

US EPA ARCHIVE DOCUMENT



Hog Island  
ECOLOGICAL RESTORATION MASTER PLAN

# Hog Island and Newton Creek

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September 2007



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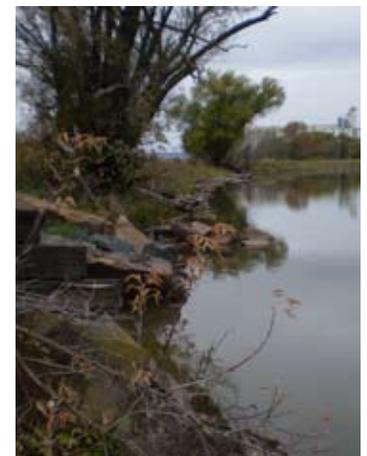


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City of Superior  
Douglas County  
Enbridge Energy  
Fond du Lac Reservation  
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Lower St. Louis River Citizens Action Committee  
Minnesota Department of Natural Resources  
Minnesota Pollution Control Agency  
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The Nature Conservancy  
NOAA Sea Grant  
Residents of City of Superior and Douglas County  
Short Elliot Hendrickson Inc.  
Service Environmental Group  
United States Environmental Protection Agency  
United States Fish and Wildlife Service  
University of Wisconsin Extension  
West Wisconsin Land Trust  
Wisconsin Department of Natural Resources





## Glossary of Terms and Abbreviations\*

**AOC** Area of Concern; a geographic area that fails to meet the objectives of the Great Lakes Water Quality Agreement [between Canada and the United States] and where such failure has caused or is likely to cause impairment of beneficial uses of the area's ability to support aquatic life.

**aquatic** Living or growing in or on water.

**aquatic nuisance species** Water-borne plants or animals that pose a threat to humans, agriculture, fisheries, and/or wildlife resources.

**assemblage** A group of species found together in a particular area. An assemblage differs from a community in that an assemblage may not be a repeating pattern of species found together in similar habitat conditions.

**baymouth sandbar** A long, narrow band of sand, deposited by waves across the mouth of a bay, often produced by the convergent growth of two spits from opposite directions.

**base flow** The sustained, or fair-weather, flow of a stream.

**bathymetry** The measurement of the depth of bodies of water

**benthic** Pertaining to the bottom of a body of water; usually refers to a bottom-dwelling organism.

**Beneficial Use Impairment** A positive or valued trait of an area that is compromised by current ecological conditions

**BMP** Best Management Practices; an agreed-upon set of actions designed to reduce negative consequences and optimize benefits from a certain activity. For example, forestry BMPs are designed to reduce water quality degradation from harvesting timber or to reduce the visual impact from tree cutting. BMPs include the best structural and non-structural controls and operation and maintenance procedures available.

**BUI** Beneficial Use Impairment

**CAC** St. Louis River Citizens Action Committee

**combined sewer overflow** A pipe that discharges untreated wastewater during storms from a sewer system that carries both sanitary wastewater and stormwater. The overflow occurs because the existing system is insufficient to carry, store, or treat the increased flow caused by stormwater runoff.

**community** An association of interacting populations defined by their interactions or by the place in which they live. A community typically demonstrates a repeating pattern of associations in similar environmental conditions. Usually used as a shorthand notation for plant associations or plant communities; however, it also may refer to human communities, depending on the context.

**conservation target** Rare or common plant or animal species, plant associations, aquatic habitats, or ecological systems of concern on which planning activities are focused in a conservation plan.

**delisting** Removal of the Area of Concern designation for a location after it has been sufficiently restored. Delisting requires meeting the BUI targets.

**dredge spoils** Sediments removed from a lake or other water body and removed to a location outside the lake

**ecological function** A role or service provided to the ecosystem. For example, primary production is an ecological function provided by green plants as they turn solar energy (an ecological component) into chemical energy (another ecological component).

**ecological process** Describes changes in, actions by, or interactions between ecological components. For example, erosion is an ecological process that carries sediment or soil from one location to another.

**ecological restoration** The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed.

\* This glossary was adapted from the St. Louis River Habitat Plan, 2002.

**ecological system** Ecological system or ecosystem; a living system made up of all the organisms in a given area together with the non-living components (e.g., climate, geology, etc.) that are present and the interactions between them. A group of plant associations that (1) occur together on the landscape; (2) are linked by ecological processes, underlying environmental features (e.g., soils, geology, topography), or environmental gradients (e.g., elevation, precipitation, temperature); and (3) form a robust, cohesive, and distinguishable unit on the ground.

**ecoregion** A geographic area defined by a shared set of physical and ecological characteristics including climate, geology, and vegetation.

**ecosystem** A group of interacting species combined with the physical environment.

**ecotype** A population or group of populations distinguished by morphological and/or physiological characteristics, interfertile with other ecotypes of the same species but usually prevented from naturally interbreeding by ecological barriers; a product of the genetic response of a population to a habitat.

**embayment** A bay or baylike shape

**emergent** Used to describe vegetation that is rooted on the bottom of a river or lake and has leaves that float on the surface or protrude above the water.

**estuary** Freshwater estuaries are areas of interaction between a river and nearshore lake water, where seiche activity and river flow create a mixing of lake and river water; may include bays, mouths of rivers, marshes, and lagoons. These ecosystems shelter and feed fish, birds, and wildlife. Most importantly, Great Lakes estuaries provide habitat for wildlife and for young-of-the-year and juvenile fish.

**estuarine** Pertaining to, or located in, an estuary.

**euryhaline** Descriptor of an organism that tolerates a wide range of salinity.

**exotic species** Species found beyond their natural ranges or natural zone of potential dispersal. Also referred to as non-native or non-indigenous species.

**flats** A relatively uniform area of riverbed or lake bottom characterized by little bathymetric relief or structure.

**GIS** Geographic Information System; a computer-based system used to store and manipulate geographic information. A GIS is designed for the collection, storage, and analysis of objects and phenomena where geographic location is an important characteristic or is critical to the analysis.

**GLNPO** Great Lakes National Program Office

**habitat** A broad term used to describe an identifiable area where a particular species or group of species live; a given habitat can be described by either physical features (such as water depth) or biological features (such as plant associations) or a combination of both.

**HAZWOPER** Hazardous Waste Operations and Emergency Response Standard

**IJC** International Joint Commission

**industrially-influenced bays** For the purposes of this Plan, industrially-influenced bays have been impacted by commercial and residential development as well as industry.

**lacustrine** Pertaining to, or living in, lakes or ponds.

**lower estuarine (dredged) river channel** For the purposes of this Plan, "lower estuarine (dredged) river channel" includes the authorized federal navigation channel where the Army Corps of Engineers is authorized to perform maintenance dredging for commercial navigation.

**LSLRHP** Lower St. Louis River Habitat Plan

**MDNR** Minnesota Department of Natural Resources

**MPCA** Minnesota Pollution Control Agency

**NISA** National Invasive Species Act (1996)



**NRCS** Natural Resources Conservation Service

**PAH** Polynuclear aromatic hydrocarbons; a family of organic chemicals based on the chemical structure of benzene. PAHs result from incomplete combustion of organic chemicals and are associated with grease and other components derived from petroleum byproducts. Some examples of the many PAH compounds include; benz(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, chrysene, phenanthrene, and pyrene.

**palustrine** Pertaining to, or living in, wet or marshy habitats.

**PCB** Polychlorinated biphenyls; PCBs are a group of over 200 nonflammable compounds formerly used in heating and cooling equipment, electrical insulation, hydraulic and lubricating fluids, and various inks, adhesives, and paints. These compounds are highly toxic to aquatic life, persist in the environment for long periods of time, and are bioaccumulative. PCBs are suspected carcinogens and are linked to infant development problems.

**peak flow** The highest discharge of a stream.

**plant association** An assemblage of plant species with a certain species composition, uniform habitat conditions, and a uniform structure. An example of a single plant association would be the "Maple - Yellow Birch Northern Hardwoods Forest." This plant association has a species composition dominated by sugar maple and yellow birch. Basswood, red maple, white pine and a few other tree species may appear in the canopy, but the maple and birch are consistently dominant. Its habitat conditions are typically relatively rich, mesic soils over glacial till in the cooler climates of the western and central Great Lakes region. Its structure is a forest (other structures include woodlands, savannas, shrublands or grasslands).

**plant community** A less technical term for plant association.

**pre-settlement** Presettlement is not a precise term, but it is widely used and understood to describe conditions before large-scale human alterations of the landscape. This term is commonly used to describe vegetation maps derived from land surveys conducted under the jurisdiction of the United States Public Land Survey. In many areas, it is believed Native Americans influenced vegetation structure and composition through setting fires. And some of the surveys were not complete before Euro-Americans had settled and also started to alter the landscape.

**RAP** Remedial Action Plan; a plan developed for an Area of Concern, describing the environmental problem, defining impaired uses, evaluating in-place and alternative remedial measures, identifying agencies responsible for implementation, evaluating implementation, describing surveillance and monitoring, and confirming restoration of uses.

**remediate** To improve or restore an area to pre-contamination or pre-destruction levels

**riverine** Formed by a river or situated along the banks of a river

**RTE** Rare, Threatened and Endangered

**SAV** Submerged Aquatic Vegetation

**seiche** A tidal-like rise and fall of water in large lakes, which occurs after water is piled up on one side of the lake by wind or high barometric pressure; when this force diminishes, the water rocks back and forth from one shore to the other with decreasing amplitude.

**stress** Processes or events, both direct and indirect, that cause negative ecological or physiological impacts on conservation targets.

**submergent** Used to describe vegetation that is rooted on the bottom of a river or lake and has leaves that stay submerged below the surface of the water.

## Glossary

**succession** Generally predictable and orderly changes in composition and structure of a plant or ecological community.

**target** See conservation target.

**terrestrial** Living or growing on land.

**threat** Factors that have a direct and negative impact on the health of conservation targets or that negatively impact the ecological systems and processes that support and maintain the conservation targets. Threats are described in two parts: stresses and the sources stress.

**TNC** The Nature Conservancy

**turbidity** Cloudiness or reduced clarity of water due to the presence of suspended matter.

**UMD** University of Minnesota - Duluth

**UMD-NRRI** University of Minnesota - Natural Resources Research Institute

**U.S. EPA** United States Environmental Protection Agency

**U.S. FWS** United States Fish and Wildlife Service

**UWS** University of Wisconsin - Superior

**viability** The overall current health of a conservation target in a given location; viability is assessed according to the size, condition, and landscape context of the conservation target in the given location.

**watershed** an area of land that drains into a lake, bay, river system or other body of water

**WDNR** Wisconsin Department of Natural Resources

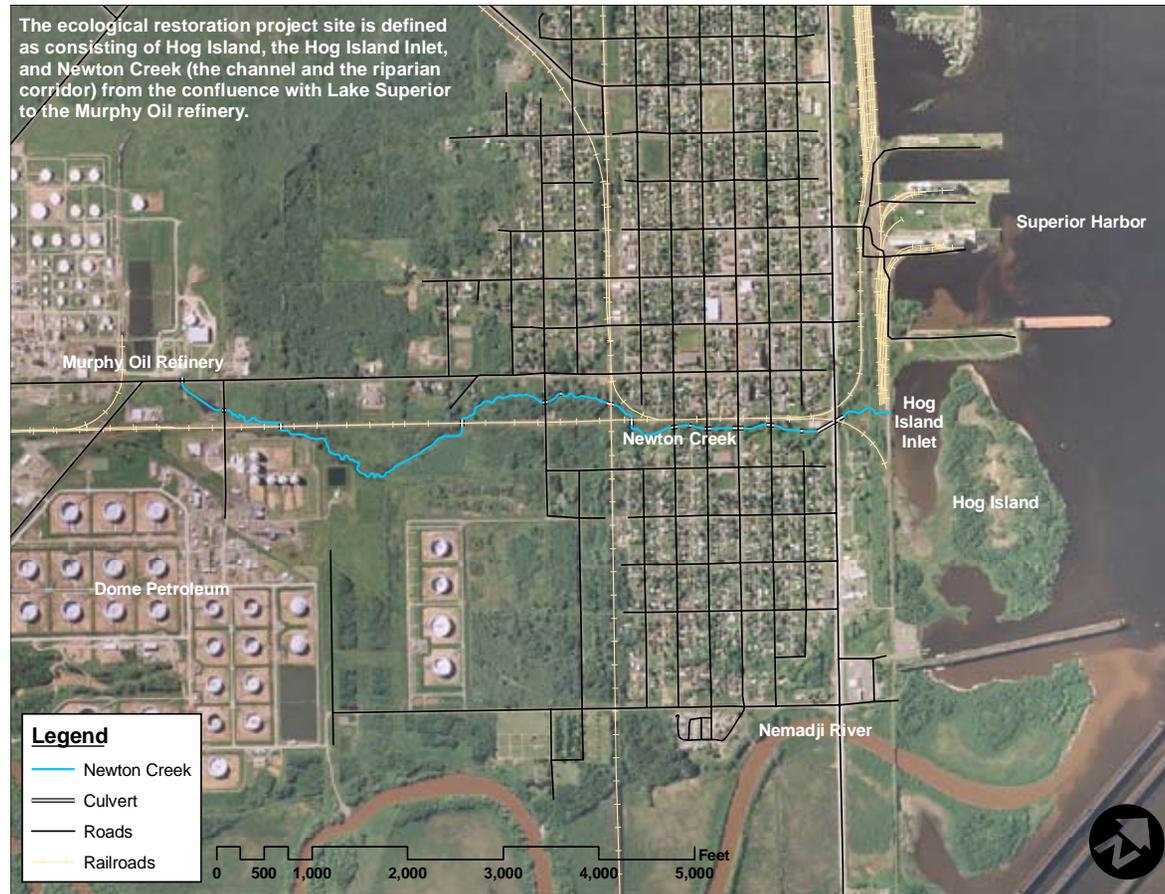
**WLSSD** Western Lake Superior Sanitary District, located in Duluth, Minnesota

**WPDES** Wisconsin Pollution Discharge Elimination System



**Introduction**

The Hog Island and Newton Creek Ecological Restoration Master Plan provides a “blueprint” for the restoration of natural communities and ecosystem processes for Newton Creek, the Hog Island Inlet, and Hog Island in Superior, Wisconsin. Historically, this area has been contaminated by industrial discharges and a former municipal combined sewer overflow. From 1997 to 2005, multiple partners remediated the contaminated sediments in Newton Creek and Hog Island Inlet. Through a process of stakeholder engagement and collaboration, this Ecological Restoration Master Plan intends to build upon the success of these remediation efforts by proposing a guiding “Vision” as well as specific Goals, Objectives, and Actions that will help to restore terrestrial, riparian, wetlands, and aquatic habitats; increase ecosystem biodiversity and resilience; and reduce threats to the natural communities in the area. It also intends to increase environmental awareness, community enjoyment, and economic vitality through passive recreational, educational, and stewardship opportunities. The Ecological Restoration Master Plan incorporates specific recommendations of the existing St. Louis River Habitat Plan, and attempts to address a suite of beneficial use impairments within the St. Louis River watershed.



The Hog Island and Newton Creek Project Site.

Hog Island, Hog Island Inlet, and Newton Creek lie within the St. Louis River watershed that drains into Superior harbor, at the westernmost tip of Lake Superior. Newton Creek is a 1.5 mile long perennial stream that originates from a large wetland complex and the discharge of the Murphy

Oil refinery. It meanders through open wetland, grassland, and woodland areas before the channel straightens into the residential areas of the City of Superior and drains into Hog Island Inlet. The 17-acre Inlet supports shallow water habitats including wetlands and mudflats. Hog Island

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itself is an artificial island, created in the 1920s and 1930s from dredge spoils from Superior harbor. It has developed a diverse array of vegetation and wildlife communities and remains under the management of Douglas County.

**Rationale for Restoration**

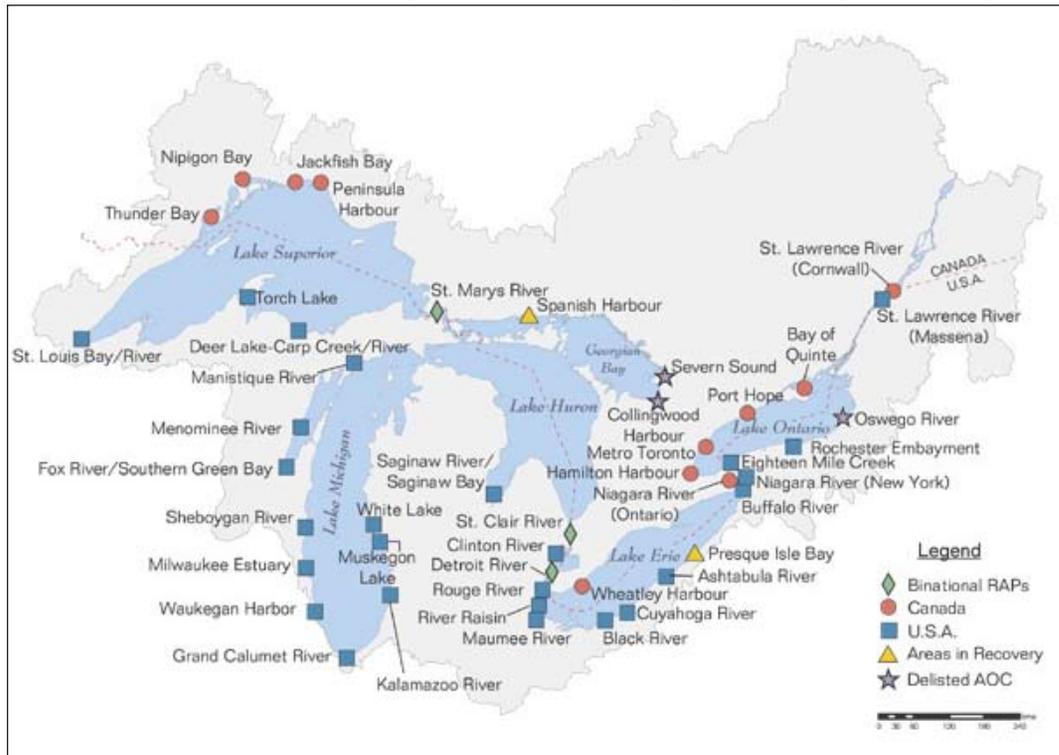
For some, the Hog Island and Newton Creek site is an obvious spot for restoration; for others, its importance is

not immediately apparent. Hog Island has a number of personalities for the City of Superior and Douglas County. It is a site for recreation, bird watching and relaxation. Ecologically, it is part of a key wetland complex that hosts a wide diversity of migratory birds and fish populations. Newton Creek provides a vital link between the lakeshore habitats and the wetlands, grasslands, and forested open spaces in the City of Superior, complimenting the existing 5,000 acre Superior municipal

forest. This area has importance locally, as an amenity to the residents of Douglas County and Superior City, and regionally, as it is linked to the larger St. Louis River watershed and Great Lakes basin.

The restoration of Hog Island, Hog Island Inlet and Newton Creek is a critical link in a much larger process to preserve the Great Lakes. Historically, many locations in the Great Lakes region have been contaminated with industrial waste products, industrial and municipal wastewater, landfills, surface runoff and chemical spills. Discharges of toxic substances into the Great Lakes Basin have been reduced in the last 20 years, but persistent, high concentrations of contaminants remain in the bottom sediments of some of the rivers and harbors that feed into the Lakes. These contaminants have the potential to cause harm to humans, aquatic organisms, and wildlife, and there are advisories against consuming the fish from most water bodies around the Great Lakes. These problem harbor and tributary areas in the Great Lakes basin have been identified and labeled as “Areas of Concern” (AOCs) (see sidebar “What are Areas of Concern?”) with 31 of the 43 AOCs located on the U.S. side of the Great Lakes.

To tackle this problem of contamination — and to take a key step toward recovery



Areas of Concern in the Great Lakes

http://www.onec.gccc.ca/water/raps/raps\_map\_e.html, 2005



of these 31 sites — the Great Lakes Legacy Act (the Legacy Act) was signed into law in 2002. The Act provides funding to take the necessary steps to clean up contaminated sediment in “Areas of Concern located wholly or partially in the United States,” including specific funding designated for public outreach and research components. The U.S. Environmental Protection Agency’s (U.S. EPA) Great Lakes National Program Office (GLNPO) was designated to implement the Legacy Act.

**Beneficial Use Impairments for the St. Louis River Watershed (in bold text)**

- **loss of fish and wildlife habitat**
- **restrictions on fish and wildlife consumption**
- tainting of fish and wildlife flavor
- **degradation of fish wildlife populations**
- **fish tumors or other deformities**
- bird or animal deformities or reproduction problems
- **degradation of benthos**
- **restrictions on dredging activities**
- **eutrophication or undesirable algae**
- restrictions on drinking water consumption, or taste and odor problems
- **beach closings**
- **degradation of aesthetics**
- added costs to agriculture or industry
- degradation of phytoplankton and zooplankton

The Legacy Act authorizes \$270 million from FY2004 through FY2008 to help with the remediation of contaminated sediment in the 31 U.S. AOCs, including specific funding designated for public outreach and research components. Priority goes to projects in which a plan is in place and ready for implementation and/or that will use an innovative approach to cleanup. Funds provided under the Great Lakes Legacy Act will mean an increase in new cleanup projects, a reduction in the amount of contaminated sediment polluting the Great Lakes, and a significant step toward environmental restoration of the Great Lakes.

**Remediation Efforts**

In 1987, the International Joint Commission identified the St. Louis River as a major Area of Concern (AOC), with a suite of identified “beneficial use impairments” that include the loss of fish and wildlife habitat, degradation of fish and wildlife populations, degradation of benthos, beach closings, and others. Remedial Action Plans (RAPs) identify specific problems in severely degraded Great Lakes AOCs and describe methods for correcting them. The St. Louis River Citizens Action Committee (SLRCAC) has formulated the “St. Louis River Habitat Plan,” which presents an initial set of strategies for the remediation and restoration

**What are Areas of Concern?**

Great Lakes Areas of Concern (AOCs) are severely degraded geographic areas within the Great Lakes Basin. They are defined by the U.S.-Canada Great Lakes Water Quality Agreement (Annex 2 of the 1987 Protocol) as “geographic areas that fail to meet the general or specific objectives of the agreement where such failure has caused or is likely to cause impairment of beneficial use of the area’s ability to support aquatic life.” The U.S. and Canadian governments have identified 43 such areas; 26 in U.S. waters, 17 in Canadian water (five are shared between U.S. and Canada on connecting river systems). Collingwood Harbour, in Ontario, is the first of these 43 sites to be delisted.

The Great Lakes Water Quality Agreement, as amended via the 1987 protocol, directs the two federal governments to cooperate with state and provincial governments to develop and implement Remedial Action Plans for each Area of Concern.

(Source: Great Lakes Information Network, 2007. <http://www.great-lakes.net/envt/pollution/aoc.html>)

of this AOC. The restoration of Hog Island and Newton Creek is listed as a goal in the St. Louis River Habitat Plan.

Starting in 1997, Wisconsin Department of Natural Resources (WDNR) and Murphy Oil removed contaminated sediments in the upper reaches of Newton Creek. In 2003, WDNR cleaned up the middle reaches of the channel (segments B-K), and in 2005 WDNR signed an agreement with GLNPO and began remediation of Hog Island

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### Milestones in the St. Louis Remedial Action Plan

- 1992 – The St. Louis River System RAP Stage One document completed.
- 1995 – St. Louis River System RAP Progress Report completed.
- 1995 – RAP Recommendation Implementation Status document drafted.
- 1996 – St. Louis River Citizens Action Committee formed.
- 1999 – The CAC received funding to implement the habitat plan recommendation.
- 2002 – “Lower St. Louis River Habitat Plan” completed. The CAC worked with several partners from city, county, state, and federal agencies and entities on this document.
- 2004 – The SLRCAC proposed restoration goals for many of the impaired uses through a citizen process and submitted them to the Wisconsin Department of Natural Resources (WDNR) and the Minnesota Pollution Control Agency.

(source: [www.epa.gov/glnpo/aoc/stlouis.html](http://www.epa.gov/glnpo/aoc/stlouis.html), 2007)



Inlet and the lower reaches of Newton Creek, removing 46,000 cubic yards of contaminated sediments at a cost of \$6.3 million. The clean up was completed in November 2005.

### Ecological Restoration

The Hog Island and Newton Creek Ecological Restoration Master Plan is the bridge between ecological restoration target-setting and implementation actions, part of the road map to delisting the habitat-related beneficial use impairments. The choice regarding implementation lies with the landowners and the local community. However, if implemented, a restored island, creek and Inlet will contribute to the delisting of the beneficial use impairments within the entire St. Louis River Area of Concern. Because it is the first such plan, it is expected this process will be reviewed and used by other Areas of Concern seeking to follow sediment remediation with restoration.

### Developing the Ecological Restoration Master Plan

The process of designing the Ecological Restoration Master Plan involved stakeholders as much as possible. The process of stakeholder participation

evolved throughout the project. Initially, two workshops were planned to identify stakeholder views and comments, which were incorporated into a Draft Plan. After the realization that more discussion was needed to effectively incorporate feedback to the draft versions of the plan, the U.S. EPA scheduled a third workshop to discuss issues that were of most concern to stakeholders.

### Remediation of Hog Island Inlet and Newton Creek

- 1996 – Agreement between Murphy Oil, U.S. EPA and Wisconsin DNR to remediate Newton Creek.
- 1997 – Murphy Oil cleaned up an impoundment area odd Stinson Ave and Section A (780 feet) of Newton Creek.
- 2003 – Wisconsin DNR cleans up middle section of Newton Creek (section B – K).
- 2005 – Multi-agency cleanup of Hog Island Inlet and Segment L of Newton Creek which removed 60,000 tons of contaminated sediment.
- 2007 – U.S. EPA prepares Hog Island and Newton Creek Ecological Restoration Master Plan.



## Layout of the Ecological Restoration Master Plan

### Chapter 1: Project Background

This section details the project background, site history and gives an overview of the components of the entire plan.

### Chapter 2: Ecological Restoration Plan

The Ecological Restoration Master Plan is divided into four major Goals:

1. Improve water and sediment quality conditions in Newton Creek and Hog Island Inlet and reduce the threat of future contamination.
2. Conserve and protect ecologically-sensitive habitats.
3. Restore selected ecosystem components in a manner that is consistent with the ecological restoration guiding principles.
4. In conjunction with restoration activities, create recreational, educational and environmental stewardship activities for City of Superior and Douglas County residents.

Each Goal provides a set of specific Objectives, which include quantifiable restoration targets. Each Objective has several required Actions, which must be implemented to partially or fully achieve an Objective. These Actions include the specific approach, reference conditions, affected area, implementation timeline, anticipated

costs, permitting requirements, and pre-implementation needs.

The implementation of the Ecological Restoration Plan is intended to be flexible in nature. Some of the major stakeholders in the watershed have concurrent planning efforts, and the actions taken for restoration of Hog Island, Newton Creek and the Inlet can adjust as plans, needs and resources change.

### Chapter 3: The Master Planning Process

The process for developing this Ecological Restoration Master Plan is of particular importance as the final product is the result of increasing collaboration with the stakeholders. This chapter explains the evolution and content of the workshops and the overall timeline for the development of the Plan.

### Chapter 4: Existing and Historical Conditions

To understand the degree of restoration necessary, an assessment of the current and historical conditions at the site is critical. Within this section, the climate, geology and soils, regional and local landscape ecology, land use and zoning are all outlined.

### Chapter 5: Ecological References

An ecological reference site provides not only a sense of the degree of restoration needed

but also serves as a benchmark for evaluating the restoration actions. The reference sites that the Lower St. Louis River Habitat Plan outlines in addition to others that were added during the development of this plan are reviewed in this section.

Ultimately, the Ecological Restoration Master Plan aims to balance economic and ecological objectives with the understanding that for a community to be viable, it needs to thrive both economically and ecologically. By taking part in setting high standards for ecosystem restoration and protection, participants in this effort are protecting their valuable natural assets; clean water, productive fisheries, healthy forests, wetlands, and open spaces. In turn they are bolstering their local economies by improving the quality of life, health, recreation, and educational experiences for residents. But ultimately, the restoration of Hog Island, Hog Island Inlet, and Newton Creek is the realization of an even larger vision: the health and vitality of the Lake Superior region - as a great place to live, for generations to come.

### Chapter 6: References

#### Appendix

The stakeholder workshop materials, including meeting minutes, attendance, and other documentation is included.

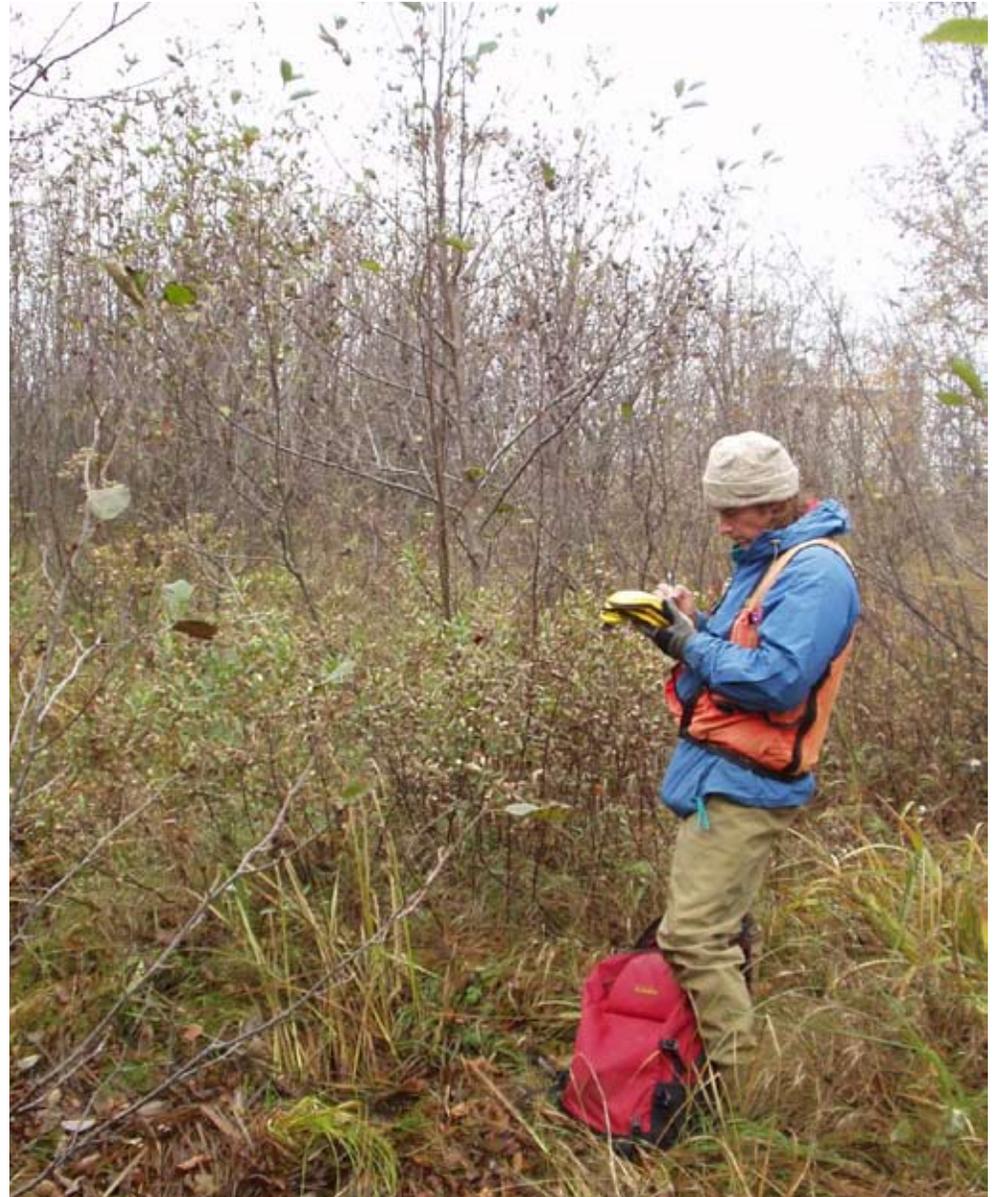
# 1.0 Project Background

*“This planning document intends to “close the loop,” providing for the restoration of a suite of ecological function and biodiversity that can now be realized...”*

The Great Lakes Legacy Act of 2002 (The Act) appropriates \$270 million in funding over five years for cleanups of contaminated sediment hotspots in the Great Lakes Basin. The Act provides funding and authorization for remediation of 31 Areas of Concern (AOC) on the United States boundary of the Great Lakes. The Lower St. Louis River System is considered an AOC. The Act proposes to take an ecological approach to restore and enhance impaired beneficial uses in the AOC.

The Lower St. Louis River AOC includes Newton Creek and Hog Island Inlet as well as parts of the St. Louis and lower Nemadji River watersheds of the Great Lakes Basin. The St. Louis River flows between Superior and Duluth twin port harbors on Lake Superior. The headwaters of Newton Creek are located at the Murphy Oil refinery wastewater discharge impoundment, in Superior, Wisconsin.

The Lake Superior Refining Company operated the oil refinery from 1951 to 1958, at which time Murphy Oil USA, Inc. (Murphy Oil) took over operations. The refinery was constructed in 1950, at the terminus of a 1,200-mile pipeline





that stretches from the oil sands region in Alberta, Canada. Wastewater associated with the refining process, which is regulated under a Wisconsin Pollution Discharge Elimination System Permit, serves as the headwaters of Newton Creek. Over the years, there have been a number of spills documented which have resulted in releases of petroleum products impacting surface water, sediment and flood plain soils in Newton Creek and Hog Island Inlet.

In light of these impacts, Murphy Oil has conducted a number of activities which have

served to improve Newton Creek (see sidebar “Murphy Oil Risk Mitigation Practices” on the following page). In 1995 the refinery built and began operating a state-of-the-art wastewater treatment plant. This enabled the refinery to meet increasingly stringent effluent requirements for the creek. In 2004 the refinery built two constructed wetlands to serve as a final polishing step for the refinery’s effluent and with the hope that the ponds would also assist in removing trace amounts of mercury. In 2006 the refinery initiated an annual creek clean-up program at the request of WDNR and in conjunction with the refinery’s community advisory panel. Additional cleaning efforts are detailed in the section below.

In addition, Lakehead Pipeline operated a petroleum transfer station at the Ogdensburg Pier adjacent to Hog Island (land which is now owned by Enbridge, Inc.). There was a documented release of petroleum products at the facility. Minor impacts from industrial and residential runoff are suggested by data collected by SEH (2000). Under a 1996 agreement between Murphy Oil, WDNR, and USEPA, Murphy Oil remediated an impoundment area and Segment A of Newton Creek in 1997 and WDNR cleaned up the middle reaches (Segments B to K) in 2003.



## The Hog Island and Newton Creek Master Plan

### **Murphy Oil Risk Mitigation Practices**

**Annual Drills** for spill response. These drills serve to familiarize refinery personnel with the incident command system and the refinery emergency response plan.

**Annual training.** All refinery personnel are trained annually on the various plans and requirements during refresher training for the HAZWOPER (Hazardous Waste Operations and Emergency Response) standard. The HAZWOPER standard requires 8 hours of refresher training annually. The refinery has 16 hours of training to ensure that the HAZWOPER regulatory training as well as other regulatory required training is covered.

**Inspections** required by hazardous waste regulations and plans mentioned above.

**Spill Prevention, Control, and Countermeasures plan.** The requirements include but are not limited to: emergency response plan development and training, secondary containment for all storage tanks, facility security, etc. This is a very comprehensive regulation regarding prevention of releases of oil.

**Storm Water Pollution Prevention Plan (SWPPP).** The purpose of the plan is to identify sources of stormwater and non-stormwater contamination to stormwater drainage systems and to implement best management practices to prevent the discharge of contaminated stormwater. This is also a comprehensive regulation with inspection, training, and implementation of practices to prevent contamination of stormwater.

**Trained emergency response team.** The refinery has an on-site emergency response team that is trained for both fire protection as well as other emergency response functions.

**Various engineered systems** such as stormwater weirs which allow the facility to completely prevent the release of stormwater that has become contaminated, a stormwater drainage system that provides numerous locations where a spill or release may be stopped, a recycle system for the refinery effluent such that if the effluent might not meet standards it can be stored and retreated.

**WPDES (Wisconsin Pollutant Discharge Elimination System) permits** for refinery effluent and stormwater discharges –these set limits designed to be protective of the environment.





The final clean up effort of Segment L and Hog Island Inlet was completed in November 2005, with a multi-agency federal, state, and local partnership. Approximately \$4.1 million of the funds to pay for this project phase were provided by the Great Lakes Legacy Act, the state of Wisconsin and other parties that provided 35 percent of the project's cost, or about \$2.2 million. These non-federal matching funds are required by the Legacy Act. Newton Creek and Hog Island Inlet were only the second Great Lakes Legacy Act project to have received Legacy Act funding.

The final phase of the cleanup involving Segment L of Newton Creek and Hog

Island Inlet removed 60,000 tons of contaminated sediment, half of which was diverted to the City of Superior Landfill. All contaminated sediments were converted to Moccasin Mike Landfill. One-half of the volume containing lead over 50 parts per million was deposited as waste. The other half was beneficially reused. The sediment removal was largely accomplished "in the dry" through a dewatering process using pumps. Water that met background turbidity and mercury limits was discharged into the St. Louis River until sampling indicated that these limits would be exceeded, at which point the water was discharged through the City's wastewater

treatment facility. During the dewatering process, a "fish rescue" operation took place which resulted in over 1,800 fish, 138 freshwater clams, and 33 painted turtles being transferred from the Inlet into the St. Louis River. Clean river rock were placed on the bed of Newton Creek, and the banks were stabilized with vegetation to prevent erosion and provide some habitat benefits.

This project marks the first time contaminated sediments have been removed from a toxic hot spot in the Wisconsin portion of Lower St. Louis River AOC, an important step in returning the AOC to full public use.

Despite the success of the combined remediation projects in Newton Creek and Hog Island Inlet, the original project goals did not include the full ecological restoration of the project site post-remediation.

This planning document intends to "close the loop," providing for the restoration of a suite of ecological function and biodiversity that can now be realized post-remediation, addressing the remaining BUIs, and ultimately delisting this AOC. The USEPA has provided the funding for this Ecological Restoration Master Plan.

## VISION

### STATEMENT:

*Restore natural, diverse, and self-sustaining ecosystems in Hog Island, the Hog Island Inlet, and the Newton Creek watershed. Make this project a leading example for Great Lakes ecosystem restoration efforts, and provide serene, safe natural areas for the residents of the City of Superior and Douglas County.*

The Hog Island and Newton Creek Ecological Restoration Master Plan is intended to guide future restoration efforts in the project area in accordance with key guiding principles (details at right). The full restoration of ecosystem function for natural areas in Newton Creek, Hog Island, and Hog Island Inlet is a process that will take many years or decades to evolve; the natural succession of restored areas will allow habitat to mature and diversify over time. The restoration actions proposed in this Master Plan will require active monitoring and adaptive management to ensure that habitat complexes and desired species assemblages remain on their desired trajectories. To provide an adequate planning framework, it is intended that this document serve as a “living plan”, which will guide these long-term restoration and management actions.

The project vision and guiding principles, restoration opportunities and constraints as well as specific restoration strategies have been determined as a result of stakeholder input and collaboration at three workshops from January to July 2007. The Biohabitats team translated and developed

### GUIDING PRINCIPLES:

- Functional groups are present, or they have the ability to successfully colonize.
- Reproducing populations of target species are present.
- Characteristic assemblages of species / communities as in reference ecosystems are present.
- Indigenous species are present.
- Self-sustaining natural communities are present.
- Potential ecosystem threats are eliminated or reduced.
- Ecosystems are resilient to normal ranges of ecological stress.
- The restoration site is integrated into a larger ecological landscape.
- Habitat diversity is maximized.
- The goals of the LSLRHP are integrated.
- Sensitive ecological areas are placed under permanent protection.
- Restoration and resources management occurs according to watershed-planning principles.
- Educational and volunteering opportunities are integrated.
- Human uses which compromise long-term ecological sustainability are restricted.
- The plan is flexible, allowing integration of new ideas and stakeholders.

these ideas into the following hierarchy of Goals, Objectives, and Actions, adding details and suggesting further strategies according to their professional expertise in ecological restoration. Each Objective includes restoration targets (often derived from the ecological references in Section 5). Individual Actions include a procedure for implementation; ecological reference sites;

planning level cost estimates for the design, implementation, and management of each action; a timeline of the restoration process; notes on any permitting requirements; and any pre-implementation requirements. The Objectives and Actions presented in this document are intended to be further developed as funding becomes available and implementation occurs.





# Ecological Restoration Plan

## 2.1 Restoration Goals / Objectives / and Actions

### Goal A) Improve water and sediment quality conditions in Newton Creek and the Hog Island inlet and reduce the threat of future contamination.

<b>Objective A1)</b>	<b>Maintain flows in Newton Creek to support aquatic and riparian habitats.</b>  <b>Action 1:</b> Determine ecologically-optimal flow regime for Newton Creek. <b>Action 2:</b> Work with Murphy Oil to coordinate ecological restoration actions with the long-term release schedule.
<b>Objective A2)</b>	<b>Stormwater management in upper watershed to limit nutrient and contaminant input into Newton Creek and Hog Island inlet.</b>  <b>Action 1:</b> Work with City of Superior to identify potential sources of pollution into Newton Creek, and develop recommendations for appropriate stormwater best management practices (BMPs) in the watershed.
<b>Objective A3)</b>	<b>Manage the threat of industrial contamination to water resources and sediments.</b>  <b>Action 1:</b> Maintain active risk reduction strategies. Use active monitoring to evaluate effectiveness of such strategies and communicate to project stakeholders.
<b>Objective A4)</b>	<b>Determine if contaminated sediments persist in floodplain sediments along Newton Creek, or within the Hog Island Inlet. If warranted, remediate these areas using mechanical or biological techniques, as appropriate.</b>  <b>Action 1:</b> Determine if contaminated sediments remain along the shoreline of Hog Island inlet and along the Newton Creek floodplain terraces. <b>Action 2:</b> Initiate additional mechanical or biological sediment remediation actions. If phytoremediation is determined to be appropriate, establish initial test plots and monitor.

### Goal B) Ecosystem conservation and protection for ecologically-sensitive habitat areas.

<b>Objective B1)</b>	<b>Place publicly held open areas and sensitive habitats into permanent protection through designation, with an emphasis on primary protection sites.</b>  <b>Action 1:</b> Work with the City of Superior and Douglas County to permanently protect remaining vacant public lands on Hog Island and within the Newton Creek watershed, with an emphasis on primary protection sites.
<b>Objective B2)</b>	<b>Encourage land owners to place privately-held restoration areas and sensitive habitats into permanent protection with an emphasis on protecting primary sites.</b>  <b>Action 1:</b> Place private lands designated as priority conservation areas into permanent land protection or conservation status, including the southeastern portion of the Ogdensburg Pier and Burlington Northern Santa Fe properties along the shoreline of Hog Island inlet. <b>Action 2:</b> Permanently protect privately-held upland, wetland, and riparian habitats within the upper Newton Creek watershed.

### Goal C) Restore selected habitat components according to the restoration guiding principles.

<b>Objective C1)</b>	<b>Control selected invasive plant species.</b>  <b>Action 1:</b> Perform a comprehensive invasive plant species inventory and mapping throughout ecologically sensitive areas. <b>Action 2:</b> Establish a vegetation management plan to control reed canary grass along Newton Creek. <b>Action 3:</b> Establish a vegetation management plan to control <i>Phragmites australis</i> along the Hog Island shoreline areas. <b>Action 4:</b> Actively monitor for migration of exotic invasive plants from the adjacent landscape, especially purple loosestrife
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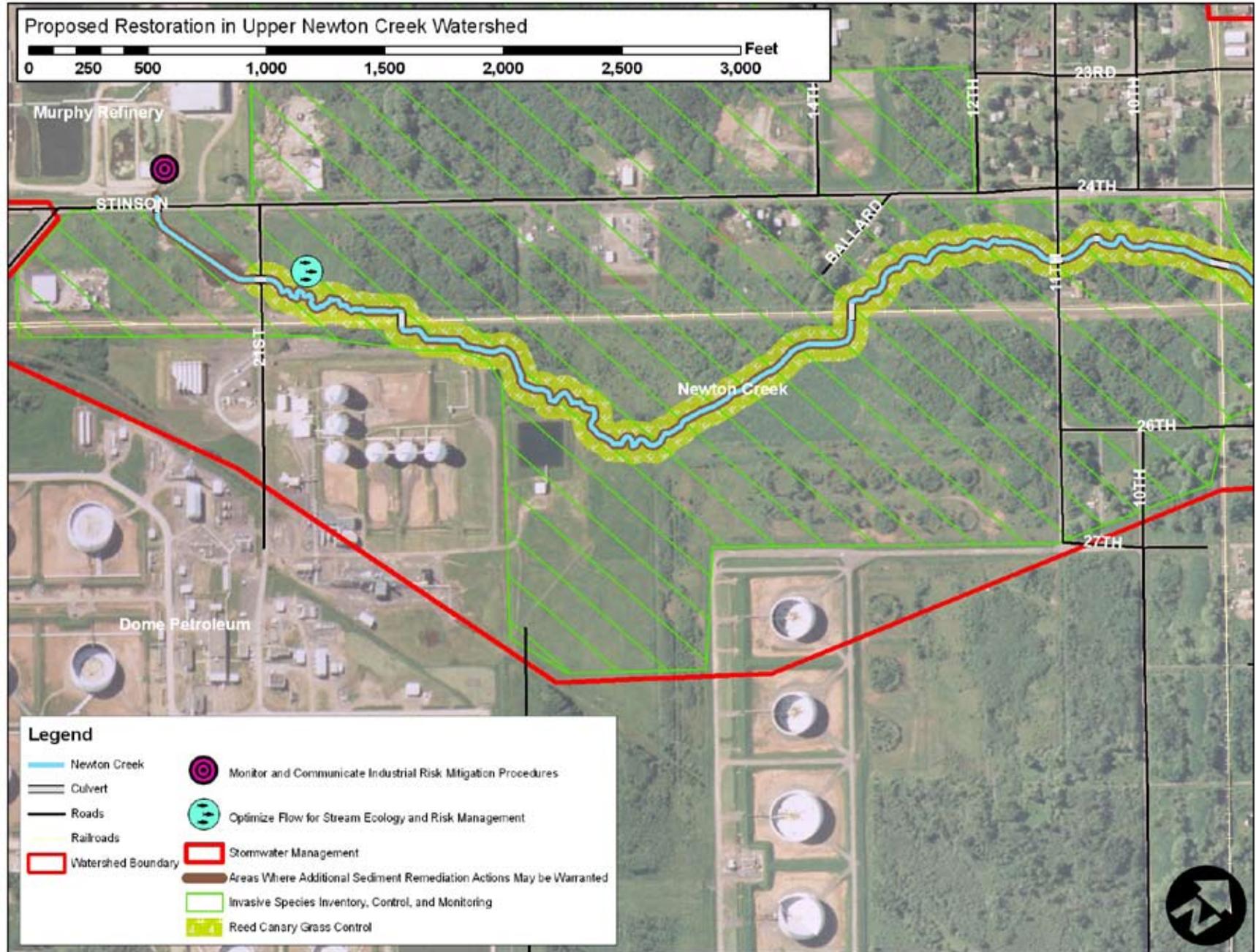


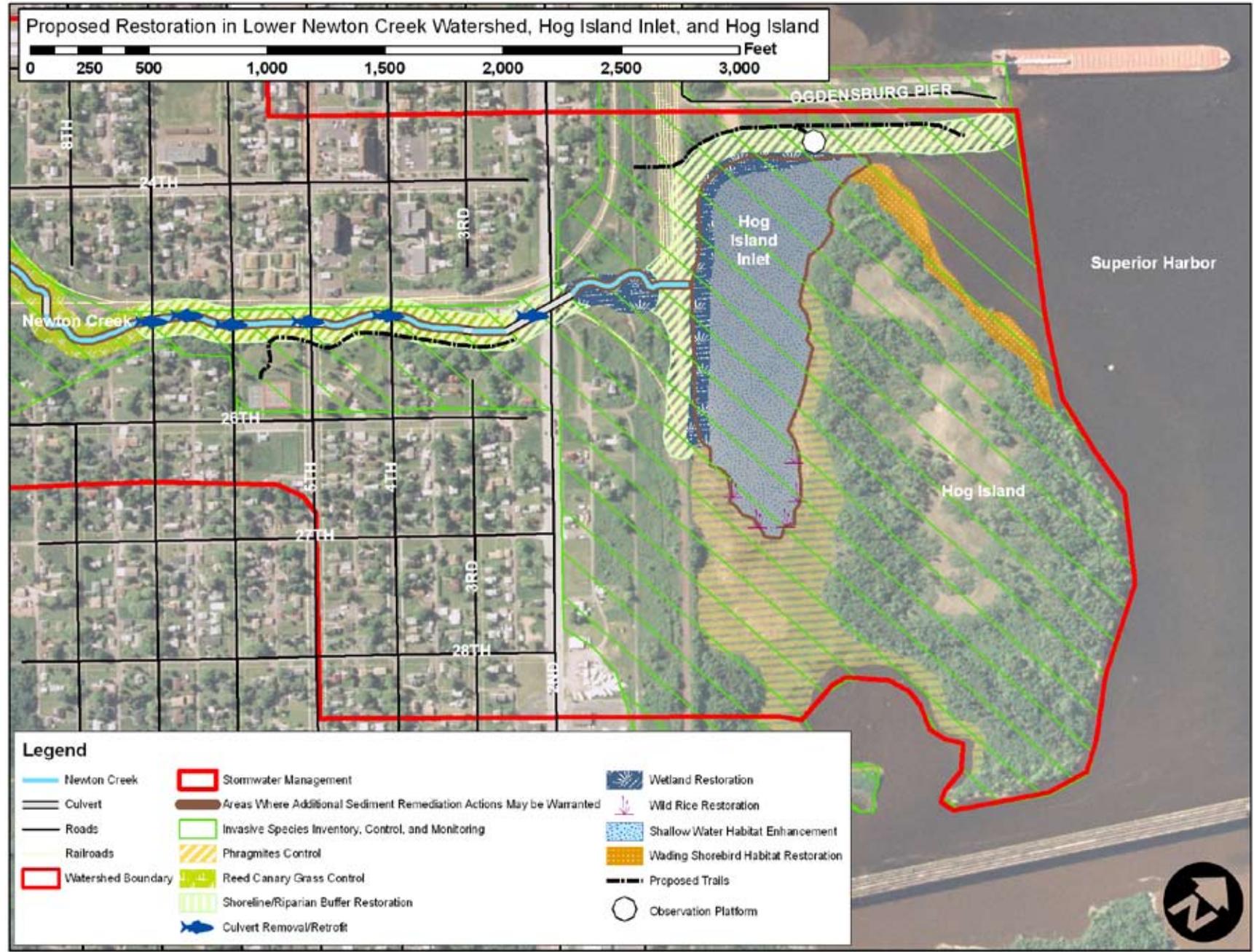
<b>Objective C2)</b>	<b>Improve landscape connectivity for natural communities by enhancing streamside and shoreline buffers, and removing barriers to aquatic and terrestrial wildlife migration.</b>  <b>Action 1:</b> Establish a 75 foot buffer along Newton Creek between 7th St and 2nd St. <b>Action 2:</b> Establish a 100 foot vegetative shoreline buffer around the perimeter of Hog Island Inlet. <b>Action 3:</b> Remove, replace, or retrofit culverts at road and sanitary sewer line crossings along Newton Creek.
<b>Objective C3)</b>	<b>Restore or enhance wetland complexes along shallow water and shoreline areas.</b>  <b>Action 1:</b> Restore sustainable, reproducing communities of wild rice along the Hog Island inlet and along the shoreline. <b>Action 2:</b> Expand areas of emergent wetland vegetation or create “floating log-bog” wetlands in the northwestern and southwestern areas of the Inlet. <b>Action 3:</b> Expand areas of wetland vegetation into the seiche-influenced areas of Newton Creek (between 2nd St. and the Inlet).
<b>Objective C4)</b>	<b>Restore or enhance habitat complexity in the open water areas of Hog Island Inlet.</b>  <b>Action 1:</b> Use large woody debris in the open waters of Hog Island inlet to provide vertical habitat structure. <b>Action 2:</b> Restore populations of submerged aquatic vegetation (SAV) in the open water areas of Hog Island Inlet.
<b>Objective C5)</b>	<b>Enhance migratory bird habitats, especially for rare, threatened, or endangered (RTE) species.</b>  <b>Action 1:</b> Establish foraging and nesting habitats for wading shorebirds on Hog Island beaches.
<b>Objective C6)</b>	<b>Initiate post-project monitoring for any restoration actions that occur, and use information to inform other restoration actions in the designated project area and within the greater St Louis River watershed</b>  <b>Action 1:</b> Establish a mechanism to communicate monitoring results to the project partners and incorporate new information into habitat restoration design and management.

**Goal D) In conjunction with restoration actions, create recreational, educational, and environmental stewardship activities for City of Superior and Douglas County residents.**

<b>Objective D1)</b>	<b>Create passive recreational opportunities compatible with sustainable ecosystem function and landowner concerns.</b>  <b>Action 1:</b> Extend existing trail system to include limited access to Newton Creek and the Hog Island Inlet. <b>Action 2:</b> Establish an additional observation / bird watching platform on Ogdensburg Pier. <b>Action 3:</b> Create interpretative signage along trails and observation platforms as part of the proposed conservation and restoration projects to educate about different natural features of the site.
<b>Objective D2)</b>	<b>Facilitate public outreach efforts, including educational, volunteer, and stewardship activities, through collaboration between existing watershed group.</b>  <b>Action 1:</b> Identify an entity to direct education, stewardship, and outreach efforts and advocate for environmental sustainability in the watershed. <b>Action 2:</b> Create environmental research and education programs for the community, local schools and universities that focus on the ecosystems and restoration processes underway within Hog Island, Hog Island Inlet, and Newton Creek. <b>Action 3:</b> Maintain a project website to keep stakeholders, watershed residents, and citizens informed of the restoration process.

# Ecological Restoration Plan





# Goal A) Improve water and sediment quality conditions in Newton Creek and the Hog Island Inlet and reduce the threat of future contamination.

## Overview

The biodiversity and health of aquatic organisms such as shellfish, macroinvertebrates, and fish species, their predators, and the successful establishment of wetland and riparian vegetative communities depends on clean waters and sediments in Newton Creek and Hog Island Inlet. Additionally, water and sediment quality conditions have great bearing on the health of City of Superior and Douglas County residents who live next to or recreate in the these areas.

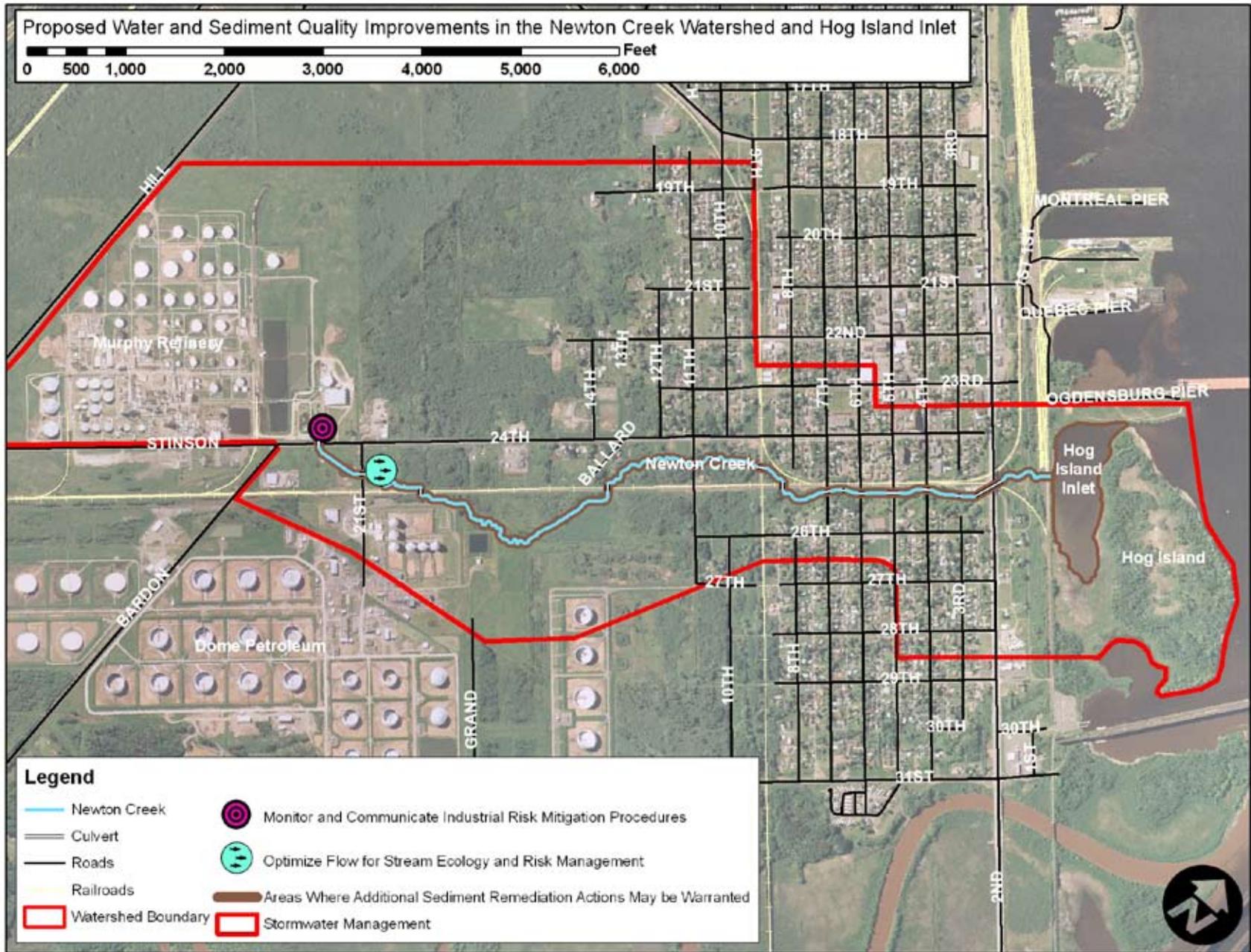
Sediment remediation efforts performed by WDNR, USEPA, and Murphy Oil have successfully removed contaminated sediments from within the stream channel and subsurface areas of the Inlet to levels that comply with federal and state standards. Residual sediment contamination from historic industrial releases may still occur in isolated areas along Newton Creek and the shoreline of Hog Island Inlet, although sampling conducted following the excavation of Hog Island Inlet indicates that the remaining contamination is below chronic effect levels.

To ensure the holistic restoration of habitat complexes and natural communities in the project area, and to provide for sustainable use by plant, insect, fish, bird, wildlife, and human inhabitants, it is necessary to maintain water and sediment quality conditions so that they do not limit ecological function and biodiversity or be continual sources of ecological stress.

## Objectives

- A1)** Maintain flows in Newton Creek to support aquatic and riparian habitats.
- A2)** Stormwater management in upper watershed to limit nutrient and contaminant input into Newton Creek and Hog Island Inlet.
- A3)** Manage the threat of industrial contamination to water resources and sediments.
- A4)** Determine if contaminated sediments persist in floodplain sediments along Newton Creek or within the Hog Island Inlet. If warranted, remediate these areas using mechanical or biological techniques, as appropriate.





# Objective A1) Maintain flows in Newton Creek to support aquatic and riparian habitats.

**Restoration Trajectory:** *Maintain flow regime in Newton Creek to support natural communities. If ecologically-optimal flow regime is considered feasible, then restore the annual hydrology of Newton Creek to resemble flows in a naturally-flowing, uncontrolled reference system such as Bear Creek or Bluff Creek within 5 years.*



**Examples of restored ecological flows.** These are images of stream channels that support a natural flow regime.

Streamflow in Newton Creek is primarily controlled by discharge from the Murphy Oil facility; it is likely that without the regular input of water from Murphy Oil, Newton Creek would be an intermittent channel, receiving water only during rainfall or snowmelt events. It is currently unknown which streamflow patterns would sustain, or optimize, healthy stream ecology in Newton Creek. Because discharge into the channel is largely controlled by the Murphy Oil facility, there is the possibility that drastic alterations could occur to streamflow patterns as a result of changes in present-day Murphy Oil operations.

Many of the restoration strategies outlined in this Master Plan aim to improve ecological conditions along the Newton Creek corridor, including the removal of barriers to allow migration by fish and aquatic macroinvertebrates, the establishment of a healthy riparian buffer zone, and invasive species control. These recommendations are based on the maintenance of flows in the channel that can support aquatic and riparian communities in Newton Creek.

Optimizing the ecological flow regime in Newton Creek may involve periodic over-bank flood events to reestablish geomorphic processes that are considered to be ecologically beneficial (including nutrient exchange, the sorting and transport of bed materials, the “watering” of riparian vegetation, and the formation of complex features in the channel such as riffles, pools, runs, point bars, and erosional and depositional areas). This must be balanced with the risk of re-suspending contaminants which may persist within floodplain sediments along the creek. The existence of these contaminated sediments is not confirmed, but any efforts to induce flood flows should consider this potential risk.

Objective A1 involves the determination of optimal flows for Newton Creek, based on reference ecosystems and stakeholder concerns, and the maintenance of flows in the channel to support natural communities.



**Action A1:1 Determine ecologically-optimal flow regime for Newton Creek.**

Because the current discharge of Newton Creek is industrially-influenced, estimating a flow regime that optimizes stream ecology along Newton Creek will allow a) an assessment the potential impacts that may occur if the current release schedule from Murphy Oil is drastically altered, and b) a “restoration target” for future restoration actions on Newton Creek, a valuable benchmark even if it is currently unattainable. This should include the determination of minimum flows that will support fish and aquatic organism survival, as well as high flow thresholds that could mobilize potentially-contaminated bank sediments.

**Procedure:**

- a) Determine appropriate reference stream systems that support a range of aquatic and riparian habitat biodiversity and stable channel morphology (Bluff Creek and Bear Creek, just 2-3 miles to the Southeast of Newton Creek, are identified as potential reference systems).
- b) Measure the hydrology and annual discharge patterns of adjacent reference stream systems. Using dimensionless ratios, create a conceptual flow-release schedule for Newton Creek that mimics reference systems.
- c) Explore the utility of The Nature Conservancy’s Indicators of Hydrologic Alteration software as a tool for computing ecological flow requirements for Newton Creek.

**Reference conditions:** Allouez Bay tributaries - Bluff Creek or Bear Creek.

**Affected area / size:** Length of Newton Creek channel (1.7 miles).

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$30,000 - \$60,000

**Permitting requirements:** None.

**Pre-implementation needs:** None.

**Action A1:2 Work with Murphy Oil to determine release schedule compatible with plant operations.**

Any ecological restoration that occurs along Newton Creek should be coordinated with Murphy Oil to ensure that release schedules are compatible with the proposed restoration objectives.

**Procedure:**

- a) Maintain a dialogue with Murphy Oil facility to monitor plant operations and projected releases into the Newton Creek channel.
- b) If the proposed restoration action is deemed to be incompatible with Murphy Oil facility operations, re-evaluate implementation of the restoration action.

**Reference conditions:** N/A

**Affected area / size:** N/A

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** None.

**Permitting requirements:** None.

**Pre-implementation needs:** None.

# Objective A2) Stormwater management to limit nutrient and contaminant input into Newton Creek and Hog Island Inlet.

*Restoration Trajectory:* Employ stormwater management best management practices (BMPs) to ensure that during a typical 1” storm event so that there is no untreated inflow into Newton Creek from open channels, stormwater drainage features, or combined sewer drainage facilities.

Currently, it is estimated that approximately 10% of the Newton Creek watershed is occupied by impervious land cover, including rooftops, pavement, concrete, and other hard surfaces. Clay-rich soils throughout the watershed limit the rate of infiltration, increasing the amount of stormwater runoff during rainfall events. The storm drain network directs runoff from these surfaces directly into Newton Creek, carrying many materials from urban and suburban areas along with it, including fertilizers used in home gardens and lawns, oil, grease, and trace metals from cars, litter, pet waste, and a host of other commonly used amenities that are considered environmental pollutants when they enter a waterbody. In addition, the dumping of lawn clippings, trash, and debris directly into the stream channel can be a source of pollutants. These sources add nutrients and pathogens which can affect water chemistry, limit the survivability and / or propagation of aquatic organisms, and pose human health concerns.

Effective stormwater management in Newton Creek includes the assessment of existing stormwater management facilities in the watershed, identification of point and non-point sources of stormwater input, and potential sources of pollution. A Newton Creek Stormwater Management Plan may include structural solutions, including facilities that infiltrate, retain, detain, and store stormwater runoff, reducing the volume and improving the quality of runoff before it enters the stream system. Potential non-structural solutions may include homeowner education, incentives for residents to implement on-site BMPs, and the amendment of existing building and sewer codes to enable stormwater BMPs within the watershed.



**Examples of stormwater managment.** These are images of rain gardens, vegetated swales, green roofs, and other BMPs that reduce the quantity and improve the quality of stormwater runoff in urban areas.



**Action A2:1** Work with City of Superior to identify potential sources of pollution into Newton Creek, and develop recommendations for appropriate stormwater best management practices (BMPs) in the watershed.

The inflow of water into the Newton Creek channel includes runoff from natural areas in the watershed and developed lands, as well as groundwater interactions. Any of these sources have the potential to transmit pollutants which could adversely affect both natural and human populations. An assessment of current and potential sources of contamination, whether from elevated nutrient inputs or toxic chemicals, will allow the development of a watershed-wide strategy to protect water quality in Newton Creek and the Hog Island Inlet.

**Procedure:**

- a) Verify the boundaries of the Newton Creek watershed, and perform a hydrological assessment of the current drainage network. Identify potential sources of pollution (including a map of outfalls and illicit discharges), pathways of entry into Newton Creek, and current stormwater management practices / facilities.
- b) Use this information to create a Newton Creek Stormwater Management Plan that is consistent with existing City of Superior NPDES permits and efforts, and programs appropriate structural and non-structural BMPs for use on public and private lands throughout the watershed. The plan should include a cost estimate and implementation strategy.
- c) Implement the Newton Creek Stormwater Management Plan.

**Reference conditions:** N/A

**Affected area / size:** Newton Creek watershed (~ 835 acres).

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$50,000 for development of Newton Creek watershed stormwater management plan  
 \$250,000 - \$500,000 for implementation

**Total cost:** \$300,000 - \$550,000

**Permitting requirements:** None.

**Pre-implementation needs:** None.

# Objective A3) Manage the threat of industrial contamination to water resources and sediments.

*Restoration Trajectory:* Through ongoing monitoring and communication between stakeholders, confirm that existing risk mitigation strategies are fully active, effective and sufficient to protect human and watershed health.



The continued industrial operations in the watershed, including Murphy Oil, Enbridge, and Burlington Northern Santa Fe railroad, constitute a potential threat to ecosystem health or the possibility of spillage of industrial byproducts into Newton Creek directly from these facilities or from transport to/from the facilities. Continuing to manage this risk is paramount; to insure that the collective investment of time and resources into this area is not squandered and long term ecological health is maintained.

Local industry is extensively regulated to prevent spills and contain contaminated materials. For example, the regulations and strategies currently in place at Murphy Oil include a Spill Prevention, Control, and Countermeasures Plan, a Stormwater Pollution Prevention Plan, staff training, annual drills for emergency spill response, an on-site emergency response team, and specially engineered systems for managing stormwater and site inspections. In addition, Murphy Oil has developed a mercury and PCB reduction guidance document and a chloride reduction plan, both actively used at the facility (Liz Lundmark, personal communication, 2007).

Ongoing monitoring of these programs and facilities and the effective communication of potential risks and associated mitigation measures with project stakeholders will help to identify any gaps and increase confidence that watershed health is being suitably safeguarded.

**The Murphy Oil and Dome Petroleum Sites.**  
The Murphy Oil refinery and Dome Petroleum tank facility are situated in the upper Newton Creek watershed.



**Action A3:1** Keep existing risk mitigation strategies in place to ensure that existing strategies are active and effective. Communicate potential risks and associated mitigation measures with project stakeholders.

Staff from WDNR and USEPA are actively working with Murphy Oil and Enbridge, the two primary industrial operators in the project area. All of these organizations are well represented in the Hog Island Working Group, and lines of communication and dialogue are open. This action intends to formalize that relationship by ensuring that industry and environmental regulators are collaborating and sharing information during the restoration process, to ensure that the investment into restoring environmental conditions is not jeopardized by industrial pollution.

**Procedure:**

- a) Maintain representatives from USEPA, WDNR, Murphy Oil, and Enbridge in the ongoing Hog Island , Hog Island Inlet, and Newton Creek restoration process. If possible, include a representative from Burlington Northern Santa Fe railroad.
- b) Share information about risk management procedures and ongoing monitoring results among project stakeholders.
- c) Actively monitor industrial operations to make sure that all permits are current and that mitigations strategies are active and effective.

**Reference conditions:** N/A

**Affected area / size:** N/A

**Implementation timeline:**



**Range of estimated costs:** Staffing costs assumed to be covered by partnering organizations.

**Permitting requirements:** Existing permits for industrial operations are on file with WDNR and USEPA. These include 40 CFR 122(SPCC) and WPDES permits.

**Pre-implementation needs:** Murphy Oil facility operational procedures and spill plan. Enbridge facility operational procedures.

# Objective A4) Determine if contaminated sediments persist in floodplain sediments along Newton Creek or within the Hog Island Inlet. If warranted, remediate these areas using mechanical or biological techniques, as appropriate.

**Restoration Trajectory:** *If sediment conditions warrant, use remediation techniques to further reduce the toxicity of floodplain and shoreline sediments to background levels. In 20 years, no evidence of historic contamination is evident anywhere in the project site.*



Initial post-remediation monitoring of aquatic habitats in Newton Creek and the Hog Island Inlet reveal that ecological conditions are improving and that water and sediment quality conditions are meeting remediation project goals. However, there are areas of residual contamination along floodplain sediments of Segments B-K, adjacent to the Burlington Northern Santa Fe railroad trestles at the mouth of the creek, and potentially within shoreline areas colonized by emergent wetlands in the Hog Island Inlet.

Objective A4 aims to alleviate the potential for these areas to become bio-available by a) performing an evaluation of post-remediation monitoring data to assess areas and levels of contamination, and b) initiating additional remediation actions that are appropriate to the location. This may include either mechanical techniques such as excavation and removal or capping, or biological techniques such as phytoremediation in areas where disturbances to existing natural communities should be minimized or mechanical remediation is determined to be inappropriate.

**Examples of sediment remediation.** The top images display excavation in conjunction with sediment remediation projects.



**Action A4:1** Determine if contaminated sediments remain along the shoreline of Hog Island Inlet and along the Newton Creek floodplain terraces.

As of August 2007, the results of the sediment remediation actions in Hog Island Inlet have not yet been released. Remediation actions are contingent upon the results of post-project surveys of sediment conditions currently existing on the project site.

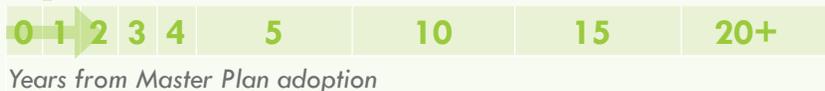
**Procedure:**

- a) Review post-project data from the sediment remediation efforts completed in November 2005 by USEPA, WDNR, and other partners.
- b) In cooperation with federal, state, and local agencies, perform additional analyses (including additional sampling, if necessary) of the Newton Creek channel, riparian corridor, Hog Island Inlet, and Hog Island Inlet shoreline areas to determine the degree and extent of residual sediment contamination.

**Reference conditions:** N/A

**Affected area / size:** Newton Creek floodplains, shoreline areas of Hog Island Inlet.

**Implementation timeline:**



**Range of estimated costs:** \$50,000 - \$250,000.

**Permitting requirements:** None.

**Pre-implementation needs:** Post-project data from the Hog Island Inlet and Newton Creek sediment remediation efforts.

**Action A4:2** Initiate additional mechanical or biological sediment remediation actions. If phytoremediation is determined to be appropriate, establish initial test plots and monitor.

Areas that may still contain contaminated sediments are likely those that are difficult to access using excavation equipment, or are ecologically-sensitive riparian or shoreline environments. Therefore, phytoremediation may prove to be the most viable alternative. If phytoremediation is pursued, a series of initial test plots should be established and monitored to determine success prior to widespread application.

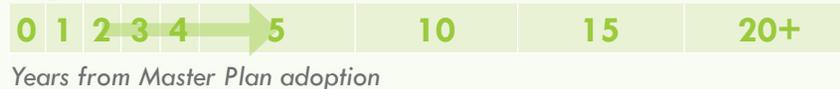
**Procedure:**

- a) In areas that are demonstrated to contain unacceptable level of contamination, design and establish a pilot project using appropriate vegetation (in hydric soils use emergent wetland vegetation such as willow, alder, and cattails; in mesic soils use ryegrass, legume, and fescue). At a minimum, the pilot should include at least 1 control plot, and 1 phytoremediation plot with appropriate vegetation.
- b) Institute a three-year monitoring program to determine the degree of remediation achieved, and the relative health of the vegetative communities.
- c) If determined to be successful, expand phytoremediation efforts to other areas of residual contamination.

**Reference conditions:** Reference (control) plots in areas identified as having “background” levels of toxicity.

**Affected area / size:** Dependent upon results of Action A4:1 / test plots should be at least 20’ x 20’ in size.

**Implementation timeline:**



**Range of estimated costs:** \$30,000 - \$50,000 to establish 2 test plots. \$20,000 / year monitoring expenses for 2 test plots (x 3 years).

Costs of expanded remediation efforts dependent upon size of area, degree of contamination, and method(s) employed.

**Total estimated cost:** \$90,000 - \$110,000

**Permitting requirements:** To be determined based on results from Actions A4:1 (determine locations of residual sediment contamination in the project site).

**Pre-implementation needs:** Pending on results from Actions A4:1 (areas of residual sediment contamination in the project site).

# Goal B) Conservation and protection for ecologically-sensitive habitats.

## Overview

This Goal proposes measures that will enable the long term protection of valuable natural areas that are currently in private ownership or lands in public ownership that could be subject to future development actions.

Currently within the Newton Creek watershed and Hog Island, there are many areas that are left as open space; unprogrammed, undeveloped, and unused by humans. Many of these areas have a high degree of ecological value, providing essential habitats for a diverse array of plant and animal species. The maintenance of these areas as high quality habitats is dependent upon the conservation of these areas as open spaces, protecting natural communities from direct and indirect disturbance that occurs with conversion to urban, suburban, industrial, or transportation-related land uses. In addition, the longevity of areas that are programmed for restoration will be contingent upon the future conservation status of those areas.

During the 3rd workshop, primary and secondary sites for conservation and protection were identified (see maps opposite). Primary conservation sites are integral to the ecological functioning and sustained restoration of Hog Island, the Inlet and Newton Creek and are designated for active restoration. The primary sites include land owned by Douglas County on Hog Island and along Newton Creek, City of Superior properties along Newton Creek, Enbridge properties along Ogdensburg Pier, the Burlington Northern Santa Fe railway along the shoreline of Hog Island Inlet, and Murphy Oil and Enbridge parcels in the upper watershed.

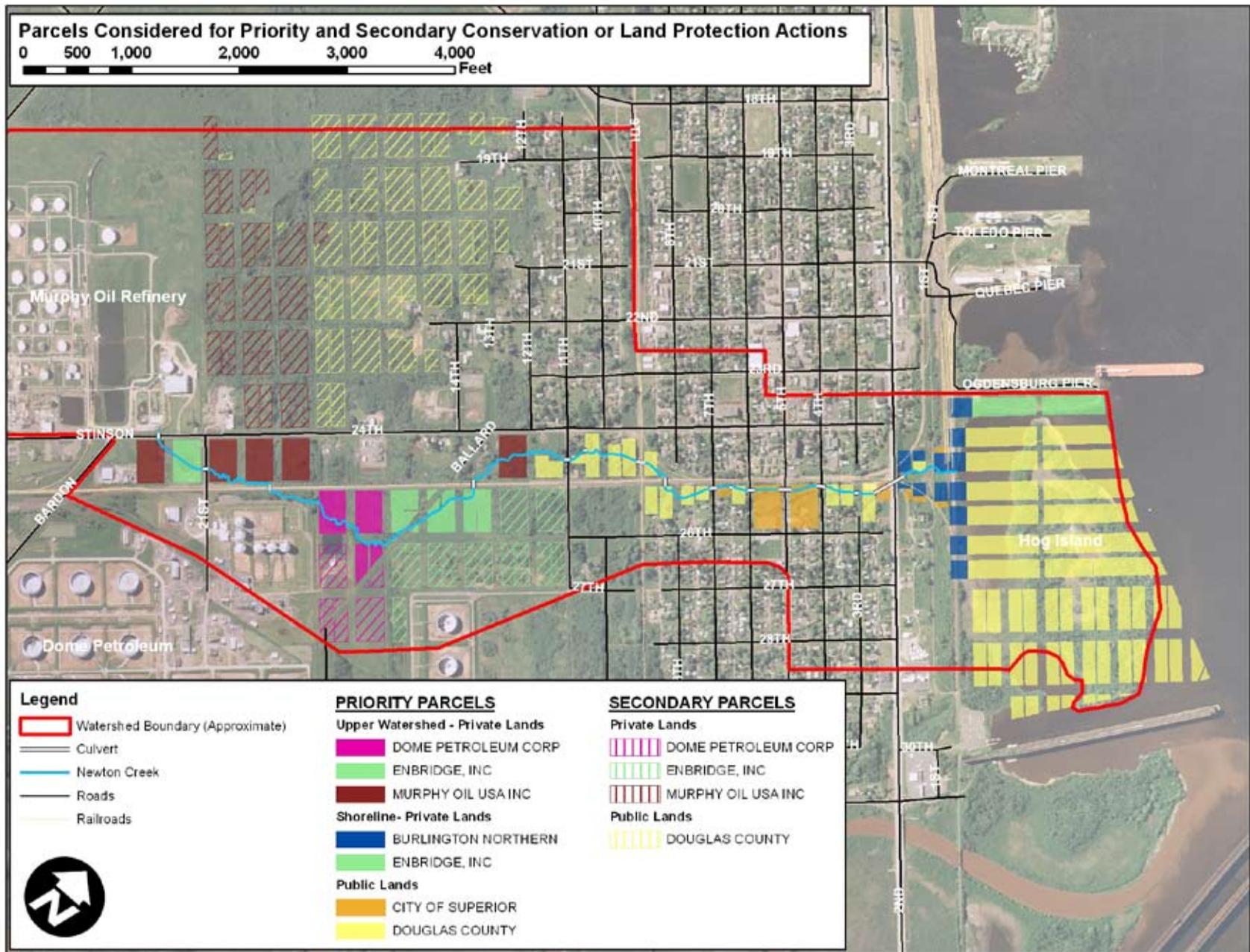
While not designated for active restoration, the secondary conservation sites are instrumental in maintaining watershed-level health and diversity. The protection of these locales will help to maintain connectivity between the Newton Creek watershed and other natural areas in the region, including the Nemadji River corridor and the superior Municipal Forest, so wildlife can migrate between suitable habitats. Further, it will protect sensitive habitats that currently exist in the area. These sites are primarily upper watershed sites and involve land owned by Douglas County, Murphy Oil, Dome Petroleum, and Enbridge.

Murphy Oil has recently acquired many undeveloped parcels adjacent to their current facilities from Douglas County. They may expand operations in the near future into these areas.

## Objectives

- B1)** Place publicly held open areas and sensitive habitats into permanent protection through designation, with an emphasis on primary protection sites.
- B2)** Encourage landowners to place open areas and sensitive habitats into permanent protection.





# Objective B1) Place publicly held open areas and sensitive habitats into permanent protection through designation, with an emphasis on primary protection sites.

*Restoration Trajectory:* Provide permanent protection for publicly-owned open spaces designated as priority conservation areas, including Hog Island, the Hog Island isthmus, and targeted properties along the shoreline and riparian corridor of Newton Creek.



In many municipalities, special provisions are taken to protect areas considered to be ecologically-valuable through passage of special city ordinances (such as the current City of Superior “Municipal Forest Protection” ordinance), rezoning sensitive habitats to protected “open space”, or designating the area as public parkland with a suite of designated uses that conserve natural features. City of Superior and Douglas County could enact similar legislation that would grant special protections to these areas with minimal associated cost.

The protection of public lands designated for active restoration is considered a high priority. Hog Island and the Hog Island isthmus are owned by Douglas County, but they do not currently receive protected status. Several undeveloped parcels adjacent to Newton Creek are in the ownership of Douglas County and City of Superior.

**Examples of publicly owned lands recommended for conservation.** These images of Hog Island display areas to be placed into permanent protection.



**Action B1:1** Work with the City of Superior and Douglas County to permanently protect remaining vacant public lands on Hog Island and within the Newton Creek watershed, with an emphasis on primary protection sites.

Douglas County has already initiated efforts to designate conservation status for their properties on Hog Island and adjacent shoreline parcels. Publicly-owned, priority land protection areas along the Newton Creek corridor include parcels owned by Douglas County and the City of Superior.

**Procedure:**

- a) For City of Superior and Douglas County, independently determine most appropriate mechanisms for granting selected parcels protected status, placing most attention on primary conservation sites.
- b) City of Superior: Engage City Planning Department and City Council to enact protections.
- c) Douglas County: Engage County Planning and Zoning Department and County Board of Supervisors to enact protections.

**Reference conditions:** N/A

**Affected area/size:** Hog Island, Hog Island isthmus, and selected parcels.  
 In City of Superior ownership: 6 acres designated for protection.  
 In Douglas County ownership: 76 acres designated for protection.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Administrative costs associated with conservation measures, estimated at \$20,000 per landowner.

**Permitting requirements:** None.

**Pre-implementation needs:** None.

## Objective B2) Encourage landowners to place privately held restoration areas and sensitive habitats into permanent protection with an emphasis on protecting primary sites.

*Restoration Trajectory:* Provide permanent protection for private parcels designated as priority conservation targets, including portions of the Ogdensburg Pier, the Hog Island Inlet shoreline, and designated open spaces along the Newton Creek corridor. If feasible, place private lands designated as secondary conservation sites into conservation easement.

**Examples of privately held open areas.** Photos of Burlington Northern Santa Fe railway (top) and the Ogdensburg Pier (bottom).



A variety of options exist for encouraging land owners to consider placing their land into protection. Direct acquisition involves the landowner selling to a land trust at either a bargain sale or fair market value. A conservation easement allows the landowner to retain the title to the land, continue to live on the land, sell it or pass it on to heirs. Under the easement the use of the land is restricted so that its natural attributes are protected. This option often significantly reduces estate taxes. Land transfers, or direct donation, are the most logistically simple method as it only involves deeding the land to the agency to which it will be donated. The West Wisconsin Land Trust and other regional land trust organizations may be able to help facilitate conversations with landowners so they are aware of the options for and benefits to placing land into protected status. More detailed descriptions of protection options are available at [www.wwlt.org](http://www.wwlt.org).

Enacting ecological restoration and conservation priorities on private lands is a delicate matter. Some of the key areas that are programmed for active restoration actions include the southwestern shoreline along the Hog Island Inlet, which is owned by Burlington Northern Santa Fe Railways, and the northwestern shoreline along the Hog Island Inlet, a portion of the Ogdensburg Pier owned by Enbridge. The acquisition of these parcels is key to shoreline buffer and wetland restoration strategies proposed in Objectives C2 and C3.

Large swaths of ecologically-valuable undeveloped lands in the upper watershed of Newton Creek are in the ownership of Murphy Oil and Enbridge, Inc. These areas are designated as secondary conservation areas; comprising a diversity of habitats that support healthy populations of plants and animal communities. In addition, these areas provide a wide buffer for Newton Creek, and a corridor for the migration of animals through the open woodland, wetland, and grassland areas that still remain in the City of Superior. Their protection will ensure the continued viability of these habitats, and protection from future development or development-related infrastructure.

The potential expansion of the Murphy Oil facility into these areas does not entirely preclude land conservation efforts. Conserving wide buffers of open lands around the perimeter of the developed areas would still allow passage of some wildlife species.



**Action B2:1** Place private lands designated as priority conservation areas into permanent land protection or conservation status, including the southeastern portion of the Ogdensburg Pier and Burlington Northern Santa Fe properties along the shoreline of Hog Island Inlet.

The Ogdensburg Pier presents great opportunities for restoring diverse shoreline ecosystems along the Hog Island Inlet, as well as the restoration of upland habitats and creation of passive recreation facilities (Action C2:2 and Objective D1). The area targeted for conservation status is a 100' swath of land on southeastern portion of the pier, bordering the Hog Island Inlet shoreline. There are some initial indications that Enbridge, the current property owners, may be willing to sell or transfer the land to an entity would provide for conservation.

Burlington Northern Santa Fe owns the railway berms which run parallel to the southwestern shoreline of Hog Island Inlet, ending at the Loon's Foot Landing parking lot. The conservation of these properties would allow for the establishment of a vegetated buffer the shoreline of Hog Island Inlet (Action C2:2), and restoration of Newton Creek channel between the 2nd St. culvert and Hog Island Inlet (Action C3:3).

**Procedure:**

Open discussions with Enbridge Energy and Burlington Northern Santa Fe to discuss options for sale or placing designated lands into conservation easement. Work with West Wisconsin Land Trust to facilitate land protection.

**Reference conditions:** N/A

**Affected area/size:** Enbridge parcels: 2.8 acres  
Burlington Northern Santa Fe parcels: 7.5 acres

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$100,000 - \$400,000 / acre for acquisition  
\$20,000 per landowner for land protection agreement fees.

**Permitting requirements:** To be determined according to individual parcels.

**Pre-implementation needs:** Valuation of Ogdensburg Pier and Burlington Northern Santa Fe properties.

**Action B2:2** Permanently protect privately held upland wetland and riparian habitats within the Newton Creek Watershed.

Secondary land conservation targets include vacant Murphy Oil and Enbridge parcels in the upper Newton Creek watershed. The preservation of these areas would allow existing woodland, grassland, wetland, and riparian habitats and terrestrial wildlife migration routes to remain intact and undisturbed. Land protection options must be coordinated with industrial operations, including the potential expansion of Murphy Oil. At a minimum, buffers of sufficient width (300 feet or greater) should be maintained along the Newton Creek corridor, and around industrial facilities, to allow wildlife migration and preserve relict habitats.

**Procedure:**

- a) Engage in discussions with relevant land owners to determine willingness to sell or place designated lands into conservation easement. Work with West Wisconsin Land Trust to facilitate land protection.
- b) Conservation actions should occur according to negotiations with respective land owners.

**Reference conditions:** N/A

**Affected area / size:** Murphy Oil parcels: approximately 24 acres designated as priority land protection sites.  
Murphy Oil parcels: approximately 85 acres designated as secondary land protection sites.  
Enbridge parcels: approximately 23 acres designated as priority land protection sites.  
Enbridge parcels: approximately 33 acres designated as secondary land protection sites.

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$20,000 per landowner for land protection agreement fees.

**Permitting requirements:** None.

**Pre-implementation needs:** Valuation of properties, discussions with primary landowners.

# Goal C) Restore selected habitat components to be consistent with the ecological restoration guiding principles.

## Overview

As indicated by the habitat profiles in the Existing Conditions section of this document, habitat complexes within Hog Island, Hog Island Inlet, and Newton Creek already contain a high degree of ecological integrity, and presently support a wide variety of biodiversity. This was recognized by project stakeholders during the stakeholder workshop series, to the degree where some participants questioned the need for any restoration actions to occur.

In fact, many of the landscape elements in the project area are not in need of wholesale, active ecological restoration actions. For instance, Hog Island itself already supports a range of appropriate habitats that are in a state of active succession as vegetation communities and soils mature. For this reason, very specific ecological restoration strategies are proposed that enhance targeted elements in these greater habitat matrices. For instance, the addition of certain species or elements of recognized significance, such as wading shorebirds, submerged aquatic vegetation, or wild rice, will add additional diversity and value to these areas, as well as the greater eco-region. In other cases, full restoration is proposed for certain areas that contain highly degraded habitats, or present excellent opportunities for re-establishing ecological connectivity between landscapes. In addition, many of these habitats can greatly benefit from the mitigation of sources of ecological disturbance, such as invasive species management, culverts and road crossings, denuded buffers, or degraded water quality. The final element of habitat restoration is the active monitoring of any restoration actions implemented as part of this plan.

The following ecological restoration recommendations are born from the vision and guiding principles articulated by project stakeholders, promoting ecological biodiversity; resilience; function ecological groups; reproducing, indigenous species; the mitigation of threats; the use of reference habitats; and congruence with the LSLRHP.

## Objectives

- C1)** Control selected invasive plant species.
- C2)** Improve landscape connectivity for natural communities by enhancing streamside and shoreline buffers, and removing barriers to aquatic and terrestrial wildlife migration.
- C3)** Restore / enhance wetland complexes along shallow water and shoreline areas.
- C4)** Restore or enhance habitat complexity in the open water areas of Hog Island Inlet.
- C5)** Enhance migratory bird habitats, especially for rare, threatened, or endangered (RTE) species.
- C6)** Initiate post-project monitoring for any restoration actions that occur, and use information to inform other restoration actions in the designated project area and within the greater St Louis River watershed.





# Objective C1) Control selected invasive plant species.

**Restoration Trajectory:** Restore target assemblages of native plant species on Hog Island, Hog Island Inlet, and Newton Creek, and eliminate the threat from invasive exotics through the control of invasive species.



**Example of invase plants.** Images of reed canary grass (top left), purple loosestrife (top right), and common reed (bottom).

Invasive species management is identified as a major threat to the long term habitat sustainability across a wide range of habitat types in the project area. Invasive species management includes baseline assessment, monitoring, active control, passive control, and the combination of invasive species management with other types of projects such as stream restoration, wetland restoration, and reforestation. Priority non-native invasive species for control are reed canary grass (*Phalaris arundinaceae*), which occurs in abundance along the length of Newton Creek, and common reed (*Phragmites australis*), which is present in large stands in the Hog Island Inlet and shoreline. Purple loosestrife is not confirmed to exist in the project area, but should be carefully monitored to ensure that future invasion does not occur from adjacent areas of Superior City where it is known to exist.



Proposed invasive species control locations.



**Action C1:1** Perform a comprehensive invasive plant species inventory and mapping throughout ecologically sensitive areas, research appropriate management strategies, and control invasive vegetation.

**Procedure:**

- a) Perform invasive species inventory and mapping using field surveys. Prioritize areas designated for conservation and restoration actions, including Hog Island, the Hog Island Inlet shoreline, the Newton Creek riparian corridor, and vacant uplands in the Newton Creek watershed.
- b) For each invasive vegetative community identified in the survey, research appropriate control strategies compatible with habitat restoration goals, and create an invasive species management plan that details the implementation of each control mechanism (see Actions C1:2 and C1:3 below).
- c) Synchronize control efforts with habitat restoration actions throughout the project site.

**Reference conditions:** N/A

**Affected area / size:** ~200 acres.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$50,000 - 75,000 for the inventory  
 \$15,000 for the invasive species management plan  
 \$5,000 / acre for control

**Total estimated cost:** \$65,000 - \$90,000 not including any control.

**Permitting requirements:** Any method of invasive vegetation treatment will likely require approval by state and federal agencies.

**Pre-implementation needs:** Existing invasive species mapping data (if available).

**Action C1:2** Establish a vegetation management plan to control reed canary grass along Newton Creek.

Contiguous stands of reed canary grass along Newton Creek have created a monoculture that suppress the establishment of native riparian vegetation and limits biodiversity. Control of this invasive plant will aid in the restoration of aquatic and riparian habitats.

**Procedure:**

- a) Use invasive species inventory generated in Action C1:1 to identify locations of reed canary grass.
- b) Create a vegetation management plan that specifies the control strategies and a schedule for implementation. Synchronize with Actions A1:1 and A1:2 for potential use of flooding to control reed canary grass populations, and Action C2:1 - restoration of the Newton Creek riparian buffer. Control methods are many and varied, but include the planting of fast-growing shrubs or trees, which will eventually eliminate reed canary grass since it is intolerant of year-round shade. Other eradication methods include burning, flooding for prolonged periods, and mowing.<sup>1</sup>

**Reference conditions:** N/A

**Affected area / size:** An estimated 25 acres.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$5,000 - \$20,000 / acre

**Total estimated cost:** \$125,000 - \$500,000

**Permitting requirements:** Any method of reed canary grass treatment will likely require approval by state and federal agencies.

**Pre-implementation needs:** Invasive species inventory and mapping from Action C1:1.

<sup>1</sup>For more info on reed canary grass control strategies, see [http://www.ipaw.org/invasiders/reed\\_canary\\_grass/draft\\_rcg\\_table\\_sm.pdf](http://www.ipaw.org/invasiders/reed_canary_grass/draft_rcg_table_sm.pdf)

## Ecological Restoration Plan

**Action C1:3** Establish a vegetation management plan to control *Phragmites australis* along the Hog Island shoreline areas.

The stands of *Phragmites australis* along the shoreline areas out-compete and displace native emergent macrophyte communities. These stands should be controlled to insure the establishment and long term sustainability of native plant communities.

**Procedure:**

- a) Use invasive species inventory generated in Action C1:1 to identify shoreline areas invaded with *Phragmites australis*, and confirm that the existing stands are non-native species..
- b) Determine effective control strategies, create a vegetation management plan, and execute. Techniques used to control *Phragmites* include chemical treatment (i.e. spraying herbicides) or physical treatments such as mowing, discing, flooding, draining or burning. Generally, the most practical method of controlling *Phragmites* involves treating the plants with glyphosate herbicide. The USEPA approved formulation of glyphosate for use in wetlands is trade named “Rodeo” and is virtually nontoxic to mammals, birds, and fish when used according to application instructions. Applications in successive years will likely be required and removal of standing dead plant material will facilitate volunteerism by desired plant species.

**Reference conditions:** N/A

**Affected area / size:** An estimated 8 acres.

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$2,000 - \$10,000 / acre

**Total estimated cost:** \$16,000 - \$80,000

**Permitting requirements:** Any method of *Phragmites australis* treatment will likely require approval by state agencies.

**Pre-implementation needs:** Invasive species inventory and mapping from Action C1:1.

**Action C1:4** Actively monitor for migration of exotic invasive plants from the adjacent landscape, especially purple loosestrife, and perform additional invasive species control if necessary.

Ongoing monitoring is necessary to prevent the migration of invasive plant species into the project site from the adjacent landscape. Especially in the early years of proposed ecological restoration actions, invasive plants will have the opportunity to colonize as native vegetation becomes established and begins to mature. The existence of purple loosestrife in the City of Superior is especially concerning, as this plant could easily become established in the Newton Creek watershed and Hog Island. The City of Superior has already engaged in successful purple loosestrife eradication programs in the Pokegama River watershed, as well as several other locations in the City.

**Procedure:**

After the invasive control efforts in Actions C1:2 and C1:3, initiate an annual survey to determine the establishment of invasive vegetative communities in the project site, and eradicate as necessary.

**Reference conditions:** N/A

**Affected area / size:** ~ 200 acres

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$10,000 / year

**Total estimated cost:** \$100,000

**Permitting requirements:** Any method of invasive vegetation treatment will likely require approval by state and federal agencies.

**Pre-implementation needs:** Existing inventories and mapping of purple loosestrife or other non-native, invasive vegetation communities in the City of Superior and Douglas County.





Reed canary  
grass along  
Newton  
Creek



# Objective C2) Improve landscape connectivity for natural communities by enhancing streamside and shoreline buffers, and removing barriers to aquatic and terrestrial wildlife migration.

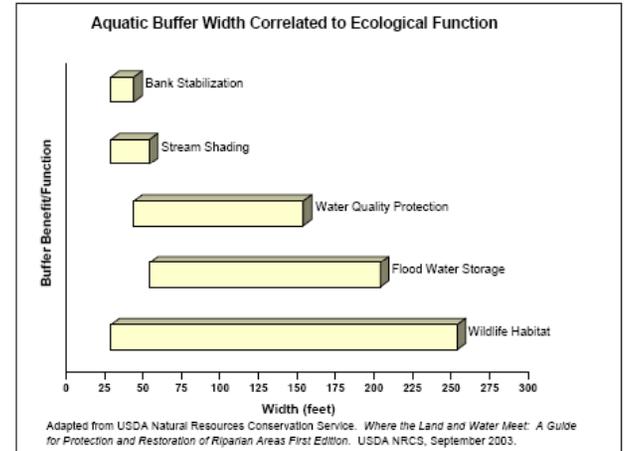
**Restoration Trajectory:** *Establish and maintain a 75' foot riparian buffer along Newton Creek between 7th St. and 2nd St. Establish a minimum of 100' shoreline buffer areas for Hog Island Inlet along Ogdensburg Pier and Superior Harbor shoreline. Remove 2nd St culvert and replace with a natural channel. Retrofit / replace culverts under 4th, 5th, 6th, and 7th streets.*



The restoration of aquatic buffers presents the most ecologically advantageous strategy for enhancing the biodiversity of aquatic organisms, avian, and wildlife populations in the project area. However, it is also ambitious. Full restoration of riparian and shoreline involves maximizing both the width and the continuity of the current riparian and shoreline vegetative communities.



Along Newton Creek, riparian buffer enhancement should concentrate on attaining an ecologically-optimal width specifying both vegetative composition and allowable uses within buffer zones, and removing or retrofitting barriers along the buffer to facilitate longitudinal migration of aquatic, avian, and wildlife species.



For Hog Island and Hog Island Inlet, buffer enhancement should occur along shoreline areas where the current buffer is denuded; along the Burlington Northern Santa Fe railroad properties on the Superior shoreline and along Ogdensburg Pier. In these areas, restoration could include the re-establishment of more gentle topography to allow for greater widths of wetland and vegetative buffer communities and to mitigate the effects of shoreline erosion.

**Examples of improved buffers and corridors.**

Photos of riparian buffers and wildlife corridors in various stages of development. At right, a map of the proposed buffer restoration actions.



**Action C2:1** Establish a 75 foot wide riparian buffer along Newton Creek between 7th Street and 2nd Street.

Below 7th Street, the vegetative buffer along Newton Creek is denuded, disturbed, or dominated by invasive vegetation in many places. Restoration of these riparian buffers with vegetative assemblages replicating reference riparian ecosystems would maximize bank stabilization and stream shading, and enhance water quality protection, flood water storage, and wildlife habitats.

**Procedure:**

- a) Identify areas that could benefit from riparian buffer enhancement, and restore vegetation communities throughout these areas to reference riparian vegetation communities found along the Allouez Bay tributaries of Bluff Creek and Bear Creek, where appropriate.
- b) Determine allowable uses in buffer zones, and coordinate with any operations and maintenance that occurs on public lands in these buffer areas.
- c) Synchronize riparian buffer restoration with culvert removal (Action C2:3), streamflow patterns (Objective A1), and invasive species management (Action C1:2).

**Reference conditions:** Riparian vegetation assemblages in Bluff Creek and / or Bear Creek.

**Affected area / size:** Up to 6 acres.

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$15,000 - \$20,000 / acre

**Total estimated cost:** \$90,000 - \$120,000

**Permitting requirements:** None required for buffer planting. If done in conjunction with invasive species control, channel alteration, or bank grading, permits will be necessary.

**Pre-implementation needs:** Establish riparian buffer reference conditions in Allouez Bay tributaries.

**Action C2:2** Establish a 100 foot vegetative buffer along the southwestern and northwestern shorelines of Hog Island Inlet.

Shoreline buffers provide a critical ecological role in the protection of diverse shoreline, shallow water, and open water habitats that exist in the project area. Currently, the shoreline buffer along the southwestern and northwestern shorelines of Hog Island Inlet is very denuded. Through the restoration of a shoreline buffer in this area, ecological services such as shoreline erosion control; water filtration; aquatic, avian, and terrestrial wildlife habitat creation; and the physical protection of sensitive shoreline habitats would be greatly enhanced.

**Procedure:**

- a) Using Allouez Bay wetlands as a reference, establish vegetative communities according to relative topographic distribution and lake hydrology; consisting of mud flats, emergent wetland vegetation, beach / dune grasses, alder thickets, scrub/shrub communities, and woodlands. Removal of hard bank structures and regrading may be necessary along railroad berms.
- b) Determine allowable uses in buffer zones, and coordinate with any operations and maintenance that occurs in these buffer areas.
- c) Synchronize riparian buffer restoration with land protection (Actions B2:2, B2:3) and invasive species management (Action C1:3).

**Reference conditions:** Shoreline buffers in Allouez Bay.

**Affected area / size:** 6 acres.

**Implementation timeline:**



Years from Master Plan adoption

**Range of estimated costs:** \$225,000 for Superior shoreline buffer enhancement (3 acres)  
\$45,000 for Ogdensburg Pier buffer enhancement (3 acres)

**Total estimated cost:** \$270,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits, City of Superior wetlands permits.

**Pre-implementation needs:**

- Establish riparian buffer reference conditions along Allouez Bay shoreline.
- Land protection / easement on Superior shoreline and Ogdensburg Pier properties.

## Ecological Restoration Plan

### Action C2:3 Remove, replace, or retrofit culverts at road and sanitary sewer line crossings along Newton Creek.

As opposed to the railroad crossings, which are large-sized arches that have a “natural” (i.e. not concrete or corrugated metal) bed, the road crossings are generally undersized concrete or corrugated metal culverts that restrict stream-flow, are often filled with sediment and vegetative debris, and are not conducive to the migration of aquatic organisms along the channel. Culverts that are closest to the Newton Creek Inlet present the greatest opportunities; their removal or retrofit would allow aquatic organisms to move to and from the Hog Island Inlet into the alluvial stream system, greatly improving and increasing the availability of aquatic habitat in these areas. The culvert under 2nd Street is the highest priority for and replacement with natural channel. The culverts under 4th, 5th, 6th, and 7th streets are also high to medium priority for removal, replacement, or retrofit.

Complete removal of these features would require the road crossings to be replaced by bottomless spans, followed by restoration to a natural channel. This is the most ecologically-optimal alternative, with the greatest improvement to riparian and in-stream habitat conditions, and the removal of terrestrial and aquatic migratory barriers. A second option is to replace the culverts with “bottomless” arches or culverts that are greater in size and have a natural bed. It is highly recommended that the streamflow pattern in Newton Creek (Objective A1) be established prior to any work in the channel of Newton Creek, as alterations to the flow regime will have enormous impacts to the engineering requirements of these culverts.

#### Procedure:

- Collect baseline data on aquatic and riparian habitat conditions along the alluvial sections of Newton Creek below 7th Ave.
- Pending the resolution of Objective A1, determine the design flows for Newton Creek at the road crossings.
- Using reference conditions from the Allouez Bay tributaries and/or upstream unrestricted sections of Newton Creek, create conceptual designs and construction documents for the daylighting of Newton Creek at the 2nd Ave culvert, with restoration to a natural channel.
- Construct natural channel at the 2nd Ave culvert, and monitor to determine ecological response.
- Contingent upon funding and opportunity, remove, replace, or retrofit culverts under 4th, 5th, 6th, and 7th streets, and monitor to determine ecological response.

**Reference conditions:** Bluff Creek and Bear Creek (Allouez Bay tributaries) / unrestricted upstream sections of Newton Creek.

**Affected area / size:** Culverts under 2nd, 4th, 5th, 6th, and 7th streets.

#### Implementation timeline:



Years from Master Plan adoption

#### Range of estimated costs:

- \$250,000 for removal of 2nd St. culvert and natural channel design/construction
- \$50,000 each for retrofit/replacement of 4th, 5th, 6th, and 7th St. culverts

**Total estimated cost:** \$450,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Establish streamflow regime (Objective A1).





Looking downstream at the culvert under 2nd Ave on Newton Creek



# Objective C3) Restore or enhance wetland complexes along shallow water and shoreline areas.

**Restoration Trajectory:** *The restoration of the Hog Island shoreline to replicate a “Sheltered Bay habitat,” such as Allouez Bay. Create 3 additional acres of wetland habitat along the shoreline of Hog Island Inlet, including 1 acre of wild rice (if determined to be feasible). Restore 0.5 acres of wetland habitat on Newton Creek between the 2<sup>nd</sup> Street culvert and the railroad trestles.*



**Examples of wetlands.** These are photos of wetlands restoration projects. A map of the proposed wetland restoration areas in the Hog Island Inlet is on the bottom right of the page.

Wetlands have long been recognized as essential habitat for many species of fish and birds that utilize these areas for forage and cover, resting and breeding. In addition, wetlands provide natural “cleansing” of waters through the process of denitrification and nutrient uptake. Historically, it is likely that the entire Superior shoreline was covered in large expanses of wetlands; the wetlands in Allouez Bay are remnants of this formerly-vast complex. Hog Island Inlet is an ideal place for wetland habitats, with naturally shallow waters protected from wave erosion, and seiche-influenced hydrology. Currently, there are large swaths of wetland habitat along the eastern and southern edges of the Hog Island Inlet. However, the northern and western edges adjacent to Superior shoreline and Ogdensburg Pier are currently lacking in wetlands habitat. The restoration of wetlands, including native populations of wild rice, along the shoreline of Hog Island Inlet would provide additional habitat for avian and aquatic species, buffer the open waters of the Inlet, and provide water quality treatment for the inflow from Newton Creek. In addition, the establishment of floodplain wetlands habitat in the seiche-influenced reach of Newton Creek (below 2nd Street) would greatly enhance the biodiversity of flora and fauna in this alluvial / lacustrine transition zone.



### Action C3:1 Restore sustainable, reproducing communities of wild rice in the Hog Island Inlet and along the shoreline.

Wild rice is a native plant to the region that has significant cultural and ecological values. It thrives in water depths of 2.5' to 3.5', to a maximum of 4.5' (Rick Gitar, personal communication), and is very sensitive to the organic content of the soil medium as well as variations in water elevation. Although it is acknowledged that establishing wild rice colonies is difficult, a large portion of the Hog Island embayment is considered potentially suitable habitat. Additional studies of the feasibility for wild rice establishment in the Hog Island Inlet need to be performed.

#### Procedure:

- a) Monitor the seiche effect in the Hog Island Inlet to determine if water level fluctuations will impair wild rice establishment. Determine organic content of substrate in target areas to evaluate if organic enrichment needs to occur to provide optimal habitat conditions.
- b) Identify a viable seed source and collect wild rice seeds (Allouez Bay and the sheltered bays of the Lower St. Louis River are potential donor sites). Seed collection should be coordinated to time the collection and distribution of the seed within the same season, as the risk of spoilage is high.
- c) Identify an area along the shoreline of Hog Island Inlet that would support wild rice populations. It is recommended that wild rice planting is timed to colonize areas that have been cleared of *Phragmites*.
- d) Distribute seeds using appropriate techniques to maximize survival, and monitor to ensure maturation.

**Reference conditions:** Wild rice habitats in Allouez Bay and the sheltered bays of the Lower St. Louis River.

**Affected area / size:** Hog Island Inlet and shoreline / 1 acre

#### Implementation timeline:



Years from Master Plan adoption

**Range of estimated costs:** \$10,000 - \$15,000.

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wild rice seed collection permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Invasive *Phragmites* control (Action C1:3).

## Ecological Restoration Plan

### Action C3:2 Expand areas of emergent wetland vegetation or create “floating log-bog” wetlands in the northwestern and southwestern areas of the Inlet

The shallow water areas of the Inlet allow for establishment of emergent vegetation along the shoreline with minimal effort, providing additional wetlands habitat for aquatic, avian, and wildlife communities. The greatest opportunities lie along the bay shoreline and the Ogdensburg Pier; tying new wetland habitats into the existing complex of wetland vegetation on the isthmus would form a contiguous complex of wetland vegetation around the perimeter of the Hog Island Inlet. This configuration of wetlands habitats replicates several reference “sheltered bay” habitats in the Superior Harbor area.

An additional opportunity lies in the creation of “floating log-bog” wetlands, suggested by Dennis Pratt at WDNR and discussed in the third stakeholder workshop. These mimic the natural woody wrack that accumulates along the shallow-water edges of the bay shoreline and become colonized by wetland vegetation, providing a unique, diverse wetlands habitat. The creation of “floating log-bog” wetlands in the Hog Island Inlet would extend the landward buffer along the perimeter of the Inlet, provide excellent forage and cover for aquatic species, and isolated roosting and foraging areas for birds. Successful establishment requires further analysis of reference habitats in Allouez Bay.

#### Procedure:

- a) Synchronize with shoreline buffer restoration in Action C2:2, as the establishment of additional emergent wetland vegetation may overlap with shoreline buffer restoration actions.
- b) Establish emergent wetland reference conditions from Allouez Bay wetlands, including target vegetation species assemblages and relative topographic and hydrologic ranges.
- c) Plant wetland vegetation or create “floating log-bog habitats”, and monitor for 3 years to ensure successful establishment.

**Reference conditions:** Allouez Bay emergent wetlands communities.

**Affected area / size:** Hog Island Inlet and shoreline / 3 acres.

#### Implementation timeline:



Years from Master Plan adoption

**Range of estimated costs:** \$20,000 - \$50,000 / acre

**Total estimated cost:** \$60,000 - \$150,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Synchronize with Action C2:2 (shoreline buffer restoration).



**Action C3:3** Expand areas of wetland vegetation into the seiche-influenced areas of Newton Creek (below the 2nd St culvert).

Currently, this area is revegetating after disturbance during the sediment remediation efforts in the area in 2005.

The right bank of Newton Creek is denuded, with sparse vegetation. The left bank supports more mature riparian vegetation. Ecologically, this is a very critical area, the interface between the alluvial sections of Newton Creek with the lacustrine habitats. Currently the railroad berms and trestles bisect the riparian and lacustrine / wetland natural communities, and the terraces are not supporting a fully –developed diversity of habitats.

By excavating the right bank terrace (and other areas deemed appropriate) to elevations that would allow hydrologic influence from high flows in Newton Creek or backwater conditions from the seiche effect, emergent wetlands communities could be established, and an active floodplain created adjacent to Newton Creek. In combination with the removal of the 2nd St culvert and replacement with a restored open channel, and the reclamation and restoration of the Burlington Northern railroad berms, the restoration of this area would allow aquatic and terrestrial communities access to and from Hog Island Inlet and the riparian habitats of Newton Creek. This type of “freshwater estuary” system could be expected to support a wide range of ecological diversity. Currently, water quality conditions in this reach of Newton creek are impacted from upstream nutrient enrichment. The establishment of additional emergent wetland vegetation in this area would improve water quality conditions prior to discharge into the open waters of Hog Island Inlet through the denitrification and sequestration of nutrients in the water column.

**Procedure:**

- a) Synchronize with the proposed conservation of Burlington Northern Santa Fe railroad properties in this area (Action B2:3), as well as the daylighting of the 2nd St culvert (Action C2:3).
- b) Establish wetland / floodplain ecological reference conditions from Allouez Bay wetlands and tributaries.
- c) Create conceptual designs and construction documents for the restoration of wetlands and floodplain habitats in the affected area.
- d) Acquire permits and perform construction. Initiate post-project monitoring to evaluate ecological response and ensure successful maturation of vegetative communities.

**Reference conditions:** The Allouez Bay tributary / wetlands interface (the regions where Bear Creek or Bluff Creek transition from alluvial to lacustrine hydrology.)

**Affected area / size:** Newton Creek below 2nd St and Hog Island shoreline / .5 acres..

**Implementation timeline:**



*Years from Master Plan adoption*

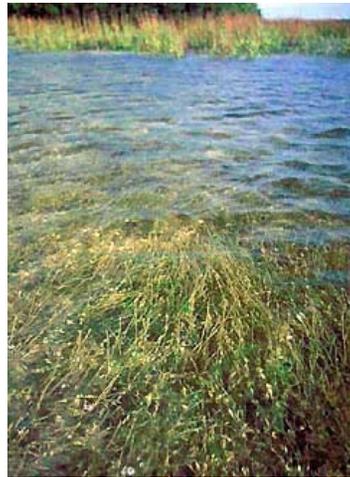
**Range of estimated costs:** \$150,000 - \$300,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Synchronize with Actions B2:3 and C2:3.

# Objective C4) Restore or enhance habitat complexity in the open water areas of Hog Island Inlet.

**Restoration Trajectory:** *The restoration of the open waters of Hog Island Inlet to replicate a “sheltered bay” habitat. Increase habitat complexity, and restore 1.5 acres of submerged aquatic vegetation in the Hog Island Inlet.*



**Examples of restored open water habitat.** These are images of submerged aquatic vegetation (SAV) and woody debris being placed into a pond to improve habitat structure. The bottom photo is of woody debris in the shallow water areas of the Loon’s Foot Landing embayment.

To support the commercial shipping industry, the Superior Harbor has been dredged and much of its shoreline filled and hardened for well over 100 years. Many shallow water areas such as emergent marsh, submerged aquatic vegetation (SAV) beds, and unvegetated mudflats have been lost to dredge and fill operations; impacting primary habitats utilized by assemblages of amphibians, fish, wildlife, invertebrates and vegetative communities. Time has allowed some of these habitat types (primarily emergent marsh and shallow water unvegetated flats) to naturally restore themselves in sheltered depositional areas such as the Inlet of Hog Island.

Prior to the recent remediation efforts, Hog Island Inlet was considered to be an “industrially-influenced bay” (according to the habitat typologies in the LSLRHP). Considering that the remediation effort was completed in late 2005, the area has not yet had enough time to fully recover from the effects of sediment excavation, although it is already showing some signs of improvement. Through the active restoration of open water areas by incorporating vertical habitat features such as large woody debris, and planting submerged aquatic vegetation, habitat diversity will be increased and the restoration of this area to a “sheltered bay” system, a specific habitat restoration target of the LSLRHP, will be accelerated.



**Action C4:1** Use large woody debris in the open waters of Hog Island Inlet to provide vertical habitat structure.

The diversity of habitat conditions that large woody debris (LWD) adds to an aquatic environment can be beneficial to a wide range of fish and wildlife species. There is potential for recycling pilings in the harbor as large woody debris. However, any railroad ties or pilings that have been treated with creosote are potential sources of water and sediment contamination, and should not be used as restoration materials. The Loon's Foot Landing side of Hog Island Inlet has treefall in the shallow water areas that currently serve as an excellent example of large woody debris features. Dead trees along the Hog Island shoreline could be intentionally deposited into the Inlet during synchronous restoration efforts.

It should be noted that invasive bivalves such as zebra mussels and quahog that exist in the harbor may colonize these features. It was determined at the third stakeholder workshop that the ecological benefits of increasing habitat complexity through the introduction of LWD would outweigh the potential drawbacks of creating desirable conditions for invasive bivalve populations. Post-restoration monitoring in the open waters of Hog Island Inlet should occur to evaluate the degree of invasion, and determine if control actions are warranted.

**Procedure:**

- a) Synchronize with shoreline and wetland restoration actions in the Inlet to reduce the cost of mobilization and labor (Objectives C2 and C3).
- b) Identify source of large woody debris, preferably local treefall, and introduce into the open water areas of Hog Island Inlet. Recommend 1 piece of large woody debris per 0.5 acres. For the open water area of Hog Island Inlet, use approximately 16 pieces of large woody debris, distributed randomly.
- c) Monitor for invasive bivalve colonization.

**Reference conditions:** Loon's foot landing embayment (southeastern side of the Hog Island isthmus) / Allouez Bay.

**Affected area / size:** Hog Island embayment / 8 acres.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$15,000 - \$40,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Locate sources of large woody debris.

**Action C4:2** Restore populations of submerged aquatic vegetation (SAV) in the open water areas of Hog Island Inlet.

Submerged aquatic vegetation in the Lower St. Louis River and Duluth-Superior Harbor area historically existed in shallow water depths of less than 2.5 feet. With the onset of the zebra mussel (*Dreissena polymorpha*) in Lake Superior, water column clarity has increased, allowing for greater penetration of photosynthetically active radiation (PAR) required for SAV growth. This has increased the potential range of establishment to 4.5 to 5 foot depth (Dennis Pratt, personal communication 2007). An area of SAV encompassing over 100 acres is found on the northern end of Dwight's Point, and is thought to have expanded in recent years with the increased depths afforded by increased PAR. The existing depths of the Hog Island embayment could be suitable for SAV habitat if turbidity from Newton Creek does not significantly affect PAR levels. This type of habitat would provide habitat benefits to fish, waterfowl and invertebrates should it become established.

**Procedure:**

- a) Analyze conditions within SAV beds at Dwight's Point to establish ecological references, and use this data to identify appropriate locations in Hog Island Inlet to establish SAV populations.
- b) Plant 1.5 acres of SAV, using broadcast distribution of native seed or the planting of growing bare root plugs. Actively monitor for three years to determine ecological response and ensure survival.

**Reference conditions:** Northern end of Dwight's Point.

**Affected area / size:** Hog Island embayment / 1.5 acres.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$20,000 - \$35,000

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Reference habitat condition data from Dwight's Point SAV colony.

# Objective C5) Enhance migratory bird habitats, especially for rare, threatened, or endangered (RTE) species.

*Restoration Trajectory: Expand available shorebird habitat on Hog Island and within the Hog Island Inlet.*

**Examples of wading shorebirds.** Clockwise from top left, piping plover, spotted sandpiper, American avocet, existing beach on Hog Island.



Hog Island has many environmental features that provide for great bird habitat. It lies along migratory routes on the western edge of Lake Superior; it is relatively secluded, quiet, and free of human habitation; it contains a variety of habitat types, including wetlands, beaches, mud flats, grasslands, and woodlands, which attract a diversity of bird species. Even though it already provides excellent habitat conditions for avian species, it could be enhanced to provide additional bird habitats.

For example, the harbor side beaches of Hog Island could be expanded through vegetation management to enhance suitable conditions for wading shorebirds, including the spotted sandpiper (*Actitis macularia*) and potentially the piping plover (*Charadrius melodus*) which is listed in the Great Lakes area as a federally endangered species. Wetland restoration actions proposed in Objective C3 will increase suitable habitat for the least bittern (*Ixobrychus exilis*), which is listed in the State of Wisconsin as a species of special concern.

Although piping plover is specified as a restoration target in the LSLRHP, the use of Hog Island as piping plover habitat is debatable, considering the potential for predation, noise and light pollution. In addition, the available beach area may not be large enough to provide the necessary habitat conditions for nesting. However, the restoration and management of this area as wading shorebird habitat will expand the range of potentially suitable piping plover foraging habitat in the region, including Superior Harbor dredge material islands and nearby Wisconsin Point.



Proposed enhancements of shorebird habitats.

**Action C5:1 Establish foraging and nesting habitats for wading shorebirds on Hog Island beaches.**

Typically, shorebirds forage in protected shallow water areas including beaches, shallow wetlands, and mudflats where the chironomid larvae are found that make a large part of the Great Lakes populations diet. Other invertebrates found along shorelines or among sparse wetland and upland vegetation are also of interest. Nesting habitat criteria varies widely by species. For piping plovers, a nesting pair typically requires sandy beaches that are wide, flat and open with little grass or other vegetation and about 100 yards of open space between nests, with male plovers protecting nesting areas. Plovers are very sensitive to human activity and predation from small mammals like foxes and raccoons, which may need to be excluded from plover sites by fencing. By managing vegetation on the sandy shoreline (the northeastern side of Hog Island), providing exclusion fencing to reduce the threat of predation by animals, and restricting human access to the area through informational signage, conditions could be created on Hog Island to attract foraging and/or nesting shorebirds, including piping plover. Ongoing monitoring and maintenance of this site would need to occur to verify the presence of wading shorebird species and adjust conditions as necessary.

**Procedure:**

- a) Synchronize restoration efforts with the conservation of Hog Island (Action B1:1).
- b) Establish wading shorebird habitat reference conditions using available literature and designated critical habitat areas in Wisconsin, including Wisconsin Point.
- c) On the northeastern shoreline of Hog Island, improve beach habitats according to reference habitat conditions. This may include such activities as vegetation management, beach expansion or restoration, predator exclusion fencing, signage to restrict human access, or other actions.
- d) Establish regular monitoring of the site during migratory shorebird foraging and nesting season (mid-May to mid-September) to verify wading shorebird utilization. Perform maintenance and improvements during the off-season.

**Reference conditions:** Designated critical habitat for piping plover on Wisconsin Point (from the mouth of Dutchman Creek to the Douglas and St Louis County line) / FWS Federal Register designation of Piping Plover Critical Habitat requirements (USFWS, 2001).

**Affected area / size:** Hog Island beaches / 5 acres

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$50,000 - \$100,000 + maintenance costs

**Permitting requirements:** USACE Section 404 and Section 10 permits; WDNR wetlands permits; City of Superior wetlands permits.

**Pre-implementation needs:** Reference piping plover habitat conditions on Wisconsin Point.

# Objective C6) **Initiate post-project monitoring for any restoration actions that occur, and use information to inform other restoration actions in the designated project area and within the greater St Louis River watershed.**

*Restoration Trajectory:* Use active monitoring to determine habitat response to restoration actions, the succession of restored habitats, and the degree to which they resemble their reference targets. Use this information to inform other restoration efforts in the St Louis River watershed and the Great Lakes physiographic province.



The ongoing monitoring of the habitat restoration actions proposed in Objectives C1 – C5 will provide opportunities for adaptive management; as monitoring data is collected and interpreted, this information can be incorporated into the planning, management, and site design for restoration actions in the project area. In addition, the strategies described in this plan can be considered as a template for future ecosystem restoration efforts in the greater St. Louis River watershed. An active ecological restoration monitoring program will enable the successes and failures to be quantified and communicated to resource managers, allowing future restoration efforts to gain from this experience.

This Objective does not have individual actions associated with it; monitoring actions are attached to the specific restoration actions they are associated with. Instead, it is intended to provide the link between the active monitoring and the translation of that information to the managing entities of the Master Plan to ensure coordination and enable the adaptive management of habitat restoration in Hog Island and Newton Creek.

#### **Post-project monitoring.**

These are images of stream and wetland monitoring efforts, including biotic surveys and measuring stream cross-sections.



**Action C6:1** Establish a mechanism to communicate monitoring results to the project partners and incorporate new information into habitat restoration design and management.

A committee composed of project partners and stakeholders shall be formed to evaluate the monitoring results associated with restoration actions proposed in this Master Plan. Based on their analyses, this “Coordinating Committee” will provide recommendations on the implementation of restoration strategies in the project area, and technical guidance on specific restoration designs. The current Hog Island Working Group is well-suited to become the proposed Coordinating Committee, although the exact composition and role of this entity will need to be determined by the project partners during implementation.

**Procedure:**

- a) Upon adoption of the Master Plan, establish the Coordinating Committee and determine specific roles and responsibilities.
- b) Establish clear lines of communication with project partners. This could be in the form of regularly-scheduled meetings, a website, or other means.
- c) Perform design review for restoration project designs. As projects are implemented, review monitoring analyses and provide recommendations for ongoing and future projects.

**Reference conditions:** N/A

**Affected area / size:** Hog Island, Hog Island Inlet, Newton Creek project area.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Staffing costs assumed to be covered by partnering organizations.

**Permitting requirements:** None.

**Pre-implementation needs:** Adoption of the Master Plan.

# Goal D) **In conjunction with restoration actions, create recreational, educational, and environmental stewardship activities for City of Superior and Douglas County residents.**

## Overview

Long-term ecological sustainability is directly linked to the actions and attitudes of the people that live, work, and play in the landscape. The concept of environmental stewardship is that residents understand, value, and care for their environmental resources, and thus are motivated to make decisions that are environmentally sustainable.

A key factor in stewardship is connection to place: people often cannot care for what they do not know. Some in the City of Superior and Douglas County know this landscape well; others have little experience with or awareness of it. As such, providing recreational, educational, and stewardship opportunities allow direct engagement with the landscape via exploration, interaction, and study. These actions encourage residents to gain knowledge of how their everyday actions affect water quality, human health, and the ecological processes of the landscape in which they live, develop a sense of caring for that environment, prioritize environmental health, and voluntarily modify their behaviors and practices toward more ecologically sustainable options.

Several recreational facilities currently exist in the area, including the Loon's Foot Landing boat launch facility, the Osaugie Trail, an observation / bird watching platform, and Gullo Park at 5th St and 26th Ave. In conjunction with the ecological restoration actions, additional recreational facilities are proposed to enhance recreational uses of the area, while preserving ecological health.

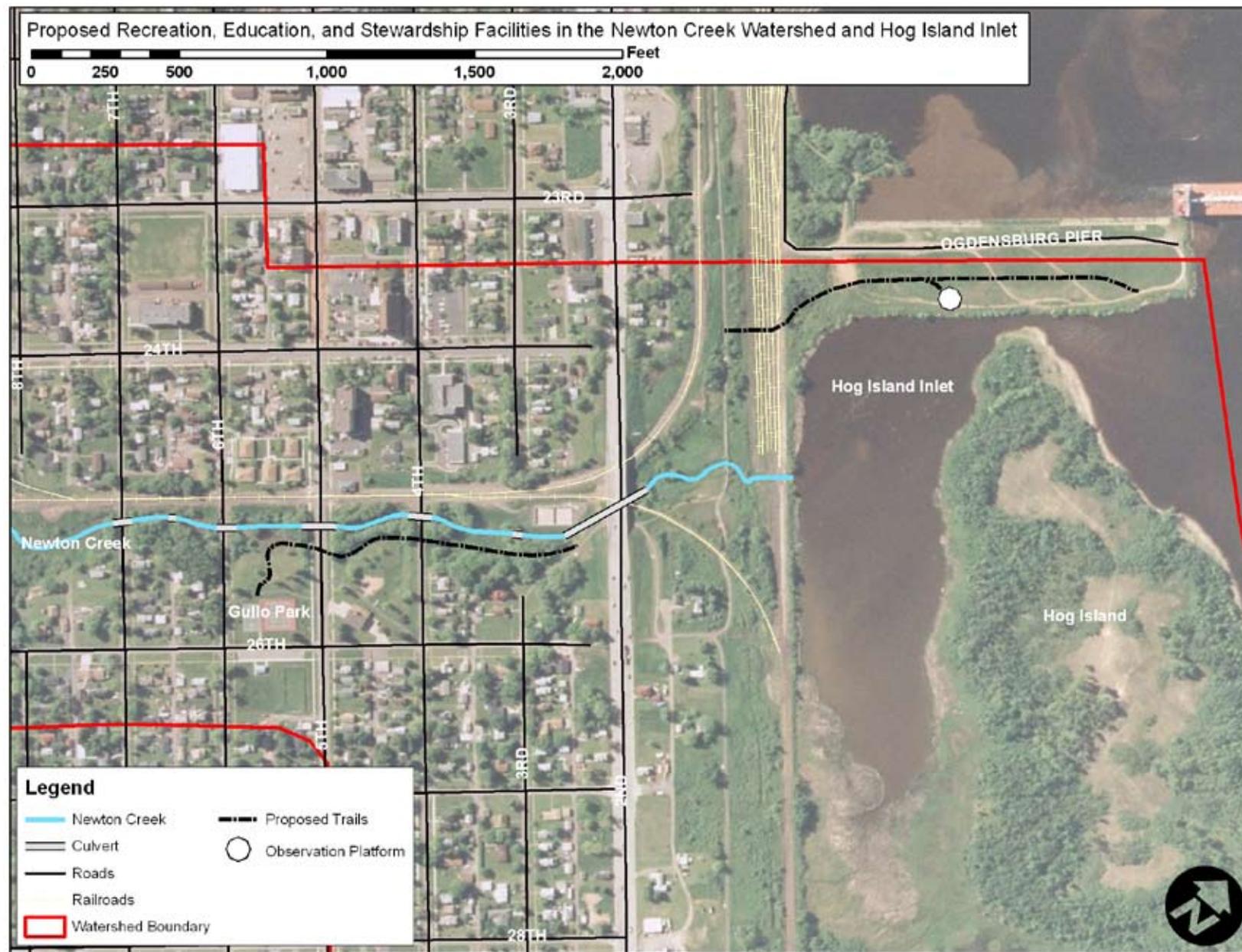
Many organizations already offer education, stewardship, and outreach opportunities for the local and regional watershed. The St. Louis River Citizens Action Committee, Douglas County, Murphy Oil, University of Wisconsin-Extension, Department of Natural Resources, Minnesota Pollution Control Agency, The Lake Superior Basin Partnership, and the Regional Stormwater Protection Team all have educational materials or outreach opportunities for residents (detailed in Objective D2). While all initiatives do not directly relate to the project site, they have important resources for developing interest in the environment.

It is recommended that these existing programs be expanded or augmented to include Hog Island and Newton Creek. This would require close coordination with the project partners responsible for implementing restoration actions to allow Hog Island and Newton Creek education and stewardship programs to take advantage of opportunities for experiential learning, academic research, or environmental stewardship efforts.

## Objectives

- D1)** Create passive recreational opportunities compatible with sustainable ecosystem function and landowner concerns.
- D2)** Facilitate public outreach efforts, including educational, volunteer, and stewardship activities, through the collaboration between existing watershed groups.





# Objective D1) Create passive recreational opportunities compatible with sustainable habitat function and landowner concerns.

**Restoration Trajectory:** *Increase the exposure of local residents and visitors to habitat restoration and their local natural environments through the creation of additional passive recreational facilities. Expand trail networks that allow limited access to Hog Island and Newton Creek. Construct additional bird watching platforms in key areas.*



**Examples of recreational features.** These are images of boardwalks and trails next to environmentally sensitive areas (top left and right) and the Osaugie Trail signage (bottom left). Below are proposed trails and recreational facilities.



A fully restored collection of landscapes is of limited consequence if it does not enhance the daily lives of the citizens sharing the environment. Without the public's continued support in both financial backing and direct participation, the Hog Island and Newton Creek landscape remains forever vulnerable and, therefore, its sustainability is not insured. One of the best ways to secure public investiture is to viscerally engage them in the aesthetic experience of landscapes. Through their personal participation in them, citizens are not only more receptive to educational lessons but also—and much more importantly—find their own reasons to care about the landscape, advocate for the preservation of the natural communities, and become connected to the watershed.

During the third workshop, participants expressed their desire to first focus on habitat restoration and recreation would follow later. There are opportunities to enhance the public use and enjoyment of these natural resources, within a coordinated plan that promotes ecological regeneration, and in ways that facilitate greater understandings of ecological processes, inspire environmental stewardship, and provide enjoyment to residents and visitors alike. For instance, by re-forming ecological and recreational connections between the upper watershed and the harbor shoreline, people can move through a succession of natural environments, experiencing the transition of habitats through this region.

Existing recreational amenities could be expanded into the natural landscapes of Hog Island, Hog Island Inlet, and Newton Creek in an ecologically-sustainable manner. Passive recreation such as bird watching, walking, and photography can be programmed to have no detriment to ecologically-sensitive habitats, and still provide City of Superior and Douglas County residents with additional opportunities to directly experience natural areas and open spaces.



**Action D1:1** Extend existing trail system to include limited access to Newton Creek and the Hog Island Inlet.

Expand the Osage trail to include a spur path at the landward edge of the proposed shoreline buffer on Ogdensburg Pier, and a path along the lower reaches of Newton Creek connecting to Gullo Park at 5th St and 26th Ave. Trail design, orientation, and signage will ensure that sensitive habitats are protected, but are visually accessible. The trail system must be developed and maintained in conjunction with City of Superior and Douglas County.

**Procedure:**

- a) Synchronize trail building efforts with the permanent conservation of relevant parcels (Objective B), the daylighting of the channel under the 2nd St culvert (Action C2:3), and the development of a streamside buffer for Hog Island Inlet (Action C2:2) and Newton Creek (Action C2:1).
- b) Coordinate with City of Superior Parks and Recreation for legal and maintenance concerns.
- c) Design and construct trails to protect sensitive habitat areas. This may include the construction of boardwalks, trash receptacles, fencing and/or railings in key locations.

**Reference conditions:** N/A

**Affected area / size:** Ogdensburg Pier, Newton Creek corridor / 2,650 feet

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Design: 20% of construction costs;  
Construction: average cost of \$100 per foot of trail.

**Total estimate cost:** \$320,000.

**Permitting requirements:** No fill of wetlands involved. Local construction permits will be required.

**Pre-implementation needs:** Easements on relevant parcels along Newton Creek and Ogdensburg Pier (Objective B); synchronize design efforts with the daylighting of the channel under the 2nd St culvert (Action C2:3) and development of a streamside buffer for Hog Island Inlet (Action C2:2) and Newton Creek (Action C2:1).

**Action D1:2** Establish an additional bird watching platform on Ogdensburg Pier.

Hog Island and Newton Creek support diverse populations of resident and migratory birds. Bird watching is an activity that is very compatible with and supportive of ecological restoration efforts. The construction of additional an observation / bird watching platform overlooking Hog Island Inlet on the shoreline of Ogdensburg Pier would provide an ideal location for bird watching; provide opportunities for education, photography, painting, and nature appreciation; and potentially be a source of tourism revenue for the City of Superior.

**Procedure:**

- a) Synchronize the construction of bird viewing facilities with the permanent conservation of relevant parcels on Ogdensburg Pier (Action B2:1), shoreline buffer restoration (Action C2:2), and trail building activities (Action D1:1).
- b) Coordinate with City of Superior Parks and Recreation for legal and maintenance concerns.
- c) Design and construct observation platform to protect sensitive habitat areas, especially the restoration of wading shorebird habitat on the northeastern shoreline of Hog Island (Action C5:1). Include interpretive signage as appropriate (Action D3:1).

**Reference conditions:** N/A

**Affected area / size:** 1 observation platform on Ogdensburg Pier.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Design and construction: \$75,000

**Permitting requirements:** Local construction permits.

**Pre-implementation needs:** Easement on relevant parcel(s) on Ogdensburg Pier (Action B2:1), designs for shoreline buffer restoration (Action C2:2), and trail building activities (Action D1:1).

Ecological Restoration Plan

**Action D1:3** Create interpretative signage along trails and observation platforms as part of the proposed conservation and restoration projects to educate about different natural features of the site.

Signage can be used as an effective educational tool, and a mechanism to augment a user’s understanding of and enjoyment of the landscape. Strategic placement of interpretative signage in areas that are accessible (along trails or on observation platforms) can call out natural features of interest such as bird species, native vegetation, or habitats, and describe habitat restoration processes.

**Procedure:**

- a) Synchronize the design and construction of interpretative signage with the design and placement of additional recreational facilities (Actions D1:1 and D1:2).
- b) Coordinate with City of Superior Parks and Recreation for legal and maintenance concerns.
- c) Determine which natural features or processes are of interest, and research / design signage.
- d) Coordinate installation with construction of proposed recreational facilities.

**Reference conditions:** N/A

**Affected area / size:** Recommend up to 6 interpretative signs on observation platforms and trail system in project area.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Design and installation: \$2,000 per sign

**Total estimate cost:** \$12,000

**Permitting requirements:** None.

**Pre-implementation needs:** Design of trails and observation platforms (Actions D1:1 and D1:2).





Boardwalk out  
to observation  
platform near  
Loon's Foot  
Landing

# Objective D2) Facilitate public outreach efforts, including educational, volunteer, and stewardship activities, through the collaboration between existing watershed groups.

*Restoration Trajectory: Increase community interest and advocacy for Newton Creek and Hog Island through expanding the outreach and educational efforts of existing interest groups.*



There are many opportunities for local communities to participate in, learn from, and enjoy the revitalization of the Hog Island and Newton Creek areas. This includes using the project site to leverage natural science and ecological education for local students as well as City of Superior and Douglas County residents. With the proper programming, the restoration project can be used as an educational resource for residents and students of all ages. In addition, the use of the site as a passive recreational amenity provides opportunities for public education about the natural sciences and the regional landscape.

**Examples of public outreach projects.** Photos of citizens planting and monitoring, and environmental education efforts.



To continue stakeholder involvement with the restoration process after the development of the Master Plan, it is critical that mechanisms are established to facilitate communication between project managers, watershed residents, and interested parties. A restored Hog Island and Newton Creek will be a valuable amenity for City of Superior and Douglas County residents; however, attracting interest in the site will require the publicity of these restoration actions to the general populace using effective media outlets.

Community-based watershed groups are often the most effective advocates for environmental stewardship within a community. Working with an organization that has strong ties to the community can best help to foster public interest and participation. As Lake Superior enjoys special attention, environmental interest groups abound. The groups below have varying degrees of connections to Hog Island and Newton Creek, but all possess resources that could be useful in helping to increase interest in and interaction with the watershed:

- St. Louis River Citizens Action Committee: Coordinates community efforts and outreach in the St. Louis River watershed.



- Murphy Oil: Leads an annual stream clean up along Newton Creek.
- Douglas County: Convenes the Hog Island Working Group to discuss opportunities in the project area. Main stakeholder forum for the Hog Island and Newton Creek Ecological Restoration Master Plan development.
- Water Action Volunteers (jointly sponsored by WDNR and University of Wisconsin Extension): Statewide program for Wisconsin citizens who want to learn about and improve the quality of Wisconsin's streams and rivers. Citizens, civic groups, 4-H clubs, students and other volunteer groups are participating in WAV programs across the state. Conducts stream monitoring training. Has a free curriculum that includes stream walk survey, watershed simulator, stream or river cleanup, erosion in a bottle, urban runoff model, critter search and storm drain stenciling.
- Citizen Based Monitoring Network of Wisconsin: Has funds available annually for monitoring streams and habitats.
- Lake Superior Basin Partnership.
- Regional Stormwater Protection Team: Provides environmental education opportunities to students and their teachers; over 800 students will take part in Riverwatch in 2007. Since 1997, Fond du Lac Tribal and Community College has directed and coordinated local secondary schools in water quality assessment of the St. Louis River and its tributaries. Monitoring sites extend from near the river's source at Seven Beaver Lake to the Duluth/Superior harbor. Students, teachers, and college student assistants collect and analyze river samples at designated monitoring sites; these data are compiled and made accessible to all the schools. Participants can then draw conclusions about the water quality of the entire St. Louis River.
- South St Louis Soil and Water Conservation District: Developed a K-12 environmental curriculum.

**Action D2:1 Identify an entity to direct education, stewardship, and outreach efforts and advocate for environmental sustainability in the watershed.**

The organization would be charged with the goal of “capacity-building” – advocating for and leveraging the restoration project to increase public awareness and interaction with the project site. This will take the form of coordinating educational initiatives, stewardship campaigns, volunteer initiatives, and public outreach. It is recommended that a non-profit organization that is already engaged in watershed advocacy and has active programs or could support active programs in the Hog Island and Newton Creek watershed be designated to facilitate this effort. The St Louis River Citizens Action Committee is a likely candidate.

**Procedure:**

- Initiate dialogue with existing non-profit watershed groups currently active in the region and determine which would be interested in assuming a mandate for environmental education, stewardship, and outreach in the project area. If no existing organizations are deemed suitable, hire a dedicated watershed coordinator to assume this responsibility.
- Organize education, stewardship, and outreach initiatives (see Actions D2:2, D2:3, and D2:4 below); develop other means of advocacy for Hog Island and Newton Creek consistent with the Master Plan; and engage in fund-raising to support these activities.
- Mediate between restoration project managers, project stakeholders, and other community interests.

**Reference conditions:** N/A

**Affected area / size:** Entire project site.

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** \$0 if integrated into an existing program. Otherwise, \$30,000 / year for a dedicated watershed coordinator.

**Total estimated cost:** \$0 - \$600,000

**Permitting requirements:** None.

**Pre-implementation needs:** None.

## Ecological Restoration Plan

**Action D2:2** Create environmental research and education programs for the community, local schools and universities that focus on the habitats and restoration processes underway within Hog Island, Hog Island Inlet, and Newton Creek.

There are great opportunities to incorporate inquiry-based learning techniques such as environmental research, environmental laboratory projects, and other academic projects which utilize the natural environments of Hog Island and Newton Creek and take advantage of the ecological restoration activities which will occur. As the slated ecological restoration projects are put into the ground, university-led research efforts provide the best potential for continued active monitoring of these completed efforts, forming the basis of an adaptive ecological restoration strategy. To ensure interest in and funding for research efforts in the Hog Island and Newton Creek area, coordination between academic institutions and resource management agencies is essential. Additionally, facilitating interaction between citizens, students and the community of professional scientists, planners, engineers, and resource managers in the watershed can introduce a multitude of careers and professional education opportunities that the participants may otherwise be unaware of.

**Procedure:**

- a) Create an academic module that focuses on the ecology of the Hog Island and Newton Creek site. Contact local universities and professors who may be interested in using the proposed ecosystem restoration actions as research topics.
- b) Harness opportunities to use student researchers to perform ongoing monitoring of restored ecosystems, baseline surveys, or other natural resources investigations that support the ecosystem restoration project. Coordinate with City of Superior School District. Contact local science teachers to add a segment about the site in science curricula.
- c) Identify activities and curriculum suitable for adult participation.

**Reference conditions:** N/A

**Affected area / size:** N/A

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Administrative costs from Action D2:1.

**Permitting requirements:** None.

**Pre-implementation needs:** - Establishment of a local watershed group to facilitate educational outreach efforts (D2:1).  
 - Coordination with Superior School District and local universities.  
 - Coordination with community volunteer organizations.

**Action D2:3** Maintain a project website to keep stakeholders, watershed residents, and citizens informed of the restoration process.

A portal for the dissemination of project-related information and data, such as updates on the status of restoration actions or postings for volunteer or education opportunities, as well as a mechanism to solicit public input, is essential to keep stakeholders involved in the ecosystem restoration project. A website is an effective medium for this type of dynamic public outreach.

**Procedure:**

- a) A Hog Island and Newton Creek project website (<http://www.biohabitats.com/hogisland/>) has already been developed by the ecological consultant Biohabitats, Inc. Migrate this to an appropriate local entity such as Douglas County after Master Plan development.
- b) Use media outlets to inform stakeholders and residents of the existence of the website, and regularly post updates and news about the project.

**Reference conditions:** N/A

**Affected area / size:** N/A

**Implementation timeline:**



*Years from Master Plan adoption*

**Range of estimated costs:** Assumed in administrative costs of managing organization.

**Permitting requirements:** None.

**Pre-implementation needs:** - Establishment of local watershed group to facilitate outreach efforts (D2:1).  
 - Transfer of website from GLNPO to local group.



## Ecological Restoration Plan

### 2.2 Alleviating Threats to Ecological Integrity

The table below lists the sources of real or potential risks to ecological health and function, how that stressor will impact the ecosystem, and provides a description of how the proposed restoration strategies may reduce or alleviate the risk.

Stressor	Potential Impact	Proposed Strategies for Mitigating Threats
Water and sediment contamination	<ul style="list-style-type: none"> <li>- Increased risk of ecological and human health problems.</li> <li>- Decreased dissolved oxygen in waterbodies.</li> <li>- Stress to aquatic organisms.</li> </ul>	<p><b>Objective A2:</b> Stormwater management in upper watershed to limit nutrient and contaminant input into Newton Creek and Hog Island Inlet.</p> <p><b>Objective A3:</b> Manage the threat of industrial contamination to water resources and sediments.</p> <p><b>Objective A4:</b> Determine if contaminated sediments persist in floodplain sediments along Newton Creek, or within the Hog Island Inlet. If warranted, remediate these areas using mechanical or biological techniques, as appropriate.</p>
Urban, suburban, and industrial development	<ul style="list-style-type: none"> <li>- Direct displacement of natural communities.</li> <li>- Alteration of watershed hydrology.</li> <li>- Degradation of stream channel conditions.</li> <li>- Increase in potential pollution sources.</li> </ul>	<p><b>Objective A1:</b> Maintain flows in Newton Creek to support aquatic and riparian habitats.</p> <p><b>Objective A2:</b> Stormwater management in upper watershed to limit nutrient and contaminant input into Newton Creek and Hog Island Inlet.</p> <p><b>Objective B1:</b> Place publicly held open areas and sensitive habitats into permanent protection through designation, with an emphasis on primary protection sites.</p>
Invasive species	<ul style="list-style-type: none"> <li>- Out-competition of native species.</li> <li>- Displacement of native species.</li> </ul>	<p><b>Objective C1:</b> Control selected invasive plant species.</p> <p><b>Objective C2:</b> Improve landscape connectivity for natural communities by enhancing streamside and shoreline buffers, and removing barriers to aquatic and terrestrial wildlife migration.</p> <p><b>Objective C3:</b> Restore or enhance wetland complexes along shallow water and shoreline areas.</p> <p><b>Objective C4:</b> Restore or enhance habitat complexity in the open water areas of Hog Island Inlet.</p>
Human access and recreation	<ul style="list-style-type: none"> <li>- Litter, graffiti, and debris.</li> <li>- Light and noise pollution.</li> <li>- Pet predation / disturbance.</li> <li>- Erosion from trail usage.</li> </ul>	<p><b>Objective D1:</b> Create passive recreational opportunities compatible with sustainable ecosystem function and landowner concerns.</p> <p><b>Objective D2:</b> Facilitate public outreach efforts, including educational, volunteer, and stewardship activities, through collaboration between existing watershed groups.</p>
Climate change	<ul style="list-style-type: none"> <li>- Increased air temperatures.</li> <li>- Decreased precipitation.</li> <li>- Decreased lake levels.</li> <li>- Alteration of vegetation community, composition and distribution.</li> <li>- Stress to aquatic organisms.</li> </ul>	<p>By increasing habitat complexity and species diversity, the biotic system may be better able to adjust to climate change on a regional scale.</p>

## 2.3 Addressing the Beneficial Use Impairments

There are nine recognized Beneficial Use Impairments (BUIs) for the St. Louis River Watershed. This Ecological Restoration Master Plan directly addresses the habitat-related BUIs, including “loss of fish and wildlife habitat”, “degradation of fish and wildlife populations”, and “degrada-

tion of benthos” in the Hog Island and Newton Creek area. Other BUIs are indirectly affected by the proposed restoration actions.

The table below demonstrates the linkages between ecological restoration activities

recommended within the Hog Island and Newton Creek watershed, and how they will address the BUIs of concern in the greater St. Louis River and Superior harbor region. Note that the quantitative delisting criteria for the St. Louis River is still under development.

HOG ISLAND & NEWTON CREEK ECOLOGICAL RESTORATION MASTER PLAN			Loss of fish and wildlife habitat	Restrictions on fish and wildlife consumption	Eutrophication or undesirable algae	Degradation of fish and wildlife populations	Fish tumors or other deformities	Degradation of benthos	Restrictions on dredging activities	Beach closings	Degradation of aesthetics
Goal	Objective	Action	Beneficial Use Impairments (BUI)								
Goal A) Improve water and sediment quality conditions in Newton Creek and the Hog Island Inlet and reduce the threat of future contamination.	Objective A1) Maintain flows in Newton Creek to support aquatic and riparian habitats.	Action A1.1 - Determine ecologically-optimal flow regime for Newton Creek.	√			√		√			
		Action A1.2 - Work with Murphy Oil to coordinate ecological restoration actions with the long-term release schedule.	√			√		√			
	Objective A2) Stormwater management in upper watershed to limit nutrient and contaminant input into Newton Creek and Hog Island inlet.	Action A2.1 - Develop recommendations for appropriate stormwater best management practices (BMPs) in the watershed.			√	√		√			√
	Objective A3) Manage the threat of industrial contamination to water resources and sediments.	Action A3.1 - Maintain active risk reduction strategies. Use active monitoring to evaluate effectiveness of such strategies and communicate to project stakeholders.	√	√	√	√	√	√	√	√	√
Objective A4) Determine if contaminated sediments persist in floodplain sediments along Newton Creek, or within the Hog Island inlet. If warranted, remediate these areas using mechanical or biological techniques, as appropriate.	Action A4.1 - Determine if contaminated sediments remain along the shoreline of Hog Island inlet and along the Newton Creek floodplain terraces.	√	√		√	√	√	√			
	Action A4.2 - Initiate additional mechanical or biological sediment remediation actions. If phytoremediation is determined to be appropriate, establish initial test plots and monitor.	√	√		√	√	√	√			
Goal B) Ecosystem conservation and protection for ecologically-sensitive habitats.	Objective B1) Place publicly-held open areas and sensitive habitats into permanent protection through designation.	Action B1.1 - Work with the City of Superior and Douglas County to permanently protect remaining vacant public lands on Hog Island and within the Newton Creek watershed.	√			√					√
		Action B2.1 - Place private lands designated as priority conservation areas into permanent land protection or conservation status, including the southeastern portion of the Ogdensburg Pier and	√			√					√
		Action B2.2 - Permanently protect privately-held upland, wetland, and riparian habitats within the upper Newton Creek watershed.	√			√					√
Goal C) Restore selected habitat components according to the restoration guiding principles.	Objective C1) Control selected invasive plant species.	Action C1.1 - Perform a comprehensive invasive plant species inventory and mapping throughout ecologically sensitive areas.	√			√					√
		Action C1.2 - Establish a vegetation management plan to control reed canary grass along Newton Creek.	√			√					√
		Action C1.3 - Establish a vegetation management plan to control Phragmites australis along the Hog Island shoreline areas.	√			√					√
		Action C1.4 - Actively monitor for migration of exotic invasive plants from the adjacent landscape, especially purple loosestrife.	√			√					√
	Objective C2) Improve landscape connectivity for natural communities by enhancing streamside and shoreline buffers, and removing barriers to aquatic and terrestrial wildlife migration.	Action C2.1 - Establish a 75 foot wide riparian buffer along Newton Creek between 7th Street and 2nd Street.	√			√					√
		Action C2.2 - Establish a 100 foot vegetative shoreline buffer around the perimeter of Hog Island inlet.	√			√					√
		Action C2.3 - Remove, replace, or retrofit culverts at road and sanitary sewer line crossings along Newton Creek.	√			√		√			√



# Ecological Restoration Plan

## HOG ISLAND & NEWTON CREEK ECOLOGICAL RESTORATION MASTER PLAN

Goal	Objective	Action	Loss of fish and wildlife habitat	Restrictions on fish and wildlife consumption	Eutrophication or undesirable algae	Degradation of fish and wildlife populations	Fish tumors or other deformities	Degradation of benthos	Restrictions on dredging activities	Beach closings	Degradation of aesthetics	
			Beneficial Use Impairments (BUI)									
Goal C) Restore selected ecosystem components according to the restoration guiding principles.	Objective C3) Restore or enhance wetland complexes along shallow water and shoreline areas.	Action C3:1 - Restore sustainable, reproducing communities of wild rice in the Hog Island inlet and along the shoreline.	√								√	
		Action C3:2 - Expand areas of emergent wetland vegetation or create "floating log-bog" wetlands in the northwestern and southwestern areas of the inlet.	√		√						√	
		Action C3:3 - Expand areas of wetland vegetation into the seiche-influenced areas of Newton Creek (below the 2nd St culvert).	√		√		√				√	
	Objective C4) Restore or enhance habitat complexity in the open water areas of Hog Island inlet.	Action C4:1 - Use large woody debris in the open waters of Hog Island inlet to provide vertical habitat structure.	√		√							√
		Action C4:2 - Restore populations of SAV in the open water areas of Hog Island inlet.	√		√		√					√
	Objective C5) Enhance migratory bird habitats, especially for rare, threatened, or endangered (RTE) species.	Action C5:1 - Establish foraging and nesting habitats for wading shorebirds on Hog Island beaches.	√		√							√
Objective C6) Initiate post-project monitoring for any restoration actions that occur.	Action C6:1 - Establish a mechanism to communicate monitoring results to the project partners and incorporate new information into habitat restoration design and management.											
Goal D) In conjunction with restoration actions, create recreational, educational, and environmental stewardship activities.	Objective D1) Create passive recreational opportunities compatible with sustainable ecosystem function and landowner concerns.	Action D1:1 - Extend existing trail system to include limited access to Newton Creek and the Hog Island inlet.									√	
		Action D1:2 - Establish an additional observation / bird watching platform on Ogdensburg Pier.									√	
		Action D1:3 - Create interpretative signage along trails and observation platforms as part of the proposed conservation and restoration projects to educate about different natural features of the site.										
	Objective D2) Facilitate public outreach efforts, including educational, volunteer, and stewardship activities, through the formation of a Newton Creek / Hog Island watershed group.	Action D2:1 - Establish an entity to direct education, stewardship, and outreach efforts and advocate for environmental sustainability in the watershed.										
		Action D2:2 - Create environmental research and education programs in local schools and universities that focus on the ecosystems and restoration processes underway within Hog Island, Hog Island inlet, and Newton Creek.										
	Action D2:3 - Create and maintain a project website to keep stakeholders, watershed residents, and citizens informed of the restoration process.											

There are certain strategies that must be performed preceding full scale restoration actions. Ecological threats should be assessed and mitigated to ensure that the investment in ecological restoration is not compromised by ongoing or future disturbances. Priority land protection actions should be initiated to assure that entities responsible for implementing the proposed actions have the legal jurisdiction to proceed. Finally, the collection of additional necessary baseline information, including invasive species surveys, reference condition surveys, and ecological flow data should be performed to inform restoration design.

These initial steps are critical to the restoration design process, providing essential data and defining the extent of these projects. For example: it will be impossible to design the shoreline buffer proposed in Action C2:2 without reference survey information obtained from Allouez Bay shorelines, and without negotiations with Burlington Northern Santa Fe about potential restoration of the existing railroad berms (through conservation easement or direct acquisition of those parcels).



Phase 2 includes the initiation of most ecological restoration efforts detailed in Goals A and C, and the continuation of ecosystem conservation efforts in Goal B. Preliminary environmental stewardship, education, and outreach programs in Goal D will begin in Phase 1, with the education component beginning in Phase 2.

The final two phases are defined by the completion of ongoing restoration efforts, the continuation of long term sediment remediation efforts (if they are necessary), active post-project monitoring to facilitate the adaptive management process, and the environmental stewardship, education, and outreach programs.



## Ecological Restoration Plan

### 2.4 Phasing of Restoration Actions

The restoration of Hog Island, Hog Island Inlet, and Newton Creek will occur incrementally. To provide an organized framework for implementation, it is recommended that work occur in four distinct phases:

#### Phase 1 0-1 years from Master Plan adoption:

- o Initiate ecological flow regime determination and feasibility assessment (A1:1, A1:2);
- o Ongoing monitoring of industrial operations. (A3:1);
- o Determine the extent of residual sediment contamination (A4:1);
- o Initiate public and private property conservation and land protection efforts (Goal B);
- o Initiate invasive species surveys and control efforts (C1:1, C1:2, C1:3);
- o Initiate SAV restoration in Hog Island Inlet (C4:2).
- o Develop monitoring plans protocols for ecosystem restoration efforts (C6:1).
- o Initiate / continue public outreach, environmental stewardship and education programs (D2:1, D2:3).

#### Phase 2 2-4 years from Master Plan adoption:

- o Initiate stormwater management in Newton Creek watershed (A2:1);
- o Complete residual sediment contamination surveys and research (A4:1);
- o Initiate additional mechanical or biological sediment remediation efforts, if necessary (A4:2);
- o Complete conservation efforts on public and private parcels designated as high priority conservation areas. (B1:1, B2:1);
- o Continue land protection on parcels designated as secondary conservation areas (B2:2);
- o Complete invasive species inventories (C1:1), and begin invasive species monitoring (C1:4);
- o Complete Phragmites control (C1:3), continue reed canary grass control efforts (C1:2);
- o Establish riparian and shoreline buffers, begin culvert removal efforts (Objective C2);
- o Initiate wetland restoration and expansion efforts (Objective C3);
- o Complete restoration of open water habitats in Hog Island Inlet (C4:1, C4:2);
- o Improve wading shorebird habitats and begin monitoring (C5:1);

- o Initiate post-project monitoring of any restoration projects that have been completed (Objective C6);
- o Begin construction of trails, observation platforms, and signage (Objective D1).
- o Initiate environmental education efforts in the project area (D2:2).

#### Phase 3 5-10 years from Master Plan adoption:

- o Continue stormwater management in Newton Creek watershed (A2:1);
- o Continue monitoring of industrial operations as needed (A3:1);
- o Complete remediation projects, and expand to other areas if warranted (A4:2);
- o Continue conservation and land protection efforts on private parcels in upper watershed (B2:2);
- o Complete reed canary grass control efforts (C1:2);
- o Continue and complete invasive species monitoring efforts (C1:4);
- o Continue and complete culvert removal efforts (C2:3);
- o Complete wetland restoration and expansion efforts (Objective C3);
- o Continue monitoring of ecosystem restoration efforts (Objective C6).
- o Continue public outreach, environmental stewardship and education programs (D2:1, D2:2, D2:3).

#### Phase 4 11 years to completion of ecosystem restoration efforts:

- o Continue monitoring of industrial operations as needed (A3:1);
- o Continue remediation projects and monitoring, if necessary (A4:2).
- o Continue monitoring of completed ecosystem restoration efforts (Objective C6).
- o Continue public outreach, environmental stewardship and education programs (D2:1, D2:3).



## 2.5 Ecological Benchmarks and the Adaptive Management Framework

Because natural communities undergo a process of maturation, succession, and diversification over time, it will take some years between initial ecosystem restoration efforts and the final development of resilient, diverse ecosystems that contain the full suite of attributes expressed in the “guiding principles”. Continual post-project monitoring by a qualified restoration ecologist will allow the measurement, documentation and ranking of this progression over time (see Objective C6). Each habitat type will have different restoration trajectories, defined by its reference ecosystems, and so the benchmarks for this progression will be distinct for each community. The

“success” of restoration actions can be determined through the evaluation of post-project monitoring data, and the use of ecological reference information to determine if ecosystem succession is occurring along the desired trajectory.

The restoration of a particular ecosystem component is completed when it has been determined that the desired restoration trajectory has been fulfilled, including:

- o The quantity or extent of the desired habitat element has been established.
- o The restored ecosystem has similar species assemblage and distribution as the reference habitat.
- o The “guiding principles” of ecosystem restoration are achieved.

The Master Plan is structured such that when all restoration Actions under a particular Objective are fulfilled, then that Objective is completed. Similarly, when all Objectives of a Goal are achieved, then that Goal is realized. Finally, when all Goals are achieved, then the Vision of a restored Hog Island, Hog Island Inlet, and Newton Creek will become a reality.

If, according to post-project monitoring data, a restoration action is not succeeding, additional studies or surveys will need to be performed to evaluate the source(s) of ecological stress, and the strategy adjusted accordingly. This Master Plan is intended to be dynamic and flexible, a “living document” that can be adjusted to account for new information and changing environmental conditions.

# Ecological Restoration Plan

## 2.6 Funding the Ecological Restoration Master Plan

The Hog Island and Newton Creek Ecological Restoration Master Plan assesses the ecological health of a small part of the St. Louis River Area of Concern and details actions to improve that health. The actions, some costly, will require federal, state, and local financial support to implement. Douglas County and the University of Wisconsin Extension have stepped forward to adopt and begin implementation of

several of those actions. The U.S. EPA Great Lakes National Program Office is committed to helping find funding. Conversations with the National Oceanic and Atmospheric Administration and U.S. Army Corps of Engineers regarding their grant programs look promising. In addition, the funding programs listed below, although not comprehensive, offer a range of grant opportunities for the community to explore.

- Grants from Federal Agencies: <http://www.grants.gov>
- Great Lakes Protection Fund: <http://www.glpf.org/>
- Great Lakes Watershed Restoration Grant Program: [http://www.nfwf.org/AM/Template.cfm?Section=Browse\\_All\\_Programs&CONTENTID=5337&TEMPLATE=/CM/ContentDisplay.cfm](http://www.nfwf.org/AM/Template.cfm?Section=Browse_All_Programs&CONTENTID=5337&TEMPLATE=/CM/ContentDisplay.cfm)

HOG ISLAND & NEWTON CREEK ECOLOGICAL RESTORATION MASTER PLAN - COST ESTIMATES

Action	Size	Cost Estimate	Cost Meter															
			≤ \$1K	\$5K	\$10K	\$20K	\$50K	\$100K	\$150K	\$200K	\$300K	\$400K	\$500K	\$1M	\$2M	\$5M +		
Action A1:1 - Determine ecologically-optimal flow regime for Newton Creek.	1.7 Miles	\$30,000 - \$60,000																
Action A1:2 - Work with Murphy Oil to coordinate ecological restoration actions with the long-term release schedule.	1.7 Miles	NA																
Action A2:1 - Develop recommendations for appropriate stormwater best management practices (BMPs) in the watershed.	835 acres	\$300,000 - \$550,000																
Action A3:1 - Maintain active risk reduction strategies. Use active monitoring to evaluate effectiveness of such strategies and communicate to project stakeholders.	NA	NA																
Action A4:1 - Determine if contaminated sediments remain along the shoreline of Hog Island inlet and along the Newton Creek floodplain terraces.	NA	\$50,000 - \$250,000																
Action A4:2 - Initiate additional mechanical or biological sediment remediation actions. If phytoremediation is determined to be appropriate, establish initial test plots and monitor.	NA	\$90,000 - \$110,000																
Action B1:1 - Work with the City of Superior and Douglas County to permanently protect remaining vacant public lands on Hog Island and within the Newton Creek watershed.	82 acres	\$40,000																
Action B2:1 - Place private lands designated as priority conservation areas into permanent land protection or conservation status, including the southeastern portion of the Ogdensburg Pier and Burlington Northern	10 acres	\$40,000 - \$4,120,000																
Action B2:2 - Permanently protect privately-held upland, wetland, and riparian habitats within the upper Newton Creek watershed.	165 acres	\$60,000																
Action C1:1 - Perform a comprehensive invasive plant species inventory and mapping throughout ecologically sensitive areas.	~200 acres	\$65,000 - \$90,000																
Action C1:2 - Establish a vegetation management plan to control reed canary grass along Newton Creek.	~25 acres	\$125,000 - \$500,000																
Action C1:3 - Establish a vegetation management plan to control Phragmites australis along the Hog Island shoreline areas.	~8 acres	\$16,000 - \$80,000																
Action C1:4 - Actively monitor for migration of exotic invasive plants from the adjacent landscape, especially purple loosestrife.	~200 acres	\$100,000																
Action C2:1 - Establish a 75 foot wide riparian buffer along Newton Creek between 7th Street and 2nd Street.	Up to 6 acres	\$90,000 - \$120,000																
Action C2:2 - Establish a 100 foot vegetative shoreline buffer around the perimeter of Hog Island inlet.	6 acres	\$255,000																
Action C2:3 - Remove, replace, or retrofit culverts at road and sanitary sewer line crossings along Newton Creek.	NA	\$650,000																

KEY:  Dark green represents the minimum range of costs.  
 Light green represents the maximum range of costs.



- Minnesota's Lake Superior Coastal Program: <http://www.dnr.state.mn.us/waters/lakesuperior/index.html>
- National Oceanic and Atmospheric Administration (NOAA): [http://www.nmfs.noaa.gov/habitat/restoration/funding\\_opportunities/funding\\_ner.html](http://www.nmfs.noaa.gov/habitat/restoration/funding_opportunities/funding_ner.html)
- U.S. Army Corps of Engineers Habitat Initiative: <http://www.glhi.org/>
- U.S. EPA Great Lakes National Program Office (GLNPO) Funding Program: <http://www.epa.gov/glnpo/fund/glf.html>
- U.S. Fish and Wildlife Service: <http://www.fws.gov/partnerships/>
- Wisconsin Coastal Management Grant Program: <http://www.doa.state.wi.us/subcategory.asp?linksubcatid=250&linkcatid=108&linkid=65&locid=9>

The costs associated with the proposed restoration strategies detailed in Section 1.1 are provided below in table format. Note that these are planning level cost estimates for design, engineering, construction, and maintenance. Actual costs may vary depending on the nature and degree of implementation.

HOG ISLAND & NEWTON CREEK ECOLOGICAL RESTORATION MASTER PLAN - COST ESTIMATES			Cost Meter													
Action	Size	Cost Estimate	≤ \$1K	\$5K	\$10K	\$20K	\$50K	\$100K	\$150K	\$200K	\$300K	\$400K	\$500K	\$1M	\$2M	\$5M +
Action C3:1 - Restore sustainable, reproducing communities of wild rice in the Hog Island inlet and along the shoreline.	1 acre	\$10,000 - \$15,000				→										
Action C3:2 - Expand areas of emergent wetland vegetation or create "floating log-bog" wetlands in the northwestern and southwestern areas of the inlet.	3 acres	\$60,000 - \$150,000								→						
Action C3:3 - Expand areas of wetland vegetation into the seiche-influenced areas of Newton Creek (below the 2nd St culvert).	.5 acres	\$150,000 - \$300,000										→				
Action C4:1 - Use large woody debris in the open waters of Hog Island inlet to provide vertical habitat structure.	1 acre	\$15,000 - \$40,000				→										
Action C4:2 - Restore populations of SAV in the open water areas of Hog Island inlet.	1.5 acres	\$20,000 - \$35,000				→										
Action C5:1 - Establish foraging and nesting habitats for wading shorebirds on Hog Island beaches.	5 acres	\$50,000 - \$100,000						→								
Action C6:1 - Establish a mechanism to communicate monitoring results to the project partners and incorporate new information into habitat restoration design and management.	NA	NA														
Action D1:1 - Extend existing trail system to include limited access to Newton Creek and the Hog Island inlet.	2,650 feet	\$320,000													→	
Action D1:2 - Establish an additional observation / bird watching platform on Ogdensburg Pier.	1 platform	\$75,000						→								
Action D1:3 - Create interpretative signage along trails and observation platforms as part of the proposed conservation and restoration projects to educate about different natural features of the site.	6 signs	\$12,000				→										
Action D2:1 - Establish an entity to direct education, stewardship, and outreach efforts and advocate for environmental sustainability in the watershed.	NA	\$0 - \$600,000														→
Action D2:2 - Create environmental research and education programs in local schools and universities that focus on the ecosystems and restoration processes underway within Hog Island, Hog Island inlet, and	NA	NA														
Action D2:3 - Create and maintain a project website to keep stakeholders, watershed residents, and citizens informed of the restoration process.	NA	NA														

KEY:  Dark green represents the minimum range of costs.  
 Light green represents the maximum range of costs.

# 3.0 The Master Planning Process

A primary intention of this project is to define a process by which other AOCs in the Great Lakes basin can be restored according to the principles of ecological sustainability and stakeholder input. As such, USEPA and Biohabitats have defined a framework (below) for the development of this plan, and are actively monitoring and soliciting input during plan development to refine the process for application to future project sites.

Biohabitats and USEPA presented the project intent, and received questions and comments from the Hog Island Working Group. The group was facilitated by Douglas County and composed of stakeholders from WDNR, St. Louis River Citizens Action Committee (SLRCAC), the City of Superior, Douglas County, Murphy Oil, and other interests.

For the next four months, Biohabitats

invasive species inventories, and reference ecosystem identification. The field assessment efforts were used to verify and inform existing datasets, as well as to determine initial opportunities and constraints for ecological restoration within the Hog Island and Newton Creek project site.

These datasets were then synthesized and evaluated for applicability to the restoration of Hog Island and Newton Creek. An “initial conditions assessment” was performed, and is reflected in Section 4 of this document. The following physical and biological parameters were analyzed:

## Plan Development Process



## 3.1 Plan Development Process

The development of the Hog Island and Newton Creek Ecological Restoration Master Plan is collaborative with state agencies, local jurisdictions, and local stakeholder groups. A series of workshops helped to define a project vision, goals, guiding principles for the restoration project, and specific restoration actions for the project site.

This process was initiated with a project kick-off meeting held on September 12<sup>th</sup>, 2006 at the Bong Museum in Superior, WI.

compiled existing datasets, reports, investigations, and geographic information systems (GIS) data from a diverse array of sources. Primary references included USACE technical reports, the Lower St. Louis River Habitat Plan, State of the Lakes Ecosystem Conference (SOLEC) proceedings, and WDNR biological and ecological datasets. In addition, Biohabitats scientists performed a three-day site reconnaissance to assess ecological and physical conditions on the project site. This included photo documentation, soil sampling, vegetation classification, channel condition classification,

- hydrologic conditions for the Newton Creek watershed and the Hog Island embayment;
- geology;
- soil and sediment conditions;
- upland, wetland, shoreline, and riparian vegetation communities;
- invasive species;
- Newton Creek channel conditions;
- fish, bird, wildlife, and insect communities;
- rare, threatened, and endangered species;
- land use and zoning;
- recreational features and amenities;
- site history;
- and ecological reference conditions.



The interactions between the physical and biological components of Hog Island, the Inlet, and Newton Creek were investigated to determine ecosystem form and function, and identify limiting factors.

### First Public Workshop

A summary of this ecological information was compiled into a series of posters for the first public workshop, which was held on January 10<sup>th</sup>, 2007 at Wisconsin Indianhead Technical College in the City of Superior, WI. Over 30 participants from state agencies, City of Superior, Douglas County, SLRCAC, Murphy Oil, and other stakeholders attended, providing input, discussion, and direct comments to the Biohabitats technical team, who facilitated the workshop. Presentation on the existing ecological conditions was followed by an interactive “visioning exercise,” which allowed participants to express their concepts of a long-term vision for the project area. This was followed by an exercise that allowed participants to rate their level of agreement with more than 20 “restoration attributes” that describe the restoration goals for the project. Next, participants were asked to describe the greatest opportunities and constraints for the restoration of Hog Island and Newton Creek. All exercises were followed by discussions between and among the stakeholder group, Biohabitats, and USEPA. Comments and edits to the existing conditions boards were made by

workshop participants, and the direct interaction between all participants allowed for a wide range of ideas, thoughts, hopes, and concerns to be addressed.

Meeting minutes, workshop materials, and posters were posted on a two websites: [http://www.biohabitats.com/hog\\_island](http://www.biohabitats.com/hog_island) and <http://epa.gov/glnpo/ecopage/hog/> for access by all interested parties.

From January through April, 2007, Biohabitats integrated the materials generated at the first public workshop with the ecological analyses previously performed. A project Vision, guiding principles, and distinct set of restoration goals, objectives, and actions were derived from the public workshop, and were further developed by the Biohabitats technical team. This document, the “Hog Island and Newton Creek Draft Ecological Restoration Master Plan” was created to enable the project team and stakeholders to provide an initial prioritization of restoration actions, and to provide comments on the Draft Plan.

### Second Public Workshop

A second public workshop was held on May 1<sup>st</sup>, 2007 at the Bong Museum in Superior, WI, to solicit direct feedback on the Draft Plan from workshop participants, and discuss prioritization and implementation of the Plan.

During this workshop, the length and formal appearance of the draft plan caused concern among a number of the stakeholders. The plan appeared overly finalized and stakeholders were concerned that content decisions had been made without their input. Realizing that more opportunities for stakeholder contribution to the Ecological Restoration Master Plan were necessary to make the participatory process successful, the USEPA made a third workshop possible.

### Third Public Workshop

The goals of the third public workshop were fourfold:

- to convey the overall rationale behind and purpose of the Ecological Restoration Master Plan and address remaining questions and concerns;
- to emphasize the local ownership of the Master Plan and funding opportunities;
- to present updated graphics and maps to better clarify primary and secondary restoration sites; and
- most importantly, to facilitate a discussion that would enable stakeholders to decide which actions would remain, which would be edited, and which would be deleted.

With the addition of the third public workshop, the Final Plan was finished on September 15, 2007.

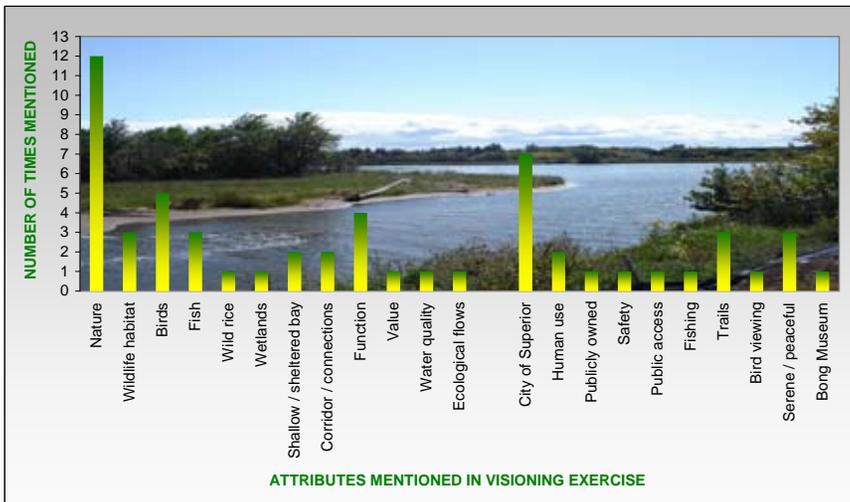
## The Master Planning Process



### 3.2 Project Vision and Guiding Principles

Vision statement:

*“Restore natural, diverse, and self-sustaining ecosystems in Hog Island, the Hog Island Inlet, and the Newton Creek watershed. Make this project a leading example for Great Lakes ecosystem restoration efforts, and provide serene, safe natural areas for the residents of the City of Superior and Douglas County.”*



of Superior”. In addition, birds, ecological function, wildlife habitat, fish, trails, and “serene/ peaceful environment” were common themes. These have been integrated to produce a vision statement that reflects these primary attributes, but also is expansive enough to include the other, more unique visions of a restored Hog Island / Newton Creek landscape.

In the “restoration attribute exercise,” workshop participants were presented with 22 statements that describe attributes of a restored ecosystem, and asked to rate their agreement. Many of these statements were derived from the Society for Ecological Restoration International *Primer on Ecological Restoration* (SER, 2004) others were created to express potentially desirable conditions particular to the project site.

Based on the results of this exercise, a restored Hog Island / Newton Creek landscape has the following attributes:

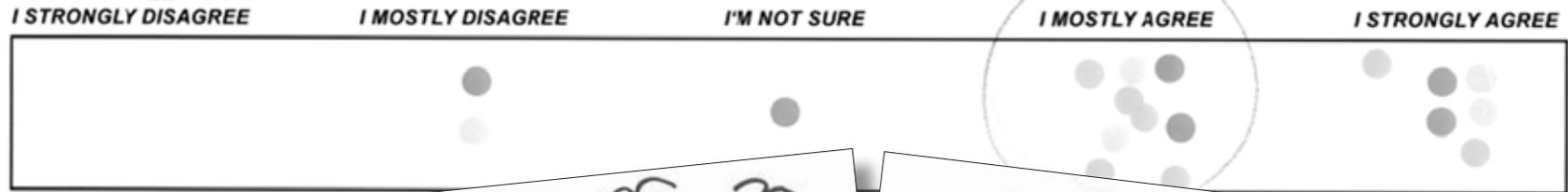
- Functional groups are present, or they have the ability to successfully colonize.
- Reproducing populations of target species are present.
- Characteristic assemblages of species / communities as found in reference ecosystems are present.
- Indigenous species are present.
- Self-sustaining natural communities are present.

This vision statement was crafted from the visioning exercise introduced at the first public workshop, which entailed participants expressing the “essence” of the project area on a strip of paper the size of a bumper sticker. The results provided a variety of attributes that would be present at the restored Hog Island and Newton Creek site.

Of note is the prevalence of “nature” in the bumper stickers, as well as the mention of “City



“The Hog Island and Newton Creek physical environment is capable of sustaining reproducing populations of the species necessary for its continued stability or development along the desired trajectory.”



HOG ISLAND  
 "PIG OUT" ON NATURE

A hand-drawn sketch of a fish swimming in water with reeds on the right side.

WATERFRONT CORRIDOR  
 • Simple • Serene • Superior

- Potential ecosystem threats are eliminated or reduced.
- Ecosystems are resilient to normal ranges of ecological stress.
- The restoration site is integrated into a larger ecological landscape.
- Habitat diversity is maximized.
- The goals of the LSLRHP are integrated.
- Sensitive ecological areas are placed under permanent protection.
- Restoration and resources management should occur according to watershed-planning principles.

- Educational and volunteering opportunities are integrated.
- Human uses which compromise long-term ecological sustainability are restricted.
- The restoration plan is flexible, allowing integration of new ideas and stakeholders.

In addition, it was determined that the restoration of these areas should NOT include:

- Restoration to the pre-development landscape (i.e. the complete removal of Hog Island).

- Programming to maximize recreation and human access to Hog Island and Newton Creek.

These guiding principles are used to determine appropriate restoration actions, define restoration “targets,” and perform as benchmarks for determining the success of restoration actions articulated in this Plan.

All public workshop materials can be found the Appendix of this document.

# 4.0 Existing Conditions



This ecological restoration master plan aims to restore and/or enhance the form and function of habitat complexes within Hog Island, Hog Island Inlet, and Newton Creek. The success of this endeavor is dependent upon an understanding of the current physical and biological conditions that exist on the site, and the primary drivers of ecological change. This includes a wide scale of environmental attributes, ranging from the physiographic province of western Lake Superior, northern Wisconsin, and northern Minnesota, to the larger Lower St. Louis River and Nemadji River watersheds, to the specific physical conditions and plant and animal communities present on the site.

At a bioregional scale, many of these ecosystem processes and components have been researched as part of the larger Great Lakes watershed restoration initiatives. Much of this information is documented in the SOLEC proceedings. In addition, the WDNR has compiled a wide array of information on shoreline and riparian habitat composition and condition for northern Wisconsin, including the study site. At the watershed scale, the LSLRHP provides specific ecological

conditions for a variety of habitat types in the City of Superior harbor and minor tributaries. This includes spatially-referenced inventories of bird species, fish, aquatic macroinvertebrates, rare, threatened, endangered species, vegetation communities and individual plant species. It is the primary reference for biological communities within Hog Island, Hog Island Inlet, and Newton Creek. Finally, the City of Superior, Douglas County, WDNR, and USEPA have produced a wide array of information specific to the project sites, mostly data collected as part of the contaminated sediment remediation project.

As part of the master plan development process, a site reconnaissance was performed by Biohabitats scientists in the Fall of 2006, and physical and biological conditions were observed and documented.

The following sections portray the ecological conditions present at the project site as of 2006/2007, and inter-relationships to the larger bioregional ecosystems. This represents the compilation and analysis of data from the myriad sources and entities mentioned previously, as well as others.



## 4.1 Site History

The Lower St. Louis River estuary is known to have been settled by a Lake Superior Chippewa Native American tribe. They lived in several small villages in the area including what is now the City of Superior. In the later 1600s, European contact and exploration of the area referred to the lower river as Fond du lac, which translated loosely into “Head” or “Foot of the Lake,” or “where the water stops.” The first European explorers were hunters and trappers, profiting from the fur trade. There is little evidence of the influence that Native American and early European inhabitants had on the regional landscape during this period, although there is an abundance of recent literature on the effect that other Native American tribes had on their environment through their use of natural resources, including hunting and fishing practices.

European trapping and trading, and later agriculture, came to the area. In the 1800s as the fur trade declined commercial fishing for trout and whitefish grew. In 1854 the U.S. government signed a treaty with the local Chippewa tribe that resulted in a population boom. By 1857, over 2,000 people lived in the City of Superior.

Construction of locks in 1855 allowed ships to move between Lakes Huron and Superior, giving access to the area’s resources of iron ore, lumber, and grain which spurred the local onset of the

industrial revolution. A railroad begun in 1861 and completed in 1870 spurred rapid growth in Duluth. The reconfiguration of the harbor shoreline began in 1872 with the cutting of a ship canal for Duluth through a baymouth sand bar. The River and Harbor Act passed by the federal government in 1873 included funds to dredge the harbor with additional work authorized in 1881. Superior began booming by 1886 with the establishment of grain elevators, flour mills, shipyards, and a coal and iron company. Official recognition of the City of Superior occurred in 1887 and by 1893 the population had reached 35,000 (by comparison, the population of Superior today is 27,180). A Congressional Act in 1896 joined the Duluth and Superior harbors under one administration, authorizing millions of dollars to enlarge the harbor and dredge channels to a depth of 20 feet.

Raw resources from logging and sawmills, rock and ore quarries, and Midwestern grain all benefited from and grew the nexus of rail and shipping that the cities of Duluth and Superior supported. Steel mills and oil companies developed in the early 1900 to meet the growing industrial needs of the region.

Shipping remains a key to the economies of Superior and Duluth, with the harbor ranking as the top Great Lakes port. Dredging and shoreline reconfiguration to support the ports completely redefined the natural area creating

deep channels, docks, and fill land for industrial and residential development. Ultimately, shipping channels were dredged to depths of 27 feet. New islands, such as Hog, Barker’s, Interstate, and Hearing Islands were formed from the dredged material.

Allouez Bay and Pokegama Bay are the only large, contiguous wetland complexes remaining that represent the historic shallow water habitats that once spread throughout the St. Louis River Estuary. While many areas of the City of Superior are currently covered in scrub-shrub, forest, and emergent/wet meadow wetlands, the relatively less abundant unvegetated flats, open water, and aquatic bed wetland types around Hog Island speak to the significant potential of the project area as a restored and enhanced natural resource.



Existing Conditions

1863

1873

1919

1924

1935

1958

1980

1850

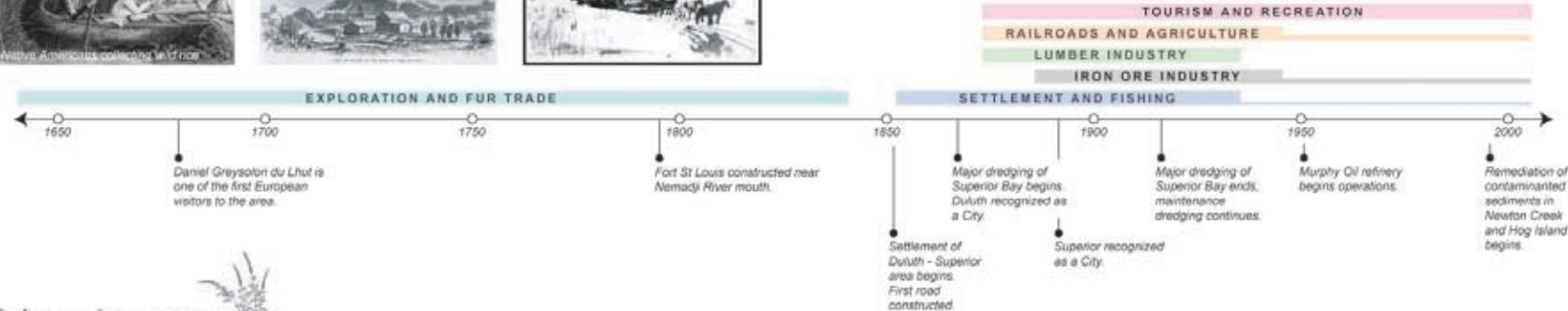
1850

1854-1855

Superior 1857

1894

1914



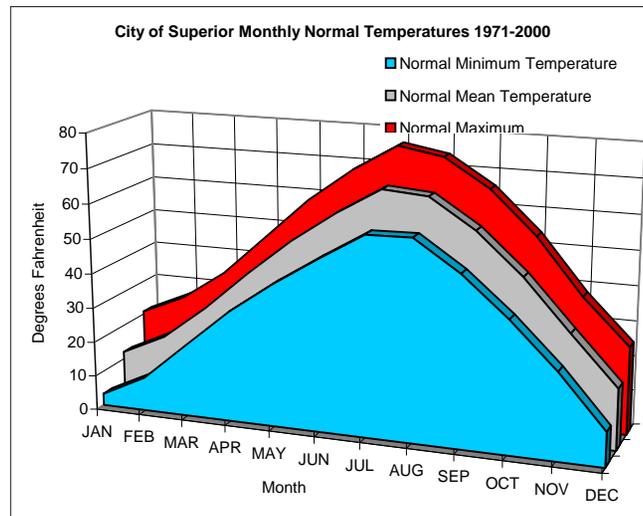
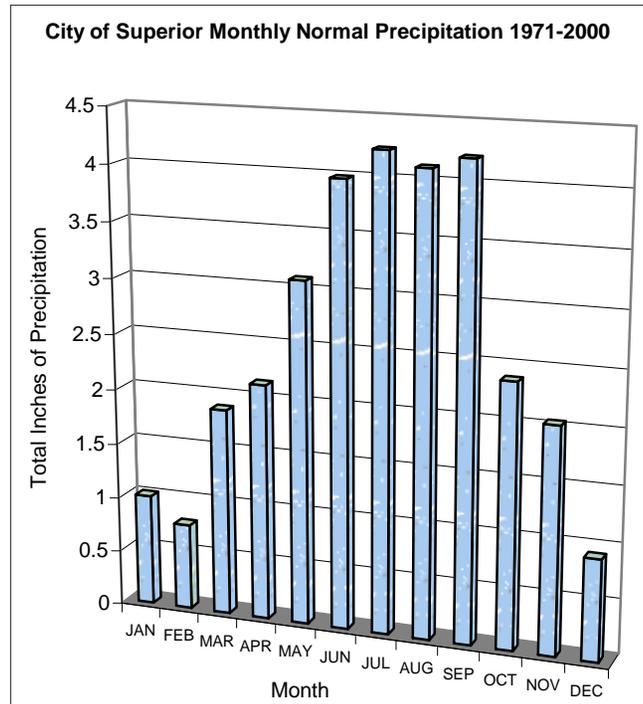
HOG ISLAND AND NEWTON CREEK HISTORY

## 4.2 The Regional Setting

The project site is located on the western shore of Lake Superior, at the mouth of the St. Louis River, at 46° N 92° W. It lies within the City of Superior, Wisconsin, and is only 5 miles east of the City of Duluth, Minnesota. Newton Creek flows northeast, into Hog Island Inlet and Superior harbor. The entire project area lies between 650 feet above mean sea level (MSL) and 600 feet above MSL, which is the approximate mean water surface elevation for Lake Superior in this region.

### 4.2.1 Climate

The climate in this northern, mid-western region of the United States tends to be influenced by the lake effect of Superior, having mild summers and cold winters. Precipitation tends to concentrate during the summer months, with an average of around 4 inches per month from June through September, although even the winter months tend to receive the equivalent of at least 1 inch per month of precipitation in the form of snow (NCDC, 2007). The annual average precipitation for City of Superior is approximately 31 inches. The maximum annual precipitation on record occurred in 1991 with 47.7 inches. The minimum annual precipitation on record occurred in 1976 with 14.9 inches (Midwestern Regional Climate Center, 2007).



#### 4.2.2 Geology and soils

The bedrock foundation of the Lower St. Louis River is a part of the Canadian Shield, the core of the North American Continent. The Lower St. Louis River and surrounding areas were created and transformed by the glaciers of the Pleistocene epoch beginning almost 2 million years ago and last receding about 10,000 years ago. Glacial meltwater moved sediments and created deposits that formed many of the surface features found around Superior today. Isostatic rebound, the land rise as a result of the removal of the heavy weight of the ice as it melted, caused the land to rise in the northeast region of Lake Superior, shifting water toward the western side of the lake. This resulted in flooding within the lower part of the St. Louis River watershed, creating the present-day freshwater estuary (LSLRHP, 2002).

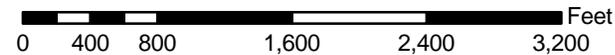
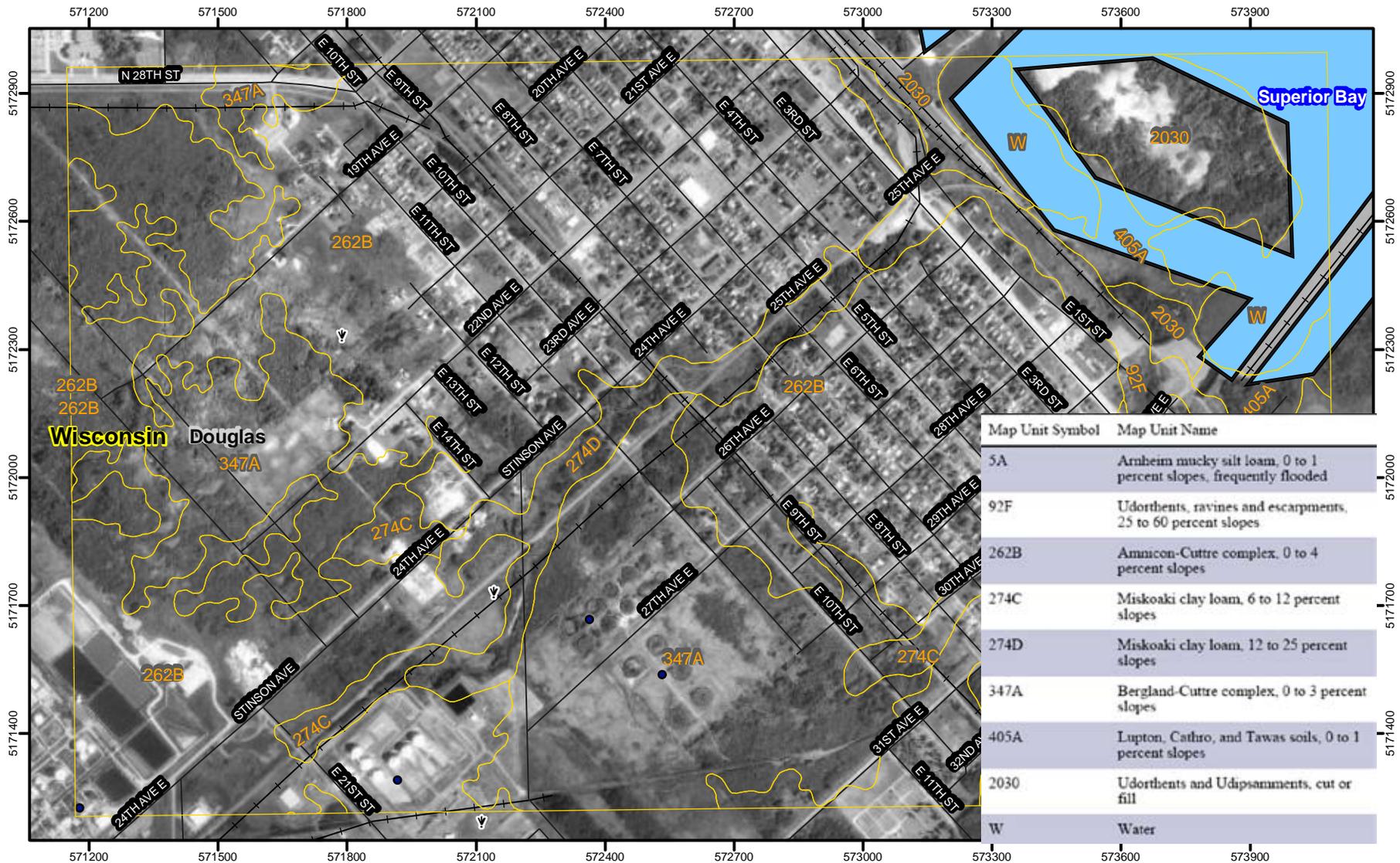
The area encompassing the City of Superior, specifically the Hog Island and Newton Creek study areas, is a part of the Superior Lowlands physiographic province. This area

is characterized by flat to gently sloping topography underlain by thick red lacustrine clay. The easily eroded red clay comprises a major component of the fine-grained lake sediments and Wisconsin-side surface soil structure.

The Superior Lowlands clays are relic deposits accumulated from a time when lake levels in the area were nearly 180 feet above the current Superior Lake level (SEH, 2003), a part of what was called Glacial Lake Duluth (LSLRHP, 2002). The primary soil types in the project site consist of the Amnicon – Cuttre complex in the urban areas; Miskoaki clay loam in the riparian areas and creek bed; Bergrand-Cuttre complex in the freshwater wetland meadows and forests found in the upper watershed; Lupton, Cathro, and Tawas soils along the Hog Island isthmus; and Udorthents / Udipsamments (cut and fill material) that make up Hog Island and the Superior shoreline. These clayey soils are moderately well drained to poorly drained (USDA, 2006).



Hog Island Soils



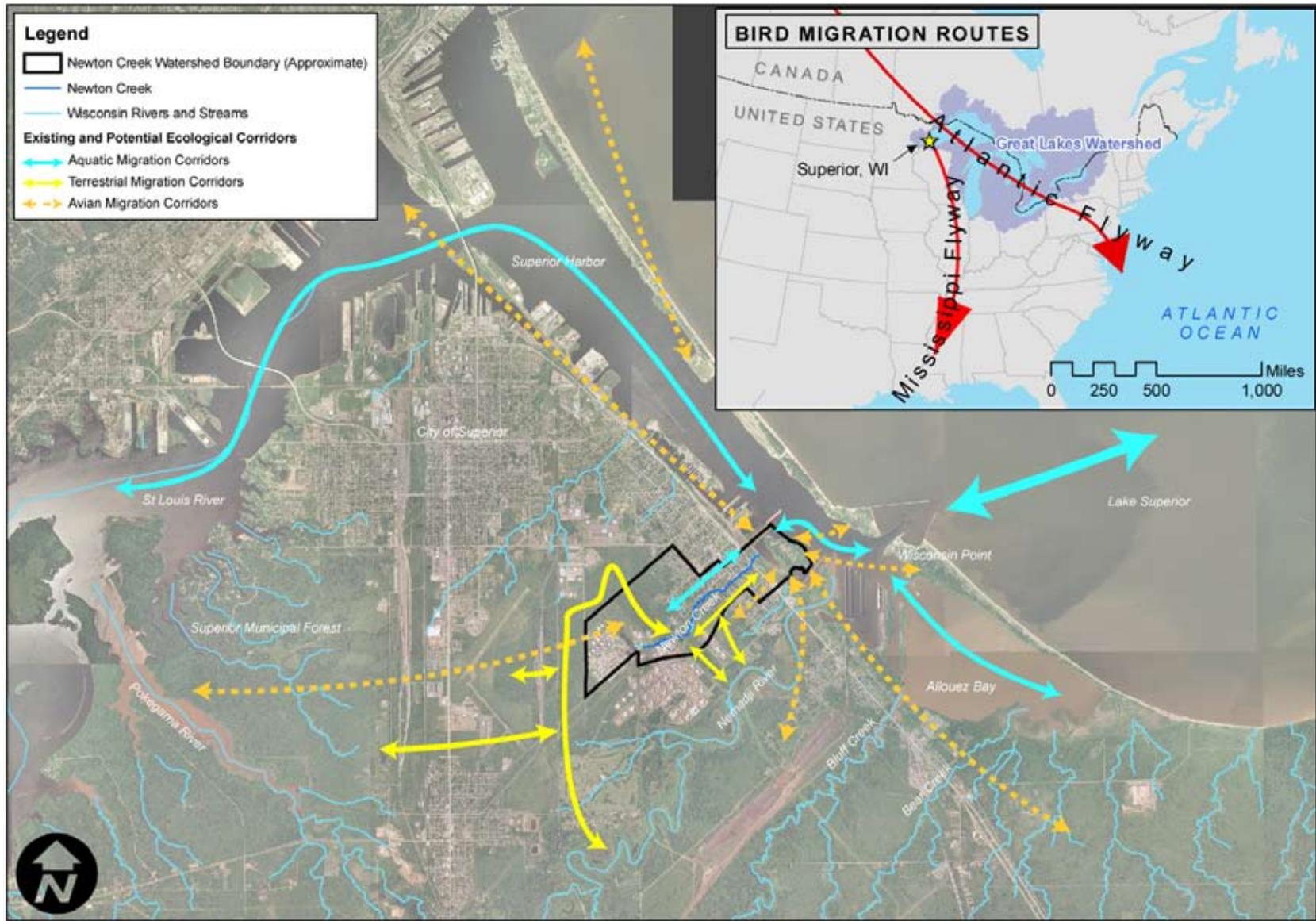
## Existing Conditions



### 4.2.3 Regional Landscape Ecology

Newton Creek, Hog Island, and Hog Island Inlet are ecologically connected to their surrounding landscapes through aquatic, terrestrial, and bird migration routes. Fish and other aquatic organisms that inhabit the greater Lake Superior and Superior Harbor waters have direct access to Superior Harbor and Hog Island Inlet and shoreline. Hog Island lies along the Mississippi Flyway and Atlantic Flyway and is important foraging and breeding habitat for many migratory bird species. The Newton Creek channel and riparian corridor provides linkages from the shoreline to the uplands and wetlands areas in the City of Superior, and via undeveloped open spaces to the Nemadji River corridor immediately to the South.





## Existing Conditions

### 4.3 Human Land Uses

The Newton Creek corridor, Hog Island, and the Hog Island Inlet are located within the City of Superior, and intersect residential, commercial, industrial, manufacturing, transportation, and recreational uses. Ecological restoration of these areas must suitably integrate the human populations, and adequately balance ecological health with existing land uses.

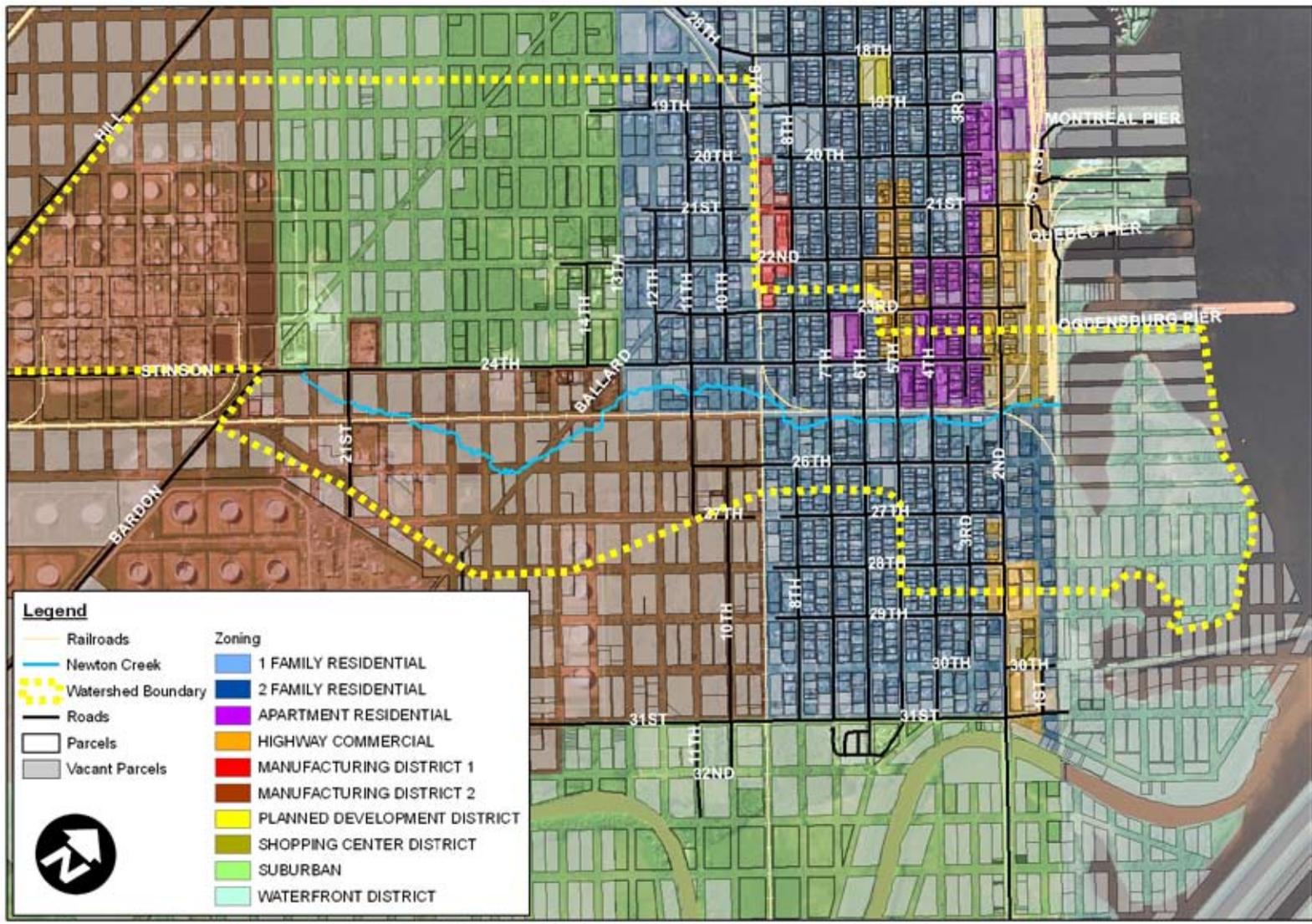
#### 4.3.1 Land Use and Zoning

The upper Newton Creek watershed is largely owned and occupied by Dome Petroleum and Murphy Oil, a petroleum processing and storage facilities. However, large swaths of land zoned as industrial properties are left as open spaces, supporting wetland, grassland, shrubland, and woodland habitats. The middle to lower reaches of Newton Creek are occupied by low density residential and some limited commercial land uses, which occur closer to the channel and tend to constrict the riparian corridor in some areas. Transportation routes and properties including roads, highways, and



railroads (including railroad berms) occur throughout the Newton Creek corridor. Railroads run perpendicular to the stream channel and parallel to the shoreline at the outlet of Newton Creek into the Inlet. Finally, Hog Island itself and the “neck” of wetland connecting it to the mainland is designated open space, and is largely unused except for hunting and fishing.





HOG ISLAND & NEWTON CREEK LAND USE AND ZONING



Existing Conditions



### 4.3.2 Recreation

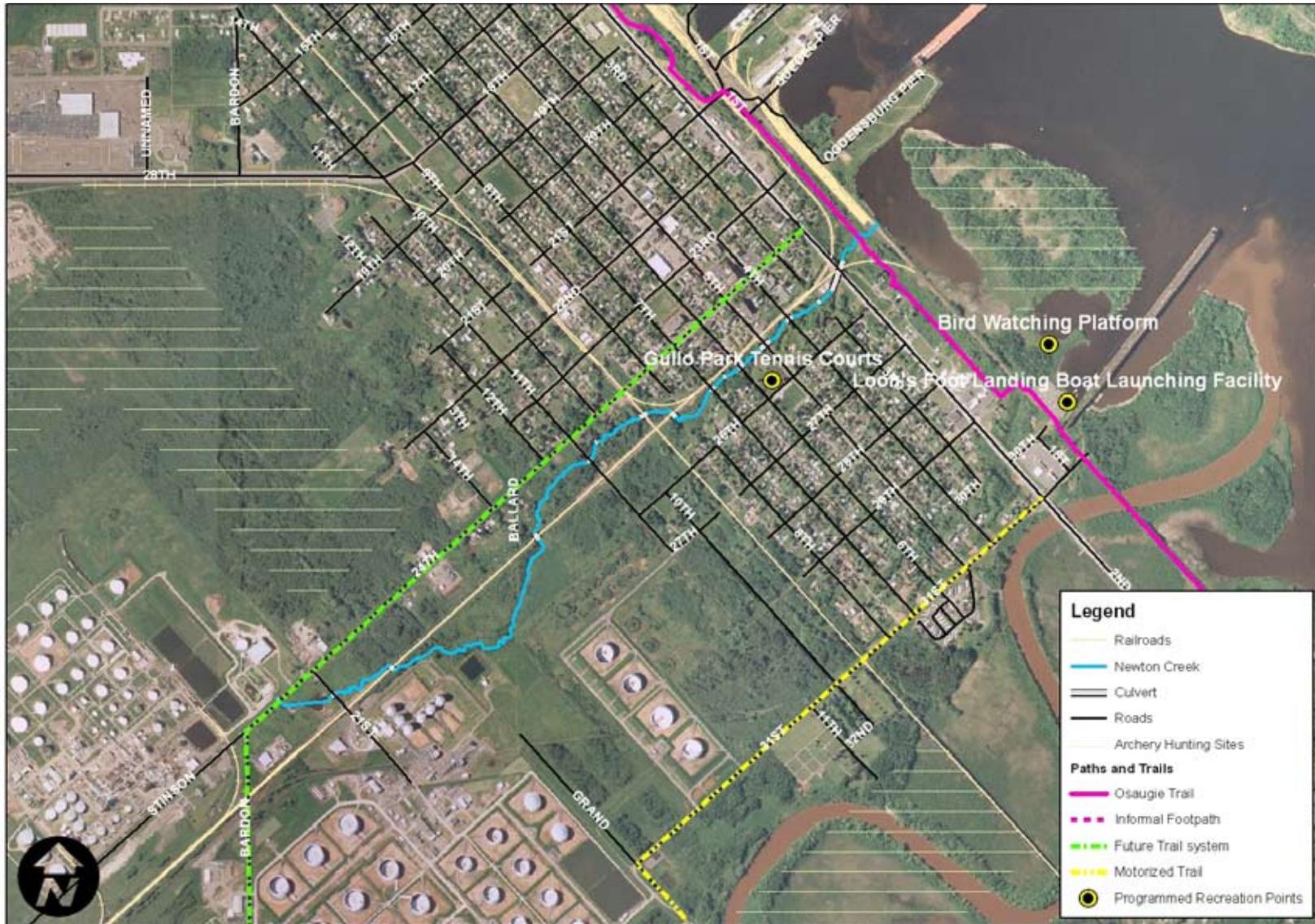
Both active and passive recreation occur at several locations in the project area. Formal recreation amenities include the Osaugie Trail, which runs north and south along the shoreline of the Superior Harbor and Allouez Bay, offering excellent opportunities for biking, hiking, photography, bird watching, and appreciation of a myriad

natural environments. Hog Island itself is a designated archery hunting spot for the City of Superior. The Loon's Foot Landing boat launch immediately to the south of Hog Island offers public access to the harbor waterways, and a bird watching platform constructed just north of the landing allows excellent views of Hog Island and the surrounding landscapes. Gullo Park, consisting of tennis courts and

a small field lie in between E 5<sup>th</sup> and E 6<sup>th</sup> streets on the south side of Newton Creek. Informal footpaths run along the shoreline and parallel to Newton Creek. There is evidence of bow hunting in the open spaces in the upper portions of Newton Creek. In the wintertime, snowmobiling is popular among Superior residents, and many areas within the project site are utilized by snowmobiles.



Existing Conditions



**HOG ISLAND & NEWTON CREEK RECREATION AREAS**  
 Based on the City of Superior Master Park Plan Update - January 2001



## 4.4 Ecological Conditions – Hog Island

Hog Island is a man-made feature. Beginning in the late 1800s, dredging operations within Superior Harbor to enlarge waterways for commercial shipping generated large amounts of fill material. During this period, the USACE disposed of this material by placing it in “open” areas of the Harbor and Allouez Bay. In the early part of the 20<sup>th</sup> century (in the 1920s to 1930s), Hog Island became a fill site, and an estimated 600,000 cubic yards of dredge material composed of sand and silt was deposited, forming an island roughly ½ mile long by ¼ mile wide. The origin of the name “Hog Island” is disputed; some think that a hog farm was situated on it at one time, others think that the island is shaped like a hog (with the “snout” being the northern tip of the island).

Early historical photographs show an island that is disconnected from the mainland, but already remarkably vegetated. In contrast to the current conditions on the island, the 1951 Hog Island had greater expanses of open grasslands in the interior, larger expanses of beach habitats on the eastern shoreline, and less emergent wetlands on the western shoreline. The isthmus of the island, connecting it to the mainland, likely developed as the natural result of emergent wetland growth and maturation in the Inlet,

and is formed from peat and sediments that accumulated during this process.

### 4.4.1 Hog Island Soils and Sediment Conditions

Hog Island was created utilizing dredge spoils produced from maintaining the shipping channel in the harbor. The soils are composed primarily of lacustrine sand fill, and are assumed to have originated from the Superior Front Channel and or the Superior Harbor Basin. Surface soil samples (0-6 inches)

analyzed from Hog Island verify a high sand textured soil and indicate a low organic matter content and low fertility. According to a study conducted by Johnson (2003), Hog Island dredged sediments had 3.0% organic matter while a particle size analysis found that greater than 95% of the sediment samples were comprised of sand with less than 5.0% consisting of clay. The pH was found to be low at 4.9. For comparison, Allouez dredged sediments analyzed for this study were also found to have a relatively low, acidic pH of 5.2.

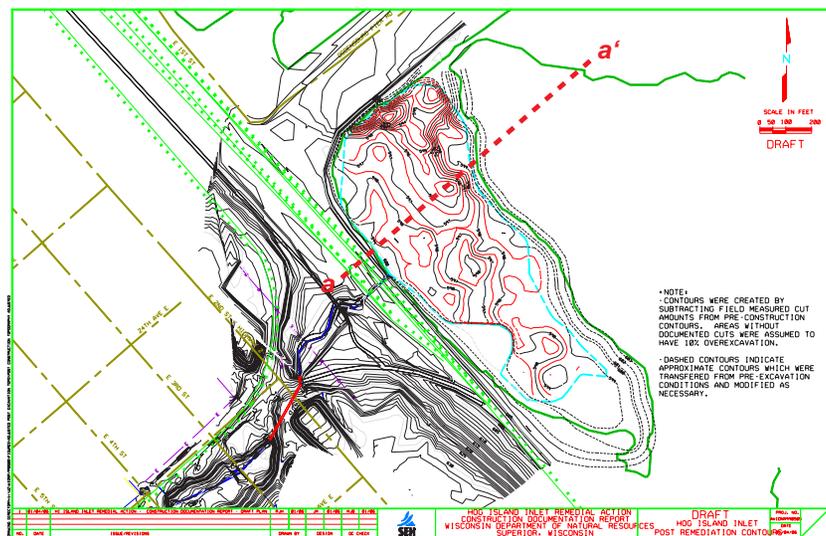


Google



Above, Hog Island in a 1951 aerial photograph. At left, a recent satellite image of Hog Island.

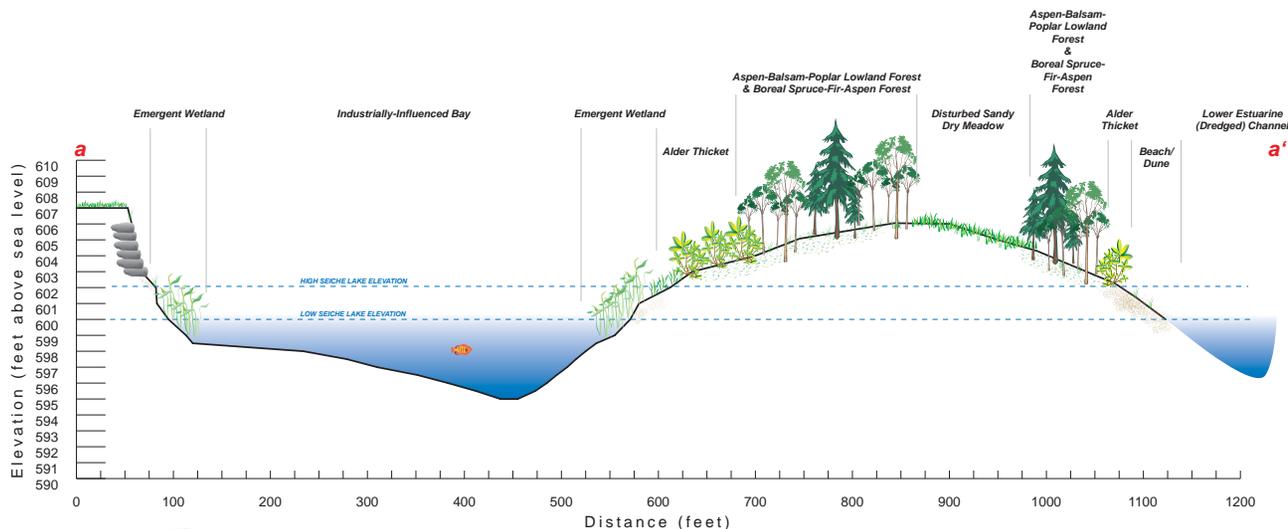
# Existing Conditions



During field reconnaissance in October 2006, soil samples were taken at two places on Hog Island; in the middle of a sandy meadow near the topographic peak of the island (sample 1), and within a woodland area (sample 2). Both samples had an organic content of approximately 1.5 and 0.6%, soil pH of 6.6 and 6.0, and Cation Exchange Capacity (CEC) of 3.9 and 2.4, respectively. Sample 1 was classified

as a loamy sand, with 86% sand content, 8% clay and 6% silt, and sample 2 was classified as sand, with 92% sand, 2% silt, and 6% clay.

CEC and pH provide an indication of soil fertility for plant growth (Brady and Weil, 2002). CEC of less than 5.0 can be limiting for the propagation or survival of many plant species. It can be inferred that the combination of low CEC and medium to low pH indicates that total exchangeable nutrients in Hog Island soils would be low, potentially limiting plant growth. However, the diverse emergent macrophyte communities at both the Allouez and Hog Island sites indicate that availability of exchangeable nutrients in the sediments may not be essential to support a fully vegetated mature wetland in these areas (Johnson, 2003). This may reflect the suitability of dredge material as a facilitator of wetland habitat, although in her thesis, Johnson (2003) speculates that the plants present in the current Hog Island system likely did not originate from the seed bank of the deposited dredge material, but may have self seeded from outside sources.



CROSS SECTION a - a' THROUGH EMBAYMENT AND HOG ISLAND



#### 4.4.2 Hog Island Vegetation Communities

Hog Island contains a mixture of vegetation communities that occur in bands by elevation from the lake surface. The four general plant communities as classified by Wetland Plants and Plant Communities of Minnesota and Wisconsin include: Shrub Swamp – Alder Thicket, Aspen-Balsam Poplar Lowland Floodplain Forest, Boreal Spruce-Fir-Aspen Forest, and a Disturbed Sandy Dry Meadow.

##### Shrub Swamp -Alder Thicket

This wetland plant community mainly occurs at the lowest elevational fringe of the southwestern side of Hog Island where saturated soils are prevalent. This is a shrub dominated community but a few larger black willow trees appear sporadically. Common plants occurring in this plant community and plants observed in the field (\*) include:

speckled alder (*Alnus incana*)\*  
 Canada bluejoint grass (*Calamagrostis canadensis*)  
 orange jewelweed (*Impatiens capensis*)  
 several asters (*Aster lanceolatus*, *A. puniceus*, and *A. umbellatus*)  
 boneset (*Eupatorium perfoliatum*)  
 rough bedstraw (*Galium asprellum*)  
 marsh fern (*Thelypteris palustris*)

arrow-leaved tearthumb (*Polygonum sagittatum*)  
 sensitive fern (*Onoclea sensibilis*)  
 black spruce (*Picea mariana*)\*  
 black willow (*Salix nigra*)\*  
 butter and eggs (*Linaria vulgaris*)\*  
 cinnamon fern (*Osmunda cinnamomea*)\*  
 tickseed (*Bidens* spp.)\*  
 sweet gale (*Myrica palustris*)\*

##### Aspen-Balsam Poplar Lowland Forest -Floodplain Forest

Further upslope on Hog Island the vegetation transitions into a floodplain type forest that is inundated by water only occasionally throughout the growing season. This community is dominated by trees but has a dense layer of herbaceous groundcover. Common plants occurring in this plant community and plants observed in the field (\*) include:

river birch (*Betula nigra*)  
 green ash (*Fraxinus pennsylvanica*)\*  
 hackberry (*Celtis occidentalis*)  
 swamp white oak (*Quercus bicolor*)  
 cottonwood (*Populus deltoides*)  
 balsam-poplar (*Populus balsamifera*)\*  
 bur oak (*Quercus macrocarpa*)  
 box elder (*Acer negundo*)  
 buttonbush (*Cephalanthus occidentalis*)  
 Virginia creepers (*Parthenocissus* spp.)  
 grapes (*Vitis* spp.),  
 poison-ivy (*Toxicodendron radicans*)

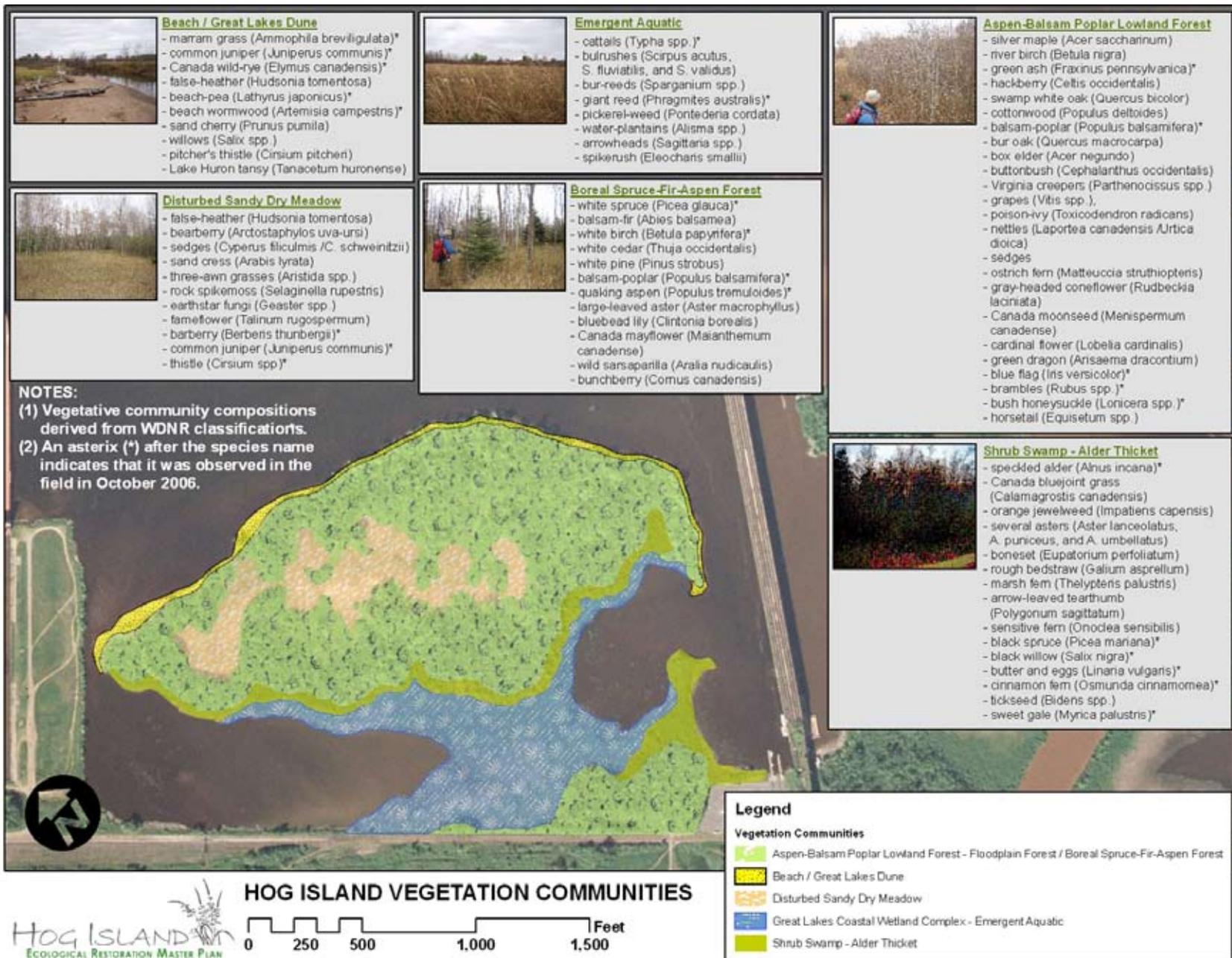
nettles (*Laportea canadensis* and *Urtica dioica*)  
 sedges  
 ostrich fern (*Matteuccia struthiopteris*)  
 gray-headed coneflower (*Rudbeckia laciniata*)  
 Canada moonseed (*Menispermum canadense*)  
 cardinal flower (*Lobelia cardinalis*)  
 green dragon (*Arisaema dracontium*)  
 blue flag (*Iris versicolor*)\*  
 brambles (*Rubus* spp.)\*  
 bush honeysuckle (*Lonicera* spp.)\*  
 horsetail (*Equisetum* spp.)\*

##### Boreal Spruce-Fir-Aspen Forest

This community is in an early successional stage with aspen and poplar occurring as the dominant trees and the spruce and fir trees just starting to appear. Below this tree canopy is a remnant old field community of grasses and forbes. Common plants occurring in this plant community and plants observed in the field (\*) include:

white spruce (*Picea glauca*)\*  
 balsam-fir (*Abies balsamea*)  
 white birch (*Betula papyrifera*)\*  
 white cedar (*Thuja occidentalis*)  
 white pine (*Pinus strobus*)  
 balsam-poplar (*Populus balsamifera*)\*  
 quaking aspen (*Populus tremuloides*)\*  
 large-leaved aster (*Aster macrophyllus*)

# Existing Conditions



bluebead lily (*Clintonia borealis*)  
 Canada mayflower (*Maianthemum canadense*)  
 wild sarsaparilla (*Aralia nudicaulis*)  
 bunchberry (*Cornus canadensis*)

### Disturbed Sandy Dry Meadow

This community type occurs in the uppermost, drier areas of the island. This area is the last to be colonized by vegetation, probably due to impacts from disturbance. Invasive/exotic plants have started to grow in these areas along with the hearty natives. The low growing herbaceous community here grows occasionally sparse on the sandy soils of this part of the island. Common plants occurring in this plant community and plants observed in the field (\*) include:

false-heather (*Hudsonia tomentosa*)  
 bearberry (*Arctostaphylos uva-ursi*)  
 sedges (*Cyperus filiculmis* and *C. schweinitzii*)  
 sand cress (*Arabis lyrata*)  
 three-awn grasses (*Aristida spp.*)  
 rock spikemoss (*Selaginella rupestris*)  
 earthstar fungi (*Geaster spp.*)  
 fameflower (*Talinum rugospermum*)  
 barberry (*Berberis thunbergii*)\*  
 common juniper (*Juniperus communis*)\*  
 thistle (*Cirsium spp*)\*

### 4.4.3 Hog Island Bird and Wildlife Communities

According to Eckart (1983), over 310 species of birds have been identified within the nearby Duluth city limits, many of which would likely frequent the Hog Island project area. Hog Island is listed as being one of the most heavily used areas of the harbor for non-colonial nesting birds. While varieties of shore, marsh, and water birds reside in or pass through the harbor area, colonial nesting birds (gulls, terns, plovers, and herons) comprise the most abundant and sensitive breeding birds in the harbor area.

While Wisconsin Point (adjacent to the project area) is noted as an exceptional feeding, resting and nesting site for numerous species of migratory birds, the piping plover (*Charadrius melodus*), a federally listed colonial nesting bird species, has not been seen nesting in the harbor area since 1985, according to the Minnesota and Wisconsin Departments of Natural Resources (USACE, 1999). Other federally listed birds known to have historically resided in or pass through the harbor area include the bald eagle (*Haliaeetus leucocephalus*) and peregrine falcon (*Falco peregrinus*). Most notably, there are recent reports that a bald eagle nest may exist on Hog Island, and a peregrine falcon has been found to nest on the Bong Bridge over the harbor (USFWS, 1998).

Migratory waterfowl utilize the harbor for

breeding, feeding, and rest during migration. While few birds over-winter in the harbor area, the snowy and great horned owls, as well as local populations of ring-necked pheasant are year-round residents along with hardy individuals of some waterfowl persisting in warm water discharge areas (USACE, 1999).

The industrial nature of the Duluth-Superior harbor area would suggest limited usage by wildlife. However, the extent and diverse variety of habitat types found in the vicinity support abundant wildlife. Mammals common to the harbor area include whitetail deer (*Odocoileus virginianus*) and black bear (*Ursus americanus*). Small game resident mammals include the snowshoe hare (*Lepus americanus*), eastern cottontail (*Sylvilagus floridanus*) and the gray squirrel (*Sciurus carolinensis*). Commonly found furbearers include beaver (*Castor canadensis*), mink (*Mustela vison*), river otter (*Lontra canadensis*), muskrats (*Ondatra zibethicus*) and other rodents common. A family of five river otter were observed at the confluence of Newton Creek into the Hog Island Inlet in July, 2007. The only federally listed mammal that may occur in the harbor area is the grey wolf (*Canis lupus*) (LSLRHP, 2002).

Numerous reptiles and amphibians are also found in the harbor vicinity and may be expected to be present to some degree in the project area.

# Existing Conditions

## Species of Probable or Confirmed Breeding Status - Quad 4609261 Block CE (Which Contains Hog Island and Newton Creek):

- Alder Flycatcher
- American Black Duck
- American Crow
- American Goldfinch
- American Redstart
- American Robin
- Baltimore Oriole
- Barn Swallow
- Belted Kingfisher
- Black-and-white Warbler
- Black-billed Cuckoo
- Black-capped Chickadee
- Blue Jay
- Blue-winged Teal
- Broad-winged Hawk
- Brown Thrasher
- Brown-headed Cowbird
- Canada Goose
- Canada Warbler
- Chestnut-sided Warbler
- Chimney Swift
- Chipping Sparrow
- Clay-colored Sparrow
- Cliff Swallow
- Common Grackle
- Common Nighthawk
- Common Tern
- Common Yellowthroat
- Downy Woodpecker
- Eastern Bluebird
- Eastern Kingbird
- Eastern Phoebe
- Eastern Wood-Pewee
- European Starling
- Golden-winged Warbler
- Gray Catbird
- Great Blue Heron
- Great Crested Flycatcher
- Great Horned Owl
- Hairy Woodpecker
- Herring Gull
- House Finch
- House Sparrow
- House Wren
- Indigo Bunting
- Killdeer
- Least Flycatcher
- Mallard
- Merlin
- Mourning Dove
- Mourning Warbler
- Nashville Warbler
- Northern Flicker
- Ovenbird
- Pine Siskin
- Purple Finch
- Red-breasted Nuthatch
- Red-eyed Vireo
- Red-winged Blackbird
- Ring-billed Gull
- Ring-necked Pheasant
- Rock Pigeon
- Rose-breasted Grosbeak
- Ruby-throated Hummingbird
- Savannah Sparrow
- Sedge Wren
- Sharp-shinned Hawk
- Song Sparrow
- Spotted Sandpiper
- Swamp Sparrow
- Tree Swallow
- Warbling Vireo
- White-breasted Nuthatch
- White-throated Sparrow
- Wilson's Snipe
- Wood Thrush
- Yellow Warbler
- Yellow-bellied Sapsucker
- Yellow-billed Cuckoo
- Yellow-rumped Warbler



• Nearby Wisconsin Point is an approved Important Bird Area (IBA) as defined by Bird Life International and the Audubon Society.

• Hog Island and Newton Creek offer a diverse combination of desirable bird habitats, including open water, beaches, and a wide variety of wetland and forest communities in close proximity to each other.

• Many bird migrants avoid flying over large bodies of water and when confronted with the western coast of Superior follow the shoreline to the inviting habitats of the Lower St. Louis River and estuary. Wetlands in particular provide the migrants and resident bird populations with food in the form of tubers, seeds and other plant parts as well as fish and invertebrates.

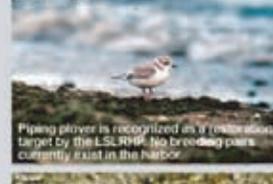
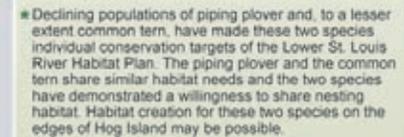
• Colonial nesting birds such as gulls, terns, plovers, and herons comprise the most abundant, and sensitive, breeding birds that inhabit the harbor area.

• Declining populations of piping plover and, to a lesser extent common tern, have made these two species individual conservation targets of the Lower St. Louis River Habitat Plan. The piping plover and the common tern share similar habitat needs and the two species have demonstrated a willingness to share nesting habitat. Habitat creation for these two species on the edges of Hog Island may be possible.

• A bald eagle nest has been identified on the site, and an eagle was spotted on the island during field reconnaissance in October, 2006.

• The Bong Bridge over the harbor is listed on the Minnesota Natural Heritage Database as a nesting area for peregrine falcon.

- Milestones for Birds (LSLRHP):
  - Populations of the common tern and the piping plover (threatened and endangered species), great blue herons, and mallards are not declining due to alteration, loss of physical habitat or exposure to contaminants.
  - A breeding population of piping plover is re-established in the AOC.
  - Public lands within the estuary are managed to ensure that appropriate habitat exists for at least one great blue heron rookery.
  - The breeding population of common terns in the Lower St. Louis River is maintained at its current (2004) level.
  - No common tern chicks with cross-bills are found at Interstate Island.



## HOG ISLAND AND NEWTON CREEK AVIAN COMMUNITIES

## 4.5 Ecological Conditions – Hog Island Inlet

The Hog Island Inlet provides access from Superior Bay to a shallow embayment that receives the flow of Newton Creek, and is connected to Superior Harbor and Lake Superior through a narrow, shallow straight on the northeastern end of Hog Island. The Inlet was formed in its current configuration by the creation of Hog Island from dredge materials in the 1920s and 1930s. Unlike other areas of the Harbor, it was never dredged until the recent sediment remediation actions, and because of this it retains a shallow depth which supports large emergent wetlands. The wetlands, beaches, and open waters support a complex ecological system, including diverse populations of fish, shellfish, and aquatic insects, as well as myriad bird and other wildlife populations that prey upon them.

In comparison to Hog Island, the Hog Island Inlet has a related, but very distinct suite of ecological drivers that control the composition and function of natural communities in the embayment. Lake level fluctuations associated with the seiche effect defines the distribution of wetland communities, and influences the fish and wildlife populations that use the open water and shoreline habitats. Other

hydrologic variables including discharge and sedimentation from Newton Creek, potential wave action from recreational vessels, and the long term effects of climate change can also greatly affect ecological conditions in the embayment.

The sediment remediation actions performed in the Hog Island Inlet during the summer and fall of 2005 excavated contaminated sediments in the open water areas of the Inlet, regrading the bathymetry as sediments were removed. Fish species were captured and ID-ed during the dewatering process.

In general, the shoreline of Hog Island and the isthmus that connects Hog Island to the Superior shoreline is composed of sandy beaches, beach grasses, and large patches of emergent wetland vegetation. The Superior City shoreline that runs parallel to the Burlington Northern railroad properties is composed of steep riprap and railroad berms, with numerous shallow areas of mudflats and wetland extending into the Inlet. The Ogdensburg Pier, which extends into Superior Harbor along the north-western end of the Inlet, has a steep, narrow shoreline buffer composed of beaches, grasses, and shrubs, with a few trees. Riprap and bulkhead banks exist in some areas along the pier.

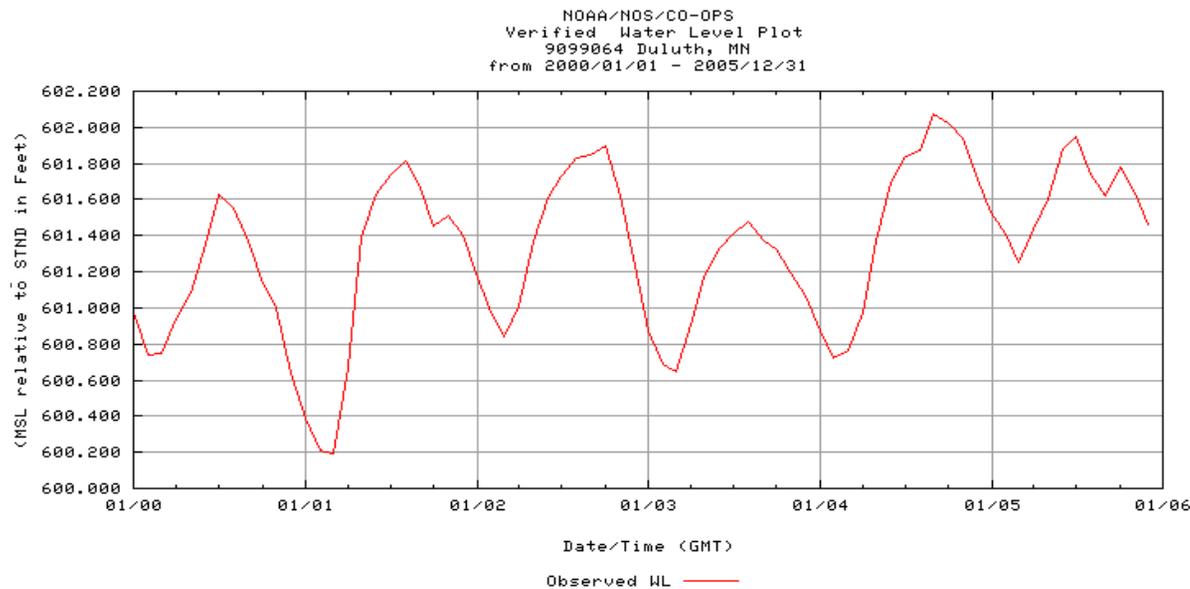
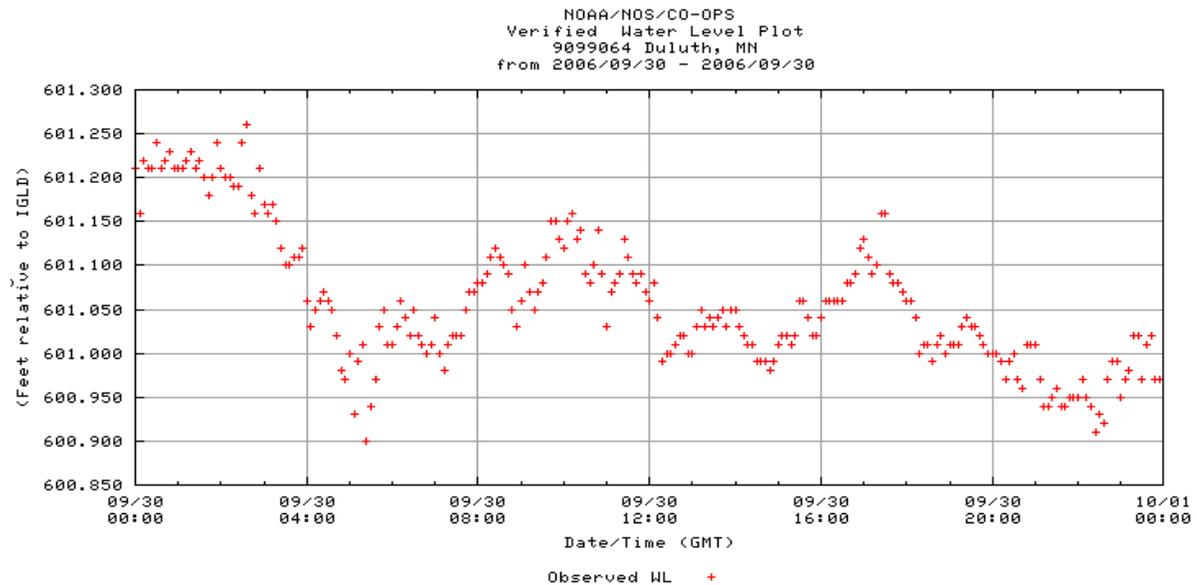


### 4.5.1 Hog Island Inlet Hydrology

While Newton Creek discharges directly into the Hog Island Inlet, its hydrologic impact is minor in comparison to the combined influences of Lake Superior and the Lower St. Louis River estuary on the Superior Bay and harbor area. Surface water elevations of Lake Superior vary between 600 and 602 feet above mean sea level with generally lower elevations in the winter and higher elevations during the summer months (LSLRHP, 2002).

The effect of Lake Superior seiches is a significant factor in inter-seasonal water level fluctuations on the Lake and the harbor.

## Existing Conditions



Seiches are caused by the “set up” of water on parts of the lake by wind, storms, or differences in atmospheric pressure with water levels correspondingly lower on the other side of the lake. Once the weather events or conditions subside, the water levels drop that were previously “set up,” creating a condition of oscillation on lake water levels that is known as a seiche. The effect of seiches, which are common on the lake, can cause changes in water level in the Lower St. Louis River estuary (LSLRHP, 2002).

Seiches have a profound effect upon the ecology along the lake margins, including the composition and distribution of wetland vegetation as well as the biological communities that they support. The regular “pulses” of freshwater along the lake fringe provides for the transfer of essential nutrients and sediments, and helps to maintain a high level of biodiversity in shoreline communities.

Water levels at Duluth, MN during a 24-hour period (top) and a 6 year period (bottom). Note that lake water levels tend to peak in summer months and decline in winter months.





## Existing Conditions

#### 4.5.2 Hog Island Inlet Sediment Conditions

Hog Island Inlet and shoreline soils are a mixture of dredged lacustrine sandy sediments and alluvially eroded clay materials from Newton Creek. Soil samples taken by Biohabitats in the fall of 2006 were analyzed for particle size and nutrients. When sampled, the soils observed in this area were very sandy in texture. The soil series mapped along the Hog Island Inlet and shoreline are a mixture of Lupton, Cathro, Tawas soils (USDA, 2006). These muck-loamy textured soils are typically deep



and very poorly drained, formed in organic deposits along the lake shore. Much of the shoreline wetlands around Hog Island occur in these soils.

Prior to remediation efforts, sediments collected at multiple sites within the Inlet by WDNR studies (1993, 1994, and 2002) revealed levels of diesel range organics (DRO) at some locations as well as more than 50 polycyclic aromatic hydrocarbons (PAHs) and PAH homologues (SEH, 2003).

As of the fall of 2005, remediation has been completed in the Newton Creek channel and the open waters of the Hog Island Inlet, which constitute the areas of greatest contamination. Sediment conditions are now at or below the target cleanup goal of 2.6 part per million for total PAHs. Limits were set based upon protection of chronic effects and protection of human health. Post-remediation sediment contaminant data has been collected, although it was not available for this document at the time of writing (Scott Ireland, USEPA, personal communication). However, the results of the sediment chemistry showed that all samples were below the clean-up targets established for this area (Scott Ireland, USEPA, personal communication).

#### 4.5.3 Hog Island Inlet Vegetation Communities

The Hog Island Inlet and shoreline vegetation are comprised of two basic plant communities as classified by Wetland Plants and Plant Communities of Minnesota and Wisconsin. These include: an emergent aquatic community as part of the Great Lakes coastal wetlands complex, and the beach/ Great Lakes dune community.

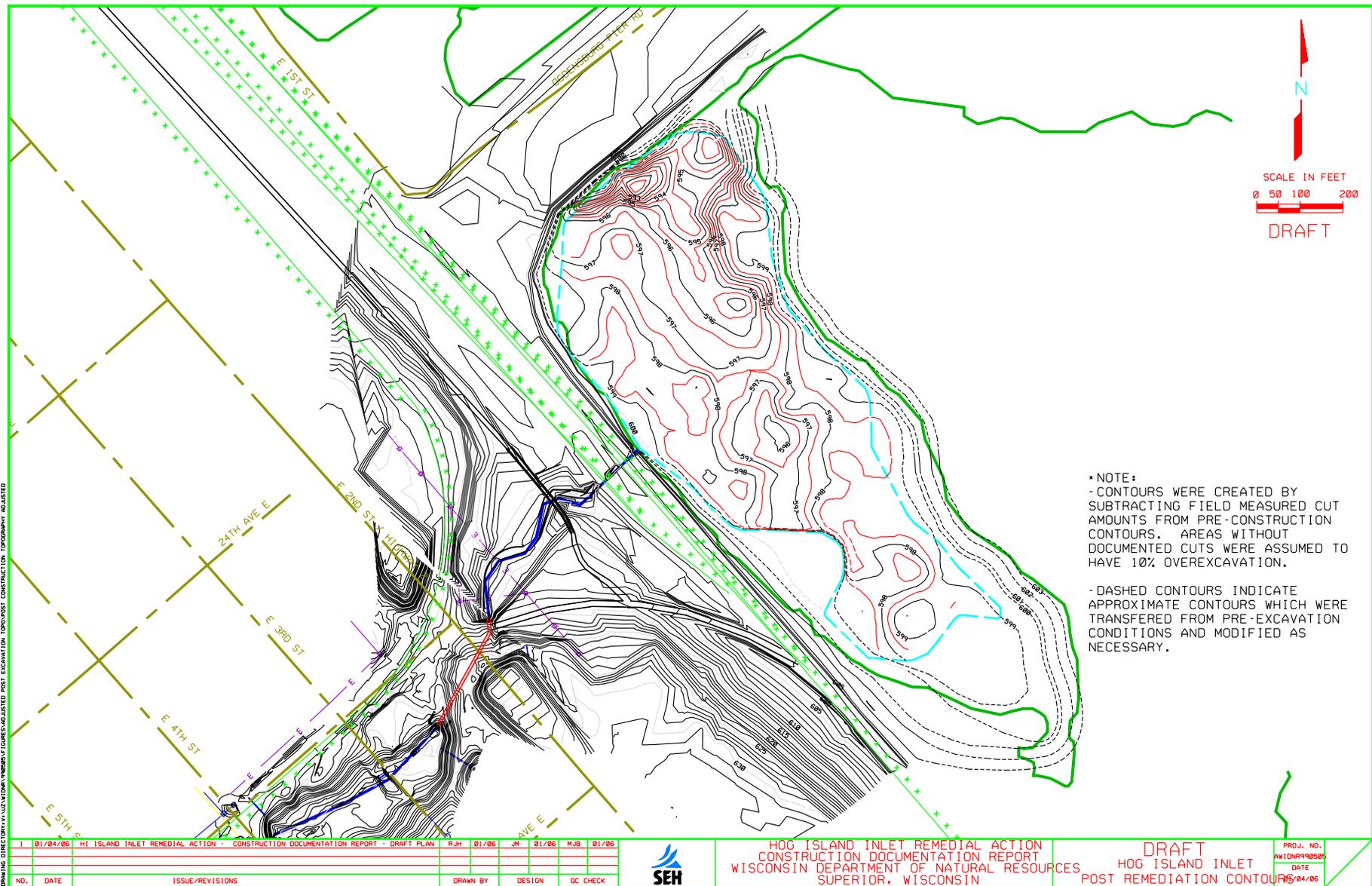
##### Beach/Great Lakes Dune

The northern shore of Hog Island receives waves from the active shipping channel it faces. These conditions have led to the development of a narrow band of beach and dune communities along the shoreline. Common plants occurring in this plant community and plants observed in the field (\*) include:

- marram grass (*Ammophila breviligulata*)\*
- common juniper (*Juniperus communis*)\*
- Canada wild-rye (*Elymus canadensis*)\*
- false-heather (*Hudsonia tomentosa*)
- beach-pea (*Lathyrus japonicus*)\*
- beach wormwood (*Artemisia campestris*)\*
- sand cherry (*Prunus pumila*)
- willows (*Salix* spp.)
- pitcher's thistle (*Cirsium pitcheri*)
- Lake Huron tansy (*Tanacetum huronense*)



Post-remediation topography in Hog Island Inlet.



...Post Construction Topography second adjusted.dwg 9/11/2006 11:26:09 AM

## Existing Conditions

### Wild Rice

The historically important emergent macrophyte wild rice (*Zizania aquatica*) was a characteristic wetland plant species found throughout the Lower St. Louis River estuary. Long term declines in this species presence and abundance have been due to human habitat manipulation, perturbations from carp and Canada geese, increased turbidity, contaminant impacts, and displacement by invasive non-native species such as purple loosestrife.

A vital food source for several species of migratory waterfowl, wild rice is found in sheltered, shallow water low energy wetland systems with a silty substrate (Eggers and Reed, 1997).

### Great Lakes Coastal Wetland Complex -Emergent Aquatic

On the calmer south shore of Hog Island, lack of continuous wave action has allowed for the development of an emergent wetland community. Since this area was dredged for sediment remediation, a mixed community of native and exotic/invasive plants has grown back. Common plants occurring in this plant community and plants observed in the field (\*) include:

cattails (*Typha* spp.)\*  
 bulrushes (*Scirpus acutus*, *S. fluviatilis*, and *S. validus*)  
 bur-reeds (*Sparganium* spp.)  
 giant reed (*Phragmites australis*)\*  
 pickerel-weed (*Pontederia cordata*)  
 water-plantains (*Alisma* spp.)  
 arrowheads (*Sagittaria* spp.)  
 spikerush (*Eleocharis smallii*)



### 4.5.4 Hog Island Inlet Fish and Aquatic Communities

Since industrialization, a legacy of habitat loss, heavy fishing pressure, and water quality problems associated with shoreline and watershed development have degraded the fishery in the St. Louis River estuary. Over the last several decades, water quality improvements from wastewater treatment upgrades seen in the Duluth-Superior harbor have been significant. The harbor area currently supports a fish community of over 50 species that use the river and estuary for spawning (MPCA and WDNR, 1992). The St. Louis River estuary is considered to be the most productive fish breeding area in the western half of the lake, supporting an extensive walleye (*Sander vitreus vitreus*) stock (USACE, 1982).

The Hog Island Inlet was once an industrially influenced bay. The pre-remediation fish community was likely characterized by those species found in the Inlet by Wisconsin DNR as the area was being dewatered (Table 4.1). During the Hog Island Inlet sediment remediation efforts, WDNR staged a fish rescue as the Inlet was dewatered. Throughout the dewatering process, over a couple of weeks, the WDNR sent crews out to capture fish in the Inlet and transfer them back into the open water of Lake Superior.



**AQUATIC HABITAT TYPES IN THE PROJECT AREA (as defined by the Lower St Louis River Habitat Plan)**

**Lower Estuarine (Dredged) Channel**

This habitat type is found in the open water channel just off of the northern edge of Hog Island. The deep-water habitat is periodically disturbed by dredging operations that maintain a channel up to 27 feet deep. Utilized by some fish as wintering habitat, it is considered an important open water feeding area for fish eating birds. Lake level fluctuations have the strongest influence on this habitat type.



**Lower Estuary (Industrial Harbor) Flats**

The industrial harbor flats are moderately deep to shallow areas adjacent to historically modified shorelines which were once heavily vegetated but now support little emergent wetland vegetation. The bottoms of these areas once likely held the greatest mussel abundance in the estuary. Lake level fluctuations have the strongest influence on this habitat type.



**Shallow Water Embayment**

The Hog Island Inlet may be considered a member of this aquatic habitat type. Generally 4-5 feet deep or less, they are often found with varying occurrences of emergent and submergent aquatic vegetation. Typically containing sediments that are highly contaminated, the Hog Island inlet was dredged in 2005 to remove much of the contaminated sediments. Lake level fluctuations have a strong influence on this habitat type with the Newton Creek tributary to the Inlet providing a secondary influence.



**Clay-Influenced Tributaries**

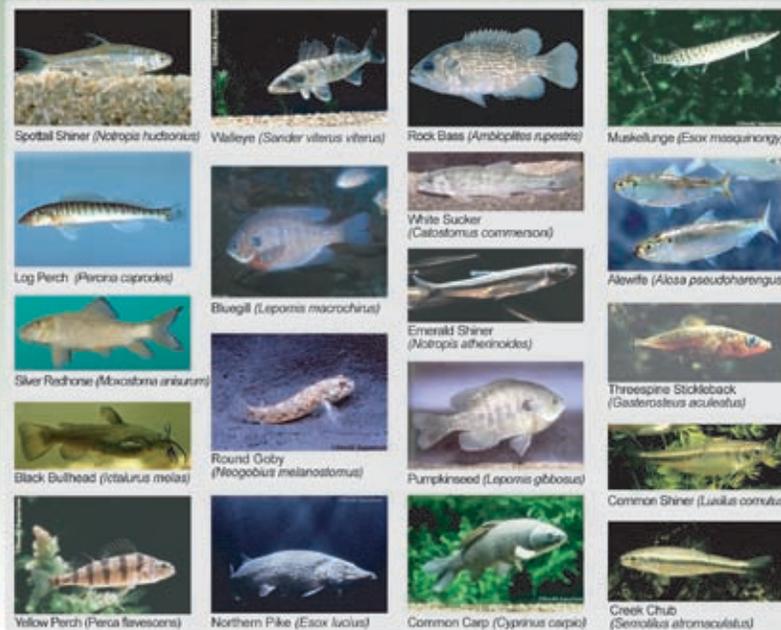
These tributaries have their own hydrologic regime, not dominated by Lake Superior or the St. Louis River. The first or second order, medium to low gradient, groundwater and surface water influenced streams flow through lacustrine red clay deposits. These tributaries, such as Newton Creek, provide habitat for a variety of native fish found in the estuary in spite of having been altered by ditches, wetland draining and other hydrologic modifications in the watersheds.



**SUPERIOR HARBOR FISH POPULATION STATUS**

- \* The Duluth-Superior Harbor area supports a diverse fish community of over 50 species that use the St. Louis River and the estuary and its tributaries for spawning (Lindgren et al., 1997).
- \* Loss of habitat, water quality impacts from a developing shoreline and watershed, exotic species introductions, and overfishing had severely degraded the fishery over the last century.
- \* Recent water quality improvements over the last 25 years have significantly improved the fishery.
- \* Hog Island Inlet is part of the nearshore zone area of Lake Superior. Virtually all species of Great Lakes fish use the nearshore waters for one or more of their critical life stages or functions. These include: permanent residence; migratory pathway for anadromous fish; temporary nursery and feeding grounds; and refuges for young-of-the year fish (SOLEC, 1997).
- \* Stocking of fish such as walleye, northern pike, and muskellunge since the late 1980's has helped to improve the harbor area gamefish stock.
- \* The historically significant lake sturgeon populations were restored to the harbor area through intensive stocking.
- \* Prior to water quality improvements begun in the 1980's, high chemical oxygen demand from organic pollutants in the harbor favored species such as northern pike, black bullhead, yellow perch, and white sucker. Since then black bullhead and yellow perch have declined in abundance while predator species increased in numbers largely due to stocking efforts.

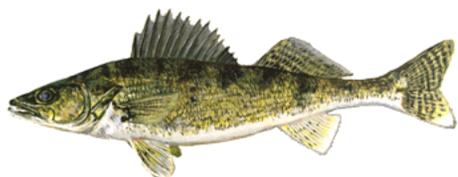
**SELECTED FISH SPECIES IN THE PROJECT AREA**



**HOG ISLAND EMBAYMENT AND NEWTON CREEK FISH COMMUNITIES**

## Existing Conditions

They used boats equipped with shocking equipment (which temporarily stuns the fish and brings them to the surface) as well as seine and dip nets to capture the fish. When possible, non-native species (such as ruffe and gobies) were identified and either destroyed or not removed from the Inlet. By the end of these efforts, over 1,700 fish were rescued



From top Walleye, Yellow Perch, Rock Bass

from the Inlet and returned to the open waters. Rescued fish included game fish like walleye, northern pike and catfish, pan fish like rock bass, crappie and yellow perch, and valued native rough fish like red horse and white suckers. Additionally, freshwater clams and turtles were rescued as part of the effort.

After remediation was completed the Inlet was restored to that of a shallow water embayment in the early stages of succession. Eventually, the fish use of the Inlet may approximate what is detailed in the St. Louis River Habitat Plan for a sheltered bay habitat type.

A site survey of bottom dwelling invertebrates in the Duluth portion of the harbor conducted in 1994 found mean total abundance ranging from 1,121 to 34,379 organisms per square meter (Crane et al., 1997). Tubificidae were the dominant taxon ranging from 38 to 78 percent of the composition from each sample site. Bivalve mollusks (9-26%), polychaetes (4-46%), Naididae (2-8%), Chironomidae (2-11%), and Trichoptera (up to 8%) were also found with several other taxa present at lower abundances. The dominance of tubificid oligochaetes are pollution tolerant indicators of low dissolved oxygen levels.

The restoration of wetland plant species, especially submerged aquatic vegetation, would be beneficial to some fish communities. This would most benefit juvenile fish habitat as a nursery and refugia for gamefish as well as forage fish species. The Hog Island Inlet, already supporting some shallow water fringing emergent wetlands, is a good candidate for the restoration of deep water emergent and submerged wetland types which are widely known as beneficial fishery habitat. Additionally, these habitats would provide feeding, resting and cover areas for migrating waterfowl and other birds.

Hog Island Inlet remediation project fish and wildlife rescue, July 21<sup>st</sup> – Aug 2<sup>nd</sup>, 2005 (source: WDNR, 2007).

Fish and Wildlife Species Rescued	Total # Rescued
<b>Fish</b>	
Black Bullhead	49
Black Crappie	31
Bluegill	5
Burbot	1
Channel Catfish	13
Common Shiner	5
Freshwater Drum	3
Golden Shiner	5
Log Perch	21
Mimic Shiner	2
Muskellunge	1
Northern Pike	62
Pumpkinseed	45
Rock Bass	574
Redhorse (Shorthead and Silver)	522
Smallmouth Bass	16
Spottail Shiner	9
Trout Perch	1
Walleye	109
White Sucker	144
White Perch	2
Yellow Perch	139
<b>Invertebrates</b>	
Native Crayfish	1
Freshwater Clam	138
<b>Reptiles</b>	
Painted Turtle	33



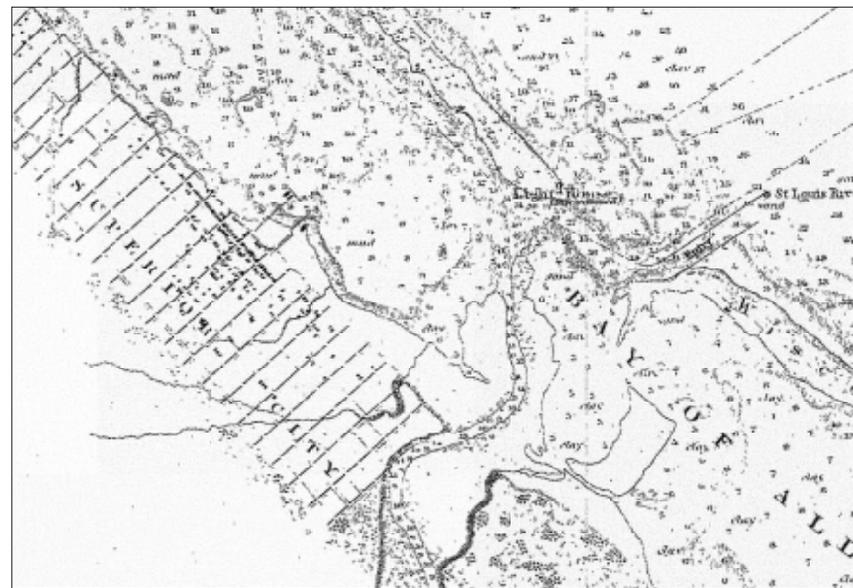
## 4.6 Ecological Conditions – Newton Creek

Newton Creek originates in the stormwater detention ponds and process wastewater discharge treatment wetlands within the Murphy Oil refinery. From there, it flows approximately 9,000 feet (1.7 miles) into the Hog Island Inlet. Today, the stream is perennial (it flows throughout the year), because the flow is largely determined by the industrial operations of the refinery, which operates year round. Historically, it is likely that the stream was intermittent (flowing for only part of the year), or at least had a much larger variation in discharge, as the source was determined by patterns of rainfall and groundwater drainage of the surrounding (mostly wetland) landscapes. Historical maps from the mid-1800s show a stream channel of similar length and sinuosity, although the urban grid was already present at this time. By the construction of the refinery the 1950s, the stream was in its present-day configuration, impacted by road crossings and railroad

berms. The 1950's era photographs show a watershed dominated by grasslands, wetlands, and the suburban grid, with fewer forests than exist today.

At the lower end of the watershed, Newton Creek flows through suburban and urban neighborhoods of Superior City, and is subject to the influence of impervious surfaces and encroachment from adjacent residential and commercial areas.

Newton Creek was the site of major sediment remediation actions beginning in the 1990s, during which time the channel sediments were excavated and heavy equipment was working in and around the channel. By 2006, contaminated sediments in the channel had been removed, and the channel bed filled with small cobbles and large gravels. Coir fiber logs, or rolled coir fiber mats had been staked into the toe of slope to increase bank stability. The majority of the work area has become revegetated.



At top, Newton Creek, 1863. Above, Newton Creek, 1951

Existing Conditions



### 4.6.1 Newton Creek Hydrology

Because of the generally flat topography and undefined nature of groundwater interactions, the watershed limits are not easily defined in the upper basin, which is comprised of the Murphy Oil facility, Dome Petroleum, and undeveloped open spaces. Contributions from the lower basin are more easily determined due to the storm drainage network that runs through the urban, suburban, and commercial areas of Superior City. In total, it is estimated that the basin size is about 835 acres, or 1.3 square miles. Of this, approximately 10% is “impervious” cover, consisting of pavement, concrete, or rooftops. The remainder of the land cover is comprised of grasslands, wetlands, woodlands, and turf grasses. The clay-rich soils in the region have slow infiltration rates (hydrologic soil type D), inferring high rates of surface runoff.

There are few tributaries that confluence with the main channel, but there are several stormwater outfalls and roadside drainage ditches that provide some contribution to flow during rainfall events. There are no combined sewer outfalls (CSOs) discharging

NEWTON CREEK WATERSHED			
Approximate Watershed Size:	835	acres	(1.3 square miles)
Length:	9,160	feet	
Hydrologic Soil Type:	D		
Approximate Impervious Area:	10.3%		
Land Use	Acres	% of Total	Notes
Roads / pavement	30.6	3.7%	assuming roads are 30' wide and all paved
Rooftop	55.8	6.7%	assumes 30% of lots are impervious
Turf Grasses	93.0	11.1%	assumes 50% of lot areas in turf grasses
Grasslands	262.4	31.4%	assumes 40% of remaining areas forested
Forest Cover (Canopy)	393.7	47.1%	assumes 60% of remaining areas in high grassland

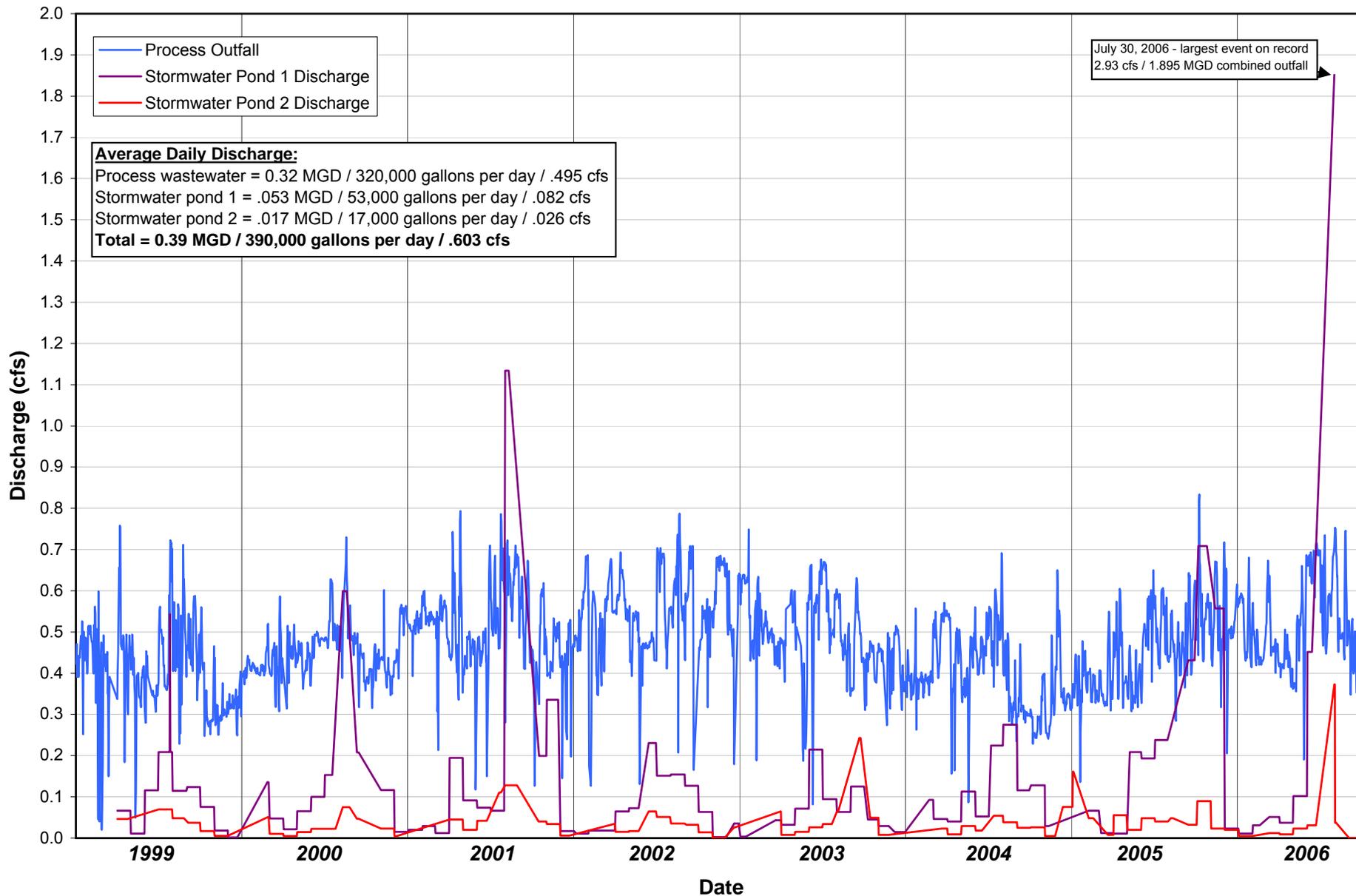
to the creek, a major stormwater outfall ( $\geq 36''$ ) is located at the base of East 10<sup>th</sup> Street and 24<sup>th</sup> Avenue East where it discharges into the Creek (Superior Comprehensive Plan, 1998). Although no groundwater data is available, it is likely that due to the clay-influenced soils groundwater contributions do not greatly influence channel flow conditions. Regionally, snow melt and the predominance of poorly drained red clay soils provide for a high wet weather runoff potential which can cause flooding to area waterways (Superior Comprehensive Plan, 1998). Regular flooding in the Newton Creek area has not been confirmed.

Operating under a WDNR-issued industrial

discharge permit, the Murphy Oil facility is the major contributor of water to the channel. An average 320,000 gallons per day (gpd) of process wastewater, cooling tower and boiler blowdown, water softener backwash and process area stormwater is treated in an activated sludge treatment system and discharged through an outfall to Newton Creek. Stormwater from non-process areas (tank farms) is routed to stormwater lagoons and discharged to Newton Creek through two outfalls with respective average flows of 53,000 gallons per day (gpd) and 17,000 gpd. The hydrograph of discharge from the Murphy facility into Newton Creek from 1999 to 2006 is displayed on the following page (graph created with data from WDNR, 2006).

Existing Conditions

Murphy Oil Process Wastewater & Stormwater Outfalls to Newton Creek, 1999 - 2006



#### 4.6.2 Newton Creek Channel and Riparian Conditions

During field work in October 2006, Jeremy Thomas and Bryon Salladin from Biohabitats, Inc. conducted a field assessment of channel and riparian conditions along Newton Creek. The following assessment is based primarily upon their findings.

Along its length, Newton Creek demonstrates the channel morphology of a stream system that does not experience wide ranges in discharge: few erosional or depositional features are present, the natural channel substrate is highly embedded (although the cobble placed in the channel post sediment remediation is loose and appears to be non-mobile), and there is little evidence of floodplain access by bankfull flow events. As a result of the steady, predictable flow patterns, there is little complexity in the channel and pools are not well defined. Riffles are poorly developed. The stream is sinuous throughout several reaches in the upper watershed, meandering as expected for a low-gradient system. In the lower reaches, the channel has been straightened to accommodate urban development and the street grid, and sinuosity decreases as stream gradient increases. The channel below 11<sup>th</sup> St. becomes more constricted between railroad and road berms. Between 3<sup>rd</sup> St. and 2<sup>nd</sup> St.

there is a backwater effect from the culvert that directs flow under 2<sup>nd</sup> St. At the outlet of the 2<sup>nd</sup> St. culvert, the alluvial influence ends, and the water from Newton Creek intermixes with water in the Hog Island Inlet. In this section, the water elevation in the channel is subject to variations in lake level.

Much of the riparian vegetation immediately along Newton Creek can be attributed to revegetation seeding following the efforts to remediate contaminated areas within the creek. Throughout this narrow band, herbaceous vegetation is dominated by a dense growth of perennial rye (*Lolium perenne*) used to stabilize the banks following disturbance by remediation equipment. Further from the stream channel the surrounding riparian wetlands are mosaics of shrub swamp and open meadow, with a few small patches of emergent marsh. Dominant shrubs include speckled alder (*Alnus*) and shrub willows (*Salix spp.*). In addition, many riparian areas immediately adjacent to the creek are often dominated by reed canary grass, a highly invasive species that forms a monoculture by suppressing the growth of other vegetation, reducing vegetative biodiversity on the flood-prone terraces.

Newton Creek is bisected 4 times by railroad berms, 8 times by culverted road



crossings, and 3 times by elevated sanitary sewer pipes, for a total of 15 crossings. Most railroad or road crossings use culverts to direct flow, in Newton Creek these range from older, well constructed

## Existing Conditions



bottomless stone arches to concrete and metal pipes. Some of the culverts are in extremely poor condition, either partially collapsed or clogged with debris. These features constrict flow, and form “hard points” that prevent the natural meander or migration of the stream channel. In addition, culverts prevent the migration of aquatic organisms along the stream channel preventing fish, shellfish and insects from moving between Newton Creek and the Hog Island Inlet and Lake Superior. These crossings also interrupt the continuity of riparian vegetation, which is used by many wildlife species as an ecological corridor, migrating from the lake to the upland natural areas.

During field reconnaissance in September and October 2006, it was observed that the lower reaches of Newton Creek below the 2<sup>nd</sup> St. culvert exhibited eutrophic conditions, with large algae blooms and high turbidity. In addition, the upper reaches of the creek exhibit many occurrences of brown algae attached to the channel substrate in riffles and shallower sections of the creek. These are indicators of elevated nutrient inputs into the creek from an upstream source.

Despite all of these disturbances, Newton Creek is blessed with generally wide,

vegetated riparian areas, and some long reaches of high quality riparian habitat in the upper watershed. In addition, human habitations are generally buffered from the main channel.

At the time of field reconnaissance, there was little evidence of litter or dumping along Newton Creek. These litter-free conditions may be due to the actions of the Murphy Oil Community Advisory Panel, which organized a Newton Creek clean-up effort on May 20<sup>th</sup>, 2006, at which time 5 pick-up loads of material were removed from the creek.

### 4.6.3 Newton Creek Soil / Sediment Conditions

As part of the Lake Superior Clay Plain Ecoregional Subsection, Newton Creek soils are lacustrine-deposited fine clay and silt. Soil samples (0-6”) analyzed from along Newton Creek verify this and indicate a higher organic matter content and fertility than Hog Island. The soil series mapped adjacent to Newton Creek is the Miskoaki clay-loam (NRCS, 2006). These fine textured soils are typically deep and well drained with very slow permeability.

Remediation of contaminated sediments in Newton Creek occurred in three phases, with Murphy Oil making improvements



to their wastewater treatment facility and cleaning up the upper reach (Segment A) of Newton Creek in 1997. In 2003, WDNR removed sediments from stream and flood plain soils along Segments B-K. The final phase of actions involved the remediation of the last reach of Newton Creek (Segment L) to the confluence with Hog Island Inlet, which was completed in November 2005. Within Newton Creek, remediation actions

consisted of excavating contaminated sediment from within the active channel to a depth of 1-3 feet, and in some places involved removal of contaminated soils from the floodplain. Excavated portions of the creek bed were then lined with rounded cobbles and breaker run. Banks were stabilized with coir fiber logs, grass seeding, and shrubbery to prevent erosion and improve the appearance of the area.



### 4.6.4 Newton Creek Vegetation Communities

Newton Creek flows through an area dominated by a variety of wetland habitats including: aquatic bed, shallow marsh, wet meadow, shrub carr, alder thicket, and hardwood swamp. A recent wetland function evaluation indicates that the wetlands above 2<sup>nd</sup> Street culvert have a functional rating of poor-medium while those downstream of the culvert have medium-high functionality (City of Superior, 2006).

#### Aquatic Bed

Newton Creek begins as an open water ponded area with water levels controlled by a dam. Dominant plants occurring in this community include lesser duckweed (*Lemna minor*).

#### Shallow Marsh

A shallow marsh surrounds the open water of the ponded area creating a fringe of emergent wetland community. Dominant plants occurring in this community include:

- cattail (*Typha angustifolia*, *T. latifolia*)
- lesser duckweed (*Lemna minor*)
- water hemlock (*Cicuta bulbifera*)
- water horsetail (*Equisetum fluviatile*)
- nodding beggarticks (*Bidens cernua*)
- purplestem beggarticks (*Bidens connata*)
- purple marshlocks (*Potentilla palustris*)
- soft stem bulrush (*Schoenoplectus tabernaemontani*)

#### Wet Meadow

The riparian vegetation immediately along Newton Creek can be partially attributed to the revegetation seeding following the efforts to remediate contaminated areas within the creek. This narrow band of wet meadow immediately adjacent to the creek is dominated by a dense growth of native and invasive/exotic vegetation that colonized the banks following disturbance by remediation equipment. Dominant plants occurring in this community include:

- reed canary grass (*Phalaris arundinacea*)
- blue-joint grass (*Calamagrostis canadensis*)
- quackgrass (*Elytrigia repens*)
- foxtail grass (*Alopecurus pratensis*)

- fowl meadow grass (*Poa palustris*)
- cattail (*Typha angustifolia*)
- green bulrushes (*Scirpus atrovirens*)
- horsetail (*Equisetum arvense*)
- redtop (*Agrostis gigantea*)
- giant goldenrod (*Solidago gigantea*)
- Canada thistle (*Cirsium arvense*)
- jewelweed (*Impatiens capensis*)

#### Shrub Carr

The shrub carr community occurs in patches throughout the length of Newton Creek. Although this is a shrub dominated community, native and invasive/exotic herbaceous plants also occur in abundance. Dominant plants occurring in this community include:

- red-osier dogwood (*Cornus stolonifera*)
- meadow willow (*Salix petiolaris*)
- speckled alder (*Alnus incana*)
- pussy willow (*Salix discolor*)
- red raspberry (*Rubus strigosus*)
- Bebb willow (*Salix bebbiana*)
- shining willow (*Salix lucida*)
- flat-topped white aster (*Aster umbellatus*)
- reed canary grass (*Phalaris arundinacea*)
- dwarf red blackberry (*Rubus pubescens*)
- woolgrass (*Scirpus cyperinus*)
- purplestem beggarticks (*Bidens connata*)
- upright sedge (*Carex stricta*)
- purple marshlocks (*Potentilla palustris*)
- water horsetail (*Equisetum fluviatile*)
- smooth black sedge (*Carex nigra*)



### Alder Thicket

Alder thickets also occur throughout the length of Newton Creek occupying areas of saturated soil. The dense canopy formed from a typical alder thicket reduces the herbaceous components of this community type. Dominant plants occurring in this community include:

- speckled alder (*Alnus incana*)
- blue-joint grass (*Calamagrostis canadensis*)
- dwarf red blackberry (*Rubus pubescens*)
- red raspberry (*Rubus strigosus*)
- meadow willow (*Salix petiolaris*)
- redtop (*Agrostis gigantea*)
- graceful sedge (*Carex gracillima*)
- horsetail (*Equisetum arvense*)
- flat-topped white aster (*Aster umbellatus*)
- common buckthorn (*Rhamnus cathartica*)

### Hardwood Swamp

The hardwood swamp community also occurs in patches throughout the length of Newton Creek. This is a tree-dominated community, with both native and invasive/

exotic shrubs and herbaceous plants in the understory. Dominant plants occurring in this community include:

- balsam poplar (*Populus balsamifera*)
- white willow (*Salix alba*)
- boxelder (*Acer negundo*)
- reed canary grass (*Phalaris arundinacea*)
- blue-joint grass (*Calamagrostis canadensis*)

- dwarf red blackberry (*Rubus pubescens*)
- red raspberry (*Rubus strigosus*)
- horsetail (*Equisetum arvense*)
- red-osier dogwood (*Cornus stolonifera*)
- speckled alder (*Alnus incana*)
- trembling aspen (*Populus tremuloides*)
- giant goldenrod (*Solidago gigantea*)
- water horsetail (*Equisetum fluviatile*)
- valerian (*Valeriana officinalis*)
- Tartarian honeysuckle (*Lonicera tatarica*)



## Existing Conditions



## 4.7 Potential Threats to Hog Island and Newton Creek Habitats

The habitat attributes described previously are part of a complex, inter-related system that includes the human populations of the City of Superior, and all of the industrial, commercial, residential, and transportation infrastructure and operations that occur in the project area. The function of these natural habitat components are greatly affected by the presence of this infrastructure, and the influence of human beings on the landscape. Currently, the project area exists in an extremely altered ecological condition compared to what occurred in pre-industrial times. Despite these changes, areas of robust, diverse natural communities still exist in the current landscape matrix.

Potential threats to habitat viability in the project area include:

- water and sediment contamination from industrial and urban development;
- the displacement of natural communities from the expansion of industrial, urban, or transportation infrastructure;
- invasive species colonization;
- human access and use of natural areas;
- and long-term climate change.

### 4.7.1 Water and Sediment Contamination

Industrial operations in the watershed pose the threat of spillage of PAHs, volatile organic compounds (VOCs), DROs, heavy metals, and other pollutants into Newton Creek and Hog Island Inlet. In addition, runoff and leakage from urban and suburban development allow pollutants to spill into waterways, threatening the ecological viability of plant and animal communities.

There are continuing industrial operations in the upper Newton Creek watershed which may pose a potential source for future contamination. The release of hazardous substances directly from an industrial facility or during transportation could potentially jeopardize the survival of aquatic communities downstream, and negate any environmental benefits that are realized from the remediation project or future restoration efforts. Since the 1970s Murphy Oil and other industries have initiated a number of spill prevention and control measures to prevent and minimize future spills.

In addition, there are additional potential inputs of nutrients, pathogens, and urban pollutants into Newton Creek and Hog Island Inlet from outfalls that drain the suburban areas in the watershed. The origin of these pollutants may be from the application of lawn fertilizers or other land use practices, spills or groundwater leakage from the sanitary sewer system, illegal dumping, or other natural or human sources.



### 4.7.2 Urban, Suburban, and Industrial Development

The expansion or additional construction of houses, roads, railroad tracks, sidewalks, and other urban, suburban, and industrial infrastructure has the potential to disturb ecosystems, through the direct displacement of plant and animal communities, alteration of watershed hydrology, and pollution.

In the project area, railroad berms running parallel to Newton Creek and the shoreline of Superior harbor have constricted these areas, and displace or prevent the re-establishment of more natural riparian and wetland communities. Road crossings that intersect Newton Creek affect channel morphology, preventing the migration of aquatic and terrestrial organisms laterally along the corridor, disconnecting the ecological link between the shoreline and upland areas.

Stormwater runoff is a major factor in local and regional water quality impacts and stream degradation. Uncontrolled stormwater washes soil from the landscape, erodes stream banks, scours channels, increases pollutant loadings, and impacts in-stream habitat. The spread of impervious surfaces throughout the watershed influences the quantity and quality of stormwater runoff into Newton Creek. Currently, Newton Creek watershed is estimated to be approximately 10% impervious, which

is generally thought to be the point at which sensitive stream elements are lost from the system (Schueler, 2003). A second threshold appears to exist at around 25 to 30% impervious cover, where most indicators of stream quality consistently shift to a poor condition (e.g., diminished aquatic diversity, water quality, and habitat scores [Schueler, 2003]).

### 4.7.3 Invasive Species

The intentional or unintentional introduction of invasive exotic plants and animals into the watershed from residential gardens, landscaping, release of exotic pets, ship ballast waters, or the migration of invasive species from adjacent areas can alter ecosystem composition and function by out-competing and displacing native species.

A comprehensive inventory and distribution of invasive plant and animal species in the project area is undetermined. The following occurrences of aquatic and plant species are based upon regional invasive species inventories, as well as observations made during the field reconnaissance effort.

Minnesota Department of Natural Resources (MDNR) fishery sampling has found numerous non-native species that have entered the harbor area in recent years. These include: alewife herring (*Alosa*



*pseudoharengus*), carp (*Cyprinus carpio*), Eurasian ruffe, freshwater drum (*Aplodinotus grunniens*), round goby (*Neogobius melanostomus*), threespine stickleback (*Gasterosteus aculeatus*), white perch (*Morone*

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*americana*), spiny water flea (*Bythotrephes cederstroem*), and zebra mussel (*Dreissena polymorpha*) (Lindgren *et al.*, 1997). Of these, only the ruffe has been considered to have become abundant in the harbor, and since 1992 their numbers have been thought to be declining. MDNR is managing predator species in the harbor, in part to control exotic fish species. Unlike other Great Lakes, zebra mussels have not been a significant problem in Lake Superior in part because the waters may be too cold and are lacking in calcium and some nutrients necessary for zebra mussel growth (USACE, 1999).

The invasive exotic wetland plant species purple loosestrife (*Lythrum salicaria*), is

*“At least 31 species currently found in Lake Superior are non-native, including sixteen fish, five invertebrates, four pathogens and parasites, and six wetland and aquatic plants (LSLRHP, 2002).”*

established in the harbor, although it is not believed to have had a negative effect on fish and bird populations. The Minnesota and Wisconsin Departments of Natural Resources have each released German loosestrife beetles (*Galerucella calmariensis* L. and *Galerucella pusilla* Duftschmidt) in the harbor area as a method of biological control (USACE, 1999). The City of Superior conducted a successful three-year purple loosestrife reduction project (2002-2004) in the Pokegama River with beetle release (and subsequent loosestrife reduction) at six sites. The presence of purple loosestrife is not confirmed in the project area.

The common reed (*Phragmites australis*) is an aggressive wetland emergent plant that can also survive in riparian and upland environments. It

has established itself in dense stands along the shoreline of the Hog Island Inlet.

Reed canarygrass (*Phalaris arundinaceae*) is present in large stands along Newton Creek, possibly introduced as a result of historic attempts at bank stabilization on road and railroad berms. Reed canarygrass forms dense, highly productive single species stands that prevents the establishment of native vegetative communities. Control methods include burning, mowing, hand pulling, and shading out the plant.

#### 4.7.4 Human Access and Recreation

All terrain vehicles, hiking trails, horse packing trails, and hunting blinds are recreational elements that occur in the area; all of these human activities have the potential to negatively impact ecosystems. Erosion, litter, pet waste and predation, noise and light pollution, and graffiti can influence plants and animals, and be sources of ecological stress.

Currently, recreational activities in the ecologically-sensitive areas of Hog Island, Hog Island Inlet, and Newton Creek are limited, and likely the associated risk of ecological disturbance is minor in comparison to other potential threats. However, any increase in recreation within or adjacent to natural communities may be incompatible with



habitat restoration goals, and be considered a more active source of disturbance.

#### 4.7.5 Climate Change

In the Great Lakes region, the impacts of climate change will be profound. Recent studies conclude that the climate of the region is already changing; winters are growing shorter, average annual temperatures are getting warmer, extreme heat events are occurring more regularly, the duration of lake ice cover is decreasing as air and water temperatures rise, and heavy precipitation events are becoming more common (Kling et al., 2003). Some climate models predict that by the end of the century, regional temperatures will be 5° to 12° Fahrenheit warmer in the winter months, and 5° to 20° Fahrenheit warmer in the summer months. Annual precipitation levels are unlikely to change, but their distribution will, leading to an overall warmer, dryer climate (Kling et al., 2003). Other climatologists predict a 2° – 4° C rise in temperatures in the Great Lakes region, accompanied by a 25% increase in precipitation by the end of the 21<sup>st</sup> century (Sousounis and Glick, 2000). Despite the increase in precipitation, lake levels are projected to decrease by an estimated 1.5 to 8 feet, due to the increase in evaporation associated with higher temperatures

(Sousounis and Glick, 2000).

The ecological consequences of these climatic trends are complex, many, and varied.

A recent report issued by the Union of Concerned Scientist and Ecological Society of America entitled *Confronting Climate Change in the Great Lakes Region* (Kling et al., 2003) offers the following predictions of ecosystem response for the Great Lakes physiographic province:

##### Lake Ecology

- Lake levels were highly variable in the 1900s and quite low in recent years. Future declines in both inland lakes and the Great Lakes are expected as winter ice coverage decreases, although levels of the Great Lakes are uncertain once they are ice-free.
- Declines in the duration of winter ice are expected to continue.
- Loss of winter ice may be a mixed blessing for fish, reducing winterkill in shallow lakes but also reducing the stream miles suitable for trout and jeopardizing reproduction of whitefish in the Great Lakes, where ice cover protects the eggs from winter storm disturbance.
- The distributions of many fish and other organisms in lakes and streams will change. Coldwater species such as lake trout, brook trout, and whitefish and cool-water species such as northern pike and walleye are likely

to decline in the southern parts of the region, while warmwater species such as smallmouth bass and bluegill are likely to expand northward.

- Invasions by native species currently found just to the south of the region and invasions of warm-water nonnative species such as common carp will be more likely, increasing the stress on native plant and animal populations in the region.
- In all lakes, the duration of summer stratification will increase, adding to the risk of oxygen depletion and formation of deep-water “dead zones” for fish and other organisms.
- Lower water levels coupled with warmer water temperatures may accelerate the accumulation of mercury and other contaminants in the aquatic food chain and ultimately in fish.
- Many fish species should grow faster in warmer waters, but to do so they must increase their feeding rates. It remains uncertain whether prey species and the food web resources on which they depend will increase to meet these new demands.

##### Streams and Wetlands

- Earlier ice breakup and earlier peaks in spring runoff will change the timing of stream flows, and increases in heavy rainstorms may cause more frequent flooding.

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- Changes in the timing and severity of flood pulses are likely to reduce safe breeding sites, especially for amphibians, migratory shorebirds, and waterfowl, and may cause many northern migratory species such as Canada geese to winter further north.
- Reduced summer water levels are likely to diminish the recharge of groundwater supplies, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- Drought and lower water levels may ultimately increase ultraviolet radiation damage to frogs and other aquatic organisms, especially in clear, shallow water bodies.
- River flooding may become more common and extreme because of the interaction of more frequent rainstorms with urbanization and other land management practices that increase pavement and other impervious surfaces and degrade the natural flood-absorbing capacities of wetlands and floodplains. The result could be increased erosion, additional water pollution from nutrients, pesticides, and other contaminants, and potential delays in recovery from acid rain.
- Land use change and habitat fragmentation combined with climate change-induced shrinking of streams and wetlands will also

decrease the number and type of refugia available to aquatic organisms, especially those with limited dispersal capabilities such as amphibians and mollusks, as streams and wetlands shrink.

### Woodlands

- The distribution of forests is likely to change as warmer temperatures cause the extent of boreal forests to shrink and many forest species to move northward. The new forest composition will depend on the ability of individual species to colonize new sites and the presence of both geographic and human barriers to migration.
- A hotter and drier climate will create ideal conditions for the start and spread of wildfires. Fire disturbance can bring about changes in the distribution of tree species and can reduce their genetic diversity.
- An increased number of forest fires can exacerbate drought episodes by reducing rainfall. Smoke particles absorb solar heat, robbing convective currents of the energy they need to transport water vapor upward, and thus interfering with the cycle that generates rainfall in the region.
- Increasing atmospheric CO<sup>2</sup> concentration is likely to spur forest growth in the short term, but the long-term response is not clear at present. Increasing ground-level ozone concentrations, for example, will probably damage forest trees, potentially offsetting the positive effect of CO<sup>2</sup>.
- Continued deposition of nitrogen from the atmosphere may spur growth in forests, but the long-term consequences include increased nitrate pollution of waterways, groundwater, and drinking water supplies.
- Long-distance migratory birds such as scarlet tanagers, warblers, thrushes, and flycatchers depend on trees and caterpillars for food. Especially for those migratory birds that time their migration by day length rather than by weather, food sources may be severely reduced when they arrive in the Great Lakes region.
- Resident birds such as northern cardinals, chickadees, and titmice might be able to begin breeding earlier and raise more broods each season. However, increasing populations of resident species could further reduce the food available for migratory songbirds that breed in the Great Lakes, ultimately reducing forest bird diversity in the region.
- The geographic range of forest pest species such as the gypsy moth is likely to expand as temperatures warm and the distribution of food plants changes.
- Changes in leaf chemistry due to CO<sup>2</sup> fertilization are possible, reducing food quality for some organisms. This could cause some leaf-eating pests to eat more and could ultimately alter aquatic and terrestrial food webs.

# 5.0 Ecological References

*A reference ecosystem serves as a model for planning a restoration project, and later for its evaluation.*

- *Society for Ecological Restoration International*

As defined by the project guiding principles articulated by the stakeholders during the workshops, the restoration of Hog Island, Hog Island Inlet, and Newton Creek will be guided by selection of appropriate reference ecosystems. Defining suitable reference systems will enable an initial framework for restoration actions, and provide specific criteria for evaluation.

Often, ecological restoration scientists use data that provide accounts of the restoration site in pre-disturbance conditions, prior to degradation. This can include the following sources of information: ecological descriptions, species lists and maps of the project site prior to damage; historical and recent aerial and ground-level photographs; remnants of the site to be restored, indicating previous physical conditions and biota; historical accounts and oral histories by persons familiar with the project site prior to damage; and paleoecological evidence, e.g. fossil pollen, charcoal, tree ring history, rodent middens (SER, 2004). In other cases, reference habitats are derived from ecological descriptions and species lists of similar intact ecosystems that display well-developed expressions of biodiversity. It should be acknowledged that where the goal of restoration is a natural

system, nearly all available references will have experienced some adverse human-induced impacts that should not be emulated. Thus, care must be taken in the interpretation of these reference sites.

The selection of appropriate reference conditions for habitat types within Hog Island and Newton Creek presents unique challenges. These systems are man-made (in the case of Hog Island), or so severely altered from their original condition that a return to a pre-disturbance state would be both difficult and very expensive. In addition, many of these areas currently support functional ecological communities. This was recognized by the stakeholders during the public workshop series, and a guiding principle of the project is that the restoration of these areas to a historic “pristine” condition is not appropriate.

So how then to define the restoration targets?

The approach adopted by this Master Plan is three-fold; 1) to use the ecological targets and references already defined by the St. Louis River Habitat Plan; 2) to use regional ecosystems that are appropriate references

for the specific ecosystem components slated for restoration in Chapter 1.0 of this Plan; and 3) to use existing literature and “tools” for helping to determine desired attributes for restored habitat complexes, such as target species assemblages or hydrologic function.

## 5.1 Lower St. Louis River Habitat Plan

The Lower St. Louis River Habitat Plan (2002) was extensively utilized in the development of this document as a reference for defining the pertinent ecological systems relating to Hog Island, the Hog Island Inlet, and the Newton Creek tributary. Biological communities and targeted species of concern that are known to exist or held potential to occur in the project areas were also highlighted from the Habitat Plan. Additionally, the conservation, management and restoration goals and actions that were developed by a consensus of the Habitat Committee members were also incorporated into the Ecosystem Restoration Master Plan in order to maintain consistency with the excellent work that had already been researched and articulated.



The Lower St. Louis River Habitat Plan habitat types and reference conditions

Habitat Type	Goals	Actions	Draft Criteria
Piping plover	Reestablish a breeding population of piping plover in the estuary.	Incorporate the results and recommendations from the USFWS for plover habitat restoration and recolonization	The establishment of one nesting pair of piping plover.
Industrially Influenced Bays	Avoid the loss of any open water and restore to habitat similar to the sheltered bays whenever possible.	Ensure a diversity of native emergent, floating leaved, and submerged aquatic vegetation as well as an increased diversity of native fish and bird species. Remediate contaminated sediments.	Compare to community types and species assemblages in adjacent Allouez Bay and Lower St. Louis River sheltered bays.
Clay-Influenced Tributaries	The hydrology and related sediment loads within the respective watersheds should be managed to more closely resemble presettlement conditions. Ensure that native species continue to utilize this habitat at current or higher levels.	Restore instream habitat where degraded.	Improve physical, biological and chemical conditions to levels approaching clay-influenced tributary reference conditions.
Great Lakes Coastal Wetlands Complex	Protect, enhance, or restore wetland vegetation components.	Restore emergent and submergent marsh vegetation types.	Establish naturally regenerating wild rice and submerged aquatic vegetation (SAV) species.
Upland Forest Communities	Maintain or enhance existing high quality remnants, and restore much of the remaining forested area to the composition and structure that would be expected if its ecological processes were operating within their natural range of variation.	Encourage native forest types along their existing restoration trajectory, promote desired forest ecotypes where applicable.	Assess existing forest ecotypes in the project areas and determine if they are comparable to recommendations made by Frelich (1999).

## Ecological References

### 5.2 Regional Ecological Reference Sites

Several areas adjacent to the project site contain habitats assemblages that provide suitable restoration “targets” identified by the Lower St. Louis River Habitat Plan, local resources managers, and Biohabitats field scientists during field reconnaissance efforts. The specific ecological reference data necessary to guide specific restoration actions has yet to be collected; including vegetative community type, distribution, and succession; the relative proportion of habitat complexes; fish and wildlife utilization; and specific hydrologic, soil, and topographic parameters.

#### 5.2.1 Wisconsin Point

Wisconsin Point is the eastern portion of a long coastal barrier spit separating the waters of Lake Superior from Allouez Bay, a portion of the St. Louis River Estuary. Major site features include several miles of open sand beach and dunes, small interdunal wetlands, and a xeric forest of white and red pines, all of which may be utilized as near-field reference conditions for Hog Island ecological restoration planning. The point and adjacent Allouez Bay receive extensive visitation by migrating birds in the spring. Infrastructure includes

roads, vehicle turnouts, a Coast Guard station, and breakwater.

A small, open interdunal swale near the western tip of the point supports a marsh community dominated by low graminoid plants, especially sedges and rushes. Several rare plants are present. The swale is surrounded by dense thickets of tall shrubs - mostly speckled alder, willows, and red-osier dogwood. These shrubs are encroaching on the openings and should be monitored and controlled if necessary. The shrubs do provide a measure of security for this fragile site by screening it from most passersby. During 1996 this swale was very wet, with standing water reaching a depth of over 30-cm in July and August.

Additionally, an area of Wisconsin Point to the east of the Coast Guard Station on the bay side of the point was cleared of vegetation and fenced to provide nesting habitat for piping plover. Another unique aspect of this particular habitat restoration effort was the excavation of the center of the sand area to a depth slightly below the water table to provide suitable colonization conditions for some rare interdunal swale plants (Epstein *et. al.*, 1997).

#### 5.2.2 Allouez Bay

Allouez Bay is situated between the City of Superior’s east-side neighborhood of

Allouez and Wisconsin Point. The eastern end of the bay is shallow and contains a large marsh with patches of sedge meadow and a drowned tamarack swamp present near the base of Wisconsin Point. Several streams, Bear Creek, Bluff Creek and the Nemadji River empty into the bay. A portion of the wetland at the head of the bay, but now cut off by the access road to Wisconsin Point, was filled in the past.

The marsh is dominated by tall native graminoids, such as bur-reeds, bulrushes, spikerush, sedges, and cattails. Broad-leaved arrowhead is also among the dominant plants. Deep areas within and on the margins of the emergent marsh support floating-leaved and submergent aquatic macrophytes. The portions of the wetland nearest the shore are dominated by sedges. Tamarack snags are scattered throughout parts of this area.

It is possible that this wetland formerly contained extensive mats of wire-leaved sedges, but eutrophication, sedimentation, and other disturbances led to changed conditions which aided the spread and eventual dominance of the coarser, more nutrient tolerant emergents. Nevertheless, this wetland is composed mostly of native species, and plant diversity and wildlife values are quite high. In the early spring,



substantial numbers of waterbirds of many kinds congregate here. This site may be especially significant in years when the break-up of ice on Lake Superior is late, and little open water is available inland. The marsh also supports many nesting birds, including uncommon marsh species and a few rare invertebrates.

This site is a critical part of the regionally-significant lower St. Louis River Estuary, containing good, though disturbed examples of natural communities endemic to the Great Lakes. This may provide suitable reference conditions for the restoration or establishment of wetland communities within the Hog Island Inlet.

### 5.2.3 Allouez Bay Small Tributaries

There are several small streams that discharge into the Allouez Bay, including Bear Creek and Bluff Creek that might be considered natural analogs to Newton Creek. Although little ecological and channel condition information on these systems is presently available, they could supply the Hog Island and Newton Creek ecological restoration effort with good near-field reference conditions with which to base restoration planning and management decisions.

### 5.2.4 Superior Municipal Forest

The City of Superior Municipal Forest contains a wealth of natural features unusual in the context of an urban-industrial center. Among the most significant of these are stands of mature coniferous forest, extensive emergent marsh, and wet clay flats supporting a mixture of shrub swamp and wet meadow. A significant portion of this site was designated as a State Natural Area in 1996. The site borders the St. Louis River Estuary, which dissects the uplands into a series of narrow, steep-sided ridges.

The extensive emergent marsh borders both sides of the Pokegama River (which is really an arm of the St. Louis River Estuary). Marsh composition is very similar to that of stands found along the lower stretches of the St. Louis River. Dominants include bur-reed, bulrushes, arrowheads, and cattail. Deeper waters support submergent and floating-leaved macrophyte species. The invasive exotic purple loosestrife is uncommon but widespread in the marsh. Efforts to control it should begin as soon as possible.

The shrub swamp and meadow complex provides habitat for several rare plants. The dominant plants are typical of Lake Superior region stands on red clay and include speckled alder, willows, lake sedge, and bluejoint grass. This wetland is the southwestern-most portion of a former large and contiguous wetland that was partially destroyed and greatly disrupted by growth of the City of



Superior. Rare animals such as Forster's Tern, Bald Eagle, and Merlin forage here.

The coniferous forests are composed primarily of species often associated with the boreal regions. Throughout the Lake Superior Clay Plain Ecoregional Subsection, this forest type has been greatly fragmented and often replaced by more monotypic stands of aspen. Thus the coniferous stands within this site have regional conservation significance.

The Superior Municipal Forest has a diverse variety of habitats that can provide references for aquatic, wetland, riparian, and upland habitats in the Hog Island and Newton Creek project area.

## Ecological References

### 5.2.3 Duluth-Superior Harbor Islands

The Duluth-Superior Harbor Islands include Interstate Island, Hearing Island, Barkers Island, and Hog Island. All were created from dredge material excavated from the harbor channels and wetlands. These islands, with the exception of Barkers Island which has significant

human development, have been allowed to develop naturally with little human interference. The Minnesota Natural Heritage Database has listed Interstate Island as a colonial waterbird nesting site used by terns and gulls (USACE, 1995) while Hearing Island is also listed as protected by Minnesota with some potential for plover habitat restoration by

vegetation removal (Dennis Pratt, personal communication). While Interstate Island may be suitable for piping plover, its use by the colonial waterbirds precludes it as a site preferred by the plover. Interstate and / or Hearing Island may provide suitable ecological reference conditions for the establishment or enhancement of avian habitat on Hog Island.





# 6.0

## References

- Barrett, R. 2006. The Oil Sands Boom; End of the Line. The Milwaukee Journal Sentinel. May 28, 2006. [http://www.findarticles.com/p/articles/mi\\_qn4196/is\\_20060528/ai\\_n16433441](http://www.findarticles.com/p/articles/mi_qn4196/is_20060528/ai_n16433441)
- Brady, N.C. and R.R. Weil. 2002. The Nature and Properties of Soils 13th Edition. Prentice Hall, Upper Saddle River, New Jersey.
- Chow, V. T, D. R. Maidment, and L. W. Mays. 1988. Applied Hydrology. McGraw-Hill, Inc.
- City of Superior. 2006. City of Superior Special Area Management Plan (SAMP II) Wetland Functional Assessments (2002-2006). City of Superior Public Works Department, Wisconsin.
- Crane, J.L., M. Schubauer-Berigan and K. Schmude. 1997. Sediment Assessment of Hotspot Areas in the Duluth/Superior Harbor. Submitted to C. Bolattino, Project Officer, Great Lakes National Program Office, U.S. Environmental Protection Agency. EPA-905-R97-020.
- Eckart, K.R. 1983. *A Birder's Guide to Minnesota*. Revised Second Edition. Published in Cooperation with the Minnesota Ornithologists Union, Bell Museum of Natural History. Minneapolis, Minnesota. Printed by The Pine Knot, Cloquet Newspapers, Inc., Cloquet, Minnesota.
- Eggers, S.D. and D.M. Reed. 1997. *Wetland Plants and Plant Communities of Minnesota & Wisconsin*. Second Edition. U.S. Army Corps of Engineers, St. Paul District.
- Epstein, E. J., E. J. Judziewicz, and W. A. Smith. 1997. Wisconsin's Lake Superior Coastal Wetlands Evaluation, Including Other Selected Natural Features of the Lake Superior Basin. A report to the Great Lakes National Program Office U.S. Environmental Protection Agency. PUB ER-095 99. Wisconsin's Natural Heritage Inventory Program, Bureau of Endangered Resources, Department of Natural Resources, Madison, WI.
- Frelich, L.E. 1999. Range of natural variability in forest structure for the Northern Superior Uplands. Report to the Minnesota Forest Resources Council. Department of Forest Resources, University of Minnesota, Minneapolis, MN.
- Hou F. S. L., M. W. Milke, D. W. M. Leung, and D. J. MacPherson. 2001. *Variations in Phytoremediation Performance with Diesel-Contaminated Soil*. Environmental Technology; Volume 22, Number 2, 1 February 2001, pp. 215-222(8)
- Invasive Plant Association of Wisconsin (IPAW). 2006. Reed Canary Grass. Accessed March, 2007. [http://www.ipaw.org/invasers/reed\\_canary\\_grass/index.htm](http://www.ipaw.org/invasers/reed_canary_grass/index.htm)
- Ireland, Scott. 2007. Personal communication via email. USEPA.
- Johnson, C.C. 2003. Predicting the early vegetation of a wetland created from dredge material in Duluth-Superior harbor. M.S. Thesis of the University of Minnesota.
- Kling, G.W., D. J. Wuebbels *et al.* 2003. *Confronting Climate Change in the Great Lakes Region*. Union of Concerned Scientists and Ecological Society of America. <http://www.ucsusa.org/greatlakes/glchallengereport.html>
- Lindgren, J.P., W.W. Ongstad, and J.R. Spurrier. 1997. The St. Louis Bay Fishery 1986-1994. Minnesota Department of Natural Resources, Division of Fish and Wildlife, Section of Fisheries, Study 4 Report, Job 422, St. Paul, Minnesota.
- LSLRHP. 2002. Lower St. Louis River Habitat Plan. Prepared by St. Louis River Citizens Action Committee, Duluth, Minnesota. Funded by USEPA, Minnesota Department of Natural Resources Conservation Partners Program, the USFWS and The Nature Conservancy.
- Martin, L. 1965. *The Physical Geography of Wisconsin*. The University of Wisconsin Press, Madison, Wisconsin.



- Midwestern Regional Climate Center. 2007. [http://www.ser.org/content/ecological\\_restoration\\_primer.asp#6](http://www.ser.org/content/ecological_restoration_primer.asp#6)
- MPCA and WDNR. 1995. The St. Louis River System Remedial Action Plan, Progress Report. Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources. April 1995.
- MPCA and WDNR. 1992. The St. Louis River System Remedial Action Plan, Stage One. Minnesota Pollution Control Agency and the Wisconsin Department of Natural Resources. April 1992.
- NCDC, National Climatic Data Center. 2007.
- Pratt, Dennis. 2007. Personal communication via email with Biohabitats staff. Wisconsin Department of Natural Resources.
- Schueler, T. 2003. Impacts of Impervious Cover on Aquatic Systems. Center for Watershed Protection. Ellicott City, MD
- SEH. 2003. Site Investigation Report: Hog Island Inlet. City of Superior, Douglas County, Wisconsin. Short Elliott Hendrickson Inc. SEH No. WIDNR9905.02.
- Society for Ecological Restoration International. 2004. The SER International Primer on Ecological Restoration (Version 2, October, 2004). Science & Policy Working Group.
- Sousounis, P. and P. Glick. 2000. The Potential Impacts of Global Warming on the Great Lakes Region; Critical Findings for the Great Lakes Region from the First National Assessment of the Potential Consequences of Climate Variability and Change. <http://www.climatehotmap.org/impacts/greatlakes.html>
- Superior Comprehensive Plan. 1998. City of Superior, Wisconsin.
- Walton, Greg. Personal communication with Biohabitats staff in February, 2007.
- WDNR. 2006. Murphy Oil Industrial Discharge Permit and Flow Records. Email from Sheri Snowbank on 10/25/2006.
- WDNR. 2007. Hog Island Inlet remediation project fish and wildlife rescue, July 21st – Aug 2nd, 2005. Wisconsin Department of Natural Resources.
- USACE. 1999. Draft Ecosystem Restoration Report and Environmental Assessment Section 204 Study. 21st Ave West Channel, Duluth, Minnesota. U.S. Army Corps of Engineers, Detroit District.
- USACE. 1982. Final Feasibility Report and Final Environmental Impact Statement on Harbor and Channel Modifications, Duluth-Superior Harbor, Minnesota and Wisconsin. August 1982 (Revised February 1983). U.S. Army Corps of Engineers, Detroit District.
- USDA. 2006. Soil Survey of Douglas County, Wisconsin. United State Department of Agriculture Natural Resource Conservation Service. [http://soildatamart.nrcs.usda.gov/Manuscripts/WI031/0/Douglas\\_WI.pdf](http://soildatamart.nrcs.usda.gov/Manuscripts/WI031/0/Douglas_WI.pdf)
- USFWS. 2001. Endangered and Threatened Wildlife and Plants; Final Determination of Critical Habitat for the Great Lakes Breeding Population of the Piping Plover. Federal Register: Volume 66, No. 88. Monday May 7th, 2001. pp. 22938 – 22969.
- USFWS. 1998. Final Fish and Wildlife Coordination Act Report: Duluth-superior Harbor Dredge Material Management Plan Phase I. U.S. Fish and Wildlife Service, Twin Cities Ecological Services Field Office, Bloomington, Minnesota. July 1998.
- U.S. Soil Conservation Service. Technical Release 55: Urban Hydrology for Small Watersheds. USDA (U.S. Department of Agriculture). June 1986. Available from NTIS (National Technical Information Service), NTIS # PB87101580. Also available on the web in .pdf format at <ftp://ftp.wcc.nrcs.usda.gov/>







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