Restoration Plan and Environmental Assessment

Saint Louis River Interlake/Duluth Tar Site

FINAL | Signed Version
February 15, 2018

Photo credit: 1854 Treaty Authority.

PREPARED BY:

1854 Treaty Authority
(governed by the Bois Forte and Grand Portage Bands of Lake Superior Chippewa)

Fond du Lac Band of Lake Superior Chippewa

Minnesota Department of Natural Resources

Minnesota Pollution Control Agency

United States Department of Commerce
(represented by the National Oceanic and Atmospheric Administration)

United States Department of the Interior
(represented by the Fish and Wildlife Service and Bureau of Indian Affairs)

Wisconsin Department of Natural Resources

WITH ASSISTANCE FROM:

Industrial Economics,Incorporated

c-s3-17b

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LIST OF EXHIBITS

LIST OF ACRONYMS

AOC	Area of Concern
BUIs	Beneficial Use Impairments
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CM	Centimeters
COCs	Contaminants of Concern
DNA	Deoxyribonucleic Acid
DOI	United States Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
FAC	Fluorescent Aromatic Compound
FDL	Fond du Lac Band of Lake Superior Chippewa
FONSI	Finding of No Significant Impact
FWS	United States Fish and Wildlife Service
GLRI	Great Lakes Restoration Initiative
IJC	International Joint Commission
LOEC	Lowest Observed Effects Concentration
MNDNR	Minnesota Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
NEPA	National Environmental Policy Act
NRDAR	Natural Resource Damage Assessment and Restoration
PAHs	Polycyclic Aromatic Hydrocarbons
PEC	Probable Effects Concentration
PCBs	Polychlorinated Biphenyls
PCDD/F TEQ	Polychlorinated Dibenzodioxin/Dibenzofuran Toxic Equivalent

PPM	Parts per Million
PRPs	Potentially Responsible Parties
RAP	Remedial Action Plan
ROD	Record of Decision
RP/EA	Restoration Plan and Environmental Assessment
RSU	Restoration Site Unit
SLRIDT	St. Louis River/Interlake/Duluth Tar
SQT	Sediment Quality Target
TPAH	Total Polycyclic Aromatic Hydrocarbons
USC	United States Code
VOCs	Volatile Organic Compounds
WDNR	Wisconsin Department of Natural Resources

EXECUTIVE SUMMARY

The purpose of this final Restoration Plan/Environmental Assessment (RP/EA) is to describe how the Trustees for the St. Louis River Interlake/Duluth Tar (SLRIDT) Natural Resource Damage Assessment and Restoration (NRDAR) – the United States Fish and Wildlife Service, the Bureau of Indian Affairs, the National Oceanic and Atmospheric Administration, the Fond du Lac Band of Lake Superior Chippewa, the 1854 Treaty Authority, the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources – will utilize funds obtained through resolution of claims for natural resource damages for the restoration of natural resources and services injured by the release of hazardous substances at the SLRIDT Site. Injuries to natural resources in the 93.6-acre Response Action Area (which is the Assessment Area for the purposes of this NRDAR), including surface water, sediment, aquatic invertebrates, aquatic vegetation, fish, birds, and other wildlife, were caused by exposure of those resources primarily to polycyclic aromatic hydrocarbons (PAHs). These injuries resulted in a loss of the ecological and recreational services that Assessment Area resources would otherwise have provided.

The Trustees recovered approximately $6.5 million in Natural Resource Damages to restore, replace or acquire the equivalent of natural resources injured, destroyed, or lost due to hazardous substances released by the potentially responsible parties (PRPs) for the SLRIDT Site. The Trustees recovered these Natural Resource Damages through a Consent Decree entered by the United States District Court for the District of Minnesota.

Consistent with the United States Department of the Interior NRDAR regulations and the National Environmental Policy Act, the Trustees evaluated a suite of alternatives for conducting the type and scale of restoration sufficient to compensate the public for natural resource injuries and service losses. This restoration would be implemented with the funds from the proposed settlement. Based on selection factors including location, technical feasibility, cost effectiveness, provision of natural resource services similar to those lost due to contamination, and net environmental consequences, the Trustees have identified Alternatives B, D, and E as the selected alternative (Exhibit ES-1). Under the selected alternative, the Trustees will conduct shallow sheltered embayment enhancement/restoration at Kingsbury Bay, which includes recreational access and cultural education opportunities; implement watershed protection at Kingsbury Creek; and restore wild rice in the St. Louis River estuary.

Kingsbury Bay is a 70-acre shallow sheltered embayment adjacent to, but separate from, the SLRIDT Site. It is a focus area for ecological, cultural, and recreational restoration under the Trustees' selected alternative. This area has experienced sedimentation due to erosion problems on Kingsbury Creek, which is adversely impacting the ecological services provided by Kingsbury Bay, eliminating aquatic habitat, and encouraging the growth of monotypic stands of cattail within the bay. Together, the Kingsbury Bay and Kingsbury Creek projects will develop and protect open water habitat; create access and recreational opportunities to the bay; create opportunities for wild rice regeneration; provide cultural education opportunities; and protect the Kingsbury Bay restoration by reducing sediment washing into the bay from Kingsbury Creek. In addition, wild rice restoration with cultural education opportunities will be implemented in areas slated for wild rice restoration under the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary (MNDNR 2014a) (described in more detail in Chapter 5 and Appendix E). Wild rice restoration will be conducted in collaboration with cultural educational opportunities by constructing displays that communicate the importance of wild rice to the health of the St. Louis River estuary as well as to maintaining the cultural traditions of local tribes.

This final RP/EA was available for review and comment for a period of 30 days in accordance with 43 Code of Federal Regulations (C.F.R.) § 11.81(d)(2). The Trustees addressed and responded to public comments as part of this final RP/EA for the project types and two specific restoration projects selected for the SLRIDT NRDAR.

EXHIBIT ES-1 RESTORATION INCLUDED UNDER THE SELECTED ALTERNATIVE

RESTORATION PROJECT	APPROXIMATE COST
Alternative B: Kingsbury Bay	$5,500,000
Alternative D: Kingsbury Creek	$637,500
Alternative E: Wild Rice with Cultural Education Opportunities	$362,000
Total Cost:	**$6.5 million**

CHAPTER 1 | INTRODUCTION

1.1 BACKGROUND

The St. Louis River is located in northeastern Minnesota and drains approximately 3,600 square miles of the state (MPCA and WDNR 1992). Shortly after flowing through Cloquet, Minnesota, the river marks the state boundary with Wisconsin before discharging to Lake Superior between the Twin Ports of Duluth, Minnesota and Superior, Wisconsin. This lower part of the St. Louis River is often referred to as the St. Louis River estuary and is the site of almost a century of industrial activity. At the turn of the last century and through World Wars I and II, industrial slips serving facilities and manufacturing plants were common in this area. A portion of the north bank in this area (230 acres) was designated a Superfund site in 1983 by the United States Environmental Protection Agency (EPA 1990). The Superfund site is composed of the St. Louis River/Interlake/Duluth Tar (SLRIDT) site and the United States Steel Corporation (U.S. Steel) site. This document focuses on the SLRIDT portion of the St. Louis River Superfund site. In addition, the entire river system from Lake Superior to Cloquet (over 30 miles upstream) was designated a Great Lakes Area of Concern (AOC) by the International Joint Commission (IJC) in 1987 (MPCA et al. 2013).

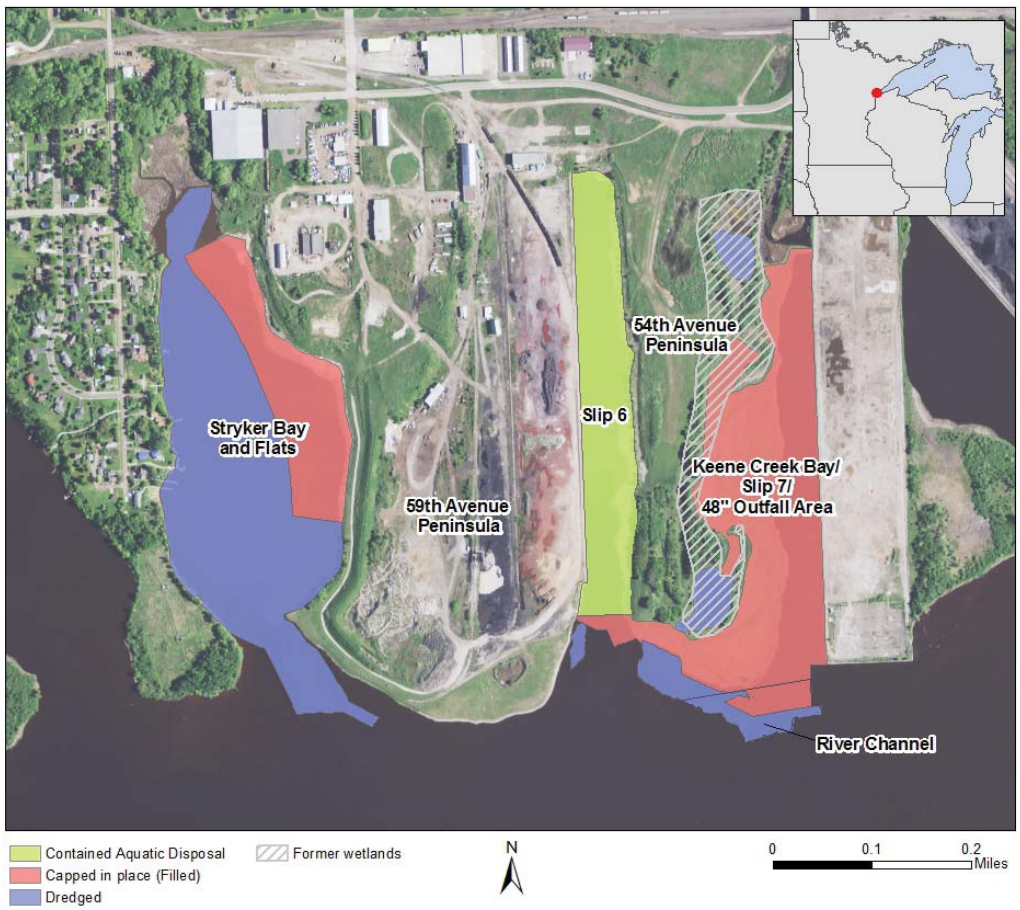
Natural resources (e.g., surface water, sediments, invertebrates, fish, amphibians, reptiles, birds, and mammals) at the SLRIDT site (the Site) have been exposed to and adversely affected by releases of hazardous substances. The primary hazardous substances at the Site are polycyclic aromatic hydrocarbons (PAHs) – a major class of environmental contaminants that are byproducts of the burning of fuel, generation of synthetic fuels from fossil fuels, and wood treatment.

> **Remediation**
>
> *"…those actions [taken]…to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment."*
>
> 42 U.S.C. §9601

Remedial activities related to sediment and surface water resources at the Site took place in a 93.6-acre Response Action Area, referred to in this document as the Assessment Area (Aether DBS 2013). The site and its sub-areas are shown in Exhibit 1-1. The Record of Decision (ROD) issued by the Minnesota Pollution Control Agency (MPCA) to direct Site response actions concluded that discharges from industrial operations at the Site were the source of sediment contamination throughout the Response Action Area (MPCA 2004). As a result, Stryker Bay, Slip 6, and Slip 7 all required remediation nearly shore-to-shore, with the exception of their respective northern ends. As described in greater detail in Chapter 2, these remedial actions, while beneficial, do not themselves restore injured natural resources to their baseline condition or compensate the public for past, present, and future contaminant-related injuries to natural resources.

This document describes how the Trustees will use natural resource damages to restore the natural resources that have been injured (and services that have been lost) due to the release of hazardous substances at the SLRIDT Site. Consistent with existing regulations, this document evaluates a reasonable number of alternative restoration actions, identifies the selected alternative, and informs the public as to the types and scale of restoration projects that are expected to compensate for natural resource injuries. The remainder of this chapter discusses the relevant regulations and authorities under which the Trustees are conducting their Natural Resource Damage Assessment and Restoration (NRDAR) and this corresponding final Restoration Plan and Environmental Assessment (RP/EA), the process and opportunities for public participation, and the administrative record.

EXHIBIT 1-1 MAP OF ASSESSMENT AREA AND RESPONSE ACTIONS



1.2 THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT AND THE DESIGNATION OF NATURAL RESOURCE TRUSTEES FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) (42 United States Code [U.S.C.] § 9601 *et seq.*) establishes a liability regime for the release of hazardous substances that injure natural resources and the ecological and human use services those resources provide. Pursuant to CERCLA, designated federal and state agencies, federally recognized tribes, and foreign governments act as trustees on behalf of the public to assess injuries and plan for restoration to compensate for those injuries. CERCLA further instructs the designated trustees to develop and implement a plan for the restoration, rehabilitation, replacement, or acquisition of the equivalent of the injured natural resources under their trusteeship (hereafter collectively referred to as "restoration"). CERCLA defines "natural resources" to include land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States (including the resources of the fishery conservation zone established by the Magnuson-Stevens Fishery Conservation and Management Act), any state or local government, any foreign government, any tribes, or, if such resources are subject to trust restriction or alienation, any member of an Indian tribe (42 U.S.C. § 9601(16)). Regulations providing guidance to the Trustees on how to implement, in general, the NRDAR processes are contained in Chapter 43 of the Code of Federal Regulations (C.F.R.), Part 11.

Federal agencies are designated as natural resource trustees pursuant to section 107 of CERCLA (42 U.S.C. § 9607(f)(2)(A)), Executive Order 12777, and the National Contingency Plan (40 C.F.R. § 300.600). For the SLRIDT NRDAR, the federal Trustees are:

- The United States Department of the Interior (DOI) (serving as the lead federal trustee), represented by the United States Fish and Wildlife Service [FWS] and Bureau of Indian Affairs; and
- United States Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA).

Indian tribes also act as natural resource trustees pursuant to 42 U.S.C. § 9607(f)(1). For the SLRIDT NRDAR, tribal trustees are:

- The Fond du Lac Band of Lake Superior Chippewa; and
- The 1854 Treaty Authority (governed by the Bois Forte and Grand Portage Bands of Lake Superior Chippewa).

State agencies are designated as natural resource trustees by the governors of each state pursuant to section 107 of CERCLA (42 U.S.C. § 9607(f)(2)(B)). For the SLRIDT NRDAR, state Trustees are:

- The State of Minnesota (acting through the Department of Natural Resources and the MPCA, serving as Trustee Coordinator); and

- The State of Wisconsin (acting through the Department of Natural Resources).

The Trustees for natural resources affected by hazardous substances from the SLRIDT Site entered into a Memorandum of Agreement, forming the St. Louis River Trustee Council (Trustees 2001). The Memorandum of Agreement provides the framework for coordination and cooperation between the Trustees, managing natural resource damage recoveries, and implementing joint damage assessment and restoration actions by the Trustees. Their overarching goals throughout the NRDAR process have been to: (1) assess the natural resource injuries resulting from the release of hazardous substances in the St. Louis River, and (2) develop and implement a restoration plan to compensate for those injuries.

1.3 PURPOSE AND NEED

To meet the purpose of restoring injuries to natural resources and related services caused by hazardous substances at the SLRIDT Site, the Trustees have identified a need to implement restoration activities. The Trustees have selected an alternative described in this final RP/EA that meets the Trustees' purpose and need to implement restoration activities. This final RP/EA describes how the Trustees for the SLRIDT NRDAR will use natural resource damages for the restoration, rehabilitation, replacement, or acquisition of equivalent natural resources and services injured by the release of hazardous substances at the SLRIDT Site. Consistent with United States CERCLA and the National Environmental Policy Act (NEPA) regulations, this final RP/EA includes a reasonable number of alternative restoration actions and identifies a selected alternative, informing the public as to the types and scale of restoration projects that are expected to compensate for injuries to natural resources. In this final RP/EA, the Trustees identify general restoration approaches that could potentially address the injuries at the Site, as well as evaluate specific projects that are consistent with those general restoration approaches. The Trustees considered public comments submitted on the draft RP/EA and have now selected a restoration alternative consistent with the environmental assessment for the proposed restoration project categories. The selected alternative is identified in this final RP/EA.

1.4 THE NATIONAL ENVIRONMENTAL POLICY ACT

Actions undertaken by federal trustees to restore natural resources or services under CERCLA are subject to the NEPA, 42 U.S.C. § 4321, *et seq.*, and the regulations guiding its implementation at 40 C.F.R. Part 1500. NEPA and its implementing regulations set forth a process of environmental impact analysis, documentation, and public review for federal actions, including restoration actions. Specifically, NEPA provides a mandate and a framework for federal agencies to consider all reasonably foreseeable environmental effects of their proposed actions and to inform and involve the public in their decision-making process. DOI and NOAA have prepared this final RP/EA as joint lead agencies for purposes of NEPA compliance, in accordance with 40 C.F.R. § 1501.5.

In general, federal agencies proposing a major federal action must develop an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the human environment. When it is uncertain whether a contemplated action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate whether an action would have significant impacts and therefore necessitate an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the human environment, the federal agencies issue a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required. The FONSI would be attached to the final RP/EA after consideration of public comments. If a FONSI cannot be made, then an EIS is required.

Sora rail over wild rice. Photo credit: © Richard Hamilton Smith.

Additionally, over time, through study and experience, agencies may identify activities that do not need to undergo detailed environmental analysis in an EA or an EIS because the activities do not individually or cumulatively have a significant effect on the human environment. Agencies can define categories of such activities, called categorical exclusions, in their NEPA implementing procedures, as a way to reduce unnecessary paperwork and delay. The consideration of NEPA requirements in the context of the selected restoration alternative for the SLRIDT NRDAR is described in Chapter 6.

1.5 COMPLIANCE WITH OTHER AUTHORITIES

In addition to CERCLA and NEPA, other legal requirements may apply to NRDAR planning or implementation. The Trustees will ensure compliance with authorities applicable to restoration projects. Whether and to what extent an authority applies to a particular project depends on the specific characteristics of a particular project, among other parameters. The subset of authorities listed below is the most relevant for the restoration projects selected for the SLRIDT NRDAR:

- Endangered Species Act (16 U.S.C. §§ 1531 *et seq.*),
- National Historic Preservation Act (16 U.S.C. §§ 470 *et seq.*),
- Coastal Zone Management Act (16 U.S.C. §§ 1451-1464),
- Federal Water Pollution Control Act (Clean Water Act, 33 U.S.C. §§ 1251 *et seq.*),
- Migratory Bird Treaty Act (16 U.S.C. §§ 703-712), and
- Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c).

1.6 PUBLIC PARTICIPATION

Public participation and review is an integral part of the restoration planning process. The Trustees made the draft RP/EA available for review and comment for a period of 30 days in accordance with 43 C.F.R. §§ 11.93(a), 11.81(d)(2). The Trustees have addressed public comments and responded to those comments as part of this final Restoration Plan/Environmental Assessment for the St. Louis River Interlake/Duluth Tar NRDAR.

Comments were submitted in writing to:

> Ronald Wieland
> Division of Ecological and Water Resources
> Department of Natural Resources
> 500 Lafayette Road
> St. Paul, MN 55155-4025

Alternatively, electronic or e-mail comments were sent to environmentalrev.dnr@state.mn.us with "SLRIDT RP/EA" in the subject line. Written comments could have also been sent by fax to (651) 296-1811.

A copy of this document is available for review online at the following website: https://www.pca.state.mn.us/waste/st-louis-river-interlakeduluth-tar-site
A hard copy of the draft RP/EA was available from the Trustees by submitting a written request to the following physical address:

> Ronald Wieland
> Division of Ecological and Water Resources
> Department of Natural Resources
> 500 Lafayette Road
> St. Paul, MN 55155-4025

Electronic or e-mail requests for document copies were sent to environmentalrev.dnr@state.mn.us with "SLRIDT RP/EA" in the subject line.

The Trustees have considered public comments submitted on the draft RP/EA and have selected a restoration alternative consistent with the environmental assessment for the proposed restoration project categories and the specific restoration projects. The selected alternative is identified in this final RP/EA.

1.7 ADMINISTRATIVE RECORD

Pursuant to 43 C.F.R. § 11.91(c), the Trustees maintain a publicly available Administrative Record for the SLRIDT NRDAR, including restoration planning activities. The Administrative Record is maintained by the Minnesota Department of Natural Resources Central Office, and is available at:

> Minnesota Department of Natural Resources Central Office
> 500 Lafayette Road
> St. Paul, MN 55155-4025

and:

> West Duluth Public Library
> 5830 Grand Avenue
> Duluth, Minnesota 55807

Historical air photo of the Site, 1939. Photo credit: MPCA.

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CHAPTER 2 | SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE REMEDY AND NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION

This chapter provides an overview of the Site's history and remediation, discusses the nexus between remediation and the St. Louis River Area of Concern, and describes the goal of NRDAR and the specific actions taken by the Trustees under NRDAR. These actions include a proposed Consent Decree to resolve the Trustees' claim against the potentially responsible parties (PRPs) natural resource damages arising from hazardous substances released to the Assessment Area.

2.1 SUMMARY OF SITE HISTORY AND REMEDIATION

The upland area of the Site is comprised of two peninsulas constructed primarily of fill during the early part of the twentieth century. The 59th Avenue Peninsula (Hallett Peninsula) is the western and larger of the two. Most of the industrial activity at the Site occurred in this area. To the west of the Hallett Peninsula is Stryker Bay, a shallow (4 to 5 feet deep) embayment with a narrow outlet to the main river. The western shore of Stryker Bay is formed by the 63rd Avenue Peninsula; this is also the western Site boundary. To the east of Hallett Peninsula is Slip 6, a former deep water (26 feet) shipping slip previously belonging to the Hallett Dock Company connected to the main shipping channel of the St. Louis River. Slip 6 is defined to the east by the 54th Avenue Peninsula, a partially wooded and unoccupied parcel which also includes the 48" Outfall Area. The third embayment and eastern boundary of the Site is the Slip 7 embayment, which prior to remediation, consisted of a shallow embayment adjacent to another deep water shipping slip. The Burlington Northern & Santa Fe Railway tracks form the northern border of the Site. The Site also extends out into select areas of the St. Louis River channel (including shoal areas extending from the peninsulas and embayments).

The Site has been used for industrial purposes for over a century beginning with the Duluth Iron and Steel Company plant in 1890. This eventually became the Zenith Furnace Company, which later split into the Interlake Iron Company and Duluth Tar and Chemical. Operation of tar and chemical facilities continued until the 1940s, while the iron plant operated until the 1960s. Operations and production included the manufacture of pig iron, coking plants, and tar and chemical companies. The tar and chemical companies used the tar byproducts of the iron companies' coking operations to make other products, including tar paper and shingles.

Coke is a hard, hot-burning fuel produced in a batch process by heating pulverized coal to very high temperatures in the absence of oxygen. This drives off volatile compounds, leaving finished coke. The volatile byproducts are collected for further processing. Some are used to fuel the coke ovens, while others are sold for use as chemical feedstocks. At the Site, the byproduct was condensed into coal tar using ammonia water, which provided the input for the tar and chemical operations. Coal tar and ammonia water were stored in various tanks around the property (IT Corporation 1991). Molten pig iron is produced in a blast furnace by combining coke, iron ore, and limestone in the presence of air and heat. The iron is poured into molds and cooled into ingots, while impurities from the ore combine with the limestone to form slag, which usually requires land disposal (IT Corporation 1991). As is typical, the iron companies at the Site used the coke produced on-Site in their iron-making operations. After the tar and chemical operations ceased in the 1940s, areas of the Site were used by several meat-packing companies. These operations ceased in the 1970s (IT Corporation 1991).

As mentioned above, the primary hazardous substances at the Site are PAHs. In the environment, PAHs are stable and persistent.[1] Some compounds adsorb to particles that settle onto the sediments (Eisler 2000), while others also partition into biological organisms and can accumulate in fatty tissues. The ROD for the Site issued by MPCA in 2004 concluded that wastewater discharge from the water gas, coking, and tar facilities formerly located at the Site were the primary source of contamination in the sediments at the Site (MPCA 2004). Wastes were discharged into the waters at Stryker Bay, Slip 6, and Slip 7 (including the 48" Outfall Area; MPCA 2004). Discharges from the coking and pig iron operations flowed from the outfall pond/ditch of the Keene Creek Bay portion of the Slip 7 area to a southerly ditch and finally to the St. Louis River via a 48" pipe at the southern end of the 54th Avenue Peninsula (the 48" Outfall) (MPCA 2013b). The presence of elevated concentrations of PAHs, volatile organic compounds (VOCs), and cyanide in sediments around the end of the outfall is consistent with past industrial operations (Malcolm Pirnie 1990).

Pre-remedial sediments in Stryker Bay were described as a distinct "butter" or "pudding-like," odorous, black-colored stratum of contaminated sediments. This tar-like material was observed at an approximate depth of 0.5 to 1.5 feet below the surface of the sediments, with a thickness ranging from 0.5 to several feet over nearly the entire embayment. Droplets of oil and tarry material were observed in the sediment matrix below the tarry layer on the east side of the embayment. Chemical analysis of the sediments revealed the presence of PAH compounds, metals, and VOCs (MPCA 2004). Investigations indicated that in several areas on the eastern side of the bay the contaminated sediment layer was up to approximately seven feet thick. In the shallows of Slip 7, a layer of hard slag underlies the soft sediments of a broad, flat, shallow shelf along the western shore of Slip 7 sub-area (IT Corporation 1997). Slag also has the potential to be a source of hazardous substances, including PAHs, metals, and elevated pH levels measured at the Site (SERVICE 1998).

[1] PAHs are typically discussed as Total PAH, which is an aggregate of individual PAH compounds. The number of compounds included in the aggregate is indicated by a number after the abbreviation. For example, this document will reference TPAH13 and TPAH17.

For the purposes of the remedial action, the lateral extent, or “footprint”, of the contaminated sediments that required remediation was defined by a sediment total PAH (TPAH) concentration of 13.7 parts per million (ppm) (MPCA 2004). The distribution of contaminants in surface sediment samples across the Site demonstrates the extent to which pre-remediation samples exceeded the remediation goal.[2] As a result, Stryker Bay, Slip 6, and Slip 7 all required remediation nearly shore-to-shore, with the exception of their respective northern ends. The area requiring capping or dredging is shown in Exhibit 1-1. Even though PAHs are found in the native sediments at low concentrations, a sharp demarcation in concentration exists between the native sediments and overlying industrially influenced sediment (SERVICE 2003a). These determinations and decisions are well-documented with further supporting detail in the Record of Decision (MPCA 2004), the Revised Draft Feasibility Study (SERVICE 2003a), and a community outreach document of the proposed plan for the Sediment Operable Unit, all available from the MPCA website.[3]

Oil bloom on Stryker Bay. Photo credit: MPCA.

In summary, a release of hazardous substances occurred, as demonstrated by evidence of contamination. Releases from Site-related industrial activities impacted all three embayment portions of the St. Louis River channel, the 54th Avenue Peninsula Wetlands, and associated shoal and flats areas. This area, encompassing the Response Action Area outside of riparian buffers, delineates the scope of the Assessment Area.

2.2 SAINT LOUIS RIVER AREA OF CONCERN

The lower 39 miles of the St. Louis River comprise one of 43 contaminated sites designated as an AOC under the United States-Canada Great Lakes Water Quality Agreement.[4] AOCs are severely degraded geographic areas within the Great Lakes region. In 1987, the St. Louis River was designated an AOC due to eutrophication caused by the large amount of suspended solids and nutrients discharged to the river from various industries and communities (MPCA et al. 2013). However, the Stage I Remedial Action Plan (RAP) for the AOC also identified mercury, polychlorinated biphenyls

[2] Sediment sampling results from the Site, along with other St. Louis River regions, are contained in the Phase VII GIS-based Sediment Quality Database for the St. Louis River Area of Concern (“Phase VII database”; Crane 2014). Data for the former 54th Avenue Wetlands can be found in SERVICE 2003b.

[3] These documents are available for download from the MPCA SLRIDT website (http://www.pca.state.mn.us/index.php/waste/waste-and-cleanup/cleanup/remediation-sites/st.-louis-river-interlake/duluth-tar-site.html).

[4] The Great Lakes Water Quality Agreement is a formal international agreement, first signed in 1972 by Prime Minister Pierre Trudeau and President Richard Nixon, and updated in 1978, 1987, and 2012. The Agreement reflects the commitment of Canada and the United States to address a wide range of water quality issues facing the Great Lakes and the international section of the St. Lawrence River.

(PCBs), dioxins, PAHs, and a variety of other metals and organic compounds as river contaminants (MPCA and WDNR 1992). These various types of contamination have contributed to the following nine of 14 beneficial use impairments (BUIs) used by the United States and Canada in determining when to list and delist AOCs:

- Fish consumption advisories
- Degraded fish and wildlife populations
- Fish tumors and other deformities
- Degradation of benthos
- Restrictions on dredging
- Excessive loading of sediment and nutrients
- Beach closings and body contact restrictions
- Degradation of aesthetics
- Loss of fish and wildlife habitat

MPCA, Wisconsin Department of Natural Resources (WDNR), Minnesota Department of Natural Resources (MNDNR), the Fond du Lac Band of Lake Superior Chippewa (FDL), the St. Louis River Alliance, and other partners have been working to remove these BUIs. Once the AOC has addressed all BUIs it will be eligible for delisting.

Actions to address BUIs accelerated after the inception of the Great Lakes Restoration Initiative (GLRI) in 2010, in particular due to a grant awarded to MPCA in 2011. In 2014, *degradation of aesthetics* was the first BUI to be removed (MPCA et al. 2016).

Since 1978, over $420 million has been invested on infrastructure upgrades, remediation, and habitat restoration and protection in the AOC. Examples of these efforts include:

- Protection of Clough Island.
- Sturgeon spawning habitat creation in the St. Louis River followed by observations of young-of-the-year sturgeon.
- Restoration of Tallas Island at the mouth of Knowlton Creek (undertaken as part of the SLRIDT remedial plan, to compensate for loss of open water areas due to the confined aquatic disposal cell within Slip 6).
- Protection of 6,500 square miles of geologically sensitive habitat in the St. Louis/Red River Streambank Protection Area.
- Colonial waterbird habitat creation at Wisconsin Point.
- Protection of more than 1,500 acres in two Wisconsin State Natural Areas within the Pokegama River watershed.
- Hog Island/Newton Creek remediation in Wisconsin.
- SLRIDT remediation in Minnesota.

Although much has been done in the St. Louis River to remove BUIs, more work must still be completed. The 2013 RAP Update (MPCA et al. 2013) presents the actions that must be taken for BUIs to be removed, as well as an anticipated timeline for their removal by 2025. More information about the St. Louis River AOC can be found in the 2013 RAP Update (MPCA et al. 2013) and online at the MPCA St. Louis River AOC website (https://www.pca.state.mn.us/water/st-louis-river-area-concern). The Trustees will ensure that restoration projects considered under this NRDAR are consistent with the broader AOC goals to the extent it is appropriate and possible.

2.3 NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION

The goal of the NRDAR process is to replace, restore, rehabilitate, or acquire the equivalent of (together, "restoration") injured natural resources and resource services lost due to the release of hazardous substances. To determine whether restoration is necessary at the Site, the Trustees completed a number of interim steps outlined in the DOI NRDAR regulations (43 C.F.R. Part 11), described below and outlined in Exhibit 2-1.

2.3.1 NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION ACTIVITIES AT THIS SITE

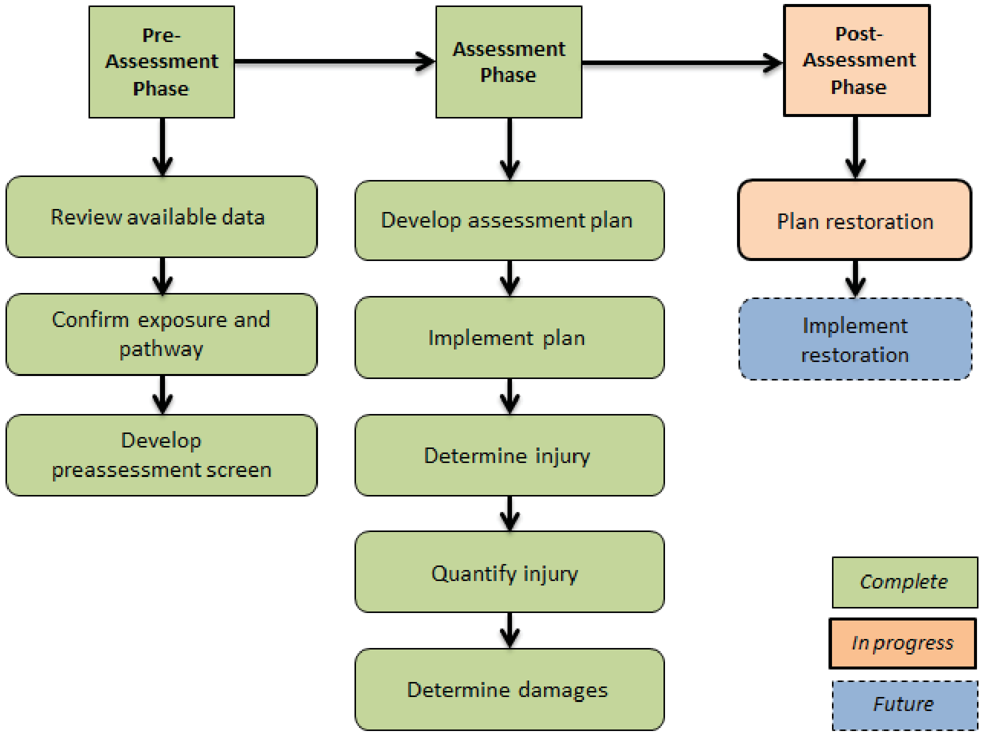
NRDAR activities at the Site commenced in 2001 with a Preassessment Screen Determination (finalized in September of that year). In the Preassessment Screen, the Trustees determined that hazardous substances were released and those releases likely adversely affected natural resources under their trusteeship. They also concluded that data sufficient to pursue an assessment were readily available or could be obtained at a reasonable cost, and that the response actions were unlikely to sufficiently remedy the injury to natural resources without further action (Trustees 2002a). The Trustees relayed these determinations to the potentially responsible parties along with a Notice of Intent to proceed with a NRDAR in December 2001.

Subsequent to the Preassessment Screen Determination was the development of several documents and activities outlined in the steps of the NRDAR process:

- *Natural Resource Damage Assessment Plan, September 2002.*
- *Fish and Avian Exposure and Injury Study Workplans, September 2002.*

The Trustees proceeded with assessment activities to evaluate injuries to natural resources and resource services resulting from the releases of hazardous substances from the Site. These assessment activities provided the Trustees with an understanding of injuries to natural resources and losses in ecological, cultural, and recreational services, as well as the type, scale, and scope of restoration activities necessary to address those injuries. Accordingly, the Trustees propose to resolve natural resource damages liability within the Assessment Area, as described in Section 2.3.3. The Trustees developed this final RP/EA to explain how they plan to use sums collected as natural resource damages for the restoration of natural resources and services at the Site.

EXHIBIT 2-1 PHASES OF THE NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION PROCESS



2.3.2 RELATIONSHIP TO REMEDIAL ACTIVITIES

The distinction between remedial activities and NRDAR is important, particularly since both sets of activities often operate concurrently. Remedial actions, as defined in 42 U.S.C. § 9601(24), are:

> *Those actions consistent with permanent remedy taken instead of or in addition to removal actions in the event of a release or threatened release of a hazardous substance into the environment, to prevent or minimize the release of hazardous substances so that they do not migrate to cause substantial danger to present or future public health or welfare or the environment.*

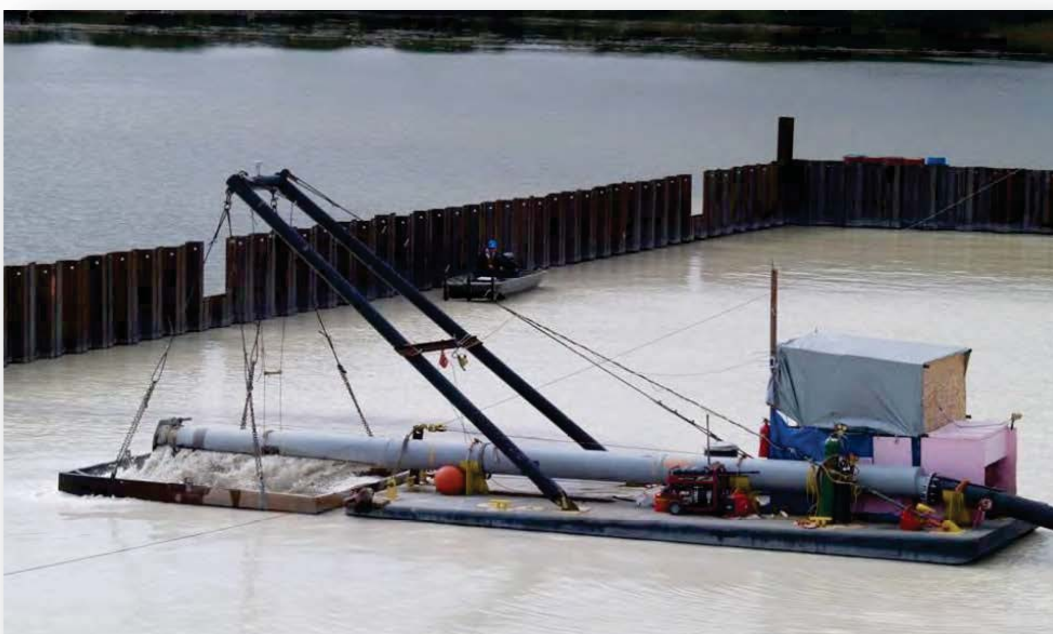
Remedial actions aim to remove and/or reduce the human health and ecological risks associated with hazardous substances at a site to acceptable levels. These efforts are typically funded by the potentially responsible parties, the Superfund program, or a combination of both. Remedial activities range from dredging and capping operations to removal and disposal of contaminated materials in landfills, for example. These efforts often re-expose site resources to the hazardous substances of concern for a short time period or may permanently alter habitat structure. It is an anticipated risk that is tempered by the knowledge that long-term benefits will be obtained through remediation of the hazardous substances.

NRDAR, however, as defined in 43 C.F.R. §11.10:

> *… provides a procedure by which a natural resource trustee can determine compensation for injuries to natural resources that have not been nor are expected to be addressed by response actions …*

NRDAR takes into account the losses that the public has incurred due to the release of hazardous substances as well as additional injuries resulting from remedial activities addressing such releases. The assessment aims to compensate the public for these natural resource losses and lost human use of the site (e.g., foregone or diminished recreational fishing trips and tribal lost use). Damages calculated through the NRDAR process allow trustees to restore injured natural resources and compensate for resource services that have been lost. To the extent possible, NRDAR and remedial activities should be coordinated (43 C.F.R. §11.31(a)(3)).

In addition to NRDAR efforts described in Section 2.3.1, the Trustees were involved with remediation activities from 2001 until 2010. These efforts included remedial action planning, review of remedial alternatives to determine long-term impacts to ecological and recreational services, and oversight of construction activities. The remedy involved dredging and capping large portions of the embayment areas as well as the construction of an on-Site confined aquatic disposal facility. Because injuries due to the remedy are compensable under the DOI NRDAR regulations, the Trustees were able to capture total Site injuries and also understand improvements due to the remedy.



SLRIDT remedial activities in Stryker Bay. Photo credit: MPCA.

2.3.3 NATURAL RESOURCES DAMAGES SETTLEMENT

The Trustees have recovered approximately $6.5 million in Natural Resource Damages to restore, replace or acquire the equivalent of natural resources injured, destroyed, or lost due to hazardous substances released by the potentially responsible parties (PRPs) for the SLRIDT Site. The Trustees recovered these Natural Resource Damages through a Consent Decree entered by the United States District Court for the District of Minnesota. The Trustees believe that the settlement achieves the goals of CERCLA to make the public and the environment whole, is fair and reasonable, and advances the public interest. The public reviewed and commented on the draft RP/EA, as well as participated in the separate commenting process for the Consent Decree. This document serves as the final RP/EA for the SLRIDT NRDAR.

Air photo of Stryker Bay and Kingsbury Bay.

Photo credit: 1854 Treaty Authority.

CHAPTER 3 | AFFECTED ENVIRONMENT

The Trustees assessed the current physical, biological, socio-economic, and cultural resources within the affected area, as described below. This information will assist the Trustees in evaluating and planning future restoration activities and ensure that potential restoration projects are designed to maximize ecological and human use benefits while minimizing or eliminating project-related adverse environmental consequences. The following description of the affected environment also informs the Trustees' NEPA analysis in Chapter 6.

3.1 PHYSICAL ENVIRONMENT

The St. Louis River is the largest United States tributary to Lake Superior, the largest and deepest of the Great Lakes. The St. Louis River drains approximately 3,634 square miles of northeastern Minnesota and northwestern Wisconsin. The lower 21 river miles of the St. Louis River include a 12,000 acre freshwater estuary that supports unique ecosystems as well as the largest harbor and international port on the Great Lakes. The Great Lakes wetland systems are unique globally, and the Lower St. Louis River wetlands are the largest such complex along Lake Superior, representing a significant source of ecological productivity for the entire Lake Superior ecosystem. The estuary and its tributaries are unusual in representing such a variety of habitat types that support a large and diverse assemblage of native fish species. In addition, the extensive baymouth bar shelters the harbor from the high-energy wind and waves of Lake Superior, allowing wetland habitats to develop. This combination of systems, the freshwater estuary and baymouth bar, are virtually absent elsewhere in the interior of North America.

3.2 NATURAL RESOURCES AND BIOLOGICAL ENVIRONMENT

Natural resources recognized under 43 C.F.R. § 11.14(z) within the St. Louis River estuary include, but are not limited to sediment, soil, air, water (surface water and groundwater), aquatic plants, invertebrates, reptiles and amphibians, fish, birds, and mammals. Wildlife and other biological resources utilize a suite of habitats within the watershed ranging from open water to wetlands to upland forests. Some species are of particular concern to the Trustees due to their threatened, endangered, or special concern conservation status, such as the lake sturgeon (*Acipenser fulvescens*) and native mussels, or because they are culturally and/or economically important. For example, wild rice (*Zizania palustris*) is of particular value due to its ecological and cultural importance. Many tribal members in the area harvest manoomin (the Ojibwe word for wild rice), continuing a long held tradition that is connected to their migration story. The varied habitats provide opportunities for recreation, including boating, fishing, and bird watching. This section describes the natural resources within the affected area, focused on the various habitat types and wildlife species present.

3.2.1 HABITAT TYPES

The majority of land cover in the watershed is forest (57 percent), followed by wetlands (23.5 percent), grass (6.7 percent), and others (NRCS 2016). Individual habitat types present within the St. Louis River estuary include aquatic habitats (wetlands, riverine, estuarine flats, upper and lower estuarine river channel, sheltered bays, clay-influenced river mouths, clay-influenced bays, clay-influenced tributaries, bedrock-influenced tributaries), baymouth bar complexes (beaches, beach grass dunes, dune shrublands, interdunal wetlands, dune pine forests), surrounding upland forests (white pine-red pine, northern conifer-hardwoods, northern hardwoods, spruce-fir boreal), swamps (conifer, hardwood, shrub), inland marshes; wet meadows, fens, and cliffs and rock outcrops. These habitat types support numerous bird, fish, and other wildlife species. During spring and fall migrations, enormous aggregations of birds utilize habitat in the Lower St. Louis River for stopover functions such as feeding, resting, and avoidance of unfavorable weather. Sheltered embayment habitat provides critical spawning and/or nursery habitat for many fish species; a high diversity and abundance of macroinvertebrates and fish; refuge for juvenile and forage fish from predation by piscivorous fish; foraging opportunities (phytoplankton, periphyton, epiphyton, snails, other invertebrates) for fish species, and aquatic, semi-aquatic and terrestrial wildlife; and refuge, nesting, and feeding habitat for wading birds, waterfowl, and semi-aquatic birds and mammals. Deep water channel areas within the St. Louis River estuary provide many critical habitat services for fish including a component of daily movement patterns, sanctuary for light-sensitive species, foraging areas, and overwintering habitat.

The biotic and abiotic resources identified above provide numerous ecological and human use services, including, but not limited to:

- Habitat for trust resources, including food, shelter, breeding, foraging areas, rearing areas, and other factors essential for survival;
- Fishing and hunting;
- Non-consumptive uses such as wildlife viewing, photography, and other outdoor recreation activities; and
- Primary and secondary water contact activities such as swimming and boating.

Land conversion, hydrological changes, invasive species, and forest fragmentation have had dramatic negative effects on the plant and wildlife communities throughout the affected area. However, the existing natural areas still host an important selection of rare and unique plant and animal species with specific habitat requirements, as well as those valued by the public for intrinsic or recreational purposes. For example, the Jay Cooke State Park on the St. Louis River (just downstream of Cloquet) contains aquatic communities, in addition to important stands of upland conifer and hardwood forests (SLRCAC 2002). A number of species utilize the park for wintering including white-tailed deer (*Odocoileus virginianus*), black bear (*Ursus americanus*), timber wolf (any of several subspecies of *Canis lupus*), coyote (*Canis latrans*), and 42 other species. One hundred seventy-three species of birds can be found, including the pileated woodpecker (*Dryocopus pileatus*), marsh hawk (*Circus cyaneus*), and the great blue heron (*Ardea herodias*). Sixteen species of reptiles and amphibians also live in the park. Naturalist courses and other recreational activities (e.g., angling, bird watching, and hiking) are available throughout the year.

3.2.2 SEDIMENT INVERTEBRATES

Over 80 genera of benthic invertebrates have been recognized in the Lower St. Louis River and include representatives from the following groups: mayflies (Ephemeroptera), caddisflies (Trichoptera), midges (Chironimidae), isopods (Isopoda), amphipods (Amphipoda), worms (Oligochaeta), and other taxa (SLRCAC 2002 and references therein). Although rare, native mussels are also present in the Lower St. Louis River and are particularly vulnerable to the known stresses in the area (e.g., development, commercial shipping). Native mussels are also a food source for many native fish species, including lake sturgeon. Although not extensively sampled, MNDNR surveys have documented eight native species, all of which were found only in the large riverine reach, the upper estuarine (undredged) river channel, and the lower estuary industrial harbor flats (such as those found in the Site). Species include the giant floater (*Pyganodon grandis*), mucket (*Actinonaias ligamentina*), eastern elliptio (*Elliptio complanata*), creeper (*Strophitus undulatus*), fat mucket (*Lampsilis siliquoidea*), white heelsplitter (*Lasmigona complanata*), creek heelsplitter (*Lasmigona compressa*), and black sandshell (*Ligumia recta*) (SLRCAC 2002 and references therein).[5]

3.2.3 AQUATIC PLANTS

Pondweeds, water lilies, wild celery, bulrushes, cattails, and arrowhead are important groups of plant life for maintaining the quality and composition of habitat in the Lower St. Louis River estuary. These areas of submergent and emergent vegetation provide desirable foraging, breeding, and refuge opportunities to birds, fish, and other wildlife. However, wild rice is of particular value due not only to its ecological importance, but due to its cultural importance as well. The tribal harvest of manoomin not only provides a tangible benefit in terms of food for tribal families, but also supports preservation of cultural heritage as tribal members bond over a shared activity, passing knowledge and skills to younger generations. This wild rice species is not rare, but has experienced long term decline throughout the estuary due to increased turbidity, contaminant exposure, hydrologic modifications (e.g., dredging and dams), and encroachment or attack by other species (e.g., purple loosestrife [*Lythrum salicaria*], carp [*Cyprinus carpio*], Canada geese [*Branta canadensis*]). It grows in sheltered bays and along shallow river flats (1.5 to 3 feet deep) with a silty or mucky substrate (SLRCAC 2002 and references therein). Introduced narrow-leaved cattails (*Typha angustifolia*) also pose a problem for wild rice and the biodiversity of the St. Louis River estuary as a whole (Milburn et al. 2007).

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[5] Plain pocketbook (*Lampsilis cardium*) shells were also found, but no live specimens were located.

Though native in other areas of the United States, narrow-leaved cattails develop monotypic stands in Minnesota that limit other types of wildlife habitat (MNDNR 2014b).

3.2.4 FISH

Approximately 45 native fish species have been documented in the Lower St. Louis River including forage species such as emerald shiner (*Notropis atherinoides*), spottail shiner (*Notropis hudsonius*), and fathead minnow (*Pimephales promelas*) as well as piscivorous species such as yellow perch (*Perca flavescens*), white bass (*Morone chrysops*), muskellunge (*Esox masquinongy*), walleye (*Sander vitreus*), and northern pike (*Esox lucius*) (SLRCAC 2002 and references therein).

The Lower St. Louis River estuary currently supports a high value sport fishery, providing both open water and ice fishing opportunities. Target fish populations include walleye (*Sander vitreus*), northern pike (*Esox lucius*), muskellunge, channel catfish (*Ictalurus punctatus*), smallmouth bass (*Micropterus dolomieu*), and perch (e.g., yellow perch). The MNDNR conducted creel studies within the estuary in 1980, ’81, ’82, ’89, and 2003 (Lindgren 2004). Creel studies are surveys of angler activity. These surveys are used to evaluate the fishing success per unit of effort, average number and size of fish caught and/or consumed, and angler fishing methods and other characteristics. The creel surveys document thousands of angler hours spent fishing in the estuary; however, fish consumption advisories for certain species have been in place since 1979. The advisories are for mercury and PCBs in a variety of species including walleye, smallmouth bass, channel catfish, muskellunge, and northern pike.

Great blue heron. Photo credit: Pixabay.

3.2.5 BIRDS AND OTHER WILDLIFE

The close proximity of diverse habitats – open water, beaches, and a variety of wetland and forest communities – makes the St. Louis River a unique and important area for birds (SLRCAC 2002 and references therein). More than 230 bird species have been documented in the Lower St. Louis River (SLRCAC 2002). Habitat in this area provides important services for both migratory and breeding bird populations. Breeding birds, such as common terns (*Sterna hirundo,* conservation concern [FWS 2017]) and other colonial nesting birds, use sandy areas of the estuary for nesting, while sedge wren (*Cistothorus platensis*), marsh wren (*Cistothorus platensis*), Virginia rail (*Rallus limicola*), golden-winged warbler (*Vermivora chrysoptera,* conservation concern [FWS 2017]), wood thrush (*Hylocichla mustelina*, conservation concern [FWS 2017]), and sora (*Porzana carolina*) nest in the emergent marsh areas and adjacent forest.[6] However, some bird species that once used the estuary for breeding have disappeared over the years (potentially due to recreational activities in the area, as noted in SLRCAC 2002), such as piping plover (*Charadrius melodus*, federally endangered [FWS 2017]), black tern (*Chlidonias niger*, conservation concern [FWS 2017]), American bittern (*Botaurus lentiginosus*, conservation concern [FWS 2017]), and yellow-headed blackbird (*Xanthocephalus xanthocephalus*). Individuals of some of these species are occasionally observed in the area which increases the chances of recolonization under appropriate conditions (e.g., restored suitable habitat). Bald eagles (*Haliaeetus leucocephalus*, conservation concern [FWS 2017]) are also year-round residents in the area and hunt in the estuary. Migratory bird guilds include songbirds, raptors, shorebirds, waterbirds (waders and waterfowl), gulls, and terns (some of which are conservation concerns [FWS 2017]). Federally-listed birds identified in the general vicinity of the Lower St. Louis River include the piping plover (endangered), red knot (*Calidris canutus rufa*, threatened), and Kirtland's warbler (*Setophaga kirtlandii* [= *Dendroica kirtlandii*], endangered) (FWS 2017). The piping plover and red knot both utilize sandy beach areas; Kirtland's warbler utilizes young jack pine stands in pine barrens distant from potential wild rice restoration locations in the estuary. Accordingly, all three listed bird species are unlikely to be in the project area.

Piscivorous mammals, such as river otter (*Lontra canadensis*), reside in the Lower St. Louis River year-round and prey on many of the fish species mentioned above. A variety of terrestrial mammals are also likely use the Lower St. Louis River area for feeding, rearing young, and as a travel corridor. Federally-listed mammals identified in the Lower St. Louis River area include the Canada lynx (*Lynx canadensis,* threatened), gray wolf (*Canis lupus,* threatened in Minnesota]), and the northern long-eared bat (*Myotis septentrionalis,* threatened [FWS 2017]).The gray wolf and Canada lynx require a relatively large extent of northern forest, and are unlikely to be present in the project area. Northern long-eared bats typically roost during summer months underneath bark or in cavities of live trees and snags (standing, dead, or dying trees); in the winter they typically hibernate in caves or mines.

3.3 SOCIO-ECONOMIC RESOURCES

The St. Louis River spans six counties across two states: St. Louis, Lake, Itasca, Aitkin, and Carlton in Minnesota and Douglas County in Wisconsin. The majority of land cover in the watershed is forest (57 percent), followed by wetlands (23.5 percent), grass (6.7 percent), and others (NRCS 2016). This area supports a population of 145,202 people (NRCS 2016). Land use is modestly agricultural, with 550 farms in the watershed. Approximately 62 percent of operations are less than 180 acres, 37 percent are from 180 to 1000 acres, and the remaining farms are over 1000 acres (NRCS 2016). Development pressure is also moderate, with some farms, timberland, resorts, and lakeshore lands parceled for recreation, lake, or country homes.

[6] A bird of conservation concern has the highest priority for conservation (FWS 2017). Complete profiles on each species listed from FWS 2017 can be found at the FWS Environmental Conservation Online System (https://ecos.fws.gov/ecp/).

Within Duluth, Cloquet (Minnesota), and Superior (Wisconsin) (the main population centers in this area), major industries and commercial activity include heavy and light manufacturing plants, food processing plants, woolen mills, lumber and paper mills, cold storage plants, fisheries, grain elevators, and oil refineries. Regionally, Duluth also serves as the center for banking, retail, and medical care for northern Minnesota, northern Michigan, and northwestern Ontario (Canada). In addition, over 2,000 jobs are dependent on the port itself, which is a designated Foreign Trade Zone and is one of the largest grain-handling facilities in the world. As human use of the St. Louis River increases, the impacts to the water body intensify. For example, international shipping brings invasive aquatic and terrestrial species that range from zebra mussels (*Dreissena polymorpha*) to fish parasites and diseases. These invasive species alter ecosystem dynamics, which affect productivity and water quality.

3.4 CULTURAL AND HISTORIC RESOURCES

The Ojibwe people have been living in Minnesota for centuries. Archaeologists have found that ancestors of present day tribal members have resided in the Great Lakes region since at least 800 A.D (Bois Forte 2016, FDL 2016). The main source of information about this time period is through oral tradition, which describes a westward migration of tribal bands from the east coast, through the Great Lakes region, finally settling in Michigan, Wisconsin, and Minnesota (FDL 2016). At the time of first recorded contact with Europeans in 1622, FDL tribal members lived a hunter-gatherer lifestyle that fished in the lakes and rivers during summer and hunted in the forests during winter (FDL 2016). Generally, the seasons dictated their activities and level of socialization, as families were often isolated during the winter, but then came together with others for maple sap gathering in the spring and wild rice collection in the fall (FDL 2016). The sustained contact with French traders fundamentally changed this seasonal lifestyle due to the introduction of new technologies that made a permanently settled lifestyle possible and desirable (FDL 2016).

Despite positive relationships with the French, the Ojibwe people did not have a similar experience with the English. Furthermore, upon the defeat of the English during the American Revolutionary War, the United States opened up its western frontier for settlement. This spurred an influx of settlers who intended to log timber and establish farmsteads (FDL 2016). In an effort to maintain peace, a series of treaties were signed that eroded Native American ownership of ancestral lands. These treaties gave rise to the reservations that exist today, including the Bois Forte Band of Chippewa, Fond du Lac Band of Lake Superior Chippewa, and Grand Portage Band of Lake Superior Chippewa. Under the Treaty of 1854, bands ceded lands in what is now present-day northeastern Minnesota. In exchange, treaty rights to hunt, fish, and gather were retained. The exercise of treaty rights continues today in the 1854 Ceded Territory. In a similar fashion, treaty rights exist under the Treaty of 1842 in present-day northern Wisconsin. These ceded territories encompass the St. Louis River estuary.

In the early years of European contact, the fur trade was the main industry in the area and the St. Louis River came to be recognized as a vital link between the western Mississippi

River waterways and the Great Lakes to the east (SLRCAC 2002). One of the first attempts at agriculture in the region was made by the North West Company (a trading company) who had constructed Fort St. Louis several miles west of the mouth of the Nemadji River. As the fur trade declined in the early 1800s, some companies shifted to commercial fishing operations on Lake Superior; exploiting lake trout (*Salvelinus namaycush*) and whitefish (*Coregonus clupeaformis*) (SLRCAC 2002). By the latter half of the 19th century, the cities of Superior and Duluth were well-established, and shipping and railroad infrastructure had been built to expedite shipment of natural resources extracted from the area (e.g., iron ore, lumber, and grain) (SLRCAC 2002).

Floating wild rice.

Photo credit: 1854 Treaty Authority.

These early industries continued to grow, leading to the establishment of several rock quarries, steel manufacturers, extensive logging and milling operations, and securing the harbor's position as a major shipping point for Midwestern grain (SLRCAC 2002).

The rich natural resource history of this area – from pre-industrial times, through the early settlement period and the present day – helps to provide an understanding not only of the importance of natural resource management, but also how integral the current state of the estuary is to residents' daily life and to the lives of future generations.

3.5 LANDSCAPE-SCALE ECOLOGICAL STRESSORS

Widespread, complex ecological stressors are causing changes to the ecological landscape of the Great Lakes. Some of these stressors, such as fluctuating water levels, invasive species, and non-point source pollution, have become both more prevalent and better understood over the last decade. This section describes Great Lakes water levels, water quality, air quality, and invasive species as each relates to the ecological function of the St. Louis River and estuary.

3.5.1 GREAT LAKES WATER LEVELS

Water levels in the Great Lakes and connected waterbodies are influenced by several factors, including regional precipitation, temperature, and lake-wide evaporation. Lake Superior stores the most water out of all the Great Lakes (2,900 mi^3) with seasonal lake-level changes altering storage by 6 mi^3 on average (Wilcox et al. 2007). Looking forward, long-term models predict that net decreases in Great Lakes water levels will occur, along with increases in extreme weather events such as flooding or drought (Hayhoe et al. 2010, Glick et al. 2011). Broad-scale and/or extreme water level fluctuations will likely affect both biological resources that utilize area habitat, as well as human uses of water resources such as navigation, agriculture, and public enjoyment (Winkler 2014). Long-term changes in Great Lakes water levels will be important to consider when enhancing aquatic and wetland habitat.

3.5.2 WATER QUALITY

Clean water is essential to the proper function of all biological resources, including those that utilize aquatic, riparian, and terrestrial habitats. Water quality is predominantly affected by the way people use the land. For example, conversion of open space to residential and commercial developments can increase the number and magnitude of pollution sources to surface water and groundwater. Agricultural fields and livestock and pasture areas carry substantial loads of nutrients, solids, and bacteria to surface waters (though this is not a major contributor in this watershed). Water quality in the St. Louis River has significantly improved since the promulgation of the Clean Water Act in 1972 and due to advances in wastewater collection and water treatment. However, the Lower St. Louis River has consistently reported impairments due to mercury in fish, PCBs in fish, *Escherichia coli*, chloride, and temperature as well as aquatic life indicators, such as fish and invertebrate assemblages and lack of cold water assemblage (MPCA 2013a). Land uses throughout the St. Louis River watershed that affect water quality include activities such as mining, land development, and livestock grazing (Fletcher and Christin 2015). Soil erosion also continues to be an issue in this watershed due to clearing and grading of shoreline property, for example (NRCS 2016).

Looking forward, without intervention water quality will continue to be an issue. Therefore, the Trustees will encourage restoration techniques that have broad-scale benefits to water quality and runoff retention, such as addressing watershed erosion issues and restoring wetlands.

3.5.3 AIR QUALITY

For the purposes of federal air quality control, the St. Louis River watershed lies within the Duluth (Minnesota)-Superior (Wisconsin) Interstate Air Quality Control Region (FERC 1995). EPA national primary and secondary ambient air quality standards apply in this region and have been incorporated into the Minnesota State Implementation Plan (40 C.F.R. Subpart Y). Throughout previous decades, the overall air quality in the St. Louis River watershed has been very good and has not been associated with any known health-related effects, symptoms, or adverse impacts (FERC 1995). However, localized, ground-level pollution (e.g., due to carbon monoxide, particulates, lead, sulfur dioxide, nitrogen oxides, and volatile organic compounds) does occur in localized areas related to major industrial sources and due to atmospheric dispersion arising from the cities of Duluth and Superior (FERC 1995). Some examples of industrial facilities include petroleum refineries, paper mills, forest products plants, iron mining and taconite production facilities, grain elevators, coal transfer facilities, and regional treatment plants.

In more recent decades and as part of the St. Louis River AOC delisting process, best management practices have been implemented at ore docks and grain elevators to reduce particulates and meet air quality targets (MPCA et al. 2016). Concerns regarding air quality in the AOC are included under BUI 8, Degradation of Aesthetics, which was removed as a BUI for the St. Louis River AOC in 2014 (MPCA et al. 2016). The Trustees will implement best management practices (e.g., limit diesel engine idling) to minimize any emissions from machinery during restoration project implementation.

3.5.4 INVASIVE SPECIES

Aquatic invasive species have been a substantial contributor to dramatic alterations in Lake Superior and its aquatic communities. Non-native species such as common carp, sea lamprey (*Petromyzon marinus*), round goby (*Neogobius melanostomus*), rainbow smelt (*Osmerus mordax*), alewife (*Alosa pseudoharengus*), zebra mussels, and quagga mussels (*Dreissena bugensis*) have negatively impacted native species through direct predation, competition, and/or habitat alteration (MN Sea Grant 2016, SLR Alliance 2016). Zebra mussels, Eurasian watermilfoil (*Myriophyllum spicatum*), and spiny waterfleas (*Bythotrephes longimanus*) are currently found in the St. Louis River (SLR Alliance 2016). Invasive species pose negative impacts to natural resources, fishing, cultural heritage, industries, agribusiness, recreation, and the economy at large (SLC Board 2015). Introduced narrow-leaved cattails also pose a problem to the St. Louis River estuary by limiting biodiversity through the growth of monotypic stands of cattails (MNDNR 2014b; Milburn et al. 2007). The expansion of narrow-leaved cattail can be facilitated by land use changes that increase sedimentation, nutrient loading, duration of floods, and water depth (MNDNR 2014b).

Riparian and wetland areas are the most vulnerable to the impacts of these invasive species. In addition, changing ecological conditions, such as declining lake levels and increasing air temperature, may increase the vulnerability of natural systems to invasive species and favor their continued spread and proliferation (NOAA 2010). In an effort to prevent, control, and minimize impacts of aquatic invasive species, the St. Louis County Board developed an Aquatic Invasive Species Prevention Plan (SLC Board 2015), which draws upon the Minnesota State Management Plan for Invasive Species (MN State 2009). Because the majority of invasive species in the Great Lakes region are introduced through human activities, these plans recognize that the continued spread of invasive species is preventable through partnerships, education, and enforcement (MN State 2009, SLC Board 2015). The Trustees will review restoration options for invasive species management and benefit to native species.

Invasive zebra mussels. Photo credit: 1854 Treaty Authority.

3.6 SUMMARY

The St. Louis River estuary encompasses a suite of habitat types that together support a wide range of plant, fish, and wildlife species. Current land use and socio-economic conditions, combined with recent trends in development and environmental degradation have adversely affected these natural resources. In addition to ecological functions, these natural resources also provide recreational, commercial, and cultural services. The Trustees will take these current resource conditions into account when evaluating and planning future restoration.

As part of the NRDAR process, the SLRIDT Trustees evaluated available information to assess whether injury to natural resources occurred from exposure to hazardous substances released into the SLRIDT Site. This chapter describes the geographic scope within which the Trustees assessed injuries, the contaminants of concern (COCs) upon which this NRDAR is focused, the pathways of those COCs through the environment, the natural resources that have been injured or have the potential to be injured, and the associated losses in ecological and recreational services.

4.1 ASSESSMENT AREA

A key component in the determination of natural resource injuries is the Assessment Area. That is, "the area or areas within which natural resources have been affected directly or indirectly by the discharge of oil or release of a hazardous substance and that serves as the geographic basis for the injury assessment" (43 C.F.R. § 11.14 (c)). The geographic scope of the Assessment Area includes several sub-areas: Stryker Bay and Flats (referred to herein as Stryker Bay); Slip 6; the River Channel; 54th Avenue Peninsula Wetland (former wetlands); and Keene Creek Bay/Slip 7/48" Outfall Area (referred to herein as Slip 7) (Exhibits 1-1 and 4-1). The Trustees divided the Assessment Area into these sub-areas to account for varied historical operations, remedial activities, and differences in expected baseline conditions.

EXHIBIT 4-1 ACREAGE OF ASSESSMENT AREA

SUB-AREAS	ACREAGE
Stryker Bay	40.7
Slip 6	14.5
The River Channel	3.7
Slip 7	27.5
54th Avenue Peninsula Wetlands	7.2
Total Assessment Area:	**93.6**

4.2 PATHWAY

Determination of injury requires documentation that there is a viable pathway for the released hazardous substance(s) from the point of release to a point at which natural resources are exposed to the released substance(s). As described in Section 2.1, site remedial documents describe hazardous substances released from the PRPs during the course of their industrial operations (occurring from the late 1800s until no later than

1961) and subsequently from deposits within the sediment. With regard to PAHs, for example:

- MPCA (2013b) reported that discharges from coking and pig iron operations flowed from an outfall pond, through a ditch, and ultimately to a 48-inch pipe at the southern end of the 54th Avenue Peninsula.
- Industrial wastewater discharges carrying hazardous substances also drained to Keene Creek Bay and Stryker Bay (MPCA 2004).
- Even after industrial operations ceased, the layer of tar acted as a source material for the migration of PAHs to surface water and for direct exposure. In 1981, a local resident reported oil rising to the surface of Stryker bay due to the slow release of coal tar waste (MPCA 2004). These sheens and oil blooms continued to be observed over 20 years later (e.g., MPCA 2003).

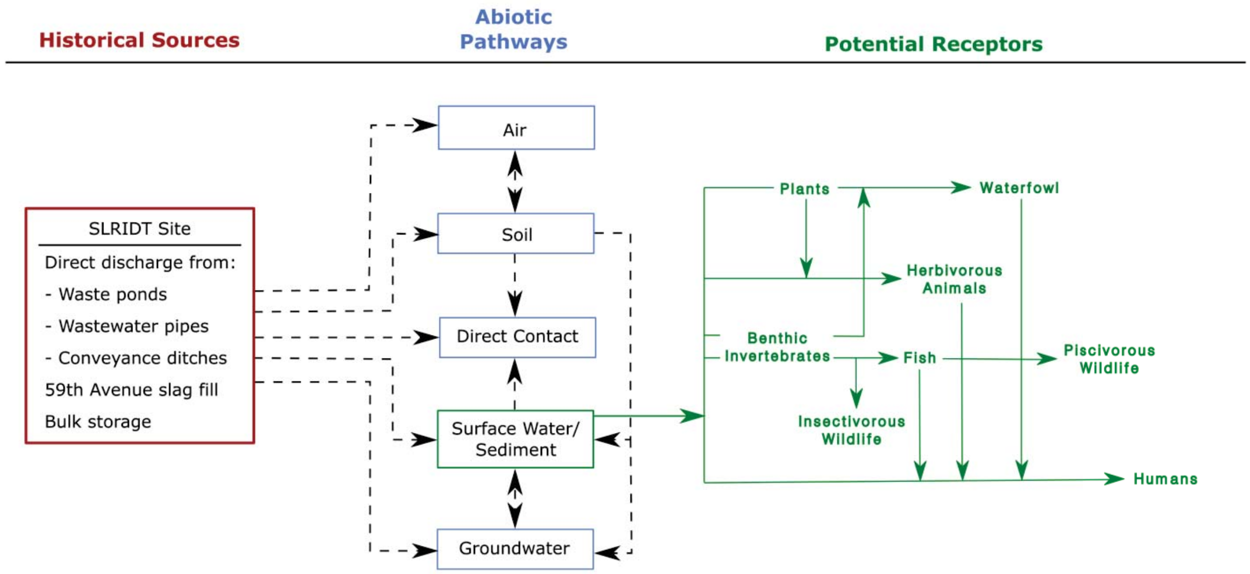
Oil bloom on Stryker Bay. Photo credit: MPCA.

Once released to the environment, hazardous substances can move throughout the environment and accumulate in sediment and biota. Although these contaminants may be absorbed dermally (or via the gills in fish) from direct contact with contaminated water or sediment, they are more likely to be accumulated by organisms through consumption of contaminated water, sediment, or prey. The chemical properties of hazardous substances, and of PAHs in particular, can cause them to bioaccumulate in some exposed organisms. Exhibit 4-2 depicts the exposure pathways of interest for the Site, showing relevant examples of species and contaminant transport pathways.

The Trustees have determined that the following natural resources have been exposed to hazardous substances at the Site:

- Surface water and sediment
- Associated invertebrates
- Aquatic vegetation
- Fish
- Birds and other wildlife

EXHIBIT 4-2 OVERVIEW OF AQUATIC ECOSYSTEM INHABITANTS AND POSSIBLE CONTAMINANT TRANSPORT PATHWAYS



Modified from SERVICE 2003.

4.3 BASELINE

In order to measure injuries, and therefore determine damages and restoration activities, the baseline conditions (i.e., physical, chemical, and biological conditions) of the affected resources and associated services must be established. Baseline is "the condition or conditions that would have existed at the assessment area had the…release of the hazardous substance…not occurred" (43 C.F.R. § 11.14 (e)). For this final RP/EA, the Trustees focused on the impacts that sediment contamination has on flora and fauna through primary and secondary exposure. As such, they established baseline for the Assessment Area using sediment data from relevant reference areas. The Trustees identified Kingsbury Bay[7] and North Bay, upstream embayments of comparable area and volume not exposed to contamination from the Site, as representative of baseline contaminant levels for Stryker Bay and the Keene Creek Bay portion of the Slip 7 sub-area.

Slip 6 and Slip 7 (including the River Channel), however, are industrialized areas that have been subject to authorized physical modifications and related shipping activities. Due to their histories, the ecological and human use services associated with baseline conditions in these industrial sub-areas are expected to be different from other sub-areas of the Assessment Area. As such, they require separate baseline consideration from the

[7] Kingsbury Bay is considered as a baseline for contaminant levels, but is not baseline for ecological services due to ecological disturbances at the site.

less physically modified and industrially zoned sub-areas of the Assessment Area (i.e., Kingsbury Bay and the Keene Creek Bay portion of the Slip 7 sub-area). To calculate baseline for these two physically modified sub-areas, the Trustees used contaminant concentration data measured in sediment samples taken from 16 other industrial slips in the Duluth/Superior harbor that are not being investigated for point-source PAH contamination.

A review of data from the reference areas indicates contaminant levels that are not expected to cause injury to natural resources (i.e., natural resources would not be injured under baseline conditions). Therefore, the Trustees concluded that in the absence of hazardous substance releases from the PRPs at the SLRIDT Site, natural resources in the Assessment Area would not be injured.

4.4 ECOLOGICAL INJURIES AND LOSSES

One method for determining injury to natural resources, as defined in the DOI NRDAR regulations, is to demonstrate adverse changes in an organism's viability (e.g., decreased reproduction) as a result of exposure to the relevant contaminant of concern.

The Trustees identified a set of natural resources within the Assessment Area on which to focus the assessment based on representativeness of the relevant ecosystem, as well as consideration of the extent of exposure and effects information available for those resources. Representative resources include sediment invertebrates, aquatic plants, fish, and birds (Exhibit 4-3).

EXHIBIT 4-3 SUMMARY OF REPRESENTATIVE RESOURCES

REPRESENTATIVE RESOURCE[1]	EXAMPLE SPECIES
Sediment Invertebrates	Caddisflies (order Trichoptera), midges (order Diptera), amphipods (order Amphipoda)
Aquatic Plants	Broadleaf cattail (*Typha latifolia*), red-osier dogwood (*Cornus sericea*), wild celery (*Vallisneria americana*), northern watermilfoil (*Myriophyllum exalbescens*), flat-stemmed pondweed (*Potamogeton zosteriformis*), wild rice
Fish	Black crappie (*Pomoxis nigromaculatus*), golden shiner (*Notemigonus crysoleucas*), yellow perch (*Perca flavescens*), northern pike (*Esox lucius*), white sucker (*Catostomus commersonii*), redhorse species (*Moxostoma* spp.)
Birds	Tree swallows (*Tachycineta bicolor*), mallards (*Anas platyrhynchos*)

[1] Additional resources may also have been exposed through contaminated prey items, but the resources listed here, and representative species or groups within those resource categories, are used to represent the overall effects of Site-related hazardous substances.

> **Injury**
>
> *"…a measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance…"*
>
> 43 C.F.R. §11.14(v)

To determine injury resulting from PAH exposure, the Trustees utilized multiple lines of evidence encompassing a wide variety of exposure and injury data within a holistic, ecosystem-based approach. This included gathering Site-specific information about past, present, and predicted future PAH concentrations for each representative resource within the Assessment Area (accounting for remedial activities). Data from the 1980s are minimal; therefore, it is possible that available data underestimate contaminant levels and corresponding injury for some resources, as concentrations were likely higher in the past. The Trustees utilized sediment data, promulgated criteria, and information from the literature in addition to Site-specific biological studies. Effects that were associated with sediment TPAH17 concentrations below baseline were not included as part of the injury assessment.

To evaluate injury resulting from PAH exposure, the Trustees focused on the exposure of invertebrates, vegetation, fish, and birds and other wildlife to contaminated sediment (described in more detail in Section 4.4.1, below):

- The Trustees evaluated **injury to invertebrates** on the basis of Assessment Area sediment concentrations and injury thresholds identified through the Site-specific toxicity studies.
- The Trustees evaluated **injury to vegetation** on the basis of Assessment Area sediment concentrations and injury thresholds identified in Site-specific toxicity studies.
- The Trustees evaluated **injury to fish** on the basis of literature-based adverse effects in fish correlated to sediment concentrations across the Assessment Area.
- The Trustees evaluated **injury to birds and other wildlife** on the basis of impacts to prey organisms (contained within invertebrate and fish injuries) and trophic transfer of contaminants, calculated based on sediment concentrations and literature-based adverse effects thresholds.

4.4.1 INJURY TO AQUATIC RESOURCES

Surface Water and Sediment

Under the NRDAR regulations (43 C.F.R. §11.62(b)(1)), an injury to surface water resources has resulted from the release of a hazardous substance if one or more of the following changes in the physical or chemical quality of the resource are measured:

- Concentrations and duration of substances in excess of applicable water quality criteria established by section 304(a)(1) of the [Clean Water Act], or by other federal or state laws or regulations that establish such criteria, in surface water that before the discharge or release met the criteria and is a committed use, as that phrase is used in this part, as a habitat for aquatic life, water supply, or recreation.

The most stringent criterion shall apply when surface water is used for more than one of these purposes.

- Concentrations and duration of substances sufficient to have caused injury as defined in paragraphs (c), (d), (e), or (f) of this section to groundwater, air, geologic, or biological resources, when exposed to surface water, suspended sediments, or bed, bank, or shoreline sediments.
- The MPCA has adopted sediment quality targets (SQTs) for the St. Louis River Area of Concern, which can be used as the basis for determining injury under this definition (Crane and Hennes 2007). The Level II SQTs were used previously in the development of the cleanup criterion for the Site and are intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms are likely to be observed. These SQTs are equal to the probable effects concentration (PEC; MacDonald et al. 2000), which represents the threshold at which adverse effects are likely to occur to aquatic life.

The Trustees calculated average PAH concentrations within the sediment, aggregating data as presented in Exhibit 4-4. As the Phase VII database indicates and can be seen in Exhibit 4-4, the SQT for PAHs (23 ppm TPAH, as TPAH13) is exceeded by multiple samples that are separated by a straight-line distance of more than 100 feet. Based on 43 C.F.R. §11.62(b)(1)(i), Minn. R. 7050.0150, and the observed exceedances of protective sediment targets, concentrations of PAHs within sediment at the Site are at levels that constitute injury.

PAH Compounds

Polycyclic aromatic hydrocarbons are a class of more than 100 chemicals composed of multiple aromatic rings (e.g., multiple benzene-like rings). PAH concentrations are calculated by summing a subset of the chemicals within the class. As such, PAH concentrations can be reported in a variety of ways across the literature and promulgated criteria.

This RP/EA reports PAH concentrations using different summations in order to compare available data across sources (e.g., TPAH17, TPAH13). In each case, the number represents the number of chemical compounds included in the sum. TPAH13, a federal and literature-based standard, and TPAH17, a Minnesota standard, both represent largely "parent" PAHs, like naphthalene, which consist of only multiple aromatic rings. Other totals, like TPAH34 and TPAH44, include alkylated PAHs, which have additional carbon groups attached to the parent rings. This final RP/EA uses TPAH13 in comparison to literature-based sediment quality guidelines and TPAH17 for reporting toxicity studies conducted by MPCA.

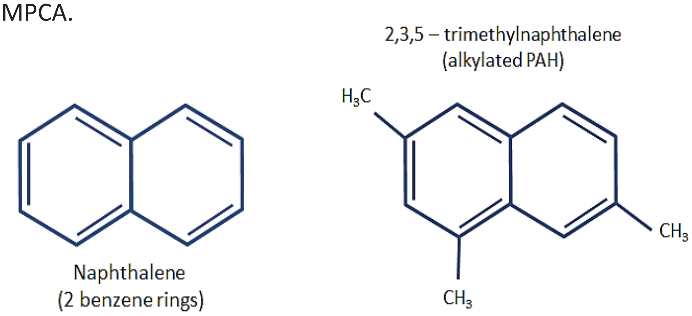
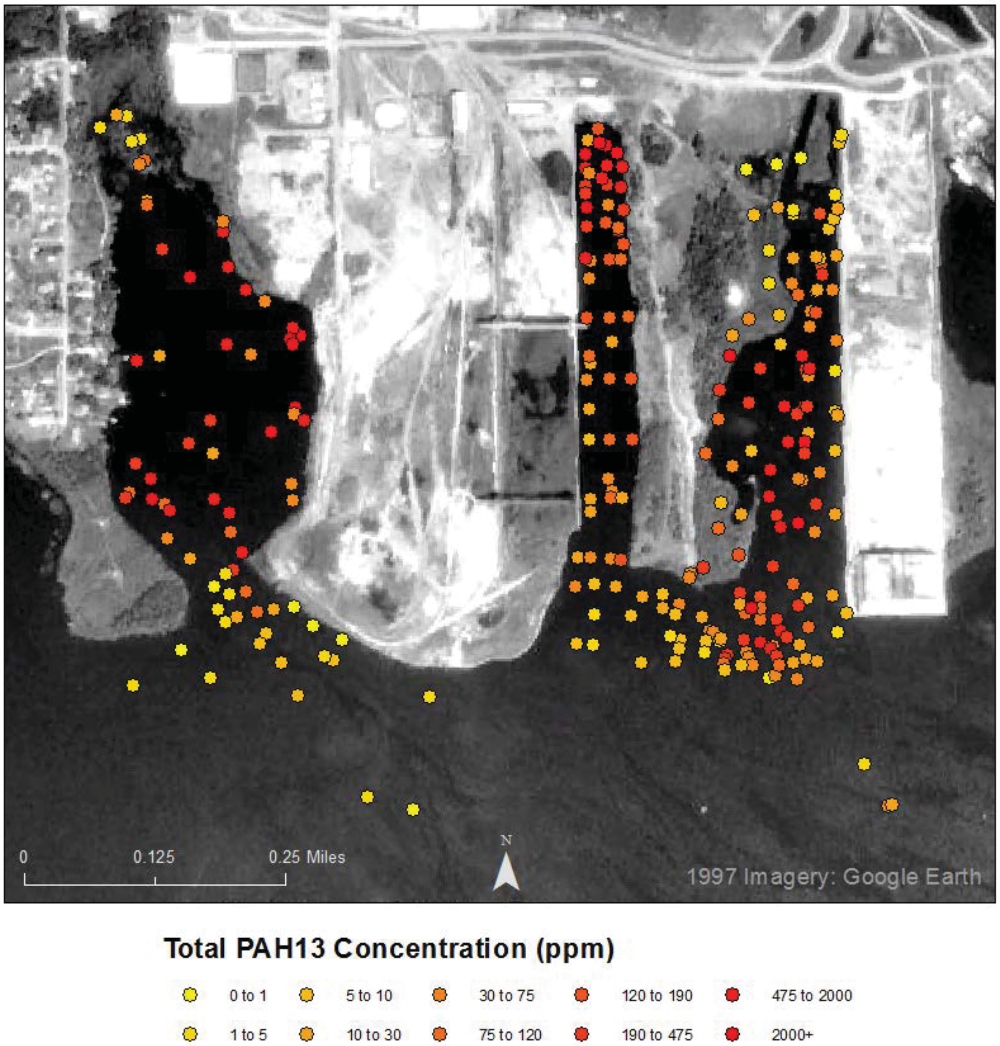


EXHIBIT 4-4 TPAH SEDIMENT CONCENTRATIONS IN HISTORICAL SURFACE SEDIMENT SAMPLES COLLECTED AT THE SITE



Source: TPAH calculation from Phase VII Sediment Quality Database for the St. Louis River Area of Concern (Crane 2014) and SERVICE (2003). A depth limit of 30.48 centimeters (cm) was used for calculating contaminant concentrations (i.e., the sediment "likely exposure zone"). A single concentration value was obtained for each sediment core by weighting the concentration of each core segment based on the proportion of the total core length. If multiple cores were taken at the same coordinates (i.e., the same station), the average of the depth-weighted core values was used.

Biological Resources

Biological resources provide a suite of ecological services (e.g., food web sustainability). Injury to a biological resource has resulted from the release of a hazardous substance if the concentration of the substance is sufficient to:

> Cause the biological resource or its offspring to have undergone at least one of the following adverse changes in viability: death, disease, behavioral abnormalities, cancer, genetic mutations, physiological malfunctions (including malfunctions in reproduction), or physical deformations (43 C.F.R. § 11.62 (f)(1)).

The Trustees determined that releases of hazardous substances caused injury to sediment invertebrates, aquatic plants, fish, and birds and other wildlife. Observed effects that were associated with sediment TPAH17 concentrations below baseline were not included as part of the injury assessment.[8]

Sediment Invertebrates

Site-specific laboratory toxicity tests describe the adverse changes in viability of benthic macroinvertebrates caused by PAHs in Site sediment, as compared to sediment from reference locations. Laboratory bioaccumulation studies on blackworm (*Lumbriculus variegatus*) exposed organisms to sediment from the Site then measured tissue uptake. These studies demonstrated that tissue concentrations for TPAH17 above 1.1 ppm wet weight were correlated with a decline in biomass (i.e., organisms with higher concentrations in their tissue were smaller). Contaminant levels in tissue from field-collected invertebrates exceeded this threshold. At the Site, amphipods from five of eight stations, caddisflies from eight of 10 stations, and midges from eight of eight stations exceeded the Site-specific tissue residue effects threshold of 1.1 ppm wet weight, while those collected from the area used as baseline did not.

Concentrations in sediment also correlated to observable impacts. Laboratory toxicity studies of amphipods and midges observed significantly increased mortality rates when concentrations of TPAH17 in sediment were greater than or equal to 54 ppm. Concentrations at or above 420 ppm resulted in complete or near-complete mortality. Likewise, for blackworms, significant mortality occurred at TPAH17 concentrations of 184 ppm with complete mortality at 209 ppm. The concentrations of PAHs in Site sediments frequently exceeded these adverse effects concentrations.

Further details on the Site-specific studies on invertebrates are found in Appendix 3 of the Record of Decision for the Sediment Operable Unit (MPCA 2004). Key thresholds and effects are summarized in Exhibit 4-5.

[8] The constituents of TPAH17 are described in MPCA 2004 (Appendix 3).

EXHIBIT 4-5 BENTHIC INVERTEBRATE SITE-SPECIFIC TOXICITY TEST RESULTS

SEDIMENT CONCENTRATION (PPM TPAH17)	OBSERVED RESPONSE IN TOXICITY TEST
5.1	Lowest Observed Effects Concentration (LOEC) for reduced biomass (reductions in growth, blackworms).
≥ 14.8	Significantly lower biomass than reference area biomass (with greater than 20 percent difference, blackworms).
≥ 23	Statistically significant reductions in growth (10-day test, midge and amphipod).
33	LOEC for reduced survival, growth or emergence (20-day test, midge).
29-48	Phototoxicity of PAHs observed, resulting in increased mortality (midges and amphipods).
48	LOEC for significant reduction in survival (28-day test, amphipod).
≥ 54	Significantly increased mortality rates (10-day test, midge and amphipod).
184-209	Significant to complete mortality (multiple species).
≥ 420	Complete or near-complete mortality (multiple species).


Invasive cattail at Kingsbury Bay.
Photo credit: MNDNR.

Aquatic Plants

Effects on plants (aquatic macrophytes as well as phytoplankton) from PAHs can consist of impacts to root and shoot growth in vegetation and impairment of photosynthesis in phytoplankton (Marwood et al. 1999, Greenberg 2003). These lead to decreases in germination and survival of exposed plants. The MPCA conducted laboratory toxicity testing, an approved biological response for evaluating death of organisms, on emergent aquatic plants which demonstrated that uptake of PAHs was occurring from the sediment and that this uptake occurred at levels injurious to plant health.

Tests conducted on broadleaf cattail seedlings resulted in germination and survival rates significantly lower in all samples with sediment TPAH17 concentrations of 120 ppm and above. From the Phase VII database, the average sediment TPAH17 concentration in the top meter in Stryker Bay (1,110 ppm) was nine times higher than the 120 ppm shown to be harmful. The maximum sediment concentration in Stryker Bay (34,820 ppm) exceeded the threshold by over two orders of magnitude. This line of evidence shows a statistically significant increase in death (increase in mortality rates) and physiological malfunction (decrease in germination) with exposure to Site sediments and indicates widespread injury to the aquatic plant component of the aquatic ecosystem in accordance with 43 C.F.R. § 11.62(f)(1).

Fish

Exposure of organisms to PAHs can result in adverse biological effects including physiological malfunctions (impaired reproductive success, impaired growth), behavioral abnormalities, cancers, physical deformity (histopathological lesions), genetic mutations, and death. Because statistically significant increases in the adverse biological effects noted above meet the definition of injury under DOI's NRDAR regulations, the Trustees evaluated histological analyses conducted on liver sections from fish collected within Site areas and reference areas to detect the frequency of abnormal tissue changes, such as early toxicopathic lesions, neoplasms, pre-tumors, and tumors. These types of observed tissue changes are consistent with those induced by carcinogenic chemicals. In addition, sediment concentrations are compared to literature-based adverse effects thresholds for fish. Data from these studies are provided in Appendix A.

In summary, preneoplastic foci of cellular alteration are significantly higher in fish collected from Slip 7 and Stryker Bay as compared to reference area samples. Although no hepatic neoplasms were detected in fish collected in 2001 and 2002, an increased prevalence of preneoplastic foci of cellular alteration indicates an increased likelihood of neoplasm development. Based on the statistically significant increase in lesion prevalence in benthic fish from the Site relative to fish from reference areas, the Trustees find that fish in the study area are injured through formation of lesions and cellular alterations induced by PAH exposure, as per 43 C.F.R. §11.62(f)(1).

Furthermore, a substantial body of literature supports the relationship between sediment concentrations of PAHs and various adverse effects in fish, with some cancer and genetic mutation endpoints, but primarily physiological malfunctions. Threshold sediment PAH concentrations derived from several of these studies are listed in Exhibit 4-6. Average concentrations of PAHs in surficial sediment for each sub-area exceed all of the literature-based thresholds by a substantial margin. Site-specific measurements of biomarkers for two adverse effects (deoxyribonucleic acid [DNA] adducts and fluorescent aromatic compounds [FACs]) were also significantly higher in fish collected within the Site than in reference area fish.

EXHIBIT 4-6 SUMMARY OF LITERATURE-DERIVED ADVERSE EFFECTS THRESHOLDS FOR FISH

SEDIMENT CONCENTRATION (PPM TPAH17)	OBSERVED RESPONSE	SOURCE
0.3	Elevated DNA adducts (DNA modification indicative of exposure to complex PAH mixtures; Increase in cancerous lesions)	Johnson et al. 2002; Myers et al. 1998; Myers et al. 2003
<1 ppm	Inhibited spawning and infertile eggs (Reproductive Impacts)	Johnson et al. 2002
1.6 ppm	Decreased growth (Growth and Metabolism)	Moles and Norcross 1998 in Payne et al. 2003
3-4 ppm	Decreased growth (Growth and Metabolism)	Kubin 1997; Rice et al. 2000
5 ppm	Gonadal development inhibition (Reproductive Impacts)	Johnson et al. 2002
5-10 ppm	Suppressed secondary immune response and increased mortality in disease challenge (Immunotoxicity)	Arkoosh et al. 1991, 1994, 2001
12.5-43.5 ppm	Adverse effects (Reproduction)	Lyons et al. 1999
18-1,350 ppm (derived from Site-specific tissue/sediment relationship)	Changes in growth and energy balance (Growth and Metabolism)	Carls et al. 1996 and Meador et al. 2006
39.8 ppm	Reduced hatchability and sperm viability (Reproduction)	Naglar and Cyr 1997
86 ppm (derived from Site-specific tissue/sediment relationship)	Alteration in a variety of biochemical markers and decreased survival in disease challenge (Immunotoxicity)	Bravo et al. 2011
120 ppm	Altered feeding behavior (Growth and Metabolism)	Payne et al. 2003

Birds and Other Wildlife

Although the Site supports various birds and mammals, data on contaminant concentrations in tissue samples from these biota are limited. The Trustees conducted one Site-specific study to evaluate contaminant levels and adverse effects in birds (Appendix B). The results of both the chemical analyses and biomarkers investigations were inconclusive. As with fish, sediment concentrations can also be used to evaluate effects thresholds in birds based on consumption of PAHs.

While the sensitivity of birds to PAHs has been widely reviewed, particularly through oil spill exposure, determination of specific thresholds for PAH concentrations in prey or through water, soil, and sediment exposure is limited (Malcolm and Shore 2003). A soil quality guideline based on estimated consumption rates of PAH-contaminated invertebrates by the American robin (*Turdus migratorius*) and available vertebrate PAH toxicity data identifies a LOEC threshold of 8.8 ppm of naphthalene in soils (CCME 2008). Adverse effects including statistical differences in physiological functions (growth and reproduction) are associated with the LOEC (CCME 2008).

Roughly one-third of the surface sediment samples at the Site exceed the naphthalene threshold for the American robin, while no samples in the areas used to define baseline concentrations do. Elevated levels of naphthalene and PAHs observed in tree swallow diet samples, as well as elevated levels in Site invertebrate tissue, corroborate the injury to insectivorous birds indicated by the significant increase in samples that exceed the LOEC in the Site versus the reference area. In addition to direct exposure to PAHs, the Trustees' injury analysis for bird and mammal species also focuses on the loss of food sources; injury to birds and other wildlife was evaluated as the loss of those food sources. The injuries identified earlier in this section to aquatic plants, aquatic invertebrates, and fish provide evidence that food sources available to predator species resident in the vicinity of the Site have been reduced.

4.5 HUMAN USE OF NATURAL RESOURCES AND SERVICES

Natural resources provide a variety of human uses associated with recreation. Provision of these services is related to, yet distinct from, the provision of ecological (i.e., habitat) services. For example, resources provide habitat services, which allow fish to grow and reproduce, which in turn provide services to humans in the form of recreational fishing opportunities. Impacts to these resources can result in losses of recreational opportunities. Although humans derive a broad range of services from natural resources, two common categories of human losses associated with releases of hazardous substances are recreational use losses and tribal use-related losses.

Recreational use losses may be associated with motorized and non-motorized boating, fishing, swimming, waterfowl hunting, and wildlife viewing (e.g., birding). Preliminary investigation of potential recreational losses by the Trustees has indicated that recreational use service losses have likely occurred as a result of hazardous substance releases to the Assessment Area. Some recreators may forgo visits due to the presence of hazardous substances. Others may proceed with a visit, but the visit may have a diminished value due to the presence of contaminants.

"Tribal lost use" refers to a loss in natural resource services of importance to the governments or members of Indian tribes, for which separate natural resource restoration actions may be needed. Due to the differences in the nature and extent of services tribal members derive from the environment – and differences in the way in which changes in these services affect tribal communities – it is often necessary to describe and evaluate service losses to tribal communities separately from service losses to the general public. For example, tribal members may hold a different value than the general public for certain resources, or their patterns of use may be different. In such cases, specific restoration actions may be required to fully compensate for losses in tribal community services.

4.5.1 RECREATION

Under the CERCLA regulations, changes in recreational quality, public access, or recreation demand attributable to hazardous releases are compensable (43 C.F.R. §11.71(e)). This section discusses the Trustees' evaluation of recreational use losses.

As noted, the Lower St. Louis River estuary currently supports a high value sport fishery. Additionally, the estuary is a regionally important recreational resource, supporting motorized and non-motorized boating, swimming, waterfowl hunting, and wildlife viewing (e.g., birding). While the releases associated with the Site likely adversely affected a variety of recreational opportunities, the Trustees' evaluation of recreational losses focused on recreational fishing within the Assessment Area.

Oil blooms, containment booms on the surface of the water, and odors in the Assessment Area all diminished fishing quality and discouraged angling in what would otherwise be attractive areas. Beginning in 2000, posted signs warned the public of the dangers of boat-based access to the public waters of the Assessment Area (Exhibit 4-7), which further reduced fishing until completion of the remedy.

EXHIBIT 4-7 WARNING SIGN POSTED FOR SITE

4.5.2 TRIBAL USES

The Trustees found that subsistence, cultural, and/or traditional uses of natural resources in the St. Louis River estuary environment have been and are currently impaired by releases from the Site. Collectively, members of three tribal entities are participating in this NRDAR (Bois Forte, Fond du Lac, and Grand Portage Bands of the Lake Superior Chippewa). Article 11 of the September 30, 1854 Treaty with the Lake Superior Chippewa, as reaffirmed in a 1988 United States District Court settlement, retains the tribes' rights to hunt, fish, and otherwise harvest natural resources in the ceded territory.

Natural resources of the St. Louis River have historically played an important role in tribal subsistence and culture. Traditional methods of resource utilization for sustenance, fishing, hunting, and gathering of natural resources remains an important part of tribal culture as well as a source of income, whether real or imputed. Tribal fishing in the estuary has been discouraged by various manifestations of its contaminated state, including exclusion from potential fishing areas, Site-specific warnings, oil blooms, and odors. Site-related hazardous substance releases and other adverse environmental changes may also have precluded or diminished wild rice harvest opportunities within the estuary. Manoomin is typically found in sheltered embayments, such as Stryker Bay and the Keene Creek Bay portion of the Slip 7 sub-area, but is not currently found in these sub-areas.

Lost tribal use of natural resources merits consideration beyond including these uses in other categories such as recreational fishing or habitat services. Absent an appropriate method to value losses associated with compromised tribal uses, the Trustees identify these losses qualitatively for purposes of identifying and scaling suitable restoration activities.

> **Restoration**
>
> *"…actions undertaken to return an injured resource to its baseline condition, as measured in terms of the injured resource's physical, chemical, or biological properties or the services it previously provided…"*
>
> 43 C.F.R. §11.14(ll)

As stated in Chapter 1, to meet the purpose of restoring injuries to natural resources and related services caused by hazardous substances at the SLRIDT Site, the Trustees have identified a need to implement restoration alternatives described in this final RP/EA. This final RP/EA describes how the Trustees for the SLRIDT NRDAR will use natural resource damages for the restoration of natural resources and services injured by the release of hazardous substances at the SLRIDT Site. Consistent with United States CERCLA and NEPA regulations, this final RP/EA includes a reasonable number of alternative restoration actions and identifies a selected alternative, informing the public as to the types and scale of restoration that are expected to compensate for injuries to natural resources.

5.1 RESTORATION OBJECTIVES

As summarized in Chapter 4, the Trustees have determined that injuries have occurred to natural resources that utilize aquatic habitats and provide ecological, cultural, and/or recreational services. The Trustees' overall restoration objective is to compensate the public for these injuries through the implementation of restoration alternatives which provide comparable services in or near the Assessment Area. In order to meet this objective, the Trustees must identify and evaluate restoration alternatives. DOI's NRDAR regulations (43 C.F.R. § 11.82(d)) provide Trustees with specific factors to consider when selecting a preferred alternative, including, but not limited to, technical feasibility, cost effectiveness, and probability of project success. In addition, the Trustees can develop site-specific factors to evaluate and prioritize restoration projects. For this Site, the Trustees have identified the following Site-specific factors:

- **Proximity:** Selected alternative(s) will provide benefits that are linked directly to potentially injured natural resources or related service losses. This includes a focus on projects within the lower St. Louis River estuary (i.e., geographic proximity to potentially injured resources).
- **Design and timing:** Selected alternative(s) have a project design that is sufficiently developed such that implementation can occur in a timely manner.
- **Longevity:** Selected alternative(s) will compensate the public for natural resource damages in perpetuity, or for the foreseeable future.

- **Consistent with local and regional plans:** Selected alternative(s) will be consistent with regional and local visions and plans for habitat conservation and restoration in the St. Louis River estuary.
- **Benefits multiple services:** Selected alternative(s) will provide benefits to multiple natural resources and/or a combination of ecological, cultural, and recreational services.
- **Public enjoyment or use of natural resources**: Selected alternative(s) should enhance use of natural resources by general recreators (e.g., kayakers, bird watchers, walkers, picnickers, etc.) and tribal members.

5.2 SCREENING OF RESTORATION APPROACH ALTERNATIVES

The Trustees considered a broad set of restoration approach alternatives that could potentially improve ecological and human use services relevant to the Assessment Area, and then identified specific projects to evaluate. These alternatives and projects were identified based on the Lower St. Louis River Habitat Plan (SLRCAC 2002), the City of Duluth's St. Louis River Corridor Initiative, and the MNDNR's St. Louis River Restoration Initiative, and Remedial Action Plan updates (MPCA et al. 2013), and are a priority of the St. Louis River GLRI program. These comprehensive plans, created with public and government input, define the work necessary to improve the St. Louis River and all of its uses. The broad categories of proposed restoration alternatives include:

- *Shallow Sheltered Embayment Enhancement/Restoration:* This habitat type is of particular importance to the St. Louis River estuary. Shallow sheltered embayments include the highest quality remaining wetlands in the St. Louis River estuary (SLRCAC 2002). These habitat areas can be classified as pulse-stable wetland communities, where seiches move water and sediment in and out of the bays. This pattern of movement helps to prevent the wetland areas from becoming inundated with sediment or becoming dominated by dense, woody vegetation. These bays have extensive emergent and submergent aquatic vegetation with associated open water areas that are 3 to 5 feet deep. Shrub swamps are also associated with some of these bays, and include stands of willow, alder, or other species. Due to this wide variety of habitat types in close association with one another, shallow sheltered embayments support a high diversity of plant and animals species, ranging from fish and invertebrates to birds and mammals. These embayments provide spawning areas for fish, support benthic invertebrate communities, allow refuge for waterfowl, and provide a suitable habitat for wild rice plants.

  Despite their importance, many shallow sheltered embayments in the St. Louis River estuary have been negatively affected by high sediment deposition rates from poor erosion control practices throughout the watershed, increased presence of invasive species (e.g., narrow-leaved cattail), and legacy waste from past industrial operations (e.g., wood waste).

Invasive vegetation and heavy sedimentation in shallow sheltered embayment habitats also diminishes recreational fishing and boating access throughout the St. Louis River estuary. Shallow sheltered embayment projects directly improve recreational fishing and boating access and may include access improvements to allow for activities such as boat-based fishing, pier fishing, and wildlife viewing in these areas.

Restoration of shallow sheltered embayment areas includes actions that rehabilitate, reestablish, and enhance the areas to increase ecological quality, diversity, and function. This alternative includes protection, enhancement, and/or restoration of shallow sheltered bays through a variety of methods (e.g., dredging excess sediment, removing historic wood milling debris, reducing sediment load, removing invasive species, replanting native vegetation, etc.). The Trustees assert that this approach is more effective and successful than habitat creation where shallow sheltered embayment habitat areas have not previously existed.

SLRCAC 2002 and MPCA et al. 2013 provide a listing of targeted habitat restoration projects in the estuary within this category. Two projects are adjacent to the Assessment Area, directly to the east (Grassy Point) and west (Kingsbury Bay) of the Site. These two projects are included in the detailed alternatives assessment below.

- *Watershed Protection Measures:* As noted above, sedimentation due to poor watershed erosion control measures is a widespread problem in the St. Louis River estuary and adversely affects ecological communities by altering normal flow patterns, allowing the establishment of upland vegetation and invasive species, and contributing to increased flooding. Land protection/management and channel stabilization projects along tributaries to the St. Louis River to slow stormwater movement and prevent erosion would increase water quality in the river by decreasing the upland contaminant and sediment loads delivered to it. Controlling sedimentation would help preserve shallow sheltered embayment habitats throughout the St. Louis River estuary. Additionally, reduced sedimentation will improve the resiliency of a shallow sheltered embayment, because the embayment will maintain deeper water levels that do not support the establishment of aquatic invasive species.

  Within this restoration category, the Trustees would target areas that contribute high sediment loads to the St. Louis River as well as areas upstream of restoration projects in order to ensure their success. This may include improved stormwater management through impervious surface removal, planting native vegetation in areas where it once existed, and installing habitat structures that slow fast moving water (allowing its sediment load to settle out). Specific watershed protection projects may include bank restoration components to stabilize severely eroding slopes. Such actions could involve, but are not limited to, implementing willow bioengineering techniques, shoring banks with biodegradable materials to allow vegetation to establish, planting native vegetation, installing geotextile mats, and/or hydroseeding (NOAA 2015). Installation of habitat structures and woody debris not only creates new, desirable habitat areas, but helps reduce erosion by slowing fast-moving water. Finally, the Trustees would also consider stormwater management strategies such as constructing rain gardens, sediment ponds, wetlands, or replacing man-made impervious surfaces with pervious surfaces.

Watershed erosion. Photo credit: MNDNR.

Recent projects within the estuary include the Knowlton Creek watershed project. While other specific tributary projects are not identified in MPCA et al. 2013, the Trustees have selected a project along Kingsbury Creek as part of the restoration alternatives, which will complement the Kingsbury Bay shallow sheltered embayment restoration alternative.

- *Wild Rice Restoration:* Wild rice has experienced long-term decline throughout the Lower St. Louis River (SLRCAC 2002). The ideal habitat for wild rice is characterized by shallow water (1.5 to 3 feet deep) with a low velocity current over a silty or mucky substrate (Eggers and Reed 1997). Stands of wild rice may help prevent re-suspension of sediment, improve nutrient cycling, and provide habitat and food for fish and birds. One acre of wild rice can produce more than 500 pounds of seed. Wild rice does not grow as a monoculture, but rather is a keystone species supporting a diverse emergent wetland community with a variety of fauna and flora.

  Manoomin is also an important cultural and ecological resource to the St. Louis River estuary. It has been a staple of Native American tribe's diets for centuries and many tribal community members participate in the annual harvest. Not only do humans harvest and consume wild rice, but maturation of the rice coincides with fall bird migration, providing a much needed source of food. In addition, many fish species, such as northern pike (*Esox lucius*), lay eggs on the submergent vegetation and the wild rice community provides refuge for juvenile fish species. However, increased sedimentation and turbidity have contributed to its decline, along with high wave action (wind fetch), hydrologic flow regime modifications (e.g., dams and dredging), contamination, and the presence of undesirable species (e.g., carp, Canada geese) (SLRCAC 2002).

  Wild rice restoration has been recognized as a priority for stakeholders within the estuary for more than 20 years. The MNDNR, WDNR, tribal partners, and non-profits are seeking to restore between 400 and 900 acres of wild rice by 2025. The St. Louis River Estuary Wild Rice Restoration Implementation Plan (MNDNR 2014a) provides a plan and general approach to restoring wild rice throughout the estuary, as well as specific locations where potential for success is high.

Generally, projects under this restoration approach would prepare a site, seed it with wild rice, and limit herbivory, as necessary.

Restoration of wild rice within the St. Louis River estuary (as a financial contribution to the broader implementation of the MNDNR 2014a plan) is selected as a restoration alternative in this final RP/EA. The Kingsbury Bay restoration alternative noted above also includes a wild rice component.

- *Cultural Education Opportunities:* Despite the extensive tribal history associated with the St. Louis River estuary, there is very little existing tribal cultural interpretation locally that can facilitate a greater understanding and awareness in the public, both resident and tourist, about this rich aspect of the region's human experience. Increasing public awareness of the cultural and historical significance of the St. Louis River estuary is important for general education as well as engendering support for the preservation and protection of these areas into the future, which in turn increases accessibility of and services provided from cultural resources such as gathering of wild rice. Accordingly, opportunities to develop displays and other educational materials as part of habitat restoration/enhancement alternatives and/or as stand-alone efforts will be evaluated. Educational signage could describe St. Louis River estuary natural resources and their importance to the surrounding tribes, which serves to deepen the public's knowledge of the St. Louis River and therefore increase their enjoyment of the area and its rich history. Opportunities to implement this approach are identified within two specific alternatives noted above; the Kingsbury Bay shallow sheltered embayment restoration and the St. Louis River Estuary wild rice restoration projects.
- *Riparian Corridor Enhancement/Restoration*: This alternative would improve riparian zones along tributaries to the St. Louis River, and could range from exclusion fencing to natural channel design. This alternative would benefit small mammals, birds, amphibians, reptiles and fish and serve to improve water quality by reducing erosion and runoff. No specific projects proximate to the injury have been identified to implement this approach, so the Trustees do not include it in the alternatives evaluation below.
- *Wetland Acquisition, Enhancement, and/or Restoration*: This alternative focuses on protection, enhancement, and/or restoration of wetlands that have some hydrogeologic or resource connection to the aquatic habitat of the St. Louis estuary. Wetlands provide benefits to a wide array of birds, amphibians, reptiles, mammals and fish and also serve as floodwater retention and groundwater recharge areas. No specific projects proximate to the injury have been identified to implement this approach, so the Trustees do not include it in the alternatives evaluation below.

Sandhill crane. Photo credit: MNDNR.

- *Land Acquisition:* Land in and around the St. Louis River would be purchased and held in perpetuity for the public. Land should provide benefit to natural resources injured from Site releases and reduce habitat fragmentation. Lands targeted for acquisition should be under threat of development, display sensitive or unique attributes, provide habitat for state or federally protected species. Acquisition would likely include parcels proximate to state lands, tribal lands, or other protected lands, and land of interest to environmental and international organizations. Since the 1995 Remedial Action Plan, 34,000 acres of land adjacent to the St. Louis River have already been permanently protected by purchase or donation (MPCA et al. 2013). Additional opportunities are limited near the Assessment Area and this approach does not directly restore resources injured at the site. Therefore, the Trustees do not include projects of this type in the alternatives analysis.
- *Transition to Deepwater Habitat Creation:* Deepwater habitat within the estuary provides important ecological functions to fish by the way of refuge habitat and for predation. This alternative would create deepwater habitat and its associated transition area, ideally within the vicinity of a shallow sheltered embayment to maximize function. This alternative would primarily benefit fish species, which would then cascade to benefitting birds and mammals through prey item consumption. While this habitat type is one of specific concern due to its loss in Slip 6 and Slip 7, no suitable projects specific to this approach have been identified in the estuary. However, the Kingsbury Bay restoration project noted above includes a deepwater component.

Using the results of the restoration approach screening and consistent with the restoration planning guidance in the DOI NRDAR regulations (42 C.F.R. §11.82 (a)) and NEPA (42 U.S.C. 4321 *et seq.*), the Trustees are evaluating five restoration alternatives:

- *Alternative A*: This is a "No Action Alternative," as required by the regulations implementing CERCLA and NEPA.
- *Alternative B*: Kingsbury Bay restoration, a shallow sheltered embayment restoration project located to the west of the Assessment Area. This project also addresses the restoration approaches of wild rice restoration, cultural education opportunities, and transition to deepwater habitat.
- *Alternative C*: Grassy Point restoration, a shallow sheltered embayment restoration project located to the east of the Assessment Area.
- *Alternative D*: Kingsbury Creek watershed protection, a watershed protection project adjacent to the Assessment Area.
- *Alternative E*: Wild Rice restoration through the St. Louis River wild rice restoration plan. This project also addresses the restoration approach of cultural education opportunities.

5.3 ALTERNATIVE A: NO ACTION

Under Alternative A, the "No Action Alternative," the Trustees would not pursue restoration projects beyond the already completed remediation, and any further restoration would instead occur through natural recovery alone. Remedial actions designed to protect human health and the environment from unacceptable risk have been completed as directed by state and federal authorities. These remedial requirements, however, did not immediately return natural resources to baseline ecological conditions (i.e., conditions but for the release of COCs). In fact, the remedial activities, including capping in Stryker Bay and confined aquatic disposal in Slip 6, resulted in long-term loss of portions of certain habitats (shallow sheltered embayment, deepwater), which would not be addressed by this alternative. Though the Trustees expect that the existing resources following remediation are not injured by releases of COCs, these resource services are at a fundamentally lower level than they would have been at baseline due to the loss of certain habitat types during remedy implementation. Thus, the Site will not return to baseline conditions through natural recovery alone.

Similarly, the "No Action Alternative" is not expected to compensate the public for interim ecological and human use service losses (i.e., losses that occurred pre-remedy and extend until COC concentrations return to baseline) due to COCs released into the Assessment Area. Remedial actions, which focus solely on removal or containment of contamination, reduce future injury but do not restore natural resources to their baseline conditions and do not make the public whole.

Lastly, the "No Action Alternative" would not utilize settlement monies for restoration or acquisition of the equivalent of lost resources and resource services, which is the purpose of the NRDAR. Therefore, the "No Action Alternative" serves as a point of comparison to determine the context, duration, and magnitude of any environmental consequences that might result from the implementation of other restoration actions.

5.4 ALTERNATIVE B: KINGSBURY BAY RESTORATION

5.4.1 OVERVIEW OF KINGSBURY BAY

Over the past century, a significant amount of sediment has amassed in Kingsbury Bay from its watershed and as a result, eliminated fish and wildlife habitat as well as allowed for the establishment of monotypic stands of non-native plants (e.g., narrow-leaved cat-tail). Aerial photographs over time show the progressive sedimentation of the upper third of the bay (Exhibit 5-1). The upper third (approximately 11 acres) is now a marsh area with water depths of approximately 1 to 2 feet and a channel depth averaging 3 feet and depths in the more open water areas are limited to approximately 1 to 4 feet (Exhibit 5-2). Recreational fishing opportunities within the bay are limited by the extensive aquatic vegetation growing in the shallow embayment. This area has also become less desireable to gamefish species due to open water conversion to upland, the shallow depth of the remaining open water, and the thick stands of submerged vegetation.

Kingsbury Bay currently contains a mix of ecological services (wetland types and quality). Certain areas of the bay are high functioning while others are too shallow or disconnected to contribute significantly to services expected from a fully-functioning shallow sheltered embayment. The northern portion of the bay is filled with sediment and densely vegetated, allowing minimal transfer of productivity. The more open portions provide reasonable fish habitat, but are shallow enough to limit hydrologic connectivity to and exchange with the river. For restoration, the primary action will be the removal of sediments from the bay and contouring to develop the characteristic shallow sheltered embayment bathymetry.

Restoration of this site for habitat and outdoor recreation, through removal of excess sediment and restoration of former depth and wetlands, is an important goal for the St. Louis River estuary and GLRI program as well as for the City of Duluth. The project is adjacent to the area of injury and will provide comparable habitat services to Stryker Bay, as well as recreational services. Project design and development of appropriate monitoring programs will ensure that the implementation meets the goals of improved habitat structure and improved recreation access (described in Chapter 7).

EXHIBIT 5-1 CURRENT CONDITIONS AT KINGSBURY BAY (FROM APPENDIX C)

EXHIBIT 5-2 PRE- AND POST-PROJECT COMPARISONS

PROPOSED MANAGEMENT UNIT	PRE-PROJECT DEPTH RANGE (FEET)	POST-PROJECT DEPTH RANGE (FEET)	PRE-PROJECT APPROXIMATE ACRES	PRE-PROJECT VEGETATION TYPE
Head	0	1-5	11	Mainly invasive narrow-leaved cattail with some conversion to scrub shrub.
Channel	1-4	1-6	25	Mainly submerged vegetation with floating leaf in SW bay.
Deepwater	1-4	6-10	3	Mainly thick submerged vegetation.
Body	1-4	1-5	25	Mainly thick submerged vegetation.

5.4.2 KINGSBURY BAY PROJECT DESIGN AND CONSTRUCTION

A draft conceptual restoration design for Kingsbury Bay developed by a broad group of stakeholders (led by the City of Duluth) is attached as Appendix C. The habitat areas and descriptions from that plan have been incorporated into the Trustees' current design. Primary restoration goals for Kingsbury Bay are:

- Develop and protect open water habitat;
- Create access and recreational opportunities to the bay;
- Create opportunities for wild rice regeneration;
- Provide cultural education opportunities; and
- Protect what has been restored by reducing sediment washing into the bay from Kingsbury Creek.

Tallas Island winter mechanical excavation.
Photo credit: MPCA.

The Trustees' preliminary estimate of the Kingsbury Bay project area is 64 acres. The Trustees are optimistic that construction could begin during winter 2017/2018 and would last approximately 1 year. The shallow areas within the head of the bay would be increased to at least 3 feet in most places, shallowing towards the shoreline. The open water area would also be deepened, with a maximum depth of approximately 9 feet in the deepwater fishing hole.

Materials removed from Kingsbury Bay as part of the restoration will also have the potential to provide additional ecological benefits within the St. Louis River estuary. The restoration team has reviewed the possibility of transferring hydraulically and mechanically dredged materials from Kingsbury Bay to other local projects that have potentially similar implementation time frames and a need for uncontaminated sediment.

The sediment removal at Kingsbury Bay will consist of both hydraulic and mechanical excavation or dredging, totaling approximately 166,000 cubic yards (Exhibit 5-3).[9] Mechanical excavation of Kingsbury Bay would occur during winter 2017/2018 with approximately 69,000 cubic yards of material available to transport by truck to other projects which require additional materials. Many restoration projects in the St. Louis River estuary include removal of wood waste or other unsuitable environmental materials, and require input of clean sediment or soil. It is expected that this material will be suitable for use in enhancing aquatic, terrestrial, and shoreline habitats. For example, the Grassy Point project described in more detail in Section 5.5 will require this type of

[9] Please note, the preliminary conceptual design in Appendix C identifies 290,000 cubic yards as the approximate volume to be dredged. However, after further investigation and interim design work, the Trustees have determined that 166,000 cubic yards is a more accurate estimate.

material. Hydraulic excavation of Kingsbury Bay would likely occur during summer 2018 and summer 2019 with approximately 98,000 cubic yards of material available for use as clean cover at other restoration projects in the St. Louis River estuary. This finer sediment would be pumped through a floating pipeline extending from Kingsbury Bay along the Minnesota shoreline. Potential projects for its use include the Grassy Point project and potentially a St. Louis River estuary restoration project at 40th Avenue West.

EXHIBIT 5-3 REMOVAL SUMMARY

REMOVAL TYPE	VOLUME (CUBIC YARDS)[1]
Mechanical	68,802
Hydraulic	97,582
Total:	**166,384**

[1] Reported volumes are estimates to be updated by an engineering design.

Wild Rice Restoration

The Wild Rice Restoration Implementation Plan for the St. Louis River Estuary (MNDNR 2014a) included Kingsbury Bay as a viable site for extensive wild rice restoration. The current design limits potential areas of wild rice to approximately 15 acres. Wild rice is both a tribally important resource, as well as a central component of a particularly high-functioning wetland habitat. Wild rice does not grow as a monoculture, but rather is a keystone species supporting a diverse fauna and flora. Emergent wetland habitat areas that are successfully seeded and maintained to include wild rice provide more ecosystem services than fully functioning emergent wetland habitat areas that do not include wild rice.

Wild rice restoration efforts may include invasive vegetation removal, seeding, additional vegetation management, and protection from herbivory by Canada geese and carp (MNDNR 2014a). The Trustees may also re-seed areas on an annual basis because a minimum three-year period is needed to establish the necessary seed bank to provide a long-term seed source (MNDNR 2014a and references therein). Actions to accomplish these objectives may include removing existing vegetation using an airboat equipped with a cutterhead to limit competition between plant species. Thicker stands of vegetation, such as cattail mats, may require the use of a sedge mat cutter. Alternatively, an aquatic plant harvester can cut vegetation at its roots and collects the cut material at the back of the boat. The seeding process can be accomplished by hand from a canoe or boat, distributing the seed into the water. As mentioned above, exclosures may be installed around stands of wild rice, but the Trustees recognize that utilizing exclosures in every wild rice restoration area is not feasible economically, logistically, or from a human use perspective. Instead, the Trustees may consider installing exclosures across the mouth of shallow sheltered embayments in order to protect the greatest number of acres from carp and geese herbivory for the least amount of effort.

Recreational Use Benefits

Approximately 40 percent of the bay is emergent wetland that precludes fishing. The remaining 60 percent of the bay has vegetation and shallow areas that reduce fishing opportunities. The selected restoration for Kingsbury Bay will increase boat-accessible habitat through dredging and invasive vegetation removal, and the construction of a fishing pier will create additional fishing opportunities.

Removal of the delta at the head of the bay will also facilitate development of additional carry-in kayak/canoe access to the River through separate funding means following habitat restoration construction. As the City of Duluth considers plans for the Indian Point Park area, birding and environmental education opportunities may also be subsequently developed along the shorelines of the restored embayment habitat. These improvements, facilitated by the use of NRD settlement funds to restore the habitats within Kingsbury Bay, will provide additional public use opportunities of aquatic resources similar to those impaired by the presence of PAHs at the SLRIDT Site. The current concept design for Kingsbury Bay also includes a “nature experience” trailhead, which has been identified by the City of Duluth as an important contributing feature in their broad revitalization vision for the western Duluth/St. Louis River Corridor. The trailhead is currently envisioned as an offshoot of the Munger Trail, which runs along the Indian Point shoreline, and would be constructed through separate funding means, but would enhance the public experience of the restored bay.

Cultural Education Opportunities

This alternative proposes providing content for an expanded interpretive component at Kingsbury Bay that specifically addresses the significance of cultural relationships to the estuary. The expanded interpretive display would provide a high-visibility setting in which to convey historic and present-day information about tribal presence and traditional lifeways in the St. Louis River estuary. The display would explicitly relate the importance of manoomin (wild rice) to Ojibwe culture and subsistence, and concretely demonstrate the importance of environmental restoration to the modern-day cultural restoration of regional tribal communities. It also represents a prime opportunity to educate the public about the unique historic significance of manoomin in this place, as it relates to the Ojibwe migration story.

Estimated Cost of Alternative

Estimated costs for the Kingsbury Bay project are presented in Exhibit 5-4. Additional components of the project, including design, planning, and permitting, will be undertaken by other entities with funding administered by MNDNR.

EXHIBIT 5-4 PRELIMINARY KINGSBURY BAY COST ESTIMATE

PROJECT COMPONENT	COST
Trustee project management and oversight	$115,000
Construction costs, including sediment management and quality assurance	$5,000,000
Post-construction monitoring and stewardship	$359,000
Total:	**~$5.5 million**

5.5 ALTERNATIVE C: GRASSY POINT RESTORATION

5.5.1 OVERVIEW OF GRASSY POINT

As described in Section 5.2, many ecological, recreational, and cultural benefits may be gained by conducting shallow sheltered embayment restoration projects. As such, the Trustees have identified another likely shallow sheltered embayment project location that is proximate to where injuries occurred.

Grassy Point is just northeast of the Assessment Area, is bounded on the north by the Burlington Northern Santa Fe Railroad line, on the southwest by the C. Reiss coal dock, and on the east by the federal navigation channel. Keene Creek flows into the west end of the bay and is a MNDNR designated trout stream. Grassy Point is similar to Kingsbury Bay in many ways. Both areas are shallow sheltered bays located in the St. Louis River estuary, are located adjacent to the Assessment Area (east and west), and have inputs from Minnesotan creeks (Keene Creek and Kingsbury Creek). However, Grassy Point is much larger than Kingsbury Bay at 180 acres and has significant anthropogenic impacts (LimnoTech 2014). Impacts that have been identified include the following:

- **Habitat alterations**: Dredging for shipping slips, existing marine debris (e.g., wood waste), and shoreline hardening along the railroad right-of-way;
- **Legacy toxins**: Sediment chemistry data indicate that contaminants exceed Level 1 SQTs (80 percent of points) for metals, PCBs, PAHs, and the polychlorinated dibenzodioxin/dibenzofuran toxic equivalent (PCDD/F TEQ).[10] Contaminants also exceed Level 2 SQTs (15 percent of points) for at least one compound, including PAHs, lead, mercury, and the PCDD/F TEQ (LimnoTech 2014);
- **Non-point runoff**: Excessive sediment primarily from the 5,000-acre Keene Creek watershed (LimnoTech 2014); and
- **Hydrologic alteration**: Loss of floodplain/connectivity immediately upstream of Grassy Point because of channel alterations at the mouth of Keene Creek.

[10] Toxic equivalents are used to report toxicity-weighted masses of mixtures.

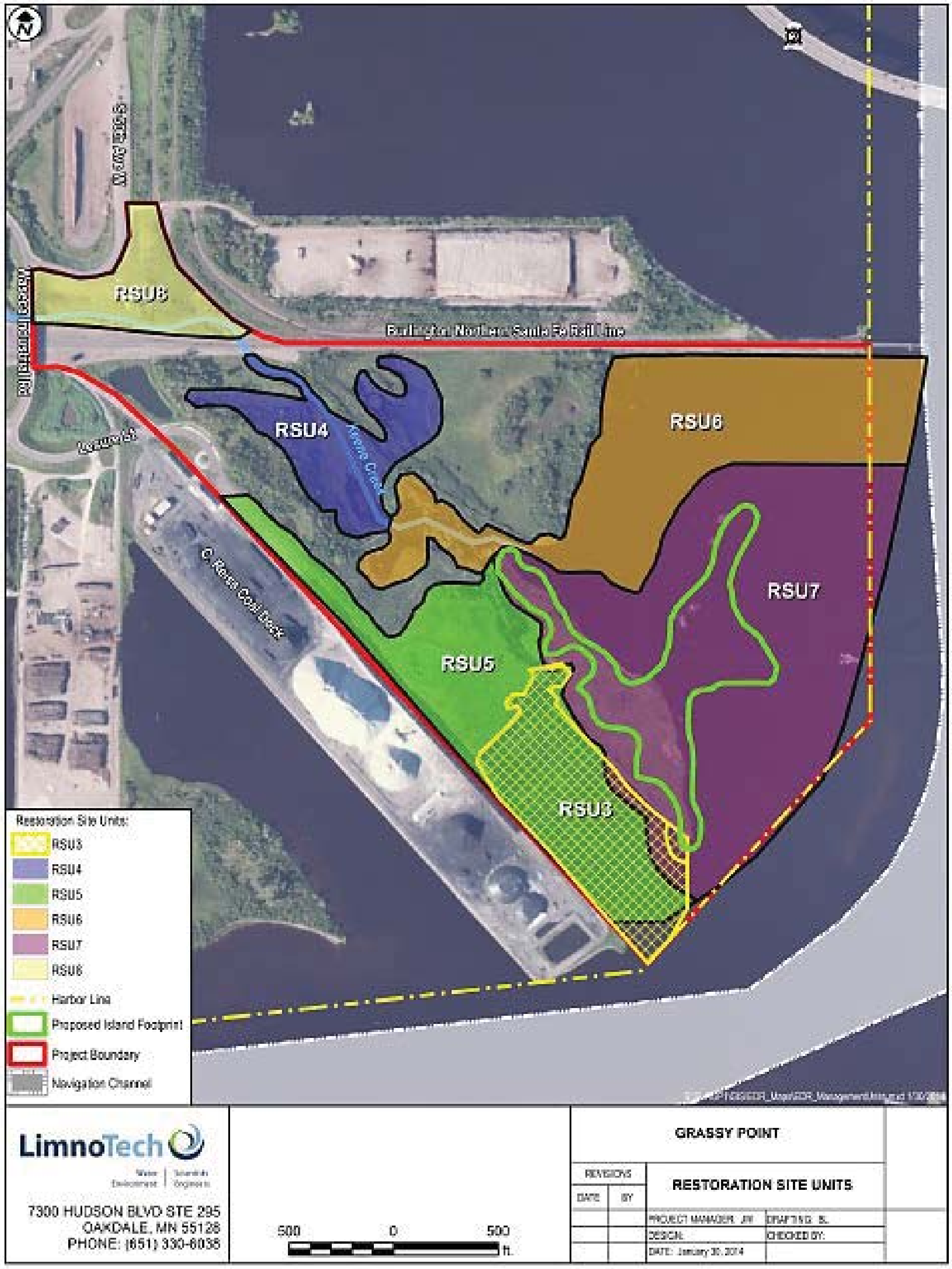
One of the major challenges to restoring Grassy Point is the volume of marine debris. Historic sawmill businesses operated at the site during the late 1800s and early 1900s (LimnoTech 2014). These businesses dumped extensive wood waste at Grassy Point, both in the bay and surrounding lowland areas. Wood waste covers approximately 80 percent of the site and ranges in thickness from 1.5 feet to greater than 16 feet (LimnoTech 2014). This material has a negative impact on the food web and beyond through limiting biological productivity, habitat potential, and recreational use of the historically open bay (LimnoTech 2014).

St. Louis River AOC coordinators developed a Conceptual Design Plan for Grassy Point in 2012 (MPCA et al. 2012). This design was based on consensus from local resource managers regarding the type of project that represents a reasonable effort to rehabilitate fish and wildlife habitat within this area. The design includes components to enhance shallow sheltered bay conditions, restore appropriate shoreline areas, reconnect the hydrologically isolated wetland areas, and conduct tributary channel restoration on Keene Creek. Specific design features include the removal of wood waste to restore fish and aquatic wildlife habitat, reconnection of hydrologically isolated wetlands at the site, and restoration of terrestrial wildlife habitat and enhancement of shallow sheltered embayment conditions by constructing islands (LimnoTech 2014). The project is currently in an active design phase, with adaptations to the conceptual design in progress. These adaptations are anticipated to substantially reduce the overall extent and cost of the project; therefore, cost estimates and site units for Grassy Point depicted in this document should be considered as preliminary.

5.5.2 GRASSY POINT PROJECT DESIGN AND CONSTRUCTION

Given the number and variety of design features, the conceptual design divided the site into nine distinct restoration site units (RSUs) in order to provide flexibility in implementation and funding; divide between types of work and methods; facilitate sequencing; maximize the potential contractor pool; minimize temporary construction impacts; and balance Cut and Fill at the site (Exhibit 5-5) (LimnoTech 2014). Due to the large size and cost of the project in the conceptual design, only three RSUs were considered by the Trustees under this alternative. The appropriate volumes for excavation and removal of sediment within these areas and the baymouth bar (RSU 7) are the focus of the ongoing design process. The key units are RSU 4 - Upper Grassy Point shallow wetland and Keene Creek Channel; RSU 5 - Lower Grassy Point South Wetland and Keene Creek Channel (south branch); and RSU 6 - Lower Grassy Point North Sheltered Bay Enhancement and Keene Creek Channel (north branch). If evaluated favorably, the Trustees may only be able to fund one or two of the RSUs with the available settlement monies, depending on costs associated with the final design of the project.

EXHIBIT 5-5 CONCEPTUAL DESIGN GRASSY POINT RESTORATION SITE UNITS (FIGURE 15 FROM LIMNOTECH 2014)



RSU 4 – Upper Grassy Point Shallow Wetland and Keene Creek Channel

The Upper Grassy Point area (9.9 acres) is dominated by shallow water and terrestrial wetland areas, ranging in depth from 1 to 5 feet (LimnoTech 2014). This area, as well as the Keene Creek Channel, would be mechanically excavated to add depth for fish and spawning habitat and improve boater access. Mechanical excavation is necessary because the shallow water depth prevents barge access. This type of excavation can be accomplished by constructing a temporary access road from Lesure Street. All excavated material at this location is expected to be a mixture of wood waste and clean sediments, totaling 80,000 cubic yards of material. It would be preferable to conduct this work during late fall and winter to minimize disturbance and increase construction efficiency. However, this work can also be done during non-frozen conditions with the appropriate best management practices.

RSU 5 – Lower Grassy Point South Wetland and Keene Creek Channel (South Branch)

The Lower Grassy Point South area (25.2 acres) is also dominated by terrestrial wetland and shallow open water area, but depths range from 2 to 6 feet (LimnoTech 2014). This area, including the South Branch of Keene Creek, would be hydraulically dredged since a barge would be able to access the site. The objective of dredging this location is to increase water circulation in the bay and provide small boat access. Excavated materials would total 116,000 cubic yards and are expected to be re-used on-site to construct islands covered under RSU 7. However, not all wood waste would be excavated at this location. Rather, 2 feet of clean sediment would be placed in these areas to create a healthy bioactive zone for benthic invertebrates and aquatic vegetation.

RSU 6 – Lower Grassy Point North Sheltered Bay Enhancement and Keene Creek Channel (North Branch)

The Lower Grassy Point North area (29.2 acres) includes shallow open water areas, a shoreline zone, and the Keene Creek Channel (varying in depth from 1 to 6 feet). Material in this area would be hydraulically removed (utilizing a barge) to depths ranging from 0 to 8 feet, with the channel being excavated to a depth of 6 feet. This removal would improve water circulation in the bay and increase boat access. However, as in RSU 5, not all wood waste would be removed. In areas with residual wood waste, a 2 foot layer of clean sediment would be placed to create a healthy bioactive zone for benthic invertebrates and aquatic vegetation. The excavated material from this RSU would total 129,000 cubic yards and be re-used on-site to construct islands under RSU 7 or it may be re-used in other areas of RSU 6 (e.g., to cap wood waste).

The estimated construction schedule projects that these RSUs could be completed within one year. However, RSUs 1 through 3 must be completed first and are expected to take eight months to construct. When the timing of RSUs 7 through 9 are considered, the Grassy Point project as a whole is expected to take at least three years to complete (LimnoTech 2014). This construction timing takes into consideration the time of year and method of excavation, with seasonality of the work having the greatest bearing on the overall schedule.

Estimated Cost of Alternative

Preliminary cost estimates for each RSU have been prepared based on the original concept plan (Exhibit 5-6).

EXHIBIT 5-6 PRELIMINARY COST ESTIMATE BY RSU (TABLE 8 FROM LIMNOTECH 2014)

RESTORATION SITE UNIT	RSU SUBTOTAL[1]
RSU 1	$1,875,000
RSU 2	$3,400,000
RSU 3	$8,250,000
RSU 4	**$3,500,000**
RSU 5	**$5,225,000**
RSU 6	**$5,438,000**
RSU 7	$3,800,000
RSU 8	$1,125,000
RSU 9	$6,469,000
Total:	**$39.1 million**
Total Proposed by Trustees Under Alternative C (in bold):	**$14.2 million**

[1] Post-construction monitoring and maintenance is not included in the cost estimates. Estimates are likely within 30 percent of actual costs, but subject to change with design changes.

Given the high materials management costs associated with the conceptual design, a revised design process is underway. The primary intent of the adaptations has been to achieve efficiencies in project implementation and to redefine the area applicable for delisting the AOC. These processes are on-going and are focused on material management (sediment removal, transport, and reuse) within the AOC. The revised Grassy Point project requires substantial inputs of sediment for regrading the bay and creating upland protective areas such as the baymouth bar. These changes are expected to result in a substantial reduction in the estimated cost of Grassy Point, as well as reduction in the anticipated costs of sediment removal and disposal at other sites in the AOC such as Kingsbury Bay. In order to achieve the minimum desired ecological outcomes, the total construction cost of the Grassy Point restoration project is anticipated to be between $7 and $8 million, based on both materials management savings and reduction in scope. The Trustees evaluated this project based on the likely final extent of the project.

5.6 ALTERNATIVE D: KINGSBURY CREEK WATERSHED PROTECTION

The Kingsbury Creek Watershed Protection project alternative will reduce sediment flow to Kingsbury Bay, improving water quality and protecting against degradation of shallow sheltered embayment habitat. Excessive sedimentation, via Kingsbury Creek, has contributed to the current ecological impairments in Kingsbury Bay. This alternative involves reducing erosion along several sections of the creek upstream of Kingsbury Bay. In addition to improving water quality, this project will complement work conducted under Alternative B, as the control of sediment entering Kingsbury Bay is essential for the resiliency of the Kingsbury Bay restoration project and will help maintain a high level of ecological service at that site over time if it is restored. While non-point source sedimentation is improving in the area, additional watershed or site-specific controls are necessary.

A final design is not complete; however, the Kingsbury Creek preliminary project design is based on restoration work currently being conducted in the adjacent Knowlton Creek watershed, which includes riverbank restoration, stabilization, and erosion control. For example, step-pool sequences made of boulder and wood structures (e.g., vanes, cross-vanes, riffles, and toe wood revetments) help to slow the flow of water and allow for the deposition of sediment. In addition to in-water structures, erosion control structures would also be constructed along the banks of the creek. Depending on final design, these structures would include silt fencing, fabric logs, mulching and/or hydromulch, seeding, and live plantings of shrubs and trees. Such erosion control activities have been conducted at Knowlton Creek and are expected to be applied to Kingsbury Creek (MNDNR 2015). The Kingsbury Creek project would include four segments of the Creek – between Highway 2 and I-35, across the 2012 blowout site at the Old Thompson Hill Road Crossing, within the Lake Superior Zoo, and between the zoo and Kingsbury Bay. The zoo segment has a 50% design prepared by the City of Duluth, which covers additional components beyond sediment source control; the sediment source control costs from the design are included in the cost estimate for the Kingsbury Creek project.

The watershed protection work along Kingsbury Creek may also provide a suitable opportunity for additional educational and interpretive signage describing the importance of sediment control to the health of the estuary.

Anticipated costs associated with this work are presented in Exhibit 5-7.

EXHIBIT 5-7 PRELIMINARY KINGSBURY CREEK COSTS

PROJECT COMPONENT	COST
Design and permitting	$137,500
Construction	$500,000
Total:	**$637,500**

5.7 ALTERNATIVE E: WILD RICE RESTORATION WITH CULTURAL EDUCATION OPPORTUNITIES

The Wild Rice Restoration Implementation Plan for the St. Louis River Estuary was developed and serves as a guide for restoration work, with cooperative restoration efforts underway since 2015. Wild rice supports an important ecological community within the coastal wetlands of the Great Lakes, providing food and shelter to many fish and wildlife species, including waterfowl. Manoomin is an important cultural resource for tribes in the St. Louis River estuary, both in diet and in trade. Restoration of wild rice typically takes place in areas with some moving water, and bays with inlets and outlets are optimal growth areas (MNDNR 2008).

Wild rice restoration efforts typically include invasive vegetation removal, seeding, additional vegetation management, and protection during establishment of the stand from herbivory by Canada geese and carp (MNDNR 2014a). Wild rice does not grow as a monoculture, but rather is a keystone species supporting a diverse fauna and flora. It may also be necessary to re-seed areas on an annual basis, as a minimum three-year period is needed for establishing the necessary seed bank to provide a long-term seed source (MNDNR 2014a and references therein). Actions to accomplish these objectives may include removing existing vegetation using an airboat equipped with a cutterhead to limit competition between plant species. Thicker stands of vegetation, such as cattail mats, may require the use of a sedge mat cutter. Alternatively, an aquatic plant harvester can cut vegetation at its roots and collect the cut material at the back of the boat. The seeding process could be accomplished by hand from a canoe or boat, distributing the seed into the water. As mentioned above, exclosures may be installed around stands of wild rice, but the Trustees recognize that utilizing exclosures in every wild rice restoration area is not feasible economically, logistically, or from a human use perspective. Instead, the Trustees may consider installing exclosures across the mouth of shallow sheltered embayments in order to protect the greatest number of acres from carp and geese herbivory for the least amount of effort.

Furthermore, as discussed in the previous section, manoomin is an important cultural and ecological resource to the St. Louis River estuary. It is tied to the Migration Story of the Ojibwe people and continues to be revered as a gift from the Creator. One of the most nutritious, natural sources of food in the region, it has been a staple of Ojibwe and other Native American tribes' diets for centuries. Today, wild rice harvest remains a very important cultural event for the Ojibwe and other tribal communities. Across Minnesota, tribal community members participate in the annual wild rice harvest. Therefore, enhancing this resource will compensate for losses in cultural services.

The goal of wild rice restoration in the St. Louis River estuary is to increase abundance and distribution of self-sustaining wild rice within the estuary, as part of a diverse emergent wetland community. The process of wild rice restoration can be broken down into three steps: site preparation, seeding, and operation and maintenance of exclosures to limit herbivory, as necessary. The entire process is estimated to be a three to five year activity. Appendix E provides tasks and timing associated with wild rice restoration at example sites over a five-year period.

Wild rice can be established as new, wild rice-centered emergent wetland on top of a young or developing post-dredging substrate. Alternatively, already-existing wild rice emergent wetlands can be enhanced. Costs associated with completing this type of project may include securing the appropriate permits, removing current vegetation, seeding the area with wild rice, constructing exclosures, and monitoring for project success.

To the extent possible, cultural education opportunities in the form of displays will be constructed in areas adjacent to wild rice restoration in order to communicate the importance of wild rice not only to the health of the St. Louis River estuary as a whole, but to maintaining the cultural traditions of local tribes. The construction of this component is likely to require the use of personnel and heavy equipment to excavate post holes and to potentially construct a pathway to and around the display (e.g., boardwalk or mulched path). Ideally, the Trustees will implement such projects in conjunction with ecological projects that experience high human use traffic for maximum visibility and readership.

Wild rice projects available under the AOC are primarily located in Wisconsin. Currently planned projects included under the Wild Rice Restoration Implementation Plan (Appendix C) range from 15 to 318 acres and cost $134,500 to $845,500.

Wild rice in the St. Louis River estuary. Photo credit: 1854 Treaty Authority.

CHAPTER 6 | ENVIRONMENTAL ASSESSMENT AND SELECTED NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION ALTERNATIVE

The Trustees' primary goal in this chapter is to identify a preferred restoration alternative(s) that compensates the public for natural resource injuries and associated losses resulting from PAH releases to the St. Louis River. The preferred alternative described in the draft RP/EA is now the selected alternative described in this final RP/EA. In Chapter 5, the Trustees identified five restoration alternatives:

- *Alternative A*: This is a "No Action Alternative," which is required to be evaluated per the regulations.
- *Alternative B*: Kingsbury Bay restoration, a shallow sheltered embayment restoration project located to the west of the Assessment Area. This project also incorporates the restoration approaches of wild rice restoration, cultural education opportunities, and transition to deepwater habitat.
- *Alternative C*: Grassy Point restoration, a shallow sheltered embayment restoration project located to the east of the Assessment Area.
- *Alternative D*: Kingsbury Creek watershed protection, a watershed protection project adjacent to the Assessment Area.
- *Alternative E*: Wild Rice restoration through the St. Louis River wild rice restoration plan. This project also incorporates the restoration approach of cultural education opportunities.

This chapter evaluates the alternatives for the purposes of CERCLA according to the Site-specific and NRDAR criteria identified in Chapter 5. The chapter also assesses the environmental consequences of each alternative under NEPA, to determine whether implementation of any alternatives would significantly affect the quality of the human environment, particularly with respect to the physical, biological, socio-economic, or cultural environments of the St. Louis River estuary. This chapter also evaluates readily available information on environmental consequences and serves as a final EA for the proposed Alternatives.

6.1 ASSESSMENT OF ENVIRONMENTAL CONSEQUENCES

In order to ensure the appropriateness and acceptability of the proposed restoration alternatives, the Trustees evaluated each alternative against a suite of restoration criteria. The DOI NRDAR regulations list ten factors to consider when selecting a preferred alternative (43 C.F.R. § 11.82(d)):

- Technical feasibility;
- The relationship of the expected costs of the proposed actions to the expected benefits from the restoration, rehabilitation, replacement, and/or acquisition of equivalent resources;
- Cost effectiveness;
- The results of actual or planned response actions;
- Potential for additional injury resulting from the proposed actions, including long-term and indirect impacts, to the injured resources or other services;
- The natural recovery period;
- Ability of the resources to recover with or without alternative actions;
- Potential effects of the action on human health and safety;
- Consistency with relevant federal, state, and tribal policies; and
- Compliance with applicable federal, state, and tribal laws.

Additionally, NEPA requires the Trustees to evaluate whether proposed restoration actions would have beneficial and/or adverse impacts to the physical, biological, socio-economic, and cultural environments. In order to determine whether an action has the potential to result in significant impacts, the context and intensity of the action must be considered according to the NEPA factors of significance (40 C.F.R. 1508.27). Context refers to area of impacts (local, state-wide, etc.) and their duration (e.g., whether they are short- or long-term impacts). Intensity refers to the severity of impact, and is partly informed by the timing of the action (e.g., more intense impacts would occur during critical periods like wildlife breeding/rearing, etc.).

In the analysis below, the Trustees examine the likely beneficial and adverse impacts of each restoration alternative on the quality of the human environment, by evaluating the context and intensity of proposed actions. After considering the public comments on the draft RP/EA (Appendix F), the Trustees have concluded that the actions associated with the preferred alternative will not significantly impact the environment, and the Trustees have issued a FONSI as an attachment to this final RP/EA (Appendix G). The Trustees will continue to evaluate environmental impacts as specific projects are implemented. If a design change during project development is expected to substantially alter the expected environmental impacts of the project, the Trustees will conduct another environmental assessment for that project as an addendum to this RP/EA. The following sections evaluate anticipated environmental consequences of the restoration alternatives in light of the NEPA significance criteria and the ten NRDA factors listed above.

6.1.1 SCOPE OF THE NATIONAL ENVIRONMENTAL POLICY ACT ANALYSIS

This final RP/EA describes and compares the potential impacts of the proposed Site-specific alternatives, as well as the No Action alternative. In particular, this final RP/EA analyzes the potential direct, indirect, and cumulative ecological, social, and economic impacts associated with the alternatives.

The following definitions were generally used to characterize the nature of the various impacts evaluated in this final RP/EA:

- **Short-term or long-term impacts:** These characteristics are determined on a case-by-case basis and do not refer to a specific timeframe. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.
- **Direct or indirect impacts:** A "direct" impact is caused by a proposed action and occurs contemporaneously at or near the location of the action. An indirect impact is caused by a proposed action and may occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action. For example, a direct impact of erosion on a stream might include sediment-laden waters in the vicinity of the action, whereas an "indirect" impact of the same erosion might lead to lack of fish spawning habitat and result in lowered reproduction rates of native fish spawning downstream where the sediment settles.
- **Minor, moderate, or major impacts:** These relative terms are used to characterize the magnitude of an impact. "Minor" impacts are generally those that may be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. "Moderate" impacts are those that are more perceptible and, typically, more likely to be quantified or measured. "Major" impacts are those that, in their context and due to their intensity (severity), have the potential to meet the thresholds for significance set forth in Council on Environmental Quality (CEQ) regulations (40 C.F.R. § 1508.27) and, thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.
- **Adverse or beneficial impacts:** An "adverse" impact is one having unfavorable or undesirable outcomes on the manmade or natural environment. A "beneficial" impact is one having positive outcomes on the man-made or natural environment. A single action may result in adverse impacts on one environmental resource and beneficial impacts on another resource.
- **Cumulative impacts:** The CEQ regulations implementing NEPA define "cumulative" impacts as the "impacts on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions." (40 C.F.R. § 1508.7) Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time within a geographic area.

6.2 EVALUATION OF ALTERNATIVE A: NO ACTION

The "No Action Alternative" would not initiate any restoration action outside of currently funded programs. Instead, the ecosystem would attenuate to background conditions based on natural processes only, with no assistance from active environmental restoration.

Although the lack of action makes this Alternative technically feasible and cost effective, this Alternative:

- Does not restore injured resources to baseline. Remediation actions are completed and the Site is currently in the post-construction monitoring phase, but lack of restoration beyond remedial actions would reduce the potential for resources to fully recover to baseline conditions. Remedial activities converted portions of certain habitats to other less beneficial habitat types that were not present under baseline conditions.
- Does not compensate the public for interim losses. Habitat quality would not be improved above baseline and recreational fishing and boating opportunities would not improve or increase.
- Is not consistent with federal and state policies and laws. Under this Alternative, the available settlement monies that are meant to be directed toward NRDAR restoration actions would not be spent in that manner.

While the "No Action Alternative" does not *create* additional adverse impacts to the environment, it also does not provide the ecological, recreational, and socio-economic benefits described in the other alternatives. Portions of the Assessment Area were fundamentally restructured during remediation, resulting in the loss of water depth, decreased slope, silty shorelines on the eastern side of Stryker Bay, the loss of deep water areas in Slip 6, and the conversion of large portions of Slip 7 to upland. Under the "No Action Alternative," these changes represent ongoing, uncompensated losses in ecological services relative to the baseline ecological services that this area once provided. That is, the "No Action Alternative" may perpetuate adverse impacts to fish and other wildlife, as well as reductions in the ecological and human use services provided by riverine and floodplain habitats, due to the lack of additional habitat functionality provided through restoration and/or preservation actions in the St. Louis River area. Therefore, the "No Action Alternative" is not a favorable restoration alternative when evaluated against the NRDAR factors. Further, the "No Action Alternative" would not meet the Trustees' purpose and need of restoring injuries to natural resources and related services caused by hazardous substances at the SLRIDT Site through the implementation of restoration activities, as it would not accomplish any restoration objectives. This Alternative serves as a point of comparison to determine the context, duration, and magnitude of environmental consequences resulting from the implementation of other alternatives.

6.3 EVALUATION OF ALTERNATIVE B: KINGSBURY BAY RESTORATION

To provide a direct comparison to Alternative A, the Trustees evaluated Alternative B by considering the DOI NRDAR restoration factors, provision of natural resource services at or above baseline, compliance with relevant regulations, and net environmental consequences.

First, the restoration factors outlined in the NRDAR regulations suggest that Alternative B is a favorable option. Habitat and wildlife restoration and public use projects in Kingsbury Bay are technically feasible, cost effective, and would be specifically targeted to benefit multiple, relevant natural resources that utilize aquatic and emergent wetland habitat. The Trustees would apply methods that have been successful in other locations to increase the probability of project success.

Second, this alternative has the potential to compensate the public for natural resource injuries by providing additional, similar services in the future. Because of habitat loss during remedy implementation, this project would compensate for lost services that cannot be reclaimed through natural recovery alone. The habitat creation and restoration portions of this project would provide natural resource services similar to the Assessment Area's baseline services. Restored shallow sheltered embayment areas and wild rice seeding would provide habitat for spawning fish and migratory birds, improve water quality by filtering sediments and pollutants from the water column, reduce erosion, and export vital nutrients to adjacent waters. These actions would also help increase production of forage fish populations, which provide prey for piscivorous fish, birds, reptiles, and mammals. The restoration of shallow sheltered embayments has the potential to increase habitat connectivity throughout the St. Louis River estuary, which is important for providing ecological services similar to those lost.

Finally, no significant cumulative environmental consequences are anticipated if the Trustees select Alternative B. Adverse impacts to environmental justice and/or socio-economic factors are expected to be minimal and may be mitigated during project selection. Any unavoidable adverse impacts would be minimized through individual project plans.

Shallow sheltered embayment enhancement/restoration creates desirable elevation and hydrologic flow regimes for wetland/riparian vegetation and fish habitat. This project category includes removing invasive vegetation, establishing native vegetation, creating recreational fishing access opportunities, dredging sediment, excavating complex channels, and grading.

As described in 5.4, the majority of these actions are expected to cause minor, short-term, localized impacts to existing resources and resource services, and result in moderate long-term benefits across a broad geographic scope. For example, removal of the existing narrow-leaved cattail stands and underlying sediment in the Head area (Exhibit 5-1) would cause short-term, localized impacts to existing vegetation at the restoration site (e.g., as existing vegetation is trampled or removed). During the active sediment removal stages, which may last for over a year, the resource services provided by that area are likely to be reduced through physical disturbance. However, long-term, moderate beneficial impacts to water resources and associated flora and fauna would occur due to the increased nutrient flow and aquatic life access provided by a more open aquatic environment and native submergent and emergent plants. Sediment removal and shoreline stabilization, in concert with re-establishment of native emergent and submergent vegetation, are expected to "… result in beneficial impacts by restoring or creating wetland and/or shallow-water habitats that provide areas for feeding and shelter for fish, as well as nutrient cycling and carbon sequestration and storage capacity" (NOAA 2015, p.154). The vegetation removal would be undertaken in such a way that designated areas of beneficial vegetation (e.g., isolated broadleaf cattail stands) would remain intact.

Dredging at Stryker Bay. Photo credit: MNDNR.

Dredging of excess sediment would cause direct and indirect short-term, localized, moderate adverse impacts on a suite of natural resources—such as sediment and aquatic biota—during implementation of the project, followed by direct and indirect long-term or permanent, moderate to major beneficial impacts. Adverse impacts may arise due to the use of heavy machinery and because of the physical removal of large volumes of sediment. As described in Exhibit 5-3, an estimated 166,000 cubic yards of material would be removed from Kingsbury Bay. Handling sediment increases turbidity, temporarily reduces water quality, causes changes in hydrology, may smother vegetation, and can cause soil compaction. However, these impacts may be reduced through the use of best management practices and turbidity monitoring. Excess turbidity would also be mitigated if necessary. Furthermore, the Trustees have experience in managing similar projects within the estuary (e.g., the sediment removal at Radio Tower Bay). Historical sediment analysis in Kingsbury Bay also indicates that levels of contaminants are low in the Bay and are not expected to cause any issues during sediment disturbance and transport.

In addition, impacted vegetation would primarily be introduced narrow-leaved cattails, which will be replaced with vegetation from the native seedbank as well as with naturally occurring native ingrowth. Successful vegetation replacement has similarly been observed by monitoring studies from the nearby Tallus Island restoration project (Barr 2015). While short-term adverse impacts may also occur on native vegetation communities during sediment removal (e.g., indirect impacts to the isolated broad-leaved cattail areas noted above), the improvements to the environment through reduction in invasive plants and increased hydrologic flow will lead to long-term benefits to native vegetation communities. Thus, overall impact of this removal on vegetation would be low. Any restoration action occurring within or near shallow habitat areas may temporarily displace managed or protected species due to the increased activity and noise associated with construction. While no such species have been identified in the area yet, if they are during the design phase, additional protections would be identified. Direct, short-term, localized moderate adverse impacts would be expected on benthic fauna and infauna that may be removed or disturbed during sediment removal activities. These impacts are expected to be temporary, as fish, for example, have been shown to return to restoration sites almost immediately or within a short time after construction (NOAA 2015 and references therein). While a longer period is anticipated for newly established benthic communities to reach their full ecological services, the net benefit is expected to be positive due to the establishment of healthier communities over a much larger area, since the aquatic area would increase by over ten acres with the clearing of the amassed sediment in the head area. Air quality around and beyond the project site would likely also experience direct, short-term, minor adverse impacts due to increased exhaust emissions from heavy machinery, increased vehicle traffic, and dust from earthmoving activities. Timing of activities would minimize this, with mechanical sediment and soil removal taking place during the winter, and the remainder of the removal through hydraulic means. In summary, cumulative adverse impacts are expected to be minor in that they are restricted in duration and localized to the project area while the more moderate impacts would be beneficial and long-lasting.

Actions associated with this restoration component are expected to be primarily in-water and at the margins of the embayment. However, it may become necessary to grade near-shoreline areas to ensure that elevation changes between the subaqueous and subaerial environment provide appropriate connectivity. Regrading a portion of a restoration area can include the following types of actions: moving soil or sediment and placing the material either within the restoration area or at a disposal site, contouring the area to satisfy hydrologic and/or vegetative goals, and amending the area with topsoil or other capping material. Depending on the scope and scale of regrading, sediment or soil may be moved by non-motorized methods (e.g., shovels) or by earth-moving diggers and other equipment. These actions are expected to result in moderate, short-term, localized impacts to the re-graded area and any area that receives sediment or soil as a result of the physical movement of material and corresponding disturbance of existing habitat, and minor, short-term localized impacts resulting from the noise and exhaust from construction vehicles. However, these adverse impacts are outweighed by the major, long-term, localized and broader benefits expected as a result of regrading. For example, likely benefits include, but are not limited to, improved hydrological conditions that would support high quality habitat and re-establish connections between habitats (e.g., wetland and riparian areas), topography that would support native vegetative communities and corresponding biota, and reduction in erosion that would improve water quality.

Cultural and historic resources and land use could experience indirect, long-term, minor adverse impacts resulting from habitat restoration. The land use in the floodplain, including any potential culturally sensitive areas, would change as the water resources in the floodplain changed (e.g., as a result of wetland restoration). Because land use would stabilize in the floodplain over time, and the area is being returned to its pre-industrial contours, the impact is expected to be minor (NOAA 2015). In general, increases in wetland habitat areas cause beneficial impacts due to the historic loss of wetland habitat areas. Improving this resource may also result in minor beneficial impacts related to socio-economic resources because of increased tourism opportunities that could result from the improvement. Drawing users to the area may have a positive economic impact on the local economy, but may result in minor increases in traffic, noise, and litter in the area.

Wild rice restoration may include, but is not limited to, vegetation removal, seeding, and exclosures. As described in more detail in Section 6.6, in the short-term, some moderate adverse impacts may occur in the restoration areas. For example, if emergent or submergent vegetation requires removal before seeding, this activity could temporarily increase turbidity, reduce the area of submergent and emergent vegetation, and disrupt the natural movement of wildlife. Direct, moderate beneficial impacts to natural resources are expected in the long-term. In addition, cultural and recreational use would likely experience direct, long-term, moderate beneficial impacts due to increased opportunities to interact with the environment and wildlife in this area.

A relatively small area of wild rice is expected to be included in the project design for Kingsbury Bay, enhancing the shallow sheltered embayment habitat area overall. The Trustees anticipate moderate, long-term beneficial impacts to natural, cultural, and historic resources in this area.

The removal of thick aquatic vegetation and increase in open water area, as well as the presence of a deepwater area, would provide additional acreage for recreational fishing, whether accessed from within Kingsbury Bay or from the St. Louis River. These benefits would be achieved as a result of the dredging activities described above. Additionally, the Kingsbury Bay project includes the creation of new access options which would provide additional compensation for reduced recreational fishing opportunities associated with Site-related contamination. Compared to the "No Action Alternative," the environmental impacts of potential projects of this type are anticipated to be minor and in many cases beneficial. The Conceptual Design envisions possible improvements to existing formal and informal access areas as well as new access opportunities. Improvements to parking lots, trails, and constructing boat ramps or piers may cause minor short-term impacts to the environment as a result of construction activities, but could help to reduce erosion, promote bank stabilization, reduce impacts to riparian vegetation, and improve user safety. Negative impacts would primarily be associated with increased use, which can result in minor increases in traffic, noise, and litter. Any significant changes to the design during the design phase would require additional environmental assessment to ensure that no significant impacts are anticipated.

This project is expected to positively impact the local economy. This project area has been specifically identified by the City of Duluth as part of their St. Louis River Corridor Initiative to reconnect local residents and the public to the River as part of neighborhood revitalization. By increasing fishing and kayaking access, it is likely that other outdoor recreation in the area would also increase resulting in corresponding long-term benefits to the recreation, accommodation, and food service industries. The project area is in close proximity to Fairmont Park and the Lake

Kayaking. Photo credit: MNDNR.

Superior Zoo, which has been recently proposed for repurposing into more of an outdoor destination and environmental education facility.[11] Enhancing access areas to the St. Louis River at Kingsbury Bay would offer urban populations additional opportunities that may not have been previously available.

The construction of a cultural education display would require the use of personnel and heavy equipment to excavate post holes and to potentially construct a pathway to and around the display (e.g., boardwalk or mulched path). These activities would likely cause direct, long-term, minor adverse impacts on the geology and soils of the site due to compaction during construction, but also from subsequent human traffic when viewing the display. The construction and human traffic would also adversely affect nearby vegetation in the long-term.

Cultural and recreational use would experience direct and indirect, long-term, beneficial impacts by enhancing the visitor experience to a site and fostering a culture of stewardship. In turn, improvements to visitor experiences can have a beneficial impact on socio-economics by drawing additional visitors to an area.

Summary of Impacts

- **Physical**: Overall, the Kingsbury Bay project is capable of direct and indirect, localized, moderate adverse impacts to the environment through dredging, invasive species removal, vegetation removal for wild rice seeding, and recreational access improvements. However, these impacts are expected to be outweighed by the major, long-term, localized and broader benefits expected post-construction.
- **Biological**: The most substantial adverse effects to biota due to the construction of Kingsbury Bay are expected to be experienced by benthic fauna and infauna. Some disruption to birds, fish, and terrestrial mammals is expected due to the presence of humans and noise from heavy machinery. However, these adverse impacts are expected to be temporary and would be outweighed by the beneficial impacts of the project in the form of improved habitat areas and connections between them.
- **Socio-economic**: There would likely be a temporary, adverse socio-economic impact during construction of the project, as recreational activities at the site are expected to decrease during that time. The beneficial impacts would be long-term and potentially major, since signage, trails, and recreational access (e.g., boating and fishing) would draw people to the area post-construction and in the long-term. This is especially true when viewing this project in its context with estuary-wide restoration efforts.
- **Cultural**: The wild rice and cultural education components of this project would provide long-term benefits to the area by fostering a culture of stewardship and

[11] For example, see planning documents available at the City of Duluth St. Louis River Corridor website (http://www.duluthmn.gov/st-louis-river-corridor/fairmount-park-and-zoo-planning/).

providing opportunities to connect to the rich history of the St. Louis River estuary.

Based on the discussion above, the Trustees do not anticipate significant environmental consequences due to the implementation of this project.

6.4 EVALUATION OF ALTERNATIVE C: GRASSY POINT RESTORATION

To provide a direct comparison to Alternative A, the Trustees evaluated Alternative C by considering the DOI NRDAR restoration factors, provision of natural resource services at or above baseline, compliance with relevant regulations, and net environmental consequences.

The Trustees determined that the selection of Alternative C would be supported by most of the restoration factors outlined in the NRDAR regulations. For example, habitat and wildlife restoration and public use projects at Grassy Point are technically feasible and would be specifically targeted to benefit multiple, relevant natural resources that utilize aquatic and emergent wetland habitat. Each of the RSUs evaluated by the Trustees would utilize similar dredging techniques that were already evaluated under the Kingsbury Bay project (e.g., hydraulic and mechanical dredging). The individual RSU project sizes (9.9 acres, 25.2 acres, and 29.2 acres) are all smaller than Kingsbury Bay, which typically would decrease the likelihood of adverse impacts. However, the potential presence of contaminated sediment in certain RSUs and large volumes of wood waste make the excavation more complicated than at Kingsbury Bay and drive up project cost. The Trustees have determined that Alternative C is not as cost effective as Alternative B due to the large volume of wood waste and potential for contaminated sediment. For these reasons, the potential for additional injury due to the proposed action is also larger for Grassy Point than Kingsbury Bay.

However, the cumulative environmental consequences of Alternative C are expected to be beneficial to natural resources. The environmental impacts described in Section 6.3 related to Kingsbury Bay are generally applicable to those associated with Alternative C, as dredging is the primary effort under this alternative. Dredging sediment would cause direct and indirect short-term, localized, moderate adverse impacts on a suite of natural resources, such as sediment and aquatic biota, during implementation of the project followed by direct and indirect long-term or permanent, moderate to major beneficial impacts. Opening water circulation in the bay would improve nutrient exchange, increase desirable fish habitat, and complement the work planned under the other RSUs.

Benefits to recreation would be moderate and long-term through the increased small-boat access. However, no boat launches are planned at this site. An additional RSU would include pathways and observation platforms which would allow recreational fishing access from shore; however, the costs and benefits of that RSU are not included in this alternative analysis. Drawing users to the area may have a positive economic impact on the local economy, but may result in minor increases in traffic, noise, and litter in the area. Due to the existence of historical saw mill structures at the site, cultural resources may be adversely impacted by this project. All applicable federal and state regulations would be followed during design and implementation of this project.

Adverse impacts to environmental justice and/or socio-economic factors are expected to be minimal and may be mitigated during construction design and implementation. Any unavoidable adverse impacts would be minimized through best management practices, and are expected to be outweighed by the beneficial impacts of this Alternative. Additional NEPA analysis would be completed if the proposed project has expected adverse effects beyond the scope of those analyzed here.

Summary of Impacts

- **Physical**: Overall, the Grassy Point alternative would be capable of similar physical adverse and beneficial impacts as described under the Kingsbury Bay alternative. However, the presence of contaminated sediment and wood waste is expected to complicate construction efforts, which could cause prolonged adverse impacts to the environment.
- **Biological**: Again, benthic fauna and infauna would likely experience the most short-term adverse impacts out of any organisms in the area due to the dredging operations. Mammals, birds, and fish would also be adversely impacted in the short-term and would likely avoid the area during construction. The beneficial impacts of this project are expected to outweigh these adverse impacts in the long-term.
- **Socio-economic**: Humans are likely to avoid the Grassy Point area during construction, which may adversely impact the local socio-economic climate. However, increased access opportunities in the form of trails, a pier, and open water would likely draw people back to the area in larger numbers post-construction (e.g., for walking, wildlife viewing, and fishing).
- **Cultural**: Cultural resources in the form of historical sawmill structures may be adversely impacted due to dredging activities at this site.

Based on the discussion above, the Trustees do not anticipate significant environmental consequences due to the implementation of this project.

6.5 EVALUATION OF ALTERNATIVE D: KINGSBURY CREEK WATERSHED PROTECTION

Kingsbury Creek contributes sediment to Kingsbury Bay and the St. Louis River due to erosion within the watershed. As such, the Trustees propose reducing erosion from this watershed as Alternative D. This project would benefit the general water quality and ecological services of the St. Louis River, and would specifically protect restoration work that may be conducted under Alternative B at Kingsbury Bay.

The project concept would largely be modeled after work that has recently been done in Knowlton Creek. Possible restoration actions include native vegetation planting, installation of habitat structures, streambank stabilization techniques, and improved stormwater management strategies. The increased noise, turbidity, altered hydrology, and displacement of organisms during construction implementation would cause direct and indirect short-term, minor adverse impacts. Depending on site-specific conditions, the use of earth-moving machines may be required and would cause minor amounts of localized soil compaction or may introduce non-native species if not properly decontaminated

(NOAA 2015). These adverse impacts would likely be short term. Completion of the project would result in indirect, long-term, minor and moderate beneficial impacts to water quality and benthic habitat in habitat areas where erosion and sedimentation is a problem beyond the project site.

As described above, planting native vegetation may cause minor disturbance of the surrounding habitat. However, disturbed areas are expected to revegetate from existing roots and seed banks soon after the work is completed (NOAA 2015). The placement of wildlife habitat structures (e.g., woody debris), bank stabilization work, and changes in stormwater management techniques may all require the use of heavy machinery. This machinery could damage the surrounding riparian area through the destruction of existing vegetation as well as through the disruption and compaction of soil. Soil disturbance and loss of vegetation during construction implementation may lead to increased turbidity and sedimentation for a short time.

The design phase will avoid or minimize impacts to cultural and historic resources, such as the Duluth Zoo, which would potentially be impacted from ground disturbance or from changes in land use as conditions at the site transform to a more vegetated and natural condition. Projects of this type would be conducted in stream segments that historically functioned as healthy stream segments, and that have been altered or eroded to their present condition. This restoration component is expected to have direct, short-and long-term, minor and moderate, adverse and beneficial impacts to land use and recreation. Erosion control improvements in watersheds would lead to water quality and habitat improvements in the St. Louis River estuary as a whole. This would ultimately provide higher quality recreational opportunities and can result in indirect short- and long-term, minor and moderate beneficial impacts to socio-economic conditions (NOAA 2015). Furthermore, the Knowlton Creek project was determined to have no significant environmental impacts. Since the conceptual project design is expected to be similar to the work conducted at Knowlton Creek, it is expected that this project would also lack any significant impacts. If design phase work results in a conceptual project design that is substantially different from that which is presented here, a new environmental assessment will be written as an addendum to this RP/EA.

Summary of Impacts

- **Physical**: Heavy machinery and related work during construction implementation may cause temporary adverse impacts to a localized area. Increased noise, turbidity, and altered hydrology are expected. The beneficial impacts to water quality and benthic habitat areas locally and more broadly are anticipated to outweigh the physical adverse impacts, particularly in the long-term.
- **Biological**: Due to the increased presence of humans and noise from heavy machinery, it is likely that organisms will avoid the area during construction implementation. However, this disruption is expected to be short term. The long-term, beneficial impacts to habitat areas in the watershed are expected to outweigh the temporary adverse impacts of construction.
- **Socio-economic**: There is limited access to Kingsbury Creek for human recreation, so adverse and beneficial impacts to the local socio-economic landscape are

expected to be minor. Kingsbury Creek runs through the Lake Superior Zoo, so some visitors may avoid the area during construction implementation, but these impacts are expected to be short-term.

- **Cultural**: Adverse and beneficial cultural impacts are expected to be minor and localized. However, broader beneficial cultural impacts may occur to the extent that reduced sedimentation increases desirable habitat for biota and wild rice stands in the estuary. Any historical sites and artifacts found during design and construction would be managed according to relevant federal and state laws.

Based on the discussion above, the Trustees do not anticipate significant environmental consequences due to the implementation of this project.

Restoration at Knowlton Creek. Photo credit: MNDNR.

6.6 EVALUATION OF ALTERNATIVE E: WILD RICE RESTORATION WITH CULTURAL EDUCATION OPPORTUNITIES

As described in Section 5.7, wild rice restoration may include, but is not limited to vegetation removal, seeding, and exclosures. In the short-term, some moderate adverse impacts may occur in the restoration areas. For example, if emergent or submergent vegetation requires removal before seeding, this activity could temporarily increase turbidity, reduce the area of submergent and emergent vegetation, and disrupt the natural movement of wildlife. Site preparation could also temporarily adversely impact human uses of the area through increased boat traffic, noise, and engine exhaust. Furthermore, the use of exclosures may temporarily prevent human access to a particular area until the wild rice seed becomes established. For some sites, additional excavation may be needed to prepare the site for restoration, which would require heavy machinery and would result in moderate, short-term, adverse impacts due to increased turbidity, noise, and emissions. The seeding process itself would have very limited short-term impacts that are not uncommon of any area that experiences non-motorized boating traffic. Overall, wild rice restoration efforts are expected to cause direct, long-term, moderate beneficial impacts to natural resources in the St. Louis River estuary.

Cultural and recreational use would likely also experience direct, long-term, moderate beneficial impacts through increased wild rice harvest opportunities, which would allow for tribal culture and heritage to be both communicated and experienced between fellow tribal members and maintained for future generations. In turn, an increase in wild rice harvest would likely provide long-term, moderate beneficial impacts to the economy of the area.

Summary of Impacts

- **Physical**: Adverse impacts due to wild rice seeding are expected to be minimal on balance. Some disruption to an area may occur, particularly if vegetation removal and exclosures are used. These adverse impacts are expected to be outweighed by the long-term beneficial impacts of establishing wild rice in the St. Louis River estuary.
- **Biological**: Adverse impacts to flora and fauna are also expected to be minimal on balance. Disruption due to boat and cutterhead noise may cause birds, mammals, and fish to avoid a seeding area temporarily. However, this avoidance is expected to be temporary and fauna would likely resume their normal patterns of use post-project. The benefits to fish and wildlife from an established wild rice emergent wetland community are expected to outweigh the short term, minor adverse impacts resulting from the work required to plant the rice.

Wild rice in the St. Louis River.
Photo credit: 1854 Treaty Authority.

- **Socio-economic**: Little disruption is expected socio-economically. Wild rice seeding is a relatively fast and localized process that may only temporarily limit boating and other water based recreation in the area. Established stands of wild rice, which would result from this project, are expected to cause long-term and broad beneficial socio-economic impacts through increased harvest opportunities and increased presence of fauna (e.g., birds and fish).
- **Cultural**: Due to the cultural importance of wild rice to local tribes, the Trustees expect that there will be long-term and possibly permanent beneficial cultural impacts. Combining wild rice projects with cultural education opportunities would also contribute to the long-term beneficial cultural impacts of this project.

Based on the discussion above, the Trustees do not anticipate significant environmental consequences due to the implementation of this project.

6.7 SELECTED ALTERNATIVE

The Trustees reviewed the alternatives above by considering the Site-specific factors developed by the Trustees (see Section 5.1) and the restoration factors outlined in the NRDAR regulations (see Section 6.1), in addition to conducting an environmental assessment of each option as required under NEPA. Alternative A (No Action) was rejected because it does not meet the purpose of restoring injuries to natural resources and related services caused by hazardous substances at the SLRIDT Site through the implementation of restoration activities. Alternatives B (Kingsbury Bay Restoration), C (Grassy Point Restoration), D (Kingsbury Creek Watershed Protection), and E (Wild Rice Restoration and Cultural Education Opportunities) are all expected to provide equivalent types of natural resource services to those injured by the release of hazardous substances at the SLRIDT Site. However, evaluation of the suite of Site-specific and NRDAR factors indicates that Alternative C is not expected to provide benefits as quickly as Alternatives B, D, and E; cannot be fully funded through available restoration monies; and is dependent on the implementation of other projects within the AOC such as Kingsbury Bay. The Trustees' selected alternative includes implementing Alternatives B, D, and E. The EA's environmental impacts analysis indicates that implementation of these alternatives would not result in any significant environmental impacts. Under the selected alternative, the Trustees will implement three restoration projects: Kingsbury Bay Restoration, Kingsbury Creek Watershed Protection, and Wild Rice Restoration with Cultural Education Opportunities.

The cumulative environmental consequences of the selected alternative are expected to benefit natural resources without adverse impacts to the economy or disadvantaged populations. The Trustees expect that project implementation will result in ecological enhancements, socio-economic benefits such as water quality improvements and increased access to recreational opportunities (e.g., wildlife viewing and fishing). The combination of Alternatives B and D will result in a holistic restoration approach for the estuary via Kingsbury Creek and Kingsbury Bay including erosion reduction in the watershed, dredging accumulated sediment, removal of invasive species, seeding wild rice and planting native vegetation. The recreational and cultural human use components encompassed by enhanced river access and cultural education provide opportunities to engage the public and encourage long-term stewardship of the estuary. Implementation of these projects will more comprehensively ensure the long-term quality and sustainability of the natural resources and ecological functions supported by these project areas.

The projects described in this selected alternative are still undergoing design processes. Additional NEPA analysis will occur if the final designs of the projects have expected adverse effects beyond the scope of those analyzed here. Additionally, Section 7 of the Endangered Species Act of 1973, as amended, requires federal agencies to review any action that it funds, authorizes, or carries out to determine whether it may affect any species listed as threatened or endangered, or listed critical habitat. Federal agencies must consult with the FWS if any such effects may occur as a result of their actions. Threatened and endangered species that may be found in the project area are identified in Section 3.2.5 of this final RP/EA; no critical habitat has been identified in the project areas (FWS 2017). Project actions to be completed under some aspects of the selected alternative may affect the northern long-eared bat through the removal of trees or snags. The Trustees will further coordinate with the FWS in the final project design phases to identify measures necessary (e.g., seasonal restrictions on tree removal) to avoid the potential for direct mortality of bats. The FWS will also complete an Intra-Service Section 7 Biological Evaluation Form to document this analysis, including any necessary restrictions, and demonstrate concurrence as part of final project designs under the selected alternative. The federal Trustees will follow Section 106 of the National Historic Preservation Act to conduct consultations for each restoration project that will be implemented. Other applicable federal and state permitting requirements will also be followed. For example:

- An Environmental Assessment Worksheet (EAW) will be completed for each project, as required by the State of Minnesota.
    - The EAW includes an up-to-date Natural Heritage Information System Review of the project area.
- All permitting will be processed by MNDNR, which includes city, state, and federal-level requirements.
    - Preliminary coordination has begun for some restoration alternatives. In particular, MNDNR is coordinating with the United States Army Corps of Engineers in the St. Paul District regarding the Kingsbury Bay project for any necessary Section 404 permits once the construction design is closer to completion.
- Historical Review will be processed by MNDNR through the state, federal, and tribal historical preservation offices.
- Access agreements will be secured by MNDNR.
- MNDNR will enroll in MPCA's Voluntary Investigation and Clean-up Program to ensure the encounter of any unknown contaminated sediments is appropriately addressed.
- A Stormwater Management Plan will be drafted and submitted.
- MNDNR will work together with the Minnesota Department of Administration to complete the construction bid process.
- MNDNR will work with the City of Duluth and other partners to prepare appropriate signage for the project site.

The Trustees will continue to inform the public of restoration project progress, as well as any substantive changes to the restoration plan.

CHAPTER 7 | MONITORING

Monitoring is critical to the success of any restoration project, as it allows success to be measured (Kerschner 1997). Thoughtful monitoring approaches and establishing success metrics and criteria enable the performance assessment necessary for project success. Monitoring determines whether the restoration project met its original objectives and provides a mechanism for altering future restoration actions as needed during the course of a project (e.g., through adaptive management). Restoration monitoring may also provide insight into ecosystem or infrastructure function which will benefit future restoration actions (Kerschner 1997, Rieger et al. 2014). The outcome of a well-designed monitoring plan is an accurate evaluation of the design and implementation of project-related restoration techniques.

Though ecological restoration projects are fairly common, monitoring to determine project effectiveness occurs for only a fraction of funded restoration projects (Roni 2005, Kimball et al. 2015). In the absence of appropriate monitoring, it is difficult to quantify and assess success or decline in habitat structure and function, as well as specific parameters such as the status of conservation species affected by a project. Monitoring efforts do not need to be expensive or time intensive, though ideally they should be integrated into an adaptive management framework (PNNL 2007; Williams and Brown 2012) to ensure the data gathered are used to inform and improve subsequent restoration actions (Gregory et al. 2006).

This chapter outlines a general approach and framework that will guide the monitoring of future restoration projects associated with the SLRIDT NRDA settlement in the St. Louis River.

7.1 SAINT LOUIS RIVER INTERLAKE/DULUTH TAR NATURAL RESOURCE DAMAGE ASSESSMENT RESTORATION MONITORING FRAMEWORK

The Trustees have outlined a monitoring framework common to all future restoration projects covered under this final RP/EA. Individual monitoring plans will be guided by standard performance criteria, or measures that assess the progress of restoration sites toward project goals and may be compared across projects. In this way, the Trustees will be able to determine which project attributes are not on target, and what actions and course corrections are needed to achieve project success. The Trustees may also use monitoring information as an outreach tool to illustrate to the public continued success over time (quantitatively and qualitatively).

Various types of monitoring exist to answer different questions (Williams et al. 1997, Roni 2005). The most appropriate type of monitoring is decided on a project-specific basis, and is influenced by the question to be answered, the expertise of the partner, and the overall need in order to reach project goals.

- **Pre-project monitoring** is designed to characterize the specific condition of the habitat prior to restoration implementation. It should be adequate to document habitat degradation specific to the goals and objectives of the restoration program, and will likely include photographing the restoration site. In many cases, this information is collected as part of normal project operations.
- **Implementation monitoring** helps determine if the restoration effort was implemented properly. Implementation monitoring may focus on the field techniques used, and documents if corrections are needed. Implementation monitoring may be undertaken during the course of project maintenance and management.
- **Effectiveness monitoring** focuses on whether the restoration action was effective in attaining the desired future conditions and in meeting project objectives. Effectiveness monitoring would determine, for example, whether target organisms are responding to restoration as expected, or if the restored habitat was functioning as proposed. This type of monitoring is more complex than implementation monitoring and requires an understanding of physical and biological factors. Sometimes effectiveness monitoring can be accomplished with qualitative methods (e.g., through site descriptions) rather than more quantitative methods. This information is often some of the most useful in illustrating how a particular restoration program is working.
- **Validation monitoring** is rigorous and specialized, and verifies assumptions made in the course of effectiveness monitoring. It is usually accomplished through ecological research. Effectiveness and validation monitoring together are specifically needed to evaluate adaptive management designs.

Exhibit 7-1 is an example of a generic monitoring framework that the Trustees will utilize for each identified restoration project and which will include details of the monitoring action outlined in a step-wise manner, performance standards, the organization or person responsible for monitoring, and the associated schedule and timing of monitoring actions.

EXHIBIT 7-1 GENERAL MONITORING FRAMEWORK

MONITORING COMPONENTS	MONITORING STEP			
	PRE-PROJECT MONITORING	IMPLEMENTATION MONITORING	SHORT-TERM EFFECTIVENESS MONITORING	VALIDATION MONITORING
OBJECTIVE: What is the objective of the monitoring step?	Document pre-construction conditions.	Document if the project implementation occurred according to design plans.	Document if the main ecological or human-use outcome was achieved.	Document if the main ecological or human use outcome persists into the future.
MONITORING PLAN: Describe the monitoring plan.	For each monitoring step, describe the approach, methods, and amount of data that will be collected and assessed. This will be specific to each selected project.			
PERFORMANCE STANDARDS: What are the performance standards?	For each monitoring step, include a specific performance criterion to evaluate progress as monitoring progresses.			
ORGANIZATIONS: Who is responsible for the monitoring step?	For each monitoring step, record the person or organization that is responsible for conducting the monitoring as well as any related assessment or analysis of monitoring data.			
SCHEDULE: How does monitoring fit into the project schedule?	For each monitoring step, outline a schedule for completion of monitoring tasks. In general, pre-project monitoring will occur before restoration begins; implementation monitoring will occur immediately following the completion of restoration actions; and short-term effectiveness and validation monitoring will use time frames specific to each selected project.			

7.2 ADAPTIVE MANAGEMENT

The concept of adaptive management has several definitions, and is broadly considered here to be the systematic improvement of resource management through iterative learning from project outcomes (for more information, see Murray and Marmorek 2003 and Williams and Brown 2012). This includes considering lessons learned from previous restoration efforts in the St. Louis River when developing restoration designs and when evaluating if adaptive management actions are appropriate. Adaptive management is a tool that synthesizes monitoring data and analyzes it against performance standards in order to maximize the benefits of the current project, as well as increase the design effectiveness of future watershed and habitat restoration efforts (O'Donnell and Galat 2008, Williams 2011).

To assess a specific objective to increase the dominance of a particular plant species, monitoring data could be analyzed to determine if the restored habitat could be adapted or modified to increase the particular species of concern.

The Trustees have both restoration planning experience and an available body of literature to enable efficient restoration project planning (e.g., Haney and Power 1996, Palmer et al. 2005, Rieger at al. 2014), which will be helpful in developing an adaptive management framework that includes common performance standards for future restoration projects. The success of adaptive management is contingent upon identifying performance standards at the beginning of a project, thus enabling specific targets to be evaluated (Kondolf and Micheli 1995, O'Donnell and Galat 2008). Moving forward with restoration projects, the Trustees will ensure long-term success by implementing standard procedures to assess whether intermediate milestones are met or whether the technical parameters need to be altered to ensure project success. The Trustees plan to efficiently allocate monitoring funds on a project-specific basis to ensure that a relevant and cost-effective type of monitoring is chosen for each project.

Part of the St. Louis River estuary. Photo credit: © Richard Hamilton Smith.

CHAPTER 8 | PUBLIC COMMENTS AND TRUSTEE RESPONSES

This chapter provides a summary of the public comments received on the draft RP/EA and the Trustees' responses to those comments. The public comment period for the draft RP/EA was held from July 6, 2017 through August 7, 2017. The Trustees received written comments from two parties. The Trustees acknowledge and thank all individuals and organizations who took the time to provide comments on the draft RP/EA. Both comments were taken into consideration in preparing the final RP/EA. A copy of the original comments is provided in Appendix F.

COMMENT 1:

The Trustees received a comment voicing support for the draft RP/EA as published, including the proposed settlement, the alternatives analysis, and the preferred alternative.

RESPONSE:

The Trustees appreciate participation in the natural resource damage assessment and restoration process and those that took the time to review and provide comments on the draft RP/EA. No changes were made to the RP/EA as a result of this comment.

COMMENT 2:

The Trustees received a comment voicing support for the preferred alternative and emphasizing the importance of restoration project monitoring. In particular, the commenter suggested thoroughly documenting pre-restoration vegetation conditions in Kingsbury Bay this growing season, if possible. Similarly, the commenter communicated the importance of pre-restoration monitoring for wild rice projects in order to determine project success.

RESPONSE:

The Trustees thank the commenter for their thoughtful review. The Trustees appreciate the importance of monitoring, particularly for ensuring and determining restoration project success. Specific monitoring guidance will be developed and described in each restoration project work plan, including Kingsbury Bay and wild rice restoration projects. No changes were made to the RP/EA as a result of this comment.

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APPENDIX A | FISH STUDY DATA

Click image to navigate to Microsoft Excel file:

Microsoft®

MPCA SLRIDT website
(https://www.pca.state.mn.us/waste/st-louis-river-interlakeduluth-tar-site)

APPENDIX B | BIRD STUDY DATA

DATA FROM 2001-2002 TRUSTEE BIRD STUDIES (TRUSTEES 2002B)

Table B.1. Polycyclic aromatic hydrocarbon (PAH) and aliphatic hydrocarbon (ALH) concentrations in tree swallow carcasses from four sites on the St Louis River near Duluth, Minnesota in 2001 and 2002.

Table B.2. Polycyclic aromatic hydrocarbon concentrations in pooled stomach contents and pooled boluses of tree swallow nestlings from four sites on the St Louis River near Duluth, Minnesota.

Table B.3. Element concentrations (µg/g dry weight) in tree swallow nestling livers from four sites on the St. Louis River near Duluth, Minnesota in 2001 and 2002.

Table B.4. Nest success, egg success, clutch size, and the number of tree swallow nestlings raised to 12 day-of-age at four sites on the St Louis River near Duluth, Minnesota in 2001 and 2002.

Table B.5. Trace element concentrations (µg/g dry weight) in tree swallow eggs from the four St. Louis River near Duluth, Minnesota in 2001 (n =13 eggs) and 2002 (n = 39 eggs).

TABLE B.1. POLYCYCLIC AROMATIC HYDROCARBON (PAH) AND ALIPHATIC HYDROCARBON (ALH) CONCENTRATIONS IN TREE SWALLOW CARCASSES FROM FOUR SITES ON THE ST LOUIS RIVER NEAR DULUTH, MINNESOTA IN 2001 AND 2002.

	RANGE OF CONCENTRATIONS (μg/g WET WEIGHT)						
	2001			2002			
ANALYTE	INDIAN POINT (N = 2)	KEENE CREEK (N = 10)	STRYKER BAY (N = 11)	INDIAN POINT (N = 6)	NORTH BAY (N = 12)	KEENE CREEK (N = 10)	STRYKER BAY (N = 10)
Dibenzo(a,h)anthracene	0.01-0.03	3ND[a]-0.03	2ND-0.08	6ND	5ND[a]-0.07	9ND-0.01	3ND-0.13
Benzo(a)pyrene	2ND	10ND	8ND-0.01	6ND	8ND-0.02	7ND-0.02	7ND-0.02
Benzo(a)anthracene	2ND	9ND-0.02	11ND	6ND	11ND-0.01	8ND-0.01	10ND
Benzo(b)fluoranthene	2ND	9ND-0.02	11ND	6ND	11ND-0.02	9ND-0.01	9ND-0.01
Benzo(k)fluoranthene	1ND-0.02	7ND-0.02	11ND	6ND	11ND-0.01	10ND	10ND
Biphenyl	2ND	8ND-0.01	10ND-0.02	6ND	12ND	9ND-0.01	10ND
Indeno(1,2,3-cd)pyrene	1ND-0.01	3ND-0.05	4ND-0.06	3ND-0.25	6ND-0.06	6ND-0.13	8ND-0.01
Benzo(g,h,i)perylene	1ND-0.06	4ND-0.03	4ND-0.07	4ND-0.13	6ND-0.05	3ND-0.19	10ND
Chrysene	2ND	8ND-0.04	11ND	6ND	11ND-0.01	10ND	9ND-0.01
Acenaphthene	2ND	10ND	11ND	6ND	8ND-0.02	9ND-0.01	9ND-0.01
Acenaphthalene	2ND	9ND-0.02	10ND-0.01	6ND	12ND	10ND	10ND
Fluoranthene	2ND	9ND-0.05	11ND	6ND	12ND	10ND	10ND
Fluorene	2ND	9ND-0.01	11ND	6ND	12ND	10ND	10ND
Naphthalene	2ND	8ND-0.02	10ND-0.01	6ND	12ND	3ND-0.03	8ND-0.01
Phenanthrene	2ND	10ND	11ND	6ND	12ND	8ND-0.02	10ND
Pyrene	2ND	9ND-0.03	11ND	6ND	12ND	10ND	10ND
Benzo(e)pyrene	2ND	8ND-0.03	11ND	5ND-0.02	4ND-0.07	6ND-0.03	9ND-0.02
Perylene	2ND	9ND-0.01	8ND-0.05	0.035-0.07	0.012-0.03	1ND-0.05	4ND-0.05
Total PAHs Geometric mean(CIs)[d]	**0.06 A[b] (0.0004-8.13)**	**0.05 A (.028-0.094)**	**0.07 A (0.046-0.109)**	**0.09 A (0.034-0.24)**	**0.10 A (0.067-0.137)**	**0.11 A (0.07-0.18)**	**0.07 A (0.047-0.111)**
Total ALHs Geometric mean(CIs)	**10.8 A (7.33-16.00)**	**11.6 A (9.88-13.7)**	**9.8 A (8.03-11.9)**	**9.1 A[c] (8.11-10.2)**	**6.6 B (6.13-7.15)**	**9.0 A (6.5-12.6)**	**7.8 AB (6.67-9.21)**

[a] The number before ND (not detected) is the number of samples below the detection limit.

[b] Geometric means for each year not sharing the same letter among locations are significantly different.

[c] Alpha level of 0.15 needed to demonstrate differences among locations.

[d] CI is the 95% confidence interval.

TABLE B.2. POLYCYCLIC AROMATIC HYDROCARBON (PAH) CONCENTRATIONS IN POOLED STOMACH CONTENTS AND POOLED BOLUSES OF TREE SWALLOW NESTLINGS FROM FOUR SITES ON THE ST LOUIS RIVER NEAR DULUTH, MINNESOTA.

	CONCENTRATION (µg/g WET WEIGHT) IN POOLED STOMACH CONTENTS//BOLUSES						
	2001			2002			
ANALYTE	INDIAN POINT	KEENE CREEK	STRYKER BAY	INDIAN POINT	NORTH BAY	KEENE CREEK	STRYKER BAY
Dibenzo(a,h)anthracene	-----/ /ns[1]	0.05/ /0.02	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
Benzo(a)pyrene	-----/ /ns	0.28/ /-----	0.07/ /-----	-----/ /-----	-----/ /0.02	0.04/ /-----	-----/ /-----
Benzo(a)anthracene	-----/ /ns	0.43/ /-----	0.09/ /0.07	-----/ /0.06	0.02/ /0.06	0.1/ /0.02	0.03/ /-----
Benzo(b)fluoranthene	-----/ /ns	0.29/ /-----	0.09/ /0.13	0.02/ /-----	-----/ /-----	0.09/ /-----	-----/ /-----
Benzo(k)fluoranthene	-----/ /ns	0.23/ /-----	0.08/ /0.1	-----/ /-----	-----/ /-----	0.07/ /-----	-----/ /-----
Biphenyl	-----/ /ns	0.03/ /-----	0.02/ /-----	0.02/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
INDeno(1,2,3-cd)pyrene	-----/ /ns	0.16/ /-----	0.04/ /0.11	-----/ /-----	-----/ /-----	0.03/ /-----	-----/ /0.01
Benzo(g,h,i)perylene	0.05/ /ns	0.16/ /0.02	0.05/ /0.08	-----/ /-----	-----/ /0.02	0.01/ /0.02	-----/ /0.03
Chrysene	-----/ /ns	0.56/ /-----	0.13/ /0.09	0.01/ /0.01	-----/ /-----	0.06/ /0.04	-----/ /0.02
Acenaphthene	-----/ /ns	0.03/ /-----	0.02/ /-----	-----/ /-----	-----/ /-----	0.02/ /-----	-----/ /0.01
Acenaphthalene	-----/ /ns	0.13/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
Fluoranthene	-----/ /ns	0.79/ /-----	0.2/ /0.09	0.02/ /-----	0.01/ /-----	0.17/ /0.07	-----/ /0.05
Fluorene	-----/ /ns	0.14/ /-----	0.05/ /-----	-----/ /-----	-----/ /-----	0.05/ /-----	-----/ /-----
Naphthalene	-----/ /ns	0.22/ /-----	0.32/ /-----	0.01/ /0.02	-----/ /0.02	0.06/ /0.01	-----/ /0.01
Phenanthrene	-----/ /ns	0.56/ /-----	0.19/ /-----	0.03/ /0.02	0.02/ /0.01	0.18/ /0.04	0.01/ /0.03
Pyrene	-----/ /ns	0.60/ /-----	0.20/ /0.07	0.02/ /-----	-----/ /-----	0.14/ /0.06	0.01/ /0.04
Benzo(e)pyrene	-----/ /ns	0.23/ /-----	0.12/ /0.05	0.08/ /0.02	0.04/ /0.04	0.11/ /0.03	0.05/ /0.04
Perylene	-----/ /ns	-----/ /-----	0.03/ /-----	0.08/ /0.03	0.05/ /0.10	0.08/ /0.04	0.07/ /0.04
Anthracene	-----/ /ns	0.18/ /-----	0.02/ /-----	-----/ /-----	-----/ /-----	0.07/ /-----	-----/ /-----
Dibenzothiophene	-----/ /ns	0.04/ /-----	0.03/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C1-chrysene	-----/ /ns	0.07/ /-----	0.03/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C2-chrysene	-----/ /ns	0.02/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C1-naphthalene	-----/ /ns	0.17/ /-----	1.20/ /-----	-----/ /-----	-----/ /-----	0.02/ /-----	-----/ /-----
C2-naphthalene	-----/ /ns	0.05/ /-----	0.55/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C3-naphthalene	-----/ /ns	-----/ /-----	0.90/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C4-naphthalene	-----/ /ns	-----/ /-----	0.68/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C1-phenanthrene	-----/ /ns	0.24/ /-----	0.21/ /-----	-----/ /-----	-----/ /-----	0.02/ /-----	-----/ /-----
C2-phenanthrene	-----/ /ns	0.07/ /-----	0.08/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C3-phenanthrene	-----/ /ns	0.12/ /-----	0.12/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C4-phenanthrenes	-----/ /ns	-----/ /-----	0.10/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
C1-fluoranthene & pyrenes	-----/ /ns	0.28/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----	-----/ /-----
TPAH	0.05/ /ns	6.10/ /0.04	5.61/ /0.80	0.27/ /0.16	0.14/ /0.26	1.31/ /0.33	0.17/ /0.29
Total ALH	**118.4/ns**	**131.6//107.9**	**104.0//135.3**	**127.9//64.0**	**95.1//106.3**	**200.8//120.5**	**161.3//104.7**
Number nests in pool	2/ /ns	10/ /9	11/ /7	6/ /4	12/10	10/ /10	10/10

[1]ns = no sample analyzed

TABLE B.3. ELEMENT CONCENTRATIONS (UG/G DRY WEIGHT) IN TREE SWALLOW NESTLING LIVERS FROM FOUR SITES ON THE ST. LOUIS RIVER NEAR DULUTH, MINNESOTA IN 2001 AND 2002.

	GEOMETRIC MEAN (µg/g DRY WEIGHT), (95% CI), {RANGE}						
	2001			2002			
Element	Indian Point (n = 2)	Keene Creek (n = 10)	Stryker Bay (n = 11)	Indian Pt. (n = 6)	North Bay (n = 12)	Keene Creek (n = 10)	Stryker Bay (n = 10)
Aluminum	14.5 (13.3-15.8) {14.4-14.6}	8.0 (6.7-9.4) {6.27-12.5}	4.4 (2.8-6.8) {1.7-12.8}	1.2 (0.66-2.1) {1 ND[a]-2.63}	1.0 (0.68-1.4) {4 ND-1.96}	0.9 (0.54-1.6) {5 ND-4.38}	1.2 (0.68-2.2) {3 ND-6.07}
Arsenic	2 ND	10 ND	11 ND	6 ND	12 ND	10 ND	10 ND
Boron	15.4 (2.0-120) {13.1-18.1}	14.2 (11-18) {8.37-22.9}	15.3 (12-20) {8.04-26.1}	13.6 (7.6-24) {6.75-23.5}	15.8 (13-20) {8.24-24.7}	15.3 (12-19) {9.5-27.4}	18.8 (15-23) {13.7-36.6}
Barium	2 ND	10 ND	11 ND	6 ND	12 ND	10 ND	10 ND
Beryllium	2 ND	10 ND	11 ND	0.06 (0.06-0.07) {0.059-0.0714}	0.05 (0.05-0.05) {0.043-0.0553}	0.05 (0.05-0.06) {0.0428-0.0834}	0.06 (0.05-0.07) {0.0496-0.0853}
Cadmium	0.15 (0.1-0.23) {0.149-0.159}	0.18 (0.14-0.24) {0.109-0.291}	0.19 (0.15-0.23) {0.089-0.261}	0.6 (0.49-0.74) {0.423-0.761}	0.66 (0.62-0.71) {0.519-0.779}	0.65 (0.58-0.73) {0.528-0.809}	0.74 (0.65-0.85) {0.589-1.11}
Chromium	2 ND	{6 ND-0.297}	{7 ND-0.208}	2.9 (2.8-3.1) {2.78-3.2}	2.7 (2.6-2.8) {2.57-3.01}	2.7 (2.6-2.9) {2.42-2.96}	2.7 (2.5-2.8) {2.38-2.98}
Copper	13.1 (2.8-62) {11.6-14.8}	15.2 (12.5-18.5) {10.5-27.3}	14.6 (13.4-15.9) {12.4-17.7}	15.6 (13.3-18.3) {12.5-18.8}	15.8 (14.5-17.1) {12.6-20.6}	14.5 (13.2-15.9) {12.2-17.9}	15.2 (13.4-17.4) {13-23.3}
Iron	1066.5 (613-1856) {1021-1114}	1002.9 (792-1270) {621-1587}	1050.0 (884-1248) {568-1537}	803.7 (412-1567) {235-1513}	1052.1 (937-1181) {784-1361}	1025.2 (755-1392) {527-1751}	1370.1 (1127-1665) {879-2197}
Mercury	0.11 (0.02-0.62) {0.095-0.125}	0.11 (0.10-0.12) {0.084-0.128}	0.09 (0.08-0.11) {0.069-0.135}	0.10 (0.09-0.12) {0.0867-.127}	0.19 (0.17-0.21) {0.148-0.269}	0.09 (0.08-0.10) {0.0748-0.111}	0.10 (0.09-0.11) {0.0623-0.12}
Magnesium	698.5 (632-772) {693-704}	747.0 (699-798) {641-861}	773.1 (745-803) {699-854}	773.1 (721-829) {723-844}	785.7 (759-813) {728-900}	763.3 (726-803) {704-839}	760.2 (731-790) {680-823}
Manganese	4.22 (2.3-7.8) {4.02-4.43}	5.8 (4.8-7.0) {4.05-8.81}	5.2 (4.8-5.7) {3.93-5.95}	5.3 (4.7-5.9) {4.77-6.08}	6.4 (5.9-7.0) {5.38-9.02}	5.2 (4.8-5.6) {4.68-6.76}	5.0 (4.7-5.4) {4.22-5.53}
Molybdenum	1.57 (NA) {1.57-1.57}	1.87 (1.66-2.11) {1.54-2.55}	1.92 (1.75-2.12) {1.48-2.26}	1.90 (1.60-2.26) {1.41-2.2}	2.24 (2.11-2.38) {1.8-2.51}	2.02 (1.89-2.16) {1.78-2.3}	1.93 (1.81-2.05) {1.76-2.35}
Nickel	2 ND	{8 ND-0.343}	0.570 (0.38-0.86) {4 ND-1.13}	6 ND	12 ND	{8 ND-1.93}	{8 ND-8.39}
Lead	2 ND	10 ND	11 ND	6 ND	12 ND	10 ND	10 ND
Selenium	2.19 (0.09-55) {1.7-2.82}	3.5 (3.1-4.0) {2.7-4.74}	3.5 (3.2-3.7) {3.07-4.41}	3.0 (2.5-3.6) {2.25-3.89}	3.3 (3.0-3.6) {2.36-3.8}	4.1 (3.7-4.6) {3.83-6}	3.9 (3.5-4.3) {3.3-5.56}
Strontium	0.254 (0.24-0.27) {0.252-0.255}	0.18 (0.15-0.21) {0.122-0.27}	0.18 (0.15-0.21) {0.141-0.353}	6 ND	12 ND	10 ND	10 ND
Vanadium	2 ND	1.9 (1.3-2.8) {1 ND-2.41}	2.3 (2.1-2.5) {1.74-2.83}	6 ND	12 ND	10 ND	10 ND
Zinc	75.5 (30-192) {70.2-81.3}	80.8 (75-87) {69.6-103}	82.2 (80-85) {77-88.4}	70.3 (66-75) {65-75.9}	82.6 (75-91) {71-125}	73.4 (70-77) {66.6-82.6}	69.1 (66-72) {62.6-76.6}

[a] The number before ND is the number not detected.

TABLE B.4. NEST SUCCESS, EGG SUCCESS, CLUTCH SIZE, AND THE NUMBER OF TREE SWALLOW NESTLINGS RAISED TO 12 DAY-OF-AGE AT FOUR SITES ON THE ST LOUIS RIVER NEAR DULUTH, MINNESOTA IN 2001 AND 2002.

			NEST SUCCESS					PROBABILITY					
YEAR	SITE	NO NESTS EGG (NESTLING)	INCUBATION A		NESTLING B		NEST SUCCESS A*B	EGG C		NESTLING D		MEAN CLUTCH SIZE E	NO NESTLINGS TO 12 DAYS OF AGE (A*B*C*D*E)
2001	Indian Point	2(2)	1	A	1	A	1	1	A	1	A	5.5	5.5
	Keene Creek	11(10)	0.93	A	1	A	0.93	0.95	A	1	A	5.2	4.6
	Stryker Bay	11(11)	1	A	1	A	1	0.92	A	0.98	A	5.7	5.1
2002	Indian Point	6(6)	1	A	1	A	1	0.95	A	1	A	5.4	5.1
	Keene Creek	12(12)	1	A	1	A	1	0.92	A	1	A	6.1	5.6
	Stryker Bay	13(12)	0.94	A	1	A	0.94	0.87	A	1	A	6	4.9
	North Bay	22(19)	0.96	A	1	A	0.96	0.95	A	0.98	A	5.6	5.1

Note: Results do not include eggs or nestlings lost to depredation or drowning. No statistical difference was found between sites or years.

TABLE B.5. TRACE ELEMENT CONCENTRATIONS (µg/g DRY WEIGHT) IN TREE SWALLOW EGGS FROM THE FOUR ST. LOUIS RIVER SITES NEAR DULUTH, MINNESOTA IN 2001 (N =13 EGGS) AND 2002 (N = 39 EGGS).

	GEOMETRIC MEAN (µg/g DRY WEIGHT) / (95% CI) / {RANGE}			
ELEMENT	**2001**		**2002**	
Aluminum	1.909 (1.35-2.71) {5nd[a]-4.7 }		1.605 (1.39-1.86) {2nd-4.41}	
Arsenic	1.053 (0.699-1.59) {5nd-3.34}		39 nd	
Boron	23.182 (19.53-27.52) {16.4-39.8}		25.185 (20.8-30.5) {0.962-42.9}	
Barium	2.445 (2.07-2.89) {1.62-4}		1.612 (1.35-1.93) {4nd-3.84}	
Beryllium	13 nd		{24nd-0.0476}	
Cadmium	13 nd		0.377 (0.337-0.422) {0.0962-0.542}	
Chromium	13nd		39 nd	
Copper	2.513 (2.05-3.08) {0.903-3.63}		2.505 (2.26-2.78) {0.481-3.59}	
Iron	111.1 (100.1-123.5) {79.8-142}		93.66 (79.2-110.7) {4.81-150}	
Mercury	0.353 (0.29-0.429) {0.159-0.546}		0.242 (0.217-0.269) {0.0481-0.43}	
Magnesium	379.7 (350.9-410.7) {332-514}		341.7 (270.6-431.4) {4.81-667}	
Manganese	3.65 (3.02-4.42) {2.12-6.53}		2.676 (2.42-2.96) {0.962-3.99}	
Molybdenum	{12nd-0.424}		39 nd	
Nickel	{10nd-1.22}		{37nd-0.952}	
Lead	13 nd		{38nd-0.54}	
Selenium	2.454 (2.26-2.67) {1.93-2.92}		2.171 (1.96-2.40) {0.481-3.94}	
Strontium	4.778 (3.50-6.52) {2.68-15.9}		3.919 (3.37-4.56) {0.481-7.9}	
Vanadium	0.838 (0.64-1.1) {3nd-1.38}		39 nd	
Zinc	67.896 (62.26-74.04) {50.9-86.1}		50.731 (40.89-62.94) {0.962-79.1}	

[a] The number before nd is the number not detected

TABLE B.6. BIOINDICATOR MEASUREMENTS OF TREE SWALLOW NESTLINGS FROM THE FOUR ST. LOUIS RIVER SITES NEAR DULUTH, MINNESOTA

	GEOMETRIC MEAN (95% CI)		
VARIABLE	2001[A]		2002[B]
Liver(g)/ nestling(g)	0.056 (0.052-0.059)		0.055 (0.053-0.057)
Ethoxyresorufin-O-dealkylase (EROD) activity[c]	122 (96-155)		64 (50-82)
Half-peak coefficient of variation (for G1 peak)	3.0 (2.9-3.2)		4.4 (4.1-4.7)
Reduced glutathione (GSH, μmol)	1.9 (1.7-2.2)		2.7 (2.5-2.8)
Total sulfhydryl (TSH, μmol)	16.6 (15.7-17.5)		20.5 (20.1-20.9)
Protein-bound thiol (PBSH, μmol)	14.6 (13.8-15.4)		17.8 (17.3-18.2)
Thiobarbituric acid reactive substances TBARS (nmol)	28.6 (25.6-32.1)		32.1 (29.2-35.2)
Oxidized glutathione (GSSG, nmol)	NA[d]		670 (623-721)
GSSG/GSH	NA		252 (225-281)

[a] N = 23 for all variables except EROD where N = 21.

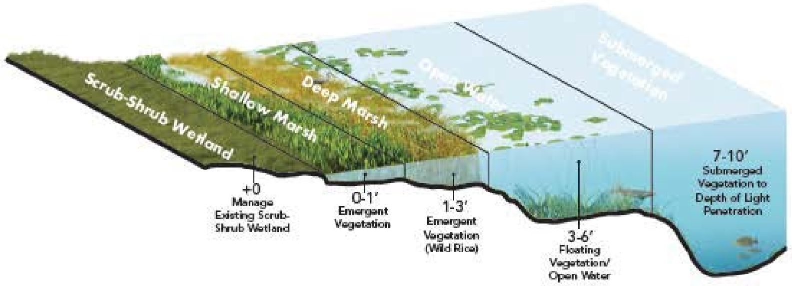
[b] N = 39 for all variables except HPCV where N = 35.

[c] EROD activity measured as pmol product/min/mg microsomal protein

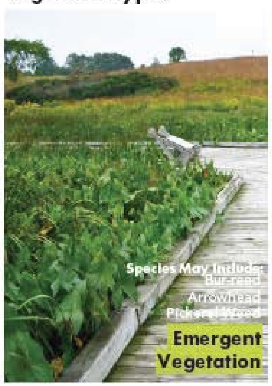
[d] NA indicates that no samples were analyzed

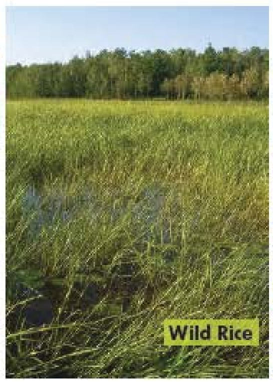
APPENDIX C | KINGSBURY BAY CONCEPT DESIGN

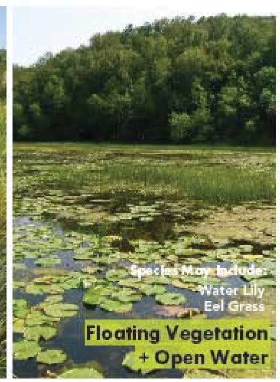
Habitat Types to Be Restored in Kingsbury Bay



Vegetation Types







Dredging Plan

Volume =290,000 CY

Approximate quantity volume to be dredged based of preliminary design

290,000 CY ≈17,059 Dump Truck Loads

Number of truck loads based on end dump truck capacity approximated to be 17 CY

Project Partners

City of Duluth, U.S. Fish and Wildlife Service, Fond Du Lac Band of Lake Superior Chippewa, Minnesota Pollution Control Agency, 1854 Treaty Authority, Natural Resources Research Institute, Lake Superior National Estuarine Research Reserve, Minnesota Land Trust, Environmental Protection Agency Water Lab, U.S. Army Corps of Engineers

Prepared by Barr Engineering Company

Kingsbury Bay Conceptual Restoration Design

Over the past century significant amounts of sediment has washed into Kingsbury Bay from its watershed. This has eliminated fish and wildlife habitat. As part of the larger St. Louis River estuary goals, Kingsbury Bay will be dredged to restore lost habitat.

Primary Restoration Goals

- Develop and protect open water habitat
- Create access and recreational opportunities to the bay
- Create opportunities for wild rice regeneration
- Protect what has been restored by reducing sediment washing into the bay from Kingsbury Creek

In conjunction with this project it will be imperative to stabilize sources of sediment from the watershed.

The sediment that is being deposited into Kingsbury Bay washes in from the Kingsbury Creek Watershed. Increased erosion began at the time of European settlement when forest clear-cutting opened the ground to the erosive force of precipitation and resulted in soil being washed into the creek. Today, the increase of impervious surfaces, including roads, buildings and parking lots, has resulted in larger volumes of stormwater being drained to the creek as overland flow. This stormwater carries sediment eroded from construction sites and other disturbed ground surfaces. The increased volume of water also erodes the creek channel resulting in deeper cutting of the banks and deposition in the bay.

Please note, watershed protection is along Kingsbury Creek, which flows from upland areas through the Lake Superior Zoo and drains to Kingsbury Bay.

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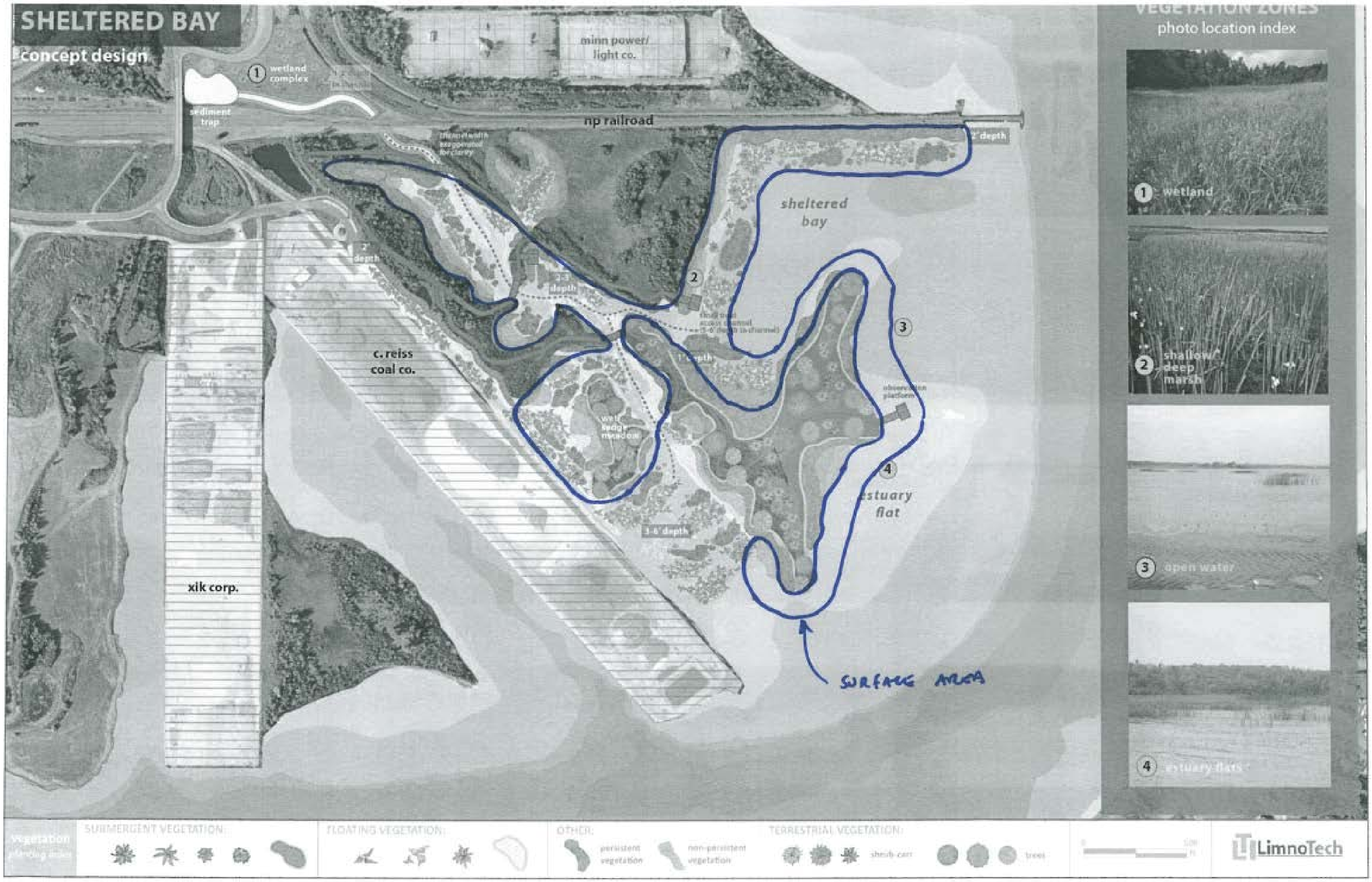
APPENDIX D | GRASSY POINT CONCEPT DESIGN


SHELTERED BAY
concept design
wetland complex
sediment trap
minn power/ light co.
np railroad
sheltered bay
c. reiss coal co.
xik corp.
estuary flat
observation platform
2' depth
3-6' depth
1' depth
SURFACE AREA
VEGETATION ZONES
photo location index
1 wetland
2 shallow/deep marsh
3 open water
4 estuary flats
SUBMERGENT VEGETATION
FLOATING VEGETATION
OTHER
persistent vegetation
non-persistent vegetation
TERRESTRIAL VEGETATION
shrub carr
trees
LimnoTech

APPENDIX E | WILD RICE RESTORATION IN THE ST. LOUIS RIVER ESTUARY

Wild Rice Restoration in the St. Louis River Estuary

June 2016

DRAFT (6/30/16)

Overview

A document entitled ***Wild Rice Restoration Implementation Plan for the St. Louis River Estuary*** (November 27, 2014) provides a blueprint for wild rice restoration opportunities in the estuary. This plan was completed for the Minnesota Department of Natural Resources and included cooperation with a number of other partners including the Minnesota Pollution Control Agency, Wisconsin Department of Natural Resources, Fond du Lac Band of Lake Superior Chippewa, 1854 Treaty Authority, Great Lakes Indian Fish and Wildlife Commission, and Minnesota Land Trust.

The document "identified the area from the Fond du Lac Dam downstream to Grassy Point and Allouez Bay in Wisconsin as the primarily focus for wild rice restoration efforts in the St. Louis River estuary. The defined project area includes sites that historically had wild rice and currently offer the best opportunities for successful wild rice restoration. This plan outlines the specific implementation strategies that will be employed over the next 10 years to restore at least 275 acres of wild rice in the estuary, to provide fish and wildlife habitat, and opportunities for wild rice harvest. Restoring at least 275 acres over the next 10 years represents the first step in a longer term goal of restoring wild rice to a greater abundance and distribution within the estuary. Restoration will include seeding, vegetation management, and protection against herbivory by Canada geese and common carp. Annual monitoring of restoration areas will provide information on success of the restoration efforts and help to inform future management actions and decisions."

Completed and Planned Actions (2015 and 2016)

Under funding obtained by the Minnesota Department of Natural Resources (Outdoor Heritage Fund) and Minnesota Land Trust (National Fish and Wildlife Foundation – Sustain Our Great Lakes), wild rice restoration work was initiated in 2015. Other partners involved in restoration implementation include the Fond du Lac Band, 1854 Treaty Authority, Great Lakes Fish and Wildlife Commission, and Wisconsin Department of Natural Resources. Restoration activities included vegetation treatment (in all areas except Radio Tower Bay where a dredging project had been recently completed) and wild rice seeding in September 2015.

Table 1. Wild Rice Restoration in the St. Louis River Estuary in 2015

Site	Vegetation Treatment (acres)	Area Seeded (acres)	Wild Rice Seed (lbs)
Rask Bay	15	33	2085
Duck Hunter Bay north	14	19	2165
Duck Hunter Bay south	27	40	1642
North Bay	11	14	1666
Radio Tower Bay	0 (29 acres dredged)	15	946
	67 acres	**121 acres**	**8504 lbs**

Under this cooperative effort, these same areas are targeted for wild rice seeding again in 2016. In addition, wild rice restoration work is planned to begin in other areas in 2016:

- Landslide Bay
- Walleye Alley Bay
- Oliver-Bear Island
- Mud Lake northeast

Other but separate cooperative efforts also completed wild rice restoration in 2015:

- Allouez Bay: 38 acres, 1932 pounds of wild rice seed
- Clough Island (east side wetlands): 5-10 acres, 400-500 pounds of wild rice seed

Additional wild rice restoration and seeding is planned for these areas in 2016.

Future Opportunities

In addition to the areas where restoration activities began in 2015, other priorities were identified in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Pokegama Bay
- Oliver Bay – Little Pokegama Bay
- Walleye Alley Bay *(planned to begin in 2016)*
- Foundation Bay
- Landslide Bay *(planned to begin in 2016)*

These areas were selected as priorities for wild rice restoration because they offer the potential to enhance or restore larger blocks wild rice relatively easily. Other areas identified with having a high probability of success for wild rice restoration include:

- Tallas Island
- back bays of the Wisconsin tributaries
- Kingsbury Bay

A second approach is to include wild rice habitat restoration as a component of other larger restoration projects. For example, the removal of wood waste from Radio Tower Bay provided an opportunity to seed wild rice in areas where the resulting substrate and water depth are favorable for establishment. Areas with existing or future restoration plans to address a legacy impact that is beyond the scope of just wild rice restoration include Perch Lake, Mud Lake, Spirit Lake, and Grassy Point. With inclusive planning and consideration, there is the potential for wild rice restoration at these sites.

The Wild Rice Restoration Implementation Plan for the St. Louis River Estuary highlighted 27 areas for wild rice restoration, including the ones listed above. The plan provides a site description, photos, wild rice restoration considerations, and maps for each area. This information can be used as a guide for restoration activities at each area. Table 2 below includes the 27 potential sites identified for wild rice restoration in the estuary.

Table 2. Potential wild rice restoration areas in the St. Louis River estuary.

Area name	Alternate Name(s)	State*
Fond du Lac – Kekuk Island		WI
Rask Bay	Fond du Lac Bay	MN
Perch Lake		MN
Walleye Alley Bay	Horseshoe Island Bay	WI
Landslide Bay	Bryozoan Bay	WI
Duck Hunter Bays	Lunch Bay, Weasel Bay, and Sunset Bay (separate bays within larger bay)	WI
North Bay	Ek's Bay	MN
Foundation Bay	Lyndy's Bay	WI
Radio Tower Bay	Cedar Yard Bay	MN
Bear Paw Island	Bear Island	MN
Oliver Landing		WI
Mud Lake West		MN
Mud Lake East		MN
Oliver Bay – Little Pokegama Bay	Little Pokegama Bay (Oliver Bay)	WI
Spirit Lake		MN
Munger Landing		MN
Clough Island		WI
Clough Island Wetlands	Devil's Elbow and Mosquito Island (separate areas within larger area)	WI
Tallus Island		MN
Kingsbury Bay – Indian Point Bay		MN
Stryker Bay		MN
Dwights Point		WI
Wisconsin Tributaries	Sawmill Bay, Kimball's Bay, Kilner Bay, Kelly Bay, and Chipmunk Hollow	WI
Billings Park		WI
Grassy Point		MN
Pokegama Bay		WI
Allouez Bay		WI

*Designated as the state where the majority of the acreage for the areas is located.

Cost for Wild Rice Restoration

It is difficult to develop probable costs for wild rice restoration since sites will be treated in different ways. The required activities associated with wild rice restoration will vary between sites and likely between years during restoration. For example, not every targeted acre will require site preparation or exclosures, and some areas may only require wild rice seeding. Successful wild rice restoration likely requires a period of three to five years for re-seeding, operating and maintaining exclosures if necessary, and monitoring success and required management actions.

Information taken directly from the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary attempts to provide cost estimates for restoration projects. Table 3 provides unit costs for individual tasks associated with wild rice restoration. Table 4 provides an example of probable costs associated with individual wild rice restoration activities implemented on a theoretical one acre wild rice restoration site over a five-year period. Again, wild rice restoration projects will likely differ in cost based on project specific activities and scale. As projects are undertaken within the estuary, associated costs could be used to better inform restoration planning in the future.

Table 3. Probable unit cost for items associated with wild rice restoration for one calendar year.

Item	Unit Cost	Comments/Notes
SITE PREPARATION		
Vegetation reduction	$1,000/acre	
Vegetation removal	$3,000/acre	Cost may be higher if additional material handling is required.
Permitting and coordination	$2,000 each	
SEEDING		
Seed	$4.00/lbs	Typical seeding rates are between 40 to 60 lbs/acre
Seeding	$200/acre	
EXCLOSURE MATERIAL		
Fence (72-in welded wire)	$1.75/foot	
Steel t-post or 4-inch wood post (8 ft)	$10/post	Posts can be spaced 8 to 24 feet on-center
Buoy	$30/buoy	
Miscellaneous (mylar ribbons, zip ties, sod staples)	$100/exclosure	General cost estimate for additional supplies beyond fence and post material.
INSTALLATION, REMOVAL AND MAINTENANCE OF EXCLOSURE		
Replacement supplies	$50/year	
Installation	$100/hour	4 hours/acre for installation
Removal	$100/hour	2 hours/acre for removal
Inspection and maintenance	$50/hour	Monthly trips may need to be considered during growing season.
MONITORING		
Site-level monitoring	$500/trip	
Aerial survey	$1,500/trip	
Analysis and report	$500/report	

Table 4. Generalized probable cost for completing individual items on one acre of wild rice restoration over a five-year period.

Item	Estimated Cost/Acre Over 5-Year Period
Permitting and coordination (Completed once with annual coordination and updates)	$4,000
Vegetation reduction (Completed twice)	$2,000
Vegetation removal (Completed once)	$3,000
Seeding (3-year period – Material and installation)	$1,200
Exclosure (1-acre perimeter of material, annual operation and maintenance over 5-year period)	$6,100
Monitoring and reporting (Annually over 5-year period)	$5,000

Potential Wild Rice Restoration Projects under Natural Resources Damage Assessment

Potential wild rice restoration projects under Natural Resource Damage Assessment for the St. Louis River Interlake Duluth Tar Site (SLRIDT) include:

- Walleye Alley Bay *(restoration under other initiatives planned to begin in 2016)*
- Landslide Bay *(restoration under other initiatives planned to begin in 2016)*
- Foundation Bay
- Oliver Bay – Little Pokegama Bay
- Clough Island (west)
- Pokegama Bay
- Wisconsin Tributaries
- Tallas Island
- Kingsbury Bay

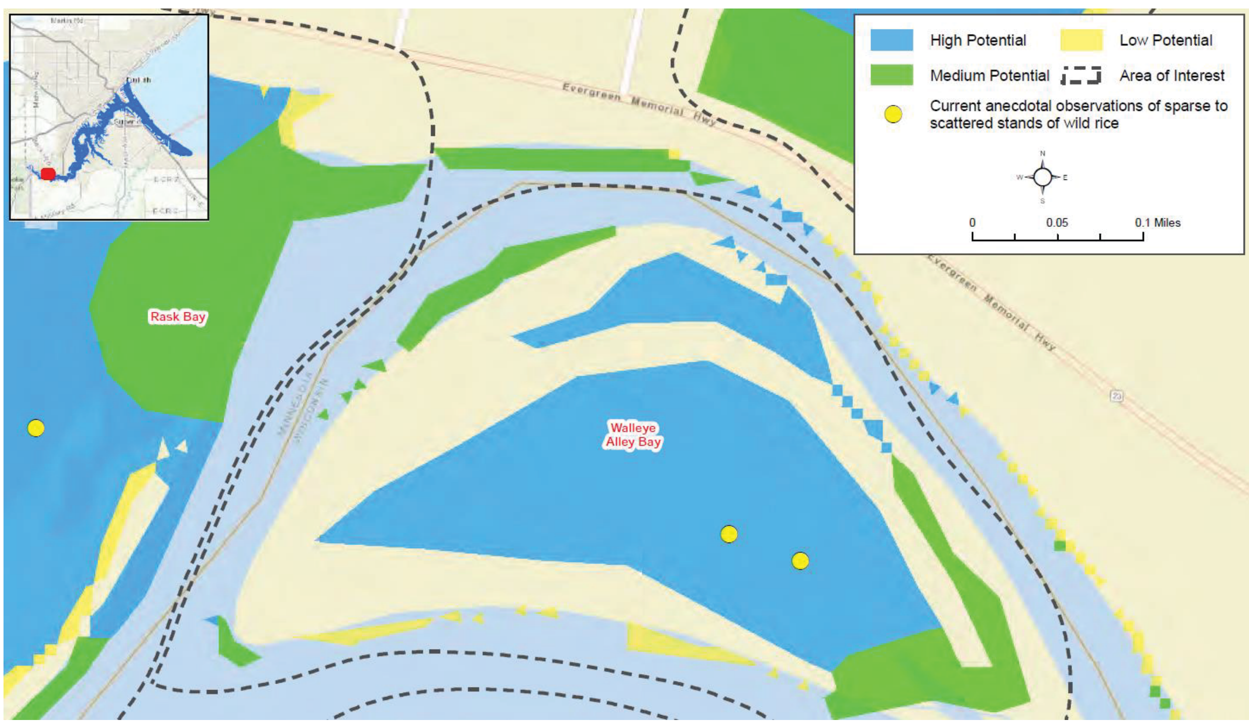
This areas are not incorporated into any other restoration projects, or provide an opportunity to complete wild rice restoration in coordination with other actions (Kingsbury Bay). Brief descriptions of each site and related restoration project information are included below. Some project areas could be broken down into a smaller scope to decrease associated costs.

Walleye Alley Bay: This area consists of two shallow, sheltered bays located within Wisconsin in the upper St. Louis River estuary. Scattered patches of aquatic vegetation with areas of open water are found near the mouths of the bays, and vegetation density increases towards the interior portions of the bays. Current anecdotal wild rice observations have been made near the entrance to the bay. High and medium potential wild rice restoration areas total 30 acres. Opportunities and strategies for Walleye Alley Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use vegetation mowing and seeding where floating and emergent vegetation is present to establish wild rice stands in sheltered bays, and use exclosures to limit herbivory.
- Use vegetation removal and thinning where cattail stands are present to establish wild rice stands.
- Consider using an exclosure across the mouths of the two bays to provide an increased area protected from herbivory.
- Use vegetation mowing and seeding around the outer fringe of the island to establish wild rice stands.

Restoration area: 30 acres
Estimated cost: $209,500

• Permitting	$ 4,000
• Vegetation removal	$90,000 ($3000 acre x 30 acres)
• Seed	$30,000 ($4/lb x 50 lb/acre x 30 acres x 5 years)
• Seeding	$30,000 ($200/acre x 30 acres x 5 years)
• Exclosure	$30,500 ($6100/acre x 1 acre material x 5 years)
• Monitoring	$25,000 ($5,000/yr x 5 years)



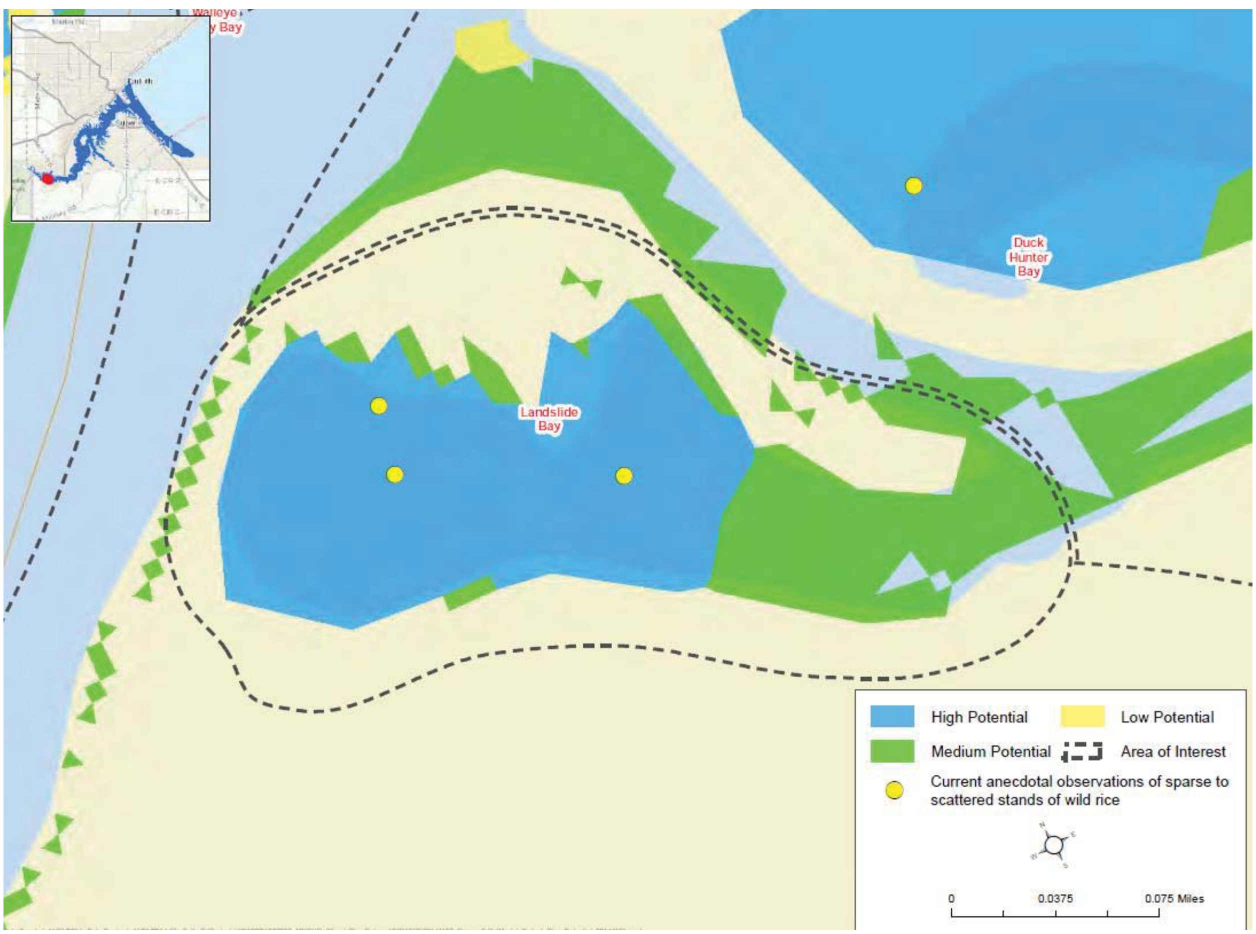
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Landslide Bay: The Landslide Bay area is a shallow, sheltered bay located within Wisconsin in the upper St. Louis estuary. The mouth of the bay lacks floating and emergent vegetation, and vegetation density increases towards the interior of the bay. Current anecdotal observations of wild rice have been made in several locations throughout the bay. High and medium potential wild rice restoration areas total 15 acres. Opportunities and strategies for Landslide Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Establish wild rice stands in a sheltered bay and use exclosures to limit herbivory.
- Use vegetation mowing and seeding where floating and emergent vegetation is present to establish wild rice stands on outer fringe of the peninsula and front half of the bay.

Restoration area: 15 acres
Estimated cost: $134,500

- Permitting $ 4,000
- Vegetation removal $45,000 ($3000 acre x 15 acres)
- Seed $15,000 ($4/lb x 50 lb/acre x 15 acres x 5 years)
- Seeding $15,000 ($200/acre x 15 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



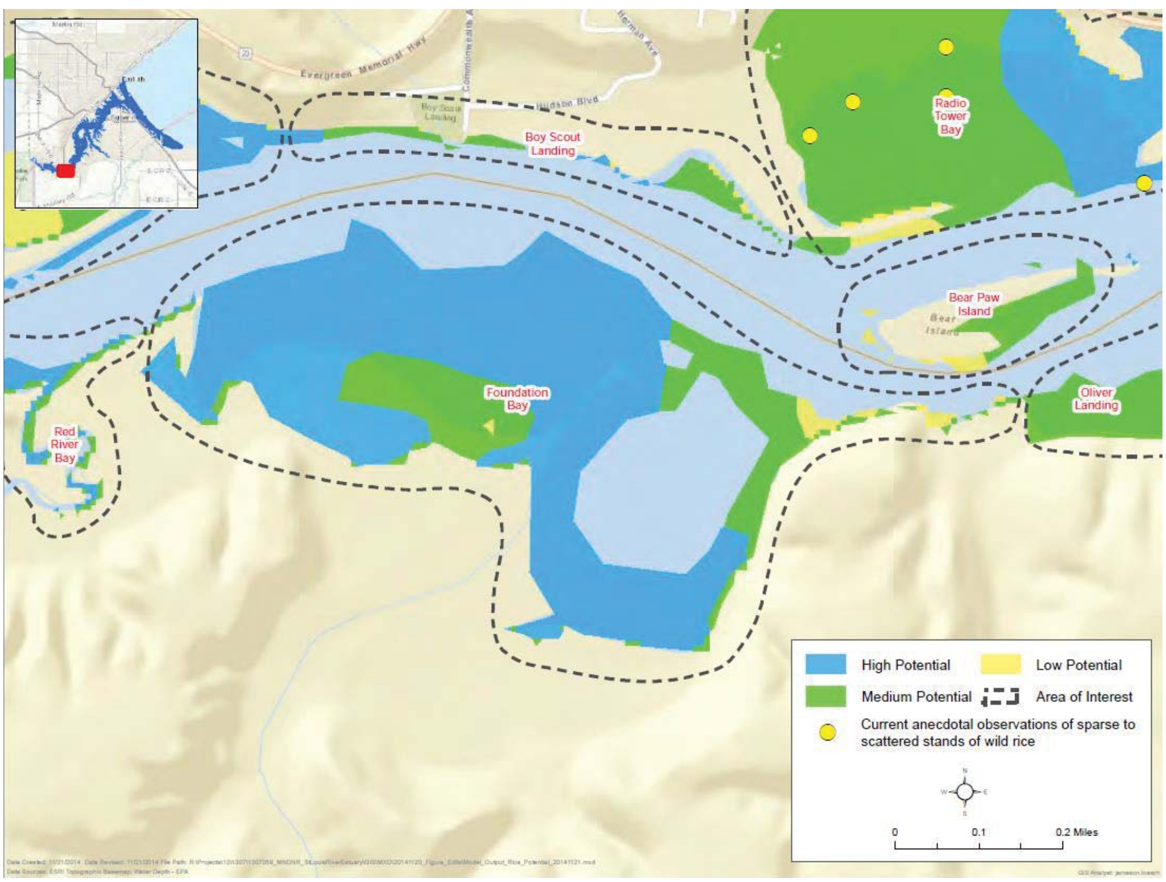
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Foundation Bay: Foundation Bay is located on the Wisconsin site of the St. Louis River estuary across from Boy Scout Landing. Only sparse vegetation is found in the eastern portion of the bay, with a cattail/floating vegetation mat along the southern and western border. A narrow band of vegetation is present around the peninsula. The center of the bay contains remnants of a train trestle, and wood waste may be an issue in some locations. High and medium potential wild rice restoration areas total 108 acres. Opportunities and strategies for Foundation Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use direct seeding to enhance habitat conditions for wild rice on the fringe of the shoreline.
- Use vegetation removal and thinning where the cattail stand and floating mat is present to establish wild rice.

Restoration area: 108 acres
Estimated cost: $335,500

- Permitting $ 4,000
- Vegetation removal $60,000 ($3000 acre x 20 acres) *portion of area*
- Seed $108,000 ($4/lb x 50 lb/acre x 108 acres x 5 years)
- Seeding $108,000 ($200/acre x 108 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



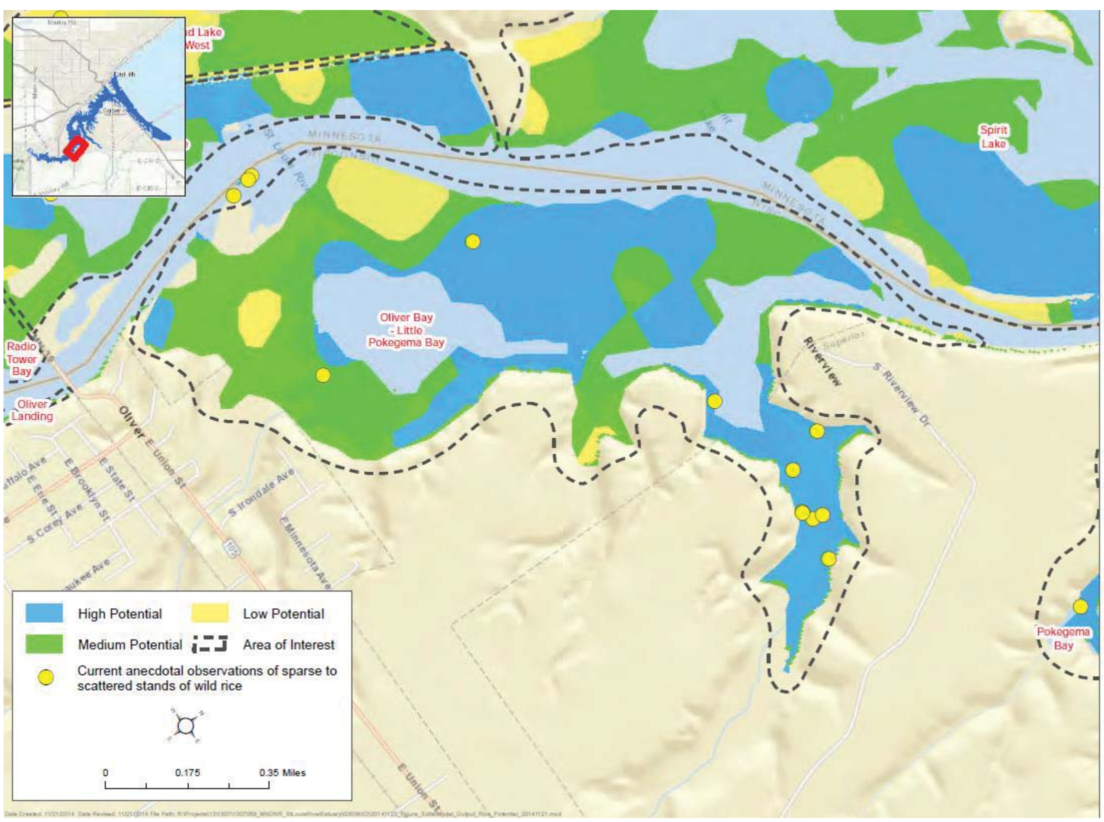
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Oliver Bay – Little Pokegama Bay: The Oliver Bay – Little Pokegama Bay area is on the Wisconsin side of the St. Louis River estuary downstream of the Oliver Bridge. It is a mixture of high quality sedge meadow on the southern portion of the area and cattail and floating mat around the perimeter. The central portion of the area is open water lacking floating and emergent vegetation, likely due to the greater water depths. Wild rice has been observed in the bay where the Little Pokegama River enters the estuary. High and medium potential wild rice restoration areas total 317 acres. Opportunities and strategies for Oliver Bay – Little Pokegama Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use vegetation mowing and seeding where floating and emergent vegetation is present to establish wild rice stands.
- Use vegetation removal and thinning where cattail stands and floating mats are present to establish wild rice stands.

Restoration area: 317 acres
Estimated cost: $753,500

- Permitting $ 4,000
- Vegetation removal $60,000 ($3000 acre x 20 acres) *portion of area*
- Seed $317,000 ($4/lb x 50 lb/acre x 317 acres x 5 years)
- Seeding $317,000 ($200/acre x 317 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



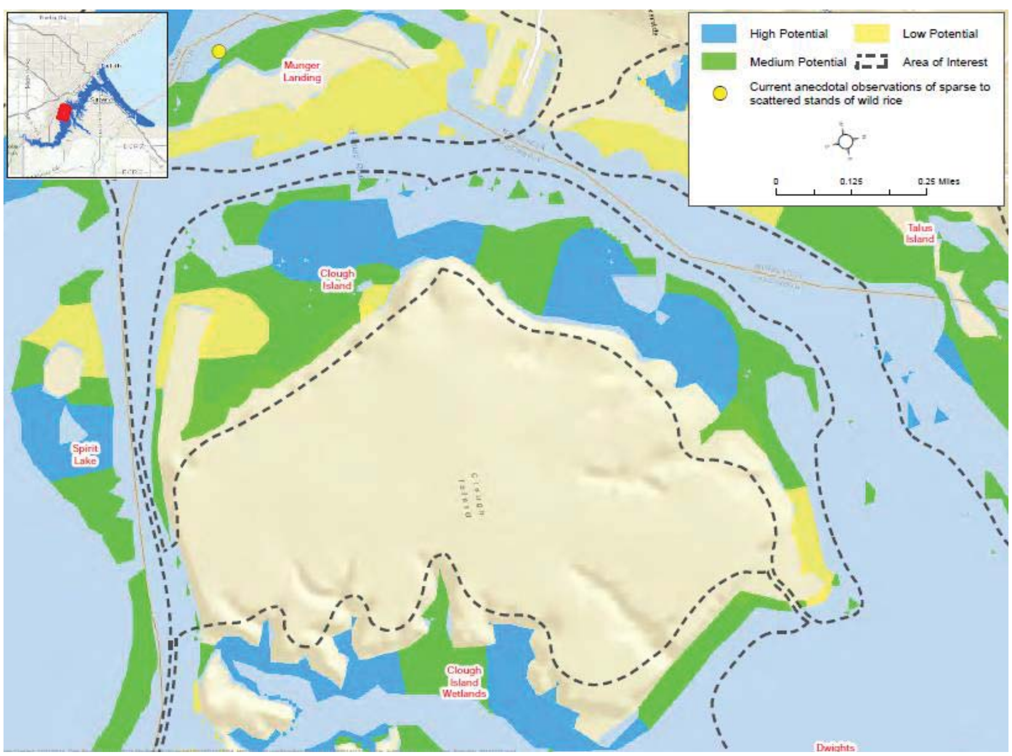
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Clough Island West: Clough Island is located on the Wisconsin side of the St. Louis River estuary. Wild rice restoration opportunities around the island have been divided into two areas: Clough Island west and Clough Island wetlands. Restoration in the Clough Island wetlands (east side and around part of the north) began in 2015. Clough Island west is the shallow and narrow band around the western half of Clough Island, adjacent to the main St. Louis River channel. Cattail stands and floating mats are present adjacent to the shore. Open water with a lack of floating and emergent vegetation is present throughout the majority of the area where water depths may be limiting plant growth. High and medium potential wild rice restoration areas total 104 acres. Opportunities and strategies for Clough Island west outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use vegetation removal and thinning along the shoreline where cattail stands and floating mats are present to establish wild rice stands.
- Seed and install exclosures to establish wild rice where depth allows and no existing floating or emergent vegetation is present.

Restoration area: 104 acres
Estimated cost: $327,500

- Permitting $ 4,000
- Vegetation removal $60,000 ($3000 acre x 20 acres) *portion of area*
- Seed $104,000 ($4/lb x 50 lb/acre x 104 acres x 5 years)
- Seeding $104,000 ($200/acre x 104 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



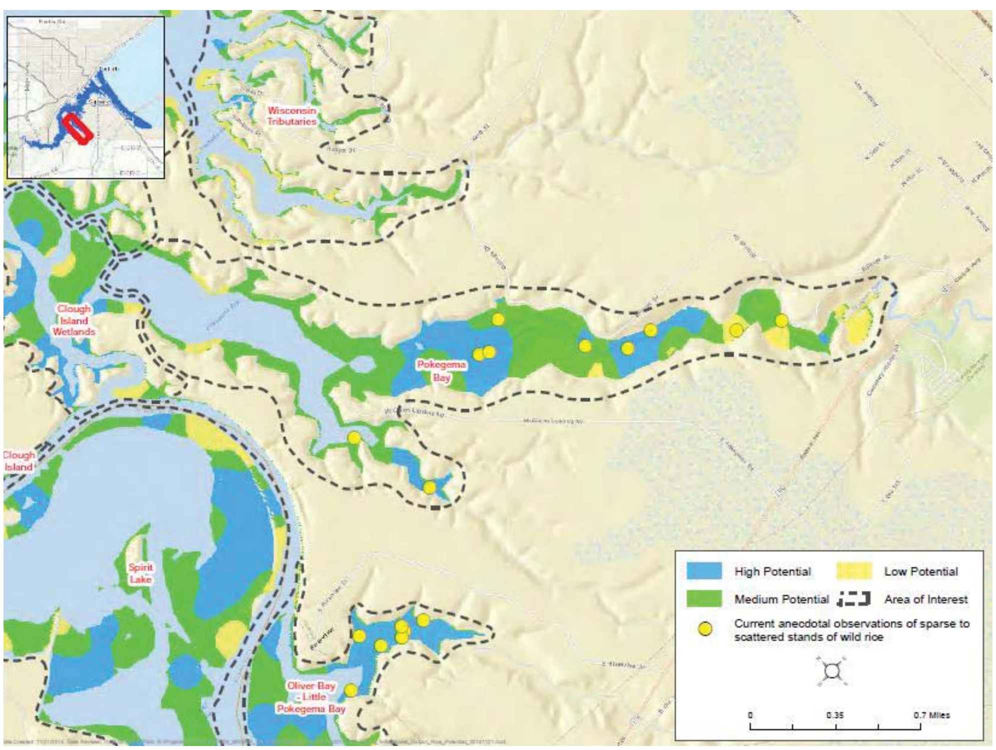
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Pokegama Bay: The Pokegama Bay area is a large bay in Wisconsin where the Pokegama River enters the St. Louis River estuary. Floating and emergent plants are restricted to the fringes at the wide mouth of the bay due to water depth. The bay narrows towards the interior and contains extensive vegetation beds. Pokegama Bay has historically been known as one of best places in the estuary to find wild rice. This must be taken into consideration if any restoration work is proposed. High and medium potential wild rice restoration areas total 318 acres. Opportunities and strategies for Pokegama Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use vegetation mowing and seeding where floating and emergent vegetation is to establish wild rice stands.
- Use vegetation removal and thinning along the northern shoreline where cattail stands and floating mats are present to establish wild rice stands.
- Seed and install exclosures to establish wild rice where depth allows and no existing floating or emergent vegetation is present.

Restoration area: 318 acres
Estimated cost: $845,500

- Permitting $ 4,000
- Vegetation removal $150,000 ($3000 acre x 50 acres) *portion of area*
- Seed $318,000 ($4/lb x 50 lb/acre x 318 acres x 5 years)
- Seeding $318,000 ($200/acre x 318 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Wisconsin Tributaries: The Wisconsin Tributaries area is a series of four shallow, narrow bays where small tributaries or drainages enter the estuary. These bays include Kimball's Bay, Kilner Bay, Kelly Bay, and Chipmunk Bay on the Wisconsin side of the St. Louis River estuary. Each bay is primary composed of open water with limited floating and emergent vegetation that increases into the back portions of the bays. Cattail stands and floating mats are limited. High and medium potential wild rice restoration areas total 75 acres. Opportunities and strategies for the Wisconsin Tributaries outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Use vegetation mowing and seeding where floating and emergent vegetation is to establish wild rice stands.
- Seed and install exclosures to establish wild rice where depth allows and no existing floating or emergent vegetation is present.

Restoration area: 75 acres
Estimated cost: $269,500

- Permitting $ 4,000
- Vegetation removal $60,000 ($3000 acre x 20 acres) *portion of area*
- Seed $75,000 ($4/lb x 50 lb/acre x 75 acres x 5 years)
- Seeding $75,000 ($200/acre x 75 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)

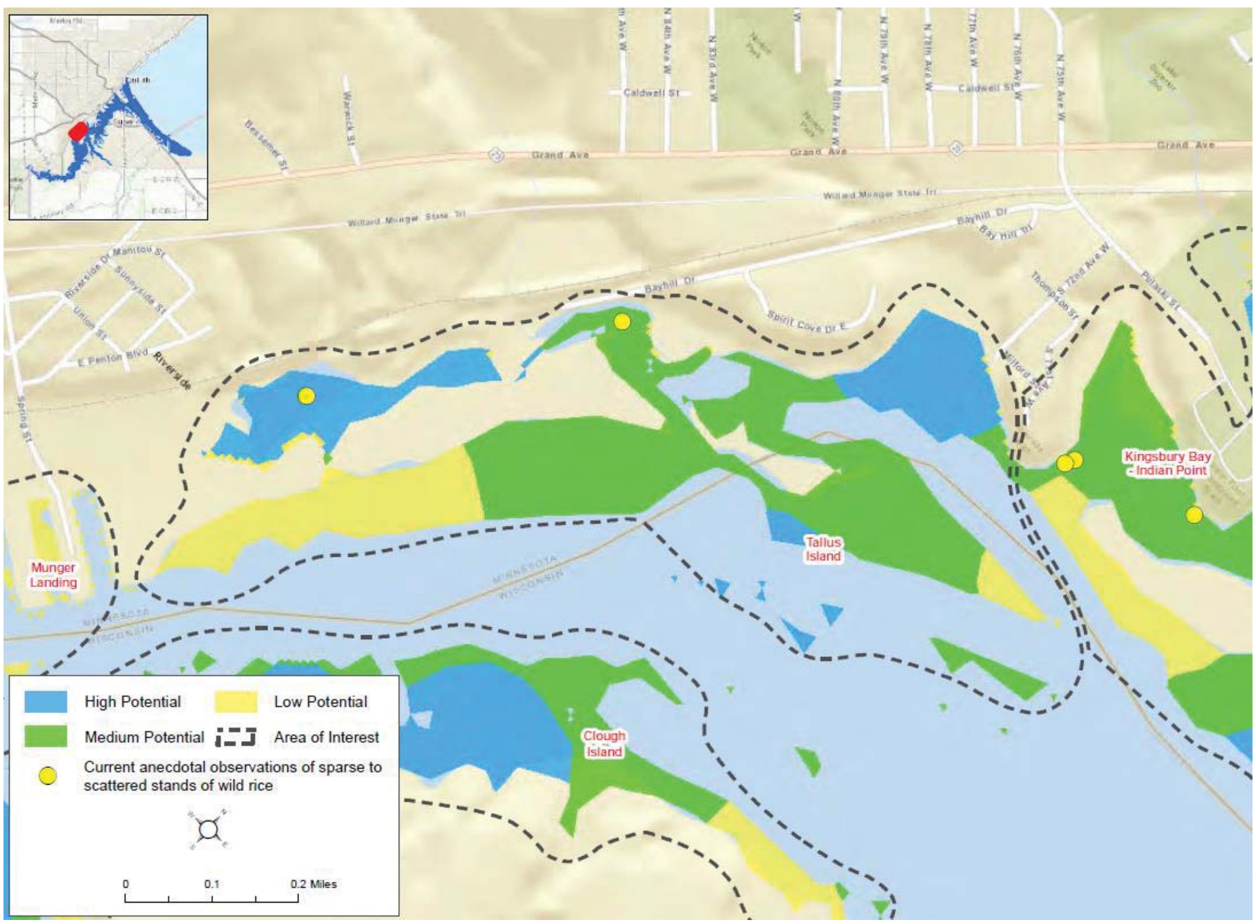
Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

Tallas Island: The Tallas Island area is shallow bay on the Minnesota side of the St. Louis River estuary. The area was the focus of a previous mitigation project for the SLRIDT site, and involved dredging to remove accumulated sediment. Some wild rice plants have been observed in the area in years after completion of the mitigation project. High and medium potential wild rice restoration areas total 69 acres. Opportunities and strategies for Tallas Island outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

- Seed and install exclosures to establish wild rice where depth allows and no existing floating or emergent vegetation is present.

Restoration area: 69 acres ***(option 1 – all high and medium potential)***
Estimated cost: $197,500

- Permitting $ 4,000
- Seed $69,000 ($4/lb x 50 lb/acre x 69 acres x 5 years)
- Seeding $69,000 ($200/acre x 69 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



Wild Rice Restoration Implementation Plan for the St. Louis River Estuary

However, due to other considerations in the Tallas Island area, the potential wild rice restoration area may be reduced. Areas on the river channel side may not be as suitable for restoration as modeling indicates. Existing and proposed access needs may also be an issue. Docks are present in the northeast portion of the area, and increased access for canoes and kayaks is possible in the southwest. If focusing on the interior of the Tallas Island area, high and medium potential wild rice restoration areas total approximately 31 acres. This could further be reduced with access considerations. Vegetation removal may be a component of this project area.

Restoration area: 31 acres ***(option 2- portion of high and medium potential)***
Estimated cost: $151,500

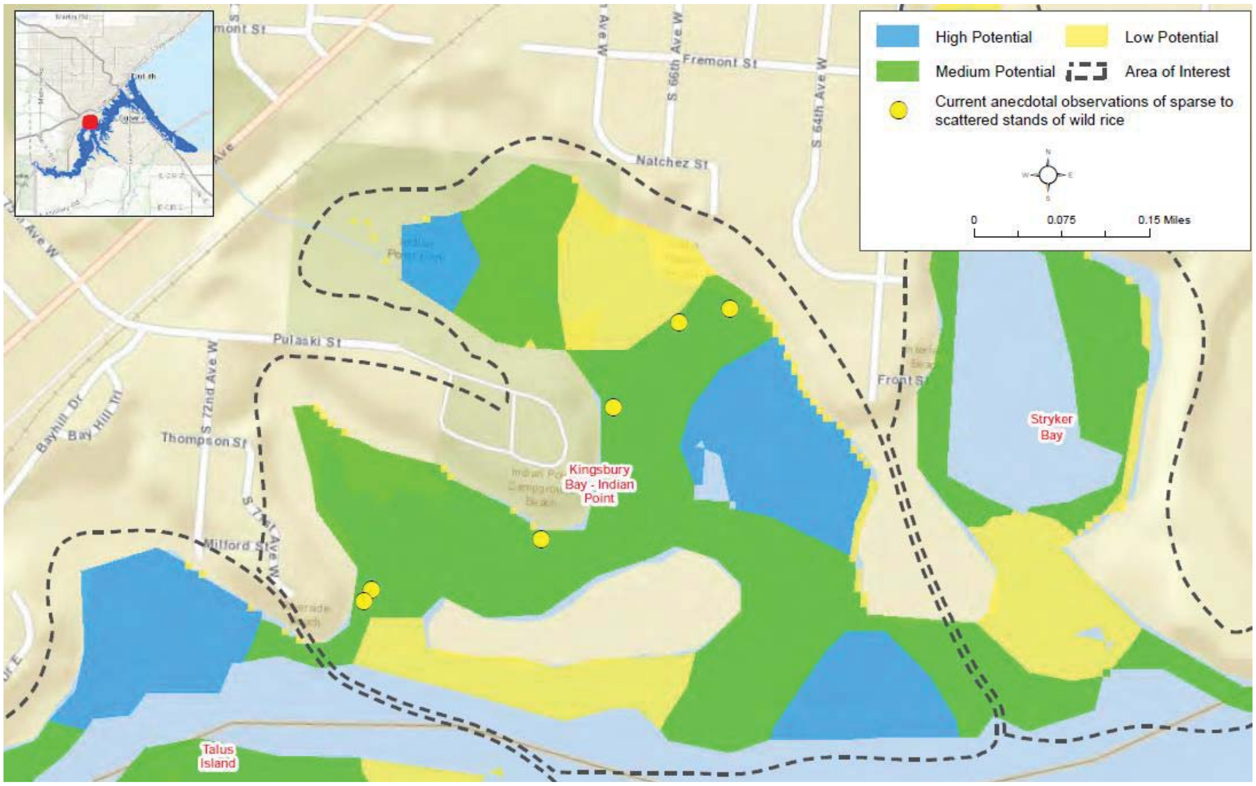
- Permitting — $ 4,000
- Vegetation removal — $30,000 ($3000 acre x 10 acres) *portion of area*
- Seed — $31,000 ($4/lb x 50 lb/acre x 31 acres x 5 years)
- Seeding — $31,000 ($200/acre x 31 acres x 5 years)
- Exclosure — $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring — $25,000 ($5,000/yr x 5 years)

Kingsbury Bay: The Kingsbury Bay – Indian Point Bay area is a series of two shallow bays on the Minnesota side of the St. Louis River estuary. Both bays contain an open water component at their mouths, but cattails and floating mats of aquatic vegetation become more dominant towards the interior of each bay. Current anecdotal observations of wild rice have been made at several locations in the area. Restoration planning is occurring for Kingsbury Bay and includes dredging to remove sedimentation. Dredging and removal of other vegetation provides an opportunity to incorporate wild rice restoration work. Modeling of high and medium potential wild rice restoration areas totaled 72 acres. However, the Kingsbury Bay Conceptual Restoration Design (April 2015) completed for the City of Duluth with input from a number of other contributors outlined approximately 15 acres of habitat for wild rice restoration. Opportunities and strategies for Kingsbury Bay outlined in the Wild Rice Restoration Implementation Plan for the St. Louis River Estuary:

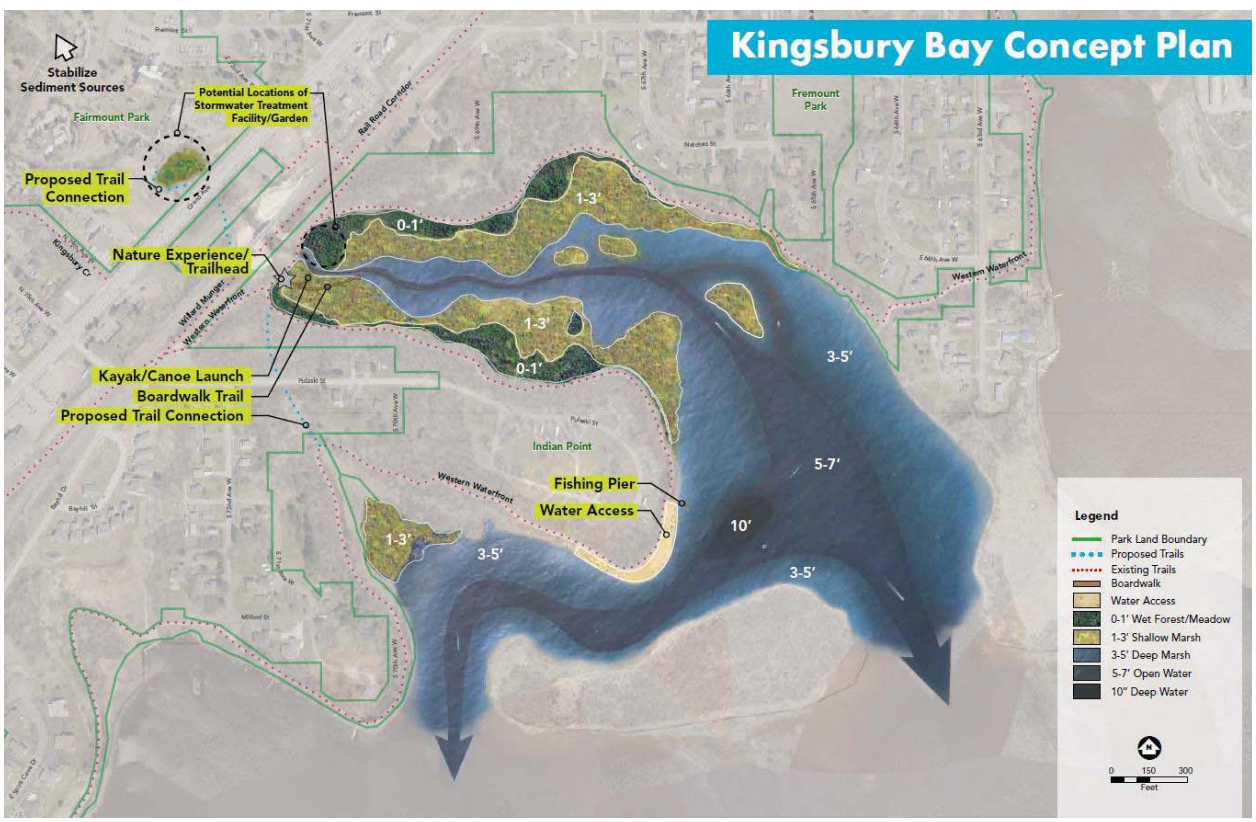
- Use vegetation removal and thinning within each bay where cattail stands and floating mats are present to establish wild rice stands.
- Seed and install exclosures to establish wild rice where depth allows and no existing floating or emergent vegetation is present.

Restoration area: 15 acres
Estimated cost: $89,500

- Permitting $ 4,000
- Seed $15,000 ($4/lb x 50 lb/acre x 15 acres x 5 years)
- Seeding $15,000 ($200/acre x 15 acres x 5 years)
- Exclosure $30,500 ($6100/acre x 1 acre material x 5 years)
- Monitoring $25,000 ($5,000/yr x 5 years)



Wild Rice Restoration Implementation Plan for the St. Louis River Estuary



Kingsbury Bay Conceptual Restoration Design (wild rice targeted in 1-3 foot depths)

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APPENDIX F | PUBLIC COMMENTS ON THE DRAFT RESTORATION PLAN/ENVIRONMENTAL ASSESSMENT

From: Daryl Peterson
To: Wieland, Ronald (DNR)
Subject: SLRIDT RP/EA
Date: Tuesday, July 18, 2017 1:35:34 PM
Attachments: Final SLRIDT RPEA comment letter 7-13-17.docx

Ron,

Please accept the attached comments from the Minnesota Land Trust on the draft Restoration Plan/Environmental Assessment for the St. Louis River/Interlake/Duluth Tar Site.

Thank you,
Daryl

--
Daryl Peterson
Director of Restoration Programs
Minnesota Land Trust
394 South Lake Avenue, Suite 404
Duluth, MN 55802

Phone: (218) 722-1416
Office: (218) 722-4641
dpeterson@mnland.org
www.mnland.org

Protecting the places you treasure...forever.

Minnesota Land Trust
394 S. Lake Avenue, Suite 404
Duluth, MN 55802

Mr. Ronald Wieland
Minnesota Department of Natural Resources
500 Lafayette Road North
St. Paul, MN 55155

Dear Mr. Wieland:

Subject: SLRIDT RP/EA July 18, 2017

The Minnesota Land Trust has reviewed the Consent Decree for Natural Resources Damages for United States of America, State of Minnesota, and State of Wisconsin, Plaintiffs v. XIK, LLC; Domtar, Inc.; and Honeywell International, Inc. Defendants (Case No. 0:17-cv-02368) and the appended draft Restoration Plan/Environmental Assessment for the St. Louis River/Interlake/Duluth Tar Site (SLRIDT site) and is submitting these comments after review of the draft Restoration Plan/Environmental Assessment (draft RP/EA) as published.

We find that:

- The natural resources damages assessment process and the settlement presented in the draft RP/EA appears thorough, fair, and appropriate.
- The restoration alternatives considered in the draft RP/EA comprise a reasonable suite of actions to compensate for damages arising from historical activities at the SLRIDT site. The three planned habitat restoration activities are aligned with existing natural resource recovery plans, including the Lower St. Louis River Habitat Plan and the St. Louis River Restoration Initiative.
- While the lost opportunities and ecological services are not recoverable and difficult to fully quantify the selected activities presented in the draft RP/EA provide reasonable and practicable restitution from historical activities at the SLRIDT site. Specifically, the planned Wild Rice Restoration and Cultural Education Opportunities projects will provide significant benefits to public users by providing increased opportunities for engagement with the invaluable resources of the St. Louis River Estuary.

In conclusion, the Minnesota Land Trust supports the draft RP/EA as published and would like to thank the Trustees for their tireless work to evaluate and select projects for restoring injury to natural resources and ecological services from the historical release of hazardous substances at the SLRIDT site.

Sincerely,

Daryl Peterson
Director of Restoration Programs
Minnesota Land Trust

From:	[redacted] on behalf of Carol Reschke
To:	Wieland, Ronald (DNR)
Subject:	SLRIDT RP/EA
Date:	Monday, August 07, 2017 5:02:12 PM

To: Ronald Wieland

I've reviewed the draft Restoration Plan and Environmental Assessment for the St. Louis River Interlake/Duluth Tar (SLRIDT) site. I commend the Trustee Council on a thoughtful presentation of the natural resource damages and restoration alternatives. I strongly support the selection of alternatives B (Kingsbury Bay Restoration), D (Kingsbury Creek Watershed Protection), and E (Wild Rice Restoration with Cultural Education Opportunities). I think these three restoration projects will be an excellent way to utilize funding from the SLRIDT NRDAR towards the goal of restoring fish and wildlife habitats in the St. Louis River estuary.

I think that the proposed monitoring described in Chapter 7 of the RP/EA is especially important, including monitoring prior to, during, and after restoration construction occurs. Since planning for Kingsbury Bay Restoration is underway (led by MDNR), and plans are to begin dredging in early 2018, I think it is especially urgent to include additional pre-restoration monitoring of the areas to be dredged in the 2017 growing season. In 2015 staff from the University of Minnesota Duluth's Natural Resources Research Institute conducted limited sampling of aquatic vegetation in Kingsbury Bay, and we plan to do a small amount of sampling there this year for a wild rice research project. I think it would be useful to more thoroughly document pre-restoration vegetation conditions in Kingsbury Bay this growing season, if possible. Additional vegetation samples in the areas in and near the dredged areas in Kingsbury Bay may be necessary to adequately assess the impacts and success of the dredging and restoration work after the work is completed.

Similarly, I think it's important for wild rice restoration efforts to document conditions prior to restoration efforts for comparison with post-restoration conditions. Since wild rice in the estuary grows in a mixed macrophyte plant community with several other aquatic plants, I think it is important to document the plant community composition as well as the condition and density of wild rice plants in order to assess the success of a wild rice restoration.

Thanks for the opportunity to comment.

Sincerely,

Carol Reschke

--

Carol Reschke
University of Minnesota Duluth
Natural Resources Research Institute
5013 Miller Trunk Hwy.
Duluth, MN 55811

(218) 788-2738

creschke@nrri.umn.edu

www.nrri.umn.edu

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APPENDIX G | FINDING OF NO SIGNIFICANT IMPACT AND ENVIRONMENTAL ACTION STATEMENT

U.S. DEPARTMENT OF INTERIOR
U.S. FISH AND WILDLIFE SERVICE
500 AMERICAN BLVD. WEST, SUITE 990
BLOOMINGTON, MN 55437-1458

FINDING OF NO SIGNIFICANT IMPACT

FOR THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE ST. LOUIS RIVER INTERLAKE DULUTH TAR SITE

The United States Department of the Interior (DOI, acting through the United States Fish and Wildlife Service and the Bureau of Indian Affairs), the National Oceanic and Atmospheric Administration (NOAA), the Fond du Lac Band of Lake Superior Chippewa, the 1854 Treaty Authority, the Minnesota Department of Natural Resources (MNDNR), the Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources serve as Natural Resource Trustees (collectively Trustees) under the Comprehensive Environmental Response, Compensation and Liability Act for the St. Louis River Interlake Duluth Tar (SLRIDT) Site. The Trustees prepared a Restoration Plan (RP) and Environmental Assessment (EA) to propose and evaluate restoration alternatives to restore injured natural resources that utilize aquatic habitats and provide ecological, cultural, and/or recreational services. Pursuant to the National Environmental Policy Act of 1969 (NEPA), DOI and NOAA prepared the EA as joint lead agencies in accordance with 40 C.F.R. § 1501.5.

Alternatives Considered

Potential projects were identified based on local habitat and restoration plans (e.g., the Lower St. Louis River Habitat Plan, the City of Duluth's St. Louis River Corridor Initiative, the MNDNR's St. Louis River Restoration Initiative, and Remedial Action Plan updates) as well as priority areas identified by the St. Louis River Great Lakes Restoration Initiative program. Through these efforts, the Trustees identified five potential restoration alternatives: Alternative A: No Action Alternative; Alternative B: Kingsbury Bay Restoration; Alternative C: Grassy Point Restoration; Alternative D: Kingsbury Creek Watershed Protection; and Alternative E: Wild Rice Restoration.

The Trustees evaluated potential restoration alternatives under the Department of the Interior Natural Resource Damage Assessment and Restoration regulations (43 C.F.R. § 11.82(d)) and site-specific factors to determine whether the alternatives would provide appropriate restoration benefits. Alternatives that met the screening criteria were then evaluated further to identify the ecological benefits of the projects as they related to the SLRIDT site injuries. Comments and additional information received during the public comment period were used to evaluate the alternatives described in the draft RP/EA.

Evaluation of a no-action alternative is required under NEPA (40 CFR 1502.14(d)). The selection of this alternative by the Trustees would mean that no actions would be taken by the Trustees to restore injured wildlife and aquatic habitat resources, and that the public would not receive compensation for losses from SLRIDT site that occurred in the past or are ongoing. This alternative may be used as a benchmark to evaluate the comparative benefit of other actions. Because no action is taken, this alternative also has no cost.

The Trustees have identified three restoration alternatives as the preferred alternative to fund and implement. The preferred alternative consists of a suite of restoration projects that cumulatively aim to compensate for injuries to wildlife and aquatic habitat resources that occurred when hazardous substances were released from the SLRIDT site.

Public Comment

Following review and evaluation of the restoration alternatives, the Trustees released the draft RP/EA on July 6, 2017 with a public comment period held through August 7, 2017. The Trustees received two comments on the draft RP/EA. These comments were addressed in the final RP/EA and used to make the final selection of projects.

Environmental Consequences Analysis Summary for the Preferred Alternative

Alternative B: Kingsbury Bay Restoration

Some biological and socio-economic disruption will occur during the construction of this project, but is expected to be temporary. Any adverse impacts from the physical construction of the project are expected to be outweighed by the major, long-term, localized and broader benefits expected post-construction. This project also seeks to foster a culture of stewardship through the wild rice and cultural education components.

Alternative D: Kingsbury Creek Watershed Protection

The use of heavy machinery will cause temporary adverse impacts in the area (e.g., increased noise, turbidity), but are anticipated to be outweighed by the beneficial impacts to water quality and benthic habitat areas locally and broadly. The restricted creek access will likely limit socio-economic and cultural impacts in the area. Broader, beneficial cultural impacts may occur to the extent that reduced sedimentation increases desirable habitat for biota and wild rice stands in the estuary.

Alternative E: Wild Rice Restoration with Cultural Education Opportunities

Minimal physical, biological, socio-economic, or cultural disturbances are expected from this restoration project. Some disruption may occur in areas needing vegetation removal or exclosures, but is expected to be minor and temporary. On balance, benefits to fish and wildlife are expected to outweigh any short term, minor adverse impacts resulting from these efforts. Furthermore, due to the cultural importance of wild rice to local tribes, the Trustees expect that there will be long-term and possibly permanent beneficial cultural impacts.

Determination

Based upon information contained within the final RP/EA, DOI has determined that Alternatives B, D, and E described above will not significantly affect the quality of the human environment. Accordingly, preparation of an Environmental Impact Statement on the proposed action is not warranted.

It is my decision to issue the Restoration Plan and begin implementation.

ACTING Regional Director/DOI Authorized Official

11/27/17
Date

UNITED STATES FISH AND WILDLIFE SERVICE

ENVIRONMENTAL ACTION STATEMENT

Within the spirit and intent of the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act (NEPA), and other statutes, orders, and policies that protect fish and wildlife resources, I have established the following administrative record and determined that the action of wildlife and aquatic habitat restoration, as described in the *Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site*:

_____ is a categorical exclusion as provided by 51 6 DM 2, Appendix I and 516 DM 6, Appendix 1. No further NEPA documentation will therefore be made.

__X__ is found not to have significant environmental effects as determined by the attached environmental assessment and finding of no significant impact.

_____ is found to have significant effects and, therefore, further consideration of this action will require a notice of intent to be published in the Federal Register announcing the decision to prepare an EIS.

_____ is not approved because of unacceptable environmental damage, or violation of Fish and Wildlife Service mandates, policy, regulations, or procedures.

_____ is an emergency action within the context of 40 CFR 1506.11. Only those actions necessary to control the immediate impacts of the emergency will be taken. Other related actions remain subject to NEPA review.

Other supporting documents (list):

__X__ Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site

[signature]
Regional Director/DOI Authorized Official
Charles M. Wooley
Acting Regional Director

11/27/17
Date

FINDING OF NO SIGNIFICANT IMPACT

Final Restoration Plan and Environmental Assessment for the St. Louis River Interlake / Duluth Tar Site, Duluth, Minnesota

Background:

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Natural Resource Trustee Agencies (Trustees), including the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service and the Bureau of Indian Affairs on behalf of the Department of the Interior (DOI), the Fond du Lac Band of Lake Superior Chippewa, the 1854 Treaty Authority, the Minnesota Department of Natural Resources (MNDNR), the Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources collectively prepared the St. Louis River Interlake/Duluth Tar (SLRIDT) Site Restoration Plan (RP) and Environmental Assessment (EA). The RP/EA evaluates restoration alternatives for natural resource injuries incurred from historical releases of contaminants from the National Priorities List Superfund site known as the SLRIDT Site in Duluth, Minnesota. The Trustees prepared a RP/EA to propose and evaluate restoration alternatives to restore injured natural resources that utilize aquatic habitats and provide ecological, cultural, and/or recreational services. Pursuant to the National Environmental Policy Act of 1969 (NEPA), DOI and NOAA prepared the RP/EA as joint lead agencies in accordance with 40 C.F.R. § 1501.5.

Injuries to natural resources in the 93.6-acre site including surface water, sediment, aquatic invertebrates, aquatic vegetation, fish, birds, and other wildlife, were caused by exposure of those resources primarily to polycyclic aromatic hydrocarbons (PAHs). A Natural Resource Damage Assessment (NRDA) determined that these aquatic resources within the 93.6-acre Assessment Area were affected by this contamination. These injuries resulted in a loss of the ecological and recreational services that Assessment Area resources would otherwise have provided. The Trustees identified restoration activities that would compensate the public for these resource injuries. The RP/EA is intended to guide implementation of NRDA restoration activities and analyze the environmental impacts of the alternatives considered by the Trustees to restore, replace, rehabilitate, and/or acquire the equivalent of the injured natural resources and their services.

Restoration Projects:

The Trustees cooperatively developed the Final RP/EA, which examines and evaluates potential projects to restore injured natural resources in the St. Louis River estuary. The Trustees evaluated potential restoration alternatives under the CERCLA Natural Resource Damage Assessment and Restoration regulations (43 C.F.R. § 11.82(d)) and NEPA, and site-specific factors, to determine whether the alternatives would provide appropriate restoration benefits. Alternatives that met the screening criteria factors including location, technical feasibility, cost effectiveness, provision of natural resource services similar to those lost due to contamination, and net environmental consequences, were evaluated further to identify the benefits of the projects as they related to the SLRIDT site injuries. Comments and additional information received during the public comment period were also used to assess the alternatives described in the Draft RP/EA. Based on these selection criteria, the Trustees identified Alternatives B, D, and E as the selected alternative. Under the selected alternative, the Trustees will conduct shallow sheltered embayment enhancement/restoration at Kingsbury Bay, which includes recreational access and cultural education opportunities; implementing watershed protection at Kingsbury Creek; and restoring wild rice in the St. Louis River estuary.

Public Involvement:

Throughout the NRDA process, the Trustees have made information available to the public. The Trustees sought the public's input on a draft version of the RP/EA. Public review of the Draft RP/EA occurred from July 6, 2017 to August 7, 2017. Two public comments in support of the Draft RP/EA and the preferred alternative were received. These comments were addressed in the Final RP/EA and considered in the final selection of projects.

Alternatives Considered Under CERCLA:

Potential projects were identified based on injuries assessed at the site, local habitat and restoration plans (e.g., the Lower St. Louis River Habitat Plan, the City of Duluth's St. Louis River Corridor Initiative, the MNDNR's St. Louis River Restoration Initiative, and Remedial Action Plan updates) as well as priority areas identified by the St. Louis River Great Lakes Restoration Initiative program. Through these efforts, the Trustees identified five potential restoration alternatives: Alternative A: No Action Alternative; Alternative B: Kingsbury Bay Restoration; Alternative C: Grassy Point Restoration; Alternative D: Kingsbury Creek Watershed Protection; and Alternative E: Wild Rice Restoration. Based on selection factors including location, technical feasibility, cost effectiveness, provision of natural resource services similar to those lost due to contamination, and net environmental consequences, the Trustees identified Alternatives B, D, and E as the preferred alternatives which was finalized after the public review and comment period (July 6, 2017 – August 7, 2017).

Evaluation of a no-action alternative is required under NEPA (40 CFR 1502.14(d)). The selection of this alternative by the Trustees would mean that no actions would be taken by the Trustees to restore injured wildlife and aquatic habitat resources, and that the public would not receive compensation for losses from SLRIDT site. The no-action alternative may be used as a benchmark to evaluate the comparative benefit of other actions. Since no action is taken, this alternative has no cost.

Environmental Consequences:

NEPA requires an analysis of the effects of federal actions on the quality of the human environment. The Federal Trustees have determined it is appropriate to combine the RP and

NEPA impacts analysis into one document, and have included an evaluation of alternatives for restoration under both CERCLA and NEPA in the RP/EA.

NOAA's Companion Manual (Jan 13, 2017) for NOAA Administrative Order (NAO) 216-6A (April 22, 2016) contains criteria for determining the significance of the impacts of a proposed action. In addition, the Council on Environmental Quality (CEQ) regulations at 40 C.F.R. § 1508.27 state that the significance of an action should be analyzed both in terms of "context" and "intensity." The significance of this action is analyzed based on the NAO 216-6 criteria and CEQ's context and intensity criteria. The criteria listed below are relevant to making a Finding of No Significant Impact, and have been considered individually, as well as in combination with the others, and include:

(1) Can the proposed action reasonably be expected to cause substantial damage to the ocean and coastal habitats and/or essential fish habitat as defined under the Magnuson Stevens Act and identified in Federal Management Plans (FMPs)?

> Response: No. As documented in the Final RP/EA, the Trustees do not expect the selected projects to cause substantial damage to coastal habitats. Essential fish habitat, as defined under the Magnuson-Stevens Act, is not present within the Great Lakes. Any short-term and temporary localized impacts from the restoration activities, such as dredging, invasive species removal, vegetation removal for wild rice seeding, and recreational access improvements would be short-term and minimized by the use of Best Management Practices (BMPs). These impacts are expected to be outweighed by the major, long-term, localized and broader benefits expected post-construction. As documented in the Final RP/EA, the Trustees expect the selected projects to result in long-term, beneficial impacts to coastal habitat and associated species by reducing erosion in the watershed, dredging accumulated sediment, removing invasive species, seeding wild rice and planting native vegetation. This will increase the area and ecological function of wetland habitat and lead to increased habitat stability.

(2) Can the proposed action be expected to have a substantial impact on biodiversity and/or ecosystem function within the affected area (e.g., benthic productivity, predator prey relationships, etc.)?

> Response: No. The selected projects are not expected to have any substantial impacts beyond a local level; the beneficial impacts on ecosystem function and species biodiversity would not be substantial at a regional or larger scale. As documented in the Final RP/EA, the selected projects are expected to result in major/moderate long-term beneficial impacts to plants and wildlife, providing additional habitat to support recovery of these sensitive communities and resulting in greater habitat complexity, diversity, and productivity. The projects are expected to increase the availability and quality of wetland habitat, including wild rice. As such there would be an expected increase in ecosystem

function and species biodiversity. Any potential adverse impacts are expected to be minimal, short-term, localized, and not expected to decrease function or species biodiversity.

(3) Can the proposed action reasonably be expected to have a substantial adverse impact on public health and safety?

Response: No. The selected projects are not expected to have any impacts on public health and safety. The implementation of the selected restoration projects would not present any unique physical hazards to humans.

(4) Can the proposed action reasonably be expected to adversely affect endangered or threatened species, their critical habitat, marine mammals, or other non-target species?

Response: No. The selected projects are not expected to adversely affect endangered or threatened species, their critical habitat, or other non-target species. Overall, the selected projects are expected to benefit species through improved habitat availability and function.

(5) Are significant social or economic impacts interrelated with natural or physical environmental effects?

Response: No. The Trustees do not expect there to be significant adverse social or economic impacts interrelated with natural or physical environmental effects of the selected projects. It is anticipated that the selected projects will provide positive social interactions with the natural environment.

(6) Are the effects on the quality of the human environment likely to be highly controversial?

Response: No. The effects on the quality of the human environment from the selected projects are not highly controversial. The selected projects are anticipated to have long-term, beneficial impacts to the human environment through improved public access to natural resources, and protected viewsheds. These impacts have not shown to be controversial.

(7) Can the proposed action reasonably be expected to result in substantial impacts to unique areas, such as historic or cultural resources, park land, prime farmlands, wetlands, wild and scenic rivers, essential fish habitat, or ecologically critical areas?

Response: No. The project areas and associated environment includes marsh and scrub shrub wetland, benthic habitat, a small creek, and river estuary. While these areas do contain unique characteristics, the selected projects are expected to be beneficial to the unique ecological characteristics of the area, and improve ecological function. Furthermore, no unique or rare habitat would be destroyed due to the restoration alternative selected in the RP/EA. Additionally, members of local tribal entities (Bois Forte, Fond du Lac, and Grand Portage Bands of the Lake Superior Chippewa) participated in the NRDA and assisted with the development of the wild rice and cultural education components of the selected alternative. These cultural components would provide long-term benefits to the area by fostering a culture of stewardship and providing opportunities to connect to the rich history of the St. Louis River estuary.

Additionally, the projects will not adversely affect National Historic Places or cultural, scientific, or historic resources. Consultation with state, federal and tribal historic preservation offices pursuant to Section 106 of the National Historic Preservation Act will be undertaken for each restoration project that will be implemented.

(8) Are the effects on the human environment likely to be highly uncertain or involve unique or unknown risks?

Response: No. The project area is well known to the project implementers, and project implementation techniques are not unique, controversial, or untried.

(9) Is the proposed action related to other actions with individually insignificant, but cumulatively significant impacts?

Response: No. The Trustees evaluated the restoration projects selected in the Final RP/EA in conjunction with other known past, proposed or foreseeable closely related projects and determined that there are no significant cumulative impacts. The projects will only temporarily impact resources during construction activities and will utilize all BMPs to minimize these impacts. Cleanup activities and other restoration projects that may occur in the vicinity would similarly incorporate BMPs. Over the mid- and long-term, the project will be wholly beneficial with no potential for incremental contribution to significant cumulative impacts.

(10) Is the proposed action likely to adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural or historical resources?

Response: No. As noted above, the project will not adversely affect National Historic Places or cultural, scientific, or historic resources, and all necessary consultations and concurrences will occur prior to project implementation.

(11) Can the proposed action reasonably be expected to result in the introduction or spread of a non-indigenous species?

Response: No. The Kingsbury Bay project expects to reduce invasive, non-indigenous species through species removal and the Kingsbury Creek watershed protection project will reduce the likelihood of invasive species establishment through improved hydrologic and ecological function and stability to reduce sedimentation within the bay which ultimately led to extensive invasive cattail growth.

(12) Is the proposed action likely to establish a precedent for future actions with significant effects or represent a decision in principle about a future consideration?

Response: No. The selected restoration projects are not expected to set a precedent for future actions that would significantly affect the human environment or represent a decision in principle about a future consideration.

(13) Can the proposed action reasonably be expected to threaten a violation of Federal, State, or local law or requirements imposed for the protection of the environment?

Response: No. Implementation of the selected projects would not require any violation of federal, state or local laws designed to protect the environment.

(14) Can the proposed action reasonably be expected to result in cumulative adverse effects that could have a substantial effect on the target species or non-target species?

Response: No. As described above and in the Final RP/EA, the Trustees evaluated the restoration projects and determined that there are no significant cumulative impacts.

DETERMINATION

Based upon an environmental review and evaluation of the "Final Restoration Plan and Environmental Assessment for the St. Louis River Interlake/Duluth Tar Site" as summarized above, it is determined that implementation of the restoration plan does not constitute a major Federal action significantly affecting the quality of the human environment under the meaning of Section 102(2)(c) of the National Environmental Policy Act of 1969 (as amended). Accordingly, an environmental impact statement is not required for this action.

Patricia A. Montanio
Director, Office of Habitat Conservation
National Marine Fisheries Service

9/26/2017
Date

David G. Westerholm
Director, Office of Response and Restoration
National Ocean Service

9/27/2017
Date

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APPENDIX H | TRUSTEE SIGNATURE PAGES

U.S. DEPARTMENT OF THE INTERIOR APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with the U.S. Department of Interior policy regarding documentation for natural resource damage assessment and restoration projects (521 DM 3), the Authorized Official for the Department must demonstrate approval of draft and final Restoration Plans with their associated National Environmental Policy Act documentation, with concurrence from the Department's Office of the Solicitor.

The Authorized Official for the Saint Louis River Interlake/Duluth Tar Site is the Regional Director for the U.S. Fish and Wildlife Service's Midwest region.

By the signature below, the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site is hereby approved.

Approved: ______________________ 11/27/17
Regional Director — Date
Midwest Region
U.S. Fish and Wildlife Service
(Authorized Official for the Department of the Interior)
Charles M. Wooley
Acting Regional Director

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with the Memorandum of Agreement among the United States Fish and Wildlife Service, the Bureau of Indian Affairs, the National Oceanic and Atmospheric Administration (NOAA), the Fond du Lac Band of Lake Superior Chippewa, the 1854 Treaty Authority, the Minnesota Department of Natural Resources, the Minnesota Pollution Control Agency, and the Wisconsin Department of Natural Resources, executed October 25, 2001, NOAA indicates by signature below their agreement to concur, in its entirety, with this Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site on behalf of their agency.

Approved:

NOAA Great Lakes Regional Coordinator
National Oceanic and Atmospheric Administration
U.S. Department of Commerce

12/7/17
Date

THE FOND DU LAC BAND OF LAKE SUPERIOR CHIPPEWA APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the Fond du Lac Band of Lake Superior Chippewa is providing its approval for the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site.

Approved:

Chairman
Fond du Lac Reservation Business Committee

1/16/18
Date

1854 TREATY AUTHORITY APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the 1854 Treaty Authority is providing its approval for the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site.

Approved:

Miie J. Myers

Executive Director
1854 Treaty Authority

12/14/17

Date

MINNESOTA DEPARTMENT OF NATURAL RESOURCES APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the Minnesota Department of Natural Resources is providing its approval for the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site.

Approved:

Barb Naramore

Assistant Commissioner
Minnesota Department of Natural Resources

11/30/17
Date

MINNESOTA POLLUTION CONTROL AGENCY APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the Minnesota Pollution Control Agency is providing its approval for the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site.

Approved:

[signature] ______________________________ 1/9/2018 ______________
Commissioner   Date
Minnesota Pollution Control Agency

WISCONSIN DEPARTMENT OF NATURAL RESOURCES APPROVAL OF THE FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT FOR THE SAINT LOUIS RIVER INTERLAKE/DULUTH TAR SITE

In accordance with Trustee protocol regarding documentation for Natural Resource Damage Assessment and Restoration (NRDAR) projects, the Wisconsin Department of Natural Resources is providing its approval for the final Restoration Plan and Environmental Assessment for the Saint Louis River Interlake/Duluth Tar Site.

Approved:

Ed Eberle

for Secretary
Wisconsin Department of Natural Resources

2-15-18

Date