DRAFT RESTORATION PLAN
AND
ENVIRONMENTAL ASSESSMENT

FOR THE

GREEN POINT AREA RESTORATION PROJECT

SHIAWASSEE NATIONAL WILDLIFE REFUGE

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Executive Summary

The Shiawassee National Wildlife Refuge (Refuge) encompasses over 9,800 acres of marsh, bottomland hardwood forest, and grasslands within a larger landscape dominated by urban development and rowcrop agriculture. The mission of the Shiawassee National Wildlife Refuge is to conserve an undeveloped expanse of floodplain forest, marshes, rivers, and associated habitat through habitat management; to encourage public land conservation and partnerships; to provide educational outreach; and, to contribute to private land stewardship.

In 1998, the U.S. Fish and Wildlife Service (Service), the State of Michigan, and the Saginaw Chippewa Tribe negotiated a settlement for natural resource damages with the General Motors Corporation, Bay City and the City of Saginaw. The settlement provided for substantial cleanup of contamination and for restoration of fish and wildlife habitats in the Saginaw River and Bay. As a result of the settlement, the Refuge received two 99-year leases of the Green Point Environmental Learning Center and an associated 80 acres of riparian and upland habitats. Additionally, the settlement provided funding for restoration at the Learning Center.

In May of 2014, the Refuge received the former 135-acre Germania Town and Country Club (Germania) as a donation from The Nature Conservancy. Germania is located immediately north of the Tittabawassee River and borders the Learning Center to the north and west.

Settlement funds available for restoration of the Green Point Area are limited. The 1998 settlement for natural resource damages required that a sum of $520,000 be provided to the Federal trustees to "use these funds and the interest thereon at the Green Point Environmental Learning Center to restore, replace, or acquire equivalent resources consistent with CERCLA and applicable regulations." At present, with interest added, the Service has approximately $600,000 for this project. The Service is the sole Federal Trustee for the Green Point Area Restoration Project.

The Service, as the Federal Trustee, now seeks to use these settlement funds to restore lands encompassing the Green Point Area, including the recently acquired Germania property, thereby achieving restoration of resources and services lost due to prior natural resource damage. The primary natural resources injured were those most closely associated with the aquatic system of Saginaw River and Bay, including birds and mammals that feed on insects and fish from the river and its floodplain. The 1998 settlement included many components, but the focus of this portion of the settlement is the natural resources along the river corridor and the services they provide. The habitat associated with these injured resources that can be restored is bottomland hardwood floodplain forest. Related services to the public of restored habitat would consist of activities including, but not limited to, bird watching and hiking.

Four draft restoration alternatives are considered in the following analysis:

- Allow natural recovery within the Green Point Area (no action)
- Maximize ecological restoration within the Green Point Area
- Maximize public use of the Green Point Area
- Conduct ecological restoration informed by ecological and community assessment

The **natural recovery alternative** relies solely on ecological processes, that is, natural succession without management intervention, to achieve ecological restoration. For example, no planting of native species, treatment of non-native species, removal of cart paths or buildings in the Germania Tract, or construction of hiking trails would occur under this alternative.

The **maximized ecological restoration alternative** places a priority on management actions to achieve restoration of bottomland hardwood floodplain forest habitats. This would include reforestation plantings and treatment of non-native invasive species throughout the Green Point Area. Hydrology would be re-established by eliminating drains related to agriculture or turf management. Amenities would be secondary to restoration activities.

The **maximized public use alternative** places a priority on management actions that would enhance public use of the Green Point Area. This might include amenities such as new trails, additional access points, interpretive signage or information kiosks, or shelters. Efforts to restore bottomland hardwood floodplain forest would be secondary to providing public use amenities.

The fourth alternative considered emphasizes **ecological restoration informed by ecological assessment and structured assessment of community interest** in the Green Point Area. This alternative places a priority on management actions to achieve restoration of bottomland hardwood floodplain forest habitats. Amenities would be secondary to restoration activities, but provisions would be made for possible future additional amenities. Planning for future amenities would be an outcome of a structured assessment of community interest in the Green Point Area. Conducting this assessment would delay implementation of restoration and would reduce the extent of it by a moderate amount. However, integrating these two assessments would ensure that conflicts between ecological restoration and planning for future amenities would be minimized. This is the preferred alternative.

With the exception of the 'natural recovery - no action' alternative, it is unlikely that settlement funds will be sufficient to fully implement an alternative. Consequently, alternatives are described in the following analysis in terms of the priority of their associated management actions. It is the Service's intent, as the Federal Trustee, to manage the restoration funds so as to maximize the funds available for implementation in order to achieve the intended restoration.

This Draft Restoration Plan and Environmental Assessment (RP/EA) was developed to inform stakeholders and the public of the purpose and need for restoration, the alternatives by which restoration might be achieved, potential impacts of the alternatives, and the means by which the public may contribute to this analysis. This Draft RP/EA is available on the Service's NRDA website at www.fws.gov/midwest/es/ec/nrda/saginawNRDA/GreenPoint. The Service is now seeking public comment on the Draft RP/EA.

The Service will consider comment it receives in preparing the Final RP/EA for the Green Point Restoration Project. Comments may be provided by either U.S. mail or by email. Comments regarding the Draft RP/EA should be sent via U.S. mail to:

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or, sent via e-mail to: saginawnrda@fws.gov with "Green Point Comment" in the subject line. The comment period closes April 15, 2016.

Abbreviations

Germania	Germania Town and Country Club
Learning Center	Green Point Environmental Learning Center
Refuge	Shiawassee National Wildlife Refuge

Acronyms

CCP	Comprehensive Conservation Plan
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CWA	Clean Water Act
DOI	United States Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
GPA	Green Point Area (Action Area)
LAT	Lead Administrative Trustee
MDEQ	Michigan Department of Environmental Quality
MDAG	Michigan District Attorney General
MDNR	Michigan Department of Natural Resources
MNFI	Michigan National Features Inventory
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
RP	Restoration Plan
RP / EA	Restoration Plan and Environmental Assessment
SDM	Structured Decision Making
TNC	The Nature Conservancy
USFWS	United States Fish and Wildlife Service

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1.0 Introduction

1.1. Overview

In 1998, the U.S. Fish and Wildlife Service (USFWS), the State of Michigan, and the Saginaw Chippewa Tribe, together acting as Trustees for natural resources, negotiated a settlement for natural resource damages with the General Motors Corporation and the cities of Bay City and Saginaw (Consent Judgment: US District Court for the Eastern District of Michigan, June 4, 1999, Docket #98CV10368). The settlement provided for substantial cleanup of river contamination and for protection and restoration of fish and wildlife habitats in the Saginaw River and Bay area. As a result of the settlement, the Refuge received two 99-year leases of the Green Point Environmental Learning Center (Learning Center) and an associated 80 acres of riparian and upland habitats. Additionally, the settlement provided funding for restoration in association with the Learning Center.

In May 2014, the U.S. Fish and Wildlife Service (USFWS), Shiawassee National Wildlife Refuge (Refuge), received the former 135-acre Germania Town and Country Club (Germania) as a donation from The Nature Conservancy (TNC). Previously managed as a public golf course, Germania entered into foreclosure in 2010 and was subsequently purchased by TNC with assistance from the Dow Chemical Company. The Germania property is located to the immediate north of the Tittabawassee River in Saginaw County, Michigan, and is immediately adjacent to the Learning Center (Figures 1 and 2). The Learning Center is operated by the Refuge under a cooperative agreement between the USFWS and the City of Saginaw, consistent with the lease provided by the settlement.

The Refuge seeks to use settlement funds to affect a restoration of the Green Point Area (GPA), which encompasses the recently acquired Germania property (Figure 2). This Draft RP/EA was developed to inform stakeholders and the public of the purpose and need for restoration, the alternative means by which restoration might be achieved, and the potential impacts of the various alternatives and to provide the public with the opportunity to provide comments on the alternatives described below (see Section 3.3).

1.2. Shiawassee National Wildlife Refuge

The Refuge was established in 1953 under the authority of the Migratory Bird Conservation Act (16 USC § 715-715s) "...for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." Additional purposes designated under the Refuge Recreation Act (16 USC § 460k-l) are "... (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, [and] (3) the conservation of endangered and threatened species."

The Refuge encompasses over 9,800 acres of marsh, bottomland hardwood forest, and grasslands within a larger landscape dominated by urban development and agricultural cultivation. The Refuge's mission is to conserve an undeveloped expanse of floodplain forest, marshes, rivers; to encourage public stewardship and partnership; to provide educational outreach; and, to support habitat enhancement on private lands in the area.

The Refuge provides resident and migratory habitats for nearly 300 species of birds as well as other taxa (Appendix B). The Audubon Society has identified the Refuge as a United States Important Bird Area for its global significance to migratory waterfowl (http://netapp.audubon.org/IBA/Reports/1644).

1.3. Authorities

Authority to act on behalf of the public is granted to natural resource trustees by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA, 42 USC §§ 9601-9675, commonly known as "Superfund"); the Federal Water Pollution Control Act (33 USC §§ 1251-1387, commonly known as the Clean Water Act, or CWA); and Part 31, Water Resources Protection, and Part 201, Environmental Remediation, of the Michigan Natural Resources and Environmental Protection Act (NREPA) (Public Act 451, as amended). For the natural resource damage assessment case related to releases of hazardous substances, primarily polychlorinated biphenyls (PCBs), from facilities along the Saginaw River, the natural resource trustees were the U.S. Department of the Interior (DOI) represented by the U.S. Fish and Wildlife Service (USFWS); the State of Michigan represented by the Michigan Department of Environmental Quality and the Michigan Attorney General; and, the Saginaw Chippewa Indian Tribe of Michigan. Collectively these agencies and the Tribe are referred to as the Trustees.

In 1998, in response to claims made by the Trustees pursuant to CERCLA and NREPA, the General Motors Corporation, the City of Bay City, and the City of Saginaw entered into a consent judgment to conduct certain restoration actions and make specific payments as compensation for natural resource damages (Consent Judgment: Docket #98CV1036, US District Court, Bay City, MI, Nov. 24, 1998). Among other restoration actions, the Consent Judgment provides that

> "Federal Trustees shall use these funds and interest thereon at the Green Point Environmental Learning Center to restore, replace or acquire the equivalent resources consistent with CERCLA and applicable regulations."

For the Green Point Area Restoration, the USFWS is acting on behalf of the DOI as the sole Federal trustee for the implementation of this provision of the Consent Judgment and is preparing this RP/EA accordingly.

The DOI's natural resource damage assessment regulations at 43 CFR Part 11 (NRDA regulations), provide guidance to Trustees for damage assessment and restoration planning under CERCLA. The NRDA regulations require that an authorized official, in this case the USFWS, will do the following:

> "(a) Upon determination of the amount of the award of a natural resource damage claim as authorized by section 107(a)(4)(C) of CERCLA, or sections 311(f)(4) and 311(f)(5) of the CWA, the authorized official shall prepare a Restoration Plan as provided in section 111(i) of CERCLA…"

Guidance for the development of restoration alternatives is provided at 43 CFR §11.82:

> (c) *Range of possible alternatives.* (1) The possible alternatives considered by the authorized official that return the injured resources to their baseline level of services could range from intensive action on the part of the authorized official to return the various resources and services provided by those resources to baseline conditions as quickly as possible, to natural recovery with minimal management actions. Possible alternatives within this range could reflect varying rates of recovery, combinations of management actions, and needs for resource replacements or acquisitions.
>
> (2) An alternative considering natural recovery with minimal management actions, based upon the "No Action-Natural Recovery" determination made in §11.73(a)(1) of this part, shall be one of the possible alternatives considered.

Actions undertaken by the Federal Trustees to restore natural resources or services under CERCLA and other Federal laws are also subject to the National Environmental Policy Act (NEPA), 42 USC § 4321-4370d, and the regulations guiding its implementation at 40 CFR Parts 1500-1508. The USFWS has determined that an Environmental Assessment (EA) is the appropriate analysis required under the NEPA.

According to the regulations at 40 CFR § 1508.9, an EA is a concise public document designed to (1) determine whether the anticipated impacts of an action on the human environment are significant enough to require an environmental impact statement (EIS; a more in-depth evaluation of impacts of the alternatives), (2) aid an agency's compliance with NEPA when no EIS is necessary, and (3) facilitate preparation of an environmental impact statement when necessary. At a minimum, an EA includes discussions of the purpose and need for the proposal, alternative actions, the environmental impacts of the proposed action and alternatives, and a list of agencies and persons consulted.

NEPA regulations are intended to ensure that Federal agencies disclose the impacts of their actions and engage the public in the development of alternative actions. This RP/EA describes the purpose and need for restoration; coordination among stakeholders; the restoration alternatives considered, including a no action - natural recovery alternative; and, the potential impacts of restoration actions on certain elements of the physical, biological, and cultural environment.

The NEPA (40 CFR §1506.6) requires that Federal agencies provide opportunity for public participation. The DOI's Department Manual (DM 516) directs the Service's NEPA compliance and specifies that the DOI's policy is

> "...to the fullest practicable extent, to encourage public involvement in the development of Departmental plans and programs through State, local, and tribal partnerships and cooperative agreements at the beginning of the NEPA process, and to provide timely information to the public to better assist in understanding such plans and programs affecting environmental quality" (DOI 2004).

Public review of the Draft RP/EA is an integral component of restoration planning. The Service will consider public comment in formulating the Final RP/EA for the Green Point Area Restoration Project. This Draft RP/EA provides the public with information about the restoration alternatives the Service may consider to address prior natural resource injury. The NEPA analysis in this document describes the expected direct, indirect, and cumulative impacts on the human environment of the alternative actions now under consideration by the Trustee agencies.

Under the NEPA, the Service is now seeking public review and comment on the alternatives intended to restore injured resources or replace lost resource services within the Green Point Area Restoration Project. The restoration alternatives are described below in Section 3.3 and further analyzed in Chapter 5 of this document.

When the Service prepares the Final RP/EA, the Service will review and consider comments received during the public comment period. The deadline for submitting comment on this Draft RP/EA will also be provided in a notice of availability of this document to be published on the Service's website at www.fws.gov/midwest/es/ec/nrda/saginawNRDA/GreenPoint.

Comments may be provided by either U.S. mail or by email. Comments regarding the Draft RP/EA should be sent via U.S. mail to:

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2651 Coolidge Road, Suite 101
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or, sent by e-mail to: saginawnrda@fws.gov with "Green Point Comment" in the subject line.

Before including your address, phone number, email address, or other personal identifying information in your comment, you should be aware that your entire comment - including your personal identifying information - may be made publicly available at any time. While you can ask us in your comment to withhold your personal identifying information from public review, we cannot guarantee that we will be able to do so.

2.0 Purpose and Need for Restoration

2.1. Purpose of the Green Point Area Restoration

The purpose of the restoration considered here is to restore, rehabilitate, replace, or acquire the equivalent of the natural resources and their associated services injured as a consequence of the release of hazardous substances into the Saginaw River and Bay. The restoration is intended to re-establish native floral and faunal communities that will support healthy populations of riverine and floodplain species that were affected by releases of PCBs, thereby making the public and environment whole for past natural resource damage. Fundamentally, the purpose of restoration would be to restore floodplain forest habitat while providing for public use of the Green Point Area, the Action Area which is described below.

2.2. Need for the Green Point Area Restoration

Historic land use within the Green Point Area has included logging of bottomland forests and subsequent conversion of land to rowcrop agriculture. The use of bottomlands for rowcrop agriculture is consistently accompanied by installation of drainage tiles to alter hydrology. Subsurface drainage likely remains in-place.

More recently, the Germania property in the north and west portion of the Green Point Area was maintained as a commercial golf course. This property is dominated by turf grasses, ornamental plantings, and the infrastructure associated with these facilities. Non-native invasive species (NNIS), such as common buckthorn (*Rhamnus cathartica*) and garlic mustard (*Alliaria petiolata)*, among others, now occur within the Green Point Area as well. As a consequence of prior land use, floral and faunal communities are not representative of the Great Lakes Basin Ecosystem. This is inconsistent with the goal of the Refuge's Comprehensive Conservation Plan (CCP) of conserving the biodiversity of the Great Lakes Basin Ecosystem and ensuring that the public has the opportunity to experience the services associated with this ecosystem.

The need for the restoration is related to the current landscape condition within the Green Point Area. Therefore, the Refuge now seeks to initiate restoration to transition the Green Point Area to more ecologically appropriate floral and faunal communities, thereby recovering those resources and services lost as a consequence of prior natural resource damage, consistent with the direction provided within the Consent Judgment noted above (Section 1.3).

3.0 Restoration Planning

3.1. Action Area – Green Point Area (GPA)

The Green Point Area consists of three adjacent tracts associated with the Green Point Environmental Learning Center: Germania, Hickey, and Green Point tracts (Figures 1, 2). The Green Point Area encompasses a total of approximately 275 acres in these three tracts, all located to the north of the Tittabawassee River. The Germania tract is the largest of the three tracts, consisting of about 135 acres. The terms 'Action Area' and 'Green Point Area' are used synonymously throughout the text that follows.

The Germania Tract has been highly altered, reflecting its recent past use as a public golf course. Prior to this, the Germania Tract was logged, cleared, and converted to agriculture (Fig. 3). The majority of this tract now consists of non-native turf grasses and ornamental trees and shrubs. The shoreline along the Tittabawassee River on the Germania Tract has been hardened by the placement of impervious material such as concrete and rock.

The forested areas of the GPA, particularly in the Hickey and Green Point tracts, now have well established populations of invasive species such as common buckthorn, garlic mustard, and a variety of other non-native invasive species. Furthermore, one of the dominant overstory trees in the GPA is green ash (*Fraxinus pennsylvanica*); these trees are largely dead or dying due to infestation by the non-native emerald ash borer (*Agrilus planipennis*).

Floodplain hydrology predominantly determines the composition of native floral and faunal communities within the GPA. The GPA occurs within the Shiawassee Flats region which is comprised of the converging watersheds of the Cass, Flint, Shiawassee, and Tittabawassee rivers. These four rivers then form the Saginaw River which empties into Saginaw Bay of Lake Huron. Though many drainage structures remain in-place, portions of the GPA routinely flood on nearly an annual basis depending upon the extent of precipitation and wind events (see below, Section 4.1.3 Water and Hydrology).

3.2. Coordination – Structured Decision Making

The Service held a five-day Structured Decision-Making (SDM) workshop in February of 2015 to begin development of a restoration framework for the Green Point Area. The intent of this effort was to begin the development of a restoration plan for the GPA, including the former Germania golf course, which would guide restoration activities to maximize the ecological and social objectives of the project and comply with both NRDA and NEPA guidelines. The restoration goals were shaped in part based on a recently completed hydrogeomorphic evaluation completed for Shiawassee NWR (Heitmeyer et al. 2013).

The alternative actions described below were an outcome of this SDM workshop. Structured Decision-Making is a general term for an organized approach to reaching decisions that achieve fundamental objectives (see an SDM fact sheet at the following web address: http://www.fws.gov/science/doc/structured_decision_making_factsheet.pdf). The results of that workshop are described in a white paper summarizing the structured decision-making process and the outcome of the workshop (USFWS 2015). The white paper is included as an appendix to this Draft RP/EA (Appendix A).

The ranking of the restoration alternatives during the SDM workshop was based on the degree to which the alternatives achieved the following criteria:

- Restored pre-European plant communities, spatially and structurally
- Connected local residents to nature
- Maximized public support
- Did not require additional commitment of Refuge resources
- Minimized any increase in contaminant exposure to humans and wildlife

Figure 1. Location of the Green Point Area consisting of the Green Point Environmental Learning Center - Hickey Tract and the recently acquired Germania tract (yellow).

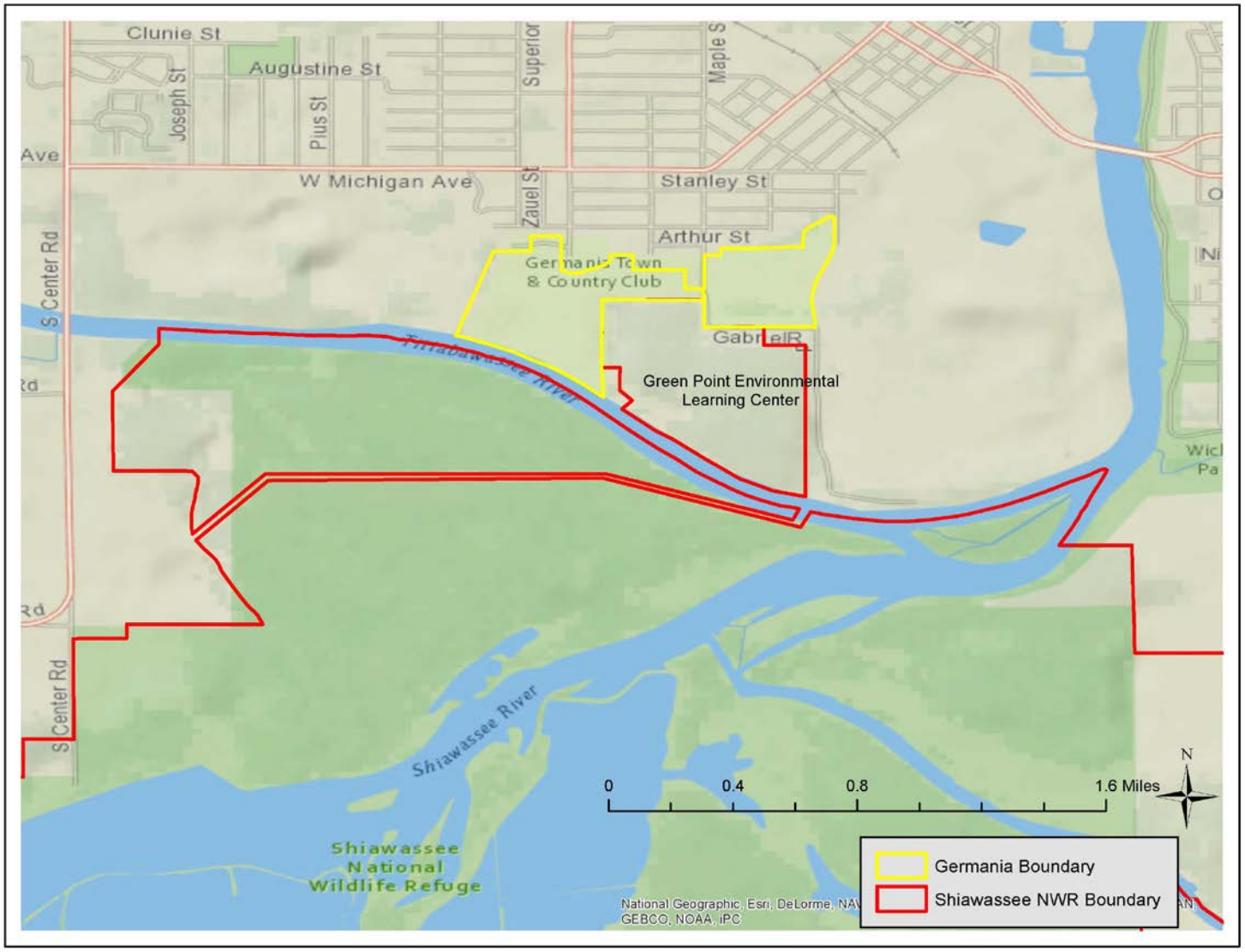

Figure 2. Aerial photograph dated 1998 depicting the three tracts that comprise the Green Point Area, consisting of the Germania Tract, the intermediate Hickey Tract, and the tract associated with the Green Point Environmental Learning Center.

Figure 3. Historic image of the Green Point Area, circa 1937, the earliest aerial imagery available for the State of Michigan.

3.3. Restoration Alternatives

Four alternative actions have been identified by the Service and stakeholders during the SDM workshop. These four alternative actions are the focus of the analysis which follows:

Alternative A: The No Action – Natural Recovery Alternative. In this case, restoration would rely solely on ecological processes (natural succession) without management intervention to direct or enhance ecological restoration. This alternative action emphasizes reliance upon ecological processes.

Alternative B: Maximize Ecological Restoration of the Green Point Area. This alternative action would seek to remediate the impacts of historic land use within the GPA. This might include elements such as reforestation, re-establishment of hydrology, and treatment of non-native invasive species, among others. This alternative action emphasizes ecological services while achieving some social services associated with ecological restoration. Restoration would be informed by assessment of hydrology, assessment of forest structure, and classification of ecological communities on the Refuge.

Alternative C: Maximize Public Use of the Green Point Area. This alternative action would attempt to provide the public with additional amenities such as trails or shelters within the GPA. This alternative action emphasizes social or recreational services; restoration would be secondary to public use.

Alternative D: Implement Restoration Informed by Ecological and Social Assessment. This alternative action would delay implementation of restoration to allow for the assessment of community interest in the GPA, in addition to assessments of hydrology, forest structure and ecological classification. The available NRDA funds would be used to maximize ecological restoration as in Alternative B while making provision in the GPA for additional future amenities that may be identified in an assessment of community interest in the GPA. This alternative represents the preferred, or proposed, action.

With the exception of the 'natural recovery - no action' alternative, it is unlikely that settlement funds will be sufficient to fully implement an alternative. Consequently, alternatives are described in the following analysis in terms of the priority of their associated management actions. It is the Service's intent, as the Federal Trustee, to manage the restoration funds so as to maximize the funds available for implementation in order to achieve the intended restoration.

3.3.1. Alternative A – No Action - Natural Recovery

The analysis of a Natural Recovery - No Action alternative is required of action agencies under the implementing CERCLA regulations (43 CFR Part 11). This alternative action would rely wholly on natural processes to achieve restoration within the GPA. For example, existing infrastructure, such as cart paths and buildings associated with the Germania Tract, would not be removed, but would be allowed to decay or degrade over time. Planting of native trees or shrubs would not occur; natural succession would determine the future composition of forest and understory plant communities.

3.3.2. Alternative B – Maximize Ecological Restoration

This alternative action would focus on ecological restoration to be informed by forest inventory and ecological classification, similar to the recent hydrogeomorphic evaluation of the Refuge (Heitmeyer et al. 2013). Public use would still be included and would be focused on establishing a trail system within the Germania Tract that would connect to existing trails on the Learning Center Tract, resulting in a new linked trail system across the GPA. Actions are listed in order of priority.

As funding allowed, implementation would include:

1. Forest inventory and ecological classification to guide reforestation.
2. Restoration / reforestation across the Germania Tract.
3. Restoration of hydrology – removal / destruction of drainage tiles.
4. Non-native, invasive species treatment across entire GPA.
5. Hiring of a seasonal land management technician for the GPA.
6. Demolition and removal of existing buildings on the Germania Tract.
7. Connecting of new trails to existing trails in the GPA.
8. Removal of existing asphalt golf cart paths on the Germania Tract.
9. The construction of new trails on the Germania Tract.

3.3.3. Alternative C – Maximize Public Use

This alternative action would focus on accommodating public use by the local community at the expense of habitat restoration. This alternative emphasizes the value of outreach and education, recognizing that the long term outcome of maximizing public use within the GPA may be reduced use of the GPA by wildlife. Actions are listed in order of priority.

As funding allowed, implementation would include:

1. Construction of new trails within the Germania Tract.
2. Connecting of new trails to existing trails within the GPA.
3. Creating new access points to the GPA, specifically intended to increase accessibility to local schools and residents.
4. Design and installation of new signs and information kiosks.
5. Creating a diverse wetland at “Big Pond,” an existing pond within the Germania Tract to the east of Maple Street.

6. Non-native, invasive species treatment across the entire GPA.
7. Forest inventory and ecological classification which would guide reforestation.
8. Hiring of a seasonal land management technician for the GPA.
9. Removal of existing asphalt golf cart paths within the Germania Tract.
10. Demolition and removal of existing buildings within the Germania Tract.
11. Tree planting on west side of Maple Street within the Germania Tract.
12. Native prairie planting on the east side of Maple Street within the Germania Tract.

3.3.4. Alternative D – Restoration Informed by Ecological and Social Assessment

This alternative action would focus on pre-restoration planning to better inform ecological restoration while identifying local goals related to public use of the GPA. Restoration would be informed by the recent hydrological assessment of the Refuge (Heitmeyer et al. 2013), assessments of forest type and ecological communities for the Refuge, and a community needs assessment. Restoration would be delayed as information is collected, but subsequent restoration effort would be better aligned with forest type and ecological communities of the Refuge, as well as informed by local community goals for the GPA. This alternative represents the proposed action; actions are listed in order of priority.

As funding allowed, implementation would include:

1. Forest inventory and ecological classification on the Refuge which will be used as reference information to guide future reforestation work.
2. Conduct a community needs assessment to characterize community interest in the Green Point Area. Identify a portion of the former Germania golf course, *east* of Maple Street, to provide for public amenities that may be identified within a community needs assessment.
3. Restoration / reforestation *west* of Maple Street, possibly funded by partners.
4. Restoration of hydrology – removal / destruction of drainage tiles.
5. Non-native, invasive species treatment across the entire Green Point Area.
6. Restoration/ reforestation *east* of Maple Street, if indicated by design, possibly funded by partners.
7. Demolition and removal of existing buildings within the Germania Tract.
8. Connecting of new trails to existing trails within the Green Point Area.
9. Removal of existing asphalt golf cart paths within the Germania Tract.
10. The construction of new trails within the Germania Tract.
11. Hiring of a landscape architect, or partner with landscape architecture program at a local University, to design an area *east* of Maple Street, informed by the community needs assessment, that will be inviting to the public.

3.4. Alternatives Considered – Not Analyzed Further

An additional alternative was initially considered by stakeholders that would emphasize the establishment of native prairie within the Germania Tract for grassland dependent species. This alternative would require establishment and regular maintenance of an early successional habitat type.

Criteria used to rank alternatives included the re-establishment of habitats typical of the Green Point Area landscape prior to European settlement, which in this case would primarily consist of bottomland hardwood forest. As this alternative did not meet this fundamental criterion, the SDM group did not consider it further (USFWS 2015, Appendix A).

4.0 Affected Environment

This section describes the affected environment of the Action Area as well as relevant issues that have been previously identified within the Shiawassee National Wildlife Refuge Comprehensive Conservation Plan and Environmental Assessment (USFWS 2001) as well as those identified as part of an SDM workshop conducted in February of 2015 (USFWS 2015, Appendix A).

4.1. General

The Saginaw Bay Watershed encompasses an area of approximately 8,700 squares miles that also includes watersheds of the Tittabawassee, Shiawassee, Bad, Cass, and Flint Rivers. This association of rivers, wetlands, and coastal freshwater marshes forms one of North America's largest freshwater wetland complexes.

Four rivers, the Cass, Flint, Shiawassee, and Tittabawassee, converge within an area known as the Shiawassee Flats to form the Saginaw River. The Refuge is located within this area where the rivers converge. Wetlands, pools, and moist soil units within the Refuge may be influenced by the hydrology of any of the rivers, depending upon location of the wetland unit and the relative intensity of precipitation or snow melt events in the watersheds. The Action Area considered here (Section 3.1; Figures 1 & 2) is bordered to the south by the Tittabawassee River near its junction with the Shiawassee River.

Proximity to Lake Huron and the early avenues of commerce provided by the rivers explains much of the history of land use within the Saginaw Bay Watershed and the Shiawassee Flats. Chronologically, past land use can be described in terms of timber, pastoral agriculture and the transition to row-cropping, urbanization and industrial development. A recent review of historical land use in the Saginaw Bay watershed (Buchanan et al., 2013) noted the following important changes in the watershed from early settlement in the middle of the nineteenth century:

- The State of Michigan was a focal area of the eastern lumber industry during the middle of the nineteenth century. The network of rivers within the Saginaw Bay watershed (Cass, Flint, Saginaw, Shiawassee, and Tittabawassee) was fundamental to the development of the lumber

industry. Rivers were routinely and repeatedly cleared of debris and snags to facilitate the movement of large volumes of logs. Substantial alterations of river and associated riparian habitat occurred in these waterways as a consequence of the development of the timber industry.

- Much of the Saginaw River watershed, including the Shiawassee Flats area that encompasses the Refuge, was heavily logged. Rivers and associated wetland complexes were profoundly affected. Forest clearing and subsequent installation of drainage across the landscape allowed the conversion of bottomland forest and wetlands to rowcrop agriculture. The mechanized tillage of industrial agricultural led to increased erosion, increased runoff, and nutrient loading of waterways. These sources of impact continue to compromise watersheds within the Shiawassee Flats.

- Cumulatively, logging, large-scale wildfires fueled by logging slash, rowcrop tillage, and the growth of communities associated with economic development, resulted in an approximate 72% reduction in forest cover and a 96% loss in wetlands from 1830 to the present in Saginaw County.

- Agriculture and the lumber industry substantially altered the landscape, but the footprint resulting from the later development of industrial and chemical manufacturing now comprises the third largest land cover type in the Saginaw Bay Watershed. Persistent contaminants associated with industrial manufacturing continue to compromise natural resources in watersheds associated with the Refuge.

This legacy of past land use (logging, agriculture, urbanization, and industrial development) remains evident in proximity to the Refuge and within the Green Point Area.

4.1.1. Geology and Soils

The Shiawassee NWR is located within the Saginaw Lake Plain Ecoregion (Omnerik 1995). Glacial advance and retreat has provided the primary force shaping the dominant features of the landscape. Recent summaries of the geology within the Saginaw Lake Plain Ecoregion and the Shiawassee Flats area are provided by Buchanan et al. (2013), Heitmeyer et al. (2013), and Newman (2011). Newman (2011) provides the following summary of the geology of the area:

> The underlying geology is primarily Pennsylvanian sandstone and shale, which is generally not exposed in this region. At the end of the last glaciation (approx. 12,000 years ago, this area was covered with an inland lake and a river which connected the present day water bodies of Lake Michigan and Lake Huron. The upper layers were initially identified as lacustrine (e.g. lake) deposited clays and silts (Farrand and Bell 1982). However, an investigation by Westjohn and Weaver (1996) suggested that the predominant surface layer in Saginaw County is a relatively thick (>50 ft.) layer of dense, clay-rich, basal lodgment till overlying a glaciofluvial aquifer.

Over 40 soil types occur on the Refuge, but they are predominately poorly drained clay and silt-clay soil types, reflecting the geologic history of the area as a glacial lake plain (Heitmeyer et al. 2013). Soils within the Green Point Area are characterized as types that experience frequent flooding (Heitmeyer et al. 2013). Soils on the Refuge range from poorly drained to very poorly drained (Heitmeyer et al. 2013, Newman 2011).

4.1.2. Water and Hydrology

Four drainage basins move water within the Shiawassee Flats Area to the Saginaw River, discharging into Lake Huron: The Tittabawassee River Basin, The Cass River Basin to the east, the Flint River Basin to the southeast, and the larger Shiawassee River Basin (Heitmeyer 2013). The basins effectively drain approximately 8,500 mi^2 of the state.

Low-lying topography within the Shiawassee Flats and fluctuating water levels within Lake Huron are the primary environmental factors that influence local hydrology. Long-term water levels in Lake Huron average approximately 580 feet above mean sea level; elevations within the Shiawassee Flats Area range from 547 to 695 feet above mean sea level. The Green Point Area is entirely encompassed within the eight-year floodplain of the Tittabawassee River (DOW 2014, Figure 2-2F). Consequently, high lake levels, or wind-driven fluctuation in water-levels (seiche events) may result in sustained periods of inundation within low-lying areas of the Shiawassee Flats, including the Green Point Area (Buchanan et al. 2013, Heitmeyer et al. 2013, Newman 2011).

4.1.3. Water Quality

The 1987 amendment to the Great Lakes Water Quality Agreement between the United States and Canada created the framework for the identification of substantial areas of environmental degradation known as Areas of Concern (AOCs). The AOCs have been characterized in terms of Beneficial Use Impairments (BUIs). When originally designated as an AOC in 1987, the Saginaw River and Bay were characterized as having 12 of 14 BUIs. Three of the BUIs have been subsequently removed: Tainting of Fish and Wildlife Flavor, Drinking Water – Taste & Odor; Loss of Fish and Wildlife Habitat (PSC, Inc. 2012; USEPA 2014). The Saginaw River and Bay AOC extends from the Saginaw Bay to 22 miles upstream along the Saginaw River, bordering the Refuge.

Impairments to water quality within the Saginaw Bay and River, and the larger watershed of the Saginaw River, parallel the history of development in the Shiawassee flats. The advent of commercial agriculture has contributed agricultural chemicals, nutrients, sediments, and wastes to area watersheds. The growth of urban centers has affected water quality by altering the characteristics of runoff and adding municipal wastes to area waters. Industrial development has added a suite of hazardous wastes to area rivers, among them legacy contaminants such as polychlorinated biphenyls (PCBs). All of the 11 remaining BUIs are associated in some way (e.g., bacteria, nutrients, hazardous chemicals) with impairment of water quality (USFWS 2010, MDEQ 2012).

4.2. Endangered, Threatened, Proposed, and Candidate Species (Federal)

Because of prior land use history and habitat types currently present within the GPA, it is unlikely that the eastern massasauga (*Sistrurus catenatus*), the eastern prairie fringed orchid (*Platanthera leucophae*a), or the rufa red knot (*Calidris canutus rufa*) occur within the Action Area. To date, none of the listed species that may occur within Saginaw County (Table 1) have been detected on the Refuge. The listed bats are considered below (Section 4.2.1).

Table 1. Federally listed species that may occur within Saginaw County, Michigan (August, 2015; http://www.fws.gov/midwest/endangered/lists/michigan-cty.html).

County	Species	Status	Habitat Associations
Saginaw	Indiana bat *Myotis sodalis*	Endangered	Small to medium rivers with well developed riparian woods; woodlots within 1 to 3 miles of rivers and streams; upland forests. Caves and mines as hibernacula.
	Northern long-eared bat *Myotis septentrionalis*	Threatened	Hibernates in caves and mines - swarming in surrounding wooded areas in autumn. Roosts and forages in upland forests.
	Rufa red knot *Calidris canutus rufa*	Threatened	Large wetland complexes during the Red knot migratory window of May 1 – Sept. 30
	Eastern massasauga *Sistrurus catenatus*	Candidate	Shallow wetlands or shrub swamps in spring. Crayfish towers or small animal burrows which are adjacent to drier upland open shrub forest sites. During summer, massasaugas move to drier upland areas.
	Eastern prairie fringed orchid *Platanthera leucophaea*	Threatened	Mesic to wet prairies and meadows.

4.2.1. Federally Listed Bat Species

Both the Indiana bat (*Myotis sodalis*) and the northern long-eared bat (*Myotis septentrionalis*) are wide-ranging, cryptic species which are difficult to detect. Bats of the genus *Myotis* are comparatively rare in southeastern Michigan (Auteri and Kurta 2013), though these bats may use the river corridors of the Shiawassee National Wildlife Refuge at least intermittently during migration.

The Indiana bat was listed as endangered under the ESA in 1967. At that time the primary threat to the species was disturbance within hibernacula, the loss of hibernacula, and the loss of summer habitat which provides roosts for maternal colonies. This species forms large, dense clusters in hibernacula making them particularly vulnerable to disturbance. More recently, the same trait has made this species susceptible to a novel disease, namely white-nosed syndrome caused by the fungus *Pseudogymnoascus destructans*. The Refuge is in the northernmost portion of the range of the Indiana bat (http://www.fws.gov/midwest/Endangered/mammals/inba/RangeMapINBA.html).

The northern long-eared bat is widely distributed throughout the eastern United States; range of the northern long-eared bat extends westward into Montana and Wyoming (http://www.fws.gov/midwest/Endangered/mammals/nleb/nlebRangeMap.html). The species was listed as threatened under the ESA in 2015. This species also hibernates in caves and is one of the species most affected by white-nosed syndrome.

4.3. Migratory Birds

The Refuge was established in 1953 under the authority of the Migratory Bird Conservation Act of 1929 (16 USC § 715) "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." The Migratory Bird Treaty Act of 1918, as amended (16 USC §§ 703-712), conveys protections for migratory birds, prohibiting the unauthorized take of these species. The Refuge has also been designated as a United States Important Bird Area (IBA; http://netapp.audubon.org/IBA/Site/1644) for its global significance to migratory waterfowl .

The Refuge is encompassed by Bird Conservation Region 12 – Boreal Hardwood Transition, but lies just north of the boundary of Bird Conservation Region 23 – Prairie Hardwood Transition. The Bird Conservation Regions (BCRs) are broad ecological units identified by members of the North American Bird Conservation Initiative (USFWS 2010). BCR 12 is characterized by both coniferous and northern hardwood forests, generally nutrient poor soils, numerous lakes, bogs, and rivers. BCR 23 was once dominated by prairies in the west and south portion of the BCR, beech-maple forests in the northern portion of the BCR, and areas of oak savannah between these two other ecotypes. Because of the variation in ecotypes in proximity to the Refuge, and its association with large rivers that may serve as migratory corridors for birds, a substantial number of avian species is known to seasonally occur on the Refuge. Consequently, bird watching remains a primary recreational activity on the Refuge. The Refuge's birding checklist notes 281 species and their occurrence on the Refuge (http://www.fws.gov/refuge/Shiawassee/wildlife_and_habitat/birding.html).

In order to facilitate the conservation of migratory birds, the Service has identified Birds of Conservation Concern. These are species that without additional conservation action are likely to become candidates for listing under the ESA. In the State of Michigan, 37 species have been identified as Birds of Conservation Concern (USFWS 2008; Table 2); many of these species occur seasonally on the Refuge. At least 16 of these species have some association with the predominant habitats that occur on the Refuge (hardwood forests, floodplain forests, wetlands).

4.4. Michigan Listed Species – Refuge Resources of Concern

The State of Michigan's Natural Resources and Environmental Protection Act (NREPA, Act 451 of 1994) confers certain statutory protections, in addition to any applicable Federal protections, to species that the State of Michigan has identified as endangered or threatened. It incorporates by reference the Federal threatened and endangered species lists and authorizes the Michigan DNR to establish a list of species that are threatened or endangered in the state. Michigan's statute makes it illegal to take species that are federally or state designated as threatened or endangered. The State of Michigan also designates species that are of special concern that may be considered for listing as threatened or endangered in the state if their populations continue to decline. Although they may not be abundant on the Refuge, or may be only rarely observed, a number of state listed species are known to occur on the Refuge. Many are associated with wetland habitats (Table 3).

Table 2. Migratory Birds of Conservation Concern (USFWS 2008) that occur within the State of Michigan in either Bird Conservation Regions 12 (Boreal Hardwood Transition) or 23 (Prairie Hardwood Transition). Summer status on the Shiawassee National Wildlife Refuge is indicated within the column labeled 'Refuge Summer Status.'

Species	Bird Conservation Region (BCR)	Refuge Summer Status	State Status	Primary Habitat Type(s) Wildlife Action Plan	Possible Threats identified in Michigan Wildlife Action Plan
Acadian Flycatcher *Empidonax virescens*	BCR 12, BCR 23	I		Hardwood, riparian-floodplain corridor	fragmentation, invasive plants and animals
American Bittern *Botaurus lentiginosus*	BCR 12, BCR 23	U	SC	Prairie, Lowland shrub, bog, wetland	conversion to agricultural land, wetland alteration
Bald Eagle *Haliaeetus leucocephalus*	BCR 12,BCR 23	U	SC	Hardwood, conifer, dunes, inland lakes,	conversion to agricultural land, dams, dredging
Black Tern *Chlidonias niger*	BCR 12, BCR 23	-	SC	Wetlands, inland lakes, ponds	conversion to agricultural land, competition
Black-billed Cuckoo *Coccyzus erythropthalmus*	BCR 12, BCR 23	O		Pastures, forests	conversion to agricultural land, grazing patterns
Black-crowned Night-heron *Nycticorax nycticorax*	BCR 12, BCR 23	C		Lowland shrub, wetland, inland lakes	conversion to agricultural land, grazing patterns
Blue-winged Warbler *Vermivora pinus*	BCR 12, BCR 23	R		Shrub, hardwood, conifer, forest opening	incompatible resource mgmt., invasive species
Bobolink *Dolichonyx oryzivorus*	BCR 12, BCR 23	-		Prairie, hayland, wetlands, fields	altered fire regimes, fragmentation, grazing patterns
Brown Thrasher *Toxostoma rufum*	BCR 12, BCR 23	O		shrub, hardwood, conifer, forest opening	altered fire regimes, biological interactions
Canada Warbler *Wilsonia canadensis*	BCR 12,BCR 23	R		shrub, hardwood, conifer, floodplain corridor	conversion to agricultural land, altered fire regime
Cerulean warbler *Dendroica cerulea*	BCR 12, BCR 23	R		Hardwood, floodplain corridor	conversion to agricultural land, fragmentation
Common Tern *Sterna hirundo*	BCR 12, BCR 23	O	T	Wetlands, inland lakes, dunes, floodplain corridor	parasites, altered hydrologic regimes, competition
Dickcissel *Spiza americana*	BCR 12, BCR 23	I		Prairie, hayland, fence row	grazing/mowing patterns, pesticides, invasive species
Field Sparrow *Spizella pusilla*	BCR 12, BCR 23	R		Prairie, fence row, shrub, forest opening	altered fire regime, grazing patterns, industrialization
Golden-winged Warbler *Vermivora chrysoptera*	BCR 12, BCR 23	R		Shrub, hardwood, forest opening, bog	conversion to agricultural land, altered fire regimes
Grasshopper Sparrow *Ammodramus savannarum*	BCR 12, BCR 23	R	SC	Prairie, hayland, pasture	conversion to agricultural land, altered fire regimes
Henslow's Sparrow *Ammodramus henslowii*	BCR 12, BCR 23	-	E	Prairie, hayland, pasture	conversion to agricultural land, altered fire regimes
Horned Grebe - nonbreeding *Podiceps auritus*	BCR 12, BCR 23	-		Prairie, wetlands, inland lakes, ponds	conversion to agricultural land
Least Bittern *Ixobrychus exilis*	BCR 12,BCR 23	U		Lowland shrub, wetland, inland lakes	conversion to agricultural land, dredging, parasites

Marsh Wren *Cistothorus palustris*	BCR 12, BCR 23	C		Wetlands, ponds, inland lakes	conversion to agricultural land, grazing patterns
Migrant loggerhead shrike *Lanius ludovicianus migrans*	BCR 12,BCR 23	-		Pasture, shrub, hardwood	conversion to agricultural land, altered fire regime
Northern Flicker *Colaptes auratus*	BCR 12, BCR 23	C		Pasture, wetland, hardwood, conifer, swamp	biological interactions (nest (site competition)
Olive-sided Flycatcher *Contopus cooperi*	BCR 12	-		Hardwood, conifer, wetlands, inland lakes	conversion to agricultural land, altered fire regime
Peregrine Falcon *Falco peregrinus*	BCR 12, BCR 23	-		Great Lakes nearshore, floodplain corridor	disease, parasites, industrialization, pesticides
Pied-billed Grebe *Podilymbus podiceps*	BCR 12, BCR 23	C		Wetlands, inland lakes, ponds, floodplain corridor	climate change, conversion to agricultural land
Prothonotary Warbler *Protonotaria citrea*	BCR 23	U		Hardwood, swamp, floodplain corridor	invasive species, wetland alterations
Red-headed Woodpecker *Melanerpes erythrocephalus*	BCR 12, BCR 23	R		Prairie, hardwood, conifer, forest opening	conversion to agricultural land, altered fire regime
Rusty Blackbird - nonbreeding *Euphagus carolinus*	BCR 12, BCR 23	-		Ponds, wetlands, shrubby shoreline	conversion to agricultural land
Short-billed Dowitcher - nonbreeding *Limnodromus griseus*	BCR 12,BCR 23	U		Mudflats, creeks	conversion to agricultural land
Short-eared owl *Asio flammeus*	BCR 12,BCR 23	-	E	Prairie, pasture, bog, wetland, hayland	conversion to agricultural land, fragmentation
Solitary Sandpiper - nonbreeding *Tringa solitaria*	BCR 12, BCR 23	U		Swamps, ponds, woodland streams	conversion to agricultural land
Upland Sandpiper *Bartramia longicauda*	BCR 12,BCR 23	R		Pastures, fields, grasslands	grazing/mowing patterns, pesticides, invasive species
Whip-poor-will *Caprimulgus vociferus*	BCR 12, BCR 22, BCR 23	-		Hardwood, conifer, forest opening	conversion to agricultural land, competition
Willow Flycatcher *Empidonax traillii*	BCR 12, BCR 23	C		Swamps, pastures, lakeshores	conversion to agricultural land
Wood Thrush *Hylocichla mustelina*	BCR 12, BCR 23	U		Hardwood, swamp, floodplain corridor	fragmentation, invasive plants and animals
Yellow Rail *Coturnicops noveboracensis*	BCR 12	-		Hayland, bog, wetland, fen	altered fire & hydrologic regime, urbanization

State Status:

E=Endangered, T = Threatened, SC = Special Concern

Bird Conservation Regions in Michigan:

BCR 12 = Boreal Hardwood Transition, BCR 22 = Eastern Tallgrass prairie, BCR 23 = Prairie Hardwood Transition

Summer Status – Shiawassee NWR (http://www.fws.gov/refuge/Shiawassee/wildlife_and_habitat/birding.html):

C = common: certain to be seen or heard in suitable habitat, not in large numbers
U = uncommon: present but not always seen
O = occasional: seen only a few times during the season
R = rare: seen every 2 to 5 years
I = incidental: seen only once OR seen every 5 years or more

Table 3. Species that may occur in proximity to the Shiawassee NWR, in Saginaw County, that have been identified by the State of Michigan as threatened or endangered within the state, or identified as species of special concern (Michigan Natural Features Inventory: http://mnfi.anr.msu.edu/explorer; SC = State Species of Concern; ST = State Threatened; SE = State Endangered; X=Extirpated).

Species	Status	Habitat Association
Mussels		
Black sandshell *Ligumia recta*	SE	Most commonly occupies rivers with strong currents and lakes with a firm substrate of gravel or sand.
Deertoe *Truncilla truncata*	SC	Firm sand or gravel substrates in rivers and lakes with a moderately swift current, but has been observed occasionally in smaller streams as well.
Eastern pondmussel *Ligumia nasuta*	SE	Fine sand to mud substrates, the Eastern pondmussel inhabits lakes and ponds, as well as slackwater areas of canals, rivers and streams.
Elktoe *Alasmidonta marginata*	SC	Small to large sized streams and rivers. A riffle species, prefers swifter currents over packed sand and gravel substrates. Typically found in clean, clear water.
Ellipse *Venustaconcha ellipsiformis*	SC	Swift currents of riffles or runs of clear, small to medium sized streams in gravel or sand and gravel substrates.
Hickorynut *Obovaria olivaria*	SE	The Hickorynut is found in large rivers and lakes in sand or sand and gravel substrates.
Kidney shell *Ptychobranchus fasciolaris*	SC	Occurs in high water quality creeks, rivers and lakes with moderate to swift currents and a sand or gravel substrate (Watters et al. 2009).
Lilliput *Toxolasma parvus*	SE	Occurs in creeks with mud or clay substrates, but can also be found in rivers, lakes, and impoundments.
Paper pondshell *Utterbackia imbecillis*	SC	Paper pondshell is most often observed in lakes, ponds and impoundments with soft mud or sand substrates.
Pink papershell *Potamilus ohiensis*	ST	Lakes and large river systems, the pink papershell is often found in the silty sand or mud of slackwater areas. This species may also inhabit impoundments.
Round pigtoe *Pleurobema sintoxia*	SC	The round pigtoe occurs in mud, sand, or gravel substrates of medium to large rivers.
Rainbow *Villosa iris*	SC	The rainbow occurs in coarse sand or gravel in small to medium streams.
Slippershell *Alasmidonta viridis*	ST	Occurs in creeks and headwaters of rivers in sand or gravel substrates. Occasionally, they occur in larger rivers and lakes and in mud substrates.
Snuffbox *Epioblasma triquetra*	SE	Inhabits sand, gravel, or cobble substrates in swift small and medium-sized rivers. Individuals are often buried deep in the sediment.
Threehorn wartyback *Obliquaria reflexa*	SE	Most common in medium to large rivers, the three-horned wartyback occurs in slackwater conditions to swift currents, and substrates of gravel to muddy sand.
Reptiles & Amphibians		
Blanding's turtle *Emydoidea blandingii*	SC	Clean, shallow waters with abundant aquatic vegetation and soft muddy bottoms over firm substrates. Ponds, marshes, swamps, bogs, wet prairies, river backwaters, embayments, sloughs, slow-moving rivers, lake shallows and inlets.
Eastern fox snake *Pantherophis gloydi*	ST	Emergent wetlands along Great Lakes shorelines and associated large rivers and impoundments. They prefer habitats with herbaceous vegetation such as cattails.

Eastern massasauga *Sistrurus catenatus catenatus*	SC	Open wetlands, particularly prairie fens. Some populations of Eastern Massasaugas also utilize open uplands and/or forest openings for foraging, basking, gestation and parturition.
Gray ratsnake *Pantherophis spiloides*	SC	Primarily deciduous forests, but they also use adjacent open habitats including shrubby fields, prairies and marsh and bog edges.
Spotted turtle *Clemmys guttata*	ST	Clean, shallow bodies of standing or slow-flowing water with muddy or mucky bottoms and aquatic or emergent vegetation. Frequently found on land in open habitats, especially during mating and nesting seasons.
Wood turtle *Glyptemys insculpta*	SC	Clear, medium-sized hard-bottomed streams and rivers with sand and/or gravel substrates and moderate flow. Wood Turtles also require partially shaded, wet-mesic herbaceous vegetation.
Fish		
Weed shiner *Notropis texanus*	X	Open, sandy streams, rivers, and impoundments with submerged aquatic vegetation. In Michigan, mostly in tributary junctions and below dams.
Channel darter *Percina copelandi*	SE	Rivers and large creeks in areas of moderate current over sand and gravel substrates. It also occurs in wave swept nearshore areas of lakes Huron and Erie.
River darter *Percina shumardi*	SE	Rivers and large streams, preferring deep, fast-flowing riffles with cobble and boulder substrates. Tolerant to turbidity.
Birds		
American bittern *Botaurus lentiginosus*	SC	Wet to wet-mesic habitats with herbaceous or herbaceous-shrub cover. Area-dependent and are typically found only in the larger wetlands.
Bald eagle *Haliaeetus leucocephalus*	SC	Suitable nest sites close to open water. Nests may be placed in snags or large live trees as well as on constructed platforms or utility poles. They are resident as long as there is open water where they can forage.
Black tern *Chlidonias niger*	SC	Floating vegetation within marshes. Well-camouflaged eggs in a shallow cup just above water surface, very susceptible to wind and wave action.
Common moorhen *Gallinula chloropus*	ST	Emergent marsh types but also lakes and ponds with emergent and grassy vegetation along the border.
Grasshopper sparrow *Ammodramus savannarum*	SC	Grasslands, cultivated fields, hayfields, and old fields and seem to prefer drier sites as long as there is tall dense grassy vegetation.
Henslow's sparrow *Ammodramus henslowii*	SE	Old field and pasture habitats such as weedy or grassy fields and meadows often in low-lying or damp areas with widely scattered shrubs.
King rail *Rallus elegans*	SE	Coastal Great Lakes wetlands. Associated with permanent marsh habitats along upland-wetland edges dominated by tussock-forming sedges.
Marsh wren *Cistothorus palustris*	SC	Narrow-leafed cattail and cord-grass marshes. Nest placement over standing water in dense cattail is preferred.
Northern harrier *Circus cyaneus*	SC	Open habitats dominated by herbaceous vegetation. Large patches of suitable habitat are important to this ground-nesting raptor.
Prothonotary warbler *Protonotaria citrea*	SC	Cavity nester. Preferred habitat is bottomland forests with streams from 20-40 m wide bordered by red maple and associated trees.
Yellow-headed blackbird *Xanthocephalus xanthocephalus*	SC	Found in cattail and phragmites stands in permanent wetlands such as marshes, sloughs, marshy lake margins, and lagoons. Colonial breeder.
Insects		
Smokey rubyspot *Hetaerina titia*	SC	Known from the southeastern MI. Larvae frequent edges of gently flowing streams and rivers where woody debris, leafy matter, or dense macrophytes.
Plants		
Beak grass *Diarrhena obovata*		In Michigan and throughout its range American beak grass is almost exclusively found in lowland riparian forests. Known from Midland Co.

Hairy mountain mint *Pycnanthemum pilosum*	ST	Known from shaded river bank as well as upland fields. In Chicago region, known in dry hills with prairie associates. Not documented in MI since 1952.
Prairie white-fringed orchid *Platanthera leucophaea*	SE	Moist alkaline and lacustrine soils. Moist prairie remnants associated with lakeplains, may occur in semi-open bogs and peaty lakeshores.
Showy orchis *Galearis spectabilis*	ST	Deciduous woods, near ephemeral ponds in sandy clay or rich loam soils, or in shady, microhabitats near common spring ephemerals.
Small love grass *Eragrostis pilosa*	SC	Weedy habitats, including railroad yards, roadsides, and in urban areas, though the exact habitat is unknown.
Twinleaf *Jeffersonia diphylla*	SC	Twinleaf is found in mesic forests with rich, loamy soils and in floodplain forests.
Whorled pogonia *Isotria verticillata*	ST	Successional bogs in southern Lower Michigan, successional oak and red maple forest in lower slopes, seasonally inundated, acid swamps

The Shiawassee National Wildlife Refuge has also identified Priority Resources of Concern (USFWS 2013). This list was developed by consulting regional conservation planning documents and then associating species with habitat types that occur on the Refuge. The Green Point Area is predominantly floodplain forest habitat or soils indicative of this habitat type. Priority Resources of Concern for this habitat are presented in Table 4.

Table 4. Priority Resources of Concern associated with floodplain forest habitats and utilization of these habitats by priority resources of concern for Shiawassee NWR, Saginaw, MI (USFWS 2013).

Habitat Type	Taxonomic Group or Natural Community	Priority Resource of Concern	Utilization of Habitat Types by Priority Resources of Concern
Floodplain Forest	Avian	Wood duck	Breeding
		Wood thrush	Breeding
		Least flycatcher	Breeding
		Rusty blackbird	Migration
		Rose-breasted grosbeak	Breeding
	Mammalian	Indiana bat	Breeding
	Natural Communities	Floodplain forest	-
		Inundated shrub swamp	-

4.5. Non-native and Invasive Species

A comprehensive vegetation inventory has not been completed for the Refuge. A recent assessment of bottomlands on the refuge being considered for restoration characterized these bottomlands as "primarily composed of weedy species" (Buchanan et al. 2013). Non-native invasives common to the Refuge include those that continue to compromise the integrity of Great Lakes coastal marshes and floodplain forests throughout the Saginaw Bay Area. Invasive species within floodplain forests on the Refuge include common buckthorn and garlic mustard; non-native species within marshes or moist soil habitats include reed canarygrass (*Phalaris arundinacea*), phragmites (*Phragmites australis*), purple loosestrife (*Lythrum salicaria*), and flowering rush (*Butomus umbellatus*).

Ecologically, the Green Point Area may be characterized as altered floodplain forest. Non-native invasive species have become well-established in all three tracts of the GPA. The majority of the Germania tract consists of non-native turf grasses, ornamental trees and shrubs. Invasive species that occur within the GPA include common buckthorn, garlic mustard, and a variety of other non-native invasive species (USFWS 2015).

The Refuge has participated in the use of biological controls to manage infestations of purple loosestrife (USFWS 2013). In the late 1990's, *Galerucella sp.* leaf beetles were released. These beetles are highly-host specific and cause only minor damage to non-target plants (Blossey et al. 1994).

Like other land management agencies, the Refuge depends on the use of herbicides to treat invasive species. Herbicide use varies by chemical depending upon the specie or species targeted and application may vary by season. For example, broad spectrum herbicides may be used to eradicate multiple species infesting a substantial area; a more selective herbicide may be used to treat a single species. Herbicide use also varies by season in order to enhance the efficacy of treatments. For example, garlic mustard is treated most effectively in early spring, *Phragmites* in late summer, and buckthorn from summer through winter. In addition, other management techniques may be used to enhance the efficacy of herbicide treatment. This may include techniques such as girdling, disking, and the use of prescribed fire.

4.6. Recreational Use

Demographically, Saginaw County contains three cities, 27 townships and five incorporated villages. The largest of these are Saginaw (51,508), Saginaw Township (40,840), Thomas Township (11,985), and Bridgeport Township (10,514) (SCPRC 2013). According to the 2010 U.S. Census, the population of Saginaw County was 200,169. Between the 2000 and the 2010 censuses, the Saginaw County population declined by approximately 5.1%.

The Refuge provides recreational opportunities for hunting, fishing, trapping, hiking, bicycling, cross country skiing, wildlife observation, photography, environmental education and interpretation, and other uses as described in more detail in the Shiawassee NWR CCP (2001). In 2006, it was determined that the Refuge received 117,500 recreational visits. This was comprised of approximately 84,400 visits by residents of the State of Michigan and 34,100 visits by non-residents (Carver and Caudill 2007). Primary recreational use consisted of non-consumptive recreational activities such as hiking and wildlife observation. The Green Point Area currently receives similar use by recreational visitors to the Refuge. The

Green Point Environmental Learning Center provides environmental education and interpretation to approximately 4,100 people per year. The regional recreational contribution provided by the Refuge and the Environmental Learning Center is also recognized within regional planning documents:

- Saginaw County Recreational Plan: 2014-2018 (SCPRC 2013).
- Tri-County Regional Path Study, Phase 2: Bay, Midland, and Saginaw Counties (TCRPCC 2009).
- Gateway Community Livability Assessment & Recommendations Report. Shiawassee National Wildlife Refuge, Saginaw, Michigan & Surrounding Communities. (TCF 2014).

4.7. Maintenance

The Refuge is comprised of multiple wetland units, many of which depend on the physical integrity of levees and control structures. These structures are subject to a variety of stressors (weather, inundation, vegetation encroachment, disturbance by burrowing animals) that require regular maintenance to maintain their function. Similarly, an extensive trail system throughout the Refuge requires regular maintenance.

With the development of the Refuge's CCP (2001), it was recognized that the resources required to perform necessary maintenance may be limiting. Consequently, the Structured Decision Making working group that developed the draft restoration alternatives for the Green Point Area (USFWS 2015) felt it necessary to constrain the alternatives by recognizing that actions that would require a large investment in Refuge staff time or funding to perform additional maintenance would not be considered unless that cost was included in the alternative.

4.8. Cultural Resources

Two fundamental authorities guide the conservation of historic and cultural resources on National Wildlife Refuge System lands: The National Historic Preservation Act of 1996, as amended (NHPA; 16 USC § 470 et seq.) and the Archaeological Resources Protection Act of 1979, as amended (ARPA; 16 USC §§ 470aa-470mm). Both laws direct the conservation of cultural resources and archaeological investigations on public lands.

Within the National Wildlife Refuge system, the authority for management of cultural resources is retained by the Service's Regional Historic Preservation Officer. Refuge managers frequently assist the Regional Historic Preservation Officer by providing information related to Service activities that may affect cultural resources or historic properties, by over-seeing archaeological investigations, and by protecting known sites.

In order to ensure that cultural resources were identified and considered during the planning process, the Shiawassee National Wildlife Refuge conducted a comprehensive assessment of cultural resources within the administrative boundary of the Refuge (Robertson et al. 1999). As related within the Refuge's Comprehensive Conservation Plan (USFWS 2001), the

Refuge has identified 31 cultural resource sites on the Refuge and an additional 42 sites on additional lands within the expansion area of the Refuge. These include prehistoric archaeological sites, historic archeological sites (Native American and Western), industrial and mining sites, farmsteads, and timbering sites. Evidence for early Paleo-Indian cultures (10,000-8000 B.C.) consists only of fluted points in private collections. Other prehistoric cultures are represented in the archeological record: Archaic (8000-550 B.C.) and Woodland (600 B.C.-1600 A.D.). Areas bordering the Tittabawassee and Shiawassee rivers within the GPA and the Refuge are considered to among the most archaeologically rich sites in the State of Michigan (Castle Museum 2015).

4.9. Contaminants

A Contaminant Assessment Process Report was completed for the Shiawassee National Wildlife Refuge in February of 2010 (USFWS 2010). A Contaminant Assessment Process is a compilation of information and initial assessment of environmental contaminants for National Wildlife Refuge system lands.

This report summarized contaminant-related issues with the following:

> The Refuge's waterways and wetlands are likely being impacted by a wide variety contaminants. These contaminants include those commonly associated with industrial facilities (e.g. PCBs and dioxins), urban runoff (e.g. oil, grease, fertilizers), as well as agricultural activities (e.g. pesticides, herbicides, nutrient loading).

Significant contaminants originating off the Refuge include discharge from wastewater treatment plants, combined sewer and sanitary sewer overflows; discharge of animal wastes from confined animal feedlot operations; releases of hazardous substances, including dioxins, into the Tittabawassee River from the Dow Chemical Company (Dow) plant in Midland; polychlorinated biphenyls (PCBs) found in all the rivers within the Refuge; mercury; and, pharmaceuticals and personal care products.

The Contaminant Assessment also notes potential sources of contaminants, which include railroads that cross the upstream reaches of the rivers that pass through the Refuge and pipelines that transport hydrocarbons through the Refuge.

The Tittabawassee River and its floodplain downstream of Midland, the Saginaw River, and Saginaw Bay are being remediated under the Superfund Alternative Site process because of the releases of hazardous substances from Dow. Dow is cleaning up areas in the river, the river banks, and floodplain sequentially from upstream to downstream with work expected in the section of river that includes the GPA sometime after 2017 (U.S. EPA, 2015). In addition, the Service, along with the State of Michigan and the Saginaw Chippewa Indian Tribe of Michigan are conducting a Natural Resource Damage Assessment (NRDA) for these releases as well. The goal of the NRDA is to restore habitats and natural resources to the condition they would have been had the hazardous substances not been released, and to compensate the public for the loss of their use or enjoyment of natural resources.

The GPA is within the 8-year floodplain of the Tittabawassee River that is being investigated and remediated by Dow under the direction of U.S. EPA and MDEQ. Dioxins are the primary contaminants being investigated and their concentrations are expressed as toxic equivalents of 2,3,7,8-tetrachlorodibenzo-*p*-dioxin (TEQs). In a 2014 report, Dow characterized the GPA as containing some areas with less than 100 pg/g TEQ, a large area with 100 – 1,000 pg/g TEQ, and some areas along the shoreline of the river and in levee deposits on the Learning Center property as having concentrations ranging from 1,000 to 5,000 pg/g TEQ (Dow 2014, Figure 3-2F). The areas of greatest concentrations may be subject to remediation in the future. Because of this, none of the restoration alternatives include soil disturbance along the shoreline of the river or in the levee deposit area.

4.10. Environmental Justice

Executive Order 12898, February 11, 1994 (59 FR 7629), requires each Federal agency to make environmental justice a part of its mission. Environmental justice means that, to the greatest extent practicable and permitted by law, all communities or populations are provided the opportunity to comment before decisions are rendered on proposed Federal actions. Furthermore, the principles of environmental justice require that certain populations or communities are allowed to share in the benefits of, are not excluded from, and are not affected in a disproportionately high and adverse manner by government programs and activities affecting human health or the environment.

Agencies have been directed to identify and address disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations, low-income populations, and Indian Tribes. Environmental justice issues encompass a broad range of impacts covered by NEPA, including impacts on the natural or physical environment and related social, cultural, and economic impacts. The primary means by which Federal agencies attain compliance related to environmental justice is through the inclusion of low-income, minority, and tribal populations in the planning process and by translating documents into other languages when members of the affected area are not English-speaking.

Much of the outreach effort by the Refuge occurs within the urban confines of the City of Saginaw. The medium household income of residents in the vicinity of the GPA is approximately $29,000. The population surrounding the GPA is comprised of 48% minorities (25% Black, 19% Hispanic, 1% Native American and 4% Multiracial) and 52% White. The Environmental Learning Center is located within 5 miles of multiple Title 1 priority schools. These schools are characterized as within the lower five percent in rankings of academic performance. For example, nearly adjacent to the Germania Tract, Merrill Park Elementary School serves nearly 300 students from pre-kindergarten to fifth grade. Based on income, approximately 98% of these students qualify for reduced price school meals. The proximity of the GPA and Environmental Learning Center to these Title 1 schools presents a unique opportunity to deliver science-based, experiential outreach to under-served and disadvantaged communities within the City of Saginaw. Currently, the Environmental Learning Center delivers environmental education and natural resource interpretation to over 1,300 students annually within a 15 mile radius of the Refuge.

4.11. Socioeconomics

Like many cities with industrial-based economies, the City of Saginaw has experienced substantial economic decline in the last several decades. Between 2000 and 2010, the population of Saginaw declined by nearly ten thousand people (TCF 2014). While the economy of the City of Saginaw continues to be anchored by manufacturing, economies of the adjacent townships of James and Spaulding are largely agricultural. In 2013, unemployment in Saginaw County was approximately 13.1% (TCF 2014).
Among the Priority Recommendations included in the recently completed livability assessment for the Shiawassee NWR and Saginaw County (TCF 2014) was the following:

> **Raise awareness of the Shiawassee National Wildlife Refuge and surrounding rivers as an environmental and economic asset.** The conservation of the natural landscape is important to preserving a unique defining element of the Saginaw region. It is important that the city and surrounding communities recognize the economic value of their natural landscape—refuges, rivers, and parks—as the foundation for active, healthy lifestyles that attract residents and employers as well as the development of sustainable tourism and a sustainable natural resource-based industry.....

Wildlife and recreation-based activities substantially contribute to both rural and urban economies in the State of Michigan. As reported in the 2011 National Survey of Fishing, Hunting and Wildlife Associated Recreation (USDOI 2013), 2011 hunting-related expenditures totaled $2.3 billion; fishing-related expenditures totaled $2.4 billion; and, wildlife watching-related expenditures totaled $1.2 billion. As noted above, public use at Shiawassee National Wildlife Refuge has grown steadily over the last decade. The recently completed livability assessment (TCF 2014), suggests that there is broad understanding of the economic contribution and opportunity, related to recreational activities, that the Refuge provides to the City of Saginaw and local communities.

5.0 Environmental Consequences

5.1. Environmental Consequences Common to All Alternatives

5.1.1. Cultural Resources

The Service is mandated by various laws, regulations, and departmental policy to protect cultural and historical resources. Statutes directing the conservation of cultural resources include the Archaeological Resources Protection Act of 1979, as amended (ARPA; 16 USC §§ 470aa-470mm) and the National Historic Preservation Act of 1966, as amended (NHPA; 16 USC §§ 470 *et seq*.). Conservation of cultural resources by the Service would not vary by alternative. That is, under all alternatives, cultural resources on Refuge lands would be conserved.

5.1.2. Environmental Justice

Implementation of any of the alternatives considered above is unlikely to disproportionately affect, in any detrimental way, minority or low-income populations.

Conversely, implementation of restoration within the GPA may benefit disadvantaged populations, particularly in the vicinity of the GPA. This may consist of additional

recreational opportunities or additional opportunity to participate in science-based environmental outreach conducted by the Green Point Environmental Learning Center.

An on-going community-based effort to integrate the Refuge, transportation, and local business development, has recognized the potential contribution that the Refuge may provide local communities (TCF 2014).

5.1.3. Contaminants

Hazardous substances, including dioxins, were released into the Tittabawassee River and now occur in the river and its floodplain, which includes the majority of lands within the Green Point Area. For example, in the southeast corner of the 80 acre Learning Center Tract, an area with relatively high dioxin concentrations has been identified along the Tittabawassee River (USFWS 2015). The State of Michigan has issued advisories about moving soil within the 100-year floodplain of the Tittabawassee River in order to minimize or eliminate soil displacement and increased exposure of contaminated soils (MDEQ et al., undated). Consequently, all the alternatives considered here are equivalent in that they are constrained to limit soil disturbance so as to avoid or minimize mobilizing existing contaminants within the Green Point Area.

5.1.4. Water Quality

Sources of impairment and practices that have contributed to the impairment of water quality on the Refuge are often beyond the scope of the management of the Refuge. These include legacy contaminants, municipal runoff, and sediments or nutrients associated with rowcrop agriculture and the operation of livestock feedlots. Many of the sources of impairment are the result of on-going practices throughout the Saginaw Bay Watershed, encompassing an area of approximately 8,700 squares miles (5.6 million acres). The Refuge is uniquely situated where the Tittabawassee, Shiawassee, Cass and Flint Rivers converge to form the Saginaw River, so the approximately 9,800 acres of the Refuge receive waters from the watersheds of all of these rivers. The Action Area under consideration includes an area of approximately 275 acres primarily influenced by the Tittabawassee River. The alternatives considered here are unlikely to alter water quality on the Refuge as a whole to any detectable degree, but alternatives which include reforestation and destruction of any drain tiles to improve hydrology on the Germania parcel may slightly improve water quality in the downstream reach of the Tittabawassee River by decreasing erosion and increasing filtration of stormwater.

5.1.5. Maintenance

The Refuge is comprised of multiple wetland units, many of which depend on the physical integrity of levees and control structures. These structures are subject to a variety of stressors (weather, inundation, vegetation encroachment, disturbance by burrowing animals) that require regular maintenance to maintain their function. Similarly, an extensive trail system throughout the Refuge requires regular maintenance.

Recognizing the continued cost of the maintenance of existing Refuge facilities, both in terms of monetary cost and staff time required, the SDM working group that developed draft restoration alternatives for the Green Point Area (USFWS 2015) felt it necessary to

constrain the alternatives by recognizing that actions that would require a large investment in refuge staff time or funding to perform additional maintenance would not be considered unless those costs were explicitly included in the alternative. That is, the alternatives are equivalent in that any alternative implemented will not result in an additional maintenance burden to the Refuge's existing budget and staff.

5.2. Environmental Consequences of the Alternatives

This section evaluates the anticipated direct and indirect effects of the alternatives on natural resources. The NEPA regulations at 40 CFR § 1508.8 describe direct and indirect effects as follows:

> (a) Direct effects, which are caused by the action and occur at the same time and place.
>
> (b) Indirect effects, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air and water and other natural systems, including ecosystems.
>
> Effects and impacts as used in these regulations are synonymous. Effects includes ecological (such as the effects on natural resources and on the components, structures, and functioning of affected ecosystems), aesthetic, historic, cultural, economic, social, or health, whether direct, indirect, or cumulative. Effects may also include those resulting from actions which may have both beneficial and detrimental effects, even if on balance the agency believes that the effect will be beneficial.

The effects of the action alternatives are summarized in Table 5; the consideration of cumulative effects, with respect to the NEPA, follows in Section 5.3.

In contrast to the consideration of elements of the human environment under the NEPA, the CERCLA regulations direct natural resource trustees to restore, rehabilitate, replace, or acquire the equivalent of injured natural resources and their associated services. In this case, resources injured as a consequence of the release of hazardous substances into the Saginaw River and Bay. The evaluation of the alternatives under the CERCLA must consider the degree to which the various alternatives achieve the intended restoration of natural resources. Evaluation of the alternatives with respect to CERCLA, the degree to which the various alternatives either restore, rehabilitate, replace, or acquire injured natural resources is addressed below in Section 5.4.

5.2.1. Endangered, Threatened, Proposed, and Candidate Species (Federal)

None of the alternatives considered here is likely to directly impact any federally listed species given that none of the alternatives proposes the removal of habitat likely to be used by federally-listed species. Furthermore, none of these species is known to occur on the Refuge, though it is likely that the listed bats use the Refuge intermittently.

Indirectly, Alternatives B and D may result in the future availability of additional suitable habitat, consisting of floodplain forest, for the Indiana bat and the Northern long-eared

bat. Restoration under alternative B may be implemented sooner than restoration implemented under Alternative D, but with respect to indirect effects (establishment of additional floodplain forest), the two alternatives are essentially equivalent.

Alternatives A, and C are approximately equivalent with respect to indirect effects in that restoration either may depend on natural succession or restoration would be secondary to other land use objectives. That is, it is uncertain that additional floodplain forest would be added to the GPA as a result of implementing either of these alternatives.

5.2.2. Migratory Birds

The Refuge is recognized as a United States Important Bird Area (IBA) for its global significance to migratory waterfowl. The Refuge is remarkable in the diversity of avian species that occur on the Refuge. Considering the Birds of Conservation Concern, at least 16 of the 37 species that occur in Michigan are associated with habitats that may be affected within the alternatives (Table 2). These habitats include hardwood forest, floodplain forest, and associated floodplain wetlands.

None of the alternatives here is likely to result in direct impacts to migratory birds, or migratory birds designated as Birds of Conservation Concern, given that none of the alternatives proposes the removal of habitat likely to be used by these species. The alternatives may differ, however, in terms of the timing and degree to which habitat is restored.

Alternatives B and D (the proposed action) may result in the future availability of additional suitable habitat, consisting of hardwood forest, floodplain forest, and inclusions of inundated shrub swamp habitat. Birds of Conservation Concern that are associated with forest, floodplain forest, or associated wetlands, may indirectly benefit from restoration. This would include species such as the Acadian flycatcher, cerulean warbler, and prothonotary warbler, all species identified as Birds of Conservation Concern (Table 2). Alternatives A and C are essentially equivalent in that it is uncertain that implementation of either of these alternatives would indirectly result in additional suitable habitat within the GPA.

Emergent marsh habitats may be improved or added to the GPA as a result of the treatment of non-native invasive species, or directly as a result of restoration that adds additional marsh acreage to the GPA. These habitats are most likely to be added to the GPA as a consequence of implementing Alternatives B and D, pending the outcome of ecological classification within the GPA. These habitats may be improved as a result of non-native invasive treatments implemented under Alternatives B, C, and D. Addition or improvement of emergent marsh habitats would likely benefit species such as the marsh wren, also a species identified as a Bird of Conservation Concern.

5.2.3. State Listed Species – Refuge Priority Resources

Although they may not be abundant on the Refuge, or may be only rarely observed, a number of state-listed species, in addition to federally threatened, endangered and candidate species, may occur on the Refuge or in proximity to the Refuge (Table 3).

Species listed by the State of Michigan include 15 species of mussels, six reptiles and amphibians, three species of fish, 11 birds, one insect, and seven species of plants. Many of the species listed by the State of Michigan have some association with wetland or riparian habitats (Table 3).

None of the alternatives here is likely to result in direct impacts to any State of Michigan listed species given that none of the alternatives proposes the removal of habitat likely to be used by these species. None of the alternatives here is likely to result in direct impacts to any of the Priority Resources identified by the Refuge given that none of the alternatives proposes the removal of Priority Resource habitats or habitats likely to be used by Priority Resource species. The alternatives may differ, however, in terms of the timing and degree to which habitat is restored.

As noted above, Alternatives B and D may result in the future availability of additional suitable habitat, consisting of floodplain forest. Alternatives A and C are essentially equivalent in that it is uncertain that implementation of either alternative would indirectly result in additional floodplain forest within the GPA. State-listed species that may benefit with the addition of floodplain forest include the bald eagle, prothonotary warbler, beak grass, showy orchis, and twinleaf.

Emergent marsh habitats may be improved or added to the GPA as a result of the treatment of non-native invasive species, or directly as a result of restoration that adds additional marsh acreage to the GPA. These habitats are most likely to be added to the GPA as a consequence of implementing Alternatives B and D, pending the outcome of ecological classification within the GPA. These habitats may be improved as a result of non-native invasive treatments implemented under Alternatives B, C, and D. State-listed species most likely to benefit with the addition or improvement of emergent marsh habitats include the common moorhen and the marsh wren.

Indirectly, among Priority Resource species, restoration may provide additional habitat, consisting primarily of floodplain forest, for the Indiana bat, least flycatcher, rose-breasted grosbeak, rusty blackbird, wood duck, and wood thrush. Priority Resource habitats on the Refuge that may benefit from restoration include floodplain forest and inundated shrub swamp. Restoration implemented under Alternatives B and D would result in the foreseeable addition of areas of floodplain forest and may result in inclusions of inundated shrub swamp habitat. Alternatives A and C are approximately equivalent with respect to indirect effects to these species and resources in that restoration either would depend on natural succession with uncertain outcome, or restoration would be secondary to other land use objectives.

5.2.4. Non-native and Invasive Species

Under the No Action Alternative (Alternative A), no treatment of non-native and invasive species would occur as this alternative would rely on natural succession. Consequently, populations of aggressive, competitive non-native species would be anticipated to increase, further compromising ecological integrity of the Action Area. Effects in this

case would lead to a negative ecological outcome relative to the restoration conveyed within the Purpose and Need described above (Section 2.0).

In this case, Alternatives B, C, D are approximately equivalent in that these alternatives propose the treatment, that is, eradication, of non-native and invasive species. It would be anticipated that direct effects related to the treatment of non-native and invasive species would have positive ecological outcomes.

Indirectly, over time, the treatment of non-native and invasive species may, in part, contribute to re-establishment of native vegetation. Native vegetation in turn provides shelter, improved breeding habitats, and foraging for native animals including pollinators.

5.2.5. Recreational Use

The four alternatives considered here differ with respect to outcomes related to recreational value within the GPA.

Some opportunistic, unmanaged, recreational use now occurs within the newly acquired Germania Tract. No additional recreational amenities would be added to the Germania tract under the No Action Alternative (Alternative A). Under this alternative, existing infrastructure such as cart paths and buildings associated with the Germania Tract may be anticipated to degrade over time without management intervention. This could result in a human health and safety concern. Consequently, recreational value within the GPA may be negatively affected under the No Action Alternative.

Both Alternatives B and D emphasize ecological restoration, but provide for incorporation of recreational opportunity in the context of restoration. The two alternatives differ in that Alternative D would be informed by a community needs assessment that would gauge recreational interest and preference among community members most likely to use the GPA. Both alternatives would be informed by an ecological assessment to direct subsequent restoration effort. Alternative D (the proposed action) may allow for the provision of recreational opportunity that is more closely aligned with community interest.

Alternative C, which maximizes recreational opportunity within the GPA, is likely to provide greater recreational opportunity than all other alternatives. This would likely be achieved by compromising both the extent and nature of intended ecological restoration.

5.2.6. Socioeconomic Value

The Refuge has previously been recognized as a substantive community asset (TCF 2014):

> Shiawassee NWR is a major natural resource hub for the region, with close proximity to Saginaw and within James and Spaulding Townships; these gateway communities are recognizing the importance of this asset as a constant as a result of the impacts of an ever fluctuating local, regional, and global economy.

There appears to be broad community consensus that the Refuge enhances the desirability of the community and may aid in attracting visitation, residents, and employers to the region (TCF 2014).

The socioeconomic value attributable to the alternatives considered here is closely related to recreational visitation (as above). Recreational valuation for the Refuge was last assessed in 2006 (Carver and Caudill 2007). Expenditures in Saginaw County by visitors to the Refuge totaled approximately $1.0 million in 2006. Non-residents accounted for approximately 63 percent of all expenditures. Non-consumptive recreational activities accounted for 87 percent of all expenditures. Local economic effects associated with recreational visits to the Refuge provide the equivalent of 15 fulltime jobs to the community and tax revenue of approximately $140,000. Total economic effects related to Refuge visitation amount to approximately $2.42 million annually added to the Saginaw County economy. That is, for every $1.00 spent on the refuge (an annual total of approximately $1.0 million), approximately $2.42 is returned to the local economy (Carver and Caudill 2007).

Because of the close association between recreational visitation and socioeconomic value, the alternative outcomes related to socioeconomic value would be identical to those described above for recreational use (Section 5.2.4). A No Action Alternative would likely result in further decay of existing infrastructure within the Germania Tract, resulting in diminished recreational and socioeconomic value. Alternative C is likely to provide greater emphasis upon recreational enmities, but at the expense of ecological restoration. Alternative B and D emphasize restoration, but incorporate recreational amenities. Alternative D differs in that this alternative would be informed by a community needs assessment that would allow recreational amenities to be more directly aligned with community interest.

5.3. Cumulative Effects

For the purposes of analyses conducted pursuant to the National Environmental Policy Act of 1969 (NEPA), cumulative effects (or 'impacts') are defined as the incremental, additional effects to the human environment that result from implementing any of the alternatives under consideration. The cumulative impact analysis must consider this incremental impact of the proposed action, and any alternative actions, in addition to the impact of past, present, and reasonably foreseeable actions regardless of the jurisdiction of their origin (CEQ 1997).

Past actions that have occurred within the Green Point Area have been described above (Section 2.2). Historic land use within the Green Point Area has included logging of the floodplain forest and subsequent conversion of land use to rowcrop agriculture. The use of bottomlands for rowcrop agriculture is consistently accompanied by installation of drainage tiles to alter hydrology. Subsurface drainage likely remains in-place within the Action Area.

In the recent past, the Germania property in the northern portion of the Green Point Area was maintained as a commercial golf course. This property is dominated by turf grasses, ornamental plantings, and the infrastructure associated with these facilities. Non-native invasive species (NNIS), such as common buckthorn and garlic mustard, among others, now occur within the Green Point Area as well.

Activities presently occurring within the Green Point Area are primarily those associated with the Green Point Environmental Learning Center. These activities include the public use of an existing trail system and outreach activities led by Learning Center staff.

Reasonably foreseeable actions that may occur in the future within the Green Point Area include the following:

- Restoration activities could result from the ongoing NRDA for releases of hazardous substances from Dow's plant site in Midland, Michigan. No settlement has been reached, but the Trustees for this NRDA published criteria for selection of restoration projects and ideas for potential restoration project types in an assessment plan (Stratus Consulting, Inc., 2008). Any action associated with this NRDA would be subject to its own requirements to comply with NEPA and CERCLA prior to related implementation. Any such actions would be expected to have similar goals as the restoration alternatives here and would likely enhance or compliment restoration work performed under this RP/EA.
- Dow may be required to remove soil along the shoreline or in the floodplain in the future, particularly in the Learning Center Tract, because of the presence of hazardous substances. Restoration alternatives considered here are constrained so as to preclude disturbance of soils in areas where contaminants are a concern (USFWS 2015).
- A Tri-County recreational path may be developed that would link to trails within the Green Point Area (TCRPCC 2009). Connection to a regional path system would be expected to increase recreational use of the area.

No additional State, County, or municipal actions are likely to occur within the Green Point Area in the foreseeable future.

5.4. Comparison of the Alternatives

The 1998 Consent Judgment (US District Court for the Eastern District of Michigan, June 4, 1999, Docket #98CV10368), specifically enjoined the Service, as the sole Federal Trustee,

> "to undertake this restoration activity which represents restoration of injured natural resources under the joint trusteeship of the Trustees. The Federal Trustee shall use these funds and the interest thereon at the Green Point Environmental Learning Center to restore, replace, or acquire the equivalent resources consistent with CERCLA and applicable regulations."

At present, the Germania Tract is dominated by non-native turf grasses, ornamental plantings, and decaying infrastructure. Four alternative actions have been identified for the purpose of advancing restoration within the GPA so as to restore resources previously injured or lost within floodplain forest as a result of prior contamination. Therefore, in addition to consideration of effects as prescribed under the NEPA, the alternatives are also summarized

below by comparing the extent and degree to which the alternatives restore ecotypes consistent with the broader Great Lakes Basin Ecosystem.

5.4.1. Alternative A: The No Action – Natural Recovery Alternative.

This alternative action emphasizes reliance upon ecological processes without management intervention to direct or enhance ecological restoration. The ecological outcome of relying on natural succession is uncertain. In this case, non-native invasive species would likely influence the outcome of natural succession and provide poorer habitat quality for floodplain species than alternatives with managed ecological restoration. Sub-surface drainage would remain in place and would, with some certainty, influence the outcome of natural succession. Existing infrastructure would remain in place but degrade over time. This would diminish the quality of recreational or cultural experiences associated with the Germania Tract and detract from the socioeconomic value of the Green Point Area. This alternative would likely be perceived as inconsistent with the foreseeable development of the Tri-County Recreation Path.

With respect to restoration potential, the site is currently dominated by non-native species and decaying infrastructure related to prior land use. Given the dominance of certain non-native species, it is unlikely that a Natural Recovery Alternative would advance restoration within the GPA toward the desired condition of native Great Lakes Basin ecosystems, minimally contributing to the restoration of floodplain resources injured by the previous deposition of contaminants such as PCBs.

Costs associated with this alternative are minimal and likely to be limited to on-going maintenance actions. However, achievement of ecological restoration and addition of benefits to local communities (e.g., recreational opportunity, socioeconomic value) is likely to be minimal.

5.4.2. Alternative B: Maximize Ecological Restoration of the Green Point Area.

This alternative emphasizes ecological restoration while achieving some social services associated with ecological restoration. Restoration would be directed by a recent assessment of hydrogeomorphology (Heitmeyer et al. 2013) and an anticipated assessment of forest community structure. Recreational amenities would include a trail system to be linked to an existing network of trails. Additional recreational opportunity, such as bird-watching, would be associated with services related to the outcomes of landscape restoration. Under this alternative it is unlikely that additional managed recreation sites, such as picnic shelters, would be added within the GPA. Managed recreational opportunity would be largely limited to the expansion of the Refuge trail system. Consequently, disturbance associated with recreation may be limited. Non-native and invasive species would be treated and therefore reduced within the Green Point Area. Though managed recreation sites would be limited to additional trails, outcomes would likely be perceived as beneficial. This alternative would likely be regarded as compatible with the foreseeable development of the Tri-County Recreation Path.

Implementation of managed restoration is likely to occur sooner under this alternative as compared to the other alternatives. Restoration may be enhanced, and probability of successful restoration improved, with the direction to be provided by the hydrogeomorphic and forest assessments noted above. Minimal recreational development under this alternative may also serve to limit disturbance within the GPA thereby contributing to restoration. Consequently, this alternative is likely to advance landscape condition toward the desired outcome of establishing representative Great Lakes Basin ecosystems and the restoration of floodplain resources injured by the previous deposition of contaminants such as PCBs.

Approximately 10 percent of the existing NRDA funds (~$600K) dedicated to the Green Point Restoration in the Consent Judgment would be expended to conduct the anticipated ecological assessment that would guide restoration within the GPA. Remaining funds would be spent to implement restoration actions informed by the assessments and to complete the trail system within the GPA. Restoration would be advanced; some additional recreational opportunities would be provided within the GPA.

5.4.3. Alternative C: Maximize Public Use of the Green Point Area.

This alternative emphasizes social or recreational services; restoration would be secondary to public use. Relative to Alternative B, it is likely that restoration would be delayed or would be undertaken only in part to achieve objectives that maximize public use. Recreational amenities, such as additional trails, picnic shelters, or viewing platforms, may be considered for addition to the GPA. Non-native and invasive species would be reduced within the GPA. Consequently, recreational opportunity would be substantially enhanced. This alternative would likely be perceived as compatible with the foreseeable development of the Tri-County Recreation Path.

This alternative action emphasizes social or recreational services; ecological restoration would be secondary to developing amenities that further public use of the GPA. Increased recreational use of the GPA may impede efforts to restore native floodplain habitats. Consequently, restoration of representative Great Lakes Basin ecosystems may occur, in part, under this alternative, but likely to a far lesser degree than under either alternatives B or D. Some portions of the GPA may be identified for restoration, but both the extent and the degree to which landscape condition would be moved toward the desired condition would be less than that likely to be achieved under either Alternative B or Alternative D. Consequently, this alternative is not likely to substantively advance restoration toward the desired outcome of establishing representative Great Lakes Basin ecosystems and the restoration of floodplain resources injured by the previous deposition of contaminants such as PCBs.

Under this alternative, expenditure of NRDA funds may be limited to those practices that can demonstrate some advancement of, or relationship to, restoration. Expenditure of these funds solely to provide recreational amenities in the absence of any association to restoration may be inconsistent with the intent of the 1998 Consent Judgment. Thus, other funding may need to be acquired in order to complete the activities listed in the description of this alternative.

5.4.4. Alternative D: Restoration Informed by Ecological and Social Assessment.

This alternative emphasizes ecological restoration to be informed by an existing hydrogeomorphic assessment (Heitmeyer et al. 2013) and an anticipated ecological assessment of forest community structure. As in Alternative B, this information would inform subsequent restoration effort within the GPA. In addition, the Refuge would conduct a community needs assessment that would identify community interest in the GPA. This would inform subsequent consideration of recreational amenities that may be developed within the GPA. Recreational amenities or opportunities identified by the community that are consistent with floodplain forest restoration would likely be valued more than those without a clear relationship to restoration.

At a minimum, recreational amenities would include a trail system to be linked to an existing network of trails. Additional recreational opportunities, such as bird-watching, would be associated with services related to the outcomes of landscape restoration. Additional amenities or opportunities identified by the anticipated community needs assessment would be considered. Non-native and invasive species would be treated and therefore reduced within the Green Point Area. Outcomes related to this alternative would likely be perceived as beneficial. This alternative would likely be regarded as compatible with the foreseeable development of the Tri-County Recreation Path.

Conducting a community needs assessment may temporarily delay implementation of restoration for one to two years. However, both restoration effort and the inclusion of any recreational amenities would be guided by immediately relevant information. Restoration effort and outcome would be similar to that described above for Alternative B. However, all benefits to the public (ecological, recreational, socioeconomic) may be delayed from one to two years in order to complete a community needs assessment. Additional stakeholders and the public would be engaged under this alternative and an additional planning effort undertaken. Though this may delay implementation, implementation may be better informed by the proposed community assessment and conflicts between restoration and amenities may be avoided. Though delayed, restoration outcome is likely to be similar to that of Alternative B. Consequently, this alternative is likely to advance landscape condition toward the desired outcome of establishing representative Great Lakes Basin ecosystems and the restoration of floodplain resources injured by the previous deposition of contaminants such as PCBs.

Under Alternative D, approximately 10 percent of the existing NRDA funds (~$600K) dedicated to the Green Point Restoration in the Consent Judgment would be expended to conduct the anticipated ecological assessment that would guide restoration within the GPA. An approximate 10 percent of these funds may be additionally expended to conduct a community needs assessment. Remaining funds would be spent to implement actions informed by the assessments with a guideline of devoting at least 75% of remaining NRDA funds to restoration of natural resources as opposed to directly paying for construction of human use amenities. Restoration would be advanced; some additional recreational opportunities would be provided within the GPA.

Table 5. Comparison of alternatives for the Green Point Area Restoration Project. A zero (0) is used to indicate an outcome of no effect to a resource related to implementation of a particular alternative. A plus sign (+) is used to indicate an outcome of beneficial effect to a particular resource; a minus sign (-) is used to indicate an outcome of negative effect. See text for additional details on relative degree of beneficial and negative effects.

Resource – Resource Issue	**Alternative A No Action**	**Alternative B Maximized Restoration**	**Alternative C Maximized Public Use**	**Alternative D Planning & Restoration**
Threatened & Endangered Species	0	+	0	+
Migratory Birds Birds of Conservation Concern	0	+	0	+
State Listed Species	0	+	0	+
Non-Native Invasive Species	–	+	+	+
Recreational Use	–	+	+	+
Maintenance	=	=	=	=
Cultural Resources	=	=	=	=
Contaminants	=	=	=	=
Water Quality	=	=	=	=
Environmental Justice	=	=	=	=
Socio-economics	–	+	+	+
Restoration Outcome	–	+	–	+

6.0 Compliance with Environmental Law, Regulation, and Policy

The following Federal, state, and local laws, regulations, and policies may affect completion of the restoration projects. All project sponsors that receive natural resource damage funding will be responsible for obtaining any necessary permits and complying with relevant local, state, and Federal laws, policies, and ordinances.

6.1. Federal Laws, Regulation, and Policy

Archaeological Resources Protection Act of 1979, as amended (ARPA; 16 USC §§ 470aa-470mm) was enacted

> ...to secure, for the present and future benefit of the American people, the protection of archaeological resources and sites which are on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals (Sec. 2(4)(b)).

The Archaeological Resources Protection Act recognizes that archaeological resources are an irreplaceable part of America's heritage and that these resources are endangered because of their commercial value. The Act relates the requirements that must be met before Federal authorities can issue a permit to excavate or remove any archeological resource from Federal or Indian lands and the requirements to curate any artifacts removed from public lands.

Section 6 of the statute describes prohibited acts, which include damaging or defacing archaeological sites in addition to unpermitted removal. The Archaeological Resources Protection Act also prohibits the sale or purchase of artifacts.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, 42 USC § 9601 *et seq*). Commonly referred to as Superfund, CERCLA authorizes the response to releases or threatened releases of hazardous substances into the environment. CERCLA also authorizes natural resource damage assessments to be conducted by natural resource trustees for releases of hazardous substances. The implementing regulations at 43 CFR Part 11 direct the efforts of natural resource trustees to assess natural resources damages resulting from releases of a hazardous substance covered under CERCLA and to restore, rehabilitate, replace, or acquire the equivalent of damaged resources and the services they provide. Natural resources include surface waters (e.g., rivers, lakes, and streams), ground water, soils, air, plants, and wildlife.

Clean Air Act of 1970, as amended, (CAA; 42 USC § 7401 *et seq*.). The CAA regulates air emissions from stationary and mobile sources to protect human health and the environment. Any activities associated with the restoration projects that result in air emissions (such as construction projects) will be in compliance with the CAA and any local air quality ordinances.

Federal Water Pollution Control Act (CWA; 33 USC § 1251 *et seq*.). The CWA is intended to protect surface water quality, and regulates discharges of pollutants into waters of the United States. Projects that move material in or out of waterways and wetlands, or result in alterations to a stream channel, typically require CWA Section 404 permits.

As part of the Section 404 permitting process, consultation under the Fish and Wildlife Coordination Act (16 USC § 661 *et seq*.) generally occurs. This act requires that Federal agencies consult with the USFWS, the National Marine Fisheries Service (NMFS), and state wildlife agencies to minimize the adverse impacts of stream modifications on fish and wildlife.

Compliance with the Rivers and Harbors Act (**33 USC § 401 *et seq*.)** generally occurs as part of the Section 404 permitting process. The Rivers and Harbors Act prohibit unauthorized obstruction or alteration of navigable waters. Any required permits under the Rivers and Harbors Act are generally included with the Section 404 permitting process.

Federal Endangered Species Act of 1973, as amended (ESA;16 USC §§ 1531 *et seq*.). The purpose of the ESA is to conserve federally endangered and threatened species and the ecosystems upon which they depend. Pursuant to Section 7 of the ESA, Federal agencies shall, in consultation with the Secretaries of the Interior or Commerce, ensure that any action that they authorize, fund, or carry out is not likely to jeopardize the continued existence of any federally endangered or threatened species, or result in the destruction or adverse modification of designated critical habitat. Before initiating an action, the Federal agency, or its non-Federal permit applicant, must determine if any threatened, endangered, proposed, or candidate species, or designated critical habitat, may be present in the project area.

In the case of the Green Point Area Restoration Project, two mammal species (Indiana bat and the northern long-eared bat), one bird species (rufa red knot), the eastern massasauga rattlesnake and one species of plant (eastern prairie fringed orchid) occur in proximity to the Refuge (Section 4.2, Table 1). None of these listed species is known to occur on the Refuge. No critical habitat for listed species occurs on the Refuge.

Fish and Wildlife Conservation Act (16 USC § 2901 *et seq*.). The Fish and Wildlife Conservation Act authorizes financial and technical assistance to state governments to develop, revise, and implement conservation plans and programs for nongame fish and wildlife.

Fish and Wildlife Coordination Act (16 USC § 661 *et seq*.). The Fish and Wildlife Coordination Act authorizes the involvement of the USFWS in evaluating impacts to fish and wildlife from water resource development projects. Federal agencies that construct, license, or permit water resource development projects are required to consult with the USFWS, and in some instances with NMFS, concerning the impacts of a project on fish and wildlife resources and potential measures to mitigate these impacts.

Information Quality Act of 2001 (guidelines issued pursuant to Public Law 106-554). As the lead Federal natural resources Trustee for this document, USFWS confirms that this information product meets its Information Quality Act guidelines, which are consistent with those of the DOI and the Office of Management and Budget.

Magnuson-Stevens Act Fishery Conservation and Management Act, as amended (16 USC 1801 *et seq*.). Coordination with the National Marine Fisheries Service and preparation of an Essential Fish Habitat (EFH) Assessment signifies compliance with the EFH provisions of the Magnuson-Stevens Act.

This statute does not apply to the Green Point Area Restoration Project.

Marine Mammal Protection Act (16 USC 1361-1326, 1371-1384 note, 1386-1389, 1401-1407, 1411-1418, 1421-1421h). Activities associated with these projects will not have an adverse effect on marine mammals. The Marine Mammal Protection Act does not apply to the Green Point Area Restoration Project.

Migratory Bird Conservation Act (16 USC § 715 *et seq*.). The Migratory Bird Conservation Act established a commission and conservation fund to promote the conservation of migratory waterfowl and offset or prevent serious loss of important wetlands and other waterfowl habitat.

Migratory Bird Treaty Act of 1918, as amended (MBTA; 16 USC §§ 703–712). The MBTA protects all migratory birds and their eggs, nests, and feathers and prohibits the taking, killing, or possession of migratory birds.

The Green Point Area Restoration Project may provide additional suitable habitat for migratory birds associated with bottomland hardwood floodplain forest.

National Environmental Policy Act (NEPA; 42 USC § 4321-4370d) requires that Federal agencies disclose the impacts of proposed Federal actions and engage the public in the development of alternative actions. Regulations for implementation of the NEPA are found at 40 CFR § 1508.9; the Council on Environmental Quality (CEQ) is the regulatory body responsible for promulgating guidance for implementation of the NEPA. In 1978, CEQ issued Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act (40 CFR §§ 1500 -1508). In 1980, CEQ issued the guidance document, Forty Most Asked Questions on the CEQ Regulations. Additional guidance and information relevant to the NEPA process is available at https://ceq.doe.gov/nepa/nepanet.htm.

National Historic Preservation Act of 1966, as amended (NHPA; 16 USC §§ 470 *et seq*.). The NHPA is intended to preserve historical and archaeological sites. Compliance with the NHPA would be undertaken through consultation with the Service's Regional Historic Preservation Officer and the Michigan State Historic Preservation Office.

Areas bordering the Tittabawassee and Shiawassee rivers within the Refuge are considered to among the most archaeologically rich sites in the State of Michigan. The Refuge has an on-going program to conserve these sites in partnership with the staff of the Castle Museum of Saginaw County History, Saginaw, MI.

National Wildlife Refuge System Administration Act of 1966 (16 USC 688dd-ee). This Act authorizes the Secretary of the Interior to permit the use of any area within the NWR System for any purpose, including but not limited to hunting, fishing, and public recreation whenever those uses are determined to be compatible with the purposes for which the area was established. The Improvement Act of 1997 is the latest amendment to the NWR System Administration Act. It supports the NWR System Administration Act's language concerning the authorization of hunting and other recreational uses on Refuge lands. The NWR Improvement Act substantiates the need for the NWR System to focus first and foremost on the conservation of fish, wildlife, and plant resources and their habitats. Other uses will only be authorized if they are determined to be compatible with this mission statement and the purposes for which the Refuge was established.

Occupational Safety and Health Act of 1970, as amended (OSHA; 29 USC §§ 651 *et seq*.). The OSHA governs the health and safety of employees from exposure to recognized hazards, such as exposure to toxic chemicals, excessive noise, mechanical dangers, and unsanitary conditions.

Refuge Recreation Act of 1962 (16 U.S.C 460k) authorizes the Secretary of the Interior to administer National Wildlife Refuges for public recreation as an appropriate incidental or secondary use (1) to the extent that is practicable and consistent with the primary objectives for which an area was established, and (2) provided that funds are available for the development, operation, and maintenance of permitted recreation.

Watershed Protection and Flood Prevention Act as amended (16 USC 1001 *et seq*.). Floodplain impacts will be considered prior to selection of final projects plans and during the permit process.

6.2. State Laws and Regulations

The Natural Resources and Environmental Protection Act of 1994, Public Act 451, as amended (NREPA). Michigan's environmental protection and natural resource management authorities have been codified in the NREPA. Permits, where required, are administered by the MDEQ, and permit application and review requirements would be consolidated whenever possible. Any restoration action undertaken by the Refuge would comply with relevant provisions of this Act and applicable rules promulgated under the Act.

Part 31, Water Resources Protection, requires that a permit be obtained prior to any alteration or occupation of the stream bed, channel, or floodplain of a river, stream, or drain. Part 31 also governs discharges to waters of the State, including wetlands and groundwater and provides for the recovery of natural resource damages attributable to discharges that are injurious to designated uses of waters of the State.

Part 55, Air Pollution Control, provides authority to the MDEQ to engage in a variety of activities to protect air quality, including the regulation of fugitive dust sources and emissions, in accordance with the provisions of M.C.L. 324.5524.

Part 91, Soil Erosion and Sedimentation Control, requires that a permit be obtained to protect against the loss of soil to surface waters, including wetlands. A permit is generally required for any activities that disturb one or more acres, or is within 500 feet of a lake or stream. Counties have the primary responsibility for issuing permits. In some cases, cities, villages, and townships have assumed permitting responsibility within their jurisdictions. Permit applications can be obtained from the respective county or municipal agencies.

Part 115, Solid Waste Management, regulates companies and businesses that dispose of solid waste. The solid waste program performs inspection, evaluation, permitting, and licensing of solid waste disposal areas in the state, including evaluation of groundwater monitoring data and corrective actions associated with releases from solid waste landfills.

Part 201, Environmental Remediation, provides legislative authority for Michigan's cleanup program for hazardous substances. The purpose of this authority is "to provide for appropriate response activity to eliminate unacceptable risks to public health, safety, or welfare, or to the environment from environmental contamination at facilities within the state" (M.C.L. 324.20102). The authority also includes "additional administrative and judicial remedies to supplement existing statutory and common law remedies" (M.C.L. 324.20102), including making claims against liable parties for "the full value of injury to, destruction of, or loss of natural resources, including the reasonable costs of assessing the injury, destruction, or loss resulting from the release" (M.C.L. 324.20126a).

Part 301, Inland Lakes and Streams, requires a permit for certain construction activities on inland lakes and streams. The Inland Lakes and Streams Program is responsible for the protection of the natural resources and public trust waters of the inland lakes and streams of the State. The program oversees the following activities: dredging, filling, constructing, or placing a structure on bottomlands; constructing or operating a marina; interfering with the natural flow of water; and connecting a ditch or canal to an inland lake or stream.

Part 303, Wetlands Protection, requires that a person obtain a permit to perform certain activities in a wetland (Table 18).

The programs in MDEQ that administer these parts have the objective of protecting human health and the environment in Michigan.

A joint state and federal permit process has been established between the MDEQ and the U.S. Army Corps of Engineers for projects in areas that have both state and Federal jurisdiction.

Table 6. Examples of types of activities that require a wetlands protection permit.

Activity	Example (partial list only)
Deposit or permit the placing of fill material	Bulldozing, grading, dumping
Dredge, remove, or permit the removal of soil or minerals	Removing tree stumps, bulldozing, digging a pond
Construct, operate, or maintain any use or development	Constructing buildings, structures, boardwalks; mining peat, treating water
Drain surface water	Diverting water to another area via ditch, pump, or drain

Part 365, Endangered Species Protection, requires that no State of Michigan designated endangered or threatened plant or wildlife may be taken or harmed. Numerous species of state threatened or endangered plants and animals (Section 4.4, Table 3) may occur within proximity of the Shiawassee National Wildlife Refuge.

The Green Point Area Restoration Project is unlikely to impact any state listed species. The outcome of restoration is likely to benefit state listed species associated with bottomland hardwood floodplain forest habitat. Nonetheless, precautions will be taken to ensure that the timing, location, type and duration of the restoration activities will limit any impacts to these species, as well as others which may inhabitant the Green Point Action Area.

Michigan Occupational Safety and Health Act of 1974, Public Act 154. The Michigan OSHA (Public Act 154 of 1974) is an act to prescribe and regulate working conditions, and places and conditions of employment to provide for occupational health and safety. The Departments of Labor and Public Health are responsible for implementing the provisions of this act. All activities associated with the Green Point Area Restoration Project would comply with provisions of this act.

6.3. Local Laws

As appropriate, restoration actions will consider and comply with local plans and ordinances. Relevant local plans could include shoreline and growth management plans. Relevant ordinances could include, but not be limited to, zoning, construction, noise, and wetlands.

6.4. Policies and Directives

6.4.1. Federal Policies and Directives

The following Federal policies and Presidential Executive Orders may be relevant to the Green Point Area Restoration Project:

USFWS Mitigation Policy (Fish and Wildlife Service Manual, 501 FW 2). This policy of the USFWS seeks to ensure "no net loss" of fish and wildlife habitat as a result of USFWS actions.

The Green Point Area Restoration Project is likely to result in the addition or enhancement of bottomland hardwood floodplain habitats.

Executive Order 11514 – Protection and Enhancement of Environmental Quality, as Amended by Executive Order 11911 Relating to Protection and Enhancement of Environmental Quality. These Executive Orders require Federal agencies to monitor, evaluate, and control their activities to protect and enhance the quality of the Nation's environment. These Executive Orders also require agencies to inform the public about these activities and to share data on environmental problems or control methods, as well as to cooperate with other governmental agencies.

The purpose of the Green Point Area Restoration Project is consistent with the intent of these Executive Orders.

Executive Order 11593 - Protection and Enhancement of the Cultural Environment. Coordination with the State Historic Officer will signify compliance. Consultation is incorporated into the CWA Section 404 and 401 permitting process.

Executive Order 11988, 24 May 1977 amended by Executive Order 12148, 20 July 1979 – Floodplain Management. This Executive Order directs Federal agencies to avoid the occupancy, modification, and development of floodplains, when there is a practical alternative. Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2). Consultation is incorporated into the CWA Section 404 and 401 permitting process.

The Refuge will work to ensure that any floodplain impacts are minimized.

Executive Order 11990 – Protection of Wetlands. This Executive Order instructs Federal agencies to avoid adverse impacts associated with destruction or modification of wetlands. Public notice of the availability of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b). Consultation is incorporated into Sec. 404 and 401 permitting process.

The Green Point Restoration Project may result in restoration or enhancement of wetland habitats. The Service will work to ensure that projects minimize any wetlands impacts.

Executive Order 12898 – Environmental Justice. This Executive Order instructs Federal agencies to assess whether minority or low-income populations would be disproportionately impacted by agency actions.

The Shiawassee National Wildlife Refuge adjoins the city of Saginaw, Michigan and serves primarily an urban, low-income population. That is, programs on the Refuge, particularly outreach programs of the Green Point Environmental Learning Center are intended to benefit these populations.

Executive Order 12962 – Aquatic Systems and Recreational Fisheries. This Executive Order requires that Federal agencies, where practicable and permitted by law, work cooperatively to improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunities. The Trustee agencies worked cooperatively to identify potential projects that would benefit aquatic resources and recreational fishing opportunities, in compliance with the intent of this Executive Order.

Executive Order 13007 - Accommodation of Sacred Sites. This Executive Order is not applicable unless activities occur on Federal lands, in which case agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

Executive Order 13045 - Protection of Children from Environmental Health Risks and Safety Risks. The Green Point Area Restoration Project would not create a disproportionate environmental health or safety risk for children.

Executive Order 13112 – Invasive Species. This Executive Order requires that Federal agencies, where practicable and permitted by law, should identify any actions that may affect the status of invasive species and take actions to address the problem within their authorities and budgets. Agencies also are required not to authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species, unless a determination is made that the benefits of actions outweigh potential harms and measures are taken to minimize harm.

With the exception of a Natural Recovery Alternative, the Green Point Area Restoration Project incorporates measures to control non-native and invasive plant species.

Executive Order 13186 – Protection of Migratory Birds. This Executive Order requires Federal agencies to evaluate the effects of their actions on migratory birds, to take actions to avoid or minimize the impacts of their actions on migratory birds, and to help promote conservation of migratory birds if actions are likely to have a measurable negative effect on migratory bird populations.

The Green Point Area Restoration Project is likely to result in the addition or enhancement of bottomland hardwood floodplain habitats that may benefit migratory birds associated with these habitats.

Executive Order 13653 – Preparing the United States for the Impacts of Climate Change. This Executive Order requires Federal agencies to manage lands and waters under their authorities for climate preparedness and resilience. Federal agencies are directed to assess "their land- and water-related policies, programs, and regulations necessary to make the Nation's watersheds, natural resources, and ecosystems, and the communities and economies that depend on them, more resilient in the face of a changing climate."

The Green Point Area Restoration Project is intended to restore habitats that are ecologically appropriate to the landscape, and restoring certain properties, such as hydrology, that should improve resilience of the landscape.

Executive Memorandum on the Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA (11 August, 1980). This memorandum directs Federal agencies to identify and rigorously consider in their environmental analyses prime agricultural lands.

The Green Point Restoration Project does not involve or impact agricultural lands.

DOI Departmental Manual, Parts 517 and 609 – Pesticides and Weed Control. With the exception of the Natural Recovery Alternative described above, implementation of any of the alternatives described in the Restoration Plan / Environmental Assessment for the Green Point Area Restoration Project would be consistent with DOI policy to use integrated pest management strategies for control of insect and weed pests. Pesticides or herbicides will only be used after a full consideration of other control alternatives; the material selected and method of application will be the least hazardous of available options.

DOI Departmental Manual, Part 518 – Waste Management. If implementation of any alternatives generates waste, the Refuge will comply with all relevant DOI directives and policies.

DOI Departmental Manual, Part 602 – Land Acquisition, Exchange, and Disposal. If the Federal government acquires any real property through implementation of these restoration projects, appropriate pre-acquisition standards – particularly the American Society for Testing and Materials standard for Environmental Site Assessments for Commercial Real Estate – will be complied with. No land acquisition is anticipated.

6.4.2. State and Local Policies

The entire 100-year floodplain, including all of the Green Point Area, is under a soil movement advisory that includes guidance on minimizing human exposure, limitations on moving and disposing of soil, and permit requirements (MDEQ et al., undated, available at http://www.michigan.gov/documents/deq/deq-whm-hwp-dow-TR-Advisory-dioxin-Color-Final_251808_7.pdf).

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8.0 List of Preparers

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Appendix A: White Paper: Putting from the Rough: Ecological and Social Restoration of a Former Golf Course - *A Case Study from the Structured Decision Making Workshop*

Putting from the Rough: Ecological and Social Restoration of a Former Golf Course

A Case Study from the Structured Decision Making Workshop
Course Dates February 9 – 13, 2015
Course Location: National Conservation Training Center, Shepherdstown, WV

Authors: Eric Dunton[1], Lionel Grant[1], Steven Kahl[1], Daniel Kashian[2], Maggie O'Connel[3], Lisa Williams[4], Patricia Williams[5],
Coaches: Greg Breese[6], Jennie Hoffman[7], and Dave Smith[8]

Decision Problem

In May 2014, the U.S. Fish and Wildlife Service (USFWS), Shiawassee National Wildlife Refuge received the former 135-acre Germania Town and Country Club as donation from The Nature Conservancy (TNC). TNC purchased the property (which fell into foreclosure in 2010) with support from The Dow Chemical Company. The Refuge seeks to develop a restoration plan which maximizes ecological and social objectives utilizing Natural Resources Damage Assessment (NRDA) funds. In 1998, a co-trustee group consisting of the USFWS, the State of Michigan, and the Saginaw Chippewa Tribe negotiated a settlement for natural resources damages with the General Motors Corporation and the Cities of Bay City and Saginaw. The settlement provides for substantial cleanup of river contamination and for protection and restoration of fish and wildlife habitats in the Saginaw River and Bay. Specifically, NRDA funds are available for restoration plan development and implementation under the Green Point Environmental Learning Center (GPELC) projects and elements section of the settlement and restoration. The decision makers for the project are Shiawassee NWR Refuge Manager, Ecological Services, and the co-trustee group.

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Background

Legal, regulatory, and political context

There is approximately $614,000 available in NRDA funds available for this restoration project. The group seeks to write a restoration plan for the GPELC area, including the former Germania golf course, that guides restoration activities to maximize the ecological and social objectives of the project and complies with both NRDA and National Environmental Policy Act (NEPA) guidelines. The group looks to implement restoration goals in part based on a recently completed hydrogeomorphic (HGM) evaluation completed for Shiawassee NWR. The project area lies within the City of Saginaw and includes the 135 acres of the former golf course, 60 acres in the Hickey tract, and the 80 acre parcel owned by the City of Saginaw and managed by the Service that includes the building that houses the learning center classroom and offices. The restoration of the former golf course within the GPELC area not only provides a unique opportunity to restore 135-acres of habitat within an urban area, but also the opportunity to connect urban residences with the National Wildlife Refuge System (NWRS) through the existing network of trails and ponds present (Fig. 1). In addition, there is a separate NRDA on-going with the Dow Chemical Company (Dow) that includes the Tittabawassee River and its floodplain.

Ecological context

Vegetation communities present in Michigan during the pre-settlement (i.e., pre-European settlement) are available for the entire State of Michigan and are based on interpretation of General Land Office surveys from the early-1800s. This data provides geospatial information on the types and distribution of general habitats historically present in the Shiawassee flats region in the pre-settlement period (Albert and Comer 2008 and Comer et al. 1995). These GLO-based maps indicate that the Shiawassee flats region contained a central core of shrub swamp-emergent marsh surrounded by diverse black ash, and mixed hardwood swamp forest (Heitmeyer et al. 2013). According to the interpreted GLO notes the Greenpoint area consisted mostly of beech sugar maple forest (Fig. 2). Beech sugar maple forests are a transitional forest types from true floodplains to uplands (Barnes and Wagner 1981, Dickman and Leefers 2004, Kost et al. 2010). Although, the interpreted GLO notes indicate Beech sugar maple forest based on information collected during a HGM evaluation indicate the area, particularly the areas closer (i.e., lower elevation) to the Tittabawassee River consisted of mixed hardwood swamp. The HGM process looks at the historical distribution of major vegetation communities/habitat types in the Shiawassee flats region in relationship to geomorphic surface, soils, topography, and hydrological regime to produce a matrix of habitat/cover types and a map of the potential distribution of cover types (Heitmeyer et al. 2013).

If we assume some of this area was more of a floodplain forest or mixed hardwood swamp these forest types can best be characterized by Michigan Natural Features Inventory (MNFI) descriptions of natural communities (e.g., floodplain forest and southern hardwood swamp). Floodplain forest is a bottomland deciduous forest subject to periodic over-the-bank flooding with cycles of erosion and deposition (Kost et al. 2010). Floodplain forest vegetation varies and changes along a gradient of flooding frequency and duration but in general the major tree species include; silver maple (*Acer saccharinum*), green ash (*Fraxinus pennsylvanica*), and American

elm (*Ulmus americana*; Kost et al. 2010). Southern hardwood swamp is similar to floodplain forest in that they occupy shallow depressions or are situated along high-order streams (Kost et al. 2010). The canopy is typically dominated by silver maple (*Acer saccharinum*), red maple (*Acer rubrum*), green ash (*Fraxinus pennsylvanica*), and black ash (*Fraxinus nigra*; Kost et al. 2010).

Although we have fairly good information on pre-settlement conditions the former golf course site has been highly altered, undoubtedly affecting the function and structure of any pre-settlement vegetative community we try to establish. Prior to the establishment as a golf course the entire Germania tract was logged, cleared, and converted to agriculture (Fig. 3). We believe there still remains a network of sub-surface tiles which influence the hydrology of the site. The majority of the Germania tract of land consists of non-native turf grasses and ornamental trees and shrubs. The shoreline along the Tittabawassee River on the Germania tract has been "hardened" by placing impervious material such as concrete and rock. Invasive species such as common buckthorn (*Rhamnus cathartica*), garlic mustard (*Alliaria petiolata),* and a variety of other non-native invasive species have become well established in all three tracts of the GPELC area. Furthermore, one of the dominant overstory trees at GPELC is green ash, which is mostly dead or dying from emerald ash borer (*Agrilus planipennis*; a non-native Asian beetle that feeds on ash species).

Decision Structure

Decision Problem

Our group framed the problem based on ecological and social objectives that meet the mission of the USFWS National Wildlife Refuge System and Shiawassee NWR while fulfilling the obligations of the NRDA agreement. Our problem statement was to determine how to best restore floodplain habitat and provide public use on GPELC area using settlement funds over the next 20 years while minimizing constraints for future actions.

Constraints

Prior to setting objectives we identified several constraints which were used throughout the workshop in objective setting and developing alternatives. These constraints included:

1. Funding – We have approximately $614,000 available in NRDA funds for this project that are to be used to restore, replace, or acquire the equivalent of the natural resources that were injured by the release of hazardous substances. Of the funds available, NRDA guidelines suggest that approximately 10 – 20% can be used for planning activities, 10 – 15% can be used for improving public use of natural resources(e.g., trails, kiosks, interpretive signs), and the remaining funds are to be used for direct implementation, monitoring and maintenance of habitat restoration to benefit natural resources. The NRDA funds are not associated with a fiscal year and are in an interest bearing account.
2. Contaminants – There is an ongoing NRDA for releases of hazardous substances from Dow's plant site in Midland, Michigan. Hazardous substances, including dioxins, were released into the Tittabawassee River and are now present in the river and its floodplain. The Michigan Department of Community Health has issued consumption advisories for fish from the river and wild game harvested from the floodplain (MDCH 2015, 2008).

   a. In the southeast corner of the 80 acre GPELC tract, investigations have identified an area with relative high concentrations of dioxins along the Tittabawassee River. Dow may be required to remove soil there in the future and in the meantime no public use activities should be planned for this area that would increase soil exposure.
   b. The State of Michigan has issued advisories about moving soil within the 100-year floodplain of the Tittabawassee River in order to minimize or eliminate soil displacement and increased exposure to or erosion of contaminated soils (MDEQ et al., undated). Nearly all of the GPELC area is within the 100 year floodplain.
   c. Any dirt moving or shoreline engineering along the Tittabawassee River would likely require additional soil testing, disposal at a licensed landfill, and contingency funding in case additional contaminants are discovered.
3. Refuge resources (i.e., refuge funds/budget and refuge staff time) – We wanted to explicitly recognize the fact that the actions we take toward restoring this site will require long term maintenance and oversight. Therefore we added a constraint that actions that would require a large investment in refuge staff time or funding would not be considered unless those costs could be covered with the available NRDA funds.
4. DTE Energy Company - Shiawassee NWR has an agreement with DTE Energy Company to provide 200 acres on the refuge for DTE to plant trees in which they will earn carbon sequestration credits. For the portions of the restoration sites that we plan to reforest we plan to explore using this agreement to purchase and plant the trees. This would allow us to maximize the NRDA funding for other aspects of the restoration but we further communication between the refuge and DTE needs to occur to ensure the restoration goals and agreement are compatible for this site.
5. Restoration actions will not inhibit future actions – During our planning process we recognized a need to write a Visitors Services plan for the GPELC area. In addition, any decisions made now will not inhibit any future actions or implementation of future plans (e.g., don't build new trails right along Tittabawassee River because this may prevent shoreline softening at a later time).

Objectives

Fundamental objectives were set by the group and reflected ecological and social goals of the project. We developed an objectives hierarchy based on the problem statement (how best to restore floodplain habitat and provide public use on Greenpoint area using settlement funds over the next 20 years while minimizing constraints for future actions) and included the following fundamental objectives; (1) restoration closer to pre-European conditions, (2) connecting local people with nature, (3) maximizing public support while being a community asset, (4) costs (initial and long-term refuge resources), and (5) minimize any increase in contaminant exposure (Fig. 4). We developed two means objectives for one of the fundamental objectives (restoration closer to Pre-European conditions): Having the correct spatial arrangement of habitat types on the landscape (e.g., % of forested habitat versus % another landcover type) and having habitat types that are structurally and functionally able to support wildlife communities similar to what was historically present. Once the objectives were set we created measurable attributes to measure the success of achieving that objective (Fig. 4).

Alternative actions

We developed alternatives by first identifying a list of actions that could be undertaken and grouping these actions into themes such as "reforestation" or "public use". By structuring the many actions under themes it was easier to develop a short list of alternatives that both spanned the range of what could be done and were strategically aligned with our objectives from the vast number of alternatives that potentially could have been developed for the restoration project (Table 1). We created alternatives by selecting strategies from the different themed lists to create alternatives with varying focus on the objectives (portfolio approach). This approach was very useful since we could develop numerous alternatives that varied widely or alternatives that were similar. We began developing these alternatives by starting with two alternatives that varied widely (i.e., an alternative that maximized restoration and an alternative that maximized native prairie planting). We used difference in vegetation cover as the extremes since the amount of funds that can be spent on public use and infrastructure are capped at approximately 20%.

Alternative 1 – Maximize Restoration (focus on ecological restoration that will be guided by forest inventory and ecological classification work, public use focuses on establishing a trail system on the Germania tract that would connect to existing trails on Greenpoint tract creating a new linked trail system for the GPELC area).

Actions:

1. Tree planting across entire golf course, if possible funded through DTE.
2. Invasive species treatment across entire GPELC area.
3. Forest inventory and ecological classification which will be used as reference information to guide reforestation work.
4. Build new trails on Germania.
5. Remove existing asphalt golf cart trails.
6. Demolition and removal of existing buildings on Germania.
7. Hire a seasonal land management technician to take lead on invasive species and land management activities on the entire Greenpoint area.

Alternative 2 – Maximize Public Use (focus on public use and use by the local community at the expense of habitat restoration recognizing the potential value of outreach and education can have long term outcomes that may outweigh the reduced use by wildlife)

Actions:

1. Tree planting on west side of Maple Street on Germania, if possible funded through DTE.
2. Native prairie planting on east side of Maple Street on Germania.
3. Invasive species treatment, entire GPELC area.
4. Forest inventory and ecological classification on the refuge which will be used as reference information to guide reforestation work.
5. Build new trails on Germania.
6. Remove existing asphalt golf cart trails.
7. Demolition and removal of existing buildings.
8. Install new signs and kiosks.

9. Connect new trails to existing trails at the rest of GPELC.
10. Create new access points to the area specifically targeting increasing accessibility to local school and local residents.
11. Restore wetland at "Big Pond" (existing pond located on Germania, east of Maple Street).
12. Hire a seasonal land management technician to take lead on invasive species and land management activities on the entire Greenpoint area.

Alternative 3 – Maximize Ecological and Social Planning Prior to Restoration (focus pre-restoration planning efforts to guide ecological restoration and public use goals by conducting a community needs assessment to better understand how the local community would and wants to use the GPELC area).

Actions:

1. Tree planting on west side of Maple Street, if possible funded through DTE.
2. Invasive species treatment, across entire GPELC area Forest inventory and ecological classification on the refuge which will be used as reference information to guide reforestation work.
3. Conduct a community needs assessment to inform what local community wants to see from restoration and how they would use the area. This information will guide development of social restoration goals.
4. Hire a landscape architect or partner with landscape architecture program at a local University to design area east of Maple Street informed by the community needs assessment as an area that will be inviting to the general public.
5. Build new trails on Germania.
6. Remove existing asphalt golf cart trails.
7. Demolition and removal of existing buildings.
8. Connect new trails to existing trails at the rest of GPELC.
9. Other habitat work and contingency.

Alternative 4 – Maximize Native Prairie Planting (focus on establishment of native prairie on the Germania tract for grassland dependent species by providing a large block of native prairie, public use focuses on establishing a trail system on the Germania tract that would connect to existing trails on Greenpoint tract creating a new linked trail system for the GPELC area)

Actions:

1. Plant native prairie plants across entire Germania golf course
2. Invasive species treatment, across entire GPELC area.
3. Hire a landscape architect or partner with landscape architecture program at a local University to design area east of Maple Street informed by the community needs assessment as an area that will be inviting to the general public
4. Build new trails on Germania
5. Remove existing asphalt golf cart trails.
6. Demolition and removal of existing buildings.
7. Connect new trails to existing trails at the rest of GPELC.
8. Other habitat work and contingency that

Decision Analysis

To analyze the data we used a Simple Multi-attribute Ranking Tool (SMART), also called a consequence table. We created a ranking system for each of the measurable attributes and then assigned a score to each measurable attribute for each alternative. This allowed us to compare alternatives against each other based on their scores (Table 2). We compared the alternatives with both un-weighted and weighted scores (swing weighting) and then conducted a sensitivity analysis to see which measurable attributes were most important in choosing the best alternative.

The highest ranking alternative varied by the weighting system used; alternative 1 (maximize restoration, alternative 2 (maximize public use), and alternative 3 (maximize ecological and social planning prior to restoration) all scored very close together in all three weightings (Table 2). Alternative 4 (maximize native prairie restoration) was the lowest ranking alternative in all three scenarios, and was eliminated from consideration.

Uncertainty

Our group identified several sources of uncertainty during the workshop. For the ecological objectives, the Refuge does not have a comprehensive forest inventory or ecological classification. This reference data is needed to set measurable goals and objectives for the forest restoration and any floodplain restoration that would be conducted, and was clearly identified as a data need from the workshop. There is also uncertainty whether DTE Energy Company will agree to reforest all or a portion of the restoration site. There is an existing agreement to plant 200 acres somewhere on the Refuge, but it is unclear if DTE will agree to this and if their goal of carbon sequestration credits will match the Refuge's goals.

The group also identified uncertainty in the social objectives, specifically uncertainty associated with what the community preference is for the site. A formal community needs assessment or engaging the local community to discover what they want from the restoration of this area is needed. This community needs assessment would be useful in guiding not only public use infrastructure but potentially vegetative cover that would be more inviting to urban residents.

Discussion

Value of decision structuring

Our group found great value in the structured decision making process. Prior to the workshop our planning team attempted a few in person meetings and conference calls to start planning the restoration. Attending the workshop and being able to spend a week working with our coaches put us at least a year ahead of schedule in the planning process. The products from the workshop will be used to develop the restoration plan and environmental assessment (EA) that are required before the funds can be allocated. The alternatives that we developed will be used for the alternatives sections of the EA along with the analysis we used to evaluate the alternatives.

Further development required

We need to further refine our cost estimates for the different alternatives. Alternatives one, two, and three all had similar rankings; this was due in part to the precision of the cost estimates we used for evaluating the alternatives (e.g., professional judgment was primarily used to estimate costs for all the actions). In addition, we need to further refine and revisit the alternatives that we developed. There were assumptions that went into the current alternatives (e.g., using DTE Energy Company to purchase and plant trees); if the assumptions are not viable then we need to refine them.

Recommendations and Next Steps

The next steps for this project include writing the restoration plan and Environmental Assessment. The group will further refine cost estimates and alternatives. There were two major data gaps identified during the workshop; forest inventory and ecological classification, and a community needs assessment. Both of these will be critical steps needed to further refine alternatives and set realistic and measureable goals and objectives for the project.

Since the NRDA funding available for this project is not associated with a fiscal year we decided that this project should take a phased approach. The first phase consists of design and planning, followed by a phased implementation strategy and then a monitoring and evaluation phase which won't be developed until the restoration design is complete. With a limited budget we will probably not have funds to develop a full monitoring plan of all the actions that will be implemented we will seek additional funds to assist in the development of this monitoring plan.

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Fig. 1. Location of Germania golf course and Greenpoint environmental learning center at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

Fig. 2. Pre-settlement (pre-European) vegetation communities interpreted from the General Land Office survey notes from the 1800's for the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

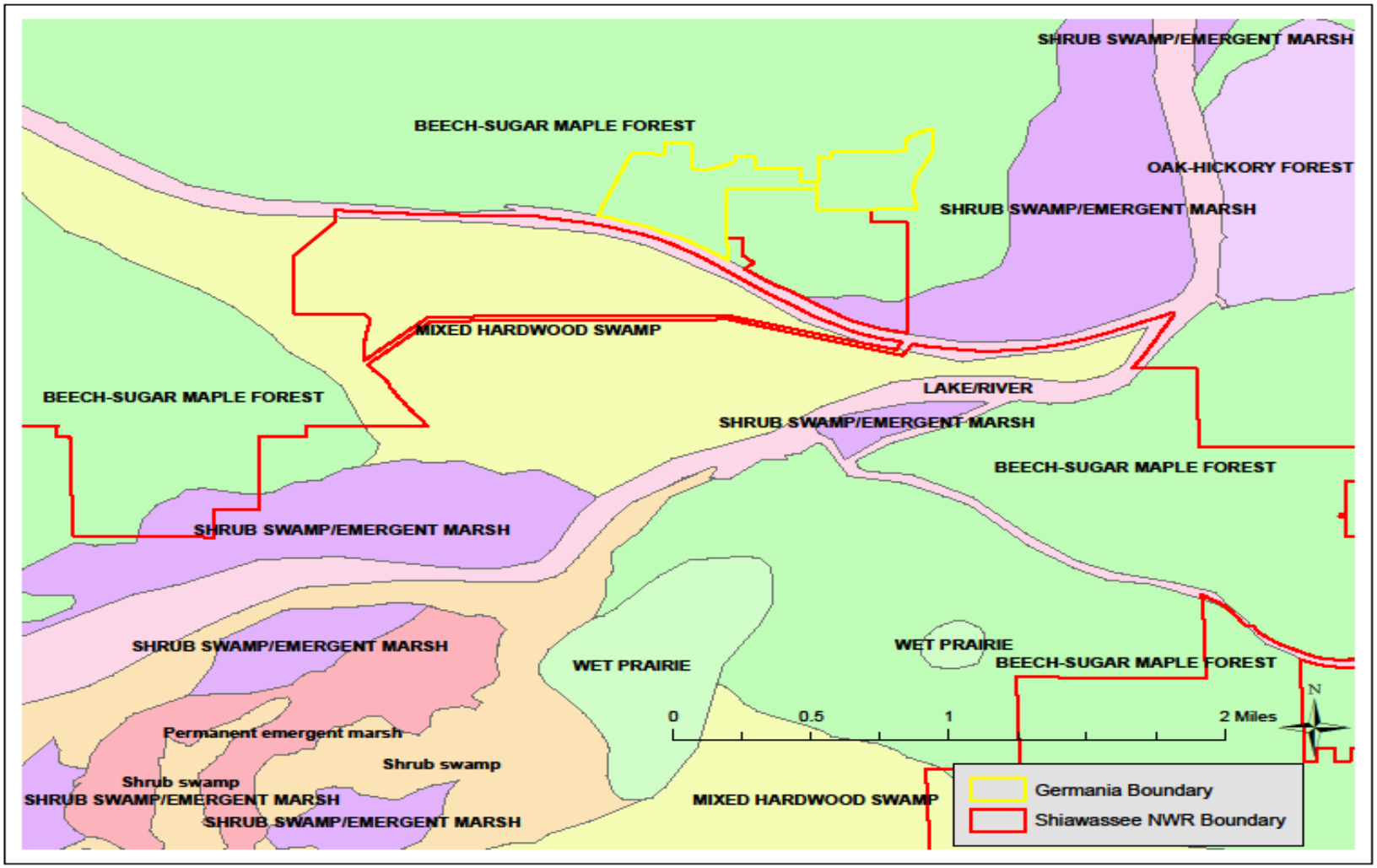

Fig. 3. Historical aerial image (circa 1937, the earliest aerial imagery available for the State of Michigan) of the Greenpoint area including the former Germania golf course (yellow boundary), which shows the forest on the golf course were cleared and converted to agriculture.

Fig. 4. Objectives hierarchy for the ecological and social restoration of the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

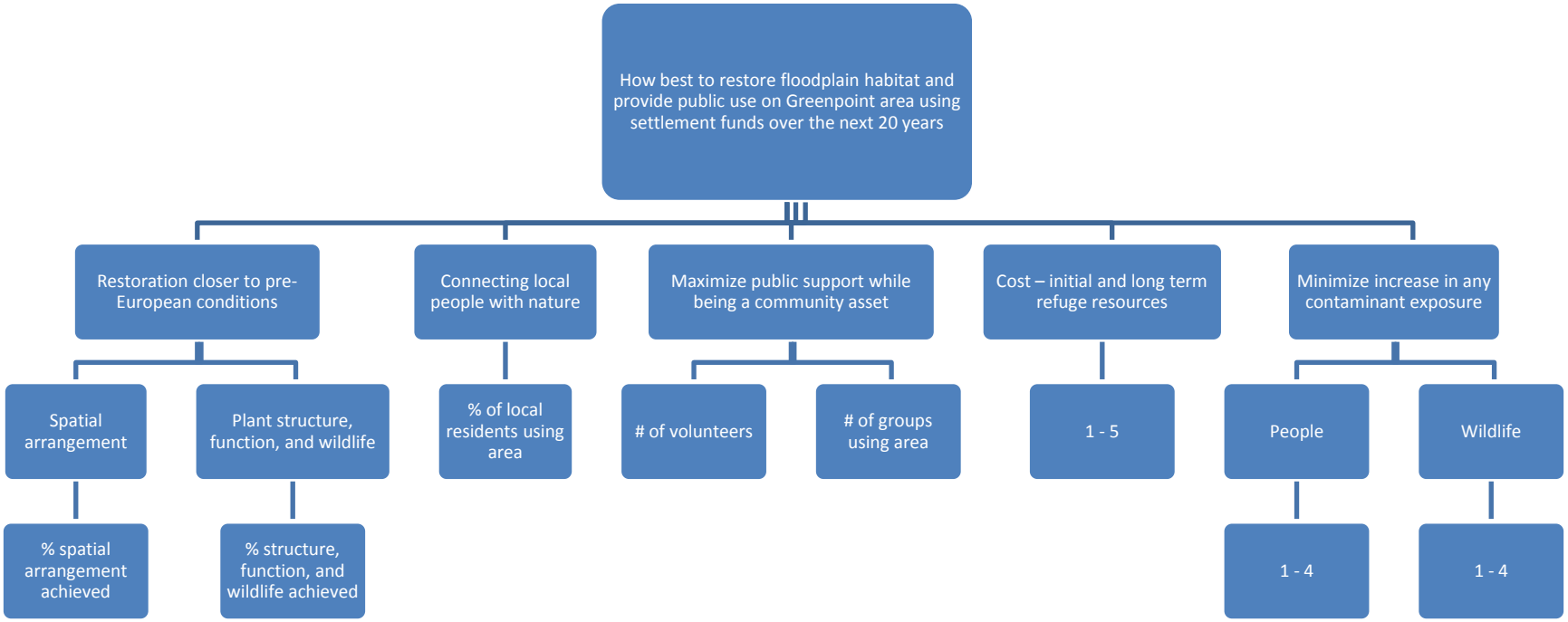

Table 1. Themes and actions used to develop alternatives for the ecological and social restoration of the Greenpoint area at Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

	Themes				
	Reforestation current conditions	Reforestation systems approach	Habitat Diversity	Public Use	Public Use Infrastructure
Actions	Tree planting	Soil testing	Prairie planting	Volunteer programs	Path to school
	Irrigation	Tile breaking	Oxbow reconnection	Interpretation	Loan golf carts
	Invasive species control	Grading	Wild rice restoration	Create city bus stop at Greenpoint	Build observation tower
	Soil testing	Hydrologic analysis	Prescribed grazing	Partner with Saginaw children's zoo	Build fishing pier on “Big Pond”
	Tile breaking	Shoreline softening	Prescribed fire	Public service announcements	Reconfigure trails to connect Germania and Greenpoint
	Herbivory control		Mowing	Hire a marketing firm	Canoe/kayak launch
	Forest inventory and ecological classification			Community needs assessment	Abandon Greenpoint ELC (build new learning center)
	Hire seasonal bio-tech			Staff into community	Build covered shelter
				Enhance youth fishing program	Move Maple and Gabriel roads
				Deer hunt	Archery area
				Loan recreational equipment	Community gardens
				Fish stocking on pond at Germania	Signage/kiosk on and off site
				Status quo	Contaminant test and contingency
					Tittabawassee river fishing pier
					Improve access for public (trail heads)
					Bike rakes

Table 2. Simple multi-attribute ranking tool (consequence table) used to evaluate four alternative actions for the ecological and social restoration of the Greenpoint area, Shiawassee National Wildlife Refuge, Saginaw, MI, USA.

			Alternatives			
Fundamental and Means Objectives	Goal	Measurable Attributes (Units)	Alt 1 Max Restoration	Alt 2 Max Public Use	Alt 3 Max Planning	Alt 4 Maximize Prairie
Closer to pre-European Conditions						
Spatial arrangement	Max	Similarity to pre-European spatial arrangement achieved (%)	85.00	60.00	65.00	50.00
Plant structure and function	Max	Similarity to pre-European structure and function achieved (%)	51.60	43.30	29.00	35.00
Connecting locals to nature	Max	Increased use by local nature novices (% locals using GP area)	5.00	30.00	50.00	20.00
Maximize Public Support						
	Max	Number of volunteers (#)	15.00	20.00	45.00	20.00
	Max	Number of groups using Greenpoint Environmental Learning Center (#)	30.00	37.00	45.00	37.00
Refuge Resources						
	Min	Opportunity cost now (1 - 5)	3.00	3.00	5.00	4.00
	Min	Opportunity cost later (1 - 5)	2.00	3.50	5.00	4.00
Minimize increase in contaminant exposure						
	Max	People exposure (++, +, 0, -; 1-4)	1.00	1.00	1.00	1.00
	Max	Wildlife exposure (++, +, 0, -; 1-4)	1.00	1.00	1.00	1.00
Un-Weighted final score			0.40	0.43	0.21	0.13
Swing weighting score 1			0.51	0.51	0.56	0.28
Swing weighting score 2			0.55	0.51	0.53	0.28

Appendix B: Resource-related References for the Shiawassee National Wildlife Refuge

Link to the Shiawassee NWR Comprehensive Conservation Plan.

- http://www.fws.gov/midwest/planning/shiawasse/index.html

Information Regarding Species Occurrence on the Shiawassee NWR.

Wildlife species known to occur on the Shiawassee NWR:

- http://www.fws.gov/uploadedFiles/refugewildlifeshi.pdf

Shiawassee NWR Bird Checklist:

- http://www.fws.gov/refuge/Shiawassee/wildlife_and_habitat/birding.html

Invertebrates of the Shiawassee NWR:

- http://www.fws.gov/uploadedFiles/refugeinvertebratesshi.pdf

Shiawassee NWR Mussel List:

- http://www.fws.gov/uploadedFiles/Musselsshi.pdf

Shiawassee NWR Plant List:
Flora found on the Shiawassee National Wildlife Refuge is currently available within the appendices of the Refuge's Comprehensive Conservation Plan:

- http://www.fws.gov/midwest/planning/shiawasse/ccp/shiccpappendix.pdf

Species Listed as Threatened or Endangered by the State of Michigan.

Animals listed as threatened, endangered, or extirpated in Michigan:

- http://www.michigan.gov/dnr/0,4570,7-153-10370_12141_12168-32950--,00.html

Plants listed as threatened, endangered, or extirpated in Michigan:

- http://www.michigan.gov/dnr/0,4570,7-153-10370_12141_12168-32951--,00.html