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ST. PIERRE WETLAND STEWARDSHIP PLAN: A MODEL FOR SEAS PROPERTIES PLANNING

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In partnership with The Stewardship Network and Huron River Watershed Council

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seas.umich.edu/research-impact/student-research/masters-projects/st-pierre-wetland-stewardship-plan-model-seas

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EXECUTIVE SUMMARY

St. Pierre Wetland (STPW) is a 130-acre property managed by the University of Michigan's School for Environment and Sustainability (SEAS) on the northern undeveloped shoreline of Bass Lake within Livingston County in Hamburg Township, 14 miles northwest of Ann Arbor. This site was donated to the School of Natural Resources in 1975 by Sam and Angeline St. Pierre for teaching and research. The wetland property is bordered by two housing developments: the Shan-Gri-La Homeowners Association to the east with a canal between the site and the neighborhood, and Bass Ridge Homeowners Association to the northwest. In addition to these neighbors, the site boasts a variety of interested parties, including the Huron River Watershed Council (HRWC), The Stewardship Network (TSN), Matthaei Botanical Gardens and Nichols Arboretum (MBGNA), other associations in the Huron River Chain of Lakes, and a number of University student organizations.

STPW contains diverse and important ecosystems. In 2017 the Huron River Watershed Council completed an on-site field assessment of STPW, highlighting that the property includes a pristine lake basin fen of very high ecological quality. Subsequent vegetation surveys conducted in 2022-2024 documented a high native plant species richness (94.6% with 105 species) and an adjusted floristic quality index (FQI) of 57.4, categorizing STPW as a floristically important, rare representation of Michigan's native biodiversity and natural landscapes. Fauna surveys in 2024 identified 79 species of birds, herps, and small mammals, including rare, vulnerable, and near threatened species.



Photo by Conor Judge
Tuberous grass-pink



Photo by KT Meono
Female red-winged blackbird

From 1975 to 2022 STPW saw minimal engagement from the University. This neglect contributed to the wetland's degradation, threatening both its ecological and educational value. The proportion of the site dominated by invasive species, especially glossy buckthorn (*Frangula alnus*), has increased over time. Unmitigated vulnerability to nutrient pollution, climate change, and trampling also negatively affect wetland diversity, function, and ecosystem services, and further limit engagement opportunities.

Like other SEAS properties, STPW lacked a site-specific, strategic management plan to guide stewardship or engagement activities. From January 2024 to April 2025, our master's project team built on the momentum of the first STPW master's project (2022-2023) by expanding on-site assessments and restoration work and by meeting the urgent need to create an informed site-specific stewardship plan. In designing this plan, we addressed the unique ecological and operational needs of STPW, while also creating a template for the development of management plans for other SEAS properties, and even for other university-owned natural areas with a research and education mission.

We identified three interdependent visions, each with more specific goals and desired outcomes to guide strategic stewardship, academic, and engagement activities. Our long-term vision for STPW is that it:

1. is a **resilient** ecosystem with characteristic wetland biodiversity and function,
2. provides opportunities for **vibrant research, educational, and stewardship programs** at the University of Michigan, and
3. is part of a **collaborative network that extends beyond the University of Michigan**, enhancing its role within its larger socio-ecological landscape.

To meet this vision for STPW, we conducted the most comprehensive ecological assessment of the site to date, collecting and synthesizing data on site conditions and biodiversity to be able to develop an informed stewardship plan. From our assessment we determined that STPW occurs on glacial outwash and postglacial alluvium with hydric soils typical of wetlands. It is hydrologically connected to the Hay creekshed within the Huron River watershed. Historically STPW was a shrub swamp with emergent marsh. Currently, the property contains six unique natural community types: southern wet meadow, prairie fen, southern hardwood swamp, southern shrubb-carr, emergent marsh, and submergent marsh. Key threats to these communities include:

- Invasive plant species
- Tampling due to the lack of a functional boardwalk
- Wetland protection policy change
- Development and pollution
- Climate change

We also determined that STPW supports *at least* 111 plant, 76 bird, 9 herp, and 4 mammal species. Notable species include pitcher plant (*Sarracenia purpurea*), grass of

parnassus (*Parnassia glauca*), spotted turtle (*Clemmys guttata*), northern shrike (*Lanius borealis*), and Wilson's snipe (*Gallinago delicata*).

STPW has the potential to be a resilient ecosystem with characteristic wetland biodiversity and function while supporting collaborative opportunities for research, education, and stewardship programs extending beyond UM. Based on our assessment of site context, history and ecology, this site-specific stewardship plan identifies and lays out the details and implementation of three strategic priorities:

1. **Adaptive Management:** Implement adaptive management to restore and maintain site ecological and educational value, including:
    a. Utilize and update a prioritized management units map to guide on-site stewardship efforts.
    b. Continue native plant restoration primarily through invasive species management using a three-tiered approach, from small-scale experimental removal, to community-driven workdays, to larger-scale contract work.
    c. Develop priorities for wildlife management based on known key species present and their landscape-level conservation.
    d. Reduce nutrient and sediment loading into the wetland through the collaborative installation of rain gardens or other green infrastructure in neighboring residential areas.



Photo by Molly Russell
Gwynne Powell and Emily Schultheis cut buckthorn



Photo by Jamie Brackman
Buckthorn regrowth in bagged treatment plot

2. **Research and Education:** Continue and expand relevant site research and education through faculty and student research and/or formal (course) and informal projects, labs, or field trips. Priorities include:
    a. Expand our knowledge of natural features and site ecology, including studies focused on hydrology, geomorphology, and ecosystem ecology.
    b. Evaluate effectiveness of existing experimental buckthorn removal treatments, as well as effective management approaches for purple loosestrife, cattail, and phragmites, while also exploring additional promising approaches to plant community restoration through studies on weed wrench use, and on the ecological and economic benefits of removed plant waste, including biochar and biofuel production.
    c. Continue and expand site assessments of birds, herps and mammals, including studies on the impact of deer on vegetation.



Photo by Gwynne Powell
Molly Russell and Jason Krick observer sedges



Photo by Sheila Schueller
Professional Stewards Hike, 2024

3. **Capacity Building:** Build capacity and processes to support long-term value, stewardship, research, and education. Critical actions include:
    a. Install *infrastructure* - a boardwalk and boathouse - to improve safety and access, while reducing negative impacts of site use.
    b. Secure *funding* through administrative budget, grants, and/or donor engagement, especially to fund contract-level site management and a staff steward position.
    c. Continue to boost university and external *community engagement* opportunities, building the relationships to implement priority actions and achieve site goals.

In summary, this plan provides a comprehensive management framework to help STPW become an active, vibrant part of academic work at SEAS—a place where students and

researchers can dig in and do meaningful work. Beyond maintaining operations, this plan transforms STPW into a living, learning laboratory and site for meaningful place-based connections. It supports the intent of SEAS properties and the mission of the school as a whole, while also considering the profound impact and value of a diverse, functioning wetland within its broader socio-ecological context.

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Personal Acknowledgements:

Project Advisors:

Sheila Schueller- Project Advisor
Mike Kost- Project Co-Advisor

Clients:

Matthaei Botanical Gardens and Nichols Arboretum (MBGNA)
University of Michigan's School for Environment and Sustainability (SEAS)
Shan-Gri-La Homeowners Association

Partners:

Huron River Watershed Council (HRWC)
The Stewardship Network (TSN)

Key Collaborators:

The Bass Ridge Homeowners Association
Stephen Brown- Past President, Shan-Gri-La Homeowners Association
Brendan O'Neill- Assistant Research Scientist and Lecturer
Sucila Fernandes- Buildings and Facilities Manager, U-M SEAS
Jacqueline Courteau- Volunteer Consultant, NatureWrite LLC
Kate Laramie- Watershed Ecologist, Huron River Watershed Council
Rachel Muelle- Senior Program Manager, The Stewardship Network

Land Acknowledgment:

SEAS acknowledges the University's origins through an 1817 land transfer from the Anishinaabek, the Three Fires People: the Odawa, Ojibwe, and Bodewadmi as well as Meskwahkiasahina (Fox), Peoria, and Wyandot. We further acknowledge that our university stands, like almost all property in the United States, on lands obtained, generally in unconscionable ways, from Indigenous peoples. In addition, our research on environmental science and sustainability has benefited and continues to benefit from access to land originally gained through the exploitation of others. Knowing where we live and work does not change the past, but understanding and acknowledging colonial practices' history, culture, and impacts is an important step towards creating an equitable and sustainable future. This site plan also takes the next step of recommending actions that can be taken to work collaboratively with tribes in a meaningful way at St. Pierre Wetland.



CHAPTER ONE

Plan Background, Development, and Purpose

1. PLAN BACKGROUND, DEVELOPMENT, AND PURPOSE

1.1. Critical context: The mission of the School for Environment and Sustainability

The University of Michigan (UM) has a long history of pioneering environmental education and research. Initially, the focus was on forestry, which then shifted to the management and conservation of all natural resources, and has now expanded to encompass transdisciplinary sustainability (Figure 1.1). The current UM School for Environment and Sustainability (SEAS) offers a variety of graduate and doctoral programs, including a Master of Science with seven specializations including Behavior, Education, and Communication (BEC), Ecosystem Science and Management (ESM), Environmental Policy and Planning (EPP), and Geospatial Data Sciences (GDS). The school also offers a Master of Landscape Architecture, a PhD in Environment and Sustainability, and an undergraduate program (Program in the Environment, also known as PitE). SEAS aims to provide students with the resources and education needed to take on leadership positions in environmental sustainability, as articulated in the SEAS mission statement:

"At the University of Michigan School for Environment and Sustainability (SEAS), we are at the forefront of building a more sustainable and just world for all by transforming the impact of higher education and reimagining the future. We are advancing action through innovation, research, education and engagement in society, and developing leaders who are empowered to halt the climate crisis and create an environmentally sound future for generations to come" (SEAS website, 2024).

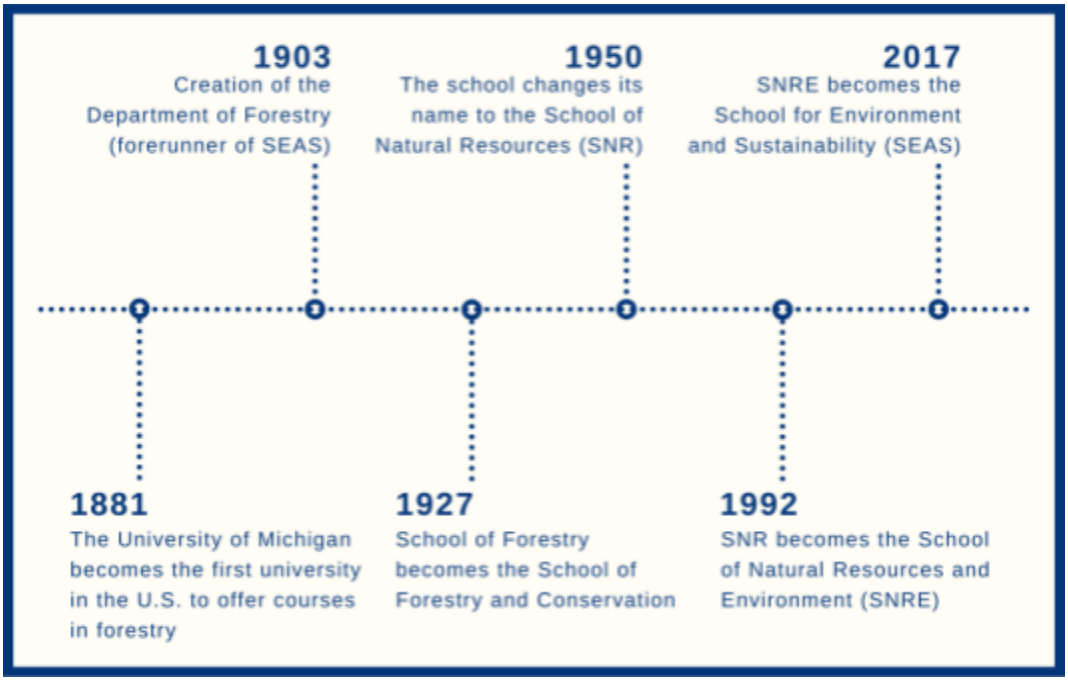


Figure 1.1. A brief timeline summarizing the evolution of the University of Michigan's School for Environment and Sustainability (SEAS) from 1881-2017.

1.2. SEAS field properties

While UM owns numerous properties and approximately 40,000 acres of land, with Ann Arbor's five campuses totaling 3,070 acres alone, SEAS specifically manages 1,800 acres across six properties in Michigan (SEAS Properties Committee Report). These properties were deeded to SEAS over time for the purpose of research and education, and contain a range of unique features including remnant forests and forestry stands, old agricultural fields and prairies, and wetlands and lake basins. The properties vary considerably in size, access, and current use; three of the properties, St. Pierre Wetland (STPW), Newcomb Tract, and Harper Preserve, are not open to the public. The distribution and proximity of the six SEAS properties to other UM properties can be seen below (Figure 1.2a & 1.2b).

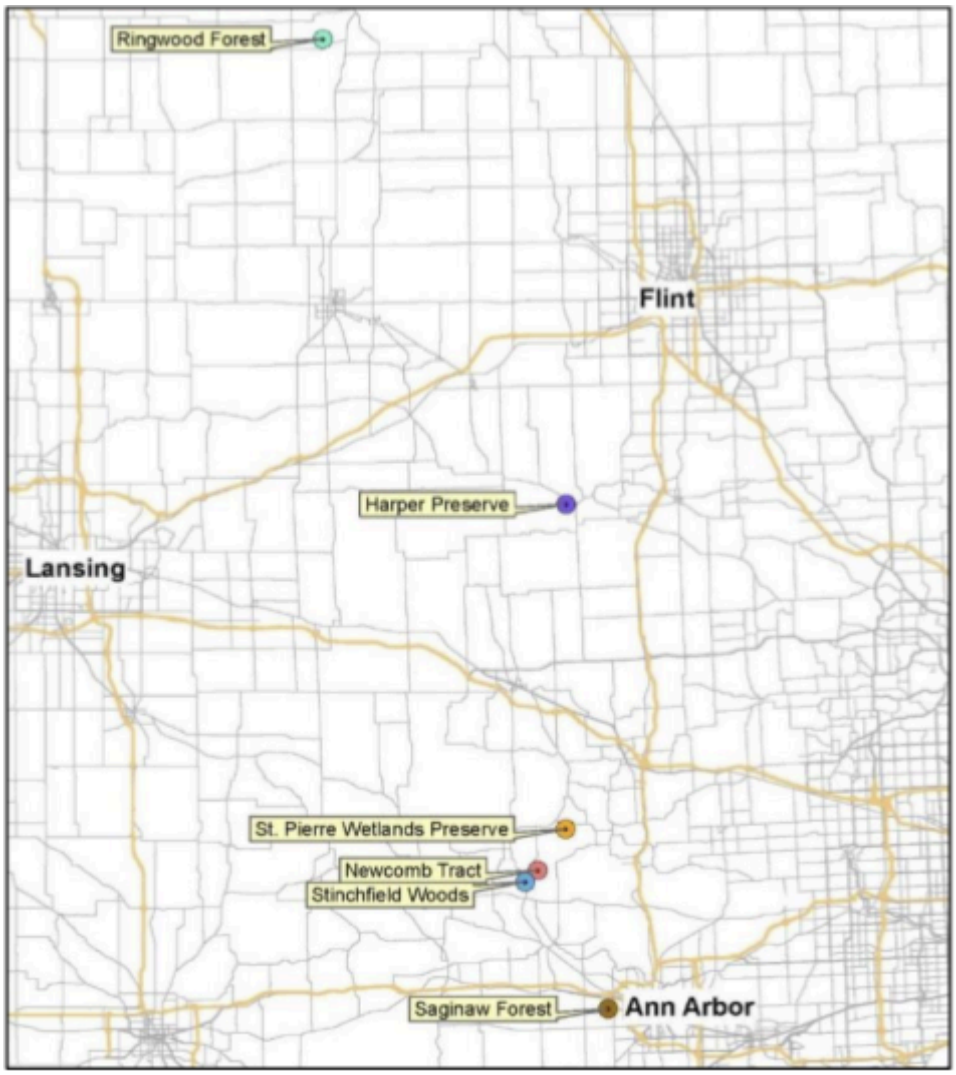


Figure 1.2a. Map showing the six SEAS-owned properties (adapted from DeYoung et al., 2020): Stinchfield Woods, Newcomb Tract, St. Pierre Wetland, Harper Preserve, Ringwood Forest, and Saginaw Forest.

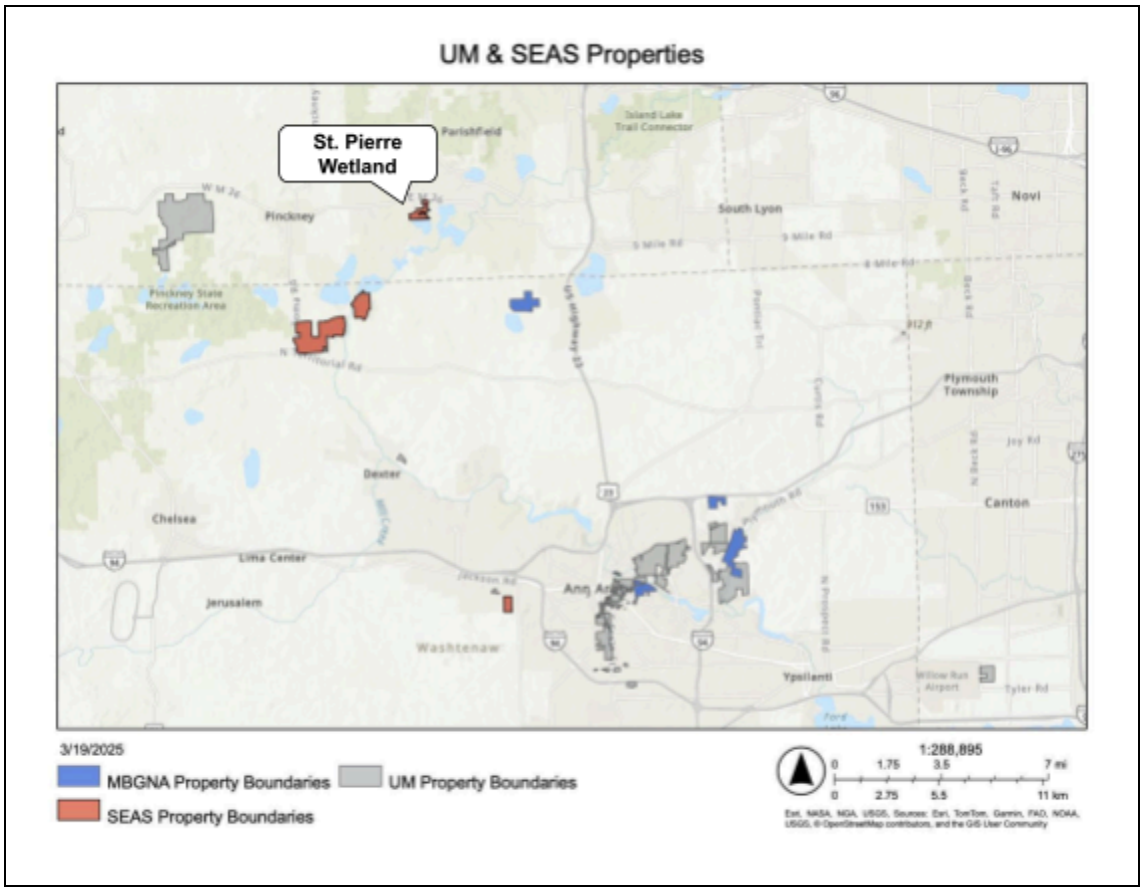


Figure 1.2b. Map showing the size and shape of the four SEAS properties (orange) located closest to Ann Arbor, as well as other UM-owned properties (gray) including Matthaei Botanical Gardens and Nichols Arboretum (blue). St. Pierre Wetland is labeled for reference.

1.3. Efforts to guide the use and management of SEAS properties to date

Over time, the management and use of the diverse properties in the SEAS portfolio have undergone changes. These efforts reflect an ever-evolving commitment to environmental sustainability and education while also adapting to changing concerns, priorities, and goals. As the academic focus generally shifted from silviculture and hands-on ecological research to broader sustainability issues, many of the SEAS-owned properties declined in research and education use. Consequently, site management declined due to reduced investment, including a drop in staffing from two permanent and up to twenty temporary employees in 1965 to only three student caretakers in 1986 (Johnson et al., 1986). Since 2014 the role of the SEAS Buildings and Facilities Manager, Sucila Fernandes, has included managing research access and maintaining infrastructure (i.e. buildings and trails) across all properties with assistance from a few part-time student caretakers. In 2024, through funding from the Provost, a SEAS research scientist and lecturer, Dr. Brendan O'Neill, took on a new part-time role to assist in SEAS properties management, with a primary goal to "bring more research and

teaching onto these preserves, through grant and donor support, increasing student and faculty engagement and building natural and physical infrastructure to support greater use" (Dean Peck email communication, August, 2024).

The shift toward increasing investment for the properties, while still operating on a very constrained budget, highlights the need and opportunity to take a more strategic approach to their management. However, to date no SEAS property has a *site-specific strategic management plan* to guide activities on that site, and many threats to their ecological and educational value are unmitigated. We met this need by developing an informed and adaptive plan for St. Pierre Wetland that could serve as a template for other SEAS properties.

1.4. Development and purpose of this plan

This site management plan for St. Pierre Wetland was developed by a team of SEAS masters students as part of a multidisciplinary master's project. Six students - Alex Hamilton (ESM, GDS) Jason Krick (BEC, ESM), KT Meono (ESM), Gwynne Powell (ESM), Emily Schultheis (ESM), and Molly Russell (EPP, ESM, Public Policy) - worked in collaboration with the Shan-Gri-La Homeowners Association, Matthaei Botanical Gardens and Nichols Arboretum (MBGNA), The Stewardship Network (TSN), and the Huron River Watershed Council (HRWC), from January 2024 to April 2025 within the Conservation and Restoration Master's Project Theme course led by Dr. Sheila Schueller. It was informed by foundational work that had already been accomplished to understand the SEAS properties generally, and STPW in particular (Figure 1.3), each of which will be discussed in more detail in this plan. The student team visited the site over 40 times in 2024, collecting hours of on-site knowledge, and conducting many engagement activities with internal and external interested parties.

The purpose of this plan is to inform activities on site for the next 10 years, and provide a process for evaluation and adaptive management within that time period and for the next 10-year plan. The intended audience is especially those who will lead efforts on site (SEAS properties staff and key faculty), but also anyone who might research, teach, learn, steward, and/or connect to the site, including: future masters project teams, stewardship-based classes, faculty and student researchers, interested organizations within the University and beyond, authors of other management plans, and more.

While this plan meets the unique ecological and operational needs of STPW, it can serve as a template for the development of management plans for other University-owned natural areas with a research and education mission.The plan outlines how research and education can include implementation of adaptive management activities– restoration of native plant communities, engagement of external partners, and regular ecological assessments– to contribute to the long-term ecological well-being of the wetland, ensuring that the site continues to serve as a valuable educational and research resource. In sum, this plan creates a management framework and roadmap to

help STPW become an active, vibrant part of the academic work at SEAS– a place where students and researchers can dig in and do meaningful work. Beyond maintaining operations, this plan transforms STPW into a living, learning laboratory and site for meaningful place-based connections. It supports the intent of SEAS properties and the mission of the school as a whole, as well as the goals of more recent of Resilient Grounds efforts to steward all of UM properties, while also considering the profound impact and value of a functioning and diverse wetland within its larger socio-ecological context.



Figure 1.3. Key previous work that served as the foundation for developing a site management plan for St. Pierre Wetland. (Linked Canva version allows UM users to click to each resource).

1.5. Literature cited

Johnson, R., McManus, P., Murray, C., Sturtz, E., & Supers, S. (1986). *Management planning for a fragmented property* [University of Michigan]. https://deepblue.lib.umich.edu/handle/2027.42/114676



Photo by KT Meono
Overlooking Bass Lake

CHAPTER TWO

Site Context and History

2. SITE CONTEXT AND HISTORY

2.1. Current setting

St. Pierre Wetland (STPW) is a 130-acre wetland property managed by the School for Environment and Sustainability (SEAS). The site occurs on the northern undeveloped shoreline of Bass Lake in Hamburg Township in Livingston County, 14 miles northwest of Ann Arbor, MIchigan (Figure 2.1). The property remains undeveloped and is not open to the public. Two housing developments border STPW: the Shan-Gri-La Homeowners Association to the east with a canal between the site and the neighborhood, and Bass Ridge Homeowners Association to the northwest. Part of the northern end of the property borders a popular biking and walking trail, the Lakelands Trail State Park, which offers open views of St. Pierre Wetland. The landscape surrounding Bass Lake has additional wetlands and waterways, and includes the Huron River Chain of Lakes, a series of nine connected lakes along the main branch of the Huron River.



Figure 2.1 Distance to St. Pierre Wetland from U-M Central Campus in Ann Arbor (left). St. Pierre Wetland property boundary (right).

In order to comprehensively inform the vision and goals for STPW and approaches for its long-term use and stewardship, this chapter provides an overview of the history of human engagement with the site by UM and others. This history provides background and detail about the site's boundaries, access, and relationships with neighbors and other interested parties and contributes important insight into the factors that shaped and continue to influence the natural communities at STPW. We also document historical underutilization of the site for research and education, and how that relates to all SEAS properties, and the role of other entities in spurring the current increased activities on the wetland, leading to the development of this site's strategic stewardship plan.



The St. Pierre Wetland: A Timeline

45 Years of Minimal U of M Activity

1800s

Several **Indigenous tribes** inhabit the land around the St. Pierre wetland. European settlers colonize the area and forcibly remove Indigenous people. The U.S. government sells the land containing the wetland in 1837 for the first time.



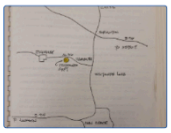
1950s - 1960s

Sam and Angeline St. Pierre acquire the property adjacent to the northern shore of Bass Lake. They drain the eastern wetlands to begin developing a **Florida-style community** that they name Shan-gri-la.



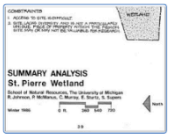
1975

Sam's death in 1961 and the Clean Water Act of 1972 limits further development of the wetland. Angeline **donates the remaining 130 acres of wetland to U of M** to be managed for education and research. SNR Properties Board memo in 1978 recognizes the site's usefulness for field research, but also for "citizen nature study."



1986

A U of M master's project team evaluates all 6 SEAS properties, stating that the St. Pierre wetland "**lacks diversity**" and "**may not be valuable for research**."



1996

Farmland along the northwest side of the St. Pierre Wetland is converted into the **Bass Ridge housing development**, most likely increasing nutrient runoff from turf grass lawns maintenance.



2017

The Huron River Watershed Council conducts an assessment of St. Pierre and classifies it as one of the **top ten wetlands** in the Huron River watershed. The wetland contains a fen, a unique and endangered ecosystem known for biodiversity.



2020

Another U of M master's project team evaluates all 6 SEAS properties to lay the groundwork for site management and stewardship. The team finds that **St. Pierre sequesters more carbon than Stinchfield Woods, a forested site six times larger** than the wetland. They recommend that a capstone team be assigned specifically to St. Pierre.



2022 - 2025

The **first St. Pierre master's project team (2022-23)** establishes site access, begins experimental buckthorn removal methods, and initiates community engagement with the area neighbors. The **second St. Pierre master's project team (2024-25)** continues work on this mega master's project. They create a comprehensive site stewardship plan, conduct an ecological site assessment, continue buckthorn removal research, and build on community engagement work. Site visits and activity dramatically increase. 2025 marks the **50th anniversary of the donation of the site to U of M.**



SEAS SCHOOL FOR ENVIRONMENT AND SUSTAINABILITY
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Figure 2.2. St. Pierre timeline from 1800s through present day.

2.2. Pre-colonial Indigenous inhabitation and post-treaty ownership history (1800's - 1950's)

Indigenous peoples occupied the area in and around the STPW for thousands of years, mostly likely from the period of glacial recession through the early 1800's when the US government either forcibly removed native people from Michigan, or attempted to forcibly assimilate them into the colonial culture. Rather than attempt to provide a complete pre-colonial history of the area, we offer a brief historical overview, a summary of some local Indigenous resources, and a glimpse of the ownership history from the period of Michigan's statehood in 1837 through the 1950's.

During the 1700's and early 1800's, several Indigenous tribes inhabited the area currently known as the STPW (see Figure 2.3). Southeast Michigan served as the crossroads for no less than eight tribes, including: the Meškwahki-aša-hina (Fox) to the south of STPW; the oΘaakiiwaki-hina-ki (Sauk) to the north; the Odawa to the northwest; and the Bodwéwadmi (Potawatomi), the Mississauga, the Wyandot, the Peoria, and the Anishinabewaki (ᐊᓂᔑᓇᐯᒡᐊᐱ), who all inhabited the lands in and around Washtenaw and Livingston counties (Native-land.ca, 2024). The three main Anishinaabe nations in Michigan collectively form The Council of The Three Fires and include the Ojibwe (Chippewa), the Odawa (Ottawa), and the Bodewadomi (Potawatomi; Ransom, 2025). The Anishinaabek people spoke a similar dialect of Algonquin, and their clan-based governance structures were similar, both of which allowed them to maintain an alliance during both peaceful and turbulent periods (Harrison, 2021).

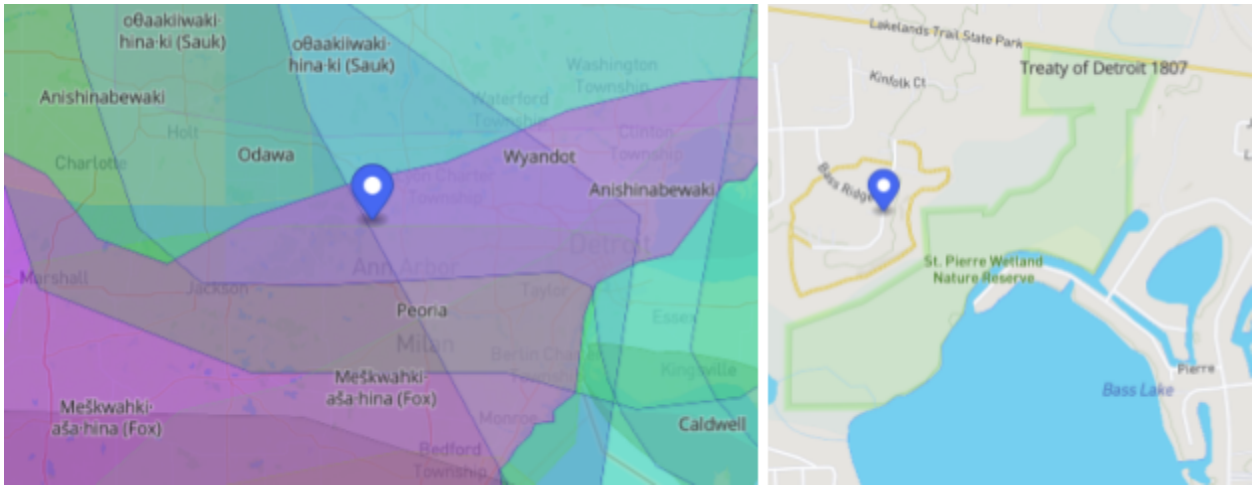


Figure 2.3. (left) Map illustrating various Indigenous inhabitation of the area surrounding STPW, and (right) map showing the STPW as part of the 1807 Treaty of Detroit (Native-Land.ca, 2025).

The University of Michigan Library provides multiple online and physical resources about Indigenous peoples and their history in the state. The main UM library maintains the Indigenous Peoples of Michigan Research Guide with resources that include: a land acknowledgement that references the 1817 Foot of the Rapids (Fort Meigs) Treaty where seven tribes made a

substantial land transfer to UM; links to federally and state recognized tribes; tribal colleges, libraries, cultural centers, and museums; information about Indian boarding schools; and other Indigenous resources. In addition, the UM Bentley Historical Library maintains a collection of Dr. Walter B. Hinsdale's papers and site files from 1893 - 1942. Hinsdale, a physician-turned-curator of the University of Michigan Museum of Archaeology (now Anthropology), conducted extensive research on the Indigenous inhabitants of Michigan. Through his fieldwork, documentation, and publications, Hinsdale established foundational Western scientific research on Indigenous peoples in Michigan that scholars still use today. In his *Archaeological Atlas of Michigan*, he mapped Indigenous trails, villages, structures, mounds, and gardens around the entire state of Michigan (Hinsdale, 1931). He noted Indigenous villages at the southern ends of both Strawberry and Base Line Lakes, both of which occur along the Huron River in Livingston county and are very close to STPW (see inset in Figure 2.4). Given the landscape context, including proximity to the Huron River and the historical oak barrens and mixed oak forests (see section 4.1.2 Landcover circa 1800), Indigenous tribes probably managed this area to produce both food and resources.



Figure 2.4. Map illustrating Indigenous trails, villages, structures, mounds, and gardens in southeastern Michigan (Hinsdale, 1931).

More recently in 2021, the Hamburg Township Historical Museum commissioned their intern Ian Harrison, a PhD candidate in public history at NC State University, to begin researching the Indigenous history of their township. The Historical Museum wanted to fill a gap in the availability of Indigenous history at the local level, which did not exist despite the amount of research at the state and regional levels. Harrison produced a paper and conducted a complementary presentation over Zoom to share his findings. (We recommend reading and viewing both since they contain slightly different and important information.) In his presentation, he provided a regional map (see Figure 2.5) to illustrate the various tribes who inhabited the present-day northeastern US and Canada in the mid-1700's. During this time, the tribes of the Council of the Three Fires inhabited both the lower and upper Michigan peninsulas.



Figure 2.5. Indigenous trade in the northeastern US & Canada circa 1760's (MSU, 2025).

Beginning in the late 1700's and continuing into the 1800's, the newly formed United States government began negotiating treaties with the Indigenous peoples of Michigan. The land comprising the current STPW fell under the 1807 Treaty of Detroit, which effectively ceded most of southeast Michigan to the US from the Ottawa, Chippewa, Wyandot, and Potawatomi peoples for meager amounts of money and resources (Treaty of Detroit, 1807). Both the Clark Historical Library at Central Michigan University and the Oklahoma State University library maintain records on all of the treaties that cover Michigan during the 1800's.

Shortly after these treaties were approved, people eager to explore the Michigan territory

began commissioning maps of the area to survey the land with plans to divide and sell it to American settlers. The University of Michigan Clark Map Library maintains an extensive physical and digital collection of original maps, especially of the southern Michigan area. Librarians Tim Utter and Allison Nicley helped locate several Michigan maps that were completed in the 1800's, all of which displayed Bass Lake as a landmark.

While Michigan became a state in 1837, colonial settlers began to arrive in Livingston county in 1831 (Harrison, 2021). Examination of the Hamburg Township records of the Livingston County Register of Deeds reveals that the United States government began selling land to private individuals in 1837 (see Figure 2.6). The tract books record each subsequent land sale by quarter section (40 acres) through the 1980's when the county digitized the tract books. The county also maintains digitized and physical records of the deeds that correspond with each tract book entry. These records confirm that Sam and Angeline St. Pierre purchased the land that now comprises the STPW and the Shan-gri-la HOA in 1954 and 1956 (see Figure 2.5 below).

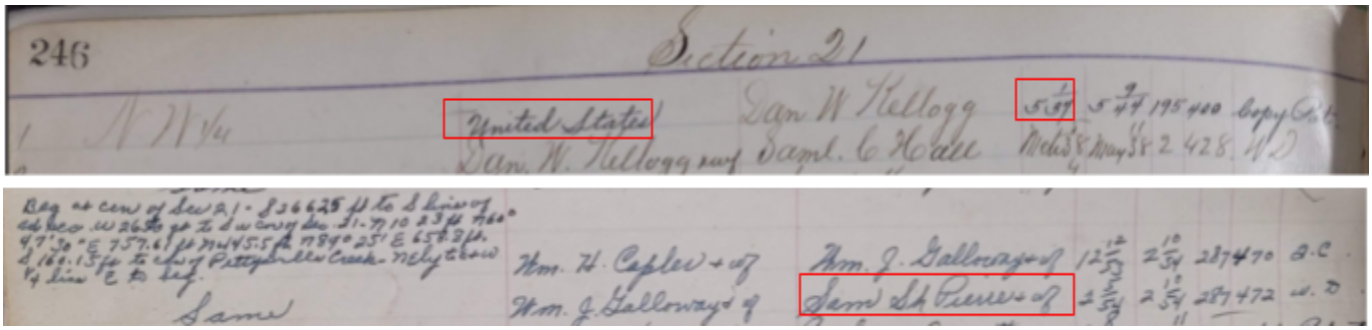


Figure 2.6. Hamburg Township tract book showing recorded sale of land in Section 21 from the United States to Dan W. Kellogg on 1 May 1837 (top) and one of the St. Pierre's purchases on 5 February 1954 (bottom).

2.3. St. Pierre land purchases, residential development & donation to UM (1950's - 1975)

In the 1950's, Sam and Angeline St. Pierre began acquiring land around Bass Lake in Hamburg Township, Michigan. Wetlands comprised much of the property on which the St. Pierre's envisioned developing a Florida-style community situated around a network of canals (Colville et al., 2023). As a result, a canal was cut through an existing wetland, and the eastern wetlands adjacent to Bass Lake (Figure 2.7) were drained and filled to construct the Shangri-la Homeowners Association in the late 1950s and early 1960s (Figure 2.8). The aerial image from 1949 in Figure 2.7 illustrates the eastern and western wetlands, both of which were undeveloped at the time. The aerial image from 1966 in Figure 2.8 illustrates the newly developed Shan-gri-la HOA dramatically altered the wetland landscape.

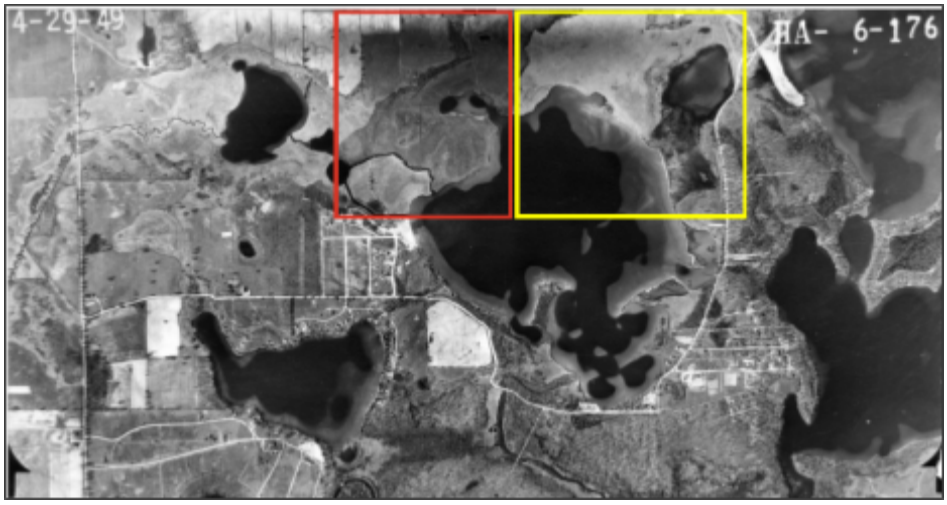


Figure 2.7. DTE historical aerial photo from 29 April 1949 showing western wetlands (red) that become STPW and eastern wetlands (yellow) that were drained and developed into the Shan-gri-la HOA (Wayne State University, 2025).



Figure 2.8. Aerial photo from 1966, showing Shan-gri-la HOA (Livingston County, 2025).

Sam St. Pierre died on December 27, 1961, which paused the HOA construction due to a property inheritance dispute which continued until 1968 and was ultimately decided by the Michigan Supreme Court (*St. Pierre v. Estate of St. Pierre*, 1968). The Clean Water Act of 1972, which banned the draining of wetlands, permanently halted the development of the western wetlands of the St. Pierre's family property (U.S. Congress, 1972). Angeline St. Pierre, then a University of Michigan Dental school staff member, decided in 1975 to donate the

western wetland to the University “to be used for teaching and research purposes under the direction of the School of Natural Resources (SNR)” (Board of Regents Meeting Records, 1975). Angeline legally conveyed the property known as the “Sam and Angeline St. Pierre Wetland and Preserve” to the University of Michigan on December 17, 1975, by warranty deed. The Regents formally accepted the gift on December 19, 1975, and delegated the wetlands management to the School of Natural Resources (Board of Regents Meeting Records, 1975).

The University owns seven parcels (see Figure 2.9), totaling 131.37 acres, within sections 20 and 21 in Hamburg township. Parcel ID#’s include: 4715-20-400-003, 4715-21-100-018, 4715-21-300-001, 4715-21-300-003, 4715-21-300-004, 4715-21-300-007, and 4715-21-303-015 (Livingston County parcel viewer, 2024).



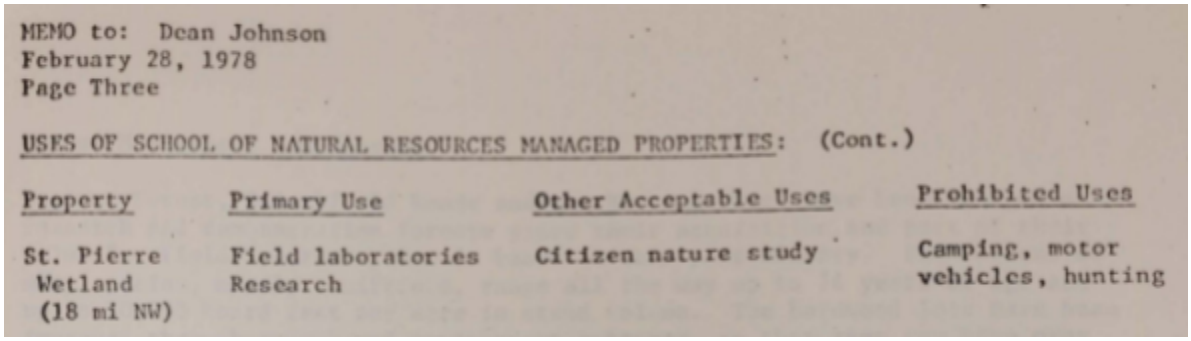
Figure 2.9. Livingston County tax parcel map (2025). Property boundaries highlighted in orange.

2.4. UM early years (1975 – 1986)

Examination of the School of Natural Resource (SNR) property records revealed that very few faculty used STPW for teaching or research over the subsequent 10 years after the St. Pierre's gift. An SNR Properties Board memo from February 28, 1978 emphasized the importance of the school's field properties:

> ***"The importance of having such properties under its control was recognized by the faculty and the Regents from the initial year of our school's formation and it has been reinforced by the many subsequent additions. Today with the increased urbanization of Southeastern Michigan, these established and developed field laboratories are not only essential to the school, but they are assuming additional importance for a variety of public uses."***

The same memo described the primary use of STPW, specifically, as "Field laboratories research" with "*Citizen* nature study" listed as "Other acceptable uses" (see Figure 2.10; SNR Properties Board Memo, 1978). This is notable given STPW's current designation as closed to the public.



MEMO to: Dean Johnson
February 28, 1978
Page Three

USES OF SCHOOL OF NATURAL RESOURCES MANAGED PROPERTIES: (Cont.)

Property	Primary Use	Other Acceptable Uses	Prohibited Uses
St. Pierre Wetland (18 mi NW)	Field laboratories Research	Citizen nature study	Camping, motor vehicles, hunting

Figure 2.10. 1978 SNR Properties Board memo highlighting the uses of the STPW.

In 1986, a master's capstone team considered establishing management plans for all its properties, including STPW. The project embraced a goal of "monetizing resources to increase cash flow" from the SNR properties. The report noted that since 1975, only the Resource Ecology course had used the site and identified site access as a constraint that limited more use. While it is not clear that any field assessment was conducted, they also described the wetland as "lacks diversity" and "not a particularly unique piece of property within the region…may or may not be valuable for research" (Figure 2.11; Johnson, et al., 1986).

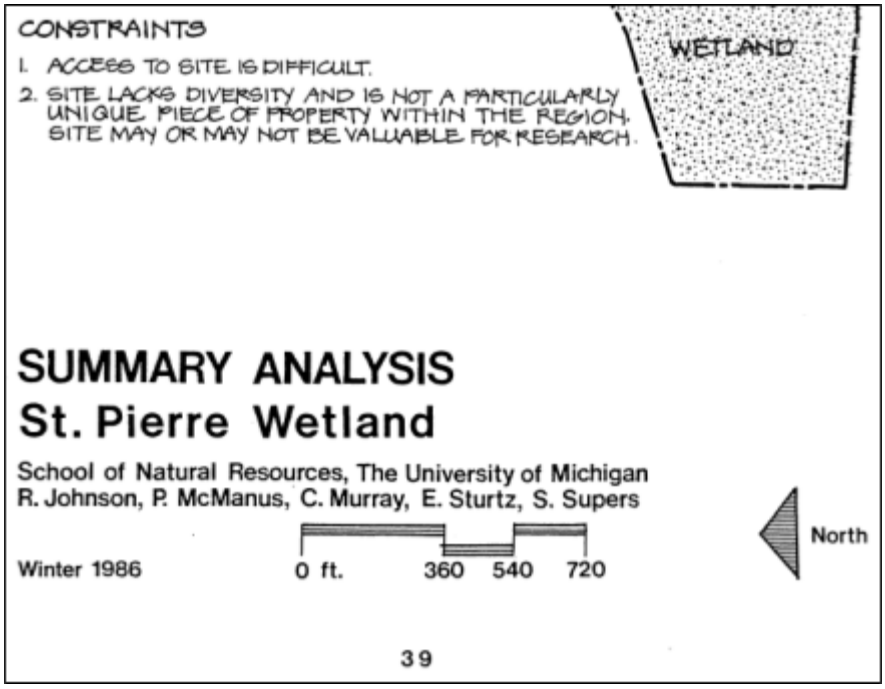


Fig. 2.11 Excerpt from 1986 capstone report highlighting STPW site constraints, the first of which remains true.

The 1986 capstone report suggested short- and long-term strategies under various scenarios for all the SNR properties. Some of these strategies specific to STPW include:

- “Periodically, notify the faculty of research potential on the six properties. Concentrate on informing faculty about those properties least used for research - ***the St. Pierre Wetland***, the Hoyt Property, and Ringwood Forest [emphasis added];
- Improving site access to STPW and suggesting that landscape architecture students create and implement the design; and
- Creating a marketing/promotional package about all six SEAS properties” (Johnson, et al., 1986).

2.5. Quiet UM years but new residential development (1987 – 2017)

While the property remained largely unvisited by UM, a new housing development, Bass Ridge, was constructed in 1996 in what was previously farmland along the northwest side of STPW (Figure 2.12). The housing association property boundaries included a portion of the wetland that was left undeveloped along the STPW property border. This housing development has more typical landscaping of a newer subdivision, with extensive areas of managed turf grass.

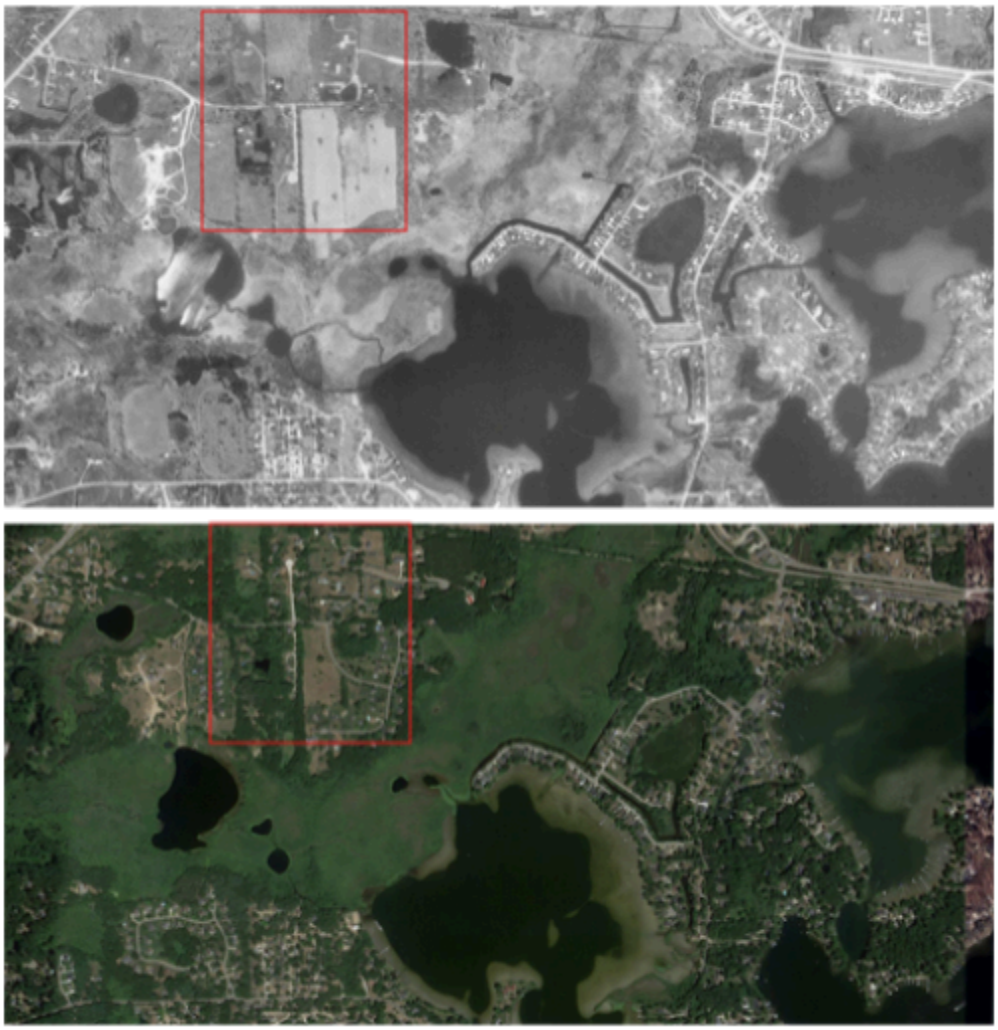


Fig 2.12. St. Pierre wetland area before (top, 1992) and after (bottom, 2023) construction of the Bass Ridge housing development in 1996. Red border highlights Bass Ridge with STPW to the east and southeast (Colville, et al., 2023).

Review of the School for Environment and Sustainability records (Box 70, University of Michigan Bentley Historical Library), covering the period from 1903 – 2012, revealed little to no documented activity at the STPW after the 1986 capstone report through 2012. In 2016, the interim Dean, Dan Brown, commissioned the SNRE properties committee to:

- “Prepare a vision for our field properties in the new school (SEAS),
- Engage faculty to find out what they know about our collection of properties,
- Record what we currently do with each property, which sites have high current value and future potential use, and which sites have low to no current value or potential for future use, and
- Rank the value of each of our properties” (SEAS Property Committee Report, 2017).

In 2017, with the arrival of the new Dean, Jonathan Overpeck, the school renamed itself the School for Environment and Sustainability. Starting in January 2017 a SEAS property committee was formed to produce an extensive report that provided an overview of each property, including the STPW and the results from a faculty research and use survey. Shared with the new Dean in October 2017, the report called for the need to reinvest in all SEAS properties by creating **site-specific management plans**, providing routine maintenance and management, improving transportation availability to each site, improving parking and site access as well as on-site equipment storage, and building partnerships, especially at more remote locations (SEAS Property Committee Report, 2017).

In the summer of 2017, the Huron River Watershed Council (HRWC) conducted a Bioreserve Site Assessment of STPW led by SNR alum Kris Olsson that for the first time shined a spotlight on the ecological importance and rarity of the site. The SEAS facilities manager, Sucila Fernandes, and SEAS faculty Sheila Schueller participated in the assessment. The field assessment, which included two site visits in the summer of 2017, assigned the wetland as being "significantly higher than average score for the field assessment, falling in the 'Top Ten' of all wetlands assessed in the Huron watershed" (HRWC, 2017). The HWRC also noted that the wetland contains a (lake basin) fen, "a unique and endangered wetland type known for its biodiversity" (HRWC, 2017). Their suggestions for maintaining and protecting this property included:

1. Having students and classes use the area for **research and education**;
2. Working with student volunteers on **stewardship** of the area and educating surrounding landowners about the **value** of this site;
3. Educating the surrounding landowners about the **ecological importance** of the wetland (especially the quality of Bass Lake, which has excellent fishing and an active lake association);
4. Working with the surrounding landowners on **stewarding the wetland**;
5. Working with the Lakeland Trail to promote it as a **scenic amenity**.

The report also contained an extensive species inventory organized by grasses/sedges, forbs, shrubs/vines, trees, and invasives which serves as a baseline measurement for tracking the changes in the ecosystem composition over time.

2.6. Revived UM and external interest (2018 – 2025)

The HRWC report, and subsequent on-site walks organized by Kris Olsson that included the SEAS facilities manager, SEAS faculty Sheila Schueller and Bob Grese, as well as neighboring Shangri-la HOA president Stephen Brown and regional interested parties from Hamburg Township and The Stewardship Network, catalyzed a renewed interest in the ecological and pedagogical value of STPW. In 2019, graduate students Rachelle Roake and

Amber Bismack, as part of their class work in Bob Grese's Restoration Ecology course, collaborated to produce a concise restoration plan for STPW. Though it lacked a complete site assessment, their report highlighted the threats to the site, interested parties, restoration goals, a timeline, budget, required permits, and monitoring suggestions. Roake and Bismack's plan also included a detailed commercial removal estimate from Cardno (Stantec), stemming from their interest on the site walks with Kris Olsson. The estimate totaled approximately $60,000 to cut and treat about 90 acres of glossy buckthorn (*Frangula alnus)* on the site (Roake & Bismack, 2019). SEAS took no action due to a lack of budget for property stewardship and a reluctance to act in isolation rather than as part of a strategic site plan.

A year later in 2020, another master's capstone team – advised by Shannon Brines (SEAS lecturer), Robert Grese (SEAS faculty), and Jonathan Overpeck (SEAS faculty and dean) – created a report that outlined a vision for all of the SEAS properties. This report served as the **third attempt since 1986 to suggest that SEAS create site-specific management plans**. The team stated the purpose of the 2020 report:

> *"The diverse array of habitats across the sites and vast networks of local and regional stakeholders present a unique opportunity to reexamine the goals and management plans for these properties, and to further demonstrate the University's commitment to land preservation, sustainable stewardship, and carbon neutrality. With these goals in mind, our team utilized several interdisciplinary research methods during the course of this project, largely consisting of carbon sequestration and storage analyses, remote sensing and GIS, and social research considerations. Over the past year, these approaches were used to arrive at holistic, concrete recommendations for both current and future property uses and considerations, which will lay the groundwork for forthcoming SEAS master's projects at each specific property. Our results point towards a wealth of new management and utilization objectives, including carbon neutrality and pricing, stewardship program initiatives, joint management models with land conservancies, and expanded opportunities for engagement with U-M faculty and students, local and regional institutions and organizations, and the general public" (DeYoung, et al., 2020).*

The team focused on nine goals during their project: developing a land acknowledgment, carbon neutrality, site management tiers, collaborative land management partnerships, stewardship initiatives, property management/funding/staffing, maintaining a single SEAS research database, increasing awareness and engagement, and launching future master's projects.

Two important highlights about STPW came out of the report. First, the team estimated the total amount of carbon stored at each SEAS property and found that **STPW contains the highest value of stored carbon of any SEAS property** - even more than Stinchfield Woods - which is seven times the size of STPW. Second, and more importantly, the team strongly recommended that SEAS create a master's capstone project team focused specifically on community engagement at STPW:

> ***"As the area has high public use and community engagement, this project would provide an excellent opportunity for students to practice communication, education, and outreach activities, such as creating interpretive signage, conducting workshops and focus groups, and leading on-site activities on the ecological and recreational value of wetlands (including invasive species management). Finally, a future team could look to increase accessibility to the underutilized property, as the creation of docks and boat storage could enable year-round access for research, university teaching, and community engagement" (DeYoung, et al., 2020).***

Following the recommendations of the 2020 master's capstone team, SEAS launched another capstone project in 2022 focused specifically on STPW. Despite The Stewardship Network offering to work with SEAS faculty to write grants to help fund the cost of contractors, it was determined that overhead costs meant that student work on site would be the best way for SEAS to contribute. Sheila Schueller advised this capstone team as part of her Conservation and Restoration master's capstone theme course and served as the thread running from the 2017 SEAS properties committee report to the HRWC assessment through the 2022-2023 capstone team's work. The 2023 team worked with their clients, SEAS facilities and Stephen Brown, Shan-gri-la HOA President. Site access served as the most significant hurdle for this team to address and overcome. Access to the STPW has historically been challenging due to its sensitive ecosystem, lack of formal entry points, and surrounding residential development.

However, this team and SEAS staff together made significant progress to improve site access for educational and research purposes. They established an informal agreement (renewed in 2024) with the Bass Ridge HOA president, Max Nettleton, granting SEAS access the wetland through an HOA easement. In addition, this team: 1) increased positive community engagement with the surrounding homeowners; 2) established experimental non-herbicidal treatments of *F. alnus*; and 3) tested LiDAR techniques to remotely sense vegetative cover. They presented their work at the Stewardship Network Conference in January 2023, introducing St. Pierre and its lessons and potential for partnerships to a large community of practitioners (Colville, et al., 2023).

To continue monitoring on site during the 2023 summer and fall without an active master's project on site, Sheila invited SEAS master's student Jamie Brackman to do an Independent Study project to follow up on the experimental buckthorn research that the first capstone team started. He presented his data and findings during a winter lecture to the Huron Valley Chapter of the Michigan Botanical Society, increasing interest in STPW within an active community of botany enthusiasts.

Continuing work on St. Pierre as a "mega-master's project" with Schueller, the second SEAS master's capstone team (current authors) began work in the winter of 2024 with the aim of completing an informed strategic site plan for St. Pierre Wetland. This required: conducting a thorough site assessment, including a detailed flora survey and a continuation of the *F. alnus*

research; beginning a survey of the fauna at the wetland; strategically broadening community engagement to several new parties, including their client Matthaei Botanical Gardens and Nichols Arboretum with co-advisor Michael Kost; and exploring more ways to build capacity for site use and stewardship.

The year 2025 marks the 50th anniversary of the donation of this site to the School. While its history after indigenous tribes has lacked extensive intentional stewardship, there is a growing interest in the site from UM faculty, staff, and students, as well as neighbors, regional partners, and others. Tapping into this interest is critical as the surrounding land use change has influenced the function and biodiversity of the original wetland.

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Photo by KT Meono
Purple loosestrife

CHAPTER THREE

Vision and Goals for St. Pierre Wetland

3. VISION AND GOALS FOR ST. PIERRE WETLAND

The St. Pierre Wetland (STPW) property has been the subject of multiple reports and projects over the last decade, yet STPW and the other School for Environment and Sustainability (SEAS) properties lack actionable stewardship plans with site-specific visions and goals to inform the future, threatening the future value of the properties. Therefore, we have provided three specific and interdependent vision statements, each with supporting goals and measures of success that can holistically guide strategic action at STPW. The methods to achieve these, and even the goals themselves, will change with time, but should serve as a foundation for future action on behalf of the site. The socioecological goals outlined in this plan are aligned with the overarching SEAS property visions, such they can serve as a template for dedicated research, engagement, and stewardship programs for all SEAS properties, supported and continued by involving students, university organizations, faculty, staff, and community members from the University of Michigan (UM) and beyond.

3.1. Vision Statement 1: St. Pierre Wetland is a resilient ecosystem with characteristic wetland biodiversity and function.

The wetland's intrinsic ecological value must be protected and the site must maintain its significance as a research and education site. Without supporting the fen's ecological integrity, these uses could be lost. The site can continue to contribute to the academic mission of the University if its high-quality conditions are maintained. Moreover, several SEAS faculty who could potentially use the site for research or education have expressed that the site's appeal *depends* on the maintenance of its biodiversity through removing invasive species.

3.1.1. Goal: Functional hydrology and nutrient dynamics appropriate for a fen are maintained, supporting regional ecosystem services.

Part of the Huron River Watershed, the St. Pierre Wetland is a lake basin prairie fen (HRWC, 2021). Fens are minerotrophic peatlands especially sensitive to changes in hydrology due to their hydric soils, anoxic conditions, and groundwater seepage (Cohen et al., 2020). The ongoing shifts in climate and land use are causing the water tables in fens to drop, leading to increased oxygen availability that alters microbial respiration and plant species composition (Rupp et al., 2012; Villa and Bernal, 2018). Increasing aerobic microbial activity leads to more rapid organic matter decomposition, changes in carbon dioxide and methane cycling; this can undermine climate mitigation benefits of fens by reducing their carbon sequestration or increasing rates of methane production (Duval & Radu, 2012; Mitsch & Mander, 2018). The presence of invasives like *Frangula alnus* also alter fen function and structure by decreasing the number of vegetative hummocks and increasing the total nitrogen and organic matter of the soil in prairie fens, changing the pH, nutrient composition, and physical structure, all of which facilitate its characteristic high plant species diversity (Cohen et al., 2020; Fielder & Landis 2012). A functioning

fen requires stewardship to protect from the effects of climate change and invasive species.

3.1.2. Goal: Critical and distinct habitats that support native biodiversity, including unique and listed species, are maintained.

STPW is the only remaining undeveloped shoreline of Bass Lake and provides habitat for many forms of wildlife. Wetlands support 59 state and federally-listed species (23 plants, 11 animals, 25 insects) (MI DNR, 2025), including the Spotted Turtle (*Clemmys guttata*) and the federally threatened Eastern Massasauga Rattlesnake (*Sistrurus catenatus*). Both of these species are found in prairie fens, emphasizing the importance of maintaining STPW and its diversity of habitats.

3.2. Vision Statement 2: St. Pierre Wetland provides opportunities for vibrant research, educational, and stewardship programs at the University of Michigan.

3.2.1. Goal: Faculty, staff, and students are aware of the opportunities presented by the property.

If STPW is to become a recognized research site with numerous collaborators, projects, publications, and grants, there first needs to be broad awareness of the site. A previous report suggested one of the major challenges of SEAS properties is this lack of awareness among students, faculty, and staff, and that “St. Pierre Wetland is a vastly underutilized SEAS property” (DeYoung et al., 2020). Beyond properties websites or fact sheets, there need to be activities that build waves of excitement, momentum, and inspiration around the wetland and its potential, facilitating long-term and continuous awareness of the site.

3.2.2. Goal: Opportunities to engage with St. Pierre Wetland are diverse and interdisciplinary.

STPW provides a real-world training ground where students can improve critical hard and soft skills in a variety of fields from wetland restoration to community engagement. Through immersive educational experiences, students are better equipped with the tools needed to be impactful professionals in the environmental field. University of Michigan individuals and groups can utilize the wetland on-site or remotely via class field trips, assignments, and projects; virtual tours; student organization events; research projects; and donor events, continuing to build both the University’s awareness of STPW and the momentum behind its stewardship. On-site opportunities need to balance physical accessibility and ecosystem sensitivity– for example, infrastructure such as boardwalks allow for easier physical access to view the wetland while minimizing human disturbance to local plant communities.

3.2.3. Goal: SEAS and the University of Michigan garner and provide resources for managing St. Pierre Wetland.

In support of other goals, SEAS and UM administrations need to actively facilitate the educational and research initiatives at STPW and ensure support for its programs and operations. This could be in the form of research grants to UM faculty or students, but also needs to include long-term administrative funding devoted to stewardship, including hiring site managers and supplying field equipment. Logistical support also includes ensuring that data and other property information is stored centrally and is easily available to educators and researchers. The most critical aspect of this goal is maintaining reliable access to the site to prevent logistical challenges from hindering research, restoration, and educational activities.

3.3. Vision Statement 3: St. Pierre Wetland is part of a collaborative network that extends beyond the University of Michigan, enhancing its role within its larger socio-ecological landscape.

3.3.1. Goal: UM has good relationships with those who neighbor the property and who view the wetland from the Lakeland Trail and Bass Lake

In previous years, UM has not always had good communication channels with the residents of the housing developments that surround the wetland. We aim for the neighbors to have a good relationship with UM and to support and understand the work that is happening, either passively or actively. The wetland's position along the Lakeland trail and Bass Lake also provides an opportunity to reach a broader public audience. In our vision the public appreciates, respects, and understands STPW's unique ecosystem type, role in the watershed, and role in research and education.

3.3.2. Goal: UM is an active collaborator with relevant area and regional partners and practitioners

As a research university and land steward, UM can increase its learning and impact through broader engagement and collaboration with the variety of existing Huron River Chain of Lakes regional partnerships and the numerous external experts, practitioners and organizations relevant to wetland stewardship. In our vision, UM is a collaborator in regional initiatives and there is an understanding of STPW's role within the larger watershed. UM and regional partners work together to share insights and foster a unified approach to watershed stewardship, and activities on site are informed through the active collaboration of a network of experts, conservation organizations, research groups, with select partners providing funding support.

Sample of specific outcomes of achieving the vision of STPW enhancing its role within its larger socio-ecological landscape:

- Bass Lake and Shangri-La neighbors are made **aware** of the work occurring at STPW and **feel empowered** to ask questions and support the work.
- UM and regional partners work together to **share insights and foster a unified approach to watershed stewardship.**
- U-M **consults and collaborates** with tribal parties to conscientiously implement relevant Traditional Indigenous Knowledge and Traditional Ecological Knowledge (TIK & TEK) into STPW's stewardship.
- Activities on site are informed through the **active collaboration** of a network of experts, conservation organizations, and research groups, with select partners providing funding support.

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Photo by KT Meono
Marsh wren on dried cattail stalks

CHAPTER FOUR

Ecological Site Assessment

4. ECOLOGICAL SITE ASSESSMENT

While several previous efforts began the *momentum* of site assessment at St. Pierre Wetland (STPW), a more comprehensive approach to assessing the site is needed to effectively direct future stewardship and engagement with the site. The 2017 Huron River Watershed Council (HRWC) bioserve site assessment identified critical native plant communities on site (HRWC, 2017), and the 2020 SEAS properties vision report estimated the stored carbon on site, bringing to light the potential ecological services and functions that the wetland can provide (DeYoung et al., 2020). The first STPW project team generalized the proportions of grasses and sedges; cattail and phragmites; and glossy buckthorn present at the site (Colville et al., 2023). Here we provide a more complete survey of the geomorphology, natural communities, flora, and fauna, based both on what is already known and our own project team's hours of field surveys and additional research in 2024.

4.1. Glacial landforms and soil

Surficial geology maps confer with the presence of current lakes, and indicate that STPW is located within glacial outwash sand and gravel and postglacial alluvium landforms (Figure 4.1). Other surrounding geologic features include coarse- and medium-textured till end moraines, fine- and medium-textured glacial till, and ice-contact sand and gravel.

The soils within the STPW property boundary are almost entirely Houghton muck, hydric soils in depressions typical of wetlands, but also include areas of Edwards muck, Fox-Boyer complex, Werner's loam, and Bronson loamy sand (Figure 4.2). The surrounding area contains a more diverse matrix of 34 variously well-drained soil types of different textures and, presumably, land use histories.

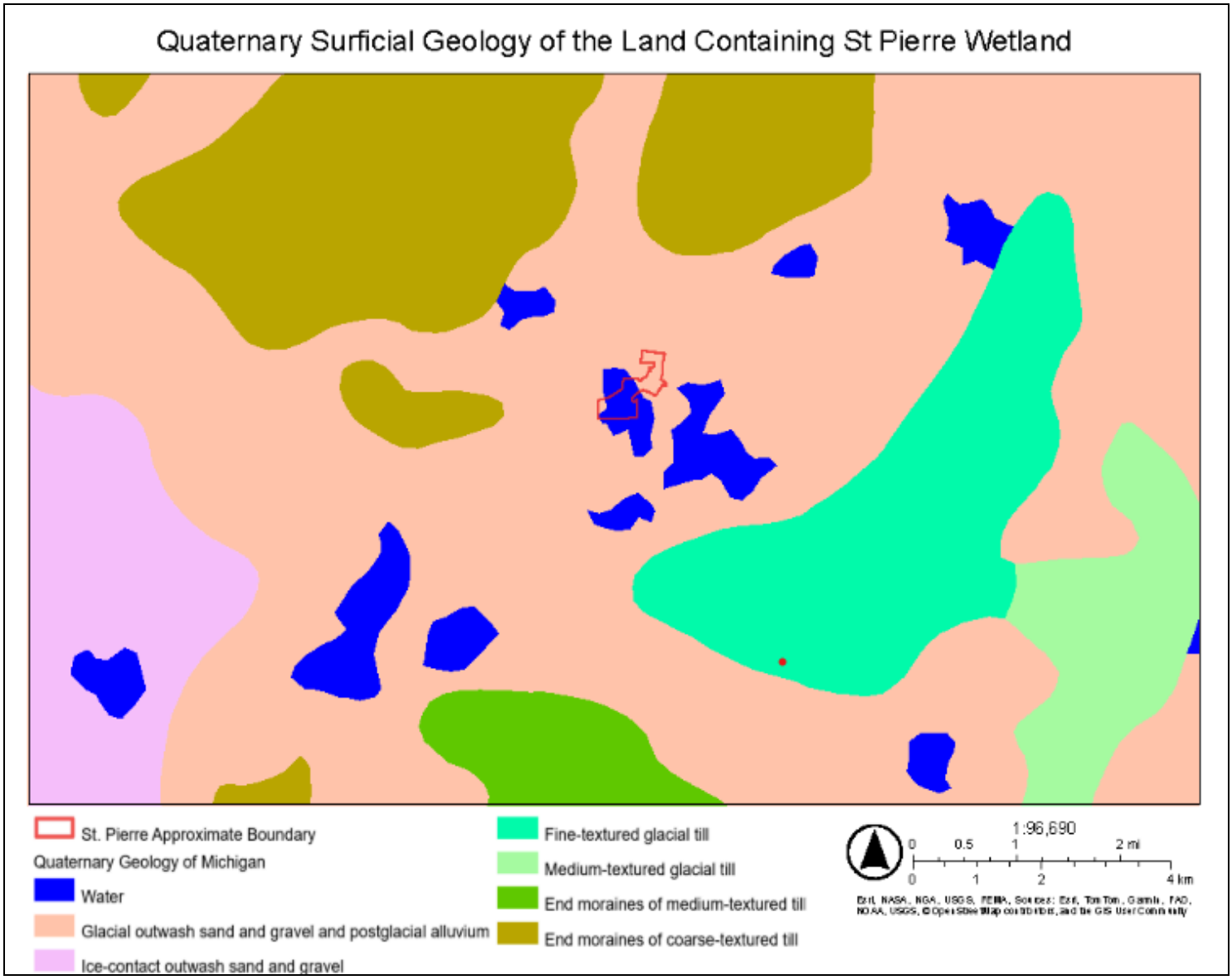


Figure 4.1. Quaternary geology of Michigan ArcGIS Online layer (Farrand and Bell, 1982). The St. Pierre wetland property boundary (outlined in red), including Bass Lake, with Strawberry Lake to the east, and Gallagher Lake to the south.



Figure 4.2. SSURGO Map Including St. Pierre Wetland. Natural Resources Conservation Service Soil Map. Refer to this soil codes table.

4.2. Historical land cover

Land cover maps from the beginning of the 19th century suggest that STPW was almost entirely shrub swamp & emergent marsh (Figure 4.3). Surrounding the swamp on the northwest side of Bass Lake were mixed oak forest, black oak barrens, and wet prairie. The east side of Bass lake had large swaths of mixed hardwood swamp and patches of oak-hickory forest. There were several areas of mixed conifer swamp to the west, north, and southeast of the wetland and Bass Lake.

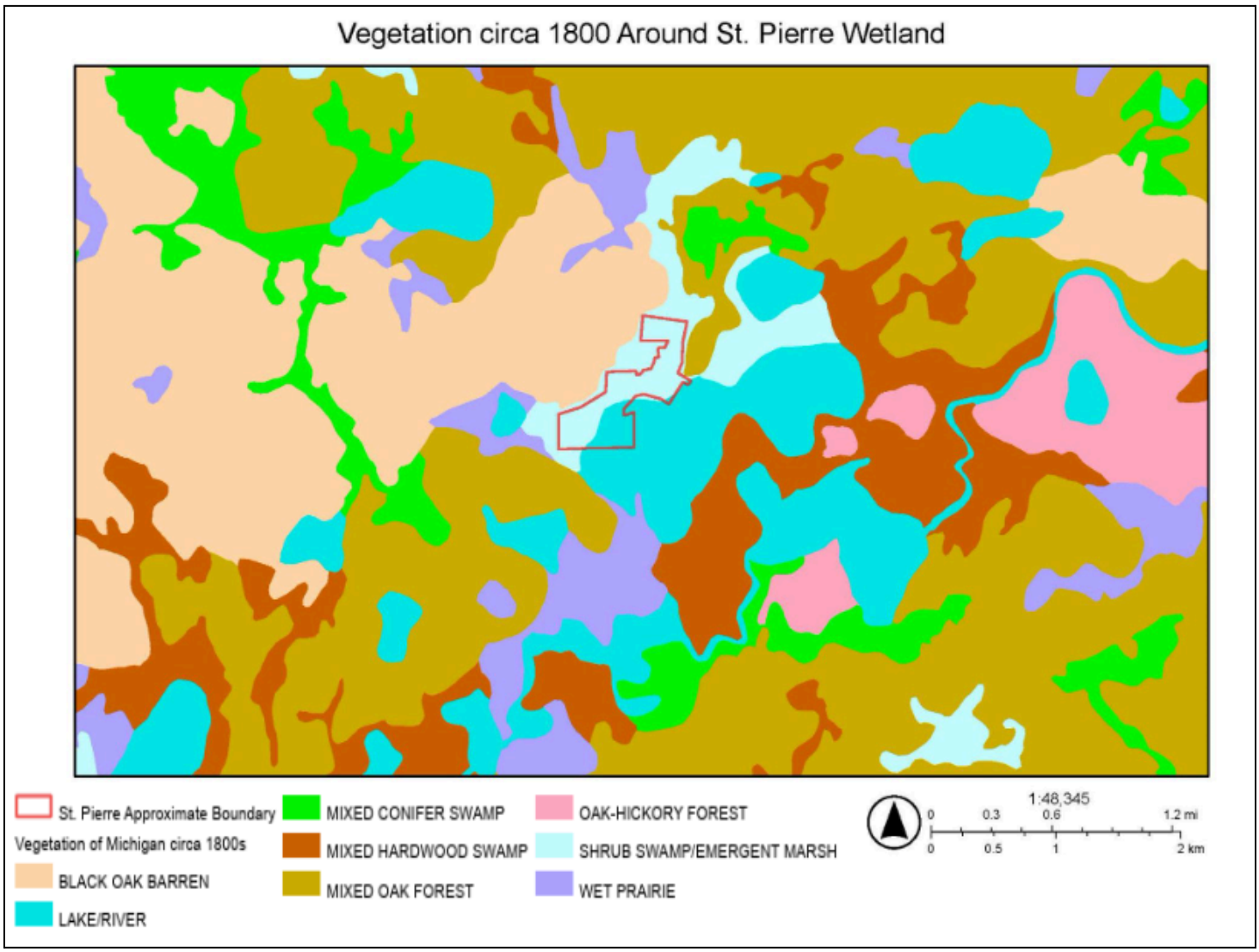


Figure 4.3. Landcover surrounding St. Pierre Wetland circa 1800 (Comer et al. 1995).

4.3. Hydrology

4.3.1. Hydrological connections and function

The STPW occurs in the Huron River Watershed within the Hay Creekshed (Figure 4.4) and just north of the Huron River Chain of Lakes region. The Huron River Watershed Council assigned the creekshed an ecological health score of 78/100, which is considered healthy. Bass Lake remains the largest (172 acres) of eight lakes in the creekshed, which drains 12 mi^2 of land area (HRWC, 2025).

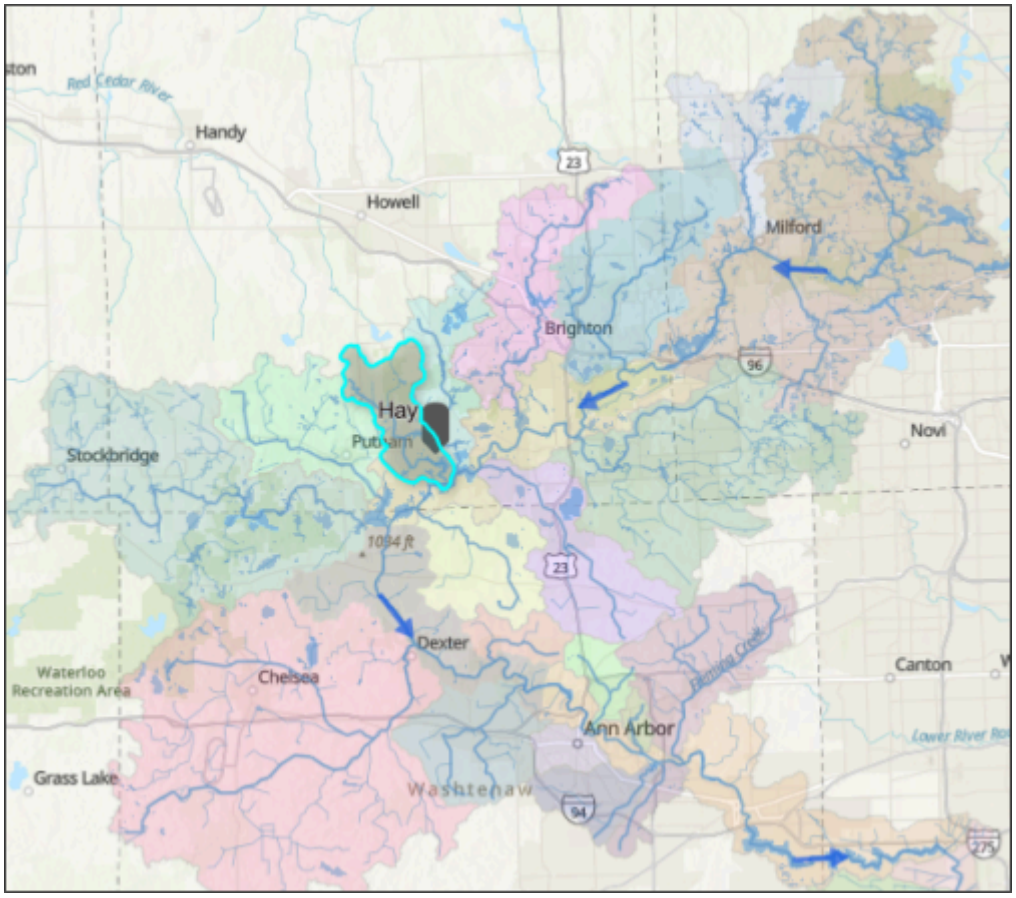


Figure 4.4. Huron River watershed with Hay Creekshed outlined in teal blue. Pin indicates location of STPW, and arrows illustrate river flow direction (HRWC, 2025).

As a wetland in the watershed, STPW has a significant impact on Huron River water quality due to its contribution to the green infrastructure and hydrological connections in the landscape (Figure 4.5). Figure 4.6 illustrates the numerous flow paths and directions that the water follows as it moves downstream through the Hay creekshed and the Huron River chain of lakes.



Figure 4.5. Landscape of wetlands and Huron River Chain of Lakes (Zukey in the northeast to Portage in the southwest) with STPW at blue pin (USGS, 2025).

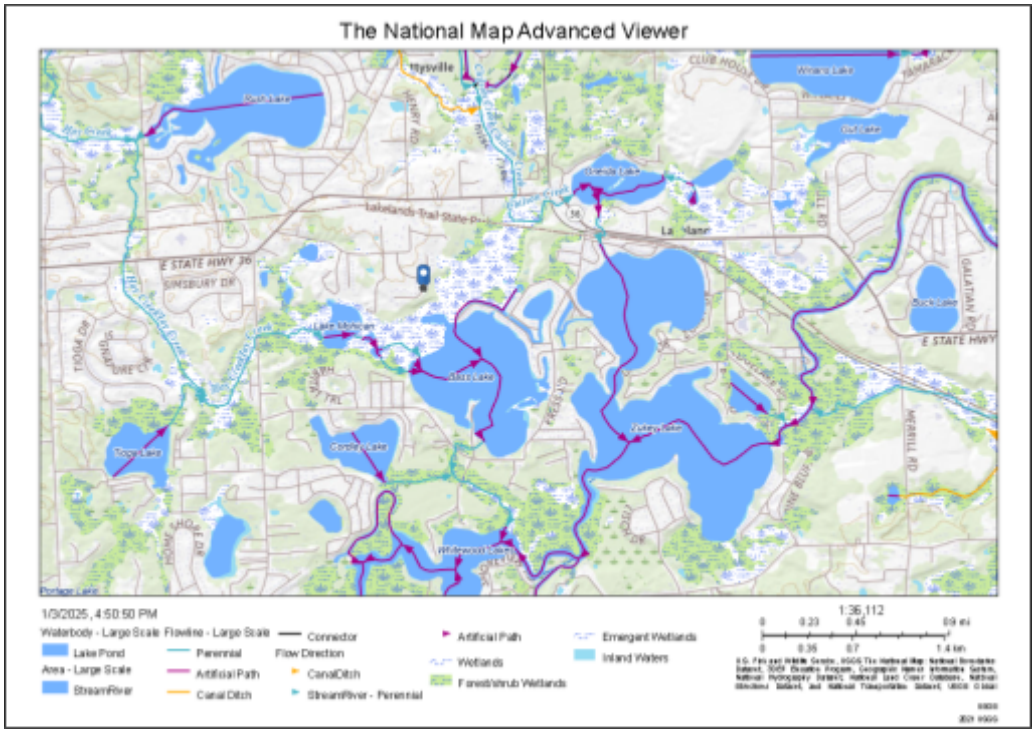


Figure 4.6. Hydrological context of STPW (USGS, 2025). “Artificial” path lines in pink drawn into the middle of each water body indicate general flow direction of water through the system.

The STPW occurs within a palustrine emergent wetland in a topographic depression directly adjacent to Bass Lake, creating a lake basin fen (Figure 4.7). According to the Michigan Natural Features Inventory, a lake basin fen is a type of prairie fen that can contain “quaking mats.” We observed both the quaking mat phenomena and marl deposits in the field in 2024, as described by Michigan Natural Features Inventory:

> ***“In some locations, the large volume of water underlying prairie fens creates a quaking mat or floating mat, which shakes and reverberates with each step. Quaking mats are especially common where prairie fens occupy former lake basins that have filled with marl or peat. These “basin fens” may occupy the entire basin of an abandoned glacial lake or occupy portions of a basin along the shores of existing lakes” (Cohen et al., 2020).***



Figure 4.7. Topographic contours showing depression that is the St. Pierre wetland, but with some scattered upland patches. From USGS Topobuilder showing elevation contours and 3DEPElevation.

4.3.2. Protection by the Clean Water Act

The Clean Water Act (CWA), established in 1972, has been instrumental in restoring and maintaining the chemical, physical, and biological integrity of U.S. waters. Its regulatory framework prohibits pollutant discharges and filling activities in wetlands under its jurisdiction. Sections 401 and 404 of the Act have historically provided robust protection against activities such as drainage and filling, ensuring the preservation of wetlands that qualify as "waters of the United States" (WOTUS) under Sections 401 and 404 of the Clean Water Act (33 U.S.C. §§1341, 1344). These provisions have been critical in safeguarding many wetland ecosystems by preventing development that could be harmful to their ecological integrity.

The Supreme Court of the United States' (SCOTUS) decision in 2023 significantly altered the definition of WOTUS, introducing stricter criteria for federal protection. SCOTUS ruled that **only wetlands with a direct and continuous surface connection to navigable waters, such that they are "indistinguishable" from those waters, are federally protected under the CWA** (*Sackett v. EPA*, 598 U.S. 651 (2023)). This excluded many isolated wetlands and those connected via subsurface or seasonal flows, reducing federal jurisdiction and protections. Maintaining federal protection now requires rigorous documentation of this connection if federal protection under the revised WOTUS criteria is challenged or if activities, such as development or permitting, require proof of compliance with the stricter definition established by Sackett v. EPA (Owen, 2024).

For wetlands like STPW, a lake basin prairie fen hydrologically connected to Bass Lake, federal protection under the revised WOTUS criteria may appear straightforward because of its surface hydrological connection to navigable waters. However, maintaining this protection still requires rigorous documentation of this connection to meet compliance standards established in *Sackett v. EPA* (Owen, 2024). Wetland delineation remains a critical tool in this process, ensuring the clear identification of jurisdictional boundaries and hydrological connections to navigable waters.

4.3.3. Current hydrological alterations

The current hydrology of STPW is influenced by several alterations from early construction of a railway through the wetland complex to more recent lake water level control measures. Any alteration to water flow through a wetland can change the vegetation and ecosystem function of the site. These hydrological alterations require further in-depth study to understand their ongoing impact on the capacity for the restoration of typical wetland plant communities on site. Here we provide some context for future studies.

The Mike Levine Lakelands Trail that currently runs along the northern boundary of STPW was a former railway, likely constructed in the late 1800s. This would have bisected the existing larger wetland complex (see Figure 4.7). Although there is a culvert under the Lakelands Trail that hydrologically connects the wetlands north and south of it to some extent, it appears that Chilson Creek, north of the trail, was likely diverted from flowing south to STPW (Figure 4.7). When the stream channel flowed through STPW the surrounding pore space of the organic soil was constantly filled with water. When the stream was diverted, the abandoned stream channel acts as a ditch that drains water from the site, rather than both draining and supplying water to the site. Thus, the diversion of stream water from the site likely leads to net loss of water on site, which can contribute to tree and shrub colonization (M. Kost, pers. comm.).

STPW hydrology is also impacted by management of the water levels of Bass Lake. In 1962, the residents of the newly constructed Shan-gri-la Homeowners Association and other residents abutting Bass Lake petitioned the Board of Supervisors of Livingston County:

> ***"That the seasonable variations of inflow and evaporation or other losses, combined with a lack of suitable control over outflow, causes the water level of said Bass Lake to vary to a degree which is harmful to our interests. That the maintenance of a stable, normal water level is necessary on said Bass Lake to protect the public health, welfare, and safety; to preserve the natural resources of the State of Michigan; and to protect the value of properties developed around the Lake" (Petition to the Livingston County Board of Supervisors, 1962).***

Later in 1962, the Livingston County Board of Supervisors issued a resolution directing the county Prosecuting Attorney to petition the circuit court to, "have the water level of said Bass Lake determined and established, in accordance with the provisions of Act 146, Public Acts of 1961, as amended" (Livingston County Board of Supervisors Resolution, 1962). On December 10, 1963, Judge Michael Carland of the Livingston County Circuit Court ordered, "the normal height and level of the waters of Bass Lake" to be set at 853.95 feet above sea level (Livingston County Circuit Court, 1963).

Currently, a fixed weir dam, managed by the Livingston County Drain Commission, passively regulates the Bass Lake water levels and influences the hydrology of St. Pierre wetland. The height of the weir determines the normal lake level and stabilizes Bass Lake levels throughout the year with fluctuations based on spring freezes/thaws, heavy rains, and droughts (M. Dempsey, pers. comm.). The county located the weir near the southwest portion of Bass Lake near Knorp Road (Figure 4.8) based on a civil engineering study that was completed in 1963. The engineers recommended the normal Bass Lake level based on the following conclusions, which do not refer to any effects on wetland hydrology:

"In light of all the foregoing information it is felt that the level of 853.95 mean sea level datum is the most desirable level for Bass Lake. This level will place the water about 0.3 ft. below the high water mark found at the Lime Lake inlet. It will give 3.75 ft.clearance between water and the top of the culverts designed to carry boats in the canals between Bass and ShanGri-La. It will place the lake 1.4 ft. below the lake's lowest cottage's front yard elevation. Assuming a maximum flood level of 854.45 (0.5 ft. above the normal level) there would be no homes at which the water would reach the front door step. This level would certainly tend to increase the safety and attractiveness of boating and bathing while not affecting the septic field operation around the lake (assuming a level between water and ground necessary as 1½ ft. for proper operation of fields), with one exception. This proposed level would not affect the operation of any known road culverts. It would not adversely affect the upstream lakes or streams, nor in any way be detrimental to the method of operation of controls for the Huron River as proposed in the study of the Michigan State Department of Conservation referred to earlier. There would be no particular problem in constructing an inexpensive control structure at the outlet of this lake" (Munzel & Munsell, 1963).

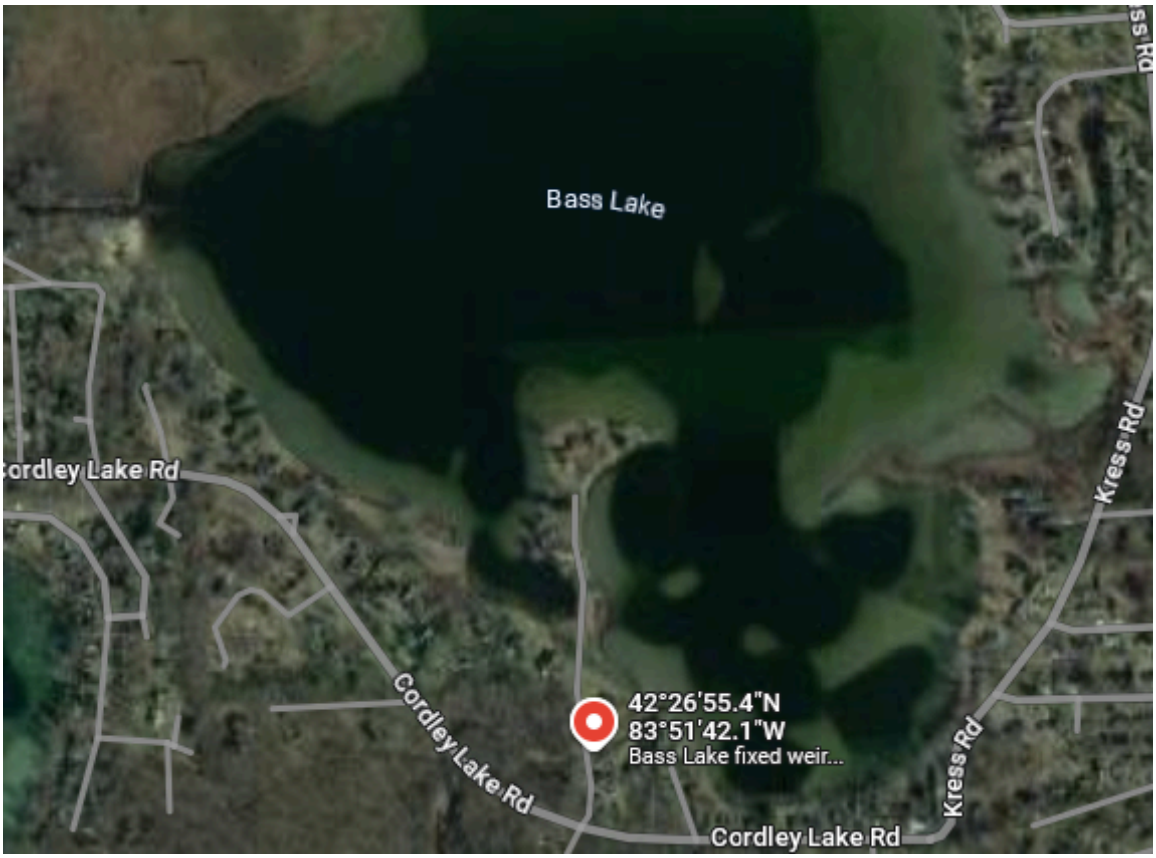


Figure 4.8a. Bass Lake fixed weir location.



Figure 4.8b. Fixed weir location (zoomed in).



Figure 4.8c. Bass Lake Fixed Weir Dam

The effect of the weir on wetland hydrology was apparent from observations of extreme water levels in the wetland related to a storm event in July 2024. On a field visit to STPW on July 9 we observed typical water levels of standing water no deeper than ankle height. The area then experienced a 3-4" rain event between July 9 and 10 (https://www.weather.gov/iln/rainfall-monitoring, accessed 12/7/2024 using zip code 48169), and on a visit to the wetland on July 12 we found water levels exceeding knee-height in some of the same areas visited before. Paul Zahner, a 25-year Shan-gri-la resident, stated that the water level at that time was, "the highest he ever remembers seeing," as it went about halfway up his lawn on Blue Water Drive (P. Zahner, pers. comm.). During a return visit to the wetland on August 13, we observed the water levels at their lowest levels in all of 2024. It is possible that with more extreme rain events the weir will cause more upstream flooding (making lake and wetland levels high), while preventing flooding downstream of the weir, which may be in the the interest of residents near Knorp Road.

4.4. Current surrounding land cover and use

Land use around the STPW has changed significantly since the 1800s in ways that influence hydrology, nutrient dynamics, and landscape connectivity. STPW, as a freshwater ecosystem, faces significant threats from anthropogenic activity related to development and pollution. These issues not only threaten the ecological integrity of the wetland but also undermine its role in the broader Huron River Chain of Lakes ecosystem. Key concerns for STPW include nutrient runoff, infrastructure development and habitat fragmentation, and litter accumulation.

4.4.1. Nutrient run-off

One of the most pressing issues affecting most freshwater ecosystems like STPW is nutrient pollution caused by fertilizers used in nearby residential and municipal areas. Excess nitrogen and phosphorus from fertilizers often enter the wetland through stormwater runoff, leading to nutrient enrichment and harmful algal blooms. These blooms can deplete oxygen in the water, block sunlight, and create conditions unsuitable for aquatic life (Paerl et al., 2016; Carpenter, 2008).

The Hamburg Township Ordinance No. 104 A, passed in July 2024, implements stringent restrictions on fertilizer use to address this issue (Steen, 2024). Key provisions include:

- Seasonal Limitations: Fertilizer application is prohibited from November 16 to April 30 to minimize nutrient runoff during frozen ground conditions.
- Buffer Zones: Fertilizer use is banned within 50 feet of wetlands or watercourses, and within designated environmental water body setback areas (Hamburg Township Ordinance No. 104 A, 2024).

4.4.2. Infrastructure development and habitat fragmentation

While STPW occurs within a landscape of many other lakes and wetlands, infrastructure development, including the construction of roads and residential areas, has led to increased impervious surfaces near STPW (Figure 4.13). This exacerbates stormwater runoff and introduces pollutants into the wetland while also fragmenting wildlife habitats (Hamilton et al., 2016).

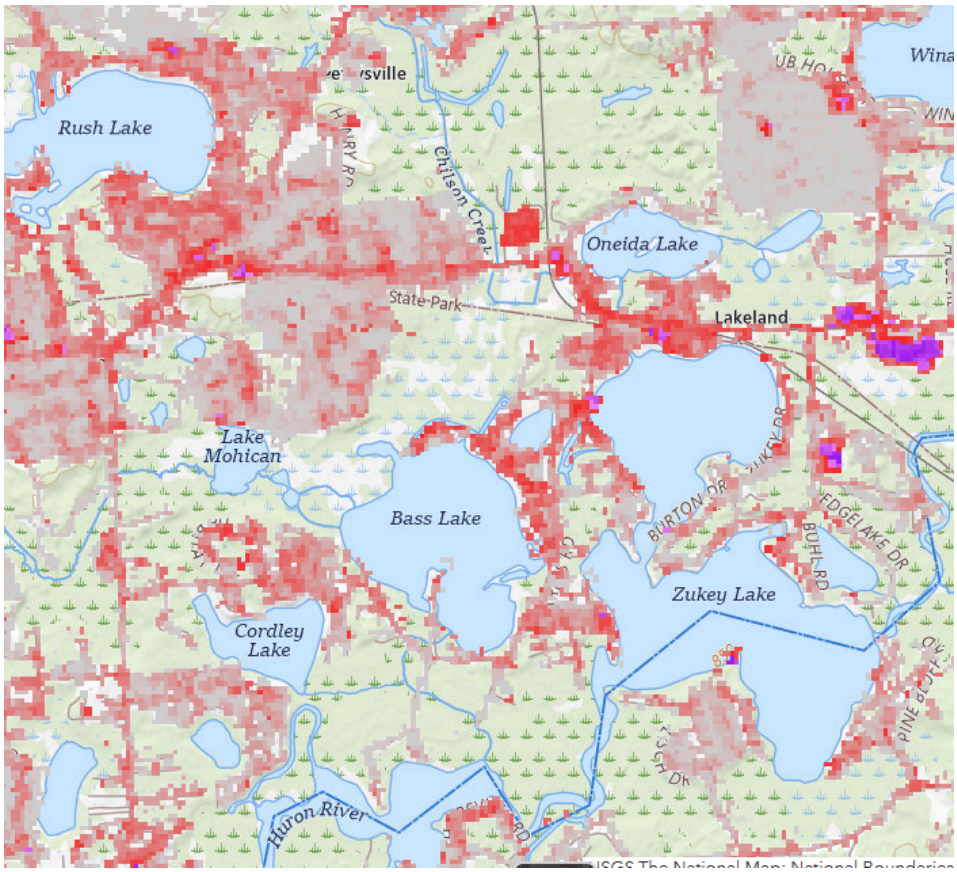


Figure 4.13. Density of impervious surface (dark red) in the area surrounding St. Pierre wetland showing potential sources of rapid run-off into the wetland (USGS https://apps.nationalmap.gov/viewer/).

4.4.3. Pollution from litter and recreational activities

Litter such as beer cans and golf balls frequently accumulate in STPW due to nearby recreational activities. This pollution could harm wildlife and diminish the wetland's aesthetic value, undermining its role as a community and ecological asset (Nwankwegu et al., 2019).

4.5. Current natural community types

We used a variety of methods to determine and map the natural plant community types, as defined in by Michigan Natural Features Inventory (Cohen et al., 2015) currently occuring at SPTW. During our field assessments of STPW we cataloged species diagnostic of each identified natural community type to delineate where each occurs. In instances of species overlap, we examined community structure and soils, including community pH levels defined by MNFI to make our final classification. Using GNSS devices and software, we made ground-truthed delineations of each of the natural communities, and used remote sensing in ArcGIS Pro to finish mapping the remaining areas.

We identified and mapped six natural community types at STPW (Figure 4.14). Southern wet meadow (SWM), prairie fen (PF), and southern hardwood swamp (SHS) communities are all groundwater-influenced while southern shrubb-carr (SSC), emergent marsh (EM), and submergent marsh (SM) are not always tied to groundwater activity (Table 4). In the case of STPW, the wetland as a whole is influenced by groundwater. The stability of all of these natural communities depends on many factors, including natural processes such as fluctuating water levels and flooding, fire, beaver activity, and, for the communities with woody plants (SHS, SSC), windthrow. PF and SHS are of highest conservation concern according to MNFI's ranking system, followed by SWM. SSC, SM, & EM are close behind and have the same Global and State Conservation Status Ranks.

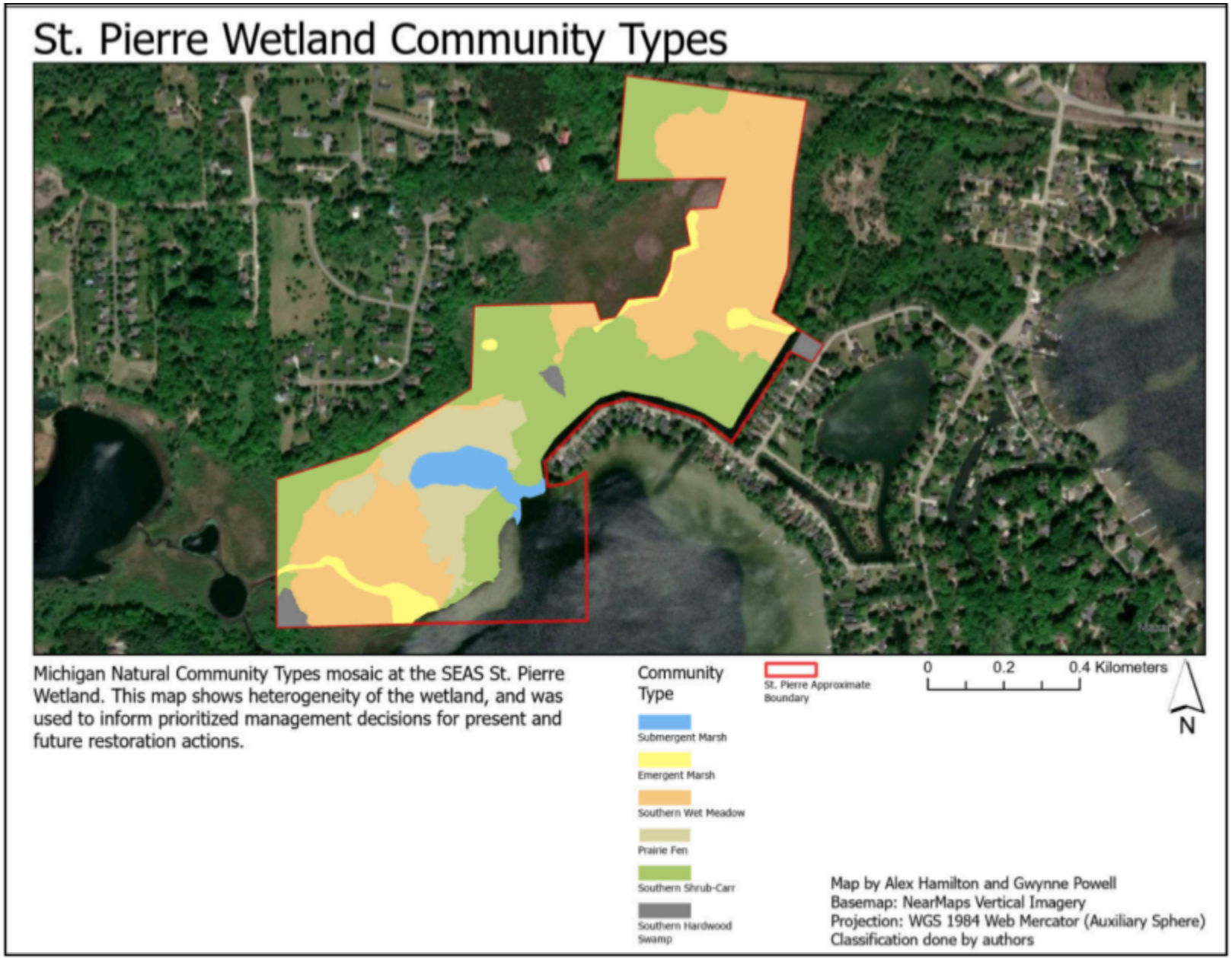


Figure 4.14. Distribution of Michigan Natural Features Inventory natural community types at the St. Pierre Wetland based on field assessment and remote sensing.

Table 4. Natural community types observed at St. Pierre Wetland and their known characteristics (*Michigan Natural Features Inventory* https://mnfi.anr.msu.edu/communities/list) *Submergent marsh pH ranges widely through acid and alkaline conditions.

Natural Community	Rankings	pH	Landform Occurrence	Soil	Hydrology	Observed Indicator Spp.
Emergent Marsh	(GU/S4)	6.6-7.5	Mineral soil and bedrock, sometimes loosely consolidated organic deposits	Organic sediments and all mineral substrates	Constant surface water inundation near lake edge; usually hold 15 or more centimeters of water for the duration of the growing season.	*Alisma subcordatum, Pontederia cordata, Sagittaria spp.*
Submergent Marsh	(GU/S4)	Varying*	Various mineral and bedrock	Loosely consolidated organics	In deep to sometimes shallow water in lakes and streams; Fluid but constant inundation through lake nexus	*Brasenia schreberi, Elodea canadensis, Nymphaea odorata, Utricularia spp.*
Southern Wet Meadow	(G4/S3/4)	5.1-7.8	Abandoned glacial lakebeds	Circumneutral Sapric Peat	Minerotrophic, fed by groundwater and surface water flow; occur along lakes, streams, abandoned glacial lake beds	*Carex stricta, Eutrochium maculatum, Solidago patula, Onoclea sensibilis*
Prairie Fen	(G3/S3)	6.8-8.4	Glacial outwash plains, outwash channels	Sapric/Hemic Peat, Marl	Constant inundation-	*Carex stricta, C. lasiocarpa, Eupatorium perfoliatum, Pycnanthemum virginianum*
Southern Shrub-Carr	(GU/S4)	6.6-7.8	Within depressions on a variety of landforms	Saturated sapric peat and mineral soils	Minerotrophic groundwater seepage	*Cornus sericea, Frangula alnus, Salix bebbiana, Toxicodendron vernix*
Southern Hardwood Swamp	(G3/S3)	6.3-7.8	Variety: shallow depressions, small stream drainages; clay lens can under lakeplains & depressions on moraines	Mineral and mounded organic soils	Minerotrophic groundwater seepage; sometimes contain an impermeable clay lens leading to seasonal flooding.	*Acer rubrum, Betula alleghaniensis*

Emergent marsh occurred in four different areas in STPW, one of which connects Bass Lake to Mohican Lake to the west. Being a part of the larger Chain of Lakes in the Huron River watershed, the emergent marsh system is an important asset not only to the ecology of STPW, but also to the watershed. Another occurrence of emergent marsh is in the west-central corner of STPW (yellow in Figure 4.14). It is unclear if this small pond and accompanying marsh is naturally-occurring or artificial; the pond also contains bass we believe are stocked for fishing. There is a small, private boardwalk leading out to this feature from the Bass Lake HOA trail, and could be an asset for accessing this portion of the wetland, where you would need to traverse a thick stand of glossy buckthorn otherwise.

We mapped out four areas of southern shrub-carr (SSC) within the property boundary, dominated by *Frangula alnus* and other invasive woody plant species, but also containing native *Cornus* and *Salix* species. SSC is a successional community between open herbaceous and forested wetlands and "frequently occurs where tall shrubs have colonized open wetlands in the absence of fire and prolonged flooding" (Cohen et al., 2015). On both the north and south ends of the property, SSC communities are bound by southern wet meadow. Similarly, submergent marsh surrounds the Bass Lake inlet and are flanked by the prairie fen communities, indicating key biotic or abiotic gradients impacting species composition.

Prairie fens in particular are unique among these six communities: PF communities occur on "moderately alkaline peat and marl in the southern Lower Peninsula" and are frequently found with "headwater streams and cold, calcareous, groundwater-fed springs." There are three semi-disjunct areas of prairie fen on the southern half of the property surrounding the small inlet from Bass Lake. These contain the area described as "a pristine fen of very high ecological quality" in the Huron River Watershed Council's assessment of STPW in 2017 (HRWC, 2017).

4.5.1. Effect of trampling

Given the way the diversity of the natural communities are tightly tied to the topography and hydrology of the site, one potential threat to the stability of the communities at STPW is trampling. We observed that frequently used trails (such as those near the entrance to the site from Bass Ridge HOA or near experimental plots where there was a lot of activity) had **altered microtopography and reduced vegetative cover** (Figure 4.15). After the largest group (about 30 people) had visited the site during particularly high water levels in July, 2024, trampling damage was also immediately evident. According to studies at other wetlands, trampling damage depends on the plant species's biochemical composition and growth habit, and so the effect of trampling varies by species and community type. Arnesen (1999) observed that vegetation on wet peat is damaged very easily in a rich fen in central Norway, but that graminoids are more tolerant of trampling than forbs. Sedges and grasses in fens can be relatively resilient to trampling compared to the species found in bogs (Pellerin et al.,

2006). As we observed, the effect of trampling may depend on the presence of other stressors, like flooding. Kuss and Graefe (1985) confirm that stresses such as inadequate moisture conditions, nutrient imbalances, insect outbreaks, or infections can cause plants to respond differently to trampling than they would under different environmental conditions. Trampling can also reduce the tolerance of other stressors. For example, Englaar and Blom (1995) observed that the benefits of morphological adaptations to flooding of *Rumex* and *Plantago spp*. were reduced when trampling occurred between flooding. Given the potential and complex impacts of trampling, an increasing challenge at SPTW will be **facilitating human presence on site** for education, research and management, **while preventing additional human disturbance** to the sensitive natural communities found on site.



Figure 4.15. (Right) Water-filled walking path next to an experimental buckthorn treatment plot. Photo taken in July, 2024. (Left) Snow-filled walking path leading from the site entrance. Photo taken in February, 2025.

4.5.2. Climate change as it affects wetlands in the Midwest

Climate change significantly impacts wetlands through various mechanisms. Rising water temperatures can lower oxygen levels, negatively affecting native plants

and animals. Additionally, more intense weather events, such as increased precipitation, are expected to become more common, leading to flooding that can harm wetland ecosystems. Conversely, prolonged droughts may also occur, causing stress to both plants and animals. Furthermore, as air temperatures increase, the ranges of plants may shift northward, altering the community composition of wetlands. This shift could result in the loss of species adapted to cooler climates and create opportunities for invasive species to establish themselves, further disrupting the ecosystem.

4.6. Flora

4.6.1. Plant inventory & FQI

A further understanding of the status of the plant communities present at STPW requires knowledge of the specific plant species on site. In 2017 the HRWC Bioreserve Site Assessment identified over 50 different plant species on site, including invasive species such as glossy buckthorn (HRWC, 2017). In 2022 the first master's project team built upon this work by identifying and recording over 40 species across the site. We filled key gaps in assessing STPW flora by conducting a series of meander surveys from May through September, 2024. Over the course of 17 site visits, **approximately 111 different plant species** were identified, photographed, and recorded by project members or visiting experts. Of these, 45 species were shared with the 2017 HRWC survey and 36 were found in the 2022 survey. Overall, 18 species were shared across all three survey years (comparisons can be found **here**). Notable contributors to the identification of species included Michael Kost, Associate Curator at Matthaei Botanical Gardens and Nichols Arboretum (MBGNA), and Anton Reznicek, Curator Emeritus at the University of Michigan Herbarium, who were particularly instrumental in identifying the *Carex* species.

Observations from the surveys were recorded in field notes or entered into the iNaturalist app. The iNaturalist Project created for STPW allowed observers to upload sightings along with images and a precise location on-site. Other observations were photographed and uploaded to iNaturalist using an approximate location at a later time. Regardless of the data collection method, all observations were stored digitally in a complete plant inventory spreadsheet. Each entry included the common and scientific names of the plant, the general location where it was observed (e.g. prairie fen, lake edge, upland), and additional details including plant family, physiognomy, duration, and native status referenced through websites like USDA Plants, Minnesota Wildflowers, and Michigan Flora.

Based on the 2024 meander surveys, a Floristic Quality Assessment (FQA) was conducted for STPW using the Universal FQA Calculator. Along with the plant inventory, the FQA summary provided useful insights into the species composition at the site (Table 4.1). The total Floristic Quality Index (FQI) for STPW was 58.7 while the **adjusted FQI**

was 57.4. This score is adjusted to reduce sensitivity to species richness while including contributions from non-native plant species (Freyman et a., 2015). In the state of Michigan, sites with a FQI of over 35 are considered floristically important while regions scoring 50 or higher are thought to be rare representations of Michigan's native biodiversity and natural landscapes (Herman et al., 2001). The summary also revealed that 105 of the 111 identified species were native, comprising over 94% of the total richness. Approximately 38.7% of the species included in the 2024 FQI had a coefficient of conservatism (C-value) between 7-10. Due to their narrow tolerance range and specific habitat requirements, the presence of these species is indicative of a **high-quality natural habitat with little anthropogenic disturbance** (Floristic Quality Assessment (FQA), n.d.; McAvoy, 2023). Notable species with C values in this range are listed in Table 4.2.

Despite the presence of many significant species on site, there are still more which are characteristic of peatlands and prairie fens that were not observed during the 2024 surveys. Rose pogonia (*Pogonia ophioglossoides*), white lady-slipper (*Cypripedium candidum*), and showy lady-slipper (*Cypripedium reginae*) are common to these systems and would have been in bloom during the surveying period, although none were observed. Wild rice or Manoomin (*Zizania aquatica* or *Z. paluastris*) is another species expected at this site based on the potentially suitable habitat provided by the inland lake, though none was observed.

Table 4.1. Summary of the Floristic Quality Assessment for St. Pierre Wetland based on a series of meander surveys conducted between May-Sept. 2024. The complete FQA summary can be found **here**.

Conservatism-based Metrics	Total Mean C	5.6	
	Native Mean C	5.9	
	Total FQI	59	
	Native FQI	60.5	
	Adjusted FQI	57.4	
Species Richness	Total Species	111	
	Native Species	105	94.6%
	Non-native Species	6	5.4%

Table 4.2. Summary of notable species found at St. Pierre Wetland with C-values ranging between 7-10.

Scientific Name	Common Name	Family	C-value
Carex buxbaumii	Buxbaum's sedge	Cyperaceae	10
Carex livida	Livid sedge	Cyperaceae	10
Carex prairea	Prairie sedge	Cyperaceae	10
Carex sterilis	Sterile sedge	Cyperaceae	10
Cladium mariscoides	Twig-rush (smooth sawgrass)	Cyperaceae	10
Eleocharis rostellata	Beaked spikerush	Cyperaceae	10
Eriophorum angustifolium	Narrow-leaved cotton-grass	Cyperaceae	10
Hypoxis hirsuta	Star-grass	Hypoxidaceae	10
Lobelia kalmii	Bog lobelia	Campanulaceae	10
Lysimachia quadriflora	Whorled lobelia	Myrsinaceae	10
Sarracenia purpurea	Pitcher-plant	Sarraceniaceae	10
Utricularia intermedia	Flat-leaved bladderwort	Lentibulariaceae	10
Utricularia minor	Small bladderwort	Lentibulariaceae	10
Calopogon tuberosus	Grass-pink	Orchidaceae	9
Carex tetanica	Rigid sedge	Cyperaceae	9
Salix candida	Hoary willow	Salicaceae	9
Symphyotrichum boreale	Northern bog aster	Asteraceae	9
Betula pumila	Bog birch	Betulaceae	8
Carex diandra	Lesser panicled sedge	Cyperaceae	8
Carex lasiocarpa	Wiregrass sedge	Cyperaceae	8
Dasiphora fruticosa	Shrubby cinquefoil	Rosaceae	8
Galium labradoricum	Bog bedstraw	Rubiaceae	8
Gentianopsis virgata	Lesser fringed gentian	Gentianaceae	8

Liatris spicata	Marsh blazing-star	Asteraceae	8
Menyanthes trifoliata	Bog bean (buckbean)	Menyanthaceae	8
Parnassia glauca	Grass-of-parnassus	Parnassiaceae	8
Pedicularis lanceolata	Swamp-betony	Orobanchaceae	8
Pontederia cordata	Pickerel-weed	Pontederiaceae	8
Rhamnus alnifolia	Alder-leaved buckthorn	Rhamnaceae	8
Salix pedicellaris	Bog willow	Salicaceae	8
Solidago ohioensis	Ohio goldenrod	Asteraceae	8
Triglochin maritima	Common bog arrow-grass	Juncaginaceae	8
Agalinis purpurea	Purple false foxglove	Orobanchaceae	7
Bidens trichosperma	Tickseed-sunflower	Asteraceae	7
Campanula aparinoides	Marsh bellflower	Campanulaceae	7
Carex aquatilis	Water sedge	Cyperaceae	7
Cephalanthus occidentalis	Buttonbush	Rubiaceae	7
Chelone glabra	White turtlehead	Plantaginaceae	7
Comarum palustre	Marsh cinquefoil	Rosaceae	7
Equisetum fluviatile	Water horsetail	Equisetaceae	7
Juncus brachycephalus	Small-headed rush	Juncaceae	7
Lathyrus palustris	Marsh pea	Fabaceae	7
Nuphar variegata	Yellow pond-lily	Nymphaeaceae	7

4.6.2. Invasive species distribution and density

Six invasive plant species were observed on site: common and glossy buckthorn (*Rhamnus cathartica* and *Frangula alnus*), narrow leaf and hybrid cattail (*Typha angustifolia* and *T. x glauca*), purple loosestrife (*Lythrum salicaria*), and yellow flag iris

(*Iris pseudacorus*). Many of these were the same invasives identified by HRWC in their assessment seven years prior. While each species presents its own unique challenges they share a common threat of out-competing native plant species for nutrients and light (Boettcher et al., 2023).

The invasive shrubs, common and glossy buckthorn, are the dominant invasive species at STPW. These species have taken over much of the shrub-carr zone bordering the site, with glossy buckthorn also encroaching on the open prairie fen and lakeshore. Invasive cattail species and common reed pose a threat to wetter regions of the site, including the east side of the property and along the lakeshore. Purple loosestrife is another significant threat in at least two areas: one along the Lakeland Trail to the northeast, where it is denser, and another just to the west of the site's entrance in the wet meadow.

To spatially record their densities and distributions across the property, invasive species were **mapped** using ArcGIS online or FieldMaps (Figure 4.16). Buckthorn and cattail coverages were mapped remotely using NearMaps imagery, while purple loosestrife was mapped on site using the FieldMaps app. A polygon was created for each invaded area and the species name and estimated density were recorded for some polygons (Figure 4.17 - 4.20; Ch. 4 Invasive Species Density Maps). To ensure the accuracy of remote mapping, some areas were ground-truthed, and the map was updated accordingly. Comprehensive mapping methods can be found **here**.



Figure 4.16. Distribution of common invasive species at STPW: *Typha x glauca* (teal), *Frangula alnus* (green), and *Lythrum salicaria* (orange). The STPW property boundary is outlined in red.

4.7. Fauna

4.7.1. Herps

Herp surveys had never occurred on site, but we were able to document the presence of at least nine species. Based on the natural communities found at the site, we thought it possible that STPW might support Eastern Massasauga (*Sistrurus catenatus*) and Kirtland's snake (*Clonophis kirtlandii*). In order to assess the presence of these critical species and other snakes on site, we installed 30 18x18in snake boards (24 wooded and 6 carpet) on the recommendation of master's student Jeffery Ferrer and PhD candidate Tristan Schramer. Boards were scattered at least 5 meters apart in the area of the wetland close to the entrance trail with prairie fen habitat. We checked under the boards 12 times from May to July in 2024, and recorded our observations using FieldMaps (SnakeSurveyBoards).

Only northern brown snakes (*Storeria dekayi*) were observed under snake boards. Incidental snake observations also included northern water snake (*Nerodia sipedon*), and common garter snake (*Thamnophis sirtalis*). However, from conversations with the neighboring homeowner's association, Shan-Gri-La, we learned that massasaugas were historically abundant at STPW and surrounding areas within the last 50 years. Eric St. Pierre said he would find them in the wetland when he would play there as a child and other neighbors confirmed they were often near or on their driveways to bask. Additionally, Steve Parrish, a Collections and Natural Areas Specialist at MBGNA, visited the wetland during the Professional Stewardship Hike and expressly agreed the habitat seemed suitable for massasaugas. That coupled with the fact that their preferred overwintering site (crayfish burrows) were plentiful and that their primary food source is common (see mammal section below), we concluded that STPW historically did host massasaugas and could host them currently or in the future.

Other herp observations were incidental encounters, including spiny softshell turtles (*Apalone spinifera*) - seen basking on and digging in the muck on the west bank of the submergent marsh inlet; painted turtles (*Chrysemys picta*); one state *threatened* (G5/S2) spotted turtle (*Clemmys guttata*); eastern musk turtles (*Sternotherus odoratus*), green frogs (*Lithobates clamitans*); and spring peepers (*Pseudacris crucifer*).

4.7.2. Birds

We conducted a modified Breeding Bird Survey (BBS) informed by the US Geological Survey and City of Ann Arbor protocols (see St. Pierre Breeding Bird Survey Protocol). We also created a STPW eBird Hotspot where our team, visiting students, and neighbors could record bird observations, and which contains the full list of bird species observed on site.

Our surveying efforts yielded 76 species observed at STPW from Feb 18 - Oct 4, 2024 while our BBS results included 47 species. When compared to a similar prairie fen habitat surveyed by the Kalamazoo Nature Center, STPW's bird diversity appears to be higher. Common species include American robin (*Turdus migratorius*), yellow warbler (*Setophaga petechia*), common yellowthroat (*Geothlypis trichas*), and red-winged blackbird (*Agelaius phoeniceus*) made up 8.5% of the BBS richness and 37.2% of the abundance. Rare species included northern shrike (*Lanius borealis*) and rusty blackbird (*Euphagus carolinus*), and species of conservation concern include the *Vulnerable* chimney swift (*Chaetura pelagica*), and the *Near Threatened* common grackle (*Quiscalus quiscula*). Other notable species include the locally declining willow flycatcher (*Empidonax traillii*) and Wilson's snipe (*Gallinago delicata*), which are discussed with all of the results in more detail in the breeding bird survey protocol and the BBS Results and Conservation Commentary.

4.7.3. Mammals

Using a modified version of the AHDriFT Camera Trap system (AHDriFT Camera Traps) we began assessing the small animals present at the site. Our version of this was inspired by Evan Douglas Amber's thesis and Martin et al.'s article (Amber, 2021 and Martin et al., 2017). Our proposal for using AHDrift Camera Traps can be found **here** while our AHDrift execution plan can be referred to **here**. By attaching motion-activated trail cameras to the underside of inverted buckets (Figure 4.6), we were able to passively survey small mammals through photographs. From this method we found 6 different species (two of which were mammals), including Meadow jumping mice (*Zapus hudsonius*) and Meadow Voles (*Microtus pennsylvanicus*), the latter of which were particularly common. Both of these small mammals serve as a major food source for many predators, including the Massasauga Rattlesnake.

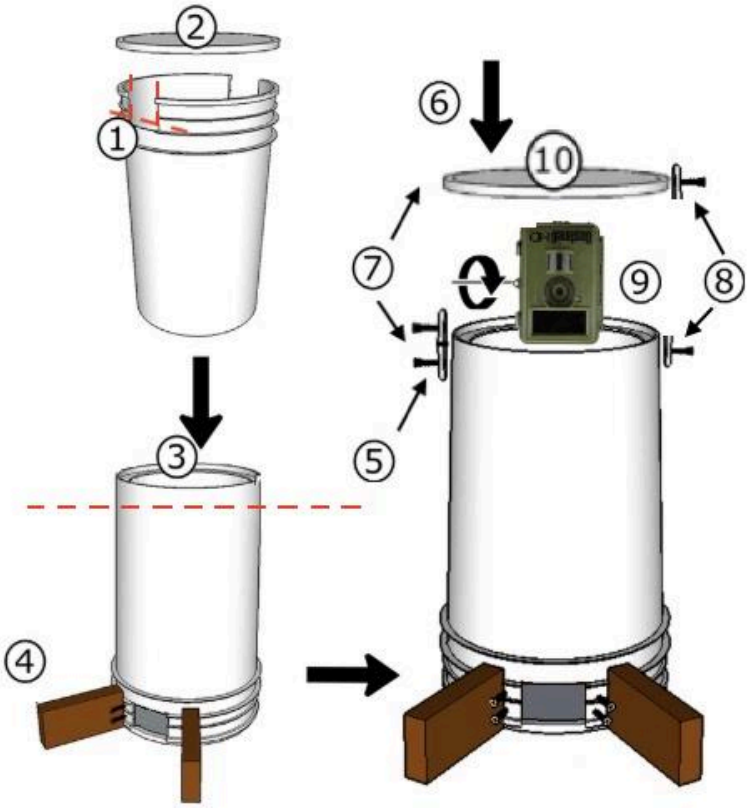


Figure 4.6. AHDriFT Camera Trap system schematic.

White-tailed deer (*Odocoileus virginianus*) are prevalent on site based on observed deer trails, bedding, and vegetation browsing. These were particularly prevalent on young buckthorn foliage. Team members also observed deer at the wetland– one of these instances was in the wet meadow habitat to the southern end of the property where the deer then ran to the west toward Mohican Lake on September 13, 2024.

Species	Observation Method
Meadow jumping mice (*Zapus hudsonius*)	Bucket Cams
Meadow Voles (*Microtus pennsylvanicus*)	Bucket Cams and visually
White-tailed deer (*Odocoileus virginianus*)	Visually and through browsing
American mink (*Neogale vison*)	Tracks

4.8. Ecological assessment summary

While further studies are still needed, our knowledge of the ecology of STPW has greatly increased from the initial surveys by HRWC in 2017 and the first master's project team in 2022-23. We know that STPW occurs on glacial outwash and postglacial alluvium with hydric soils typical of wetlands. It is hydrologically connected to the Hay creekshed within the Huron River watershed. While historically STPW was a shrub swamp with emergent marsh, increases in impervious surfaces surrounding the wetland threaten to change its community composition. The property contains six unique natural community types: Southern wet meadow, prairie fen, southern hardwood swamp, southern shrubb-carr, emergent marsh, and submergent marsh. Threats to these communities include:

- Invasive species
- Tampling due to the lack of a functional boardwalk
- Wetland protection policy change
- Development and pollution
- Climate change

STPW supports *at least* 108 plant, 76 bird, nine herp, and four mammal species. Notable species include pitcher plant (*Sarracenia purpurea*), grass of parnassus (*Parnassia glauca*), spotted turtle (*Clemmys guttata*), northern shrike (*Lanius borealis*), and Wilson's snipe (*Gallinago delicata*). STPW has the potential to be a resilient ecosystem with characteristic wetland biodiversity and function while supporting collaborative opportunities for research, education, and stewardship programs extending beyond UM. The following chapters will outline how we have been navigating these visions and what we are recommending for the future of STPW.

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Photo by Jason Krick
Mike Kost standing amongst purple loosestrife

CHAPTER FIVE

Strategic Priority 1: Implement adaptive management to restore and maintain site value

5. STRATEGIC PRIORITY 1: Implement adaptive management to restore and maintain site value

Management of STPW should focus on maintaining its integrity for its research and education value, as well as its diversity and ecological contribution to the landscape. A degraded wetland is neither interesting for study, nor can it support the normal biodiversity characteristic of this habitat type. Adaptive management can meet the goal of maintaining a wetland with critical and distinct biodiversity and functional hydrology and nutrient dynamics. Recommended actions are guided by a whole-site approach to prioritizing actions based on need and feasibility, while also being informed by small-scale, on-site studies. As will be detailed in strategic priority 3 (Build capacity and processes to support long-term value, stewardship, research, and education), many of the on-site management actions outlined here can be implemented by students (informally in student organizations or formally in course settings) to support the site education mission: *providing experiential training in stewardship*. Specifically, these recommended actions can provide hands-on experience and training in natural area stewardship, on-site ecological design, and community engagement.

5.1. Management units map with identified priority areas

5.1.1. Methods

To identify and delineate management units, we first started by mapping the boundaries of the natural communities types present at STPW (Figure 4.1). To provide a standard target for restoration across management units, no unit contained more than one community type within. We then identified and mapped management units around primary contiguous priority threats (i.e., large patches of glossy buckthorn or purple loosestrife).

To prioritize units for management, we took a multiple-criteria approach using ecological, engagement, and feasibility criteria (Table 5.1). Ecological criteria included community type global and state conservation ranks, as well as both invasive species richness and estimated density within the unit. Accessibility was based on the distance from the Bass Ridge HOA entrance and terrain between trail and unit. Viewshed status captured the extent to which the unit can easily be seen from Bass Lake and HOA neighborhoods, thereby potentially motivating involvement or support. Finally, “Knowns and Efforts” reflects whether some work has already been done in that unit, increasing its continued study value (for example purple loosestrife research conducted on the north end of the wetland by Evyn Ladendorf-Lilly, or buckthorn treatment plots from STPW I/II). To calculate ranks, we summed the total of the criteria values. The largest summed value has the highest rank. All of the maps used to assess these ranks by unit can be found in the Final Data.zip file in the “**Start Here**” folder in Google Drive.

Table 5.1 Management Prioritization Multicriteria Decision Analysis criteria used to rank management units

Criteria	Weight/Scale
NatureServe Global/State Ranking of MNFI Communities	**Modified Inverse Scale**
Invasive Species Richness	**# Invasive Species Present**
Invasive Observed Density	**Perceived Density (0-3)**
Viewshed Status	**Binary (0-1)**
Accessibility	**Easy (3); Medium (2); Hard (1)**
Knowns and Efforts	**Observational value (0-3)**

5.1.2. Results

We identified and ranked 28 management units in three outcome iterations. The first iteration is an equal weight model where no one criteria is weighted higher than any other (Figure 5.1). This provides a broad view of one management strategy tactic that accounts equally for all factors. The second iteration weighs the richness and density of invasive species more highly than other factors (Map 5.2). In this model, the top ranked unit does not change, but two 2-5 are different, likely because of the loss of relative weight from the accessibility criteria. The last iteration ranks units with high invasive species richness but low density highest. This was inspired by feedback received from the Huron Valley Chapter of the Michigan Botanical Society following a presentation regarding our finding where a member suggested the restoration and preservation of more nearly intact units before those with more densely established invasives may be both more efficient considering capacity, as well has more effective in long-term restoration ensuring that no new units become degraded.

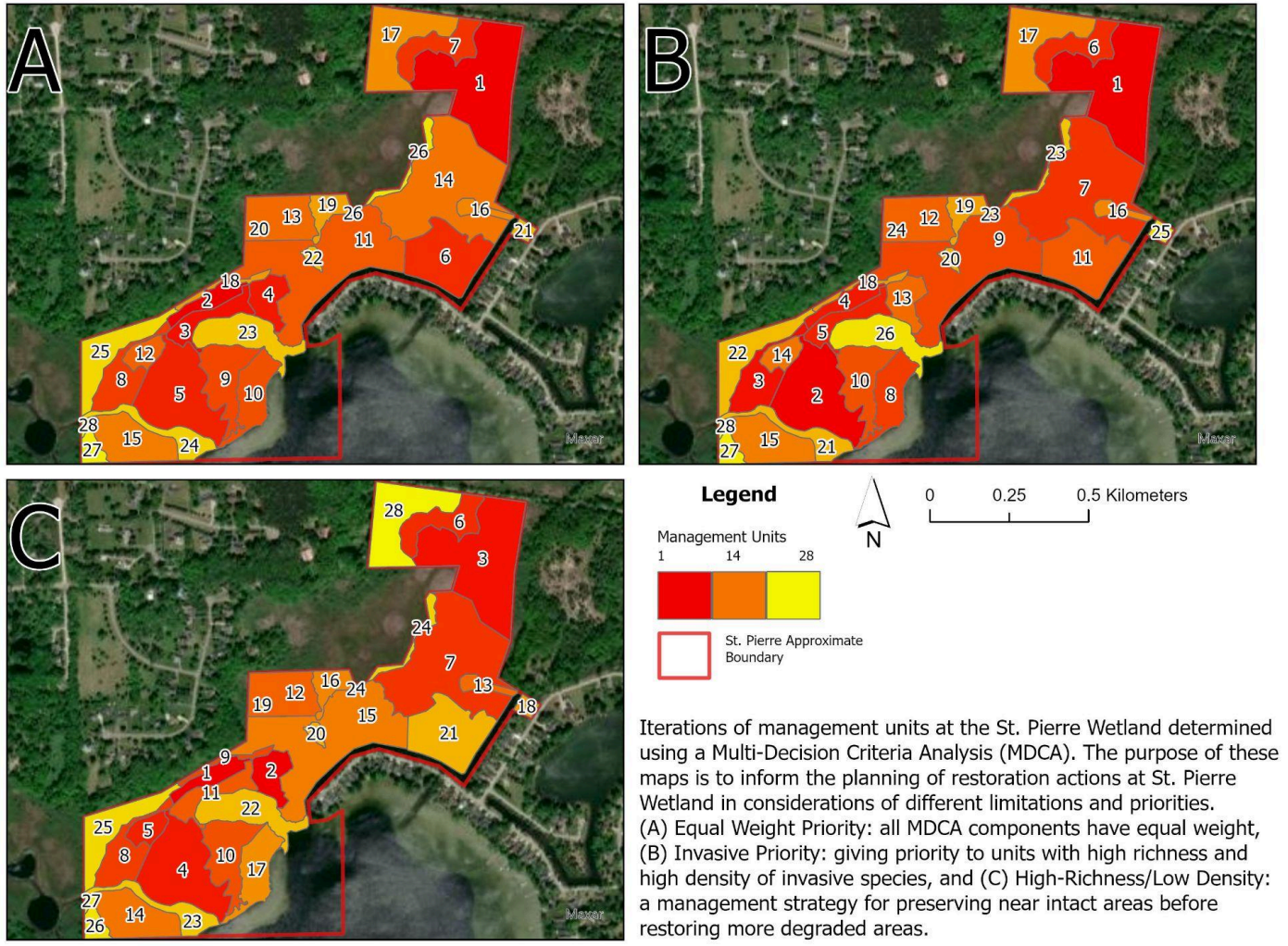


Figure 5.1 Management Unit Map Iterations for strategic restoration planning

Future masters capstone teams, the university, stewards and neighbors of STPW should continue to iterate on which criteria should be weighted more heavily depending on the needs of the parties involved. This choice will then inform the design and scheduling of management actions taking place in accordance with the best practice methods for each species or community type. Most of invasive plant removal recommendations below use the map that weighs high richness and low density of invasive species more highly than other factors, to prioritize areas that are high quality (high global/state rank), accessible, in the viewshed, and have previous work, but especially that currently have multiple but less abundant invasive species. This aligns with advice we received from multiple practitioners to start invasive species removal efforts in areas where, with less effort, we can have a greater impact, and then from those areas work our way outward to dense invasive zones.

5.2. Native plant community restoration

Native plant community restoration at St. Pierre Wetland relies heavily on the continued removal of invasive species which can be approached from three scales as outlined in Table 5.2. Ultimately, a combination of all three approaches will have the most success in meeting the restoration goals of St. Pierre Wetland. Although these approaches may be applied to the removal of all invasive species present at STPW, here we provide examples of how they have been or can be applied to glossy buckthorn, which has been the focus of removal efforts to date.

Table 5.2. Outline of the three invasive species removal approaches at St. Pierre Wetland: small, medium, and large. Removal descriptions are listed for each.

Removal Approach	Removal Description
Small-scale: Experimental removal	**Small experimental plots of replicated removal techniques managed by U-M researchers.**
Medium-scale: Community-driven removal	**Designated areas for manual removal as student- or researcher-led workdays involving students, faculty/staff, student organizations, or other interested community members.**
Large-scale: Contractor removal	**The physical and chemical removal of large expanses of invasive species, including prescribed burns, by a licensed contractor.**

5.2.1. Invasive buckthorn removal

The removal of buckthorn remains the highest priority for restoring the native plant communities present at the site. During the Professional Stewards Hike hosted at STPW in July 2024, a number of practitioners agreed that continued buckthorn removal efforts should be focused in areas with sparse buckthorn and a higher presence of native species, with some individuals stating that the use of herbicide will be necessary to control the site. It is also recommended that removal take place primarily during the winter months to avoid trampling of native fen species (Professional Stewards Hike Notes, July 2024).

5.2.1.1. Experimental approach

While vital for informing ongoing management on site and elsewhere, experimental buckthorn treatments such as installing buckthorn baggies or repeat cutting are most feasible for small-scale buckthorn removal in controlled experimental plots (see Strategic Priority 2: Continue and expand relevant on-site research and education). Other techniques, such as applying the fungal biocontrol *Chondro*, would also need to start at the small scale and potentially be applied at a larger scale after study. Continuing experimental buckthorn removal within designated plots will contribute to ongoing buckthorn management research by documenting buckthorn's response to different removal techniques and providing comparisons across multiple treatments.

5.2.1.2. Community-driven approach

Community-driven removal should prioritize the open prairie fen zone (**management units 1, 2, 4, 5, 10, & 11**; Figure 5.1c) where buckthorn density is low, and will require the guidance of UM student researchers or staff working at the site. This approach should involve multiple manual removal events using brush cutters followed by the application of herbicide (i.e. cut and dab technique). Due to the large time investment associated with community-driven buckthorn management, a motivated group of community volunteers and/or students/staff will be required for the sustainability of this approach (See Strategic Priority 3: Build capacity and processes to support long-term value, stewardship, research, and education).

We examined four key examples of community-engaged prairie fen site restorations. Jason Krick, one of the current [2024-25] capstone team members and plan authors, visited all four sites from April - August 2024 to see the work that volunteers completed to transform these four fens.

The **Nature Conservancy's Ives Road Fen Preserve** serves as a model for implementing community-driven invasive species removal in a fen ecosystem and should be considered in the planning of community-driven removal at STPW. Ives Road Fen Preserve occurs as a 703-acre site in Tecumseh, MI. The Nature Conservancy established the preserve in 1987, and volunteers began taking a lead role in the fen restoration in 2005 (C. Pearson, pers. comm.). Led by Chuck Pearson, a long-term dedicated steward, a small team of volunteers cleared over 450 acres of glossy buckthorn-infested fen with hand tools and herbicide. Over the course of 20 years, staff and volunteers removed 2.5 million adult buckthorn stems, burned 10 million buckthorn seedlings, and burned 400 buckthorn brush piles. Chuck graciously shared his recipe to attract and retain dedicated volunteers over the course of his tenure at Ives Road Fen Preserve. Jason visited Ives Road with Mike Kost in early June 2024 during the Michigan Botanical Society's annual foray. Mike last visited the site 25 years ago, and he was shocked at how the site had been transformed by dedicated volunteers, hand tools, and herbicide (M. Kost, pers. comm.).

At the same foray, Jason visited two more fen sites that dedicated community volunteers restored. Chuck Pearson gave us a tour of **Michigan Nature Association's Goose Creek Grasslands Nature Sanctuary**, located in Lenawee County, Michigan. The site occurs as a 70-acre fen in which Chuck and his team are diligently working to remove an infestation of glossy buckthorn. Likewise, we explored the **Ohio DNR's Irwin Prairie State Nature Preserve** in northeast Ohio near Toledo. Dr. Todd Crail, an ecologist at the University of Toledo, led a team of students who worked on the fen restoration for academic credit through Todd's program Greening UToledo Through Service Learning (GUTS).

In August 2024, Kim Steinberger from The Nature Conservancy hosted Jason at TNC's 627-acre **Grand River Fen Preserve**. TNC has shifted away from volunteer and community-engaged restoration, utilizing small groups of permanent staff members to complete restoration work.

5.2.1.3. Contractor approach

The contracted removal of buckthorn should be reserved for the highest density areas, such as the shrub-carr region along the perimeter of the site (**management units 9, 12, 25, & 28**; Figure 5.1c). This approach will require hiring a licensed contractor such as Stantec, which in 2024 estimated the buckthorn removal cost of $205,000, and so requires a significant funding source, discussed below. Some of UM land management is already contracted out, and so there is a precedent for this type of coordination.

A contractor would also be necessary for conducting prescribed burns on site, if that later becomes a priority. Prescribed burning in fens yields varying

support from practitioners and should be used with caution due to the resulting input of nutrients to the system which may promote the growth of opportunistic invasive species (Professional Stewards Hike Notes, July 2024).

5.2.2. Removal of other invasive species: cattail and purple loosestrife

Practitioners from TNC, USGS, and Metroparks (Professional Stewards Hike Notes, July 2024) agree that proactive management of both invasive cattail and purple loosestrife is necessary where they encroach on the open prairie fen community at the center of the site (**management units 1, 2, 11, 22, & 10**; Figure 5.1c), which can be accomplished through experimental and community-driven approaches. Cattail removal using herbicide was initiated on site in August 2024 (see 6.3.2), and continued removal of cattail in **management unit 2** (Figure 5.1c) should draw knowledge from the literature and similar projects, such as PAMF and MBGNA studies, as described in the research strategy below. The use of fire should be avoided in areas with cattail to prevent stimulating its growth and expansion with additional nutrient input. Continued cattail management on site should also consider effects on species that use even hybrid cattail stands as habitat, such as Wilson's snipe (*Gallinago delicata*), which was observed on site (see 4.7.2 Birds and below).

The management of **purple loosestrife** should be focused across **management units 1, 6, and 11** (Figure 5.1c) and involve manual and chemical control, as well as passive biological control from weevils. A student independent project in fall 2024 EAS 509 (project summary here) confirmed that the purple loosestrife biocontrol beetle was present in all stands of loosestrife, though leaf damage was highest in the northern higher density area. M. Kost noted in the summer that plants in **management unit 1** (Figure 5.1c) looked healthier than expected if biocontrol were adequate. Further research should be planned for summer or early fall 2025 to determine if biocontrol translocation or reintroduction is needed, using standard methods of monitoring leaf damage and plant density (Blossey et al. 2024). If needed, biocontrol beetles can be ordered locally through Kieser & Associates, LLC, which recommends using biocontrol for dense loosestrife patches, and manual control for less dense patches.

Removal of invasive cattail, and other invasive species that may create habitat for fauna should not be removed during the breeding bird season. Female red-winged blackbirds (*Agelaius phoeniceus*) are known to build nests low to the ground in dense stands of cattails and phragmites, as well as sora (*Porzana carolina*) and other rail species (*Rallidae spp.)*. Birds are also known to nest in glossy buckthorns. During 2024, our team observed willow flycatchers (*Empidonax traillii*) and yellow warblers (*Setophaga petechia*) nesting in the edges of dense buckthorn stands. Therefore, ***any removal efforts should be avoided from mid-April to late-July.*** Bird diversity should be assessed, and stewards or partners knowledgeable in avian physiology and behavior should be consulted prior to removal efforts, as nesting and fledging times vary across

species, as well as identifying if precocial species are present (altricial birds may provide leeway for summertime removals).

5.3. Wildlife management

Having a diverse faunal inventory, STPW comes with challenges regarding the conservation of wildlife. The first challenge is not knowing all of the faunal species present due to lack of time and resources invested into inventorying them all. Second is capacity and understanding of the site specific requirements of the species we have identified as needing some level of conservation, and the **complex intersection of maintaining a large, mosaic habitat to meet ideal conditions for many species**. For example, we identified the common grackle as utilizing the glossy buckthorn at STPW, whereas for the restoration of floristic quality we would like to see the buckthorn removed. If federally threatened species are found on site, such as the eastern massasauga rattlesnake (EMR), this may require coordination with the US Fish and Wildlife Service to ensure that EMR environmental screening and best management practices are followed.

We recommend collaboration with neighboring wetland owners, managers, and non-profit organizations (see strategy 3) to identify species present at a landscape level, and delegate restoration for specific species requirements. This does mean that STPW may not be fit to carry as many grackles, but if a neighboring wetland does meet the grackles requirements, it will not be extirpated from the larger landscape.

5.4. Nutrient and hydrology management

Mitigation strategies to reduce nutrient and sediment loading into the wetland should prioritize **rain garden installations** in residential areas, capturing and filtering runoff before it reaches STPW. These gardens, planted with native vegetation, help reduce nutrient loads by allowing water to infiltrate into the soil naturally (Sharma & Malaviya, 2021). Partnering with homeowners to support sustainable lawn care practices, such as reducing fertilizer use, will be important for long-term nutrient management (Eisenhauer et al., 2015).

A targeted recommendation is to design and install a rain garden in the easement area leading to the trail, where runoff from residential properties poses a challenge. This rain garden, which could serve as a living example of ecological design for students in Landscape Architecture (LA) courses, would:

- **Capture and filter runoff before it reaches the wetland, reducing nutrient and sediment loads.**

- **Utilize native vegetation to promote water infiltration and enhance biodiversity.**
- **Provide a hands-on learning experience for students while contributing to restoration and community engagement efforts.**

Because runoff from Bass Ridge and Shan-Gri-La HOAs likely contribute to nutrient loading, working directly with HOA boards and residents to promote voluntary runoff reduction strategies. This work can be advised by Susan Bryan and others at the Washtenaw County Water Resources Commission (WCWRC), given their expertise in training homeowners to install rain gardens. The Huron River Watershed Council also assists with the instruction of the regional Master Rain Gardener Class alongside and in collaboration with WCWRC and could provide support to homeowners in this capacity. Specific actions include:

- **Hosting a homeowner workshop focused on rain gardens, native landscaping, and sustainable lawn care practices that minimize nutrient runoff**
- **Developing a "Rain Garden Implementation Guide" tailored for residents, providing step-by-step instructions on site selection, recommended plant species, and maintenance**
- **Exploring small grant opportunities or sponsorships to subsidize materials or labor for homeowners implementing runoff reduction strategies**
- **Promote the regional Master Rain Gardener Class to HOA members**

To assess the effectiveness of nutrient reduction efforts, baseline and ongoing stormwater runoff monitoring could be conducted in partnership with HRWC, SEAS faculty, and student research projects. Specific actions include:

- **Establishing stormwater sampling sites at key inflow points to measure nutrient concentrations over time**
- **Comparing nutrient loads before and after rain garden installations to track effectiveness**
- **Using student research projects to conduct longer-term hydrological assessments and vegetation performance monitoring**

Beyond rain gardens and green infrastructure, further nature-based strategies can support nutrient reduction, including:

- **Encouraging no-mow buffer zones along the wetland perimeter to slow runoff velocity and filter pollutants**
- **Promoting regenerative lawn care techniques, such as mulching leaves instead of raking and aerating soil to improve infiltration**
- **Encouraging the implementation of bioswales and stormwater retention systems in residential areas to capture and filter runoff before it reaches STPW**

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Photo by Molly Russell
Emily Schultheis and Gwynne Powell lead a buckthorn removal workday

CHAPTER SIX

Strategic Priority 2: Continue and Expand Relevant On-site Research and Education

6. STRATEGIC PRIORITY 2: Continue and expand relevant on-site research and education

6.1. Introduction

This strategic priority aims to support progress primarily toward the two interdependent plan visions for STPW to be **1) a resilient ecosystem with characteristic wetland biodiversity and function, while also 2) providing opportunities for vibrant research, educational, and stewardship programs at the University of Michigan.** St. Pierre Wetland offers an *infinite* array of possible investigations and further study, both to inform ongoing adaptive site management toward goals and just to increase learning or understanding across a variety of sustainability fields. Given the existing work to date, and the needs and opportunities on site as they relate to its ecological state and UM expertise, we have identified a variety of *priority* areas for further study. These could be scaled up or down to be the focus of faculty research, student research (undergraduate honors or master's thesis or project), and/or formal and informal student projects, labs, or field trips. Below we elaborate on some of the key research priorities and in the sample of research priorities and opportunities at STPW, we provide an overview table organized by academic topic to serve as a user-friendly menu of research and education options that best leverage the site's assets while also informing management.

6.2. Expand knowledge of natural features and site ecology

6.2.1. Conduct regular photo monitoring using established set-ups

We built and installed two photo monitoring stations that allow for consistent and easy photo documentation using a permanent wooden stand designed to hold a mobile phone (Figure 6.1). One of these is located at (42.457907°N, 83.866444°W) to assess changes in plant communities and the water level of Bass Lake. The other is located at (42.458715°N, 83.865209°W) to monitor the expansion of the Purple Loosestrife (*Lythrum salicaria*) in management unit 1 (see Figure 5.1c).

Photos should be taken at these stations and added to the Photo Monitoring folder on the Shared Google Drive at least once in September and once in May each year to best see changes over time. There are many available programs that could then allow combined photos to show an animated time-lapse of landscape change.



Figure 6.1. (Top left) KT Meono demonstrates how to use the photo-monitoring setup positioned along the lakeshore (station 1). (Top right) KT and Emily Schultheis use the photo-monitoring stand at station 1 to take a photo. (Bottom left) View of water level and Phragmites from station 1. (Bottom right) View of encroaching purple loosestrife from station 2.

6.2.2. Continue to add to species inventories and iNaturalist

Any species observed on site during site visits or informal meander surveys can be recorded in the plant inventory spreadsheet as well as in the St. Pierre iNaturalist project. For each species, all columns of the inventory should be filled out and any photos taken on site should be included. Photos, a location point, and a brief description of identifying characteristics should be included in iNaturalist to ensure accurate identification. Additional plant surveys should especially focus on the shrub-carr zone, which received less attention than the sedge meadow zone of the prairie fen.

6.2.3. Ground-truth the invasive species and prioritization maps

As the wetland changes it's important to revise the invasive species distribution map as well as the management unit prioritization map with more accurate, up-to-date estimates of the density (not just presence) and distribution of invasive species through **ground-truthing**. This will guide future restoration efforts and assess the rates of expansion or reduction of invasive species in mapped areas. The full invasive species mapping protocol can be found **here**. For the management unit prioritization map, accessibility ratings could be updated over time in ways that inform the prioritization, by exploring the feasibility of access from other entrances, such as from the Lakelands Trail head (parking where it intersects with Kress Rd.).

6.2.4. Conduct hydrology studies

Native community restoration depends on an understanding of the current and changing site hydrology. To date, our ecological assessment only relied on existing hydrological maps. More research is needed to better understand the hydrologic impacts of the bike path (former railway), stream diversion, drainage canals, as well as shoreline development and the weir on Bass Lake. As a start to better understand site hydrology we recommend at least two actions:

- Acquiring, installing and maintaining at least one water level gauge along the shoreline of Bass Lake. An appropriate model might be the shallow pressure range (M5) Levelogger 5 or Levelogger 5 Junior.
- Studies of soil moisture levels in relation to topography, pH, and plant community zones along gradients from the shore to the upland, which could be conducted as a part of a student lab course on site.

6.3. Continue experimental invasive species removal practice studies

St. Pierre wetland is an ideal location to train students and advance empirical evidence in the field of restoration ecology. In addition to the species-specific removal methods research described below, studies may pursue biotic resistance, or how additional native species plantings can improve native community restoration (Feldman et al 2024).

6.3.1. Buckthorn (*Frangula alnus* and *Rhamnus cathartica*)

Since winter 2023, several experimental glossy buckthorn (*Frangula alnus*) removal treatments have been established at STPW across three plots (one 10x24m and two 10x12m) to test the effectiveness of different **non-herbicidal treatments**. Detailed plot diagrams can be found **here**. These treatments were designed to control buckthorn by limiting:

- ***Oxygen and light*** by cutting below water level (submerged cuts),
- ***Light and resources*** by cutting and covering with a dark plastic bag (Buckthorn Baggies), and
- ***Resources*** by cutting low or at chest height and repeatedly removing resprouts at critical resource-exhausting times.

Based on initial analyses, the submerged cut treatment seemed to be highly effective in reducing the number of buckthorn in the following year (for details see Experimental BT treatments and prelim results 2023-24). However, this result may have been an artifact of the initial number of buckthorn complexes in each subplot. We found before treatment, the submerged subplots had fewer buckthorn complexes compared to the other treatment subplots. It was also unclear how many stumps were completely removed rather than cut during treatment implementation, making it difficult to accurately record the number of resprouting buckthorn complexes. Therefore, the submerged cut treatment was not continued, although we did learn that complete stump removal, though laborious when done by hand, can be effective in preventing buckthorn regeneration.

The light and cut treatments were replicated to further assess their effectiveness over time and require continued implementation until at least winter 2027. For more information and to complete this *priority* research, consult the draft buckthorn removal experiments manuscript which will allow for the important results to be shared more broadly with the field of invasive ecology and native plant restoration.

Another experimental buckthorn removal treatment we considered is a fungal biocontrol treatment. Lalcide Chondro is a relatively new commercial biocontrol product which uses the targeted application of the pathogenic fungus, *Chondrostereum purpureum*, to treat cut buckthorn stems. Experimental research (Dolinski et al., 2024; Roy et al., 2010; Shamoun and Elliot 2022) and informational webinars (Rhoda deJonge, Bio Forest at Lallemand Plant Care and Allison Winmill, R.P.F., Technical Manager Forestry & Tree Nurseries) suggest this method offers an alternative to traditional herbicides and may be especially useful in wetland systems where land managers are limited by the products they can apply. In winter 2024 Steve Parrish at MBGNA made an effort to obtain Chondro from a Canadian distributor Lallemand, but by winter 2025 learned that the product had been discontinued by the manufacturer, and does not appear to be available elsewhere. While it may be possible to culture the fungus from field samples (Brendan O'Neill, pers. comm.), there are rare (but possible) risks with human health that need to be considered (Suvvari et al., 2023).

In addition to the already explored and initiated treatments, priorities for future experimental approaches to buckthorn removal include:

1. **Complete manual removal**: Removing whole root masses with a **pullerbear**, or type of weed wrench, can be effective for smaller or already weakened plants, but requires study to determine its effect on hummock topography and native plants. The SEAS ecology lab has two different sized Pullerbears to try. The submergent treatments in Plot I referenced above would be an ideal location for a pilot study. To reduce the impacts of trampling, this treatment should commence in the early spring when the ground has begun to thaw but the native vegetation has not fully re-established.

2. **Interaction with deer:** It is also critical to understand how any buckthorn removal treatment coincides with deer browsing on site. We noticed well-used game trails throughout the site and significant deer-browsing within our experimental treatment plots, especially on resprouting buckthorn stems. An initial study of deer browse within the treatment plots in fall 2024 did find many stems with browse damage, but did not count total stems to calculate the *percent* of stems with damage, and so a future study is needed that would allow for quantitative comparison of percent browse among treatments and plant species. We also recommend studies assessing the impacts of deer trampling along game trails on site hydrology, nutrients, and plant species composition.

3. **Ecological and economic benefits of removed plant waste:** With increased removal of invasive plants, there is a need to more sustainably address use of plant waste in ways that motivate and sustain continued removal efforts with positive economic and ecological outcomes (Orian, 2015; Lorenzo and Morais, 2023). Removal of buckthorn, to date, has generated two large brush piles of cut plants near our experimental plots in an attempt to reduce the spread of seeds and the impacts of trampling across the fen, while shading out existing patches of buckthorn at the border of the fen and experimental plots. What are the benefits of these piles? Do these piles successfully smother buckthorn? Can they provide effective wildlife habitat? We observed one snake atop the brushpile, but quantitative comparison is needed. There is also a need to explore other potentially beneficial *uses* of the buckthorn. What are the costs and benefits of using a wood chipper on site to provide mulch for Bass Ridge HOA trails? We also recommend further exploring the idea of using a **biochar** kiln to convert removed buckthorn into a valuable and climate-mitigating commodity. This could be accomplished by collaborating with surrounding communities and UM entities, such as Campus Farm or the Michigan Sustainability Community guided by Joe Trumpey, to develop a shared-cost summary and implementation plan for biochar production. (Similarly, below we discuss the potential for phragmites to be used as biofuel.) In its native range, buckthorn has also been used to produce valued herbal medicines, gunpowder, and dyes (Chisholm, 2025), all of which could be explored at STPW.

6.3.2. Cattail (*Typha angustifolia & T. x glauca)*

The STPW project team hosted the MBGNA Natural Areas Team, led by Jeff Plaake and Steven Parrish, on August 15, 2024 to remove invasive cattails. Removal efforts focused on a patch of suspected *Typha x glauca* at the northeast end of the property, with some sporadic *Typha* and *Frangula alnus* stems removed between the treatment area and the site entrance. We mapped and flagged the entire cattail treatment area and 15 (1m x 1m) quadrants in FieldMaps (Figure 6.1) to sample for *Typha* abundance. The number of stems in each quadrant ranged from 4 - 15 with a mean of 12 stems. All *Typha* stems in the quadrants were cut and treated with 100% Aquaneat and flowering heads were collected for disposal. The full data file can be found here: St Pierre II & MBGNA Typha Workday 2024.08.15

The cattail removal plot will require ongoing annual monitoring for *Typha* resprouting to evaluate the effectiveness of the removal methods. To prevent the expansion of Typha into the open fen area, continuous cutting and treating of resprouts should occur in the quadrants. Expanding this removal effort to include more quadrants in the same treatment area, as well as other areas where Typha is present, will facilitate cross-site comparisons. Additionally, incorporating other techniques, such as multiple cuts within one season, may offer more insights into Typha's response to cutting.

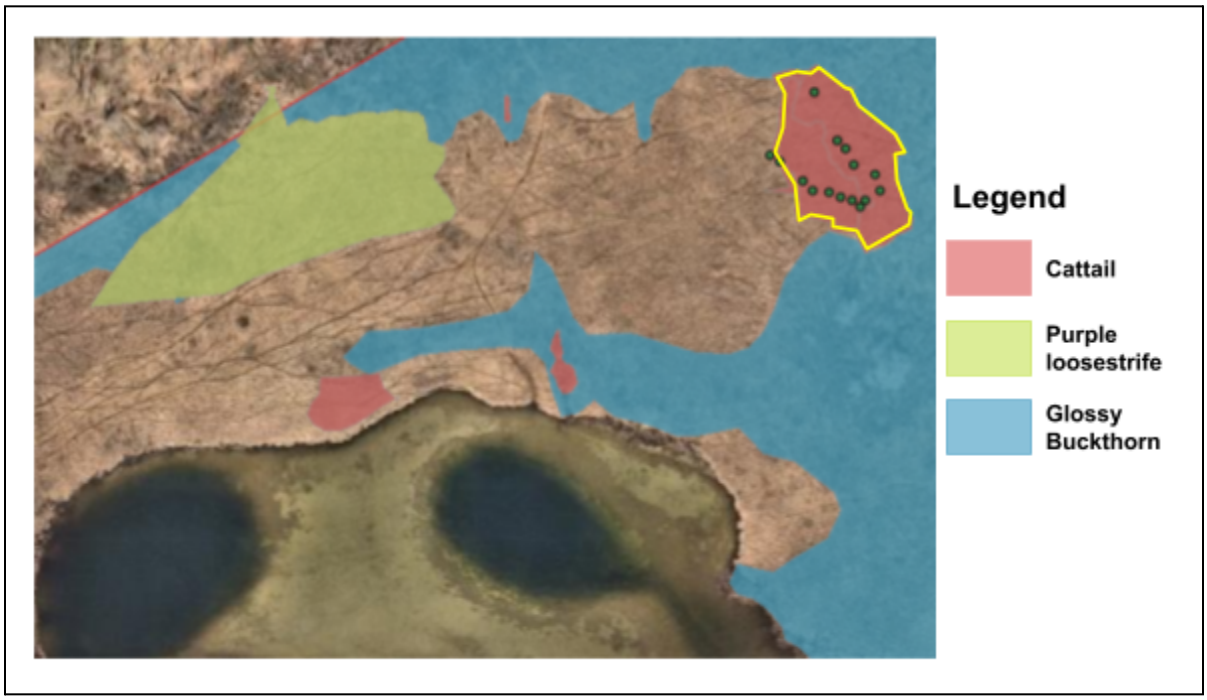


Figure 6.5. Map of experimental cattail removal area in reference to other areas of invasive species. Areas of cattail are represented by red polygons. The cattail treatment area is outlined in yellow. Experimental quadrants are indicated by green dots.

6.3.3. Phragmites (*Phragmites australis*)

Besides observing a large stand of phragmites across the lake inlet at the southwest end of the property and a patch near the Lakeland Trail, little is known about the current extent of invasive phragmites at STPW. The HRWC Bioreserve Site Assessment listed only native phragmites (HRWC, 2017), but further investigation should confirm the subspecies (invasive *subsp. australis* versus native *subsp. americanus*) in each known location. On April 4, 2025, a member of our team met with Spenser Widin and McKenzie Smith from the USGS Great Lakes Science Center to assess STPW for phragmites research. It was determined that the site is too wet for the current phragmites research, and it was recommended that we send samples in for genetic testing (S. Widin, pers. comm.). Resources for confirming phragmites identification, including genetic testing, can be found on the Great Lakes Phragmites Collective website. If the phragmites present is confirmed to be the invasive subspecies or a hybrid, the area should be surveyed and added to the invasive species map with density estimates. Additionally, the photo-monitoring station along the lake inlet (station 1) should continue to be used annually to monitor the expansion of the larger phragmites stand. STPW should also be enrolled in the Phragmites Adaptive Management Framework (PAMF) to guide effective management of any invasive phragmites stands on site, while becoming part of a larger data network. STPW researchers could also explore the potential of on-site phragmites to be used as biofuel, in collaboration with relevant work by Shane Lishawa at Loyola University and others.

6.3.4. Best practices for applying herbicides and biocontrol agents on site

All applications of EPA-registered, unregistered, or experimental herbicide or biocontrol substances for invasive plant species management should follow a guideline of best practices, including but not limited to:

1. Ensuring that individuals applying the product have their MDARD Commercial Pesticide Applicator License *or have been trained* as applicators by the Certified Applicator
2. Wearing sufficient personal protective equipment (PPE) as defined by the EPA label. In the case of unregistered or experimental products, appropriate PPE should be defined prior to application by the Certified Applicator and applicators.
3. Thorough documentation of: the date applied, the Certified Applicator's name, the trained applicator's name, the quantity of active ingredient applied, the application method, equipment used, re-entry interval (REI), weather conditions on the date of application, and (if applicable) EPA registration number
    a. Example 1
    b. Example 2
4. Compliance with all applicable EPA and MDARD regulations under FIFRA
5. Ensuring that current and anticipated site conditions - such as flooding or high winds - will not interfere with application or cause pesticide drift

6. Proper storage and disposal of containers previously or currently containing pesticides

6.4. Continue inventory/assessment of fauna on site and expand the scope

Assessments for wildlife were first conducted in 2024, and so there needs to be a continued effort to assess which species are present and to quantify densities. Beyond ad hoc observations which can be added to the existing species inventories (eBird Hotspot), this includes the need for more formal surveys of mammals, birds and herps, but also efforts to expand the scope of study to include macroinvertebrates and terrestrial insects. There are also many opportunities to assess how wildlife, especially indicator species and overabundant deer, interact with the plant communities and management efforts. Specific wildlife research priorities and opportunities are captured in the sample of research priorities and opportunities at STPW.

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Photo by KT Meono
Monarch butterfly on a stem of glossy buckthorn

CHAPTER SEVEN

Strategic Priority 3: Build Capacity and Processes to Support Long-term Value, Stewardship, Research, and Education

7. STRATEGIC PRIORITY 3: Build capacity and processes to support long-term value, stewardship, research, and education

Implementing adaptive management to restore and maintain site value and expanding relevant on-site research and education will require more than just a single grant or a few extra hands on the ground. It means creating a system where interest, support, and communication flow freely between all stakeholders—faculty/staff, students, local homeowners, and environmental groups—so everyone involved can work toward shared goals. To secure the future of STPW as an active and high quality site for research and education and with landscape-scale value, long-term success depends on establishing the capacity and processes needed to *sustain* efforts. Strategic Priority 3 outlines specific actions to build three main sources of capacity: infrastructure, funding, and people.

7.1. Infrastructure

Ensuring reliable access to the site is essential to prevent logistical challenges from hindering research, restoration, and educational activities. Investment in infrastructure at this site has been deferred for five decades. University staff, faculty, and administrators have discussed some of these improvements since early 1975, when the University was considering accepting the land as a gift from Angeline St. Pierre. The wetland needs two inexpensive capital investments to improve safe accessibility to the wetland and improve its health – a boardwalk and a boathouse.

7.1.1. Signage

STPW lacks educational signage on or near the site. Signage would inform the public about the ecological importance of wetlands and would provide specific information about the rarity of STPW's natural communities. As with the boathouse (see section 7.1.3), almost all prior reports and recommendations for STPW have suggested adding signage, especially along the heavily traveled Lakelands Trail - a linear, paved trail owned by the DNR running along the northern boundary of STPW. Pat Hohl, the Hamburg Township Supervisor, committed to the first and second master's project teams that the township would cover up to $300 for sign production and install it along the Lakelands Trail. We met with SEAS facilities and learned that producing an official sign with the University of Michigan logo requires many levels of review and approval. Additional signs should also be added at the entrance into the wetland from the Bass Ridge HOA trail, and "Research in Progress" signs would help indicate sensitive research areas to avoid.

7.1.2. Boardwalk

As discussed in our ecological site assessment (see chapter 4), trampling wetland vegetation poses a risk to the quality of the natural communities on site, but

there is a need to access the site regularly to manage for other threats on site such as invasive species, and to fulfill the site mission. To minimize costs and footprint, experts at Matthaei Botanical Gardens and Nichols Arboretum (MBGNA) suggested installing a narrow boardwalk using a metal mesh that will allow light and precipitation to pass through to continue supporting life underneath the structure. MBGNA installed this type of boardwalk in Radrick fen in the 1960s and it continues to provide access while minimizing impact to the fen (Figure 7.1; J. Plakke, pers. comm.). A boardwalk like this will greatly improve safety, as the current entryway is slippery and unstable, especially in the winter when site visits are needed to complete treatments.

The location of the boardwalk would begin at the entrance to the wetland off of the Bass Ridge HOA trail (42°27'33.2"N 83°51'54.6"W), continue southeast for approximately 200 feet to 42°27'33.2"N 83°51'54.6"W, and continue another 250 feet to 42°27'30.2"N 83°51'55.1"W before terminating. The boardwalk would extend through the area most widely used by student researchers (i.e., the path out to the experimental buckthorn plots).



Figure 7.1. MBGNA Radrick Fen boardwalk, installed in the 1960's.

7.1.3. Boathouse

When the SNR considered accepting the wetland from Angeline St. Pierre in 1975, internal memos recommended that the University only accept the land if it included deeded access to the wetland. The final gift assignment and warranty deed included a 0.41-acre parcel (ID: 4715-21-303-015) that sits on the Shangri-la canal and would provide direct riparian access to Bass Lake and STPW (Figure 7.2). Every report that has been produced since that time has recommended the construction of a boathouse to store kayaks, canoes, paddles, and safety equipment. Given the increased need for site restoration, a boathouse could also double as a storage facility for brush cutters, chainsaws, and hand tools that could be used for restoration work. This would also reduce safety concerns of needing to load boats onto vehicles and transport them from Newcomb Tract.



Figure 7.2. The 0.41 acre parcel [4715-21-303-015] denoted with a yellow arrow that UM required at the time of the 1975 gift. The land was intended to house a structure to store boats and maintenance supplies.

SEAS has a verbal agreement with the Bass Ridge HOA to access the wetland by parking on HOA property, walking through the HOA easement and onto the HOA trail, and into STPW from the trail. The lack of legal terrestrial access to the site poses a potential risk of the HOA revoking authorization in the future. Constructing a boathouse on the parcel adjacent to the Shangri-la canal significantly mitigates this risk and provides an alternative access point to the wetland. Once dense glossy buckthorn is removed along the canal, SEAS visitors can cross the 20-foot-wide canal in a kayak from this parcel and be in the wetland within minutes, improving access and efficiency.

7.2. Funding

Securing sustainable funding for the St. Pierre Wetland (STPW) requires a multi-faceted approach that integrates grant applications, donor engagement, and partnerships. These efforts will ensure resources are consistently available to support restoration, community engagement, and educational initiatives.

A top funding priority is the creation of a dedicated property steward position for SEAS-owned properties. The long-term ecological and educational value of St. Pierre Wetland depends on consistent on-site management, coordination, and institutional memory. These roles are currently fragmented or handled by volunteers. A staff steward would ensure continuity in restoration work, assist with monitoring experimental plots, facilitate research and teaching logistics, and serve as a liaison between SEAS, student groups, neighbors, and regional partners. Funding this role through administrative budgets, endowments, or grants is essential to fully realizing the vision laid out in this plan.

7.2.1. Grant Funding

Table 7.1. Potential Grant Opportunities for Wetland Restoration and Research

NFWF Five Star and Urban Waters Restoration Grant Program	• Purpose: Provides funding for projects that integrate ecological restoration and environmental education. • Funding Range: Awards range from $30,000 to $60,000 with an average size of $45,000 and 30-40 grants awarded per year. • Application Due Date: End of January
North American Wetlands Conservation Act (NAWCA) U.S. Standard Grants	• Purpose: Supports projects that protect and restore wetlands critical to biodiversity. • Funding Range: Awards range from $1,000 to $250,000 • Application Due Date: Mid-October
McNALMS and MLSA	• Purpose: Supports wetland and lake management projects

Student Lake Research Grants	in Michigan. ● Funding Range: Typically offer a total funding pool of around $4,000 per year. ● Application Due Date: Mid-March
Wildflowers Association of Michigan (WAM) Grants	● Purpose: Promotes education and habitat restoration projects using native plants. ● Funding Range: Up to $1,250 in support. ● Application Due Date: Early December
LSA Sustainable Living Resources Grant	● Purpose: Provides sustainability-focused funding for faculty- and student-led projects. ● Funding Range: Up to $2,500. ● Application Due Date: Varies
McIntire-Stennis Cooperative Forestry Research Grant	● Purpose: Focuses on forestry and wetland-related ecological research. ● Funding Range: The amount available for support of this program in FY 2024 was $35,474,478. ● Application Due Date: Late September

7.2.2. Donor Engagement

Engaging donors is a critical pillar of funding for STPW. Efforts should focus on building relationships with SEAS alumni, local conservation advocates, and community members.

- Targeted Alumni Outreach:
    - Identify Alumni with Conservation Interests: Work with SEAS Development staff to analyze alumni records and segment individuals with professional or personal ties to environmental work, specifically with wetlands.
    - Craft a Compelling Narrative: Develop materials, including videos and newsletters, that highlight how alumni contributions directly support impactful projects at STPW, such as invasive species removal, fen restoration, or student research.
    - Alumni Events: Host exclusive events for alumni, such as guided tours of the wetland, where participants can witness restoration efforts firsthand and connect with SEAS faculty and students involved in the project.
    - Offer Naming Opportunities: Create a program where alumni can sponsor specific elements of the wetland, such as the "Alumni Legacy Rain Garden," a trail, or specific stewardship events.
- Community Donor Campaigns:

    - Partner with Local Homeowners Associations (HOAs): Collaborate with the Shan-Gri-La and Bass Ridge HOAs to host presentations about the wetland's role in preserving water quality and biodiversity in the area. Highlight how their support contributes to local ecological and recreational benefits.
    - Sponsorship of Stewardship Events: Invite local businesses and individuals to sponsor events, such as invasive species removal or educational workshops. Sponsors could be recognized through signage at the events or on promotional materials.

- Personalized Donor Engagement:
    - Personal Invitations to Exclusive Site Visits: Invite high-potential donors to private tours with SEAS faculty or student researchers to demonstrate the wetland's ecological importance and its educational potential.
    - Customized Proposals: Develop funding proposals that outline specific projects, their impact, and how the donor's contribution will be acknowledged (e.g., naming a restored habitat area or funding a long-term research station).
    - Regular Progress Updates: Keep donors engaged by providing quarterly reports, photos, and videos showcasing the progress of the projects they've supported.

7.3. Internal and external community engagement

Community engagement is essential for STPW to provide vibrant research, educational, and stewardship programs and to be a valuable part of the larger socio-ecological landscape. There are clearly many ways for those within the University to both benefit from and support the site. Strategic priority 1 (Implement adaptive management to restore and maintain site value) and 2 (Continue and expand relevant on-site research and education) provide numerous recommendations that are inquiry and experiential activities that could be the focus of faculty research, student research, and/or formal and informal student projects, labs, or field trips. They also include activities that are not inquiry-based, but are experiential (e.g., seeing an example of a prairie fen, participating in on-site collaborative workday, etc.) that lend themselves to a variety of university audiences for engagement. Students in field-based courses could visit the wetland for data collection or observation. Students can use knowledge gained from classes to design on-site opportunities for surrounding community members. MLA faculty and students could lead the design and installation of rain gardens or bioswales in the neighborhoods surrounding STPW. At a broader level, on-site engagement may also involve EEB and Earth Sciences students or related student organizations such as SEAStheWetlands, the Ecological Restoration Club, and the Society of Conservation Biologists.

Beyond the University, there is widespread interest in or connection with the wetland – from residents neighboring both sides of the wetland, to public boating by the southern edge or

riding on the Lakeland bike trail on the northern edge, to regional partnerships in an area already organized around an interest in regional wetland and lake habitats, and natural area stewardship experts and practitioners. Impacts of engagement extend beyond the property. For example, engaging local residents in restoration efforts at STPW can foster a sense of responsibility and pride in the wetland, reducing threats like littering through proactive care rather than reactive measures (DiEnno & Thompson, 2013). Community outreach and education programs can help reinforce these values and encourage sustainable use of the ecosystem (Ardoin, Bowers, & Gaillard, 2020).

There is also a need for long-term relationship-restoration with indigenous tribes that have a deep historical connection to the wetlands of STPW, as noted in Site History and Context. In an attempt to begin outreach with a local Indigenous tribe, in September 2024 our team met with Shiloh Maples, an Anishinaabe seed keeper, educator, community organizer, and citizen of Little River Band of Ottawa, and a visiting scholar with the Center for Braiding Indigenous Knowledges and Science (CBIKS) at the Matthaei Botanical Garden (MBGNA). We decided to connect with her after reading her MBGNA interview where she discusses humans' relationships with plants, especially invasive ones. During our conversation, Shiloh strongly recommended that we consider incorporating Indigenous Ecological Knowledge into our management plan framework by engaging with a local tribal leader. She also encouraged us to have patience by pointing out that this work is "generational," and that we would be planting a seed for the university to possibly move in the direction of Indigenous co-management or co-stewardship of the land (S. Maples, pers. comm.). We recommend beginning with a collaboration with CBIKS, as they have already begun creating relationships. While STPW may be a suitable and desired site for manoomin (wild rice) restoration, efforts to reintroduce such a culturally sensitive species can only be done in a "good way" (*Partnering with Native Nations in a Good Way Guide*) and specifically by applying best practice from *We All Live Together in a Good Way with Manoomin: Stewardship Guide*, recently developed by the collaborative efforts of the Michigan Wild Rice Initiative.

Given the breadth of possible engagement opportunities, we first identified the range of existing and potential interested parties and our vision for each (Table 7.2) and then created a tool to guide specific actions over time. Our **STPW Community Engagement Framework** presents a structured framework for the ongoing management and stewardship of STPW designed to serve as a dynamic, adaptable tool for guiding future actions and documenting progress. The framework provided gives a comprehensive overview of achievements to date and a menu of potential future engagement efforts, categorized by key interested parties, and links specific actions to goals and measurable outcomes. This living document is intended to facilitate continuity and accountability by outlining accomplishments to date, prioritizing next steps, and defining clear evaluation metrics. By aligning goals, actions, and measures, this tool ensures that efforts to steward the wetland remain focused, collaborative, and responsive to evolving needs, enabling future stakeholders to build on these foundational strategies and sustain the wetland's ecological, educational, and research value.

A cornerstone of this collaboration should be a **bi-monthly email newsletter** sent to all interested parties (which may be called “The Friends of St. Pierre Wetland”), including faculty, staff, students, local homeowners, and community organizations. These email newsletters should be sent by the primary contact at UM when a MSP team is not working, and by members of the current MSP team when a project is in progress. These newsletters will:

- **Provide updates** on ongoing restoration and research efforts.
- Announce upcoming **stewardship workdays and events** with clear **opportunities to participate**.
- Highlight **community and student involvement**, celebrating the efforts of different groups.
- **Invite feedback and new ideas**, ensuring two-way communication.

This regular communication will ensure that everyone involved remains informed, connected, and engaged, laying the groundwork for long-term collaboration and success.

Achieving this broad community engagement vision requires more than financial support or occasional involvement; it demands a system to ensure communication flows freely among all stakeholders. This system will serve as the backbone for collaboration and coordination, addressing logistical challenges and ensuring that everyone involved works toward shared goals.

Table 7.2. Range of interested parties in the **STPW Community engagement framework**, with associated visions to guide actions. The linked framework contains a range of actions to meet each vision.

INTERESTED PARTY CATEGORY	*ENGAGEMENT VISION*	GROUP/ORGANIZATION
PUBLIC	*The public appreciates, respects, and understands STPW's unique ecosystem type, role in the watershed, and role in research and education.*	- Lakeland Trail Users - Bass Lake Recreationists
NEIGHBORS	*The neighbors have a good relationship with UM and support and understand the work that's happening, either passively or actively.*	- Bass Ridge HOA - Shan-Gri-La HOA
INTERESTED PARTY CATEGORY	***ENGAGEMENT VISION***	**GROUP/ORGANIZATION**
CHAIN OF LAKES	*UM is a collaborator in regional initiatives*	- Cordley Lake Association

REGIONAL PARTNERSHIPS	*and there is an understanding of STPW's role within the larger watershed. UM and regional partners work together to share insights and foster a unified approach to watershed stewardship.*	- Hamburg Township - Huron River Chain of Lakes Association (Previously Portage Base & Whitewood Owners Association) - Livingston County - Mohican Lake Collaboration - Rush Lake Property Owners Association - Strawberry Hill Estates Homeowners Association - Strawberry Point Bluffs Homeowners Association
EXTERNAL EXPERTS, PRACTITIONERS, AND ORGANIZATIONS	*Activities on site are informed through the active collaboration of a network of experts, conservation organizations, research groups, with select partners providing funding support.*	- Goose Creek Grasslands - Herpetological Resource and Management - hyfi - Huron River Watershed Council - Huron Valley Chapter Michigan Botanical Society - Michigan Wetlands Association - NatureWrite, LLC - Niswander Environmental, LLC - Society of Wetland Scientists - Stantec - USGS Great Lakes Phragmites Collaborative
		- Ducks Unlimited - Great Lakes Audubon - Michigan Inland Lake Partnership - Michigan Natural Shoreline Partnership - MiCorps - Midwest Glacial Lakes Partnership - North American Lake Management Society - The Nature Conservancy - The Stewardship Network
INTERESTED PARTY CATEGORY	***ENGAGEMENT VISION***	**GROUP/ORGANIZATION**

ACADEMIC RESEARCHERS, STUDENTS, AND UM/SEAS ADMINISTRATION	*STPW is a recognized research site with numerous collaborators, projects, publications, and grants.*	- SEAS Faculty
		- SEAS/PiTE Students (UROP, thesis, MSP)
		- Researchers (faculty & students) from other units within UM (EEB, EES...)
		- Central Michigan University - Eastern Michigan University - Michigan State University - Loyola University Chicago's School of Environmental Sustainability (Team Typha)
	STPW is an ecological training ground where students have improved critical hard and soft skills in a variety of fields from wetland restoration to community engagement. Through immersive educational experiences, students are better equipped with the tools needed to be impactful professionals in the environmental field.	- U of M Ecological Restoration Club - U of M Chapter of the Society for Conservation Biology - SEAStheWetlands - Other student clubs
		- MBGNA Natural Areas - UM Herbarium
		- Courses
ACADEMIC RESEARCHERS, STUDENTS, AND UM/SEAS ADMINISTRATION	*SEAS and UM administrations actively facilitate the educational and research initiatives at STPW and ensure support for its programs and operations.*	- UM Resilient Grounds/Provost
		- SEAS Dean - SEAS Executive Director of Development and Alumni Relations - SEAS Chief Administrative Officer
		- SEAS Properties

7.4. Literature cited

Ardoin, N. M., Bowers, A. W., & Gaillard, E. (2020). *Environmental education outcomes for conservation: A systematic review. Biological Conservation, 241*, 108224. https://doi.org/10.1016/j.biocon.2019.108224.

DiEnno, C. M., & Thompson, J. L. (2013). *For the love of the land: How emotions motivate volunteerism in ecological restoration. Emotion, Space and Society, 6*(1), 63–72. https://doi.org/10.1016/j.emospa.2012.02.002 .



Photo by KT Meono
Sandhill cranes in flight

CHAPTER EIGHT

Plan Implementation and Evaluation Timeline

8. PLAN IMPLEMENTATION AND EVALUATION TIMELINE

The three-year priority implementation plan is a structured yet flexible roadmap designed to guide the next phase of stewardship, research, and community engagement at STPhi gW. This plan is not a comprehensive list of all possible actions, but instead **prioritizes** specific tasks that are feasible and actionable in the **next three years**. After completing this three-year cycle, a new three-year implementation schedule should be developed using:

- The **overarching guidance** provided in the rest of this management plan
- An **assessment of progress, challenges, and lessons learned** from the previous three-year period
- Possible **future actions listed** in the community engagement spreadsheet

The implementation plan table is organized directly around the three strategic priorities and their corresponding sub-priorities that are listed in this plan. Each row in the table corresponds to a single, specific action item along with a detailed description, when the item should be completed by, and the item's status. The table includes a filtering and sorting functionality, allowing users to view actions by strategic priority, sub-priority, semester to be completed, and current status.

By structuring the implementation plan this way, the table acts as a practical, working document that can be referenced and updated throughout the three-year period. The level of specificity ensures that tasks are not just ideas but immediately executable steps that support the long-term management of STPW.