Restoration Vision for Allouez Bay

Lake Superior Headwaters Sustainability Partnership

Prepared by

Minnesota Land Trust

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Note: This document was compiled in draft form in 2022. Additional information was added in 2026 to address partner comments on the original document. The document now links to the 2026 Landscape Stewardship Vision for Lower St. Louis River/Upper St. Louis Bay and Allouez Bay (see https://headwaterspartnership.org/). Since the Allouez Bay Restoration Vision was completed in draft form in 2022, additional community data, monitoring, studies, and restoration project work has been completed. This information is not included in this report.

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1 INTRODUCTION

The Allouez Bay geographic zone was selected to test the planning framework established for the Lake Superior Headwaters Sustainability Partnership (Headwaters Partnership) and serves as a prototype of the "Level 2 analysis". The Lower St. Louis River Landscape Conservation Design Scoping Report (Minnesota Land Trust, 2021) describes the planning framework under which this restoration vision was developed. The intent of the Level 2 analysis is to establish a partner- and community-supported vision for restoration on a meso-scale within the large Lake Superior Sustainability Partnership Region (Figure 1), such that individual projects that may be undertaken by partners within the geographic zone can align with and contribute to the achievement of the restoration vision over time.

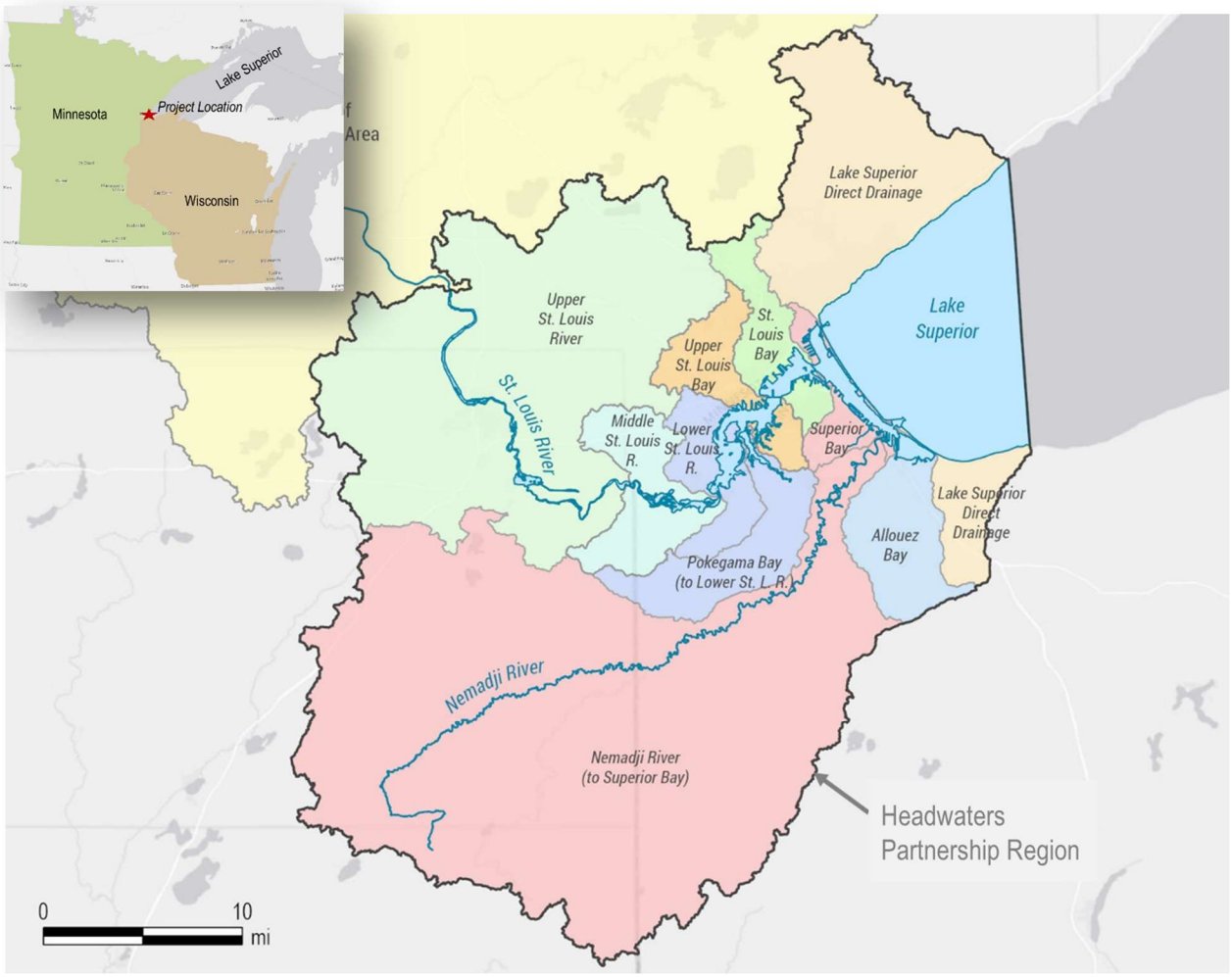

Figure 1: Geographic Zones within the Headwaters Partnership Region

The restoration vision for Allouez Bay was developed based on information gathered from a large group of partners (Appendix A) working within the geographic zone. A series of team meetings and workshops were held to discuss available information, current conditions, and information gaps and to develop the components of the restoration vision presented herein. An understanding of community values was developed through outreach efforts conducted by the Lake Superior Research Reserve.

2 SITE DESCRIPTION

The Allouez (pronounced el-louise) Bay geographic zone is located in the St. Louis River estuary on the east side of the Headwaters Partnership region (Figure 1) adjacent to the Allouez and Itasca neighborhoods of Superior, WI. Its contributing watershed is approximately 20,000 acres in size, with two main tributaries, Bear and Bluff Creeks. Allouez Bay is connected to the St. Louis River and partially separated from Lake Superior by the 3-mile-long Wisconsin Point coastal barrier spit. Allouez Bay is influenced by the Nemadji River which enters the estuary just to the north of the bay, as well as Lake Superior seiche and storm surge. Allouez Bay includes a matrix of wetlands and upland forests with land stewarded by the City of Superior, Douglas County and the Fond du Lac Band of Lake Superior Ojibwe. The region is situated within the boundaries of the 1842 treaty between the US government and the Anishinaabe Ojibwe First Nations.

This section describes historical conditions relevant to the restoration vision for Allouez Bay and compares these to the current physical configuration of the bay.

2.1 HISTORICAL CONDITIONS

Wisconsin Point is ancestral territory of Ojibwe people and included within the 1842 Ceded Territory. A small settlement led by the 1854 treaty signatory Chief Joseph Osaugie and his descendants occupied Wisconsin Point and the bay. The family was forcibly removed and a cemetery disinterred in 1918, but many descendants remain deeply connected to the region. The Fond du Lac Band of Ojibwe regained land at the end of Wisconsin Point in 2017 and land that was formerly the cemetery in 2022. Osaugie family members have shared valuable oral histories of conditions in Allouez Bay. Their stories tell of Allouez Bay teeming with waterfowl and full of wild rice. Families gathered rice and other medicinal plants in the area and continue to do so when possible. Cultural and historic resources on Wisconsin Point are described in the Wisconsin Point Management Plan (NRPC, 2012).

The 1863 Hearding map (Bureau of Topographical Engineers of the War Department, 1863) is one of the most detailed historic maps of the St. Louis River estuary and provides valuable information about the location and extent of wetlands and other features within Allouez Bay prior to dredging and industrial uses of the river (Figure 2). Extensive areas of floating vegetation were historically located in

the southeast portion of Allouez Bay, and river islands and land spits on both the north and south formed a somewhat closed entrance to the bay.

Based on the evaluation of aerial photography (Figure 3) and navigational charts (Appendix B), the spatial extent of wetlands in Allouez Bay has decreased over time. Koch (1981) mentions that this trend is the opposite of what one would expect with the incoming streams providing significant sediment loads, but also recognizes that other factors, such as water level changes, may be involved.

Figure 2: 1863 Hearding Map Zoomed into Allouez Bay

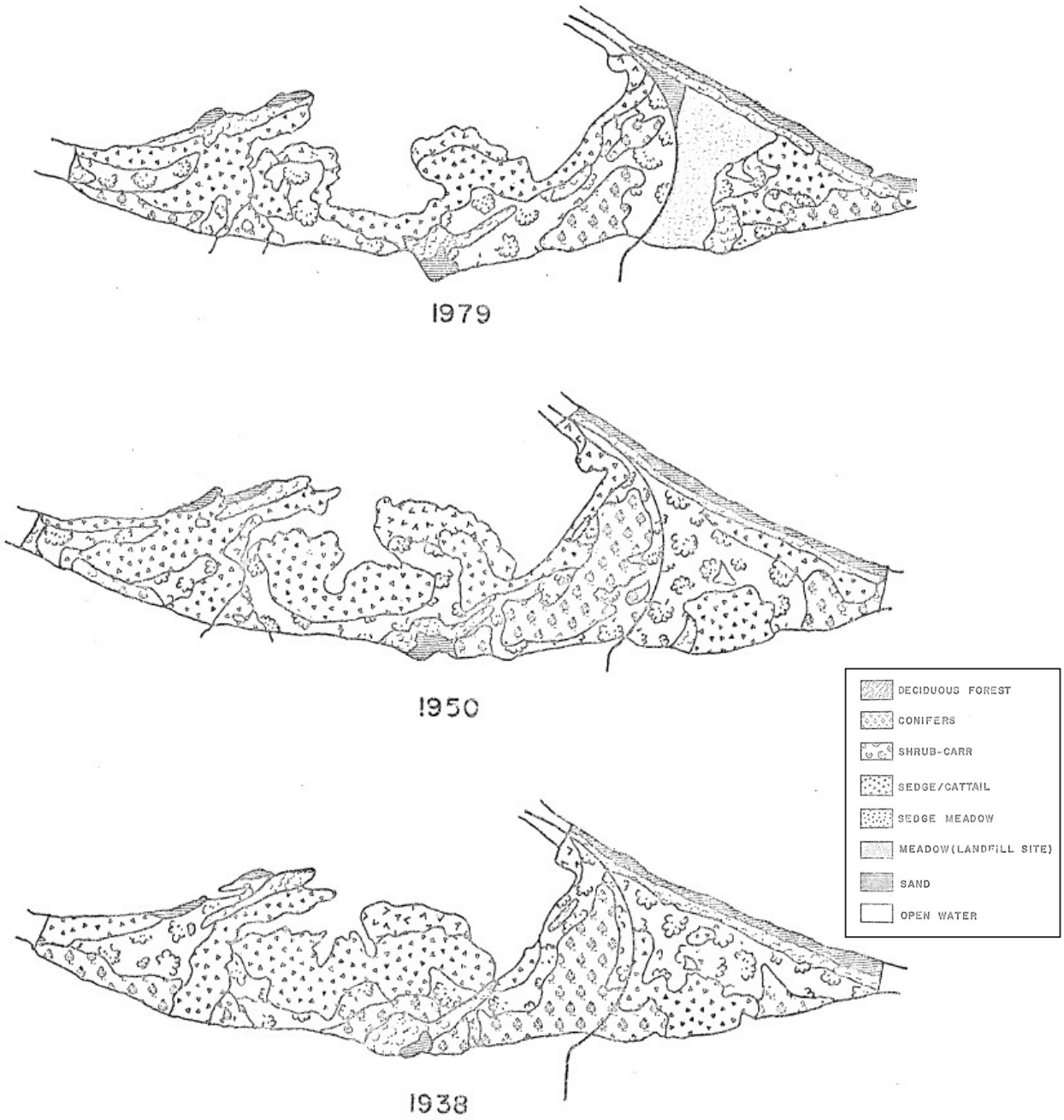

Figure 3: Vegetation Cover of the Allouez Bay Wetland Complex as Interpreted from Aerial Photography (Source: Koch, 1981)

Wisconsin Point is in the NE portion of the image, with the shoreline of Allouez Bay to the south.

2.2 CURRENT CONDITIONS

Current and historical data and reports for Allouez Bay were shared by partners and stored on a Sharepoint site. This information was reviewed and then discussed by partners in a series of meetings with the intent of developing an understanding of what is known and unknown about conditions in Allouez Bay. This section presents a brief summary of known conditions for important physical and biological features in the bay. Uncertainties and information gaps are listed in Section 9.

Bathymetry and Relative Exposure Index

The most recent available bathymetry information for Allouez Bay at the time of the report (Figure 4) is from a 2012 dataset developed by the U.S. Environmental Protection Agency Great Lakes Toxicology and Ecology Division (USEPA GLTED) using LiDAR data, National Oceanic and Atmospheric Administration sounding data for the estuary, and bathymetric surveys conducted for specific remediation and restoration sites (SRA International, 2012).

Allouez Bay is generally shallow, with water depths of less than 14 feet through most of the bay (Figure 4) based on shoreline elevation of 601.1' IGLD85, which is the low water datum for Lake Superior. A deep hole with water depths ranging from 14 to 20 feet exists in the southern portion of the bay.

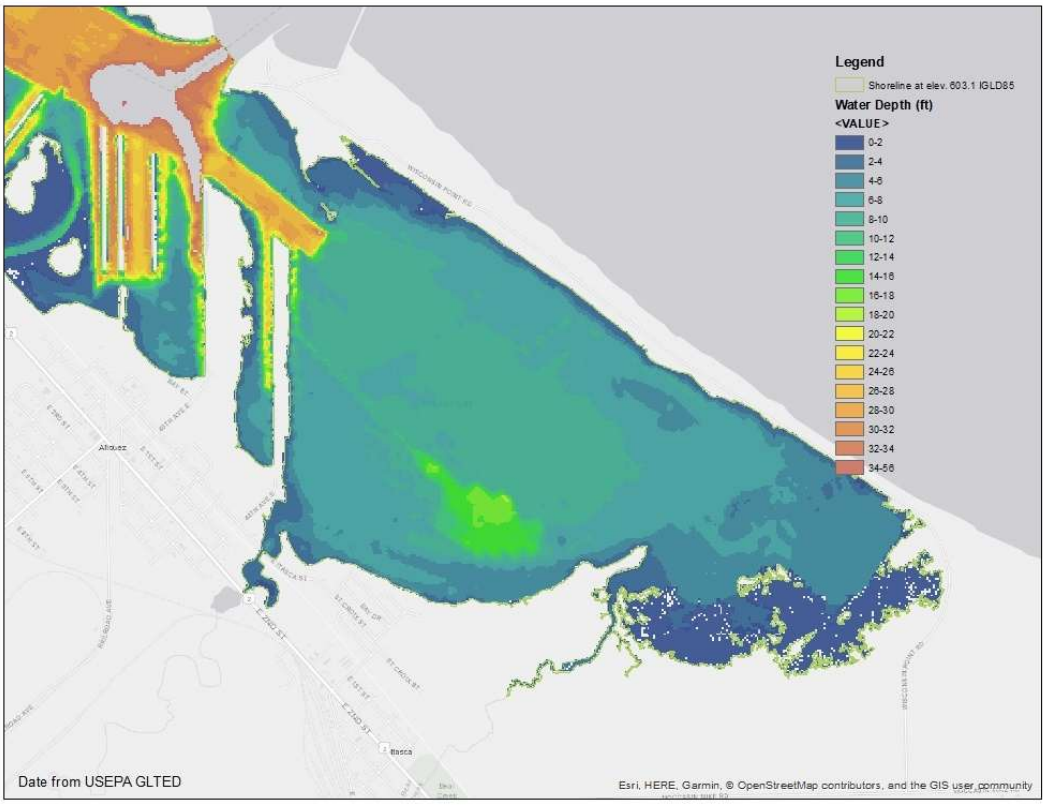

Figure 4: Water Depths with Shoreline at Elevation 601.1' IGLD85 (Lake Superior Low Water Datum)

The relative exposure index (REI) for the St. Louis River was developed by researchers at USEPA GLTED. The index integrates fetch distance by wind duration and wave height (a function of fetch, wind speed, and wind direction) into a scaled index, with higher numbers indicating exposure to higher wind and wave energy (Angradi et al., 2013). REI model results for Allouez Bay prior to and after creation of the Piping Plover sanctuary on Wisconsin Point in 2019 indicate that the wetlands in the southeast portion of Allouez Bay receive the greatest predicted wind and wave energy, likely due to the long fetch from Superior Bay into Allouez Bay (Figure 5 and Figure 6). This information led partners to suspect that wind and wave energy may be contributing to the spatial loss of wetlands in the bay over time.

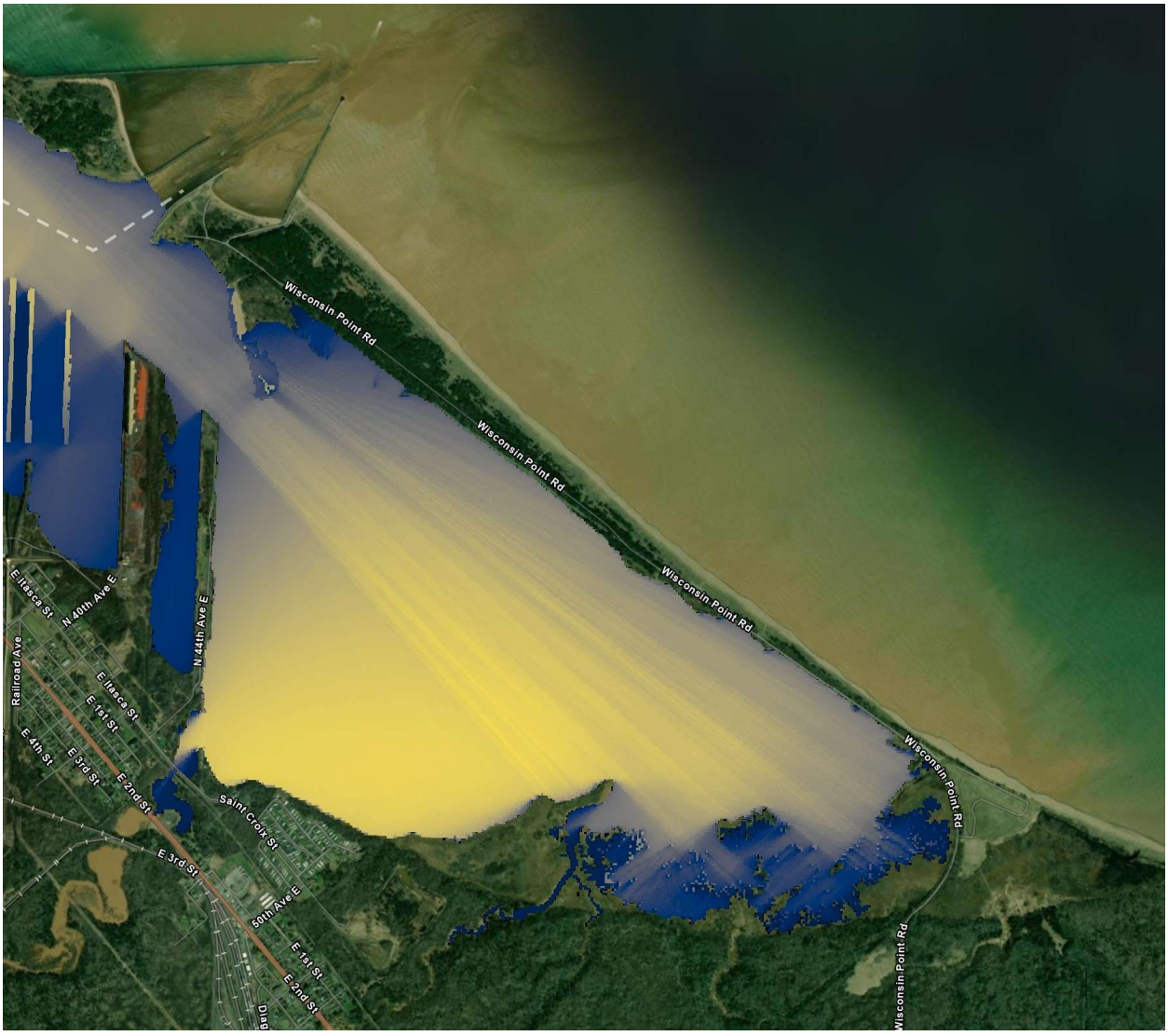

Figure 5: Relative Exposure Index for Allouez Bay with Shoreline at Elevation 603.1' IGLD85 Prior to Creation of the Piping Plover Sanctuary

Darker yellow indicates higher Relative Exposure Index values. Source: Jon Launsbach, contractor to US Environmental Protection Agency. March 2026.

Figure 6: Relative Exposure Index for Allouez Bay with Shoreline at Elevation 603.1' IGLD85 After Creation of the Piping Plover Sanctuary

Darker yellow indicates higher Relative Exposure Index values. Source: Jon Launsbach, contractor to US Environmental Protection Agency. March 2026.

Aquatic Vegetation

Aquatic vegetation in Allouez Bay, as well as macroinvertebrates and sediment contaminants as discussed below, were evaluated by Minnesota Pollution Control Agency (MPCA) and the U.S. Army Corps of Engineers (USACE) in an estuary-wide study (Hayhurst et al., 2023). ArcGIS 10.8.1 was used in the study for the spatial analysis to represent the observed datasets in the St. Louis River estuary for select metrics. Thiessen polygons were created based on each metric data point to define an area of closest proximity surrounding each sample. Estuary wide metric data were classified relative to pooled reference data based on selection criteria established for each specific metric across data types. Each polygon for aquatic vegetation, mercury, and benthic community was assigned a ranking based on a quantile regression (Hayhurst et al., 2023, p. 8). The values less than the 5th percentile were classified as "extremely poor", the 5th-25th percentile classified as "poor", the 25th-75th

percentile classified as “typical”, the 75th-95th percentile were classified as “good“, and greater than the 95th percentile were classified as “extremely good” informed by reference data (Hayhurst et al., 2023, p.8).

Mean C is used as a metric for qualitatively assessing aquatic macrophyte communities. The Coefficient of Conservatism (C) is an index value ranging from a 0-10 rating that is assigned to a plant species, reflecting whether the species is intolerant of disturbances and has specific habitat requirements. The Mean C is the average of the C scores for all plant species observed within a sample. A low-ranking Mean C indicates that the species is tolerant of disturbance and has low habitat specificity. Low Mean C values are often associated with plant communities that have colonized disturbed sites and are dominated by invasive species that have outcompeted native species. Mean C rankings in Allouez Bay (Figure 7) range from extremely good to typical in most areas where vegetation data exists. Isolated locations of poor to extremely poor exist, primarily in the northeast portion of the bay that has experienced alteration from navigation channel development and shipping through time.

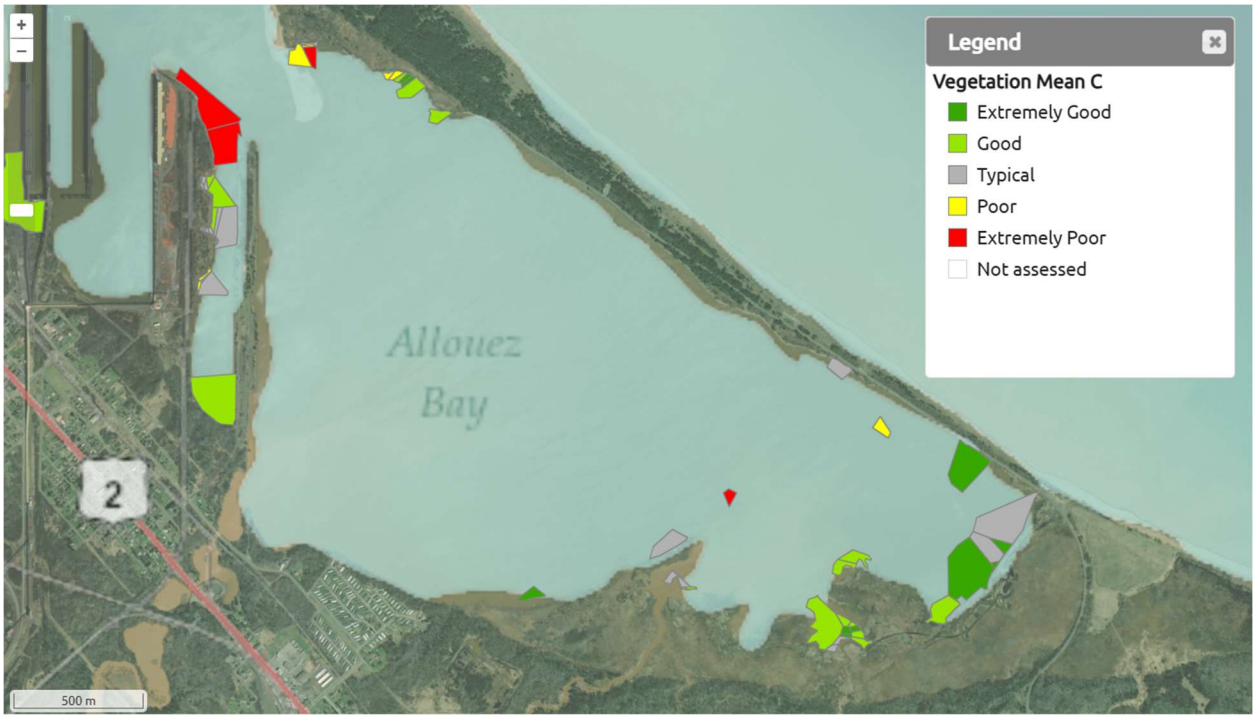

Figure 7. Vegetation Mean C in Allouez Bay

Rankings are based on a quantile regression, categorizing the data into "Extremely Poor", "Poor", "Typical", "Good", and "Extremely Good" categories. The mean C areas were generated using Thiessen polygons.

Birds

Allouez Bay is a regionally significant coastal marsh habitat for breeding marsh birds, including the state-endangered Black Tern, and likely significant for shorebirds (breeding and stopover) and land bird stopover. Its value is particularly linked to hemi-marsh habitat (Grand, 2020). Recent surveys indicate that breeding marsh birds are still present; nine of the ten selected focal species (see Section 4) were identified in monitoring completed in 2020 and 2021 (Bracey et al., 2022). However, it is thought that the density is lower than could be expected for the size of the marsh. The recent restoration of the sandy shoreline within the restricted access Piping Plover restoration area is expected to support increased use by migrating shorebirds with the intent of supporting possible nesting of Piping Plover.

Coastal Wetlands and Wild Rice (Manoomin)

The wetlands in the southeast portion of Allouez Bay consist of intact native plant communities with infestations of hybrid cattail, purple loosestrife, and other invasive species. A total of 84 native plant species and seven invasive species were identified in surveys conducted between 2011 and 2020 in submergent, emergent, and wet meadow areas (Hartsock et al., 2022). Based on oral histories, the extent of wetlands in the bay has been reduced significantly due to water level changes.

Hybrid cattail infestation is extensive in these wetlands (Figure 8), with the highest-density populations existing along the shorelines of the floating mat and emergent marsh (Schwarting and Beaster, 2021).

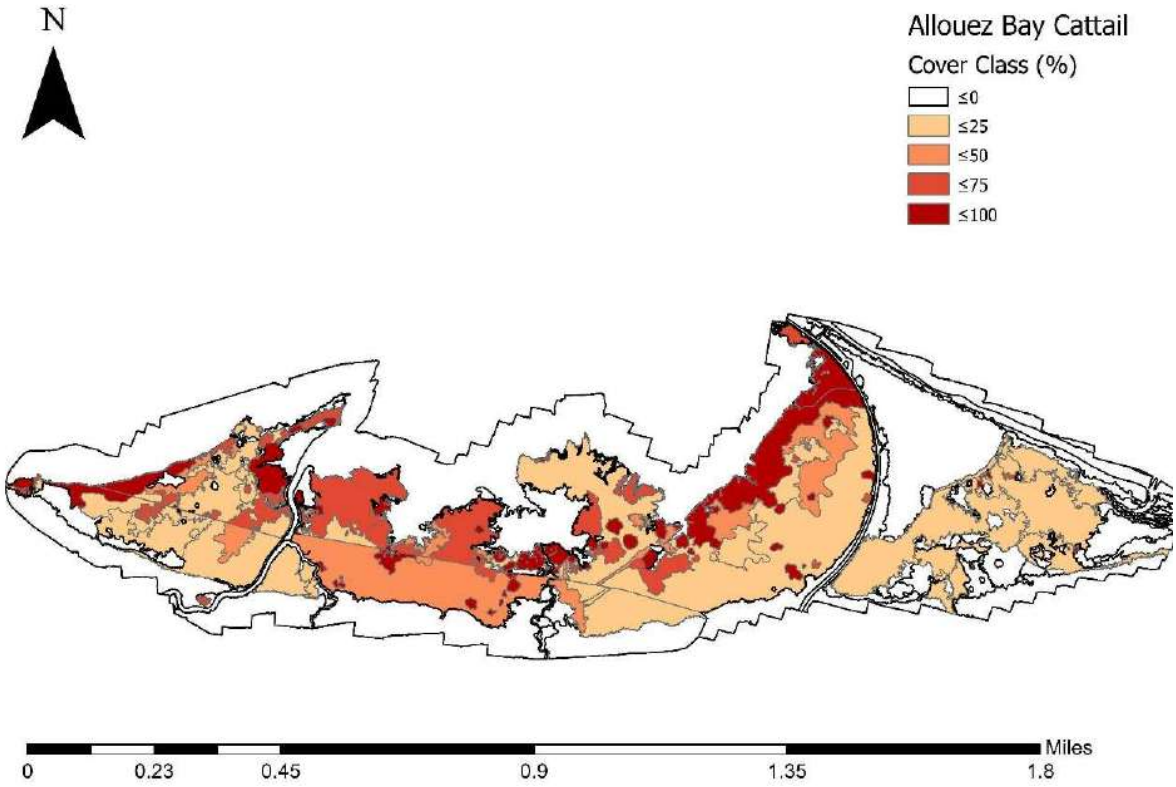

Figure 8: Cattail Cover in Allouez Bay Wetlands (Source: Schwarting and Beaster, 2021)

There are three Great Lakes Coastal Wetland Monitoring Program sites located in Allouez Bay (Figure 9). Sites are monitored for fish, vegetation, macroinvertebrates, anurans, birds, and water quality on schedules that vary by site and an index of biological integrity (IBI) is calculated for each taxonomic group. Partners from University of Minnesota Duluth – Natural Resources Research Institute (NRRI) responsible for monitoring these sites discussed the relevancy of the CWMP monitoring data for these locations during development of the restoration vision. Rankings for IBIs are established for comparison of coastal wetland sites across the Great Lakes. The NRRI researchers cautioned against using the IBI rankings to evaluate conditions in Allouez Bay based on their professional opinions that the rankings do not provide an accurate picture of status when considering Lake Superior alone and particularly considering that Allouez Bay is clay influenced. The CWMP data for these sites is provided in Appendix C for reference and should be used with caution to evaluate status of these biota in Allouez Bay.

Figure 9. Coastal Wetland Monitoring Program Sites in Allouez Bay

Wild rice restoration efforts have been underway in the bay since 2010, when the University of Wisconsin – Superior, Lake Superior Research Institute completed a pilot wild rice restoration effort. Wild rice was initially seeded in two areas (totaling approximately 4 acres) near the outlet of Bear Creek, where it was historically known to be present (MDNR, 2014). Wild rice grows well when it is protected from browsing geese and competition from invasive plant species (Beaster, 2021).

Many of the wetlands in the southeast corner of the bay have been cut off by Moccasin Mike Road that leads to Wisconsin Point. Culverts under the road are likely limiting hydrologic exchange with the wetlands east of the road.

Fish

Allouez Bay has a viable recreational fishery supported by the varied habitat features such as shoreline and fringe wetlands and deeper, open water (Piszczek, 2021). The wetland habitats are critical for phytophilic spawners such as Northern Pike and Muskellunge, which use those habitats in the spring. They will also use those habitats for cover in the summer if water temperatures are suitable. Sucker and walleye have been well documented in Bear and Bluff Creeks during the spawning season. The deeper, open water is used in the summer by Walleye and Lake Sturgeon; these species typically spawn near the Duluth neighborhood of Fond du Lac, well upriver from Allouez Bay, during the spring. Allouez Bay also supports a healthy panfish fishery, which WDNR surveys every

three years. The bay also supports non-game species that serve ecological functions as well as provide a prey base (e.g., various sucker and minnow species).

Macroinvertebrates and Sediment Contaminants

Available macroinvertebrate and sediment chemistry data for Allouez Bay was compiled and analyzed by Minnesota Pollution Control Agency (MPCA) and the USACE in an estuary-wide study (Hayhurst et al., 2023). The MPCA St. Louis River Area of Concern Sediment and Biological Database was the primary source of data for evaluating sediment chemistry, Sediment Quality Target Level II (SQT II) exceedances, and benthic macroinvertebrate communities in the study (Hayhurst et al., 2023). The data presented in this section are available on the Headwaters Partnership mapping tool at **https://headwaterspartnership.org/tool?mode=map**.

A scaled macroinvertebrate community index was one of two metrics used to map benthic condition. The scaled Tri-Metric Index (s-TMI) is a combination of three taxonomic-based scores using taxa richness, percent non-oligochaete abundance, and percent Ephemeroptera, Trichoptera, and Odonata abundance. Values range from 0-1, where 1 is indicative of healthier benthic conditions (Angradi et al. 2017, Hayhurst et al. 2023). Based on the TMI results, macroinvertebrate communities in Allouez Bay are ranked as predominantly typical and poor, with several areas ranking good. Locations with s-TMI ranked as extremely poor were in in the deep hole in the center of Allouez Bay. Benthic community conditions are similarly documented throughout the estuary where mean water depths are recorded greater than 10 feet (Figure 10; Hayhurst et al., 2025).

The MPCA and USACE study (Hayhurst et al. 2025) also evaluated the presence of Mayflies from the family Ephemeridae: Ephemeroptera in the sediment of Allouez Bay using the scaled Hexagenia Density Index (s-HDI). Results range from 0-1, where 0 is poorest Hexagenia density and 1 is the best. *Hexagenia*) are indicators of good water quality because of a larval stage that is in constant contact with sediment (burrowing for protection and to filter particles from the pore water). Overall, this family of aquatic insects is sensitive to sediment pollutants, pore water quality, and habitat disturbance. The s-HDI values in Allouez Bay indicate a predominance of typical to extremely good Hexagenia density throughout the bay, with areas of poor density scattered throughout (Figure 11). Limited areas ranking as extremely poor are present and typically are co-located in shallow areas with abundant macrophyte assemblages.

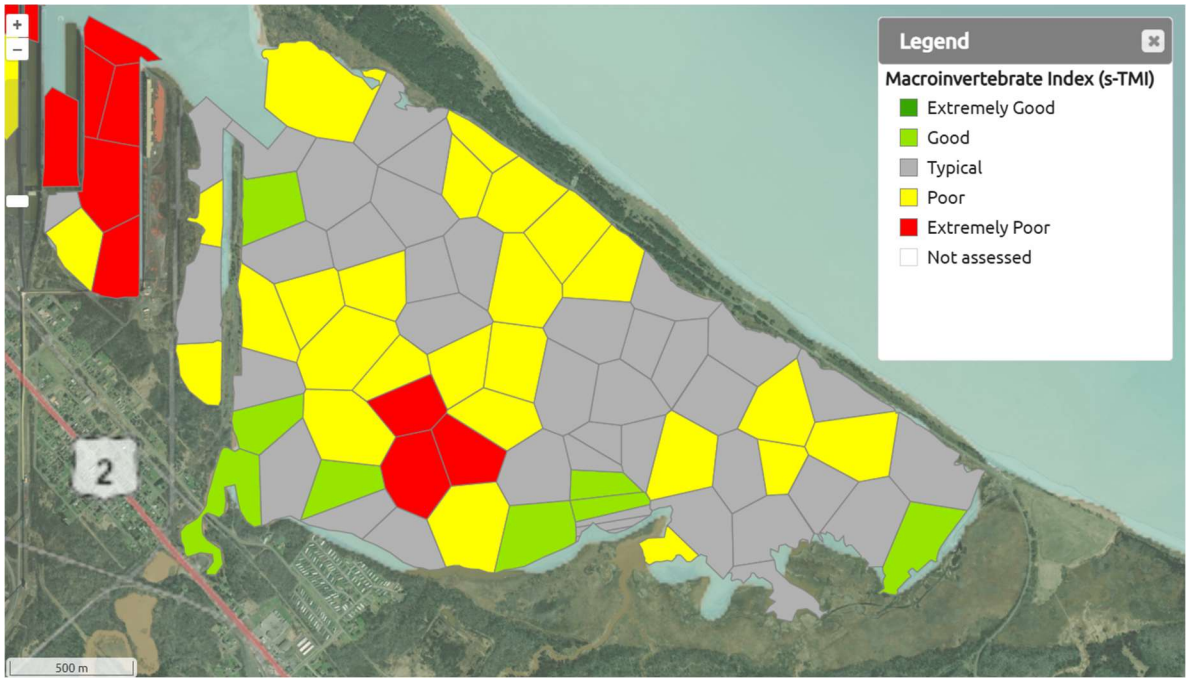

Figure 10. Macroinvertebrate Condition in Allouez Bay based on s-TMI

Rankings are based on a quantile regression, categorizing the data into "Extremely Poor", "Poor", "Typical", "Good", and "Extremely Good" categories. The s-TMI areas were generated using Thiessen polygons.

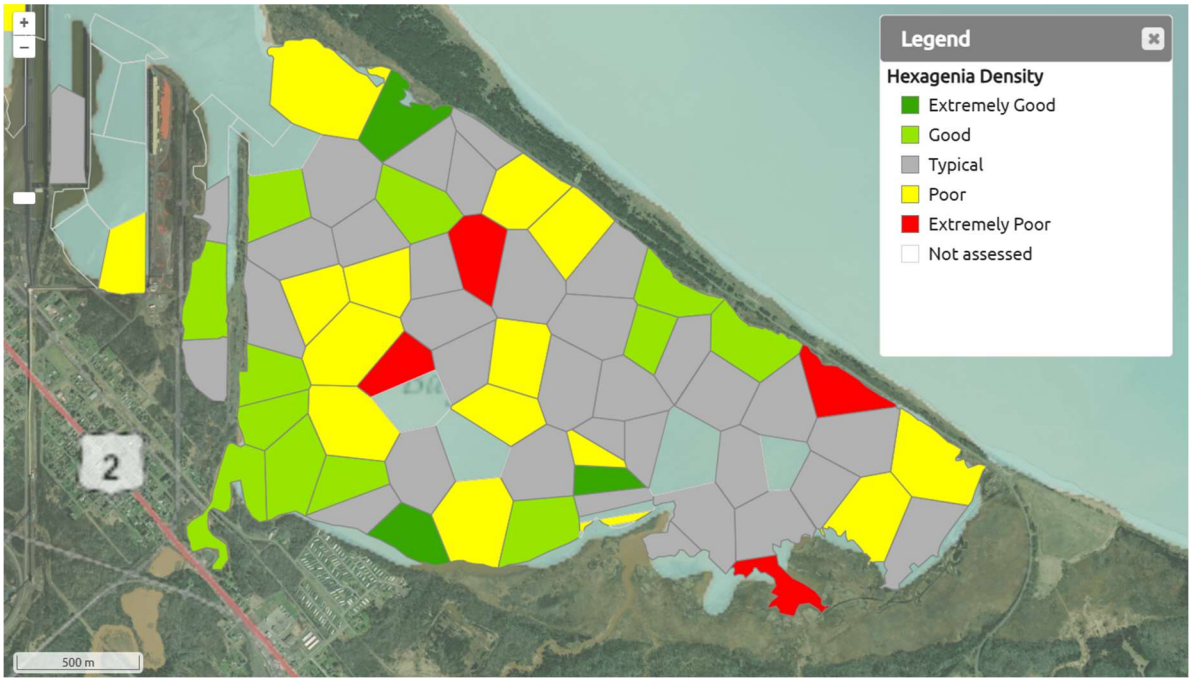

Figure 11. Hexagenia Density in Allouez Bay based on s-HDI

Rankings are based on a quantile regression, categorizing the data into "Extremely Poor", "Poor", "Typical", "Good", and "Extremely Good" categories. The s-HDI areas were generated using Thiessen polygons. Polygons are shown where Hexagenia was collected.

Sediment mercury concentrations, normalized for total organic carbon content, were mapped and ranked using a quartile analysis. Mercury concentrations in Allouez Bay sediments ranked from good to typical throughout the bay, with lower mercury concentrations in the east side of the bay (Figure 12).

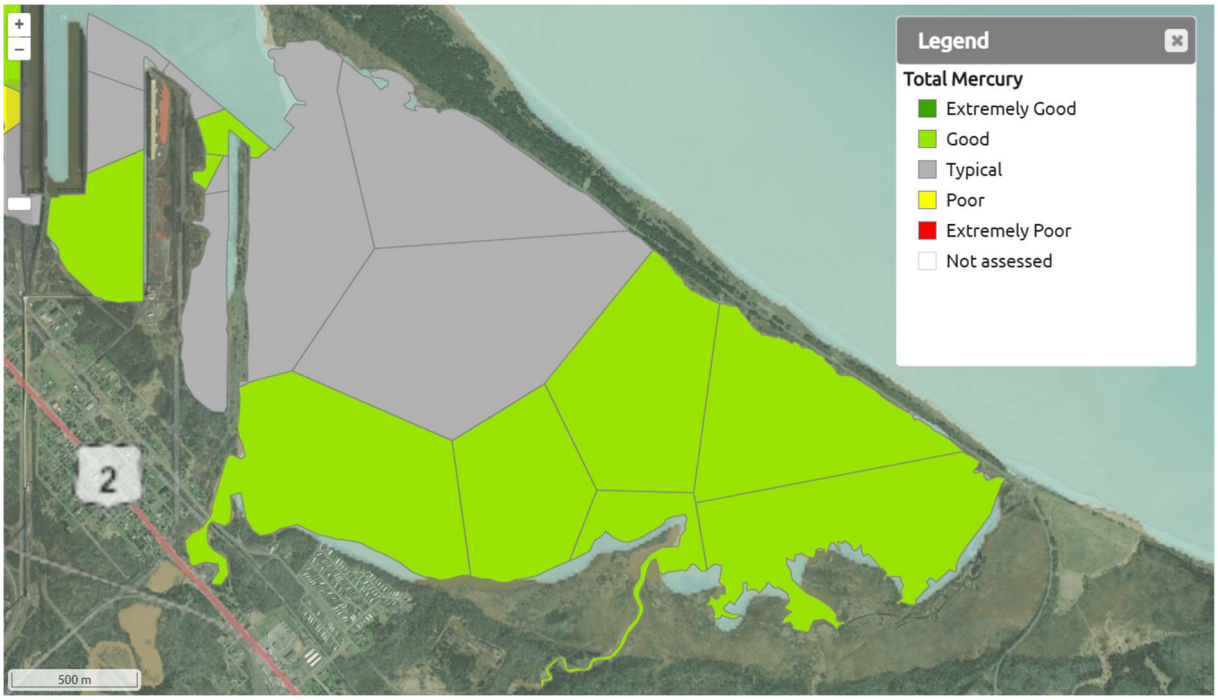

Figure 12. Total Mercury in the Sediment of Allouez Bay

Rankings are based on a percentile analysis, categorizing the data into "Extremely Poor", "Poor", "Typical", "Good", and "Extremely Good" categories. The Hg TOC normalized areas were generated using Thiessen polygons.

Sediment contaminants for which sediment quality targets (SQTs) have been established were also mapped and ranked using a quartile ranking. Level II SQT values represent the concentrations above which harmful effects on sediment-dwelling organisms are likely. In Allouez Bay, no surface sediment concentrations of contaminants exceed Level II SQT values (Figure 13).

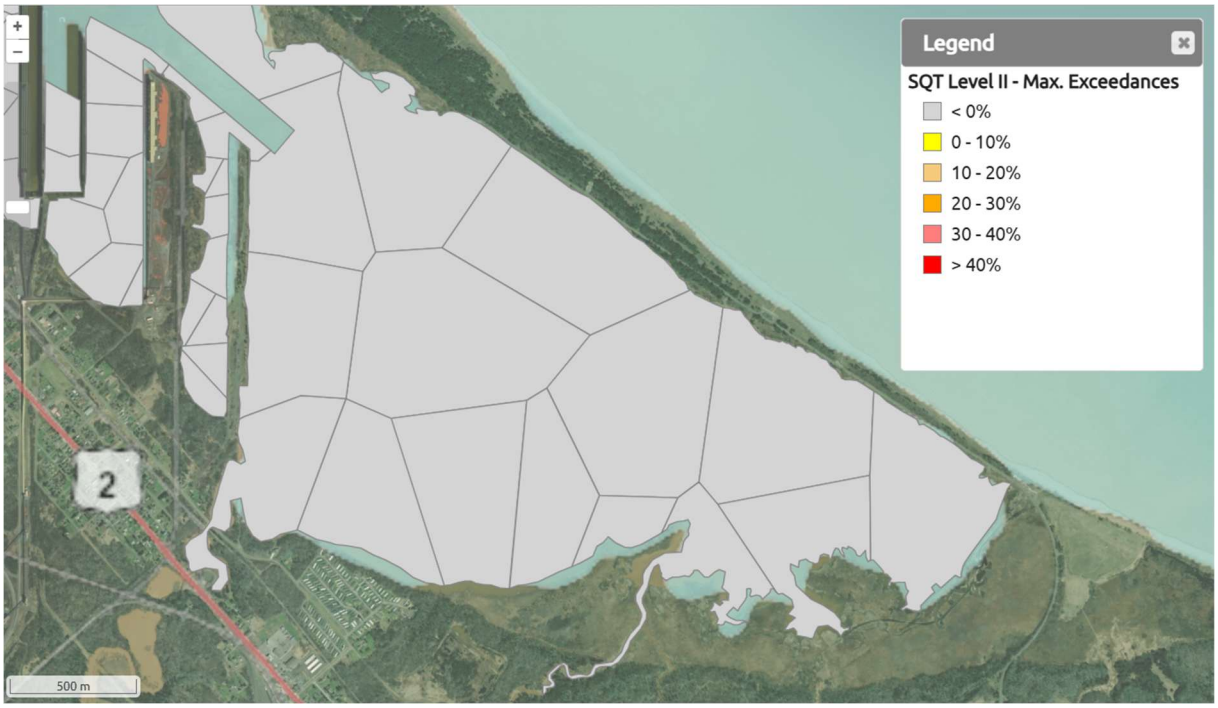

Figure 13. Sediment Quality Target Exceedances in Allouez Bay based on SQT Level II

Polygons displaying areas where at least one surface sediment contaminant exceeds SQT II and areas with no exceedances.

Water Quality

Allouez Bay is clay-influenced and is one of three bays that experiences higher total suspended sediments and total phosphorus concentrations than the rest of the St. Louis River estuary (Bellinger et al., 2016). Water temperature in the bay is influenced by both Lake Superior and the surrounding watershed inputs. Allouez Bay can partially stratify when cold Lake Superior water pushes into the bay. This brings with it the potential for fish species to use this bay that normally would not if it was warm and turbid throughout. Based on paleolimnology results, open-water nutrient concentrations have increased over time, and there are signs further eutrophication will occur (Reavie, 2020). Dissolved oxygen point sampling conducted under the ice in 2016, 2017, and 2018 show the bay is prone to winter hypoxia (<3mg/L) and even anoxia (<0.5mg/L) especially areas deep in the bay (Garono, et al. 2025). The monitoring of the Bear and Bluff Creeks tributaries to Allouez Bay found that the average total phosphorus concentration from all data collected in both streams was greater than the state water quality standard of 75 ug/L for total phosphorus (WDNR, 2020). Both Bear and Bluff Creek are listed as impaired for phosphorus on Wisconsin's Clean Water Act 303(d) list.

Watershed Conditions

The Allouez Bay geographic zone covers 32 square miles of which 19% has some level of protection in the form of public land (Figure 14). Bear and Bluff Creek are the main tributaries in this watershed.

Jurisdictions in the Allouez Bay geographic zone include the city of Superior, Parkland Township, Superior Township, and Oakland Township. Landcover is 45% forested, 15% agricultural/grassland, 31% wetland, 4% developed and 6% other based on the 2016 National Oceanic and Atmospheric Administration Coastal Change Analysis Program land cover dataset.

The targeted watershed assessment of the Bear and Bluff Creek watersheds completed by WDNR in 2020 (WDNR, 2020) included fish surveys, fish habitat evaluations, and macroinvertebrate sampling in addition to water quality monitoring. While the streams were determined to be impaired for total phosphorus as mentioned above, fish populations were found to be generally fair to good and macroinvertebrate sampling results indicated general good water quality and habitat conditions (WDNR, 2020). Beyond the targeted water quality assessment, limited information exists related to watershed conditions and watershed loading to Allouez Bay. At the time of this report, Douglas County Land Conservation was not conducting work within these areas.

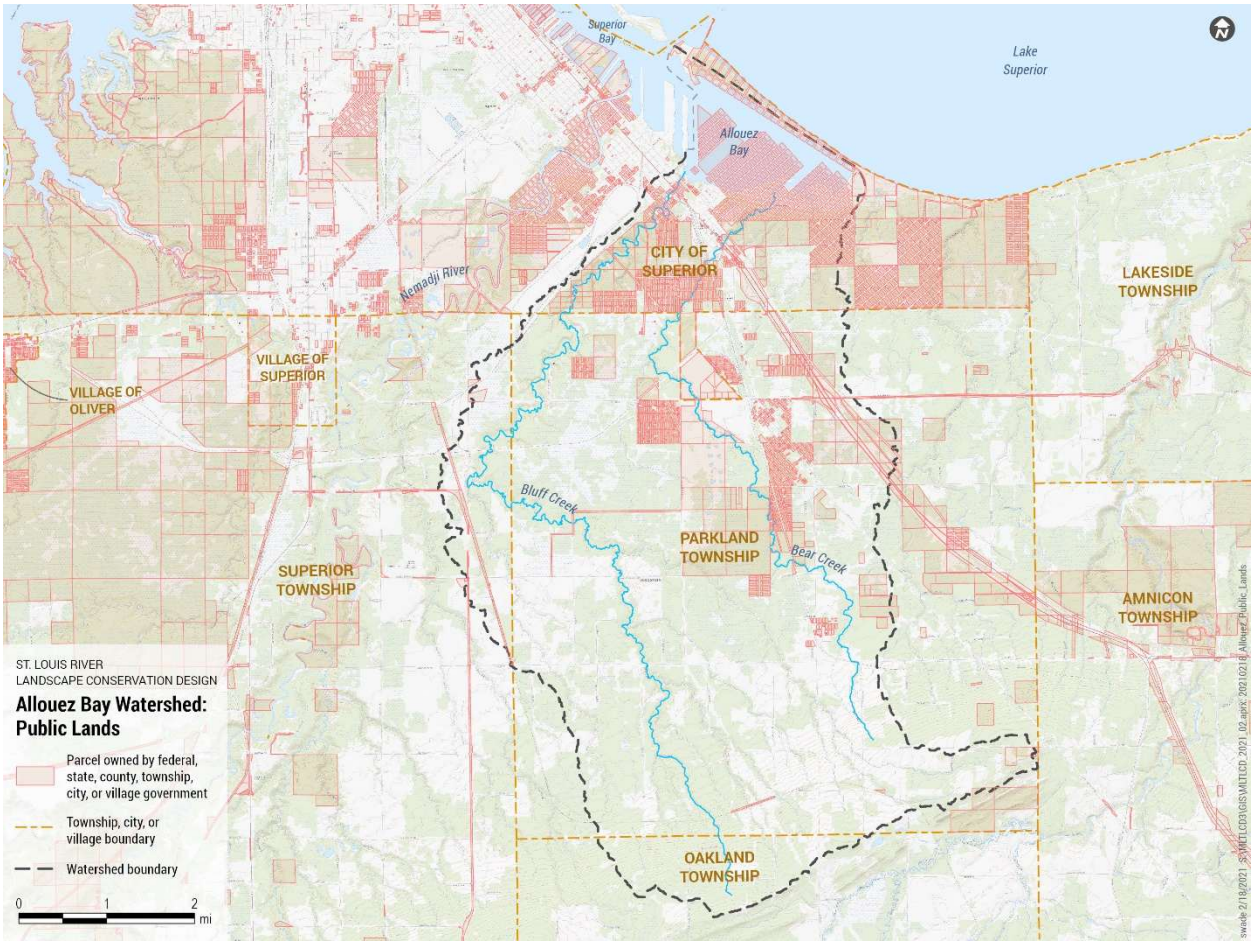

Figure 14. Public Land, Jurisdictions, and Major Tributaries in the Allouez Bay Watershed

2.3 COMPARISON OF HISTORICAL AND CURRENT CONDITIONS

The wetlands in the southeast portion of Allouez Bay are of particular importance due to their extent and the presence of high-quality native plant communities. Relative Exposure Index (REI) modeling (Figure 7) indicates that a possible mechanism for the spatial decline of the wetlands may be due to increased wind and wave energy from human alterations. For comparison to current conditions, the REI model was run by staff from USEPA GLTED for historical conditions using a digitized, orthorectified version of the 1863 Hearding map created in GIS.

Comparison of the REI exposure index for current conditions and the historical conditions (Figure 1515) confirms the hypothesis that prior to physical alterations in the bay, including construction of the Superior shipping entry, dredging of the navigation channel, and construction of piers in the bay, wind and wave energy was historically lower due to the presence of river islands, floating vegetation, and protective spits. This comparison led to the concept of creating a more sheltered wave environment in Allouez Bay in order to create conditions that support the expansion of the wetland area, as described in Sections 7 and 8.

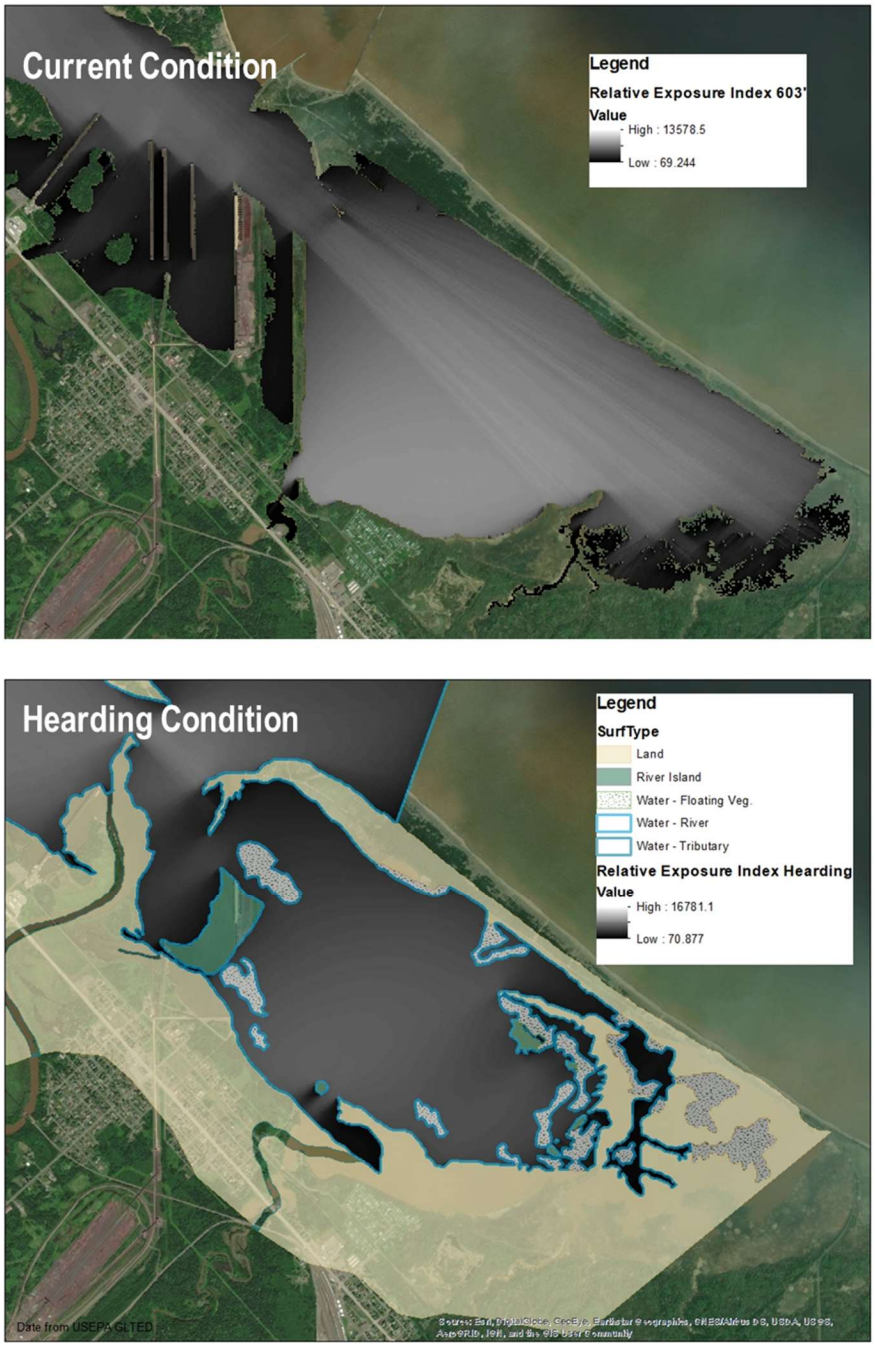

Figure 15: Comparison of Predicted Relative Exposure Index for Current Conditions and Historical Conditions

3 COMMUNITY VALUES

Allouez Bay is situated alongside the Itasca and Allouez neighborhoods in Superior. Many families have frequent and sometimes multi-generational experiences there. To better understand relationships with the bay and inform thoughtful conservation planning that supports these relationships, the Lake Superior National Estuarine Research Reserve conducted a series of informal input sessions for community members. The information from these sessions is summarized in this section and documented in Appendix D.

To collect personal input in an informal setting, the Lake Superior Reserve Director created a poster showing maps of Allouez Bay past and present and set up a table at four community events spanning the time period of June to October 2021.

The Reserve director had conversations with 34 community members over this time period. This number does not include several very brief conversations where no substantial input was provided. Additionally, the director spoke with Superior City Councilor Jenny Van Sickle, who represents the district.

The following themes emerged from the community input received:

1. Community members engage in and value opportunities to hunt, fish, gather, and explore along Allouez Bay year-round and are interested in the fish and wildlife habitat provided by Allouez Bay.
2. Community members have observed some ecological losses or changes through time.
3. Most access to Allouez Bay from neighborhoods is unimproved, informal, or difficult. In most cases, improved access is desired.
4. Community members value the beauty and undeveloped nature of Allouez Bay and wish to see it preserved or restored.

An overall conclusion from the community input is that there is a need for increased community outreach. As the restoration process moves forward, it will be important to provide informational opportunities and seek guidance and input from community members at the neighborhood level to refine restoration projects. City Councilor Jenny Van Sickle recommended providing information and seeking input at common neighborhood gathering locations such as churches and church socials, the popular and historic Belgian Club, and public schools or soliciting input directly at the 44th Ave E boat launch. With urban neighborhoods so close to the area, knowledge and engagement in the process of conservation can support overall community identity and well-being.

4 PRIORITY SPECIES AND COMMUNITIES TARGETED FOR CONSERVATION

Allouez Bay provides habitat for a wide variety of fish, insect, wildlife, and plant species. The individual species and plant communities listed in this section were identified as priorities for conservation in Allouez Bay by partners. Restoration actions should be cognizant of impacts and benefits to species and communities present on this list. More information, including monitoring, may be needed to establish baseline datasets for species in some cases. The intent of this list is to represent the importance of Allouez Bay to a myriad of species, such that conservation efforts consider the benefits and tradeoffs of ecosystem management and restoration as a whole.

Birds

- Bald Eagle (*Haliaeetus leucocephalus*)
- Osprey (*Pandion haliaetus*)
- Piping Plover (*Charadrius melodus*) and other migrating shorebirds
- Migrating songbirds
- Breeding marsh birds, focal species include:
  - Pied-billed Grebe (*Podilymbus podiceps*)
  - Virginia Rail (*Rallus limicola*)
  - Sora (*Porzana carolina*)
  - Black Tern[1] (*Chlidonias niger*)
  - American Bittern (*Botaurus lentiginosus*)
  - Least Bittern *(Ixobrychus exilis)*
  - Sedge Wren (*Cistothorus platensis*)
  - Marsh Wren (*Cistothorus palustris*)
  - Swamp Sparrow (*Melospiza georgiana*)
  - Yellow-headed Blackbird[2] (*Xanthocephalus xanthocephalus*)
- Waterfowl (excluding Canada Geese)

[1] Note: Black Terns were last recorded nesting in Allouez Bay in 1994. This species has experienced extreme regional and statewide declines. Providing artificial nesting platforms placed at selective openings in emergent stands may provide an initial attractant, but in the long term until regional and state numbers begin to trend upward.
[2] Yellow-headed Blackbird reappeared in the St. Louis River estuary 2021. As marsh restoration proceeded and with appropriate structure, this bird may become a regular breeder in Allouez Bay.

Fish

- Lake Sturgeon (*Acipenser fulvescens*)
- Muskellunge (*Esox masquinongy*)
- Northern Pike (*Esox Lucius*)
- Walleye (*Sander vitreus*)

Insects

- Hairy-necked tiger beetle (*Cicindela hirticollis rhodensis*)
- Alkali bluet (*Enallagma clausum*)

Reptiles

- Blanding's turtle (*Emydoidea blandingii*)

Mammals

- Muskrat (*Ondatra zibethicus*)
- Beaver (*Castor canadensis*)
- Mink (*Neovison vison*)
- Otter (*Lontra canadensis*)
- Franklin's Ground Squirrel (*Poliocitellus franklinii*)
- Northern Long-Eared Bat (*Myotis septentrionalis*)

Plants and Plant Communities

- Wild rice (*Zizania palustris*, Manoomin)
- Emergent marsh community
- Sedge meadow wetland community
- Native submergent plant community
- Great Lakes dune community
- Great Lakes beach community
- Northern Dry-mesic Forest

5 PRIORITY INVASIVE SPECIES FOR CONTROL

The following invasive species are present in the Allouez Bay geographic zone and have been identified as important targets for the management of impacts or potential impacts on habitat:

- Curly leaf pondweed (*Potamogeton crispus*)
- Emerald ash borer (*Agrilus planipennis Fairmaire*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)
- Hybrid cattail (*Typha x glauca*)
- Purple loosestrife (*Lythrum salicaria*)
- Phragmites (*Phragmites australis* ssp. *australis*)
- Yellow iris (*Iris pseudacorus*)

Consideration should also be given to the prevention of future establishment of invasive species through appropriate restoration design and implementation. Aquatic habitat modifications should discourage colonization by non-preferred, non-native fishes such as goby and ruffe. These species are often found in and among large substrates such as cobble and small and large boulders, particularly throughout the lower river and bays.

While not an invasive species, Canada geese (*Branta canadensis*) have hindered wild rice reestablishment due to their herbivory on wild rice once germination occurs during the growing season. Herbivory management has been identified as an integral component of wild rice restoration efforts.

6 GUIDING PRINCIPLES FOR RESTORATION

The following principles were established by partners to guide restoration activities within the Allouez Bay geographic zone:

- Conduct meaningful community engagement with communities surrounding and using Allouez Bay.
- Protect and maintain high-quality habitats while seeking opportunities to enhance areas degraded by invasive species.
- Increase ecosystem resiliency to climate change by identifying adaptation and mitigation strategies and applying designing with nature approaches as projects are implemented.
- Identify and seek to fill important data and knowledge gaps. Avoid unintended consequences (i.e., do not make things worse) through the use of an integrated planning approach.

7 ECOLOGICAL DESIGN GOALS

Based on the review of available information, identification of issues to be addressed, and community interviews, partners determined that the overall goal for restoration in Allouez Bay is to increase sheltered conditions in the bay to support extensive and diverse marsh habitat that supports fish, birds, and other wildlife that is valued by the community.

The following list of actions is intended to guide the implementation of this vision:

- Reduce wind and wave energy in the eastern portion of the bay
- Protect existing high-quality habitat areas
- Increase the extent of softened natural shoreline features
- Increase the extent and density of aquatic vegetation
- Preserve existing off-channel deep water
- Protect, restore, and enhance habitat for the priority animal and plant species prioritized for conservation
- Maintain or increase cultural and recreational uses, including but not limited to: hunting, fishing, gathering, birding, and paddling
- Increase public access for surrounding neighborhoods
- Maintain the undeveloped nature and natural beauty of the bay
- Protect cultural heritage of the area
- Advance understanding of any additional or emerging stressors that may affect achievement of the vision

8 RESTORATION VISION

The vision for restoration of Allouez Bay includes creation of a sheltered bay system that is functionally similar to what was historically present, resilient to anticipated threats and stressors including climate change, and is integrated into other habitats and community access objectives in Allouez Bay, Wisconsin Point, and the wetlands east of Moccasin Mike Road. Note: While Wisconsin Point is wholly ecologically connected to Allouez Bay, this plan aims to address only the portion of the Point adjacent to the Bay itself. Other plans address Wisconsin Point in its entirety (NRPC, 2012).

The restoration vision (Figure 16) includes protection, restoration & enhancement, and public access elements as described below. The numbers following each item correspond to the numbers in Figure 16.

Existing high quality habitat protection (1, 2, 3, 4, 5) – High quality habitat exists in a number of locations throughout Allouez Bay and its riparian areas. These include the pine forest and dune communities on Wisconsin Point; the restored limited-access shorebird area; and portions of the wetlands on the southeast corner of Allouez Bay. These areas support a wide range of conservation priority species established for the area. Preservation of these habitats may include planning for climate resiliency, particularly as it relates to storm surge and water level fluctuations, as well as addressing invasive species such as EAB.

Sheltered bay creation (6, 7) – Establishment of sheltered conditions focuses on the reduction of wind and wave energy across the bay, the creation of underwater shoals. This reduction in energy will promote the presence of submerged, emergent, and floating leaf vegetation. Increased water clarity within the more sheltered areas of the site is anticipated. Bottom surface elevations will be established to support the presence of seasonal mudflats (Figure 17) to support migrating shorebirds as water levels fluctuate. The expansion of aquatic vegetation in the sheltered areas will also increase the available habitat for fish, marsh birds, and aquatic mammals.

Deep water habitat preservation and enhancement (8) – The existing deep water habitat of 8-15 feet in Allouez Bay could be preserved and expanded. A connection will be made to the deep water of the navigational channel to support migration of fish throughout the system. Clean, organic, and mineral soils and gravel are desired substrates. Deep, open water provides overwintering habitat for native fish species such as Walleye, Lake Sturgeon, Muskellunge, Northern Pike, Black Crappie, Bluegill, and Bass. Species such as Lake Sturgeon and Walleye use deep-water habitats in the summer. Some benthic macroinvertebrates also utilize this habitat.

Wetland complex creation at the mouth of Bluff Creek (9) – A wetland complex is desired at the mouth of Bluff Creek to reduce turbidity from the stream by providing opportunities for settling within the wetland vegetation. A wetland complex was historically present in this location.

Evaluate and address culverts for fish passage and hydrologic connection (10) – Culverts along Bear Creek will be evaluated for fish passage and addressed as needed. Culverts under Moccasin Mike Road will be assessed for both fish passage and their impact on hydrology of the wetlands east of the road. Impacts of beaver activity on hydrologic connection in the vicinity of the Moccasin Mike Road culverts will be evaluated and addressed.

Softened shoreline creation along Wisconsin Point bayside (11) – Shoreline on the bay side of Wisconsin Point will be softened to increase the amount of habitat available for marsh birds in the bay.

Emergent marsh habitat enhancement on Wisconsin Point bayside (12) – Enhancement of these existing wetland areas will include evaluating opportunities for establishing vegetation, including potentially seeding for wild rice.

Protect high quality wetlands, control invasives, and enhance interspersion (13) – Priority will be given to preserving the integrity of existing high quality native plant communities, particularly coastal fen, within these areas. More impacted areas will be enhanced through invasive species control and enhancing interspersion through techniques such as channeling and potholing.

Public access creation on southeast side of Allouez Bay (14) – A location to provide public access to neighborhoods adjacent to Allouez Bay will be sought on the south side of the bay. A potential location is the 44th Avenue East Dock.

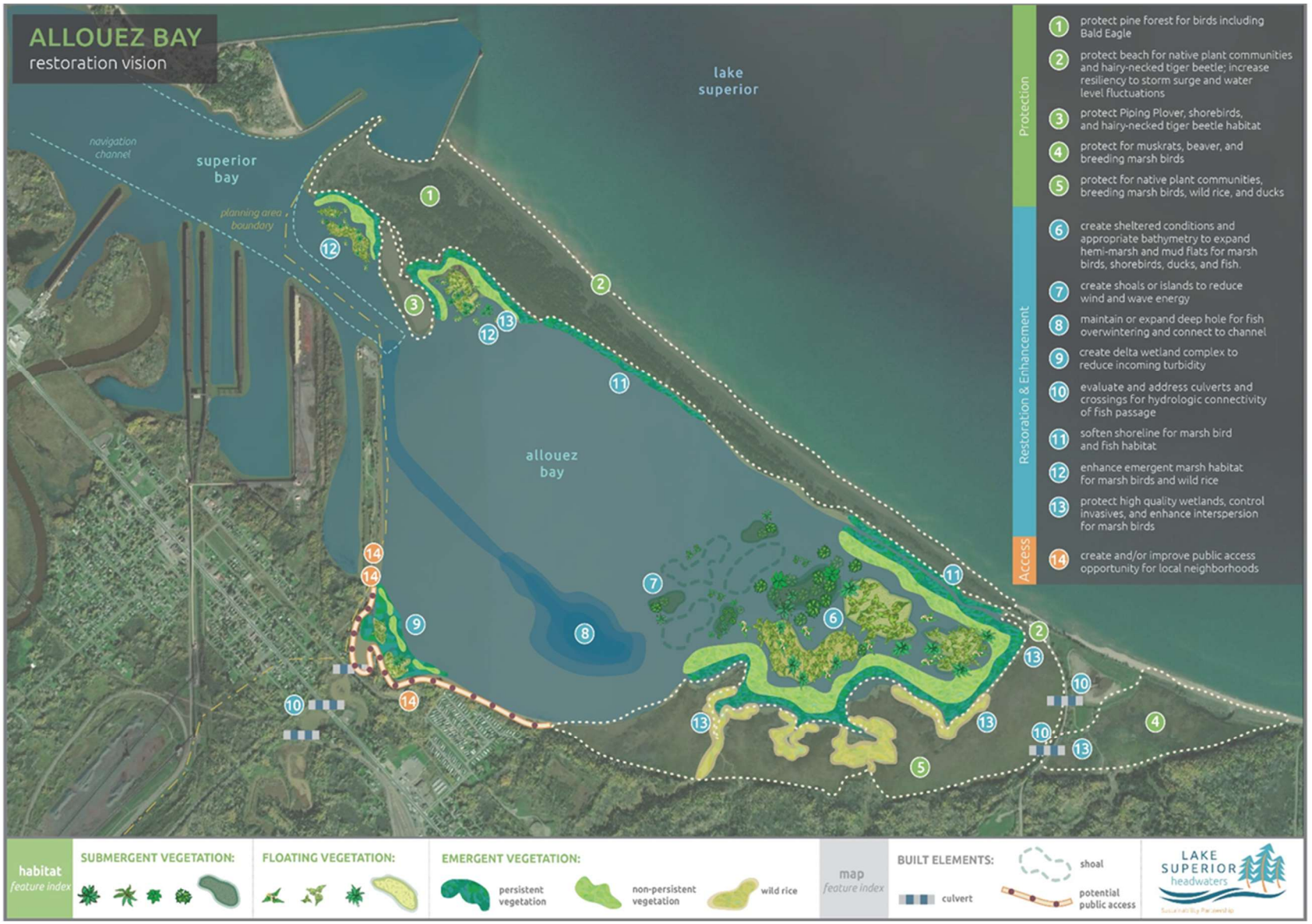

Figure 16: Plan view of Restoration Vision for Allouez Bay

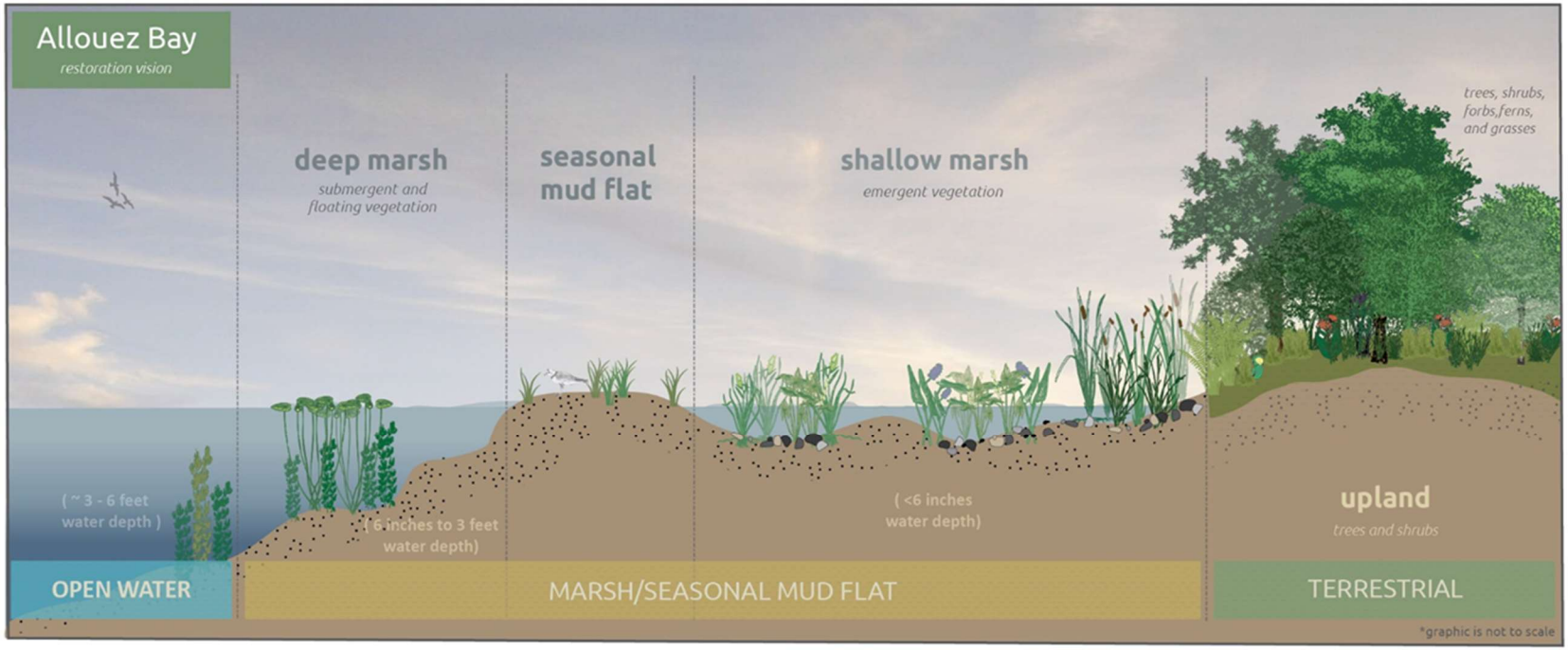

Figure 17: Cross-Section of Marsh/Mudflat

9 UNCERTAINTIES AND INFORMATION GAPS

Based on a review of available information and discussion amongst partners involved in this planning process, a number of uncertainties and information gaps should be recognized at this conceptual planning stage. Following is a list of information that will support further planning and project design:

- Hydrodynamic modeling of Allouez Bay to understand circulation and energy patterns to inform restoration design and habitat suitability models for target species
- Water quality monitoring - the dynamics of total phosphorus, dissolved oxygen, and turbidity are of particular interest to assist habitat suitability modeling
- Large-scale submergent and emergent macrophyte data survey
- Turtle survey, particularly considering Blanding's turtle
- Fish surveys -including fish species data, as well as utilizing appropriate metrics to determine the response of the fish community to restoration work
- Small mammal survey, including muskrat and otters
- Detailed bathymetric survey for restoration design and improving cut/fill calculations
- Soil/sediment borings within the marsh area to better understand substrate composition, and historic sediment loading, native plant communities and inform geotechnical analysis and site stability
- Hydraulics, hydrology, sediment loading, and water quality from Bear and Bluff Creek, as well as the Nemadji River and St. Louis River.
- Community engagement and communication plan
- Land ownership – address platted lots in the bay to determine jurisdiction for submersed parcels
- Identify opportunities for land conservation/protection in publicly owned terrestrial areas adjacent to Allouez Bay.

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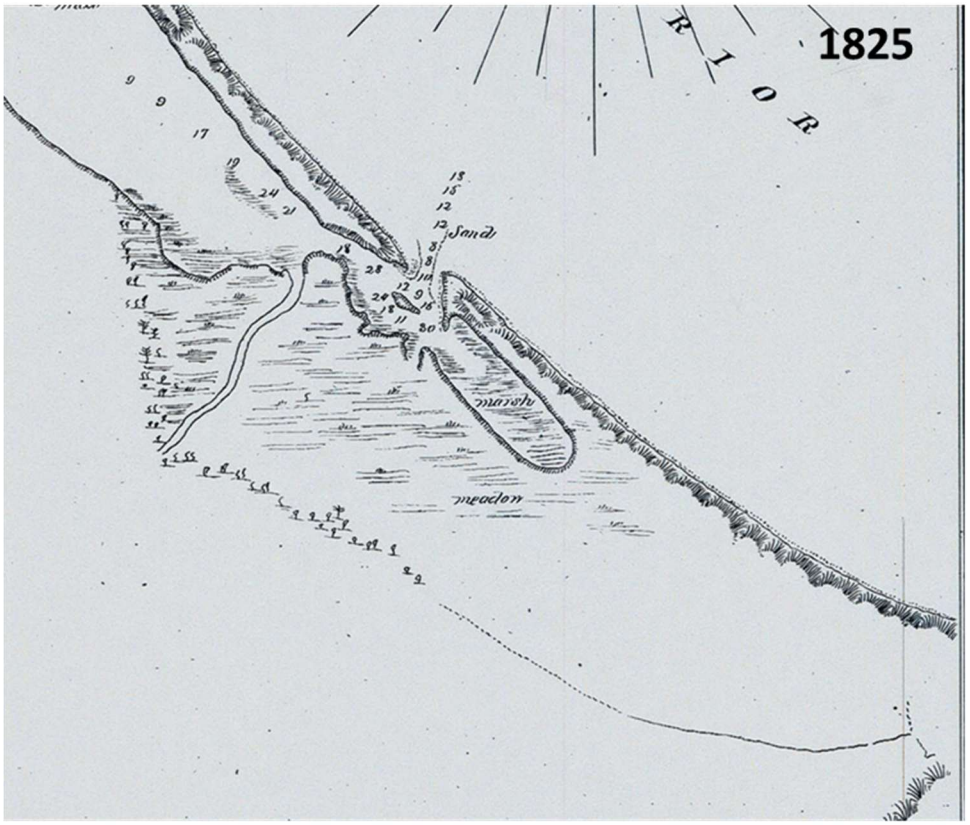
APPENDIX A: Partners Participating in the 2021-22 Planning Process

Name	Affiliation	Role/Expertise
Gini Breidenbach	Minnesota Land Trust	Project manager
Reena Bowman	US Fish and Wildlife Service	Headwaters Partnership Advisory Group
Cherie Hagen	Wisconsin Department of Natural Resources (WDNR)	DNR lead; Headwaters Partnership Advisory Group
Deanna Erickson	Lake Superior Reserve	Managing community interests' pieces
Kelly Beaster	LSRI	Coastal wetlands; wild rice
Jeremy Bloomquist	St. Croix Chippewa	Tribal interests
Annie Bracey	NRRI	Birds
Val Brady	NRRI	Coastal wetlands
Linda Cadotte	City of Superior	Headwaters Partnership Advisory Group; City of Superior parks; Wisconsin Point Plan
Ellen Cooney	WDNR	Sediment, Water Quality
Josh Dumke	NRRI	Fish
Amy Eliot	LSRI	Wild rice
Dara Fillmore	WDNR	Invasive species
Christopher Filstrup	NRRI	Water quality
Dave Grandmaison	WDNR, MDNR	Wild rice, Terrestrial Habitat Integrity
Alexis Grinde	University of Minnesota - Duluth - Natural Resources Research Institute (NRRI)	Birds
Dustin Haines	Lake Superior National Estuarine Research Reserve, UW-Madison Division of Extension	Water quality
Jeremy Hartsock	University of Wisconsin-Superior Lake Superior Research Institute (LSRI)	Coastal wetlands

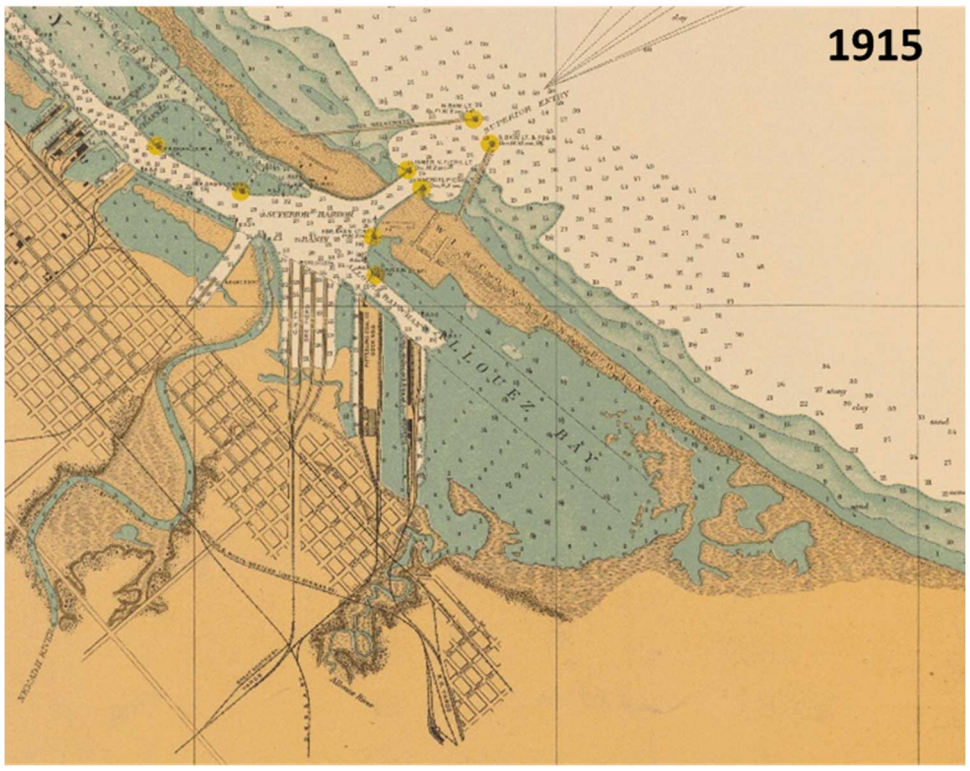
Name	Affiliation	Role/Expertise
Kari Hedin	Fond du Lac Band; St. Louis River Habitat Workgroup co-chair	Tribal interests; St. Louis River Habitat Workgroup liaison
Tom Howes	Fond du Lac Band of Lake Superior Chippewa	Tribal interests
Bradford Kasberg	Audubon Great Lakes	Birds
Steve LaValley	WDNR	General knowledge and experience
Jim Luke	US Army Corps of Engineers	Coordination
Ryan Magana	WDNR	T&E Species; High quality habitat
Sumner Matteson	WDNR	Birds
Nat Miller	Audubon Great Lakes	Birds
Paul Piszczek	WDNR	Fish
Hannah Rammage	Lake Superior Reserve	Water quality
Euan Reavie	NRRI	Paleolimnology
Reed Schwarting	LSRI	Coastal wetlands
Matthew Steiger	WDNR	St. Louis River, Wild rice
Beilke, Stephanie	Audubon Great Lakes	Birds
Hollenhorst, Thomas	US Environmental Protection Agency Great Lakes Toxicology and Ecology Division	Mapping
Ashley Vandevoort	Douglas County, Wisconsin	Watershed

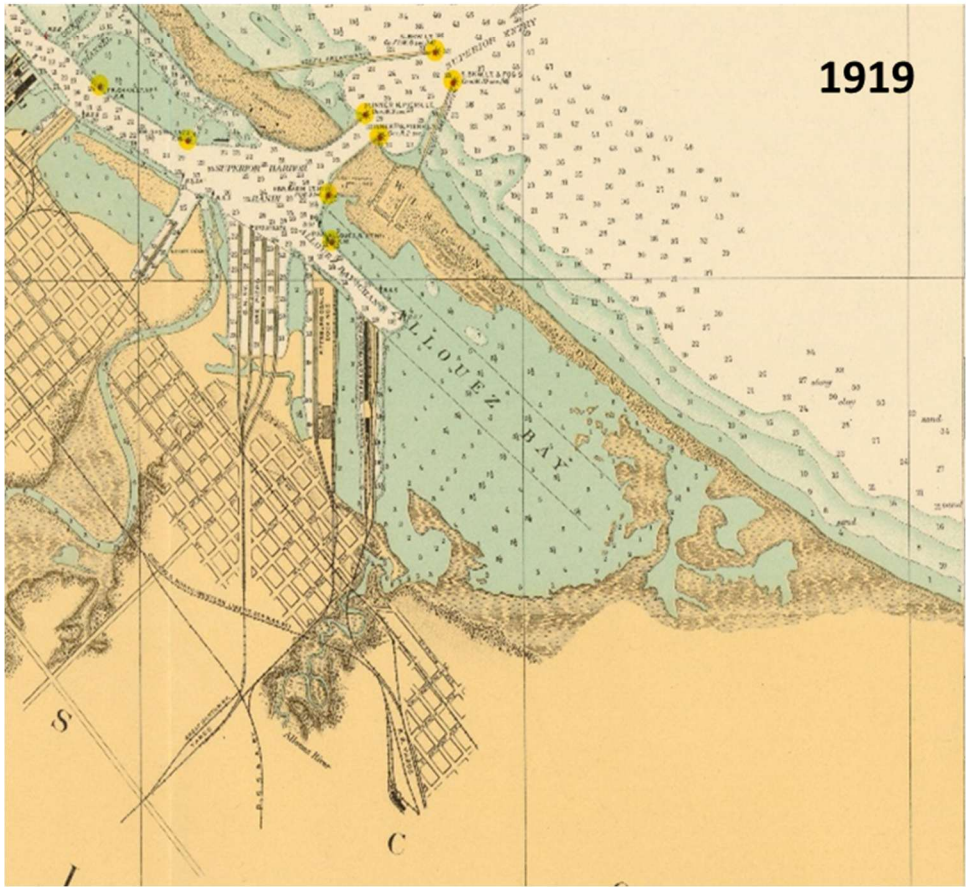
APPENDIX B: Allouez Bay Historical Navigation Charts

- Data source: **https://historicalcharts.noaa.gov/**
- Notes: The cropped images in this time series were from NOAA charts catalogued in the link above. There may be other charts available for years between the charts shown. However, the series was selected based on significant changes in Allouez Bay indicated on the maps.


1825
Sand
marsh
meadow


1863
Light House
BAY OF
ALLOUEZ
Fox River


1915
ST. LOUIS BAY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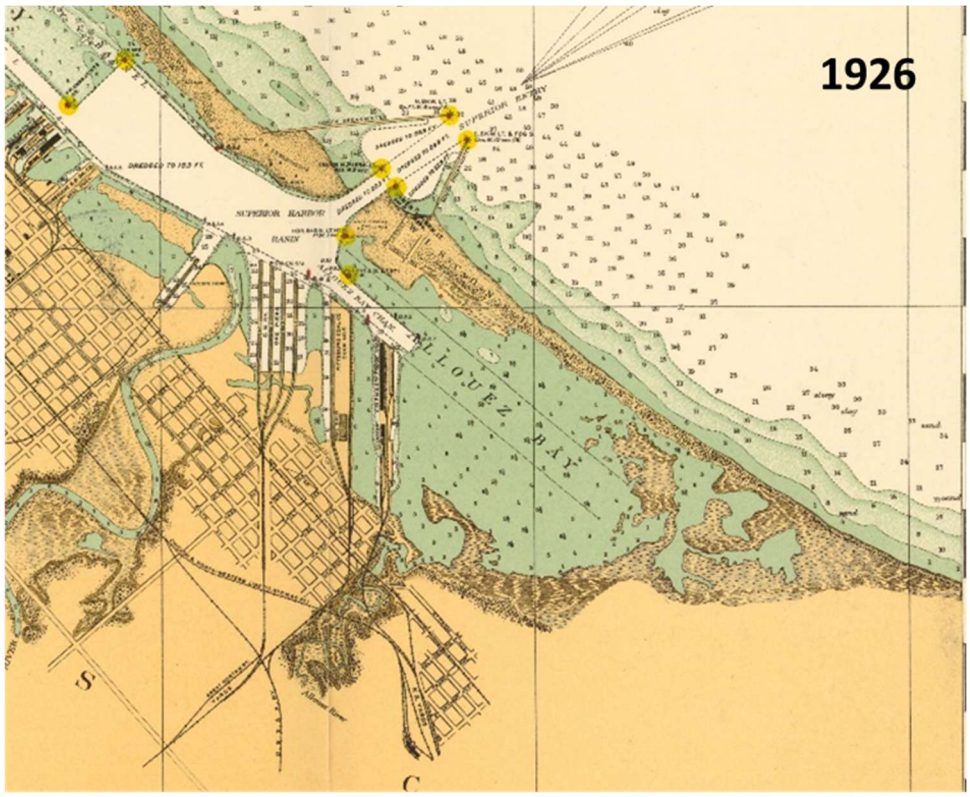
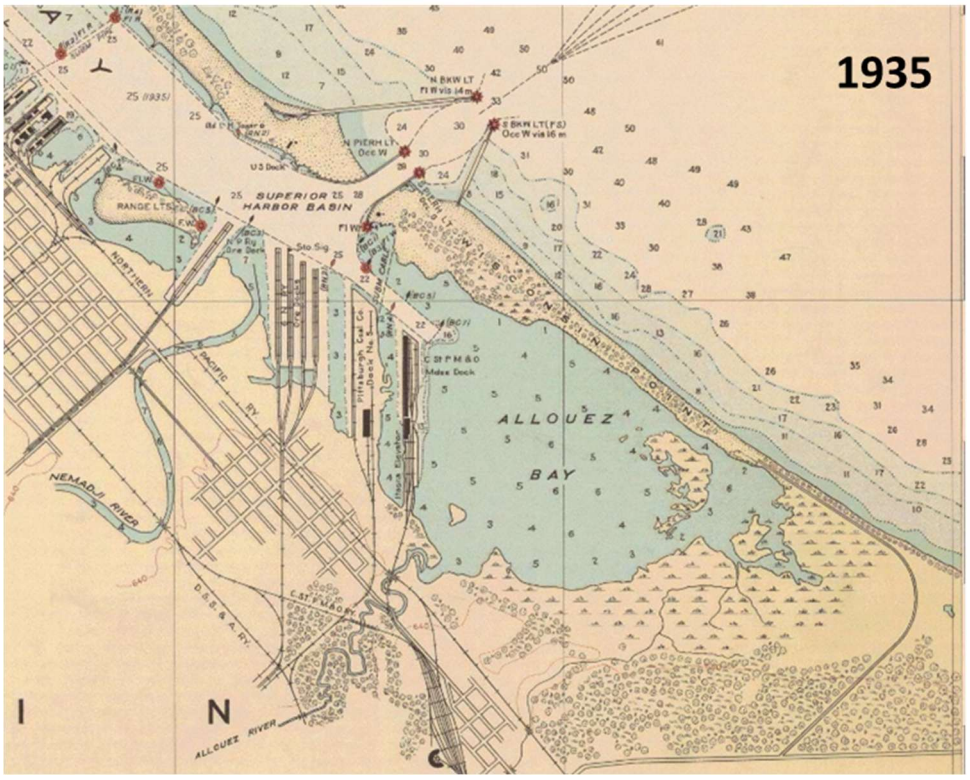
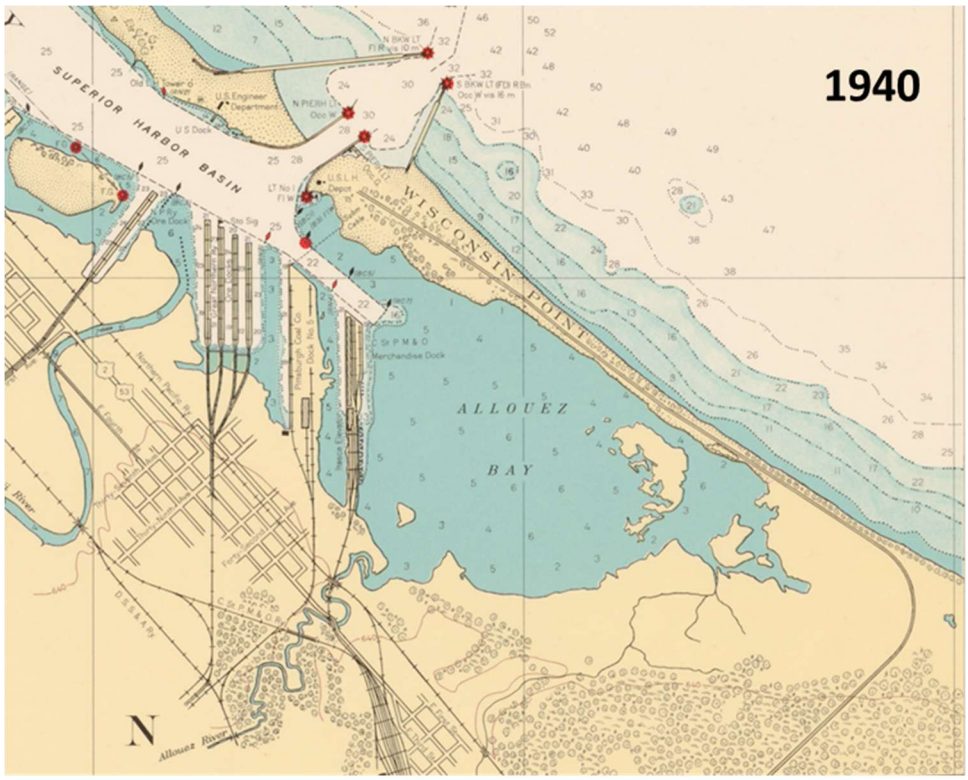
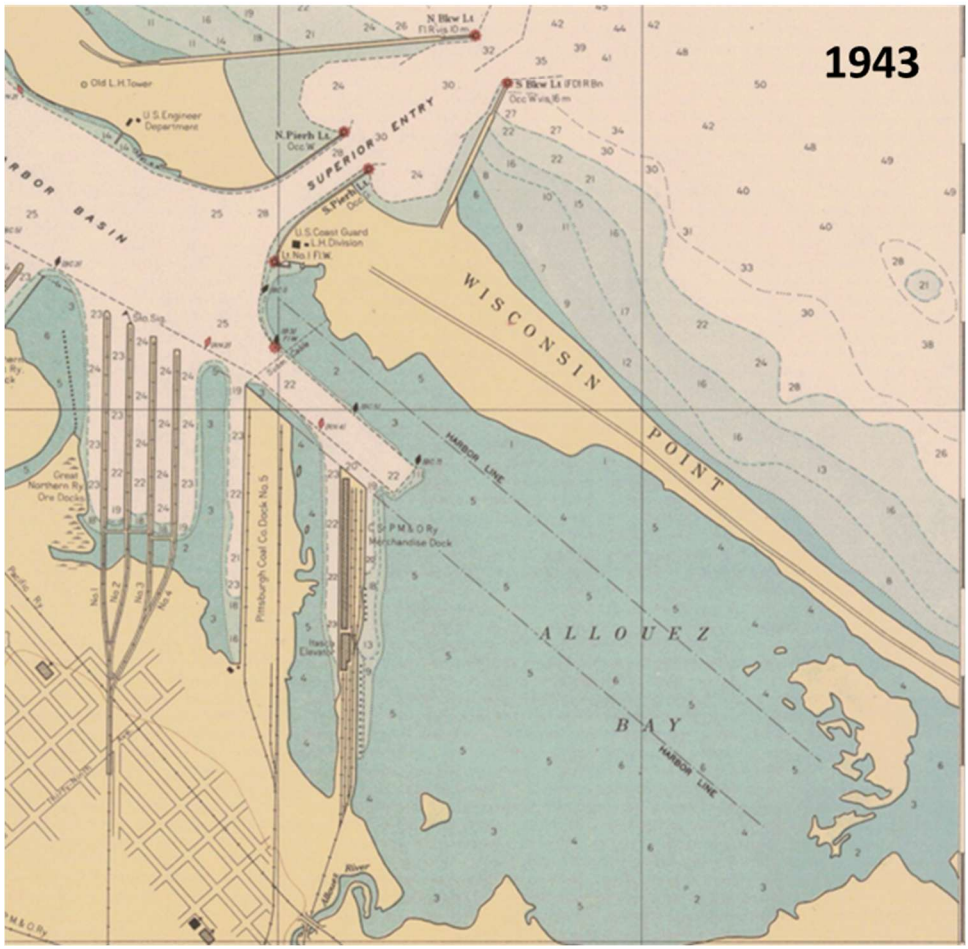
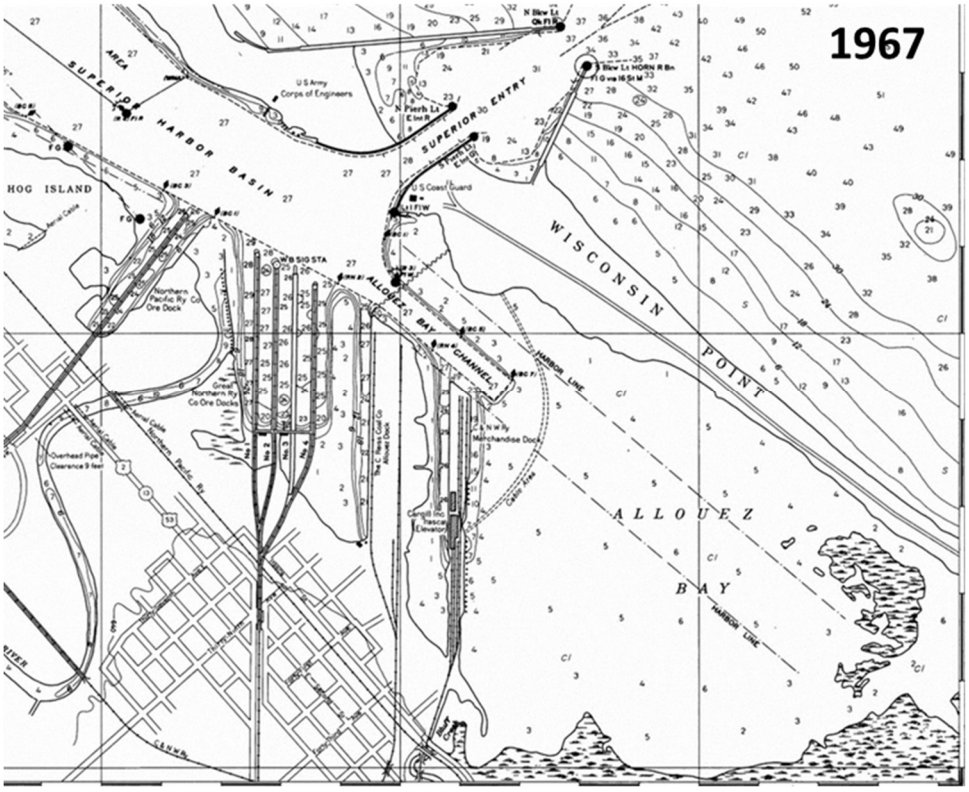
ST. LOUIS BAY

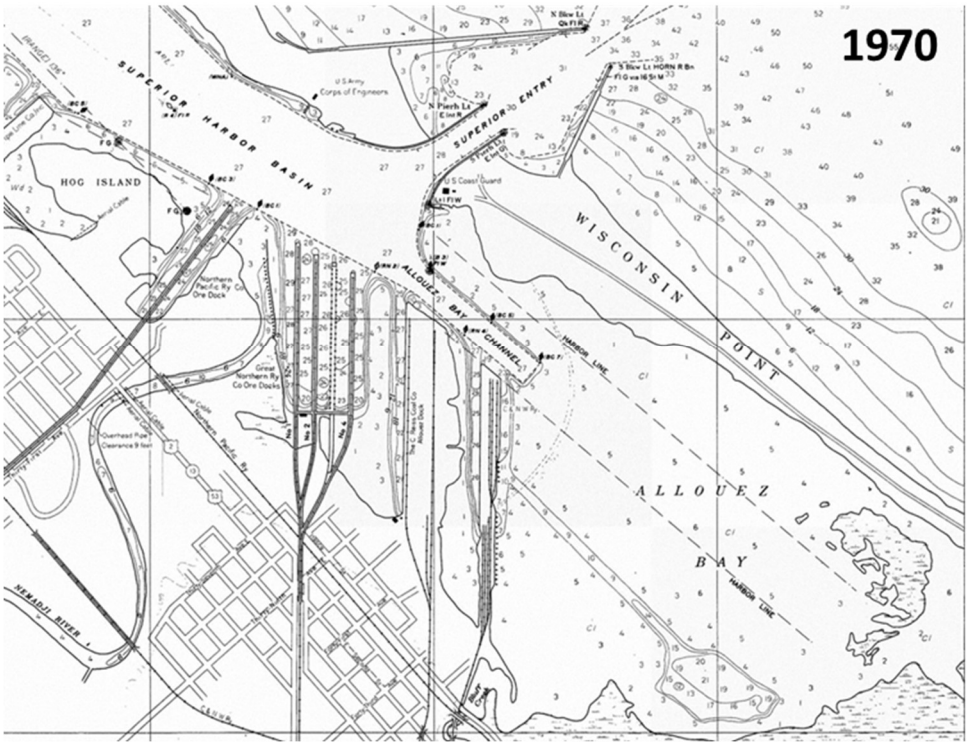

1926
ALLOUEZ BAY

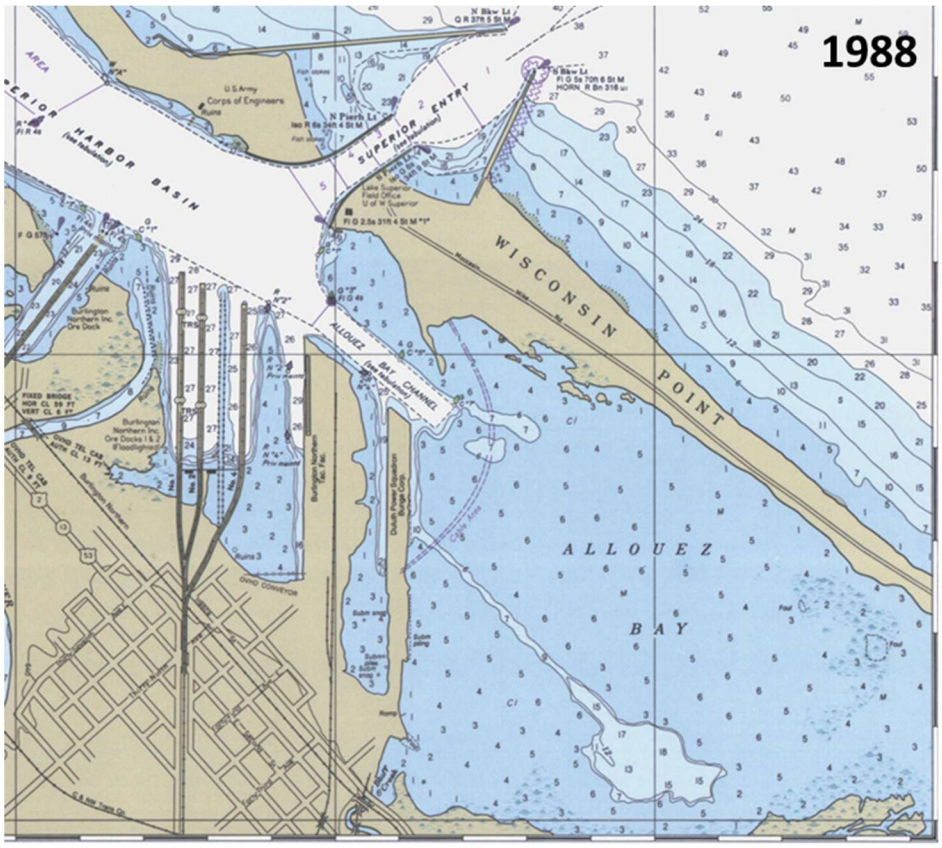

1935
SUPERIOR HARBOR BASIN
ALLOUEZ BAY
NEMADJI RIVER
ALLOUEZ RIVER

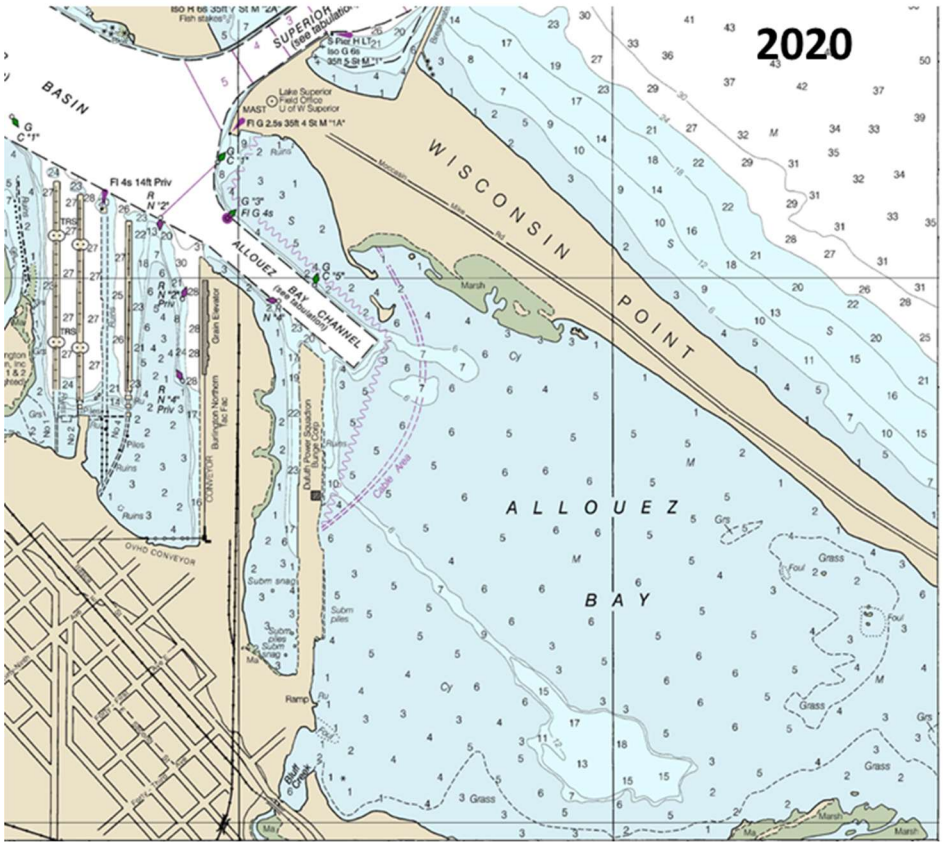

1940
SUPERIOR HARBOR BASIN
WISCONSIN POINT
ALLOUEZ
BAY
N
Allouez River


1943
SUPERIOR ENTRY
WISCONSIN
POINT
HARBOR LINE
ALLOUEZ
BAY
HARBOR LINE


1967
SUPERIOR HARBOR BASIN
SUPERIOR ENTRY
HOG ISLAND
WISCONSIN POINT
ALLOUEZ BAY
HARBOR LINE
U S Army Corps of Engineers
U S Coast Guard
Northern Pacific Ry Co Ore Dock
Great Northern Ry Co Ore Docks
Overhead Pipe Clearance 9 feet
Aerial Cable
N W Ry Merchandise Dock
Cargill Inc Itasca Elevator
CLOUD

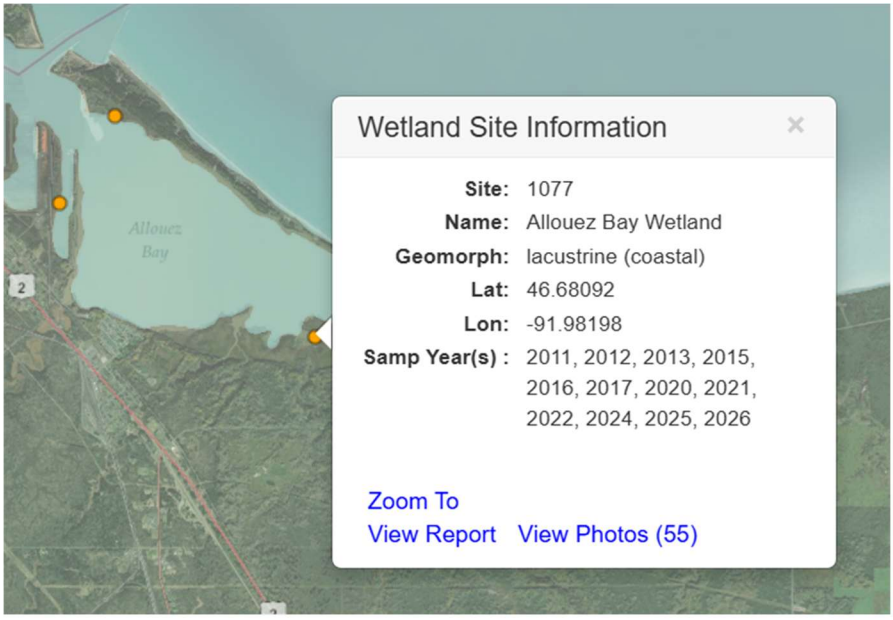

1970
SUPERIOR HARBOR BASIN
SUPERIOR ENTRY
HOG ISLAND
WISCONSIN POINT
ALLOUEZ BAY
HARBOR LINE
U S Army Corps of Engineers
U S Coast Guard
Northern Pacific Ry Co Ore Dock
Great Northern Ry Co Ore Docks
Overhead Pipe Clearance 9 feet
Aerial Cable
NEMADJI RIVER
CLOUD


1988
HARBOR BASIN
SUPERIOR ENTRY
WISCONSIN POINT
ALLOUEZ BAY
ALLOUEZ BAY CHANNEL


2020
BASIN
SUPERIOR
WISCONSIN POINT
ALLOUEZ BAY
ALLOUEZ BAY CHANNEL
Fl 4s 14ft Priv
Fl G 4s
OVHD CONVEYOR

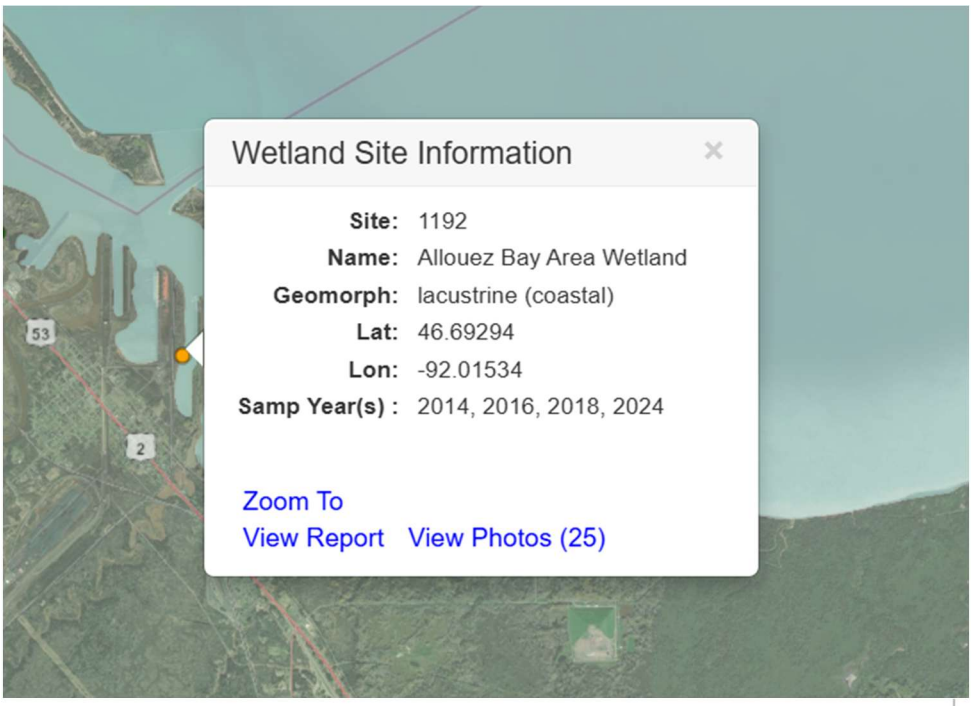
APPENDIX C: Coastal Wetland Monitoring Program IBIs for Allouez Bay Sites

Data in this appendix are from the Great Lakes Coastal Wetland Monitoring Program (CWMP) Mapping Tool which is accessible at this link with a user login: **https://www.greatlakeswetlands.org/Map.vbhtml**. Data in this appendix were retrieved on February 21, 2026.



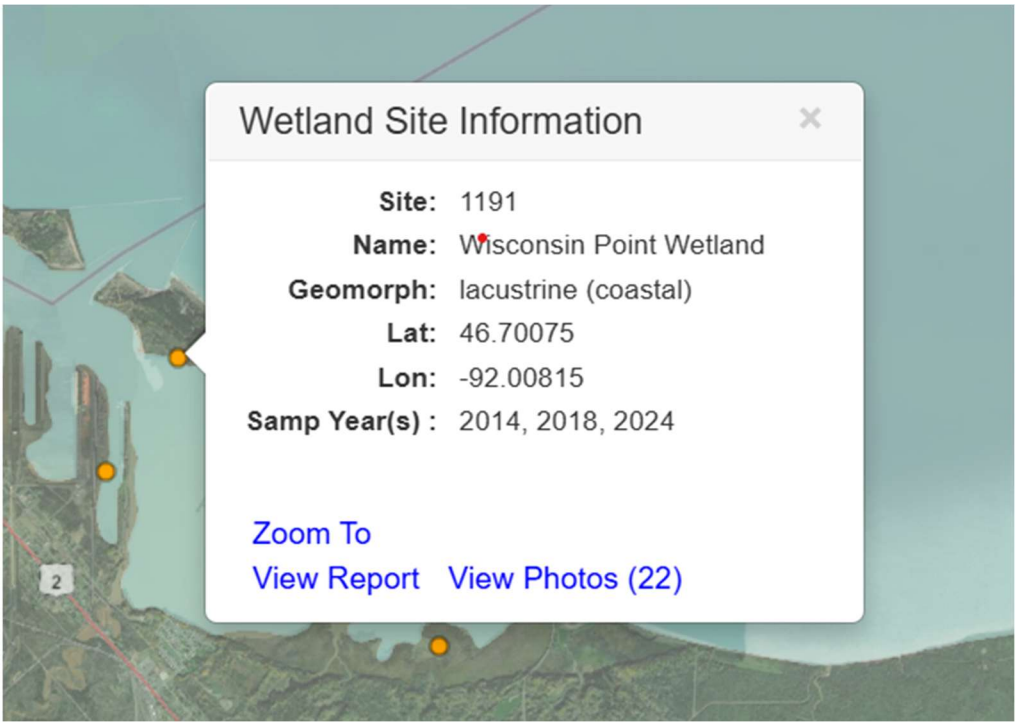
Site-Level IBI Results

Year	Fish	Invert	Veg	Anuran	Bird	WQ Index
2024	--	--	--	--	Moderately Degraded	--
2022	--	--	Mildly Impacted	--	Moderately Degraded	--
2021	--	--	--	--	Moderately Degraded	--
2020	3: Moderately Impacted	--	Mildly Impacted	Moderately Impacted	Moderately Impacted	Moderately Impacted
2017	3: Moderately Impacted	--	Mildly Impacted	Moderately Impacted	Moderately Degraded	Moderately Impacted
2016	3: Moderately Impacted	--	Mildly Impacted	Mildly Impacted	Moderately Degraded	Moderately Impacted
2015	2: Moderately Degraded	3 - Moderately Degraded	Mildly Impacted	Mildly Impacted	Moderately Degraded	Mildly Impacted
2013	3: Moderately Impacted	--	Mildly Impacted	Moderately Degraded	Moderately Degraded	Mildly Impacted
2012	--	--	--	Moderately Degraded	Moderately Degraded	--
2011	1: Degraded	3 - Moderately Degraded	Reference Conditions	Degraded	Moderately Degraded	Moderately Impacted



Site-Level IBI Results

Year	Fish	Invert	Veg	Anuran	Bird	WQ Index
2024	3: Moderately Impacted	--	Moderately Impacted	Moderately Impacted	Degraded	Moderatel Impacte
2018	3: Moderately Impacted	--	Moderately Impacted	Moderately Degraded	Degraded	Moderatel Impacte
2016	--	--	Moderately Impacted	--	Degraded	Moderatel Impacte
2014	--	--	Mildly Impacted	Moderately Degraded	Degraded	Moderatel Impacte



Site-Level IBI Results

Year	Fish	Invert	Veg	Anuran	Bird	WQ Index
2024	2: Moderately Degraded	--	--	Moderately Degraded	Moderately Degraded	Moderately Impacted
2018	--	--	--	Degraded	Moderately Degraded	--
2014	4: Mildly Impacted	3 - Moderately Degraded	Mildly Impacted	Moderately Degraded	Degraded	Moderately Impacted

Appendix D: Community Values and Experiences at Allouez Bay

Community values and experiences at Allouez Bay

Deanna Erickson, Director, Lake Superior National Estuarine Research Reserve
11/22/21

Allouez Bay is situated alongside the Itasca and Allouez neighborhoods in Superior. Many families have frequent and sometimes multi-generational experiences there. To better understand relationships with the Bay and inform thoughtful conservation planning that supports these relationships, the Lake Superior National Estuarine Research Reserve conducted a series of informal input sessions for community members.

Method of gathering community input

To collect personal input in an informal setting, the Reserve Director created a poster showing maps of Allouez Bay past and present (*Figure 1)* and set up a table at the following events:

- A Wisconsin Point bird walk hosted by the Friends of the Lake Superior Reserve, June 1, 2021
- Lake Superior Day Celebration on Barkers Island, July 18, 2021
- The Osaugie Family reunion on Wisconsin Point (*The Osaugie family members descend from Chief Joseph Osaugie, a signatory of the 1854 Treaty. The family lived at Wisconsin Point until they were forcibly removed in 1918),* August 7, 2021
- Lake Superior Elementary School parent teacher conferences on two separate evenings. *(Lake Superior Elementary serves the Itasca and Allouez neighborhoods),* October 26 & 28, 2021

While interviews were structured as informal conversations, the questions that guided each discussion were:

1. What do you remember about Allouez Bay in the past? What changes have you observed over time?
2. What do you do here or what have you done here? What might you like to do here that you don't do now?
3. What do you hope Allouez Bay is like in the future?

The Reserve Director had conversations with 34 community members over a four-month period in summer and fall 2021. This number does not include several very brief conversations where no substantial input was provided. Additionally, the director spoke with City Councilor Jenny Van Sickle, who represents the district, in a separate phone call. Conversations were not recorded but were transcribed in notes following each conversation.

Themes emerged from an author review of the notes and were distilled based on the overall frequency and depth/length of comments, as well as reflections from the length and specificity of conversations with community members. Emerging themes were highlighted and color coded in printed notes, then tallied and synthesized. The themes were reviewed by

two members of the Lake Superior Reserve staff who were not present at the input sessions but read notes from the conversations.

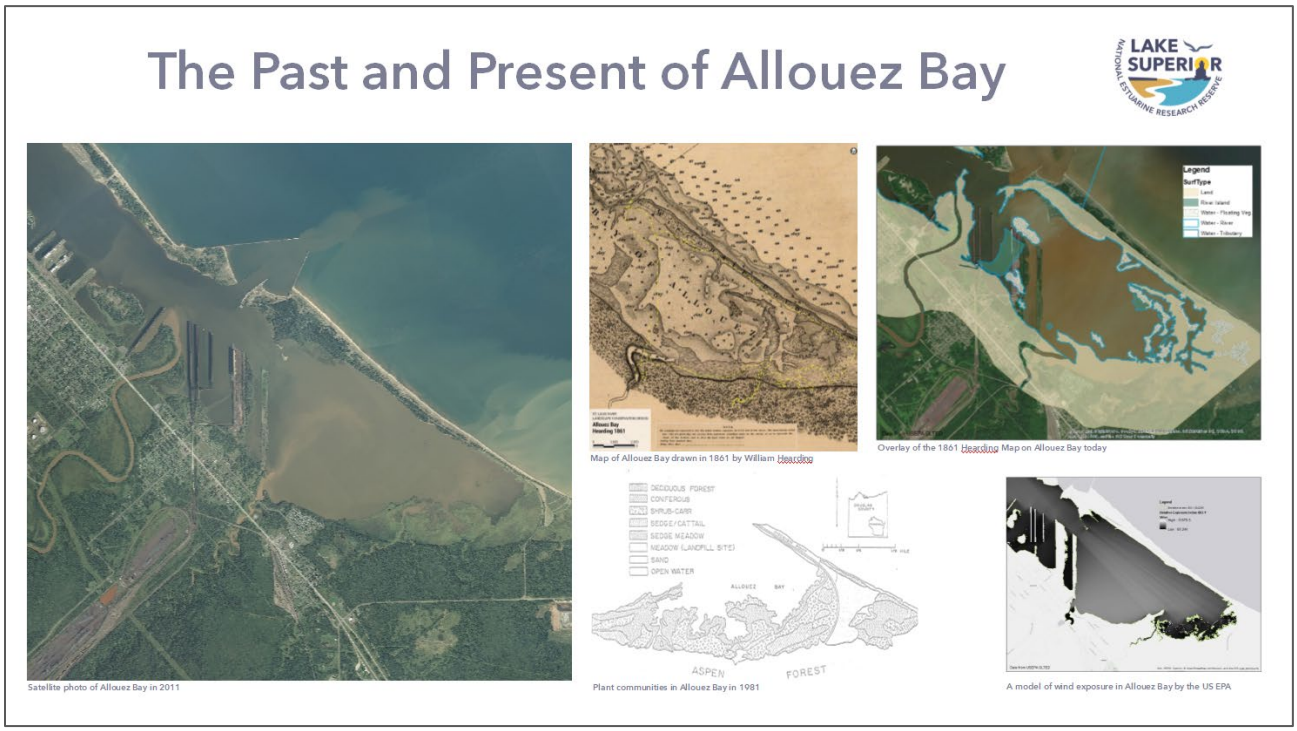


Figure 1 The maps used during Allouez Bay conversations at each event

Themes

1. Community members engage in and value opportunities to hunt, fish, gather and explore along Allouez Bay year-round and are interested in the fish and wildlife habitat provided by Allouez Bay.

Fishing and duck hunting were the most frequently described activities on and near the Bay, followed by paddling activities like canoeing or kayaking. People who described fishing often talked about the best locations to fish, noting that much of the bay is shallow. Walleye fishing in June near the mouth of the bay is popular, but anglers also referenced perch, crappie and northern pike. Ice fishing was referenced and may occasionally conflict with annual ice races that access the ice from the boat launch near the Power Squadron dock. Several people referenced fishing in the

Figure 2. Fishing and hunting activities were described in each of these approximate locations by multiple people. Duck hunting locations were not specifically described.

deeper water (~10 feet) area to the west of the mouth of Bear Creek and two people shared that they believed this deeper area was dredged out during construction of Highway 53. One said that dredged sediment from the bay had been used to construct the bridge over Bluff Creek.

Most access for fishing and duck hunting was from the boat launch at 44th Avenue East. Paddlers also described launching there or from the boat launch on Wisconsin Point. The most often referenced place to paddle was up the mouth of Bear Creek.

One community member talked about bow hunting for deer on land around the bay and shared that he had seen several bear and once, a wolf in the area.

Several people shared that they learned these activities from a parent or grandparent or that they share them with their children or siblings.

2. They have observed some ecological losses or changes through time.

A discussion with members of the Osaugie family who live in Superior illuminated some of the ecological losses that community members have observed at Allouez Bay. One elder talked about a change in duck populations in the bay. He had hunted ducks throughout his life and remembered large populations of ducks throughout the open water season in his youth and then mostly migratory waterfowl coming through in later years. He also reported that his duck blind had been stolen at one point and he had to find a new location. He wasn't sure if duck hunting was allowed in the bay today, a question asked by several people at Lake Superior Elementary as well. He had also gathered plants at Wisconsin Point and Allouez Bay in his youth and said "you can't do that anymore." Another elder remembers wild rice in the bay as a child in the 1950s, as well as "millions of muskrats" that he trapped in a series of small channels (his description of the bay was reminiscent of a dendritic form of estuary). He was concerned about lead shot being used in the bay that may still be in the sediment and shared a story from his grandfather of boats with "cannons" on the front being used to hunt large numbers of ducks during migration, likely before the Migratory Bird Treaty Act was passed in 1918.

Members of the birding group described similar loss of habitat and bird populations at Allouez Bay. An older woman who had birded there for many years remembered mud flats being in the bay, saying that birds need places to rest and that constructed mud flats would need to be resilient to changing water levels. A birder also shared that the closed demolition dump at the base of Wisconsin Point may have been a seiche fen before it was constructed in the 1950s.

The demolition dump site and the active Superior landfill were both discussed by several people. Concerns expressed about the closed dump included the proximity to Lake Superior, concern about the quality or contamination in the sediment from Howards Pocket being used to cap the site and concern about leachate. A construction/demolition worker at Lake Superior Elementary shared that he had dumped material at the site before the dump was closed in the 1980s and remembered liquid bubbling up to the surface. Another reported unverified accounts of barrels with unknown content from the oil refinery being

deposited there. Regarding the modern landfill, a hunter reported that plastic blowing off the site litters the nearby woods and impacts wildlife.

Other changes associated with possible climate or water level impacts were noted by two people who also fish in the Bay; an increase in submerged aquatic vegetation in shallow areas over the last five years and an increase in clay and turbidity in the water.

3. Most access to Allouez Bay from neighborhoods is unimproved, informal or difficult. In most cases, improved access is desired.

One of the most common responses to questions about Allouez Bay was a lack of experience with the bay. Frequent comments along the lines of "We've never been out there", "It's a long drive out there" or "It's really hard to get down there from our house" or "There's no easy way to get there." illustrate a perceived and actual lack of formal access from the neighborhoods adjacent to the Bay. A few people said that you needed a boat to get to Allouez Bay.

Several people talked about access that had formerly existed along the retired grain dock known as the Power Squadron dock (for the boat club that has a private launch there). People reported they "used to walk their dogs out there", watch birds and a "little park". However, private property at the base of the dock seems to have reduced or eliminated access to this waterfront area at the end of 44th Ave. E in Itasca.

Existing access was primarily from the boat launch at the base of the Power Squadron dock, Loons Foot landing or boat launch at Wisconsin Point. People had positive reflections on the improvements at Wisconsin Point, especially the availability of parking. Many people also reported positive experiences on the relatively new Bear Creek Trail and appreciated the new view of the bay, though one person who enjoyed "tromping" around near the bay with his children reflected that the trail brought a loss of solitude.

Aside from the boat launches, reported access to the Bay seemed to be mostly informal, such as small trails through the woods or crossing private land to access waterfront areas and the woods surrounding Bear Creek.

When asked about hopes for the future, a frequent response was improved access to the area as well as interest in maintaining the natural and undeveloped state of Allouez Bay.

4. Community members value the beauty and undeveloped nature of Allouez Bay and wish to see it preserved or restored.

While no one shared memories of harvesting wild rice on Allouez Bay, many people expressed support for the restoration of wild rice in the Bay, especially because wild rice is a food source for ducks. A couple people who said they were Ojibwe band members were interested in the opportunity to take children ricing closer to home in the future.

People expressed support for both maintaining natural habitat and restoring wetlands. Several explicitly mentioned that they did not want to see buildings constructed along the bay and said "Keep it like it is." or "Keep it natural for birds and animals." Notably, those who discussed fishing experiences in the bay did not express concern about wetland restoration

when it was described using the map, perhaps because the wetland areas at the back of the bay was not described as a frequent fishing location.

In many discussions, community members talked about the beauty of the area and the uniqueness of Lake Superior. One person especially appreciated the wetlands that connect the bay to Lake Superior, saying it was very pretty in the winter when the wetlands froze and you could explore. Another parent at Lake Superior Elementary had a photography business and used both Wisconsin Point and the Bear Creek Trail as a background for family portraits. One person exclaimed "We're so lucky to have this kind of stuff here!"

Conclusion: A need for increased community outreach

Throughout the discussions, many community members who had multi-generational experiences or personal knowledge of Allouez Bay expressed a sense of ownership over the area. They were interested in restoration projects, water quality and the capping of the closed demolition dump. Their many eager questions also gave a sense that they had not had readily available access to information or prior opportunities to ask questions about the area near their homes, especially in the input sessions at Lake Superior Elementary. As the landscape design process moves forward, it will be important to provide informational opportunities and seek guidance and input from community members at the neighborhood level to refine restoration projects. City Councilor Jenny Van Sickle recommended providing information at common neighborhood gathering locations such as churches and church socials, the popular and historic Belgian Club, and public schools, or soliciting input directly at the 44th Ave E boat launch. With urban neighborhoods so close to the area, knowledge and engagement in the process of conservation can support overall community identity and well-being.