater enjoyment of the natural spaces which will contribute to improved health forthe public, as green space is evidenced to promote good health. Habitat restoration and park improvements will create a more pleasant environment, which will promote the public's interest in utilizing the spaces and reaping the public health benefits they provide. The renewed aesthetics of these natural spaces will please those who already use these sites and will also attract new users. Further, as Grassy Point is improved, the public's perception of the park as being dangerous and derelict will change. This requires proper maintenance of the habitat, as the conditions could deteriorate and the aesthetics worsen, reversing the gains made.

Cultural Resources

Public use of the green space for cultural resources will be increased as a result of the restored habitat. Utilizinglocal species, including species that are culturally significant and medicinally used, will increase the cultural benefit of these environments. By preserving, promoting, and respecting the cultural and religious significance of these natural spaces and the species and conditions that support them, the decision-makers can further improve the overall health and well-being of area residents, including indigenous communities in and near Duluth.

Potential Health Impacts Related to Changes in Social and Cultural

Habitat Restoration – Construction and Operation

It is **highly likely** that during construction, the habitat restoration will **detract from health**, as the construction will limit the ability of users to utilize the green space for social interaction, spiritual reflection, or cultural resources. This will negatively impact well-being and overall health and stress as a result of the lack of access. Once the construction is completed, it is **highly likely** that the habitat restoration construction will **benefit health**, as the restored habitat will provide an opportunity for the public to engage in all of the activities included in this pathway that contribute to health. The public will be able to enjoy the area as a site for social interaction, through recreation and social events; for spiritual reflection; and for cultural resources, such as the restoration of wild rice production, and restoration of sustainable populations of medicinal plants. The negative impact during construction will be moderate because the public will be impacted in their ability to use the space. The renewed habitat will have a high impact, once restoration is complete, because the public will be able to use this space that was previously impaired and then under construction. The groups that are most likely to be impacted during construction and operation are birders, people with dogs, and nearby residents. The impact will be minor in that their overall health and well-being will not be severely impacted as a matter of life-threatening. The negative impact on social and cultural use of the habitats will be short-term during construction and the restored habitat's positive health impact will be permanent, as long as the site is maintained. There is strong evidence that providing public access to green space for social interaction, spiritual reflection, and cultural use positively impacts overall health and well-being and stress.

Park Improvements – Construction and Operation

The park improvements construction will **likely detract from health** and well-being and have a negative effect on stress levels, as the construction will limit users' ability to utilize the green space for regular uses, including social interaction (park use), spiritual reflection, or cultural resources (e.g., fishing). This will have a negative impact or increase the amount of stress as a result of the lack of access. Once the construction is complete, it is **highly likely** that the park operations and maintenance will **benefit health** and well-being of the users of Kingsbury Bay and Grassy Point, as the habitat restoration will create more fish habitat and conditions for native and culturally-important plants. Also, the park improvements will enhance the access to green spaces for regular uses, including social interaction, spiritual reflection, or cultural resources (e.g., fishing). The negative impact from construction will be moderate because the

public will be impacted in their ability to use the space. The positive impact from the park improvements will also be moderate because of the diversity of public that will benefit from the restoration and park amenities. The groups that are most likely to be impacted during park improvements construction and operation and maintenance are birders, nearby residents, trail and campground users, as well as anglers. The impact of both will be minor in that the increase in stress will not be life-threatening. Construction will have a short-term impact on the public's access to these parks and therefore their health, but once the park construction is complete, the positive impact on the public's health will be permanent as long as the site is maintained. There is strong evidence that access to green space for social interaction, spiritual reflection, and cultural use lowers stress.

Main Findings and Preliminary Recommendations Related to Social Cultural Aspects

Based on the main Assessment findings of this pathway, these recommendations were developed for promotingthe positive health impacts and/or mitigating the adverse health impacts of the Kingsbury Bay and Grassy Point Habitat Restoration and Park Improvements projects.

Main Finding

Parks are places of social and cultural value and sites for spiritual reflection. Social cohesion, spiritual reflection, and the ability to participate in culturally-significant behavior are all positively correlated with health.

- The planning team should conduct stakeholder meetings to the extent possible to gather information needed to understand the social and cultural significance of these parks to the various populations in the community, including but not limited to a cultural heritage assessment of the sites
- Outreach should be conducted to engage and encourage park use by the African American youth in Duluth, perhaps through the YMCA, the Valley Youth Center, and the Duluth Outdoor Collaborative
- To encourage park use by minority groups, the City of Duluth Parks Department could hire leaders from these underrepresented populations to work in public engagement, outreach, and park operations
- The City should provide a means for assessing park usage and the ends to which the sites are being used (e.g., for social cohesion, spiritual reflection, and access to cultural resources). This could include reaching out to the University of Minnesota-Duluth Environmental and Outdoor Education program or other local organizations to create a service learning or citizen science project that monitors, through a 5-year monitoring and evaluation timeline, the use of the parks for these means or providing signage at the sites that includes a description of how to report usage of the park, including a QR code that sends them directly to a feedback form
- Bag stations for dog poop pick-up should be installed at each park

Main Finding	As part of the St. Louis River, this place has special significance to the Anishinaabe people. These aspects should be considered in the development of the Habitat Restoration and Park Improvements plans.
Main Finding	Spiritual reflection, while significant, may be challenging to address because of the urban nature of the parks, but it should not be minimized or ignored in the development of habitat restoration and park improvements plans.
Main Finding	Public use of the green space for cultural resources will be increased as a result of the restored habitat, including wild rice production and restoration of viable populations of medicinal plants.

- Consult with 1854 Treaty Authority, Duluth Indigenous Commission, and Fond du Lac Band resource managers to identify significant sites for any use and determine the best approach to preserve, enhance or interpret resources
- The planners should strive to create natural spaces for solitary spiritual reflection. Attention should be paid to develop spaces for spiritual reflection that minimize the noise and distraction from the nearby industry and take into account the vistas from the space
- Signage may be considered that demarcate culturally-significant spaces and promote quiet reflection. The Duluth Indigenous Commission, Fond du Lac Band, and 1854 Treaty Authority should be consulted when developing signage to denote spaces that are significant for Native American populations
- The planning team should prioritize the placement of native, medicinal, and culturally-significant plants
- Attention should be paid to promote the presence of wildlife that may be culturally significant and specifically the abundance of fish for subsistence fishing

Conclusions

The proposed habitat restoration and park improvements will have health impacts, both positive and negative. The majority of the negative health impacts potentially associated with the work are expected to be of short duration and include air quality, noise, and traffic impacts from equipment operation, traffic, and transport, as well as reduced access or impaired user experiences at the sites or nearby recreational sites during the construction phases of the project. In the long-term, there is the potential for increased traffic as a result of this work and other park improvements in the area, which could increase exposure to traffic-related accidents and air quality impacts; however, **the habitat restoration and park improvements projects are expected to have a net positive impact on public health and community well-being overall** through improved water quality and aquatic habitat, reductions in crime as a result of the beautification and maintenance of the created green spaces, increased opportunity for recreation and physical activity, and space for engagement with nature, social interaction, spiritual reflection, and access to cultural resources (such as wild rice)**.** Recommendations for enhancing the positive health impacts and reducing the negative health impacts of the Kingsbury Bay-Grassy Point Habitat Restoration Project are provided in the HIA for consideration by decision-makers. Some of the recommendations for the habitat restoration work were already adopted in design, included in theEAW, or adopted in the contract; these are noted in the full HIA Report.

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