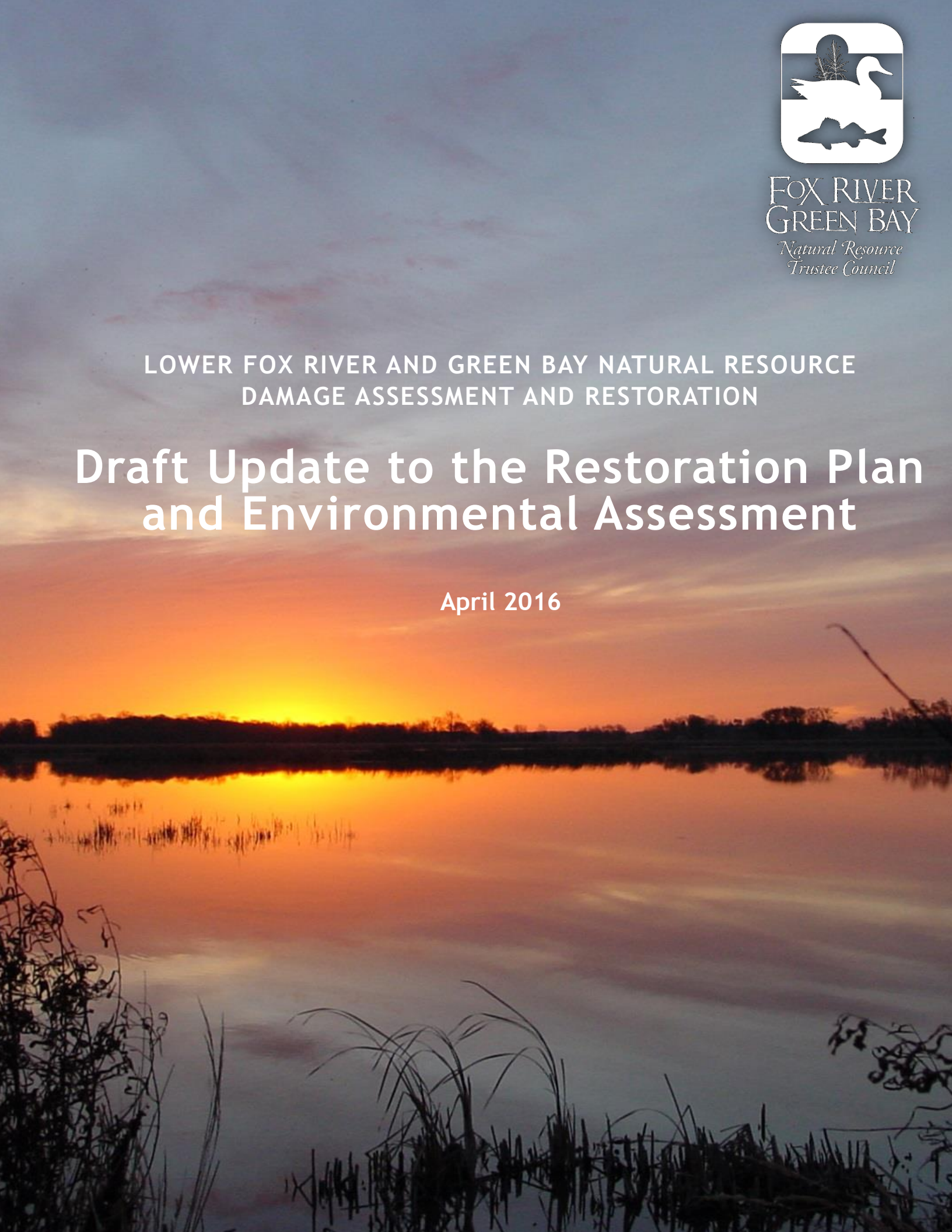

FOX RIVER
GREEN BAY
Natural Resource Trustee Council

LOWER FOX RIVER AND GREEN BAY NATURAL RESOURCE DAMAGE ASSESSMENT AND RESTORATION

Draft Update to the Restoration Plan and Environmental Assessment

April 2016

From top: Dwarf lake iris (FWS); Edge of the Woods (Oneida Tribe of WI); a piping plover (FWS); Little Lake Butte des Morts trail and wetland (FWS)

Cover photo: Rush Lake, a prairie pothole (DU)

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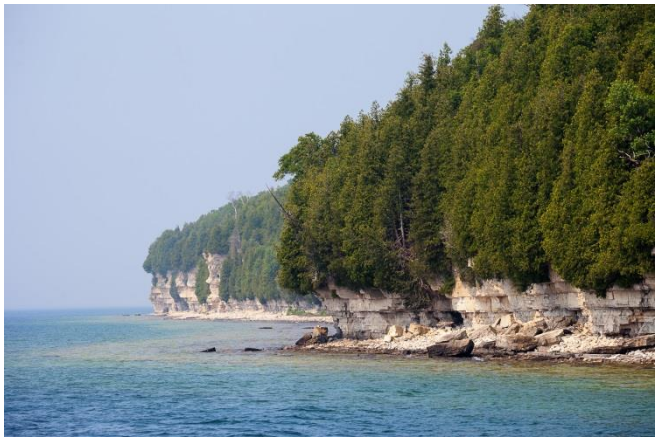
LIST OF ACRONYMS

A/N/R	Aquatic / Nearshore / Riparian Restoration
AOC	(Great Lakes) Area of Concern
AP	Assessment Plan
API	Appleton Paper, Inc.
BIA	Bureau of Indian Affairs
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CZM	Coastal Zone Management
DOI	U.S. Department of Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FCA	Fish Consumption Advisory
FDA	U.S. Food and Drug Administration
FONSI	Finding of No Significant Impact
FWS	Fish and Wildlife Service
GLRI	Great Lakes Restoration Initiative
MDNR	Michigan Department of Natural Resources
MOA	Memorandum of Agreement
NCR	National Cash Register Company
NEPA	National Environmental Policy Act
NHI	(Wisconsin's) Natural Heritage Inventory

NHL	National Historic Landmark
NOAA	National Oceanic and Atmospheric Administration
NPS	National Park Service
NRDA	Natural Resource Damage Assessment
PAS	Preassessment Screen
PCB	Polychlorinated biphenyl
PNNL	Pacific Northwest National Laboratory
POTW	Publicly Owned Treatment Works
PRP	Potentially Responsible Party
RCDP	Restoration Compensation and Determination Plan
RP/EA	Restoration Plan and Environmental Assessment
RPR	Restoration Progress Report
T&E	Threatened and Endangered
TMDL	Total Maximum Daily Load
TVE	Total Value Equivalency
USDA	U.S. Department of Agriculture
WCA	Waterfowl Consumption Advisory
WDNR	Wisconsin Department of Natural Resources
WICCI	Wisconsin Initiative on Climate Change Impacts
WTM	Wisconsin Tissue Mills Company

CHAPTER 1 | INTRODUCTION

The Lower Fox River and its associated watershed in eastern Wisconsin are major contributors of freshwater to Green Bay. Since the 1950s, the Lower Fox River system has been contaminated by the release of polychlorinated biphenyls (PCBs) from paper mills, paper recyclers, public treatment works, and other sources (Exhibit 1-1). Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), certain federal and state government agencies and Indian tribes are authorized to act on behalf of the public to assess and recover natural resource damages, and to plan and implement actions to restore, replace, or acquire the equivalent of resources or resource services injured or lost as a result of a release of a hazardous substance (42 U.S.C §§ 9601-9675 (2016); 43 C.F.R. Pt. 11 (2016)). In order to address the injury from the release of PCBs into the Lower Fox River and Green Bay, the following natural resource trustees formed a Trustee Council: the United States Department of the Interior (DOI), represented by the Fish and Wildlife Service (USFWS) and Bureau of Indian Affairs (BIA); the United States Department of Commerce, represented by the National Oceanic and Atmospheric Administration (NOAA); the State of Wisconsin, represented by the Wisconsin Department of Natural Resources (WDNR); the Oneida Tribe of Indians of Wisconsin; and the Menominee Indian Tribe of Wisconsin (together, Trustees).[1]

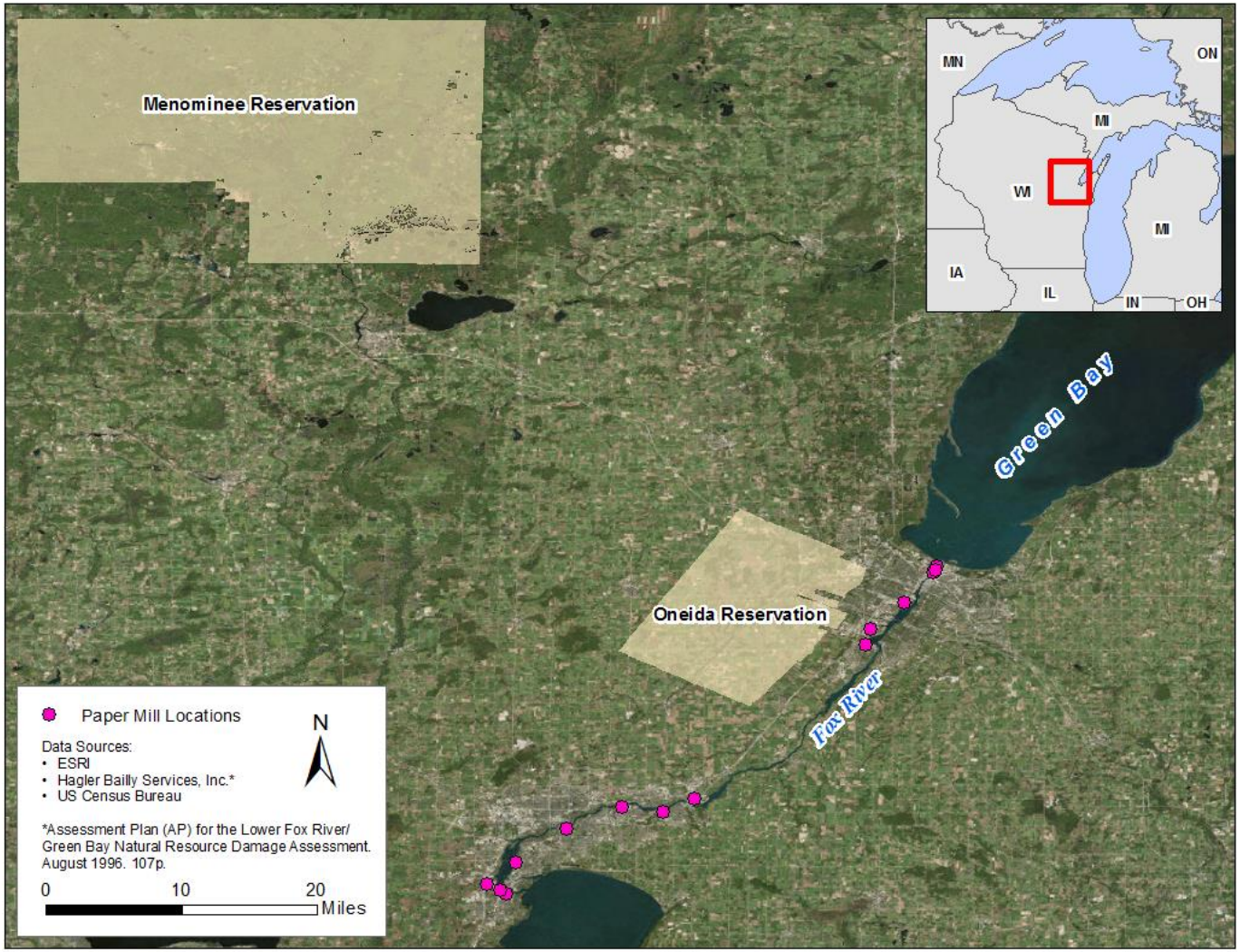


St. Martin Island bluffs (Frykman Gallery)

The Trustees are responsible for: 1) evaluating injuries to natural resources and corresponding losses in ecological and human use services as a result of PCB contamination, and 2) implementing restoration to compensate the public for those losses. The NRDA process exists separately from the site remediation process, which is the purview of the United States Environmental Protection Agency (EPA) and WDNR and involves actions to reduce contamination levels such that human and environmental health risks are minimized. The Trustees and EPA signed a Memorandum of Agreement (MOA) in 1997 to work collectively and cooperatively towards remedial and NRDA goals in the Lower Fox River and Green Bay system. The current Trustee Council was formed through an additional MOA in 2002.

1 The current Fox River Trustee Council was formed in 2002 through a Memorandum of Agreement. The Trustees listed above continue to participate in the Trustee Council. The State of Michigan, represented by the Michigan Department of Environmental Quality and the Michigan Attorney General, participated in the Council from 2002-2009. The FWS is the Federal Lead Administrative Trustee.

EXHIBIT 1-1 HISTORIC PAPER MILLS LOCATED ON THE LOWER FOX RIVER AND GREEN BAY



This chapter describes the purpose of and need for continued NRDA restoration efforts, and outlines the NRDA process and major milestones for the Lower Fox River and Green Bay.

1.1 PURPOSE AND NEED FOR RESTORATION

The environmental contamination from PCBs in the Lower Fox River and Green Bay has spanned several decades and continues to present day. During this time period, the U.S. EPA and Wisconsin Department of Natural Resources have implemented innovative remedial strategies to remove and isolate contaminated sediments, and the Trustees have employed a suite of restoration techniques to address natural resource injuries. The Trustees now benefit from a more informed perspective concerning the success of the remedial strategy, progress in restoration implementation, knowledge of restoration science, and partnerships with other conservation entities. Since initial restoration efforts began in 2002, regional programs with shared objectives have also highlighted ecological restoration and conservation within the Great Lakes. For example, the Great Lakes Restoration Initiative (GLRI), launched in 2010, is a restoration program that utilizes federal funding to accelerate Great Lakes restoration. The GLRI action plan prioritizes cleaning up the Great Lakes Areas of Concern (AOC)[2], which includes the Lower Green Bay and Fox River AOC; preventing and controlling invasive species; reducing nutrient runoff; and restoring habitat to protect native species. Together, the recent NRDA settlement, close of the natural resource damages claim, remedial progress, restoration progress, and regional conservation efforts provide an important opportunity for the Trustees to build on their previous restoration efforts and purposefully plan for future restoration implementation.

To acknowledge the substantial restoration progress made since 2003, and inform future restoration priorities and goals, the Trustees developed this update to the 2003 Restoration Plan and Environmental Assessment (RP/EA) in accordance with 43 C.F.R § 11.93(c) (2016). This report ("RP/EA Update") will be available for public comment for 30 days, at which time the Trustees will incorporate public feedback and publish a final version.

This Update describes the remedial progress, restoration actions initiated or completed, and changes to the conservation landscape to-date. The framework of the Update is guided by the 2003 RP/EA, and attention is paid to the process the Trustees have used to guide restoration actions to-date, the original restoration categories and goals, and the project selection criteria. Based on this information, the Trustees determined that a re-evaluation of the NRDA restoration categories and goals set in the 2003 RP/EA is warranted. The Update evaluates alternative future actions to restore, rehabilitate, replace, and/or acquire the equivalent of (together, restoration) natural resources, resource

[2] Areas of Concern are designated by the United States and Canadian governments as areas that have significant impairment of beneficial uses as a result of human-caused stressors. More information about the Fox River and Green Bay AOC is available at the following link: http://dnr.wi.gov/topic/greatlakes/greenbay.html

services, and cultural uses injured by PCBs released to the Lower Fox River and Green Bay. In addition, Chapter 7 of the Update is a draft environmental assessment (EA) of the proposed restoration alternatives, which allows the Trustees to determine the expected adverse impacts of each restoration alternative on the environment. The Trustees will determine whether to prepare a separate environmental impact statement (EIS) or finding of no significant impact (FONSI) after receiving public comments on this Update.

The following chapters describe progress toward restoration objectives, summarize the current state of environmental and socio-economic conditions within the Lower Fox River and Green Bay, review potential restoration alternatives and corresponding environmental consequences, and define an updated preferred restoration alternative and goals for future restoration.

1.2 NRDA PROCESS TO-DATE

Over the last few decades, there have been a number of milestones relevant to the Fox River NRDA. For example, pursuant to the process for conducting a NRDA, as outlined in 43 C.F.R. Pt. 11 (2016), the USFWS and participating Tribal Governments published a Preassessment Screen and Determination in 1994 (PAS 1994). The PAS determined an assessment should be carried out, given the suite of resources potentially affected by PCB releases to the Lower Fox River and Green Bay and the reasonable probability of making a successful NRDA claim. In 1996, the USFWS, Menominee Indian Tribe of Wisconsin, and Oneida Tribe of Indians of Wisconsin published an Assessment Plan (AP) to describe for the public which natural resources would be addressed due to confirmed exposure to PCBs (AP 1996). Injuries and service losses due to the release of PCBs are described in injury determination reports for various natural resources, developed in accordance with the AP. Data indicate that multiple natural resources have been injured, (Stratus 1999a, 1999b, 1999c, 1999d, 1999f). The nature and extent of natural resource injuries are summarized in the Restoration Compensation and Determination Plan (RCDP 2000). These and additional milestones in the Lower Fox River and Green Bay NRDA are depicted in Exhibit 1-2, including but not limited to:

- Natural resource pathway report (Stratus 1999e).
- Trustee Council Memorandum of Agreement (MOA 2002).
- Initial restoration begins in 2002, as the result of interim settlements with potentially responsible parties (PRPs).
- Restoration Plan and Environmental Assessment (2003 RP/EA).
- Settlements 2001-2015:
    - 2001: Appleton Papers, Inc. and National Cash Register Corporation (NCR)
    - 2002: Fort James Operating Company and Georgia Pacific
    - 2004: Wisconsin Tissue Mills (WTM) and P.H. Glatfelter
    - 2006: Appleton Paper Inc. (API) and NCR Corporation

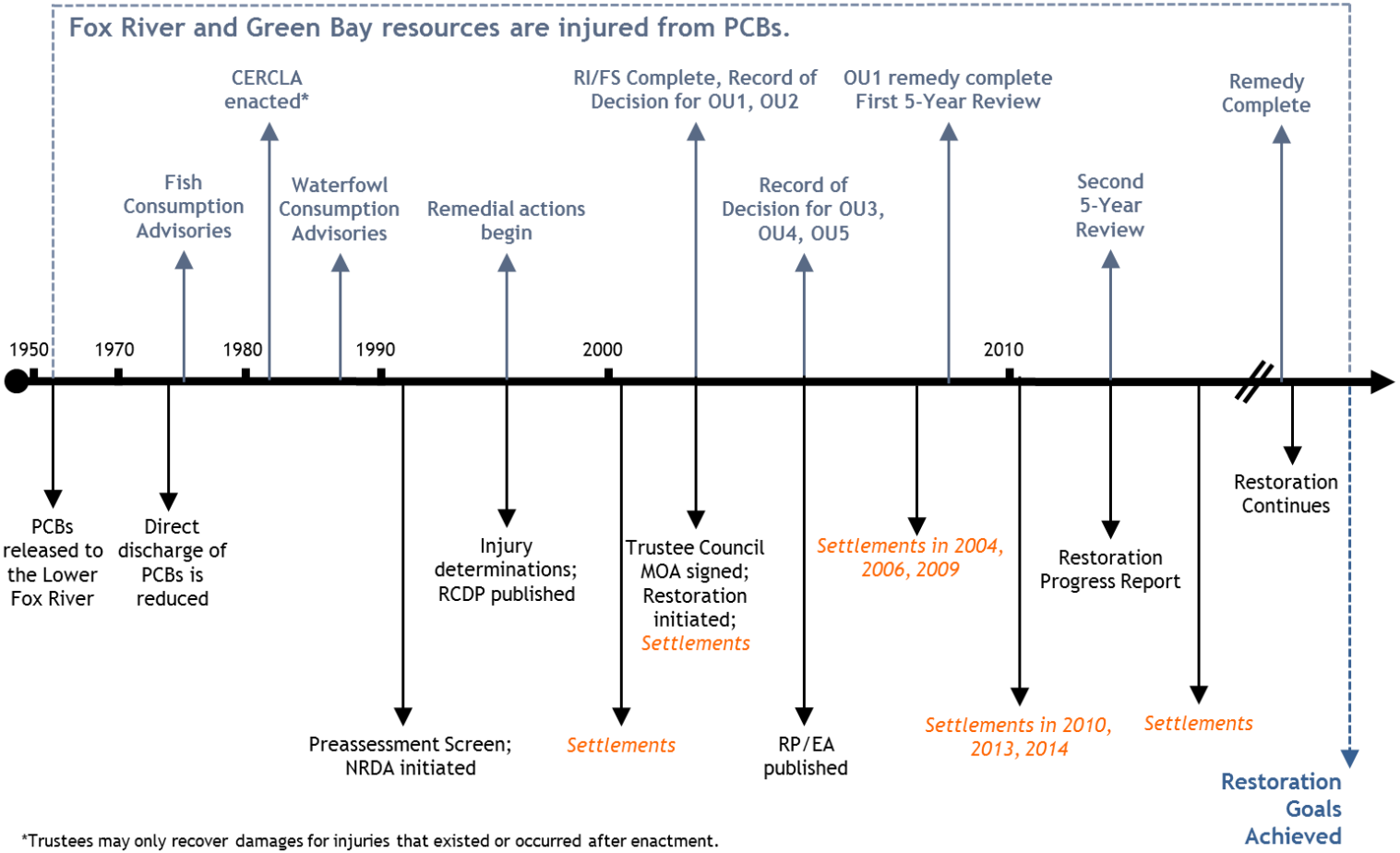
    - 2009: George Whiting Paper Company
    - 2010: 12 *de minimis* parties,
    - 2013: Brown County, the City of Green Bay, and settling federal agencies
    - 2014: Kimberly-Clark Corporation and NewPage Wisconsin System, Inc.
    - 2015: Menasha Corp., Wisconsin Tissue Mills Company (WTM I), U.S. Paper Mills Corporation, the City of Appleton, the Neenah-Menasha Sewerage Commission, and the State of Wisconsin.
- Restoration Progress Report (RPR 2013).
- Withdrawal of claim for natural resource damages (2015).

Once natural resource injuries resulting from PCB releases into Lower Fox River and Green Bay were assessed, the restoration planning phase of the NRDA began. The Trustees developed a Restoration and Compensation Determination Plan (RCDP), which was followed by a Restoration Plan/Environmental Assessment a few years later. Together, these documents quantify injury, describe restoration priorities, present the scale of required restoration, and select, among alternatives, a restoration option, "Alternative C: Natural Resource-Based Restoration Within and Beyond the Assessment Area." The public was integral to this process, contributing at various stages from the Assessment Plan to the development of the 2003 RP/EA and selection of the restoration alternative. The public process has been central to development and implementation of restoration actions that compensate for the natural resource losses in the Lower Fox River and Green Bay.

The Trustees and their partners have implemented restoration projects consistent with Alternative C as described in the 2003 RP/EA. Trustee responsibilities include scoping, approving, implementing, and monitoring projects to meet the restoration goals. The restoration categories and goals set forth in the 2003 RP/EA have guided restoration decision-making, and the Restoration Progress Report (RPR 2013) summarizes the status of the 68 restoration projects initiated by the Trustees from 2002 to June 2012.

Together, Trustee settlements with potentially responsible parties provide necessary compensation for natural resource injuries in the Lower Fox River and Green Bay. Over the course of the NRDA process, the Trustees have recovered $106 million (2016 dollar value). A recent settlement recovered $41 million, which will be spent on future NRD restoration and related activities.

EXHIBIT 1-2 TIMELINE OF MILESTONES RELATED TO THE LOWER FOX RIVER AND GREEN BAY NRDA



*Trustees may only recover damages for injuries that existed or occurred after enactment.

1.3 PUBLIC PARTICIPATION

Public participation and review is an integral part of the restoration planning process. The Trustees have coordinated with the public throughout this NRDA and will continue to encourage active public participation. The Trustees have made this Update available for review and comment for a period of 30 days in accordance with 43 CFR § 11.32(c)(1). The Trustees will address public comments and will document responses to those comments as part of the final Update for the Lower Fox River and Green Bay NRDA.

Comments must be submitted in writing to:

Betsy M. Galbraith
Fox River / Green Bay Natural Resource Trustee Council Coordinator
2661 Scott Tower Drive
New Franken, WI 54228

FoxRiverRPcomment@FWS.GOV

A copy of this document is available for review online at the following websites:

www.foxrivernrda.org

www.fws.gov/midwest/es/ec/nrda/foxrivernrda/

Interested parties can obtain a hard copy of this Update from the Trustees by submitting a written request to the following email or physical addresses:

Betsy M. Galbraith
Fox River / Green Bay Natural Resource Trustee Council Coordinator
2661 Scott Tower Drive
New Franken, WI 54228

FoxRiverRPcomment@FWS.GOV

As restoration progresses, the Trustees may amend this Update and will subsequently notify the public. These amendments, if any, will be made publicly available. In the event of a significant modification to the Update, the Trustees will provide the public with an opportunity to comment on that particular amendment.

1.4 ADMINISTRATIVE RECORD

An administrative record, that is, a catalog of all documents Trustees used to develop and make decisions related to NRDA, including this Update, is maintained by The U.S. Fish and Wildlife Green Bay Field Office, and is available at 2661 Scott Tower Drive, New Franken, Wisconsin.

CHAPTER 2 | CONTAMINATION AND RESTORATION OF THE LOWER FOX RIVER AND GREEN BAY THROUGH 2014

One goal of NRDA is to compensate for natural resource injuries accrued over time (i.e., interim losses) by preserving or restoring habitats so that additional natural resource services are provided in the future. These additional services should be closely linked to the resource services lost due to contamination. To provide context for understanding the restoration progress made to-date, this chapter summarizes the following:

- Contaminant releases and subsequent natural resource injuries in the Lower Fox River and Green Bay,
- The development of an initial damage claim by the Trustees,
- The status of remedial activities at the Lower Fox River and Green Bay Superfund Site,
- The selected restoration alternative from the 2003 Restoration Plan (2003 RP/EA), and
- The Trustee process for evaluating potential restoration projects under the 2003 selected alternative.

2.1 PCBS IN THE LOWER FOX RIVER AND GREEN BAY

This section describes contaminant releases and the pathways that continue to expose natural resources in the Lower Fox River and Green Bay to PCBs derived from paper companies and associated handlers of paper byproducts along the Fox River. It then summarizes resulting natural resource injuries, and describes the process for determining an initial damage claim.

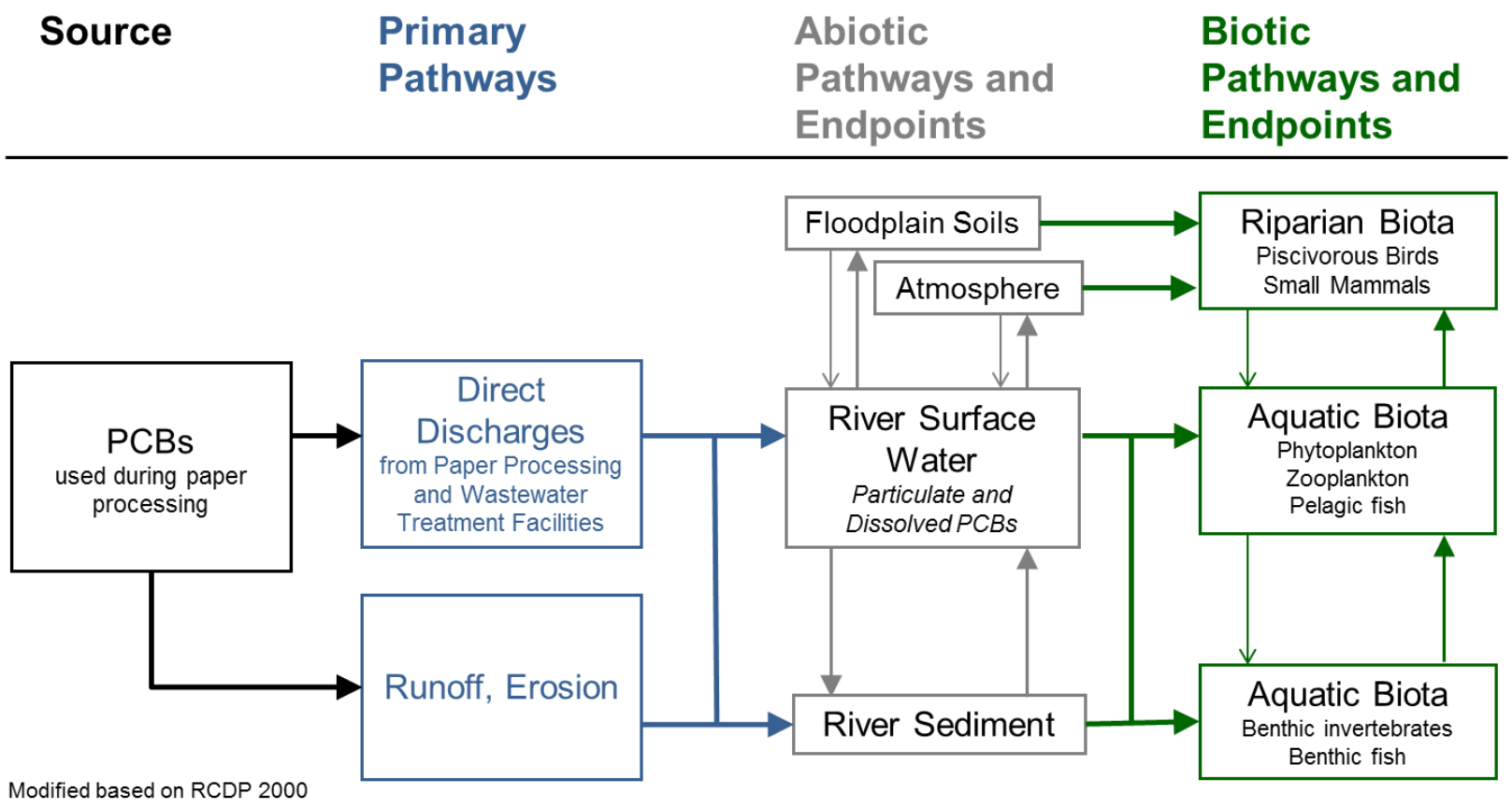
2.1.1 CONTAMINANT RELEASES

Release of PCBs to the Lower Fox River ecosystem began in 1954 when paper companies and waste treatment facilities disposed of waste water containing the contaminant into the Fox River (Exhibit 2-1). PCBs are a class of synthetic hydrocarbon chemicals, with properties such as chemical stability, heat resistance, and electrical insulation that made them useful in a variety of industrial and commercial applications (e.g., PCBs were widely used within electrical equipment and carbonless copy paper). Commercial production of carbonless copy paper, also called NCR paper, involved coating the paper with a solution containing PCBs in the form of a commercial mixture known as Aroclor 1242 (RCDP 2000). This process resulted in the release of PCBs into the environment (Stratus 1999e). Waste water from the coating process was discharged to the City of Appleton sewage system and from there into the Lower Fox River. The coated paper was sent to secondary fiber mills, such as Fort James Green Bay West Mill (formerly Fort Howard), P.H. Glatfelter, and Wisconsin Tissue Mills, where paper

trimmings and post-consumer papers containing the carbonless copy paper – and therefore traceable amounts of PCBs – were processed (Stratus 1999e). Secondary mills stripped carbonless copy paper trimmings of the PCB coating before recycling the pulp. The Neenah-Menasha publicly-owned treatment works (POTW) received and discharged waste water containing PCBs from the secondary fiber mills. The P.H. Glatfelter Arrowhead Park landfill received carbonless copy paper from secondary fiber mills and subsequently released PCBs to the Lower Fox River system. These contaminated wastewater and landfill releases directly exposed the surface water and sediment of the Fox River to PCBs, and indirectly exposed air and geologic resources (e.g., floodplain soils) in contact with contaminated runoff and surface water. Wildlife that used the river and its habitats were in the past and continue to be exposed through ingestion of PCB-contaminated water, sediment, and prey; and the physical and chemical characteristics of PCBs allow them to be taken up by biota and subsequently magnified through the food web. Those same characteristics cause PCBs to resist degradation and remain for decades in aquatic systems. General pathways of PCBs through the environment from initial release to natural resource exposure are shown in Exhibit 2-1 and further described in Stratus (1999e). These pathways continue to expose natural resources.

The majority of PCB releases to the Lower Fox River are likely to have coincided with the peak production years of carbonless copy paper from 1965 to 1970, though releases continued to occur after 1971, when PCBs ceased to be used in the production of carbonless copy paper (Stratus 1999e). Contamination spread from point sources along the Lower Fox River to Green Bay. WDNR estimated that approximately 300,000 kg of PCBs were released to the Lower Fox River from the mid-1950s through 1997. WDNR calculated that between 39,400-47,300 kg of PCBs remained in bed sediments throughout the Lower Fox River in 1999, which is approximately 13-16 percent of the total PCBs released to the system (RCDP 2000 and sources within). The Lower Fox River is the prevailing source of PCBs to Green Bay (RCDP 2000). In the past, dredging within the Fox River may have re-suspended some portion of PCBs bound to sediments, which increases the exposure of wildlife using the Fox River as a source of habitat and food as well as the load of PCBs to Green Bay. To-date, removal of PCB-contaminated sediment is ongoing as part of remedial actions within the Fox River. Sediment removal in Green Bay is not anticipated as part of remediation due to the associated scale and cost. Any PCBs not removed from the system are predicted to eventually attenuate, although this is expected to take decades and natural resources will continue to be exposed to and potentially injured by PCBs until attenuation to baseline conditions is complete.

EXHIBIT 2-1 PATHWAY OF PCBS FROM PAPER MILLS TO THE LOWER FOX RIVER AND GREEN BAY



Modified based on RCDP 2000

2.1.2 INJURY ASSESSMENT

The Trustees determined and quantified injury to natural resources, in accordance with the DOI NRDA regulations, in the Lower Fox River and Green Bay system. As described in the AP, the assessment area incorporates the 39 miles of the Lower Fox River, adjacent floodplain and ecologically connected uplands, all of Green Bay and adjacent coastal wetlands (including areas adjacent to Lake Michigan), and associated tributaries upstream to the first impoundment.

Within the assessment area, resources have been injured due to PCB exposure, and, as noted above, act as pathways of PCBs to other resources (Exhibit 2-1). Surface water resources, including sediments, have been and continue to be injured along the Fox River from Little Lake Butte Des Morts to Green Bay due to PCB concentrations in exceedance of water quality criteria and sediment quality values (RCDP 2000, EPA 2014). Data indicate that phytoplankton have been exposed to PCBs in surface water, and benthic invertebrates have been exposed to PCBs in sediments (Stratus 1999d). Surface water resources also present a pathway for exposure, uptake, and concentration of PCBs in both forage and predator fish (i.e., fish that consume plankton and benthic invertebrates), and in turn piscivorous (i.e., fish-eating) and predatory birds and mammals (Stratus 1999e). Site-specific studies reported elevated concentrations of PCBs at all levels of the food web for 45 fish species and 25 bird species from the Green Bay system, with higher concentrations in predatory species due to biomagnification[3] in upper trophic levels (RCDP 2000). Pathological injuries to walleye (*Sander vitreus*), including increased liver tumors relative to reference data, were specifically documented, in addition to adverse changes in fish viability (Stratus 1999a, 1999c). Avian injuries occurred in the form of physiological malfunctions, such as reduced reproductive success, as well as physical deformities such as misshapen beaks (Stratus 1999b). These injuries reduced the ecological services that the resources would have provided but for PCB contamination (Exhibit 2-2).

In addition, the Trustees determined injury to fish and avian resources due to the existence of fish and waterfowl consumption advisories throughout the Lower Fox River and Green Bay, which continue to the present day for several commercial and recreational fish species (Stratus 1999c; WDNR 2015a; WDNR 2015b; 43 C.F.R. § 11.62(f)(1)(iii) (2016)). Depending on the specific location there are "Do Not Eat" fish advisories for multiple fish species (WDNR 2015b). Additionally, wildlife consumption advisories recommend limiting the number of meals consumed, and that waterfowl hunters remove the skin and visible fat, as well as discard drippings (WDNR 2015a). Wildlife advisories are targeted to mallards harvested from (1) an upstream segment of the Lower Fox River from Lake Winnebago to Kaukauna, or (2) the De Pere Dam to the mouth of the Fox River at Green Bay, and lower Green Bay south of a line from Point Sable to the western shore of Green Bay (WDNR 2015b). These advisories are largely

[3] Biomagnification is defined as "the concentration of toxins in an organism as a result of its ingesting other plants or animals in which the toxins are more widely dispersed" (Oxford dictionaries).

driven by PCB contamination and have caused a loss in human use and cultural services. For example, anglers have experienced losses related to lower quality fishing trips taken to Green Bay, trips taken to a substitute location, and/or resulting from forgoing fishing trips completely due to the consumption advisories (Exhibit 2-2).

2.1.3 INITIAL DAMAGE CLAIM

Once the Trustees determined injury to natural resources in the Lower Fox River and Green Bay had occurred, they developed an initial damage claim. This claim, presented in the RCDP, was developed based on both the public's willingness to pay for the restoration necessary to restore the Lower Fox River and Green Bay, and a study that separately quantified recreational fishing losses (RCDP 2000). Ecological damages were quantified using a total value equivalency (TVE) study that investigated the public's restoration preferences and willingness to pay for different types of restoration. A study consisted of a survey posed to citizens in ten local Wisconsin counties, and responses were used to derive random utility models that determined how much of one type of restoration was equivalent in value to other types of restoration. The Trustees determined that several types of restoration were necessary to equal the scale of injury. A mix of restoration projects, including wetland restoration, park enhancements, and runoff control measures, was used to determine ranges of restoration parameters (e.g., number of wetland acres to restore, additional inches of water clarity) that could compensate for injury. These mixes of restoration projects also varied based on the planned intensity of remedial activities (e.g., intensive remediation over 20 years versus intermediate restoration over 40 years) to account for the fact that EPA had not yet selected the remedy. The results of the restoration scaling exercise were then monetized to develop an initial damage claim for ecological losses ranging from $111 and $268 million (2000 dollar value)[4], depending on the efficiency at which the remedial scenario returned the Lower Fox River to baseline conditions. To avoid double counting, damages to recreational fishing were estimated separately at $65 million (2000 dollar value).[5]

[4] The ecological damage claim is equivalent to $153-$369 million in 2016 dollars.

[5] The recreational fishing damage claim is equivalent to $89 million in 2016 dollars.

EXHIBIT 2-2 NATURAL RESOURCE INJURIES (ADAPTED FROM RCDP 2000)

LOCATION	HABITAT	SURFACE WATER RESOURCES (Including Sediment)	FISHERY RESOURCES		AVIAN RESOURCES		
			FORAGE FISH	GAME FISH	PISCIVOROUS BIRDS	OMNIVOROUS BIRDS	WATER-FOWL
Lower Fox River	Aquatic habitat	Water quality criteria/ standard exceedances	FCAs, exceedence of FDA tolerance level[d]	Walleye tumors, FCAs, exceedence of FDA tolerance level	--	--	WCAs[f], exceedance of FDA tolerance level
	Shoreline habitat	--[c]	--	--	--	Bald eagle reproduction reduced[e]	--
Inner and outer Green Bay	Aquatic habitat (near shore and open water)	Water quality criteria/ standard exceedances	FCAs, exceedence of FDA tolerance level	Walleye tumors, FCAs, exceedence of FDA tolerance level	--	--	WCAs, exceedence of FDA tolerance level
	Shoreline habitat	--	--	--	Forster's tern reproduction reduced, deformities increased; common tern and cormorant reproduction reduced[e]	Bald eagle reproduction reduced[e]	--
Other aquatic habitats	Green Bay tributaries [a]	--	FCAs	FCAs	--	--	--
	Little and Big Bays de Noc	--	FCAs	FCAs	--	--	--
	Lake Michigan[b]	--	FCAs	FCAs	--	--	--

Notes.

This table was adapted from RCDP Table 2.5, "Summary of natural resource injuries." Injuries were determined as outlined in the DOI NRDA regulations. This table does not summarize documents published since 2000.

[a] Includes Duck Creek, Oconto River, Peshtigo River, Menominee River, Cedar River, and other tributaries.

[b] Includes Lake Michigan north of Frankfurt, Michigan and Wisconsin waters of Lake Michigan and its tributaries up to the first dam, including the Root River, Milwaukee River, Sheboygan River, Manitowoc River, and Kewaunee River.

[c] The symbol "--" indicates the field is not applicable and/or data do not exist.

[d] FCA (Fish Consumption Advisory), FDA (Food and Drug Administration)

[e] Studies documented reduced reproductive rates and/or reduced hatching success in Forster's terns, common terns, cormorants, and bald eagles.

[f] WCA (Waterfowl Consumption Advisory)

2.1.4 REMEDIAL UPDATE

Since the Trustees developed their initial damage claim[6] (RCDP 2000), the EPA and WDNR released a proposed plan for remediation that involves extensive removal of PCB-contaminated sediments within the Fox River, one of the largest sediment cleanup projects conducted by the EPA (WDNR and EPA 2001). In 2007, the EPA issued a Unilateral Administrative Order to eight companies to complete river cleanup actions (EPA 2007). Remedial actions are currently ongoing and involve a combination of dredging and disposal of PCB-contaminated sediments, installation of sediment caps, and monitored natural recovery. The most recent Five-Year Review (2014) stated that the remedy is not yet protective of human and environmental health based on PCB concentrations in surface waters and fishery resources (EPA 2014). The majority of the Fox River sediment removal is expected to be complete within 2-3 years, but remediation will not be entirely complete until monitoring demonstrates that levels of PCBs in environmental resources are below the actionable limits set by EPA (EPA 2014; WDNR 2014a).

The remedy has successfully removed or isolated PCBs in the Lower Fox River, most of which are bound to sediments. While this will eliminate a large mass of PCBs from the system, it will likely take decades for natural resources to fully attenuate and return to baseline conditions given the recycling of PCBs in the system (e.g., through cycling within the food web). Therefore, remedial actions include long-term monitoring to assess natural progress in PCB attenuation after removal actions are completed. This time frame implies that continued restoration will be necessary to account for continued natural resource injuries. To the extent that surface waters, sediments, and biological resources remain injured, and fish and waterfowl consumption advisories remain in effect, the Trustees will use this information to highlight restoration objectives and set priorities to improve water quality, fisheries, and wildlife and compensate for continuing natural resource injuries.

2.2 2003 RP/EA AND RESTORATION PROCESS

To strategically plan for restoration in the Lower Fox River and Green Bay, the Trustees released a Joint Restoration Plan and Environmental Assessment in 2003. The 2003 RP/EA considers actions that will restore natural resources and resource services injured by the release of PCBs in the Lower Fox River. The 2003 RP/EA selected a restoration alternative that described the geographic scope of restoration and restoration categories and goals. This information and project selection criteria are described in more detail below.

2.2.1 2003 RP/EA SELECTED RESTORATION ALTERNATIVE

[6] The Trustees relied upon the Green Bay Mass Balance Study as well as the NRDA pathway investigation (Stratus 1999e) to evaluate remedial scenarios before the proposed plan and Records of Decision (RODs) were developed.

The restoration alternative selected in the 2003 RP/EA, "Natural Resource-Based Restoration Within and Beyond the Assessment Area," focuses on preservation and restoration of natural resources in wetland habitat as well as upland habitat associated with wetlands within and around the Lower Fox River and Green Bay (Exhibit 2-3). Originally introduced in the RCDP, the selected alternative was informed by responses to a public survey conducted during the injury assessment phase (RCDP 2000). The survey identified strong public preferences for natural resource restoration.[7] The restoration preferences documented in those public surveys, along with Trustee priorities, resource management goals, and feedback received during project scoping and public comment periods, led to the development of the 2003 RP/EA selected restoration alternative. The 2003 RP/EA includes an assessment of the environmental and socio-economic impacts of restoration alternatives, in accordance with the National Environmental Policy Act (NEPA), to ensure projects do not significantly adversely affect the quality of the human environment. Additionally, the selected alternative is consistent with the ten factors listed in the DOI NRDA regulations that Trustees considered at the beginning of the restoration planning phase (43 C.F.R § 11.82(d) (2016)). These factors include:

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

2.2.2 GEOGRAPHIC SCOPE OF RESTORATION

As described in the 2003 RP/EA, the selected alternative addresses ecological losses through enhancements to natural resources and resource services in both the PCB-affected environment and surrounding watersheds (Exhibit 2-3). This alternative provides greater benefits to Lower Fox River and Green Bay than other considered alternatives by expanding the geographic scope of restoration to encompass areas that contribute to the ecological health of the ecosystem, and increases the likelihood of achieving initial restoration goals. The expanded geographic area acknowledges the potential limitations

[7] Based on responses from residents of ten local Wisconsin counties surrounding the Fox River and Green Bay.

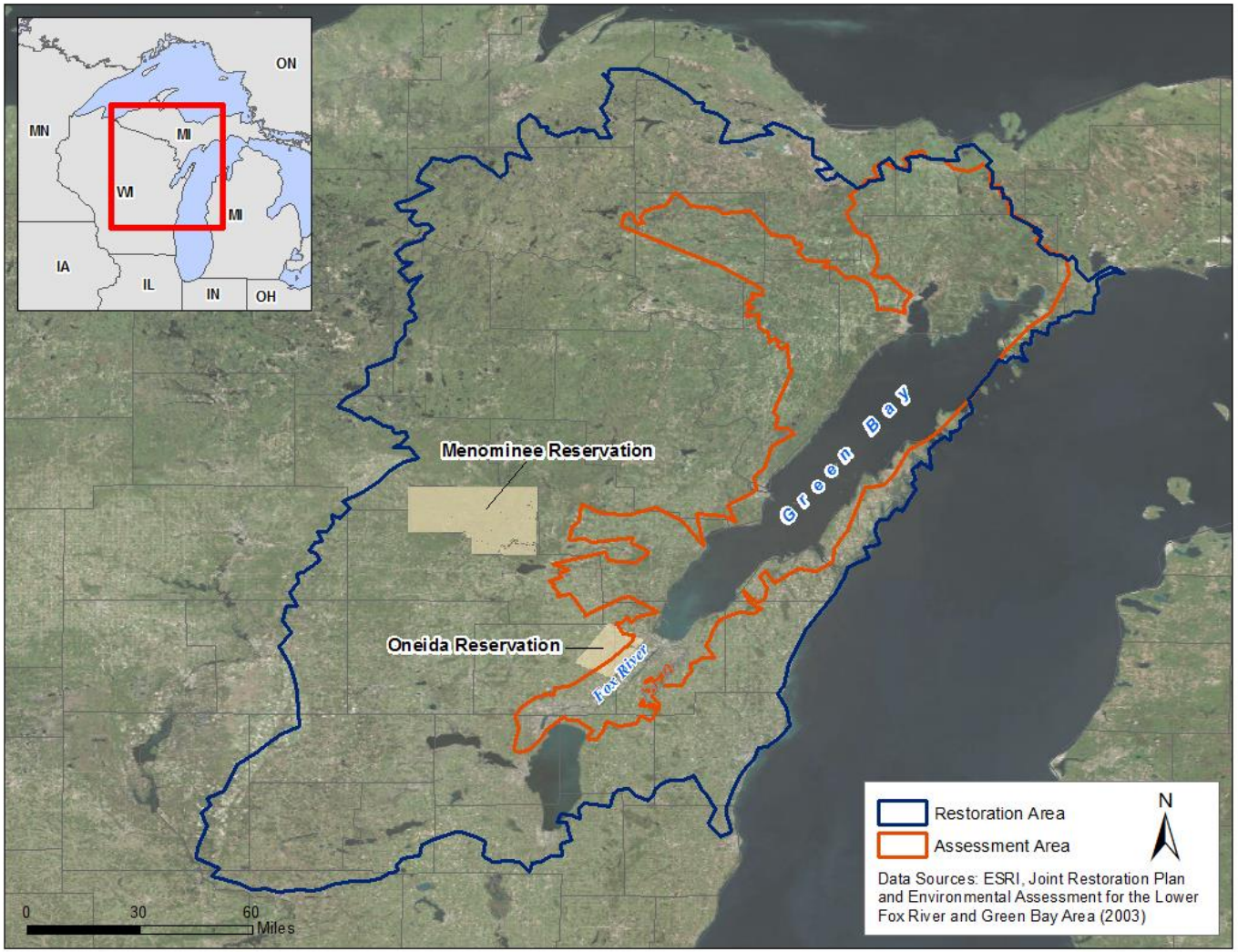
on the number of acres available for preservation and/or restoration within the designated assessment area. Additionally, the expanded geographic focus allowed for increased upstream benefits, which could lead to greater restoration gains downstream in the Lower Fox River and Green Bay. The 2003 RP/EA clearly delineates the geographic priorities identified at that time, in the following order:

- The 39 miles of the Lower Fox River, adjacent floodplain, and ecologically associated uplands;
- Green Bay and adjacent coastal wetlands;
- Tributaries to the Lower Fox River and Green Bay to the headwaters, including adjacent floodplains and ecologically associated uplands; and
- Watersheds adjacent to the referenced river systems.

This preference for broad-scale conservation within northeastern Wisconsin set the stage for cooperative efforts between Trustees and other public partners (see Appendix A). Partnerships have enhanced the NRDA process by providing additional conservation perspectives, expanding the diversity of technical restoration expertise, and leveraging funds and cost sharing, all of which contribute to successful restoration in the Lower Fox River and Green Bay.

Little Lake Door County Land Trust

EXHIBIT 2-3 THE ASSESSMENT AND RESTORATION AREAS WITHIN THE LOWER FOX RIVER AND GREEN BAY SYSTEM



2.2.3 RESTORATION CATEGORIES AND GOALS

Within this geographic scope, the 2003 RP/EA defines restoration categories and associated goals that together satisfy the objective of the selected restoration alternative, while still considering public preferences for certain types of restoration. Both the categories and goals ensure that the benefits expected from restoration have a nexus to the PCB-related injuries in the Lower Fox River and Green Bay, and that the Trustees achieve a balanced mix of restoration actions. The restoration categories in the 2003 RP/EA include:

- Wetland and associated upland habitat preservation;
- Wetland and associated upland habitat reestablishment or enhancement
- Aquatic, nearshore, and riparian habitat quality improvements (A/N/R);
- Fishery resource enhancements; and
- Natural resource-based public use enhancements.

The Trustees developed a single restoration goal for each category to measure each restoration project in terms of the gain in ecological or human use services achieved. For example, progress in three categories (wetland/upland preservation; wetland/upland restoration; and aquatic, nearshore, and riparian habitat improvement) is measured as the number of acres of habitat improvements gained through implementation of projects that falls within those categories.[8] Progress in the fishery resource restoration category is measured using a more qualitative goal, while progress in the public use enhancements category is achieved by utilizing a certain percentage of settlement funds (Exhibit 2-4). The restoration categories and goals act as a touchstone to the original injury determination, as the Trustees considered the resources injured by PCB contamination when defining categories and setting restoration objectives. The restoration goals assist the Trustees in achieving a balanced mix of restoration techniques that compensate for PCB-related losses in the Lower Fox River and Green Bay.

The restoration categories allow for multiple types of restoration, giving the Trustees flexibility in identifying specific projects that will help achieve restoration goals. In addition, the combination of restoration categories with the expanded geographic scope increases the probability that, together, restoration projects will act synergistically to restore the resources and resource services provided by the Lower Fox River and Green Bay. For example, a wetland project focused on benefitting fishery resources (e.g., providing higher quality spawning and nursery habitat) may also benefit migratory birds and other wildlife. Likewise, upland habitat preservation may lead to improvements in local water quality while indirectly improving water quality further downstream for cultural resources such as wild rice and cold water fisheries.

EXHIBIT 2-4 RESTORATION CATEGORIES AND GOALS IN THE RCDP (2000) AND 2003 RP/EA

[8] Each project is assigned to a single restoration category to avoid double counting.

2000 RESTORATION CATEGORY (RCDP 2000)	2003 RESTORATION CATEGORY (RP/EA 2003)	RESTORATION GOALS (RP/EA 2003)	EXPECTED RESTORATION BENEFITS (RP/EA 2003)
Wetland preservation	Wetland/upland habitat preservation	9,900 acres preserved	Preservation of wetlands and associated uplands to benefit fish, waterfowl, piscivorous birds, and water quality.
Wetland restoration	Wetland/upland habitat restoration	3,300 acres restored	Protect and restore wetlands and associated uplands to benefit fish, waterfowl, piscivorous birds, and water quality.
Water quality improvements (as riparian buffer strips and conservation tillage)	Aquatic, nearshore, riparian habitat improvement	12,000 acres improved	Protect and restore habitat for migratory birds and fish spawning, and improve water quality.
*	Fishery resource enhancement	Self-sustaining fisheries	Enhance fish stocks, leading to self-sustaining and balanced fish populations.
Park facilities improvements	Outdoor public use enhancement	Utilize less than 10 percent of total settlement funds	Improve outdoor recreational facilities.
Note. *Recreational fishing losses are mentioned in terms of the damage claim, but not as a restoration category.			

2.2.4 PROJECT SELECTION CRITERIA

Given the suite of restoration opportunities, range in project costs, and the uncertainty of available funding at that time, the 2003 RP/EA does not outline specific projects that achieve the goals of each restoration category. Rather, the Trustees identified a suite of criteria to apply in addition to the DOI NRDA factors (43 C.F.R. § 11.82(d) (2016)) when evaluating potential restoration projects. The Trustees used these criteria both to prioritize projects based on the expected ecological and human-use benefits and nexus to injured resources, and to ensure selected restoration projects were technically feasible with a reasonable likelihood of success. Project selection criteria were divided into two main groups, acceptability criteria and ranking criteria, which are described in more detail below. Highly ranked projects proceeded for final review and evaluation by the Trustees (RCDP 2000). In general, the Trustees sought to maximize the scope of ecological, social, and cultural benefits gained through restoration actions as well as the time over which project benefits accrue.

- *Acceptability criteria* served as an initial screening process and involved three sub-criteria (RP/EA 2003):

- The project complies with applicable laws, policies, and regulations;
- The project addresses Lower Fox River and Green Bay injured natural resources; and
- The project is technically feasible.

- *Ranking criteria*, originally published in the 2000 RCDP, reflect site-specific Trustee requirements and priorities for NRDA restoration projects. Criteria were grouped in terms of "focus" to evaluate overall project objectives, "implementation" to evaluate the proposed methods, and "benefits" to evaluate the type and amount of benefit expected from a project (RP/EA 2003).
    - Focus criteria include:
        - On-site restoration (within or adjacent to the affected environment), which is preferred to projects further upstream.
        - Addresses restoration of preferred resources, including wetlands, fish communities, specific aquatic habitats, state and federally-rare, threatened or endangered species, and native species.
    - Implementation criteria include:
        - Benefits can be measured for success.
        - Project is cost effective, including planning, implementation, and long-term operation, maintenance, and monitoring.
        - Project uses established, reliable methods/technologies known to have a high probability of success.
        - Project is consistent with tribal, federal or state priorities, policies, missions, goals, and planning.
    - Benefits criteria include:
        - Project provides the greatest scope of ecological, cultural, and economic benefits to the largest area or population.
        - Project provides benefits that are not provided by other restoration projects being implemented/funded or benefits that have insufficient planned funding under other programs.
        - Project aims to achieve environmental equity and environmental justice.
        - Project maximizes the time over which benefits accrue.

For more than a decade, the Trustees have utilized these screening criteria to identify restoration projects that preserve and restore wetlands and associated uplands; improve aquatic, nearshore, and riparian habitats; enhance outdoor recreation; and enhance the abundance and diversity of self-sustaining fishery populations.

2.3 SUMMARY

Natural resources in the Lower Fox River and Green Bay have been injured by releases of PCBs. Injuries are still ongoing, and though remedial progress is evident, the system is not yet fully recovered to its baseline condition. The 2003 RP/EA outlines a comprehensive approach to restoration in the Lower Fox River and Green Bay in the Trustees' selected restoration alternative, "Natural Resource-Based Restoration Within and Beyond the Assessment Area." Under this alternative, restoration project selection has been guided by DOI NRDA factors as well as site-specific criteria identified by the Trustees. The 2003 RP/EA provides a framework for addressing landscape-scale conservation issues within the Lower Fox River and Green Bay system. The geographical scope of restoration was expanded from the RCDP-defined assessment area to include adjacent uplands and watersheds that feed into the Lower Fox River and Green Bay. This preference for broad-scale conservation within northeastern Wisconsin set the stage for cooperative efforts between Trustees and other public partners, which have contributed to successful restoration in the Lower Fox River and Green Bay.

A canoe on the Peshtigo River Trail (WDNR)

CHAPTER 3 | PROGRESS TOWARD RESTORATION GOALS

Together, the members of the Trustee Council work to restore the natural resources of the Lower Fox River and Green Bay area through implementation of the selected restoration alternative. To effectively manage restoration projects, the Trustees established an organizational structure and operating procedures, which include a Trustee Council Coordinator to manage Trustee Council business and a Technical Team to provide subject matter support to the Trustee Council. The Trustees work closely with partners and technical experts to identify and develop projects that meet the parameters of the selected restoration alternative. The Technical Team evaluates potential restoration projects based on criteria identified in the 2003 RP/EA (Section 2.2), and recommends restoration projects that meet the evaluation criteria to the Trustee Council for their consideration. The Trustee Council approves projects for funding and implementation through resolutions signed by each Trustee Council Representative. The Trustees and their restoration partners ensure that NRDA-funded projects meet project-specific goals and timelines.

Trustee Council restoration efforts have been funded by Lower Fox River NRDA settlements for over a decade (Exhibit 3-1). This Chapter summarizes the Trustees' restoration progress[9] within the five restoration categories selected in the 2003 RP/EA (described above in more detail in Exhibit 2-4):

- Wetland/upland habitat preservation.
- Wetland/upland habitat restoration.
- Aquatic, nearshore, riparian habitat improvement.
- Fishery resource enhancement.
- Outdoor public use enhancement.

As the Trustees work to plan future restoration efforts, they will consider the scale, scope, type, and success of restoration that has been accomplished to-date.

[9] Chapter 3 summarizes restoration progress from the initiation of restoration projects in 2002 until December 31, 2014.

EXHIBIT 3-1 FOX RIVER / GREEN BAY NRDA SETTLEMENTS (2001-2015)

YEAR	PARTY	SETTLEMENT AMOUNT *
2001	Appleton Papers, Inc., and National Cash Register Corporation (NCR)	$ 34.3
2002	Fort James Operating Company and Georgia Pacific	$ 16.4
2004	Wisconsin Tissue Mills (WTM) and P.H. Glatfelter Company	$ 4.2
2009	City of De Pere	$ 0.04
2010	12 *de minimis* parties	$ 0.52
2013	Brown County, the City of Green Bay, and federal agency settlers	$ 4.44
2014	Kimberly-Clark Corporation and NewPage Wisconsin Systems, Inc.	$ 0.25
2015	City of Appleton; CBC Coating, Inc.; Menasha Corporation; Neenah-Menasha Sewerage Commission; U.S. Paper Mills Corporation; and WTM I Company [1]	$46
Total NRDA Settlements (2000-2015)		**$106 M**

Notes.

* Settlements are expressed in 2016 dollar value and may include funding set aside for past NRDA assessment costs and future administrative costs.

3.1 RESTORATION PROGRESS

Under the selected alternative identified in the 2003 RP/EA, the Trustees continue to make progress toward each restoration goal. Since 2002, the Trustees have initiated 78 projects, conducted thousands of acres of on-the-ground preservation and restoration, and implemented projects to enhance fishery resources and public use opportunities (RCDP 2000, RP/EA 2003, RPR 2013). Appendix B provides a list of all funded projects through 2014, NRDA funding allocated, and partner contributions.

To-date, the Trustees have allocated approximately $43 million (in 2016 dollars) in NRDA settlement funds for restoration project implementation, focusing on projects consistent with one of the five restoration categories identified in the 2003 RP/EA. In addition to the criteria set forth in Chapter 2, factors that influenced which projects received NRDA funding included the availability of high-quality projects with the closest nexus to PCB-caused injuries in the Lower Fox River and Green Bay, support by project partners and collaborators, ongoing projects that leverage conservation funds, and overall availability of settlement funds. Restoration progress to-date has been measured in metrics of acres of preserved and/or restored habitat, as well as the amount of funding

dedicated to fisheries and public use enhancements. For example, through 2014, the Trustees had:

- Preserved 6,085 acres of wetland and upland habitat,
- Restored 3,961 acres of wetland and upland habitat,
- Improved 1,747 acres of aquatic, nearshore, and riparian habitat,
- Implemented 11 fishery resource enhancement projects, totaling $8.5 million (in 2016 dollars), and
- Spent approximately five percent of settlement funds on public use enhancements (Exhibit 3-2).

Because of the ongoing nature of restoration efforts, the Trustees elected to compile a report of the first ten years of restoration progress, 2002-2012, in the Restoration Progress Report (RPR 2013). Subsequent to the RPR (2013), the Trustees implemented additional projects, which have also contributed to progress towards restoration goals. For each restoration category, Exhibit 3-2 summarizes initial restoration goals as defined in the 2003 RP/EA, the restoration implemented with settlement funds through 2014, and the corresponding percent of restoration goals achieved. A summary of each restoration category is provided below. Additional details regarding some of the specific restoration projects can be found in the Restoration Progress Report (RPR 2013).

EXHIBIT 3-2 RESTORATION PROGRESS (2002-2014)

RESTORATION CATEGORY	INITIAL RESTORATION GOAL (2003 RP/EA)	RESTORATION ACHIEVED (2002-2014)[1]	PERCENT OF INITIAL GOAL MET (2002-2014)
Wetlands and associated uplands habitat preservation	9,900 acres	6,085 acres	61
Wetlands and associated uplands habitat restoration	3,300 acres	3,961 acres	> 100
Aquatic, nearshore, and riparian habitat quality improvement	12,000 acres	1,747 acres	15
Fishery resource enhancement	Self-sustaining fisheries	$ 8.4 million allocated	On target for completion
Public use enhancement	Spend no more than 10 percent of settlement funds	5.7% of available funds spent	On target for completion

Notes.

[1] These numbers reflect achievements from NRDA settlement funds directed from 2002 through December 2014. Data are from the RPR (2013) and progress reports from the USFWS. Funding was updated to 2016 dollar value.

3.1.1 WETLAND AND ASSOCIATED UPLAND HABITAT PRESERVATION

The Trustees have funded 17 projects[10] that preserve wetland and ecologically-associated upland habitats for a variety of fish and wildlife species, and provide functions similar to those impaired by PCB releases along the Lower Fox River. Habitats have been preserved through land acquisition, land donations and/or transfers, and conservation easements. Where possible, the Trustees have sought to preserve land that is adjacent to protected habitats to increase the benefits of preservation (e.g., maximize the acres of adjacent protected lands to increase connectivity of nesting habitat for a variety of birds). In particular, the Trustees have targeted the Green Bay West Shores Wildlife Area, which contains a substantial amount of wetlands within the Lake Michigan drainage, and the Wolf River Bottomlands and Rush Lake area, which serve as a stopover for migratory waterfowl and other water birds.

3.1.2 WETLAND AND ASSOCIATED UPLAND HABITAT RESTORATION

The Trustees have funded 11 projects that restore the functions of degraded wetland and ecologically-associated upland habitats in order to sustain the fish, birds, and other wildlife that depend on those habitats. Restoration has included a variety of actions to rehabilitate, reestablish, and enhance wetlands and uplands to increase the quality and functionality of downstream resources. Within this restoration category, the Trustees targeted Green Bay coastal areas impacted by development and modification of natural wetland habitats, floodplains that offer minimal flood or water quality protection, and wetland and/or upland areas with minimal connectivity and impaired ecological function. Projects have improved hydrology by altering drainage regimes to allow water levels to fluctuate, such as constructing dikes and levees and repairing existing pumping and water control structures to manage water levels. Projects have also increased the diversity and quality of wetland and upland habitats through removal of invasive species and re-vegetation with native plants.

3.1.3 AQUATIC, NEARSHORE, AND RIPARIAN HABITAT IMPROVEMENTS

The Trustees have funded 31 projects[11] that improve the quality of aquatic, nearshore, and riparian habitats. This restoration category accomplishes the goal of improving downstream water quality and aquatic habitats by reducing runoff and stabilizing stream banks. Aquatic habitat improvements have focused on both preserving and restoring spawning and nursery habitat for native fish species, barrier islands for fish and wildlife, and stream bank corridors. Improving northern pike (*Esox lucius*) habitat along the western shore has been a focus of several projects in this category. In addition, the Trustees have completed projects focused on enhancing or creating nesting habitat for waterbirds that were injured by PCB releases to the Lower Fox River and Green Bay, such as the Forster's tern (*Sterna forsteri*), the common term (*Sterna hirundo*), and the bald eagle (*Haliaeetus leucocephalus*). For example, the Cat Island Restoration Project is

[10] Fifteen projects are described in the RPR (2013). The remaining two projects were implemented after June 2012.

[11] Twenty-five projects are described in the RPR (2013). The remaining two projects were implemented after June 2012.

a long-term project that provides high quality shallow-water habitat for resident waterbirds and migratory waterfowl, as well as provide spawning, nursery, and rearing habitat for Green Bay fish species.

3.1.4 FISHERY RESOURCE ENHANCEMENTS

The Trustees have funded 11 projects that enhance fishery resources in the Lower Fox River and Green Bay. This restoration category is focused on projects that make progress towards the Trustees' goal of self-sustaining fish populations and a healthy fish community in the restoration focus area. Enhancing fishery resources is important from both ecological and human use perspectives, and the Trustees have implemented projects to enhance fisheries to compensate, in part, for recreational fishing losses (e.g., as a result of Food Consumption Advisories (FCAs)). The Trustees focused on increasing the abundance and diversity of top predators and prey species, while acknowledging that future projects may consider invasive species such as carp (*Cyprinus carpio*) and round goby (*Neogobius melanostomus*). Projects have improved fish rearing facilities to increase production and stocking rates of predator species and native sport fish, in addition to two projects that have benefitted subsistence and recreational fisheries.

3.1.5 PUBLIC USE ENHANCEMENTS

The Trustees have funded eight projects that enhance public use facilities and outdoor recreation in riparian and coastal habitats located far from ecologically sensitive areas. Projects in this category are intended to compensate for general recreational losses caused by PCB releases to the Lower Fox River and Green Bay. For example, restoration actions in this category include trail construction, development of park facilities and wildlife viewing platforms, and improvement of recreational fishing access through construction of boat launches and shoreline fishing piers.

3.2 PARTNERSHIPS AND COLLABORATION

The Trustees' collaborative approach to restoration has resulted in a coalition of conservation partners (Appendix A). The Trustees have actively invited non-Trustee government agencies and municipalities, local non-profit groups, university scientists, sport fishing and hunting groups, and conservationists to participate in restoration initiatives. This coalition of partners brings together a community of natural resource restoration practitioners who engage on conservation issues within the watershed, such as non-point source pollution control and remediation of beneficial use impairments associated with the Lower Fox River AOC. This collaborative approach has enabled efficient identification and implementation of restoration projects that address overlapping conservation issues within the greater watershed (e.g., non-point source pollution and fishery degradation) and increase engagement in landscape scale conservation across the Lower Fox River and Green Bay.

The collaborative approach adopted by the Trustees has resulted in an additional $53 million in leveraged funds (in 2016 dollars), which have increased the scope of

restoration beyond what could be achieved with NRDA settlement funding alone. Projects benefited from matching contributions, as well as in-kind donations of time and services from restoration partners. Exhibit 3-3 summarizes the additional restoration gains achieved through leveraged funds. Certain types of projects received more support and leverage from local groups and initiatives. For example, leveraged funds are responsible for an additional 1,789 acres of wetland and upland habitat preservation and 3,286 acres of wetland and upland habitat restoration.

In addition to matching and in-kind funding, conservation partners have contributed restoration ideas, technical expertise, long-term goal identification, and on-the-ground activities necessary for project completion. The Trustees acknowledge that restoration efforts have been greatly enhanced by partnerships, and are committed to continuing these relationships in the future. Moving forward, the Trustees envision the same direct, hands-on approach to engage conservation partners in completing rehabilitation and restoration of the Lower Fox River and Green Bay.

EXHIBIT 3-3 RESTORATION ACCREDITED TO LEVERAGED FUNDS

RESTORATION CATEGORY	LEVERAGED FUNDS SPENT (2002-2014)[1]	ADDITIONAL RESTORATION ACHIEVED WITH LEVERAGED FUNDS
Wetlands and associated uplands habitat preservation	$9.2 M	1,789 acres
Wetlands and associated uplands habitat restoration	$1.5 M	3,286 acres
Aquatic, nearshore, and riparian habitat quality improvement	$26.6 M	3,367 acres
Fishery resource enhancement	$15.6 M	$ 15.6 M allocated
Public use enhancement	$61,512	$ 61,512 allocated

Note.

[1] These numbers reflect achievements from leveraged funds directed from 2002 through December 2014. Data are from the RPR (2013) and progress reports from the USFWS. Funding was updated to 2016 dollar value.

3.3 RESTORATION PROGRESS AND FUTURE EFFORTS

Substantial progress has been achieved in all restoration categories, which is largely a function of the availability of projects as well as cost effectiveness and restoration expertise. Of the restoration goals set within the 2003 RP/EA (Exhibit 3-2), only the wetland and upland habitat restoration goal has been achieved. The accomplishments in each restoration category, as well as the variable interest of partners and leveraged funds, are important factors for the Trustees to consider when identifying an updated preferred restoration alternative as discussed in more detail in Chapter 7. For example, the Trustees may consider shifting priorities to focus future restoration actions on habitats and species that are still experiencing natural resource injuries. The Trustees will evaluate whether future efforts should focus on the habitats and species benefitting from ongoing or completed restoration, or on natural resources that have not yet been specifically targeted, in order to best compensate the public for the injuries caused by PCB releases to the Lower Fox River and Green Bay.

East River Trail Extension (Brad Lange, Village of Allouez)

CHAPTER 4 | NECESSITY FOR THE RP/EA UPDATE IN 2015

The overall purpose of this Update is to re-evaluate alternative actions to restore, rehabilitate, replace, and/or acquire the equivalent of natural resources and resource services injured by PCBs released to the Lower Fox River and Green Bay. As described in Chapters 2 and 3, both restoration and remedial actions in the Lower Fox River and Green Bay system have progressed substantially since the 2003 RP/EA. In addition to these achievements, for future restoration planning the Trustees will also consider the availability of restoration funds, the current landscape within the Lower Fox River and Green Bay (including other stakeholder efforts to restore the region), and lessons learned in ecological restoration and project management. Each of these considerations is described in more detail below.

4.1 SETTLEMENTS IN 2015

In February 2015, the U.S. District Court for the Eastern District of Wisconsin approved a settlement between the United States, Wisconsin, and six PRPs, known as the "Settling Six," which includes the City of Appleton, CBC Coating, Inc., Menasha Corporation, Neenah-Menasha Sewerage Commission, U.S. Paper Mills Corporation, and WTM I Company.[12] This settlement, among other things, sets aside approximately $46 million for natural resource damages[13], bringing the total recovery for NRD at the site to $106 million (in 2016 dollars).[14] As noted in Section 1.2, the Trustees determined that the 2015 settlements, in combination with prior settlements, provide necessary compensation for natural resource injuries in the Lower Fox River and Green Bay (Exhibit 3-1). With this significant settlement, the public is appropriately compensated without further litigation or delay, and therefore the plaintiffs, the United States and Wisconsin, withdrew their complaint. The Trustees now have a known amount of funding, a certainty that will greatly assist with restoration planning into the future.

4.2 CHANGED LANDSCAPE IN THE LOWER FOX RIVER / GREEN BAY SYSTEM

The Lower Fox River and Green Bay system has changed since the 2003 RP/EA was developed. Importantly, many human-caused stressors have increased pressure on ecological landscapes, habitats, and associated wildlife. This section describes the ecological changes caused by four particular stressors – fluctuating water levels, degraded water quality, invasive species, and climate change – that were not directly addressed in the 2003 RP/EA but that likely affect restoration success. Interestingly, the presence of these stressors has led to an increasing number of conservation initiatives that

[12] The Consent Decree for this settlement also resolves any potential liability for the State of Wisconsin.

[13] The $46 Million includes funds directed toward past assessment costs (approximately $5 M) as well as funds to be directed toward future restoration actions including Trustee administrative costs (approximately $41 M).

[14] Calculated in 2016 dollar value.

extend into the restoration area. Understanding both the stressors themselves, as well as associated conservation planning is essential to the Trustees' evaluation and identification of future restoration efforts. The Trustees will consider the impact of these stressors in the context of restoration planning and implementation, encouraging restoration techniques that help manage water levels, support native populations of biological resources, contribute to invasive species control, and are consistent with long-term climatic predictions. Where possible, the Trustees will also consider the goals and objectives of existing conservation plans developed by organizations within the Great Lakes basin.

4.2.1 ECOLOGICAL CHANGES

Widespread, complex ecological stressors are causing changes to the ecological landscape of the Great Lakes. Some of these stressors, such as fluctuating water levels, invasive species, and non-point source pollution, all of which can be exacerbated by climate change, have become more prevalent and better understood over the last decade. This section describes Great Lakes water levels, water quality, invasive species, and climate change as each relates to the ecological function of the Lower Fox River and Green Bay.

Wetland habitat in the Lower Fox River/Green Bay watershed continues to decline due to anthropogenic stressors, such as land use changes and invasion by reed grass (*Phragmites australis*). Coastal wetlands are in fair condition with the caveat that current trends toward sedimentation and development may challenge progress (Wisconsin Sea Grant 2013). Upland habitat that surrounds the Lower Fox River and Green Bay is heavily concentrated with agricultural row crops and concentrated animal feeding operations, which leads to lower species richness and diversity, and contributes to ongoing issues with non-point source pollution of phosphorous, nitrogen, and suspended solids resulting in degraded water quality. Increased urbanization also contributes to non-point source pollution, which is often difficult to control and adds to the degradation caused by specific point sources of pollution. Improved partnerships and connectivity among federal, state, and local governments, tribes, non-governmental organizations, academia, and the public are required to implement sustainable practices that improve water quality.

Great Lakes Water Levels

Water levels in the Great Lakes and connected waterbodies are influenced by several factors, including regional precipitation, temperature, and lake-wide evaporation. In Green Bay, water levels have been measured since the late 1800s. Oscillations occur on decadal cycles, and mean monthly fluctuations of more than six feet have been measured (Harris and Wenger, 2010). Between the 1960s and 1990s, the Great Lakes experienced higher than average water levels. Levels severely declined beginning in 1997, and January 2013 saw the lowest average monthly water levels in Lakes Michigan and Huron ever recorded (Cruce and Yurkovich, 2011; Gronewold and Stow 2014; Wisconsin Sea Grant 2013). However, since September 2014, monthly water levels have been above average in all of the Great Lakes (NOAA 2015). Looking forward, long-term climate

models predict that net decreases in Great Lakes water levels will occur, along with increases in extreme weather events such as flooding or drought (Hayhoe et al, 2010; Glick et al, 2011).

Broad-scale and/or extreme water level fluctuations will likely affect both biological resources that utilize area habitat, as well as human uses of water resources such navigation, agriculture, and public enjoyment (Winkler, 2014). For example, the combination of lower than average water levels and sedimentation has increased the need for dredging navigational channels, ports, and marinas throughout Green Bay (Wisconsin Sea Grant 2013). Wetlands and shorelines that provide spawning and nursery habitat for fish and feeding and nesting areas for birds may be inundated or stranded by severe water level changes, limiting the ecological functions of these habitat types. Long-term changes in Great Lakes water levels will be important to consider when enhancing aquatic and wetland habitat.

Water Quality

Clean water is essential to the proper function of all biological resources, including aquatic, riparian, and terrestrial habitat function. However, increased use of the land and interruption of natural water flow negatively impacts runoff, surface waters, and downstream receiving waters. Nutrients, sediments and suspended solids, and other hazardous substances contribute to water quality degradation, and continue to be stressors to the Lower Fox River and Green Bay. For example, non-point source pollution from agricultural practices and urban environments, as well as point source pollution from industrial sources, has led to excessive sediment loading and high phosphorus levels in the Lower Fox River and Green Bay (WDNR 2011). In limited quantities, phosphorus is a necessary nutrient and stimulates plant growth, but excess phosphorus can lead to algal blooms and result in oxygen-depleted waters. Suspended solids reduce the amount of sunlight able to penetrate the water column to reach submerged aquatic vegetation. Reduced water clarity diminishes capacity for photosynthesis, and suspended solids may bury important micro-habitats and fish rearing areas (Cadmus 2012; WICCI 2010; Wisconsin Sea Grant 2013).

Wisconsin has a non-point source management plan that governs state-wide actions to curb contributions of non-point source pollution, which includes excess fertilizers, herbicides, and insecticides from agricultural lands and residences; oil, grease, and chemicals from urban runoff; sediment from construction sites, forests, and eroding streams; salt from irrigation and acids from mining sites; and bacteria and nutrients from livestock, pet waste, and septic systems (WDNR 2011). The Wisconsin non-point source management plan outlines the current issues, stakeholders, and the goals and strategies necessary to comply with total maximum daily loads (TMDLs) across the state (WDNR 2011).[15] Loadings of phosphorus from the Fox River account for approximately 70

[15] EPA approved TMDLs for total phosphorus and total suspended solids in the Lower Fox River under the Clean Water Act Section 303(d) regulations (40 CFR § 130 (2016)) (EPA 2012). The TMDLs were based on calculations showing loadings in the

percent of the total load to Green Bay, and contributions from tributaries may be influenced by urban development and precipitation (Graczyk et al. 2012). These data clarify that the Fox River corridor affects a broad geographical area, and plays an important role in the health of Green Bay.

Looking forward, without intervention water quality is expected to continue to decline. According to the State of the Bay report, much of the recent land development has been for agricultural purposes, and to a lesser extent, to expand urban areas (Wisconsin Sea Grant 2013). As urbanization and agricultural pressure increase, runoff will likely increase, making non-point source pollution of water resources by constituents such as contaminants, phosphorous, and suspended solids a growing concern. Great Lakes climate predictions for the next 100 years include warmer conditions, more intense weather events, and an increase in heavy rainfall events greater than one inch. These rainfall events are predicted to increase runoff and erosion, leading to even higher concentrations of suspended solids (Cruce and Yurkovich 2011; Wisconsin Sea Grant 2013). Current and future increases in water temperature also exacerbate a suite of stressors on water quality. Warmer lake temperatures decrease concentrations of dissolved oxygen, potentially leading to fish kills and mobilizing contaminants, which may distribute contaminants within the food web (Cruce and Yurkovich 2011). The Trustees will encourage certain restoration techniques that (1) have broad-scale benefits to water quality and runoff retention, such as creating riparian buffers and conserving land, and (2) enhance the resiliency of fish and wildlife, such as population enhancement, habitat protection and restoration, and reduction of competition by invasive species.

Invasive Species

Aquatic invasive species have been a large contributor to dramatic alterations in Lake Michigan and its aquatic communities. Non-native species such as common carp (*Cyprinus carpio*), sea lamprey (*Petromyzon marinus*), round goby (*Neogobius melanostomus*), rainbow smelt (*Osmerus mordax*), alewife (*Alosa pseudoharengus*), common reed grass (*Phragmites australis*), zebra mussels (*Dreissena polymorpha*), and quagga mussels (*Dreissena bugensis*) have had negative impacts to native species through direct predation, competition, or habitat alteration. The invasive round goby eats fish eggs and creates competition for food with native bottom-dwelling fish affecting the populations of fish such as smallmouth bass (*Micropterus dolomieu*). Zebra mussels negatively impact the economy by clogging water intake structures for municipal, industrial, and hydroelectric plants that can cost billions of dollars to repair (Wisconsin Sea Grant 2013). Common reed grass is also a growing concern for the Green Bay, as it colonizes wetlands and out-competes diverse native communities. Invasive species contribute to the declining biological diversity within Lake Michigan (WDNR, 2015).

Fox River Basin of over 500,000 pounds of phosphorus per year and over 176,000,000 pounds of suspended solids per year from both non-point and point sources (EPA 2012).

Invasive species pose negative impacts to the local economy by threatening agriculture, forestry, navigation, tourism, recreation, and the fishing industry. For example, annually over $800 million in damages to sport fishing have been attributed to invasive species; sea lamprey can kill up to 40 pounds of fish in its lifetime, which contributes to diminished populations of native and sport fish (Wisconsin Sea Grant 2013).

Changing ecological conditions, such as declining lake levels and increasing air temperature, may increase the vulnerability of natural systems to invasive species and favor their continued spread and proliferation (NOAA 2010). Due to the increasing rate of invasions and associated negative impacts, a council was formed to develop the first statewide strategic plan on invasive species for Wisconsin published in 2013 (WDNR 2013). Because the majority of invasive species in the Great Lakes region are introduced through human activities, the plan recognizes that the continued spread of invasive species is preventable through partnerships, investment, and action (WDNR 2013).

Climate Change

Although predicting the impacts of climate change is an inherently complex task, some climate-induced changes are already manifest in northeastern Wisconsin and are likely to continue. For example, climate change is likely to affect water budgets in terms of precipitation and air temperature, though the magnitude of these shifts is unclear. Great Lakes climate predictions for the next 100 years include warmer conditions and an increase in heavy rainfall events greater than one inch (Wisconsin Sea Grant 2013). These altered conditions could affect flow regimes, cause fluctuations in species compositions, and reduce habitat sustainability (e.g., if habitats cannot migrate or adapt to new climate conditions). Precipitation and temperature fluctuations may affect at-risk biological resources in niche riparian and aquatic habitats.

The Trustees will consider the long-term implications of fluctuating climate and climate change adaptation principles (e.g., NOAA 2010) when developing an updated preferred restoration alternative. Although there is a high degree of uncertainty regarding the effects of climate change on restoration, precautionary approaches can be taken to consider a range of possible effects and increase the resiliency of the NRDA restoration program.

4.2.2 PROGRAMS WITH SHARED OBJECTIVES

As described above, the Lower Fox River and Green Bay system is subject to a complex set of environmental stressors. Regional programs with shared objectives for addressing these stressors have increased in the years since the 2003 RP/EA was released, and highlight an increasing conservation presence within the Great Lakes. Examples of these initiatives are described briefly below:

- The Great Lakes Restoration Initiative (GLRI) was launched in 2010 as a federal restoration program to accelerate Great Lakes restoration. The GLRI action plan prioritizes cleaning up Great Lakes AOCs, which includes the Lower Green Bay and Fox River AOC. The GLRI prioritizes prevention and control of invasive

species; reduction in nutrient runoff; restoration and protection of coastal wetlands; and restoration of habitat to protect native species.

- The Wisconsin DNR, with input from a Citizen Advisory Committee and local conservation stakeholders, directs efforts to improve the AOC. Eleven Beneficial Use Impairments (BUIs)[16] are listed for the AOC and two additional BUIs are suspected. For example, "restrictions on fish and wildlife consumption" and "loss of fish and wildlife habitat" are BUIs for the Lower Green Bay and Fox River AOC.
- The Landscape Conservation Design (LCD) project, led by the USFWS, coordinates actions to achieve a collaborative conservation community's shared missions, mandates, and goals. Partners and stakeholders use these determinations to plan and implement conservation actions within the Lower Fox River and Green Bay watersheds.
- Innovative water quality improvement projects are being implemented by federal, state, local, and tribal governments; non-governmental organizations; academia; and landowners. Projects seek to increase sustainable farming practices, develop a trading program for phosphorous in runoff, coordinate land preservation projects, and implement best management practices to improve water quality. Pilot projects are supported by monitoring partnerships with local universities or government agencies.

By considering the related conservation initiatives with a strong presence in northeastern Wisconsin, the Trustees will maximize the ecological benefits of NRDA-related restoration to injured resources. The overlapping goals between continued NRDA restoration and these conservation initiatives, in addition to goals set forth in species-specific and topical management plans (e.g., TMDLs, invasive species), present opportunities to achieve broader, landscape scale conservation.

4.3 LESSONS LEARNED IN ECOLOGICAL RESTORATION AND MANAGEMENT

In addition to the restoration knowledge the Trustees bring to the Council in their individual capacities, the Trustees now have more than a decade of experience in conducting a variety of on-the-ground restoration and preservation activities to achieve the 2003 RP/EA goals. Since the 2003 RP/EA was written and the first projects were conducted more than ten years ago, the scientific understanding of successful, impactful restoration techniques has evolved. In addition, the Trustees have gained valuable insight into project management and implementation. This section describes some of the advances in restoration science and lessons learned in implementing and managing NRDA restoration projects.

[16] Impairment of beneficial use is defined as "a change in the chemical, physical, or biological integrity of the Great Lakes system sufficient to cause any of the 14 identified use impairments" (IJC 2015).

4.3.1 RESTORATION TECHNIQUES

The Trustees have implemented a mix of natural resource restoration projects in order to address a suite of natural resources injuries and provide associated resource services throughout the Lower Fox River and Green Bay restoration area. To achieve project success, the Trustees have modified their techniques over time. For example, the Trustees shifted from conducting narrowly-focused wetland preservation and restoration to broader projects that incorporated both wetland habitats and ecologically-associated uplands. Outdoor public use enhancements associated with recreation in riverine or coastal habitats became specifically directed away from ecologically sensitive areas. Successful restoration techniques to address recreational fishing losses included rehabilitation of top predators through stocking and habitat restoration as well as projects that enhance the abundance and diversity of native prey fish species.

More substantial shifts are evident in the transition from the water quality improvement category within the RCDP to the aquatic, nearshore, and riparian habitat improvement category within the 2003 RP/EA. The RCDP focused on creating vegetated riparian buffer strips and conducting tillage of agricultural and conservation lands. In contrast, while the 2003 RP/EA retained the concept of water quality improvements, the Trustees shifted away from improvements in agricultural practices to reduce erosion, as those techniques were not feasible to achieve the overarching water quality goals. Instead, to address water quality, habitat fragmentation, and encroachment of developed lands, restoration was expanded to include protection, reestablishment, or enhancement of aquatic habitats; spawning and nursery habitats for native species; wildlife barrier islands; oak savanna habitat on river islands; and stream bank corridors, through stabilization with native plant species.

Aerial view of the Mink River (Carter, TNC)

Moving forward, the Trustees envision that restoration techniques similar to those outlined in the 2003 RP/EA will be a continued focus, and describe these in more depth in Chapters 6 and 7.

4.3.2 RESTORATION IMPLEMENTATION

The Trustees have over 14 years of experience implementing on-the-ground restoration and preservation within the Lower Fox River and Green Bay restoration area, and have partnered with organizations with a breadth of experience in varied types of ecological restoration. This experience has led to increased efficiency in all aspects of planning, execution, monitoring, and long-term project management. Several examples of lessons

learned are described below, including the integral role of partners, methods to achieve greater ecological benefits through management techniques, and the infrastructure necessary for monitoring.

A successful restoration project depends on good project management from the onset of project planning. Management by the Trustees ensures high quality restoration and preservation projects that achieve restoration goals. The Trustee Council Coordinator, Technical Team, and newly appointed Restoration Coordinator contribute to the planning, implementation, monitoring, and maintenance of restoration projects. Field visits and project tracking are important activities to ensure accurate project outcomes, such as estimating the number of NRDA-credited acres restored by a particular project. The Trustees set management expectations in the planning phase to ensure that restoration funds are spent efficiently and deliver high quality restoration and preservation projects that help achieve restoration goals.

Success also depends on developing a network of conservation partners that bring expertise and leverage matching funds to complete additional restoration, in addition to what is credited to NRDA dollars. An additional 8,500 acres of landscape-scale ecological conservation and recreational benefits have been made possible due to leveraged funds. In addition to matching funds, cost sharing, and in-kind donations of time and services, the Trustees have developed a coalition of conservation partners that provides ancillary benefits in terms of shared knowledge, experience, and expertise that assists the coalition in reaching broader conservation goals.

Collaboration with partners and discussions about geographic scope has led to enhanced ecological benefits. For example, the Trustees have outlined a broad restoration area within which restoration and preservation could be accomplished. However, to achieve the maximum benefits for objectives such as improved water quality, it is necessary to group certain types of projects together to increase the likelihood of beneficial impacts on downstream water quality. Broad-scale objectives are likely to benefit from clusters of projects within a more defined geographic scope, and discussions among conservation partners at the beginning of a project can determine the best location to maximize the ecological benefits for the same project costs.

To ensure all ecological benefits are appropriately measured, maintenance and monitoring plans are outlined at the beginning of a project. Monitoring is critical to project success. It provides updated metrics to better understand the project outcomes, as well as a mechanism for measuring the interim success of a project while it is ongoing and then adapting the restoration technique, as needed, to ensure a successful outcome. The Trustees acknowledge that the best strategy when conducting monitoring is to have a plan in place, for each project, that is guided by standard performance criteria. Similarly, maintenance plans are necessary to ensure long-term goals are achieved for projects that need a certain amount of project funding to continue into the future, such as provisioning maintenance costs for a wetland pumping infrastructure. Monitoring is considered in more detail in Chapter 8.

The Trustees will use these lessons to implement future restoration projects that are efficient and focused to achieve the best ecological and human use outcomes.

4.4 SUMMARY

The Trustee Council has conducted more than 14 years of on-the-ground restoration within the restoration area. During this time, remedial actions have reduced the PCB load within the system by removing PCB-laden sediments from the Lower Fox River and developing institutional controls. However, natural resource injuries still exist within the system, and a settlement achieved in 2015 paves the way for additional restoration actions into the future. Given the progress in restoration, the availability of settlement funds, the changing ecological landscape within northeastern Wisconsin, and the lessons learned in conducting and managing restoration projects, the Trustees deem it necessary to develop this RP/EA Update to account for the progress to-date and thoughtfully plan for future restoration actions that reflect the current conservation landscape in the restoration area. Subsequent chapters discuss the affected environment (Chapter 5) to lay the remaining groundwork before sketching and re-evaluating restoration alternatives in Chapters 6 and 7.

CHAPTER 5 | AFFECTED ENVIRONMENT

In addition to a thorough review of restoration progress to-date (Chapter 3) and the changed environmental landscape of the Lower Fox River and Green Bay (Chapter 4), as part of this Update the Trustees assessed the current physical, biological, socio-economic, and cultural resources within the restoration area, described below. This information will assist the Trustees in evaluating and planning future restoration activities within the restoration area, and ensure that potential restoration projects are designed to both maximize ecological and human use benefits while minimizing or eliminating project-related adverse environmental consequences.

5.1 PHYSICAL ENVIRONMENT

The restoration area encompasses a broad expanse of land and water resources within northeastern Wisconsin and the Upper Peninsula of Michigan. This section describes the specific geographic scope of the restoration area, as well as associated land use and socio-economic conditions, which the Trustees will consider when developing future restoration projects.

5.1.1 GEOGRAPHIC SCOPE

The Lower Fox River and Green Bay watershed within northeastern Wisconsin and the Upper Peninsula of Michigan is part of the larger Great Lakes ecosystem. As outlined in the 2003 RP/EA, and consistent with this Update, the restoration area includes 39 miles of the Lower Fox River, the bordering floodplain and associated uplands, Green Bay and bordering coastal wetlands, and tributaries to the Green Bay and Fox River watersheds including the headwaters and their adjacent floodplains and uplands (Exhibit 2-3). In Wisconsin, this includes lands held by the two Tribal Trustees for the Lower Fox River and Green Bay, the Menominee and Oneida Tribes, as well as land in the following counties: Adams, Brown, Calumet, Columbia, Door, Florence, Fond du Lac, Forest, Green Lake, Kewaunee, Langlade, Manitowoc, Marathon, Marinette, Marquette, Menominee, Oconto, Oneida, Outagamie, Portage, Shawano, Waupaca, Waushara, and Winnebago. In Michigan, the restoration area includes land in Alger, Delta, Dickinson, Iron, Marquette, and Menominee counties.

The Menominee Tribe holds lands that encompass most of Menominee County, and manage a heavily forested landscape over approximately 235,000 acres, including remnant older forests, northern wet-mesic forests, and forested watersheds, notably the Wolf River corridor, a National Scenic Riverway (WDNR 2012a). The Oneida hold lands in Brown and Outagamie counties. The Oneida lands generally exist within the central Lake Michigan coastal landscape from Lake Winnebago to Green Bay, totaling approximately 65,000 acres (WDNR 2012a). Additionally, the restoration area encompasses several Wisconsin management projects consisting of Wildlife Areas, Fisheries Areas, Natural Areas, and State Forests.

5.1.2 LAND USE

The 2003 RP/EA identifies the major land uses in the restoration area as agricultural or farming, with forests used by the logging industry and for recreation, as well as residential developments, accounting for a smaller portion of land uses near the Lower Fox River (RP/EA 2003). Since that time, land uses have changed. Current land use practices in the Lower Fox River Basin include agriculture (approximately 50 percent) and urban land use (approximately 35 percent) (WDNR 2011). In fact, the restoration area includes the third most urbanized and industrialized area in Wisconsin (Census 2010) near the cities of Appleton and Green Bay along the Fox River corridor. Data from the 2010 Census indicate a 28 percent increase in the footprint area of Green Bay, WI since 2000. In six counties of the Green Bay drainage basin (Brown, Outagamie, Winnebago, Oconto, Marinette, and Door) impervious surfaces account for one to seven percent of land cover and were mainly converted from agricultural land (Wisconsin Sea Grant 2013).

Considering information about land use in northeastern Wisconsin enables the Trustees to assess the conservation landscape, anthropogenic pressures, and the manner in which lands are occupied or altered, all of which may affect the benefits expected from planned restoration. For example, urbanization along the Fox River decreases the amount of land available for restoration and increases costs associated with land preservation and restoration. Environmental quality is expected to become increasingly degraded in concert with urbanization and agricultural use, which can lead to increases in non-point source pollution (e.g., road runoff, fertilizer runoff) and degradation of adjacent habitats (e.g., due to edge effects; WDNR 2011).

5.1.3 SOCIO-ECONOMIC CONDITIONS

The 2003 RP/EA reports on the population in the Lower Fox River valley from Lake Winnebago to the mouth of the Fox River in Green Bay (412,900 people), as well as counties surrounding Green Bay in Wisconsin (119,100) and Michigan (63,000) (RP//EA 2003). Notably, the central Lake Michigan coastal counties, including Brown and Outagamie, have a population density that is about twice that of the state as a whole. Updated population estimates from the most recent Census (2010) include a ten percent population increase in the city of Green Bay from 2000-2010. Within the restoration area in Wisconsin (see "Geographic Scope"), the Census reports a 5.4 percent population increase from 2000-2010 to 1,443,855 people. Restoration area counties in Michigan have seen a 1.8 percent decrease in population to 175,761 during 2000-2010.

Specifically within the restoration area, industries such as paper milling are important employers. The Fox River alone has 24 paper mills along 39 stream miles (Exhibit 1-1). In contrast, agriculture and tourism are important sources of employment and revenue in the counties surrounding Green Bay. State and local parks and forests provide areas for outdoor recreation and sport fishing. Other industries are unchanged from those reported in the 2003 RP/EA, including metal working, printing, food, textiles, wood products, chemicals, and agriculture (RP/EA 2003).

Current data from the 2009-2013 American Community Survey (Census 2014) estimate 2,839,636 civilians over the age of 16 are employed in Wisconsin, and the major industries in the state have shifted to service professions such as educational services, health care, and social assistance. Other major industries include manufacturing (18.2%) and retail trade (11.4%), while agriculture (combined with forestry, fishing, hunting, and mining) employs only 2.5 percent of workers in the state of Wisconsin. Employment industries are similar in Michigan, with over 20 percent of the workforce employed in educational services or health care. Other major industries in Michigan are manufacturing (16.9%) and retail (11.6%), while agriculture employs 1.4 percent of total workers. Estimates from the U.S. Bureau of Labor Statistics (BLS 2015) show declining unemployment rates from 2014 to 2015 across the United States, and in November 2015 unemployment was estimated in Wisconsin at 4.2 percent and in Michigan at 5.1 percent. Understanding the socio-economic conditions of the restoration area will help the Trustees identify restoration techniques that benefit the public and that will take a balanced approach to environmental justice to avoid adverse environmental effects on minority or low-income populations.

5.2 NATURAL RESOURCES AND BIOLOGICAL ENVIRONMENT

Natural resources recognized under 43 C.F.R. § 11.14(z) (2016) within the Lower Fox River/Green Bay watershed include, but are not limited to, surface water and sediment, invertebrates, fish, birds, mammals, amphibians, reptiles, and plants. Wildlife and other biological resources utilize a suite of habitats ranging from open water to upland forests. Some species are of particular concern to the Trustees, due to their threatened or endangered conservation status, or because they are culturally and/or economically important. For example, certain species are caught and consumed through hunting and fishing activities. The varied habitats of northeastern Wisconsin provide opportunities for recreation, including running, hiking, and water sports. Many natural resources, such as threatened bird and mammal species, hold intrinsic value for the public. This section describes the natural resources within the restoration area in northeastern Wisconsin, with particular attention to describing the various habitat types and wildlife species present.

5.2.1 HABITAT TYPES

The restoration area in Wisconsin and Michigan encompasses transitional climates that encourage a variety of plant and wildlife communities. WDNR considers 16 ecologically distinct regions in Wisconsin, seven of which are represented within the restoration area (WDNR 2012a Appendix C). Hardwood forests and agrarian habitat exist closer to the Lower Fox River and southern Green Bay, while conifer forests are spread throughout the upper portion of Green Bay and Michigan's Upper Peninsula (RP/EA 2003). A notable feature within the restoration area, the Menominee forests have been sustainably managed for over 140 years and contain rich, contiguous habitat structures no longer present in most of Wisconsin (WDNR 2012a). The location of individual ecological landscapes found within the Lower Fox River and Green Bay restoration area and a

summary of the important features and species occupying these landscapes are provided in Appendix C.

In addition to providing habitat for diverse communities of aquatic organisms, wetlands and riparian habitats provide a physical buffer between sensitive aquatic communities and the agricultural and residential areas that are sources of runoff and pollution. Within the Green Bay system, the western shore contains approximately half of all coastal wetlands in the form of lagoons and barriers, ridges and swales, shorelines, embayments, riverine areas, and deltas (Wisconsin Sea Grant 2013). Rare habitats exist within northeastern Wisconsin, filling specific ecological niches and supporting endemic wildlife species.

5.2.2 FISH AND WILDLIFE SPECIES

The diverse habitats within the restoration area support a wide variety of fish and wildlife species. This section discusses the fish populations and fisheries that are supported within the Lower Fox River and Green Bay; the native and migratory bird populations that utilize the habitats that comprise the restoration area; and the mammal species that often serve as top predators within the Fox River restoration area, with particular attention to the species injured by PCB releases along the Lower Fox River. These species have been impacted by environmental stressors such as habitat loss, contamination, degraded water quality, and landscape scale environmental changes (e.g., climate change).

Fish

Fish are an essential component of the Green Bay ecosystem. Fish are predators, consuming plankton, invertebrates, and smaller prey fish. Some fish are also prey for piscivorous birds and mammals, such as bald eagles (*Haliaeetus leucocephalus*), terns, ducks, otter (e.g., North American river otter, *Lontra canadensis*), and mink (*Mustela vison*). The range of aquatic habitats found in Green Bay support diverse populations of fish species (Qualls 2014). The southern portion of Green Bay is relatively shallow and warm during the summer months, and is utilized by year-round populations of warm- and cool-water species (e.g., yellow perch (*Perca flavescens*), walleye (*Sander vitreus*), smallmouth bass (*Micropterus dolomieu*), northern pike (*Esox Lucius*)). The tributaries, estuaries, and embayments of Green Bay also provide spawning and nursery habitat for these species. Northern Green Bay is deeper and colder, and sustains cool- and cold-water fish (e.g., walleye (*Sander vitreus*), brown trout (*Salmo trutta*), steelhead (*Oncorhynchus mykiss*), and salmon species).

Certain fish species that may be considered "non-native" are a major element of the Green Bay fish community. Species such as brown trout, rainbow trout (*Oncorhynchus mykiss*), Chinook salmon (*Oncorhynchus tshawytscha*), and Coho salmon (*Oncorhynchus kisutch*) continue to be purposely stocked into Green Bay and Lake Michigan to maintain predator-prey balance and provide a diverse sport fishery (Paoli 2015; WDNR 2015c). In addition to stocking, some of these trout and salmon have established naturally reproducing populations in Lake Michigan. Other species, such as common carp

(*Cyprinus carpio*), round goby (*Neogobius melanostomus*), rainbow smelt (*Osmerus mordax*), and alewife (*A. pseudoharengus*), negatively impact native species through direct predation, competition, and habitat alterations. However, some provide forage for desired fishes (e.g., predators such as smallmouth bass, walleye, and salmon), and rainbow smelt are desired for both recreational and commercial fishing. Therefore, management of the fishery is complicated, involving consideration of both positive and negative impacts.

Historically, Green Bay maintained large commercial and sport fisheries (Kraft 1982; Qualls 2014). Substantial restoration efforts in northeastern Wisconsin have resulted in significant progress toward restoring fish populations in Green Bay. Green Bay currently supports sport fisheries for walleye, yellow perch, lake whitefish, Great Lakes spotted musky (*Esox masquinongy masquinongy)*, smallmouth bass, northern pike, trout, and salmon, as well as commercial harvest of lake whitefish, yellow perch, and rainbow smelt (WDNR 2015c). In recent years, Green Bay anglers have harvested about 100,000 walleyes per year and walleye recruitment has been consistently high (Hogler 2015). Pollution control efforts and tributary habitat improvements have also led to partial recovery of lake whitefish such that these fish are now spawning in Green Bay tributaries (Pers. Comm., WDNR).

Lake sturgeon (*Acipenser fulvescens*) populations have also benefited from over two decades of restoration efforts in northeastern Wisconsin, and self-sustaining natural reproduction currently occurs on the Menominee, Peshtigo, Oconto, and Fox Rivers (Donofrio et al. 2015). Green Bay contains the largest populations of lake sturgeon in Lake Michigan, though the current population is less than one percent of the historic population. Spotted musky are stocked in an attempt to restore an extirpated population (WDNR 2012b). While abundance remains low, a spotted musky trophy fishery has developed and some natural reproduction has been documented (WDNR 2012b; *unpublished WDNR data*). Other native species such as lake herring (*Coregonus artedi*), also known as cisco, have been functionally extirpated (*unpublished WDNR data*).

Birds

The Green Bay, Lower Fox River, and Winnebago Pool Lakes are situated along a major flyover pathway, and provide critical habitat and food sources for migratory and resident populations of aquatic birds. Large numbers of waterfowl use Green Bay during seasonal migrations, and wetlands within the restoration area support breeding populations of some duck species. Surveys conducted during the fall migration period in 2012 showed increased waterfowl use of Green Bay when compared to earlier periods. Up to 230,000 diving ducks and 15,000 tundra swans (*Cygnus columbianus*) were counted in a single census (WDNR unpublished data).

Population status varies among colonial nesting waterbirds in the restoration area, a list which includes terns, gulls, herons, cormorants, and the American white pelican

(*Pelecanus erythrorhynchos*). The four species of summer resident terns[17] within the restoration area are all listed as threatened or endangered by the state of Wisconsin, and have experienced nesting improvements since NRDA restoration was initiated. Beneficial habitat projects include artificial and permanent nesting islands, acquisition and protection of suitable habitat, and manipulation of water levels in wetlands which support breeding tern colonies. Historically, Lower Green Bay and the Winnebago Pool Lakes had stable populations of common, Forster's, and black terns, and recovery of nesting populations in these locations will contribute to statewide recovery goals. Double-crested cormorants (*Phalacrocorax auritus*) nest and forage within the area, with high numbers of breeding pairs near Cat Island. Population levels are managed under a Double Crested Cormorant Management Plan, which sets a level of 1,000 nesting pairs in lower Green Bay (WDNR 2007; USDA 2009). Restoration and species management within the Cat Island colony have stabilized the cormorant population near the target level. White pelicans returned to Lower Green Bay in the 1990s and nesting has increased to a little over 2,000 on Cat and Lone Tree Islands.

Bald eagles have been removed from state and federal endangered species lists due to recovery throughout their range. However, contaminant levels in bald eagles associated with the Great Lakes shorelines and large rivers in Wisconsin have previously been measured at higher concentrations than in eagles caught near inland waters (Dykstra et al. 2004). Bald eagles nest and winter throughout the restoration area and continue to be exposed to PCB contamination within aquatic habitats and fishery resources. In addition to feeding on fish and the carrion of large mammals, bald eagles consume dead or crippled waterfowl. In 2015 alone, successful bald eagle nests were observed in Door, Kewaunee, Calumet, Outagamie, Brown, Oconto and Marinette counties in Wisconsin (WDNR unpublished data).

Mammals

Upland and agricultural areas in northeastern Wisconsin support diverse mammal species such as bats, rabbits, ground squirrels, red fox (*Vulpes vulpes*), coyote (*Canis latrans*), and white-tailed deer (*Odocoileus virginianus*). The native forests that support wide-ranging mammals continue to decline due to land conversion, but what remains throughout the restoration area provides habitat for the jumping mouse (*Napaeozapus insignis),* northern flying squirrel (*Glaucomys sabrinus*), fisher (*Martes pennant*), raccoon (*Procyon lotor*), skunk (*Mephitis mephitis*), American black bear (*Ursus americanus*), and white-tailed deer. Additionally, northern white-cedar swamps provide habitat for bobcat (*Lynx rufus*), remnant savannas and grasslands are preferred habitat for the badger (*Taxidea taxus*), and the gray wolf (*Canis lupus*) utilizes woodlands and grasslands throughout the restoration area.

[17] Summer resident terns in the Lower Fox River and Green Bay restoration area include Caspian terns (*Hydroprogne caspia*), common terns (*Sterna hirundo*), Forster's terns (*Sterna forsteri*), and black terns (*Chlidonias niger*).

Coastal, marsh, and riverine wetlands occur in the restoration area, which is home to aquatic furbearers such as American mink (*Neovison vison*), North American river otter (*Lontra canadensis*), muskrat (*Ondatra zibethicus*), and American beaver (*Castor canadensis*). Mink and river otters are piscivorous, while muskrat primarily consume plant matter. Shoreline development and subsequent habitat loss has decreased the amount of suitable habitat available for these species.

5.2.3 THREATENED AND ENDANGERED SPECIES

Certain wildlife species have been adversely impacted by environmental stressors (e.g., habitat degradation) to an extent that their long-term viability is uncertain. Many of these species are afforded special protection under federal and/or state legislation for endangered species. The Lower Fox River and Green Bay restoration area supports both federally- and state-listed threatened and endangered species.

In 2003, federally-listed species within the assessment area included a number of plant and wildlife species (Exhibit 5-1). As of 2015, the status of some previously listed species has improved, while new species have been designated as threatened or endangered (Exhibit 5-1). Conservation success stories include the de-listing and recovery of the bald eagle and the gray wolf (*C. lupus*) based on continued progress in the conservation of these species. Recently listed species include the northern long-eared bat (*Myotis septentrionalis*), the rufa red knot (*Calidris canutus rufa*), the sheepnose mussel (*Plethobasus cyphyus*), the snuffbox mussel (*Epioblasma triquetra*), and the Poweshiek skipperling (*Oarisma poweshiek*). Notably, any future restoration actions would need to minimize ecological impacts on these species.

Exhibit 5-1 cross-references federally-listed species with their conservation status at the state level in Wisconsin and Michigan. According to WDNR's Natural Heritage Inventory (NHI) of species of concern, there are several hundred species of conservation concern within the state (WDNR 2014b). Within the restoration area counties in Wisconsin and Michigan, there are 95 unique species that are listed as endangered by WDNR and/or MDNR that are not federally listed.[18] More information on endangered species is available in Appendix C.

[18] For a full listing of listed and extirpated species in Wisconsin, see WDNR 2014b.

EXHIBIT 5-1 FEDERALLY LISTED THREATENED AND ENDANGERED SPECIES IN THE RESTORATION AREA (2003-2015)

GROUP	SPECIES (COMMON NAME)	FEDERAL STATUS		STATE STATUS (2015)	
		2003	2015	WISCONSIN	MICHIGAN
Plant	Dwarf lake iris	Threatened	Threatened	Threatened	Threatened
	Eastern prairie white-fringed orchid	Threatened	Threatened	Endangered	*Endangered*
	Fassett's locoweed	Threatened	Threatened	Endangered	*Not listed*
	Pitcher's thistle	Threatened	Threatened	Not listed	Threatened
	Prairie bush-clover	Threatened	Threatened	Endangered	Not listed
Insect	Hine's emerald dragonfly	Endangered	Endangered	Endangered	*Endangered*
	Karner blue butterfly	Endangered	Endangered	Special concern	*Threatened*
	Poweshiek skipperling	Not listed	Endangered	Endangered	*Threatened*
Mussel	Higgins eye	Endangered	Endangered	Endangered	Not listed
	Snuffbox mussel	Not listed	Endangered	Endangered	*Endangered*
Bird	Bald eagle	Threatened (proposed removed)	Delisted	Special concern	Special concern
	Kirtland's warbler	Endangered	Endangered	Endangered	Endangered
	Piping plover	Endangered	Endangered	Endangered	*Endangered*
	Whooping crane	Experimental population	Experimental population	Special concern	*Not listed*
Reptile	Massasauga rattlesnake	Candidate	Proposed Threatened	Endangered	Special concern
Mammal	Canada lynx	Threatened	Threatened	Special concern	Endangered
	Gray wolf	Endangered	Endangered	Special concern	Special concern
	Northern long-eared bat	Not listed	Threatened	Threatened	Special concern

Notes.

2003 Federal status is based on listings in the 2003 RP/EA and additional information from the US Fish and Wildlife Service.

2015 Federal status is based on listings from the US Fish and Wildlife Service.

Wisconsin state status is based on WDNR 2014b (NHI) listings, T&E Species List, and online tools at http://dnr.wi.gov/topic/NHI/.

Michigan state status is based on MDNR T&E Species List and online tools at http://mnfi.anr.msu.edu/data/county.cfm.

Italic text indicates a species is not found within the Michigan portion of the restoration area.

5.3 CULTURAL AND HISTORIC RESOURCES

Historically, the Lower Fox River and Green Bay provided food, transportation, and shelter to Native peoples prior to European settlement, and due to its strategic location and rich biological resources was an important area for trading posts and military fortifications (RP/EA 2003). In the 23 counties that encompass the restoration area in Wisconsin, 578 sites are included in the National Register of Historic Places[19] and six of these properties are co-registered as National Historic Landmarks[20] (NPS 2015a, 2015b). Within the restoration counties in Michigan, there are zero sites registered as National Historic Landmarks and 171 properties registered as National Historic Places (NPS 2015a, 2015b). In keeping with the 2003 RP/EA, preservation and/or restoration of resources that hold cultural value, especially those resources that are important to the Oneida and Menominee Tribes is a priority for the Trustees. This section outlines the cultural history and natural resource values of the Oneida and Menominee Tribes, as described by the tribes.

5.3.1 HISTORY OF THE MENOMINEE AND ONEIDA TRIBES IN WISCONSIN

The Menominee Indians are the oldest continuous residents of Wisconsin. The Menominee are an Algonquin speaking nation and the name "O-MAEQ-NO-MIN-NIWUK" means "wild rice people." Long ago, the French called the Menominee the "Folle Avoine Nation" or the "Nation of the Wild Oats" because of the dependence on the Wild Rice. It was said that when the Menominee entered an area the Wild Rice followed and when they left the area, the Wild Rice passed. The Menominee once occupied over 10 million acres of land which is now central and mid-eastern Wisconsin and part of the Upper Peninsula of Michigan. The boundaries of their land holdings were north to the Escanaba River, south to the Milwaukee River, including the Door Peninsula and west to the Mississippi River. Through a series of treaties the Menominee were forced to cede most of their land and in 1854, the Wolf River Treaty was signed, granting the Menominee 12 townships "for a home, to be held as Indian lands are held, that tract of Country lying upon the Wolf River," to be used as a Reservation and home.

In the early 1820s, members of the Oneida Tribe of Indians journeyed from their homeland in the State of New York and entered into agreements with the Menominee and Ho Chunk Tribes for permission to stay in their territories. They settled along Duck Creek, where the presence of white pines was reminiscent of the Oneidas' attractive homelands. In the following years, more Oneida migrated to this rich and fertile region to create a new homeland. In 1831, the Menominee entered into a Treaty with the United States and ceded 500,000 acres to the United States for the resettlement of the "New

[19] The National Register of Historic Places is authorized by the National Historic Preservation Act of 1966 and is part of a national program to coordinate and support public and private efforts to identify, evaluate, and protect America's historic and archeological resources. For more information, see www.nps.gov/nr.

[20] National Historic Landmarks (NHLs) are nationally significant historic places designated by the Secretary of the Interior. They possess exceptional value or quality in illustrating or interpreting the heritage of the United States. For more information, see www.nps.gov/nhl.

York Indians," including the Oneida. In 1838, the Oneida entered into a Treaty with the United States in which the Oneida relinquished their claim to the 500,000 acre tract, and the United States agreed to set aside land for the Oneida encompassing their settlements along Duck Creek and measuring 100 acres for each member of the Oneida Tribe. This resulted in an Oneida Reservation of approximately 65,400 acres, measuring 8 miles by 12 miles and located west of Green Bay in parts of Brown and Outagamie Counties. For nearly 200 years Oneida people have made this place home.

5.3.2 NATURAL RESOURCES VALUED BY THE TRIBES

The Menominee lived by hunting, fishing and gathering. The abundant wild rice was the staple food which was augmented by corn, beans, and squash grown in small gardens. Boiling and roasting were the common methods of cooking, but some foods were dried in the sun for winter use. Maple sugar and syrup were used as sweeteners and flavorings. Lake sturgeon was also particularly important as a food source, especially in the spring when the sturgeon would spawn at Keshena Falls on the Wolf River. The sturgeon was a welcome food source after long winters. Wild game and fish was abundant and utilized by the various bands of Menominee that roamed the land.

An Oneida Tribe member fishing

From the 1830s through the end of the 19th century, the Oneida Reservation hosted abundant fish and waterfowl resources, forest and wetland birds, amphibians, reptiles and mammals. Game species included waterfowl, deer, rabbit, grouse, bear, muskrat, and squirrel. Game fish included brook trout (*Salvelinus fontinalis*), suckers, northern pike, bass, sturgeon, and walleye. In fact, the current Reservation area in Wisconsin was chosen by the Oneida leaders in part because of the abundant wildlife, fish populations, and habitat diversity. The splendor of the Reservation when the Oneida people first arrived has been well documented in stories and written literature. At the time of migration the area was largely forested and fish populations in Duck Creek and its tributaries were very high. With the relocation to the Wisconsin region in the 1820s, the Oneida diet adapted to coincide with the available resources in the area. Although the Oneida culture was threatened by change and pressured to comply with the European lifestyle, the Oneida maintained their diet with a consistent consumption of fish, deer, turkey, duck, goose, raccoon, rabbit and bear along with the seasonal vegetables (e.g., leeks, wild onions, corn, beans, squash and wild rice). A variety of berries and fruits were also included in the diet, such as strawberries, blueberries, raspberries, apples, and wild grapes. As a woodland tribe, the Oneida also

utilized many tree resources such as nuts of the hickory tree, walnuts, butternuts, chestnuts and collected sap for making maple syrup.

Along with these abundant foods, the Oneida had an annual fishing season, which included the harvest of trout, walleye, pike, bass and white suckers (*Catostomus commersoni*). Other noted species include bluegills (*Lepomis macrochirus*), crappies (*Pomoxis* sp.), and bullheads (*Ameiurus melas*). The harvest of fish played a key role in the Oneida way of life and was honored by ceremony and offerings to the Creator. There were established fishing and gathering areas along the waterways that were utilized annually. For example, suckers were cooked during the spring run, salted in barrels and canned for future use. Even with resource depletion in the early 20th century, harvesting continued as an important element of life on the reservation. Since the beginning of time, the Oneida and each of the five Nations of the Iroquois Confederacy have been and continue to care for and protect all of Creation, including all fish and all of the waters. This sentiment is encapsulated in the Thanksgiving address, which acknowledges and gives thanks to all of Creation for continuing to provide for the people on Mother Earth.

5.4 SUMMARY

The Lower Fox River and Green Bay restoration area encompasses a suite of habitat types that together support a wide range of fish and wildlife species. Current land use and socio-economic conditions, combined with recent trends in development and environmental degradation have adversely affected these natural resources. Some species have benefitted from recent restoration efforts (e.g., lake sturgeon), while the sustainability of other species has become more tenuous (e.g., cisco). In addition to ecological functions, these natural resources also provide recreational, commercial, and cultural services. The Trustees will take these current resource conditions into account when evaluating and planning future restoration.

CHAPTER 6 | TRUSTEE VISION FOR COMPLETION OF NRDA RESTORATION IN THE LOWER FOX RIVER AND GREEN BAY

One goal of the RP/EA Update is to re-evaluate the restoration alternatives described in the 2003 RP/EA in order to take advantage of a more informed Trustee perspective when directing the completion of NRDA restoration in the Lower Fox River and Green Bay. Consistent with the DOI NRDA regulations, the Trustees may modify the 2003 RP/EA based upon necessity as restoration proceeds (43 CFR § 11.93(c) (2016)). Chapter 4 of the Update discusses the many inter-related factors that may necessitate a modification or update to the 2003 RP/EA, including:

- Finality of settlement funds;
- Knowledge gained from more than 14 years of on-the-ground restoration within the restoration area;
- Current Trustee perspectives on conservation priorities and initiatives within the Lower Fox River and Green Bay watershed, and how NRDA restoration may enhance landscape scale conservation;
- The type, scale, and success of remedial actions; and,
- Presence of additional ecological stressors, such as fluctuating Great Lakes water levels, invasive species, urbanization, and climate change, which may influence Trustee restoration goals.

In this chapter, the Trustees describe potential restoration alternatives considered for implementation, as well as one restoration alternative that was considered, but ultimately not pursued by Trustees as an option for continued restoration. The potential restoration alternatives take into account NRDA restoration progress, as documented in Chapter 3 of the Update, as well as other related conservation initiatives in the Great Lakes region. These alternatives are described below and are evaluated in Chapter 7 based on compliance with the DOI NRDA factors (11 C.F.R. § 11.82(d) (2016)) as well as the National Environmental Policy Act (NEPA) to ensure the preferred alternative does not impact the quality of the human environment.

The Trustees outline the restoration categories that are envisioned as part of the alternatives, and describe their preferred alternative for continued restoration in the Lower Fox River and Green Bay. The preferred alternative remains consistent with information gathered during the public process, with a strong connection to the selected alternative in the 2003 RP/EA, and focuses NRDA settlement funding on resources that continue to be injured by PCB releases in the Lower Fox River and Green Bay.

6.1 RESTORATION ALTERNATIVES CONSIDERED

The Trustees identified three distinct restoration alternatives in addition to the "No Action" alternative (Alternative 1). Alternatives 2 and 3 include a suite of restoration categories similar to those outlined in the 2003 RP/EA and consider restoration progress to-date, but differ in their approaches to setting restoration goals. In contrast, Alternative 4 takes a broader approach to defining restoration categories than Alternatives 1-3 or any of the alternatives considered in the 2003 RP/EA. Each Alternative is described in more detail below.

6.1.1 ALTERNATIVE 1: NO ACTION

Alternative 1, the "No Action" alternative, considers the environmental consequences of conducting no further restoration actions during or after the mandated remediation is completed. Under the "No Action" alterative, remedial actions designed to protect human health and the environment from unacceptable risk are completed as directed by state and federal authorities. These remedial requirements, however, are not expected to immediately return natural resources to baseline ecological conditions (i.e., conditions but for the release of PCBs). Natural resources will likely take decades to attenuate to baseline PCB concentrations after remedial actions are completed, given the continued presence of the contaminant within the system. For example, the Green Bay Mass Balance Study estimates that after intense remedial actions remove PCBs from the Fox River, recovery will likely take an additional 20 years due to the PCBs that remain in the system (i.e., in the water column, sediment, and biological tissues). Recovery of Green Bay is estimated to take longer, because removal of PCB-laden sediments is not a viable action within the large area of exposed natural resources in Green Bay.

Similarly, the "No Action" alternative is not expected to provide additional compensation to the public for interim ecological and human use service losses due to PCBs released into the Lower Fox River and Green Bay system. Remedial actions, which focus solely on removal or containment of contamination, reduce future injury but do not provide the additional natural resource services required to make the public whole.

Lastly, the "No Action" alternative would not utilize settlement monies for restoration or acquisition of the equivalent of lost resources and resource services, which is a stated purpose of the most recent settlement agreement. Therefore, the "No Action" alternative serves as a point of comparison to determine the context, duration, and magnitude of any environmental consequences that might result from the implementation of other restoration actions. Environmental consequences are considered in Chapter 7.

6.1.2 ALTERNATIVE 2: NATURAL RESOURCE-BASED RESTORATION WITHIN AND BEYOND THE ASSESSMENT AREA

Alternative 2, "Natural Resource-Based Restoration Within and Beyond the Assessment Area" retains the same restoration categories and goals identified in the 2003 RP/EA selected alternative. This alternative is consistent with previous restoration documents, maintaining the restoration categories as they were outlined in the 2003 RP/EA and

inherently acknowledging the feedback gained through the public process. The restoration goal for the wetland and upland habitat restoration category, to achieve 3,300 acres of habitat restoration, has been surpassed to-date. Therefore, the Trustees would focus actions under Alternative 2 on the four remaining restoration categories: wetland and upland habitat preservation; aquatic, nearshore, and riparian habitat improvement; fishery resource enhancements; and outdoor public use enhancements. That is, this Alternative emphasizes and prioritizes the categories that have not met their individual restoration goals with available settlement funding. Restoration progress would be assessed against the same goals and metrics presented in the 2003 RP/EA. At this time, the Trustees prioritize ecological benefits to fisheries and water quality over public use enhancements. However, the scale of restoration defined by Alternative 2, that is, the goals identified in the 2003 RP/EA, are likely not achievable with the current settlement funds due to increases in current restoration costs and decreased availability of suitable, cost effective projects that would provide sufficient ecological benefits.

Wetland and Upland Habitat Preservation

Wetland and upland habitat preservation focuses on acquiring and managing coastal wetlands, those in areas of higher population growth, and high quality wetland habitat, while also considering ecologically-associated upland habitats. The primary objective is to protect fish and wildlife habitats, with a secondary objective to improve downstream water quality and habitat functionality. Wetland and upland preservation will allow the Trustees to acquire and/or replace habitats that have been lost or degraded by PCBs in the Lower Fox River and Green Bay.

As part of Alternative 2, wetland and upland habitat preservation goals would continue to be assessed based on acres of habitat preserved using NRDA settlement funds.

Aquatic, Nearshore, and Riparian Habitat Improvement

The overarching objectives of A/N/R category are to increase healthy habitats available for wildlife and fisheries by improving water quality. This restoration category includes many types of projects that have inter-related benefits to fisheries, water quality, wildlife restoration, and ecological health. Experience implementing restoration projects within this category has led the Trustees to include a broader suite of restoration objectives and techniques than the original "aquatic, nearshore, and riparian restoration" category as defined in the 2003 RP/EA. Enhancement, restoration, and preservation of aquatic and nearshore wetlands and riparian habitats is preferred. A/N/R may encompass habitat restoration within Fox River tributaries, enhancement of migratory bird and waterfowl nesting habitat, and actions to improve water quality by reducing runoff from urban and agricultural lands. Projects implemented to benefit specific natural resources (e.g., migratory birds and waterfowl) will also benefit aquatic and riparian habitats, leading to accrued benefits in water quality and habitat functionality.

As part of Alternative 2, aquatic, nearshore, and riparian habitat improvement (A/N/R) goals would continue to be assessed based on acres of habitat restored using NRDA settlement funds.

Fishery Resource Enhancements

As described in the 2003 RP/EA, the fisheries enhancement restoration category includes hatcheries, stocking and rearing, as well as projects to specifically benefit fish species and the healthy habitats necessary for reproduction and survival of fish populations. These types of restoration projects will be a continued Trustee focus and are viewed as long-term solutions to rebuilding fishery populations, achieving self-sustaining fisheries, and maintaining top predators as part of a balanced fish community. Fisheries restoration will likely include the rehabilitation of top predators through stocking efforts, which may subsequently assist in stabilizing fluctuations of predators and prey within aquatic ecosystems in the Fox River and Green Bay. For example, predators in sufficient numbers may deter invasive species from continued geographical expansion, and in this way may enhance ecosystem diversity and native species abundance. Additionally, projects that provide infrastructure as habitat for various life stages of fish species may increase the abundance of native species and the likelihood of survival for fish that enter the system from a hatchery or stocking effort. These ecological benefits will not directly address the presence of PCBs in the system, but will lower the additional stressors to the system and allow fisheries to recover more quickly once PCBs have been fully remediated and attenuated. Addressing fish consumption advisories by increasing the availability of uncontaminated fish for consumption is also an objective of this category.

As part of Alternative 2, fishery resource enhancements would be evaluated based on the extent to which projects, together, achieve self-sustaining fish populations and a healthy fish community. The metric for this restoration category would continue to be the amount of NRDA settlement funds directed toward this goal.

Public Use Enhancements

The public use enhancement category may be shifted slightly from the 2003 RP/EA to place enhanced emphasis on public use projects that have a nexus to fishery resources. Moving forward, the Trustees envision the main focus of this category will be to provide access to fisheries, such as installing or rehabilitating boat ramps and fishing piers, rather than conducting trail restoration or other land-based projects. In this way, projects will closely address the injured natural resources and human use losses stemming from fish consumption advisories.

The presence of PCBs has impaired certain ecological functions that are not addressed through public use enhancements; however, certain high-quality educational projects, such as signage, kiosks, or other installations that promote education about the Lower Fox River and Green Bay, and its ongoing achievements in ecological restoration, may also be considered. Consistent with the 2003 RP/EA, the Trustees support public use enhancements that divert high-intensity activities away from ecologically-sensitive areas and protect the integrity of sites undergoing ecological restoration (e.g., away from projects funded in the A/N/R or fisheries enhancement restoration categories).

As part of Alternative 2, public use enhancements would be measured against the Trustees' original goal to utilize less than 10 percent of available settlement funding for public use enhancement projects.

6.1.3 ALTERNATIVE 3: UPDATED NATURAL RESOURCE-BASED RESTORATION

Alternative 3, "Updated Natural Resource-Based Restoration," retains three of the restoration categories defined in the 2003 RP/EA. In contrast to Alternative 2, Alternative 3 reconsiders the type of habitats that are prioritized for on-the-ground restoration, and evaluates and updates the goals for each restoration category. Given the achievements to-date in wetland and upland habitat preservation and restoration, Alternative 3 re-focuses future efforts on the following restoration categories: aquatic, nearshore, and riparian habitat improvement; fishery resource enhancements; and outdoor public use enhancements. The ecological objectives and restoration techniques considered within these categories are revised from the 2003 RP/EA to best reflect the current ecological landscape.

The restoration objectives for the fishery resource enhancement and outdoor public use categories are similar to those considered in Alternative 2. For aquatic, nearshore, and riparian habitat improvement, Alternative 3 includes a stronger focus on preservation of aquatic, nearshore, and riparian habitats that would specifically benefit injured resources within the Lower Fox River and Green Bay restoration area.

Restoration goals and associated metrics for this Alternative are defined based on factors such as continued progress toward initial restoration goals, finality of funding, availability of suitable projects, nexus with injured resources, project costs, Trustee preferences for achieving additional gains in ecological restoration and human use enhancements, and the current status of conservation initiatives in the Great Lakes. Taking into consideration the factors that have changed the restoration landscape over the past 10 years (see Chapter 4), the Trustees propose slightly revised categories that are associated with new targeted goals. Therefore, in contrast to Alternative 2, the scale of restoration that can be achieved under Alternative 3 is, by definition, achievable with the current settlement funds.

6.1.4 ALTERNATIVE CONSIDERED, BUT NOT PURSUED: LANDSCAPE SCALE NATURAL RESOURCE RESTORATION

With Alternative 4, "Landscape Scale Natural Resource Restoration," the Trustees considered a broader approach to continued restoration in the Lower Fox River and Green Bay. Alternative 4 defined a single restoration category distinct from those defined in the 2003 RP/EA and emphasized a high-level conservation goal consistent with restoration of the Lower Fox River and Green Bay, specifically, either enhancement of fisheries and fish populations, or enhancement of water quality throughout the watershed. The ecological objective could have been the recovery of a particular fish species or species group, or a decrease in a parameter that causes degraded water quality. The corresponding range of actions that specifically addresses the category's restoration

objective would have been based on the current restoration landscape, the priorities and preferences of Trustees, the ten years of progress made through NRDA restoration efforts, and the availability of funding. Restoration goals would have ensured that benefits to natural resources retain a nexus with those resources and resource services that were injured due to PCB releases in Lower Fox River and Green Bay.

Increasing investment in conservation initiatives and ecological restoration in the Great Lakes over the past decade provide an opportunity for the Trustees to consider the broader context for continued NRDA restoration. In developing Alternative 4, the Trustees took a broader approach to revising restoration goals as well as the geographic area for restoration. The Trustees considered the benefits of such an approach, such as the potential synergistic gains from focusing NRDA restoration on a specific conservation issue that is also the target of broader ongoing efforts, and deliberated whether Alternative 4 was warranted in addition to Alternatives 2 and 3, which utilize the groundwork from the 2003 RP/EA. The Trustees concluded that:

- Synergistic benefits could be achieved by Alternatives 2 and 3,
- Alternatives 2 and 3 would more fully reflect the restoration progress since 2002, and
- The Trustees desired more varied options for defining the restoration categories, goals, and individual project objectives than a single watershed-wide restoration alternative would allow.

Thus, Alternative 4 is not pursued further.

6.2 SUMMARY

Restoration in the Lower Fox River and Green Bay is expected to continue with the settlement funds received in 2015. This chapter provides context for how the Trustees will select an updated preferred alternative (Alternative 3) by describing three restoration alternatives, including the restoration categories and types of expected projects that may fall within a category. The Trustees identify one additional alternative, "Landscape Scale Natural Resource Restoration," that is not pursued further. Instead, the Trustees focus on Alternatives that maintain consistency with previous restoration planning documents (e.g., RCDP 2000, RP/EA 2003) and focus more specifically on injured habitats and resources within the Lower Fox River and Green Bay restoration area. The Trustees evaluate the environmental consequences of the three restoration Alternatives, and identify their preferred restoration Alternative, in Chapter 7.

CHAPTER 7 | ENVIRONMENTAL CONSEQUENCES AND PREFERRED NRDA RESTORATION ALTERNATIVE

The Trustees' primary goal in this chapter is to identify an updated restoration alternative that compensates the public for natural resource injuries and associated losses resulting from PCB releases along the Lower Fox River and into Green Bay. Given the identification and evaluation of revised restoration alternatives, this chapter assesses the environmental consequences of each alternative to determine whether implementation of any of the alternatives may significantly affect the quality of the human environment, particularly with respect to the physical, biological, socio-economic, or cultural environments of the Lower Fox River and Green Bay. In combination with Chapters 5 and 6, this chapter evaluates all pertinent information on environmental consequences and serves as a draft environmental assessment (EA) for the Lower Fox River and Green Bay NRDA.

The Trustees use the evaluation of net environmental consequences, in combination with Trustee priorities, restoration progress to-date, the availability of funding, and the relevant conservation landscape within northeastern Wisconsin to identify an updated preferred restoration alternative. Beginning in Section 7.2 the Trustees outline the details of the Preferred Alternative, including the anticipated restoration categories, objectives, and goals, as well as considerations for updating project selection criteria under the Preferred Alternative.

7.1 ASSESSMENT OF ENVIRONMENTAL CONSEQUENCES

In order to ensure the appropriateness and acceptability of the proposed restoration alternatives, the Trustees evaluated each alternative against a suite of restoration criteria. Ten factors are listed within the NRDA regulations as considerations when evaluating a preferred alternative (43 C.F.R § 11.82(d) (2016)):

- Technical feasibility,
- The relationship of the expected costs of the proposed actions to the expected benefits from the restoration, rehabilitation, replacement, and/or acquisition of equivalent resources,
- Cost effectiveness,
- The results of actual or planned response actions,
- Potential for additional injury resulting from the proposed actions, including long-term and indirect impacts, to the injured resources or other services,
- The natural recovery period,

- Ability of the resources to recover with or without alternative actions,
- Potential effects of the action on human health and safety,
- Consistency with relevant federal, state, and tribal policies, and,
- Compliance with applicable federal, state, and tribal laws.

Additionally, actions undertaken to restore natural systems are expected to have beneficial and/or adverse impacts to the physical, biological, socio-economic, and cultural environments. In the analysis below, the Trustees examine the likely beneficial and adverse impacts of each restoration alternative on the quality of the human environment. Given the similarity of Alternatives 2 and 3 to the 2003 Selected Alternative, "Natural Resource-Based Restoration Within and Beyond the Assessment Area," the expected impacts mirror those described in the 2003 RP/EA. If the Trustees conclude that the actions associated with the updated preferred alternative will not lead to significant adverse impacts, then the Trustees will issue a finding of no significant impact (FONSI). If significant impacts are anticipated, the Trustees will proceed with an environmental impact statement (EIS) to delineate the extent of adverse impacts and outline a plan for using best management practices to mitigate those impacts. The Trustees will continue to evaluate environmental impacts as specific projects are implemented under this Update. The following sections and Exhibit 7-1 evaluate anticipated environmental consequences of the restoration alternatives in light of the ten NRDA factors listed above.

7.1.1 ALTERNATIVE 1: NO ACTION

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

Evaluation of Alternative 1

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

- Does not restore injured resources to baseline. Remediation is expected to include years of monitoring after sediment removal actions are completed, but lack of restoration beyond remedial actions will reduce the potential for resources to fully recover to baseline conditions.
- Does not compensate the public for interim losses. Habitat quality would not be improved above baseline, wildlife would still exhibit biological injuries from PCBs, recreational fishing and boating opportunities would not increase, and no additional recreational opportunities would be available to the public.
- Is not consistent with federal, state, and tribal policies and laws. Under this Alternative, the available settlement monies that are meant to be directed toward NRDA restoration actions would not be spent in that manner.

While the No Action Alternative does not *create* additional adverse impacts to the environment, it also does not provide the ecological and socio-economic benefits described in the other alternatives. Given the long time frame until natural attenuation of PCBs is achieved after sediment removal actions conclude, under the No Action Alternative, adverse environmental consequences from PCBs (i.e., ecological and human use injuries) are expected to continue into the future and would not be mitigated through restoration actions. Therefore, the No Action Alternative may result in adverse impacts to migratory birds and other wildlife and habitats such as wetlands, due to the lack of additional habitat provided through restoration and/or preservation actions in the Lower Fox River and Green Bay. Therefore, the No Action Alternative is not a favorable restoration alternative when evaluated against the NRDA factors. This Alternative serves as a point of comparison to determine the context, duration, and magnitude of environmental consequences resulting from the implementation of other Alternatives (Exhibit 7-1).

7.1.2 ALTERNATIVE 2: NATURAL RESOURCE-BASED RESTORATION WITHIN AND BEYOND THE ASSESSMENT AREA

Alternative 2, "Natural Resource-Based Restoration Within and Beyond the Assessment Area" is based on the 2003 RP/EA Selected Alternative, with a single update to the restoration categories that are encompassed. Due to the fulfillment of the wetland and upland restoration goal (Exhibit 3-2), the Trustees prefer to focus on the other categories that have not yet achieved the restoration goals set in the 2003 RP/EA: wetland and upland habitat preservation; aquatic, nearshore, and riparian habitat improvement; fishery resource enhancements; and outdoor public use enhancements. Thus, wetland and upland restoration is no longer a focus under Alternative 2.

Evaluation of Alternative 2

To provide a direct comparison to Alternative 1, the Trustees evaluated Alternative 2 for consistency with the DOI NRDA restoration factors, provision of natural resource services at or above baseline, compliance with relevant regulations, and net environmental consequences (Exhibit 7-1).

First, Alternative 2 is consistent with the restoration factors outlined in the NRDA regulations. For example, habitat and wildlife restoration and public use projects within the Lower Fox River and Green Bay restoration area are technically feasible, cost effective, and will be specifically targeted to benefit multiple, relevant natural resources that utilize aquatic and associated upland habitat. The Trustees plan to apply methods that have been successful in other locations to increase the probability of project success, building on remedial actions completed to-date.

Second, projects under Alternative 2 have the potential to compensate the public for natural resources injuries by providing additional, similar services in the future. Projects may either allow resources to more rapidly achieve baseline, or may improve resource conditions such that the habitat or resource provides services above and beyond baseline.

For example, habitat creation and restoration activities provide natural resource services similar to the assessment area's baseline services. Restored wetlands and riparian areas provide habitat for spawning fish and migratory birds, improve water quality by filtering sediments and pollutants from the water column, reduce erosion, and export detritus. These actions influence increased production of forage fish populations, which provide prey for piscivorous fish, birds, reptiles, and mammals. Preservation actions such as land acquisition and conservation easements protect ecologically important habitat from current and future land development. Restoration of wetland, upland, and riparian habitats has the potential to increase habitat connectivity throughout the restoration area, which is important in providing ecological services similar to those lost.

Finally, the cumulative environmental consequences of Alternative 2 are expected to be beneficial to natural resources. The anticipated beneficial impacts of Alternative 2 are similar to those described for this Alternative (Alternative C) in the 2003 RP/EA and, are thus incorporated by reference (RP/EA 2003; Exhibit 7-1). Examples of benefits to the Lower Fox River, Green Bay, and surrounding areas include: increased abundance, diversity, and accessibility of fishery resources; improved water quality through projects that reduce runoff, erosion, and sedimentation; increased habitat and food resources for migratory birds and other wildlife; improved quality and quantity of productive wetland habitat in the Lower Fox River and Green Bay; and enhanced wetland, upland, and other ecosystem services within with restoration area.

Project-related adverse environmental effects are expected to be short-term and localized, similar to the environmental consequences outlined in the 2003 RP/EA. Examples of possible adverse impacts include: disturbance of sediments, benthic habitat, shipwrecks, or archaeological resources; initial reductions in water quality due to upstream soil and/or sediment disturbance; and increased noise and human presence in sensitive habitats during on-the-ground restoration and installation and/or enhancement of recreational facilities. The Trustees will ensure that any public use projects will complement the water quality and fisheries goals, avoiding impacts that are in opposition to ecological goals. Adverse impacts to environmental justice and/or socio-economic factors are expected to be minimal and may be mitigated during project selection. Any unavoidable adverse impacts will be minimized through individual project plans, and are expected to be far outweighed by the beneficial impacts of projects under this Alternative.

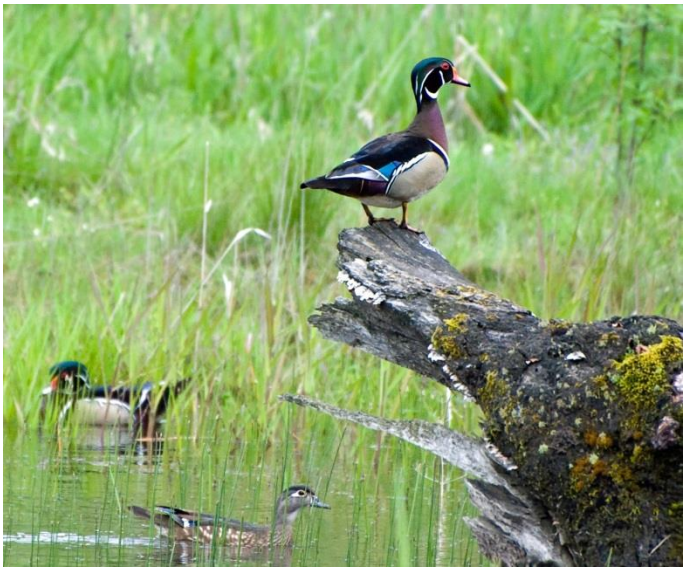
Additional scoping and, as needed, additional NEPA analyses will be conducted for any future restoration or preservation project that does not meet reasonable expectations of low environmental impact. Project-specific NEPA documents, based on the Update and 2003 RP/EA, will be generated as needed. The Trustees will monitor to ensure that adverse impacts from project-specific actions are offset by project benefits to the physical, biological, socio-economic, and cultural environments. Therefore, the Trustees consider Alternative 2 a viable alternative.

7.1.3 ALTERNATIVE 3: UPDATED NATURAL RESOURCE-BASED RESTORATION

Alternative 3, "Updated Natural Resource-Based Restoration" revises the restoration categories and priority habitats and resources included in the 2003 RP/EA Selected Alternative to account for restoration progress, environmental conditions within the restoration area, and Trustee restoration priorities. Due to the fulfillment of the wetland and upland restoration goal, and significant progress in wetland and associated upland habitat preservation (Exhibit 3-2), the Trustees prefer to focus on the remaining three restoration categories: aquatic, nearshore, and riparian habitat improvement; fishery resource enhancements; and outdoor public use enhancements. Thus, wetland and upland preservation and restoration are no longer a focus under Alternative 3.

Evaluation of Alternative 3

As part of the Trustees' evaluation of this alternative, they determined that the ecological and human use projects encompassed within Alternative 3 have the potential to compensate the public for injuries to natural resources and associated ecological services. All restoration actions considered within Alternative 3 are consistent with those outlined as part of Alternative 2, and each potential action considered here would incur the same environmental consequences that are outlined in the Alternative 2 evaluation (Exhibit 7-1). The main difference is that Alternative 3 focuses on aquatic, nearshore, and riparian habitats, as opposed to Alternative 2 which also focuses on wetland and associated upland habitat preservation. The smaller number of habitat types considered under Alternative 3 concentrates the direct and indirect ecological benefits of each project for resources and habitats that the Trustees have identified as priorities. Therefore, this Alternative is more likely to result in enhanced benefits to priority resources that have a closer nexus to injury, as opposed to resources in wetland and associated upland habitats that are farther removed from the assessment area.[21] Alternative 3 results in greater ecological and human use benefits, concentrated in habitats that continue to be injured by PCBs released along the Fox River, and is therefore more likely than the other Alternatives to satisfy the Trustees' ultimate ecological goals of improved water quality and fishery enhancements. The focus on a smaller number of habitats may have adverse impacts from conducting on-the-ground restoration in concentrated areas (e.g., increased



Wood ducks (WDNR)

21 Restoration projects farther from injured resources and habitats have been a focus of restoration actions to-date.

noise disturbance, increased human presence), thus creating the same type of environmental impacts as the other alternatives but spread over fewer locations. However, Alternative 3 provides the greatest benefits and the least environmental impacts because the magnitude of expected ecological benefits outweighs those expected with Alternatives 1 or 2, while the magnitude of adverse impacts remains small in comparison to the expected ecological and human use benefits. Through careful project planning and utilization of recognized best management practices, the Trustees will monitor that any adverse impacts are offset by project benefits to the physical, biological, socio-economic, and cultural environments. Therefore, the Trustees consider Alternative 3 a viable alternative.

7.2 IDENTIFICATION OF THE UPDATED PREFERRED ALTERNATIVE

To identify the updated preferred alternative, the Trustees evaluated the following for each Alternative (Exhibit 7-1):

- Expected benefits,
- Nexus of benefits to the original injury,
- Consistency with the 2003 RP/EA and the feedback received in the public process,
- Satisfaction of factors outlined within NRDA regulations,
- Likelihood of providing additional natural resource services to achieve or exceed baseline conditions,
- Ability to achieve restoration goals, and
- Anticipated environmental consequences (Exhibit 7-1).

In addition to these characteristics, the Trustees prefer that the alternative account for, and be able to accommodate, changes in the affected environment (e.g., shifts in environmental and socio-economic conditions), changes to the conservation landscape caused by additional stressors (e.g., climate change, invasive species), lessons learned conducting on-the-ground restoration, and remaining ecological priorities based on restoration achievements from 2001-2014.

Based on the evaluation of these alternatives, the Trustees identified Alternative 3 as their preferred restoration alternative. The Trustees believe that Alternative 3, in combination with all of the NRDA restoration undertaken to-date, 1) compensates the public for the ecological and human use losses resulting from PCB releases, 2) is consistent with the requisite factors and considerations such as project feasibility, consistency with applicable policies and laws, 3) maintains consistency with the original restoration preferences identified through the public process, and 4) will lead to the greatest long-term benefits to the environment while causing the least adverse environmental impacts. When compared to the other alternatives, Alternative 3 is achievable with the new goals set by Trustees, provides the greatest focus on original restoration goals that have not yet

been achieved, and focuses on restoration of aquatic, nearshore, and riparian habitats that will likely have increased downstream benefits for water quality and fisheries than what is possible under the other alternatives.

EXHIBIT 7-1 COMPARISON OF ALTERNATIVES

PARAMETER	ALTERNATIVE 1 (NO ACTION)	ALTERNATIVE 2 (THE 2003 RP/EA SELECTED ALTERNATIVE)	ALTERNATIVE 3 (UPDATED NATURAL RESOURCE-BASED RESTORATION)
ASSISTS IN RESTORING RESOURCES TO BASELINE	NO	YES	YES
COMPENSATES FOR INTERIM LOSSES	NO	YES	YES
IS CONSISTENT WITH FEDERAL, STATE, AND TRIBAL POLICIES AND LAWS	NO	YES	YES
SATISFIES NRDA RESTORATION FACTORS	NO	YES	YES
GOALS ARE ACHIEVABLE WITH AVAILABLE FUNDS*	NO	NO	YES
EXPECTED IMPACTS ON THE HUMAN ENVIRONMENT**	NO ADVERSE OR BENEFICIAL IMPACTS	SOME ADVERSE IMPACTS THAT ARE OUTWEIGHED BY BENEFICIAL IMPACTS	SOME ADVERSE IMPACTS THAT ARE GREATLY OUTWEIGHED BY BENEFICIAL IMPACTS

Notes:
* Alternative 1 does not set restoration goals, and therefore, would not utilize NRDA settlement funds in the intended manner. The goals associated with Alternative 2 are not achievable because the scope of restoration envisioned in the RCDP and 2003 RP/EA exceeds the amount of total NRDA restoration funding.
** Alternative 3 is expected to have the greatest beneficial environmental impacts and the least adverse environmental impacts as compared to Alternatives 1 and 2.

7.3 SUMMARY OF THE UPDATED PREFERRED ALTERNATIVE

Alternative 3, "Updated Natural Resource-Based Restoration," retains much of the same intent of the 2003 selected restoration alternative ("Natural Resource-Based Restoration Within and Beyond the Assessment Area") while allowing the Trustees to define new, achievable goals that more closely reflect the progress in certain restoration categories, the current environmental and social conditions in the Lower Fox River and Green Bay, the availability of certain types of projects, and the amount of funding available to restore injured natural resources. Alternative 3 focuses on restoration and preservation actions that target improvements to water quality and fisheries as well as actions to improve access to fishery resources. To achieve this Alternative, the Trustees updated the goals for the three associated restoration categories and the project selection criteria used to evaluate future restoration projects. The updated goals and criteria are described below.

7.3.1 UPDATED RESTORATION GOALS

In the context of Alternative 3, the Trustees set new restoration goals for the three priority restoration categories, while maintaining consistency with the previously-defined goals discussed in the 2003 RP/EA. In order to set new goals, the Trustees considered the following:

- The ecological and human use compensation that would be needed to fully achieve the 2003 RP/EA goals,
- Restoration and remedial progress to-date,
- Trustee restoration priorities,
- Updated project costs based on restoration accomplished to-date,
- Available funding, and
- The changing landscape of the Lower Fox River and Green Bay.

The overarching ecological and/or human use objectives for each restoration category directly inform the associated restoration goal, in terms of both the metric used to assess progress and the amount of progress the Trustees expect to achieve. Ultimately, the Trustees identified qualitative goals for each restoration category (Exhibit 7-2) to reflect the widespread benefits expected to water quality and fishery resources. The Trustees also identified a quantitative ecological goal to measure progress in aquatic, nearshore, and riparian restoration (i.e., 2,100 acres restored), and a quantitative metric to use no more than ten percent of available funding for public use improvements to increase public access to fishery resources. The qualitative goal related to fishery enhancements is modified from the 2003 RP/EA to include more specific parameters that could be measured to assess progress (e.g., diversity and sustainability of fish populations). The goals in Exhibit 7-2 reflect the remaining restoration necessary to compensate the public for PCB-related injuries to natural resources in the Lower Fox River and Green Bay. The Trustees believe that these updated goals are achievable with the available settlement funds.

EXHIBIT 7-2 RESTORATION GOALS UNDER THE PREFERRED ALTERNATIVE, "UPDATED NATURAL RESOURCE-BASED RESTORATION"

RESTORATION CATEGORY	GOALS
AQUATIC, NEARSHORE, AND RIPARIAN RESTORATION	Improved water quality and aquatic, nearshore, and riparian habitat health
FISHERIES ENHANCEMENTS	Enhanced diversity and sustainability of fish populations
PUBLIC USE IMPROVEMENTS	Increased public access to fishery resources

7.3.2 PROJECT SELECTION CRITERIA

The project selection criteria within the 2003 RP/EA provide a detailed framework for accepting and then ranking proposed restoration projects (see Section 2.2). In developing those criteria, the Trustees sought to maximize the scope of ecological and social, including cultural, benefits gained through restoration actions as well as the time over which project benefits accrue. Given the updated preferred alternative and a greater focus on specific habitats and types of restoration, the Trustees also refined the project selection criteria.

Moving forward, each potential restoration project will be evaluated against the criteria outlined below, and, if needed, additional NEPA documentation will be prepared. The Trustees will ensure that projects will comply with additional compliance laws, such as Section 7 of the Endangered Species Act and Section 106 of the National Historic Preservation Act.

Updated Criteria

The Trustees do not envision any changes to the "acceptability criteria" from the 2003 RP/EA, which serve as an initial screening process to ensure that the project provides a substantive link to injured resources. These include the following:

- The project complies with applicable laws, policies, and regulations;
- The project addresses Lower Fox River and Green Bay injured natural resources; and,
- The project is technically feasible.

However, the Trustees envision the following changes to the ranking criteria, which reflect Trustee requirements and priorities for NRDA restoration projects. Future restoration projects will be evaluated against the criteria outlined below.

- *Focus criteria* include:
    - On-site restoration (within or adjacent to the affected environment), which is preferred to projects further upstream. Specifically, the Trustees propose the following geographic priorities:
        - A/N/R improvements focused in Green Bay coastal wetlands and islands; Green Bay tributaries (both east and west shore); Rush Lake area; the Pool Lakes; Wolf River and associated bottomlands; Duck Creek and tributaries; and the Fox River and Green Bay Area of Concern.
        - Fisheries enhancements focused along the 39 miles of the Lower Fox River; tributaries to the Lower Fox River and Green Bay up to the first impoundment; Green Bay; and the Pool Lakes, Wolf River, Oneida and Menominee Reservations.
        - Public use enhancements focused along the 39 miles of the Lower Fox River; in tributaries to the Lower Fox River and Green Bay up to the first impoundment; along the shores of Green Bay; and within the Oneida and Menominee Reservations.
    - Addresses restoration of preferred resources, including aquatic, nearshore, and riparian habitats, fish communities, state and federal rare, threatened or endangered species, and native species. Specifically, the Trustees propose the following wildlife and fisheries priorities to be considered:
        - Aquatic or wetland-dependent species, particularly those potentially affected by contaminants in the system. This includes colonial-nesting waterbirds, piscivorous raptors and furbearers, waterfowl, and threatened and endangered species. Sites that provide both breeding and foraging opportunities for colonial nesting waterbirds within the watersheds of the Fox and Wolf Rivers and other wetland dependent birds will receive higher scores in this category.
        - Fish species including Lake sturgeon, Great Lakes spotted musky, cisco, northern pike, yellow perch, bass, and pan fish. Actions that provide coastal and tributary spawning and rearing habitat, native aquatic submerged and emergent vegetation communities, and self-sustaining native fish populations will receive higher scores in this category.

- *Implementation criteria* include:
    - Benefits can be measured and monitored for success.
    - Project uses established, reliable methods/technologies known to have a high probability of success.
    - Project has additional contributions from conservation partners, including in-kind donations, matching funds, and technical expertise.
    - Project is cost effective, including the amount of funds expended for planning, implementation, and long-term operation; and the project is well planned, including consideration of maintenance and monitoring costs into the future.
    - Project is consistent with tribal, federal or state priorities, policies, missions, goals, and planning. Project proposal considers all relevant natural resource plans.
- *Benefits criteria* include:
    - Project provides the greatest scope of ecological, cultural, and economic benefits in terms of both areal extent and time frame over which benefits accrue. Collaborative partnerships that extend the scope of benefits are preferred.
    - Project provides ecological and human use benefits, within the scope of the preferred alternative, that otherwise have insufficient funding and demonstrated a need for NRDA restoration dollars.
    - Project provides measurable benefits to cultural resources and allows for increased cultural practices within the restoration area.
    - Project appropriately considers environmental justice and does not cause disproportionate, adverse impacts to a specific location or group.

7.3.3 LEGAL COMPLIANCE

To ensure that future restoration actions comply with environmental statutes and authorities, including NEPA, the Trustees will consult the recommended regulations to the fullest extent possible (see 40 CFR § 1500.2 and 1502.25). This includes, but is not limited to the following:

Endangered Species Act – Section 7 (16 USC 1531-1544)

Threatened, endangered, and special status species are considered in other sections of this document. This Update is the first step in a consultation process pursuant to Section 7 of the Endangered Species Act (ESA), which will focus on threatened and endangered

species (listed in Appendix D), with increased focus on those species listed since the 2003 RP/EA was published.

National Historic Preservation Act (16 USC 470)

The 2003 RP/EA was provided to the State Historic Preservation Officers and Tribal Historic Preservation Officers as part of the public review and comment process. Regulations are described in 36 CFR Part 800. Any future projects will include the appropriate consultation with State and Tribal Historic Preservation Officers.

Clean Water Act (33 USC 1251)

Any applicable statutes from the Clean Water Act will be considered before any potential future projects are implemented. The Lower Fox River currently has an active total TMDL approved by the EPA for total suspended solids and total phosphorus. By definition, projects considered for restoration under this NRDA would lead to long-term beneficial impacts on the water resources of the Lower Fox River and Green Bay by aiding the prevention of point and non-point source pollution and supporting the continued integrity of riverine, aquatic, and wetland habitats.

Data Quality Act (Public Law 106-554)

As a federal agency and natural resource Trustee, the FWS will follow all applicable statutes to ensure and maximize the quality, objectivity, utility, and integrity of the data and information produced from any potential future restoration projects, as well as follow any guidelines issued by the FWS pursuant to the requirements of the Data Quality Act of 2002.

Coastal Zone Management (CZM) Act (16 USC 1451-1465)

The Trustees will follow any applicable statutes concerning the current state of the coast and Great Lakes, and will coordinate with state-level CZM representatives to ensure project goals are consistent with CZMA goals that enhance coastal and aquatic resources.

Magnuson-Stevens Fishery Conservation and Management Act – Essential Fish Habitat (Public Law 94-265)

The Trustees will ensure that future restoration, rehabilitation, and public use projects comply with applicable statutes within this law, including provisions for protecting essential fish habitat.

7.4 COMPLETION OF RESTORATION

In developing this Update, the Trustees acknowledge the substantial progress toward ecological and human use restoration goals since NRDA restoration projects were first initiated within the Lower Fox River and Green Bay. Together, the restoration achievements to-date, the Trustees' experience conducting on-the-ground restoration, the availability of new settlement funds, the close of the NRDA claim, the increase in related conservation initiatives in northeastern Wisconsin, and the changing landscape of the Lower Fox River and Green Bay warrant an update to the preferred restoration alternative

to thoughtfully guide and plan future restoration efforts. Such restoration is expected to compensate the public for PCB-related injuries to the habitats, wildlife, and cultural and recreational uses within and adjacent to the Lower Fox River and Green Bay.

Moving forward, the Trustees propose to conduct restoration focusing on sensitive aquatic, nearshore, and riparian habitats, as well as fishery resources, to ultimately improve water quality and fisheries within the entire restoration area. The Trustees also propose to implement projects that increase opportunities for the public to benefit from an enhanced fishery in the Lower Fox River and Green Bay system. The Trustees set new restoration goals that are achievable with available funds, and developed updated project selection criteria to reflect new goals and address geographic, species-specific, and cultural priorities for future restoration in the Lower Fox River and Green Bay. Partnerships have played a strong role in Fox River NRDA restoration accomplishments and the Trustees intend to continue to build upon those successes as they implement future restoration. The public has also played a substantial role throughout the restoration process, and the Trustees will continue to inform the public of restoration project plans and progress toward ecological and recreational goals in the future.

CHAPTER 8 | MONITORING

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

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

This chapter outlines a general approach and framework that will guide future restoration projects in the Lower Fox River, Green Bay, and the associated restoration area.

8.1 FOX RIVER NRDA MONITORING FRAMEWORK

The Trustees have outlined a monitoring framework common to all future restoration projects. In general, comprehensive evaluation of restoration is scarce, and thus, future restoration within the Lower Fox River and Green Bay presents an opportunity to utilize a standard monitoring framework to collect data that will inform the ongoing project success (Kondolf and Micheli 1995; Roni 2005). Ultimately, the outcomes of restoration projects, as determined through monitoring data, will assist the Trustees in determining the best ecological techniques and the most appropriate geographical locations in which to focus projects.

Monitoring plans will be guided by standard performance criteria, or measures that assess the progress of restoration sites toward project goals and may be compared across projects. In this way, the Trustees will be able to determine which project attributes are not on target, and what actions and course corrections are needed to achieve project success. Monitoring information may also be used by the Trustees as an outreach tool to illustrate to the public continued success over time (quantitatively and qualitatively).

Support for future restoration-based programs may increase due to increased public outreach (Roni 2005).

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

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

Exhibit 8-1 is an example of a generic monitoring framework that the Trustees will utilize for each identified restoration project. The following are components of a project-specific monitoring plan: the details of the monitoring action outlined in a step-wise manner, the performance standards, the organization or person responsible for monitoring, and the associated schedule and timing of monitoring actions.

EXHIBIT 8-1 GENERAL MONITORING FRAMEWORK

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

8.2 ADAPTIVE MANAGEMENT

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

For example, a spawning bed may be restored for a specific fish species, but without effective monitoring data it will not be possible to determine if the targeted fish is using the newly restored habitat, or if the habitat is sufficiently restored. Using monitoring data about the actual use of the habitat, the project may be adapted to try a different approach that increases fish utilization of the spawning bed.

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

8.3 GUIDANCE FOR FUTURE PROJECTS

The Trustees will prepare a publicly-available document that describes, in greater detail, a standard monitoring and adaptive management framework for the Lower Fox River and Green Bay NRDA. In that document, the Trustees will provide information on performance standards, approaches to monitoring, and data management considerations. Information will be directly relevant and specific to the types of restoration encompassed within the alternative that is ultimately selected in the final version of this Update. The Trustees plan to efficiently allocate monitoring funds on a project-specific basis to ensure that a relevant and cost effective type of monitoring is chosen for each project.

Originally part of the John Muir family farm; parcel acquired through Fox River NRDAR (NHLT).

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APPENDIX A | RESTORATION PARTNERS

FEDERAL

US-Fish and Wildlife Service – Fisheries

US-Fish and Wildlife Service – Partners for Fish and Wildlife

US-Fish and Wildlife Service – Endangered Species

US-Fish and Wildlife Service – Refuges

Pendills Creek National Fish Hatchery

Iron River National Fish Hatchery

Natural Resources Conservation Service

US-Environmental Protection Agency

US-Army Corp of Engineers

US- Geological Survey

US-Forest Service

National Oceanic and Atmospheric Administration

Bureau of Indian Affairs

STATE

MI-Department of Natural Resources – Fisheries Division

MI-Department of Natural Resources – Wildlife Division

MI-Department of Environmental Quality

WI-Department of Natural Resources – Wildlife Program

WI-Department of Natural Resources – Fisheries Program

WI-Department of Natural Resources – Endangered Species Program

WI-Department of Natural Resources – Fish Propagation Program

Wild Rose Fish Hatchery

NATIVE AMERICAN TRIBES

Menominee – Environmental Services Department

Oneida Environmental, Health and Safety Division

Oneida Conservation Department

Oneida Nation Farms

Oneida Division of Land Management

Oneida Department of Public Works

LAND TRUSTS

Door County Land Trust

Northeast Wisconsin Land Trust

Gathering Waters Conservancy

Natural Heritage Land Trust

NOT-FOR-PROFIT ORGANIZATIONS

The Nature Conservancy

Ducks Unlimited

Pheasants Forever

Walleyes for Tomorrow

Wild Ones, Inc.

Baird Creek Preservation Foundation

WI Wetlands Association

Rush Lake Watershed Restoration, Inc.

Natural Resources Foundation of Wisconsin

Ice Age Trail Foundation

Wisconsin Friends of John Muir

The Prairie Enthusiasts

John Muir Chapter Sierra Club

Trout Unlimited

COUNTIES

Brown County Land and Water Conservation Department

Brown County Port and Resource Recovery

Brown County Parks

Outagamie County Land and Water Conservation Department

Oconto County Land Conservation Department

Green Lake County Land Conservation Department

MUNICIPALITIES

City of Neenah

City of Green Bay

City of Green Bay - Parks, Recreation, and Forestry

City of DePere - Parks, Recreation, & Forestry

Town of Menasha

Town of Poygan

Eaton Township

Humboldt Township

Village of Suamico

Village of Howard - Parks Department

Village of Allouez - Parks, Recreation, & Forestry

Village of Ashwaubenon - Parks, Recreation, & Forestry

Village of Bellevue - Parks, Recreation, & Forestry

Village of Kimberly - Parks, Recreation, & Forestry

Town of Pittsfield

SPORTSMAN'S CLUBS

Lake Poygan Sportsman's Club

Green Bay Area Great Lakes Sport-Fishermen Club

Butte des Morts Conservation Club

Brown County Conservation Alliance

OTHERS

UW-Green Bay (Cofrin Center for Biodiversity)

Green Bay Packers

Shedd Aquarium

Green Bay Northeast Wisconsin Lions Club

Purdue University

Ontario Ministry of Natural Resources

Lake Puckaway Protection and Rehabilitation District

Lake Puckaway Association

Chambers Island Landowner Association

Brown County Golf Course

MATCHING FUND PROGRAMS

FEDERAL

US-Fish and Wildlife Service - Program Funds

US-Fish and Wildlife Service - Challenge Cost Share & Cooperative Conservation Initiative

US-Fish and Wildlife Service - Duck Stamp Funds

US-Fish and Wildlife Service Coastal Program

National Fish & Wildlife Foundation Grant

North American Wetlands Conservation Act

US-Environmental Protection Agency

US-Army Corp of Engineers Program funds

US-Forest Service

National Oceanic and Atmospheric Administration - Coastal Grant

Bureau of Indian Affairs Circle of Flight Program

Natural Resources Conservation Service Programs

Great Lakes Restoration Initiative Funds

Migratory Bird Joint Venture Funds

STATE

WI-Department of Natural Resources - Program Funds

WI-Department of Natural Resources - Duck Stamp Funds

WI-Department of Natural Resources - Trail Development Grant

WI-Department of Natural Resources - Knowles-Nelson Stewardship Fund

WI Waterways Commission Grant

WI Coastal Management Fund

Michigan Natural Resources Trust Fund

TRIBAL

Oneida Tribal Funds

Menominee Tribal Funds

OTHERS

Sustain Our Great Lakes

Fund for Lake Michigan

NEW Water

Lake Michigan Fishery Trust

Village of Kimberly

Purdue University

Private Donations and In-Kind Services

APPENDIX B | FUNDED RESTORATION PROJECTS (RPR 2013; FWS PROGRESS REPORTS)[22]

RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Wetland and Upland Habitat Preservation	Land Transfer in the Green Bay West Shores Wildlife Area	$2,512,708	$2,512,708	$0
	Wolf River Basin, Green Bay West Shores, and Door Peninsula Wetlands Habitat Preservation	$9,465,945	$7,852,084	$1,613,861
	Little Tail Point Area Habitat Preservation	$29,724	$9,300	$20,424
	Green Bay West Shores Wildlife Area Wetlands Habitat Preservation	$128,400	$18,720	$109,680
	Wolf River Bottomlands Natural Resource Area Habitat Preservation	$2,800,000	$2,800,000	$0
	Upper Fox River Habitat Preservation	$754,701	$600,000	$154,701
	Little Lake Butte des Morts West Shore Preserves Habitat Preservation	$2,002,875	$1,686,275	$316,600
	Point au Sable Habitat Preservation	$340,787	$155,000	$185,787
	Baird Creek Watershed Habitat Preservation	$575,450	$400,000	$175,450
	Establishment of the Gordon Nauman Conservation Area	$487,525	$487,525	$0
	Mink River, North Bay, Bayshore Blufflands Habitat Preservation	$2,816,058	$1,792,551	$1,023,507
	Little Lake Wildlife Habitat Area Preservation	$1,441,435	$361,190	$1,080,245

[22] Funds are valued in the year of the award and are not updated to 2016 dollar value. Projects listed include completed, new, and on-going projects. Leveraged and total funds may not be available for new projects.

RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Wetland and Upland Habitat Preservation	Detroit Island, Detroit Harbor, Bayshore Blufflands, and Little Lake Habitat Preservation	$1,031,629	$626,000	$405,629
	Detroit Harbor State Natural Area Habitat Preservation	$304,323	$35,300	$269,023
	Garden Bluffs Habitat Preservation	$3,636,892	$1,500,000	$2,136,892
	Waterfowl Habitat Preservation	*	$540,000	*
	Upper Fox River Headwaters Preservation	$895,580	$450,000.00	$445,580.00
Wetland and Upland Habitat Restoration	Oconto Marsh Pump and Water Control Replacement	$64,500	$25,000	$39,500
	Coyote Run Wetlands Restoration	$252,208	$240,000	$12,208
	Wolf River Bottoms Wildlife Area Wetland Restoration	$270,447	$200,000	$70,447
	Fox River National Wildlife Refuge Native Grassland Habitat Restoration	$200,000	$150,000	$50,000
	Fox River National Wildlife Refuge Wetland Restoration	$279,791	$151,291	$128,500
	Uihlein Waterfowl Production Area Habitat Restoration	$748,177	$264,139	$484,038
	Rush Lake Habitat Restoration and Preservation	$970,722	$420,000	$550,722
	Killsnake and Brillion Wildlife Areas Habitat Restoration	$27,042	$14,500	$12,542
	Prairie Restoration for Waterfowl Nesting Habitat Near Wetlands, Waterways, and Rivers	$167,552	$100,000	$67,552
	Outagamie Pump and Pump house Replacement	$69,042	$40,000	$29,042

RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Wetland and Upland Habitat Restoration	Edge of the Woods Wetland Habitat Enhancement in the Duck Creek Watershed	$36,750	$35,000	$1,750
Aquatic, Nearshore, and Riparian Improvements	Lowland Hardwood Forest Protection in Little River, Oconto County	$353,000	$189,000	$164,000
	Pensaukee Marsh Northern Pike Habitat Restoration	$55,154	$30,000	$25,154
	Sensiba Wildlife Area Northern Pike Spawning Area and Waterfowl Enhancement Project	$845,375	$124,500	$720,875
	Northern Pike Habitat Restoration on the Western Shore of Green Bay	$1,000,056	$622,000	$378,056
	South Branch of the Suamico River Stream Restoration	$425,000	$425,000	$0
	West Branch of the Wolf River Habitat Restoration	$95,188	$93,688	$1,500
	Lancaster Brook Habitat Enhancement	$75,807	$30,000	$45,807
	Trout Creek Habitat Preservation	$150,000	$75,000	$75,000
	Duck Creek Watershed Habitat Preservation (Part 1)	$1,920,000	$960,000	$960,000
	Duck Creek Watershed Habitat Preservation (Part 2)	$100,000	$100,000	$0
	Door County Habitat Reforestation	$132,090	$131,530	$560
	South Bay Marina Habitat Enhancement	$120,000	$98,000	$22,000
	Lower Green Bay Purple Loosestrife & Phragmites Control	$100,000	$100,000	$0

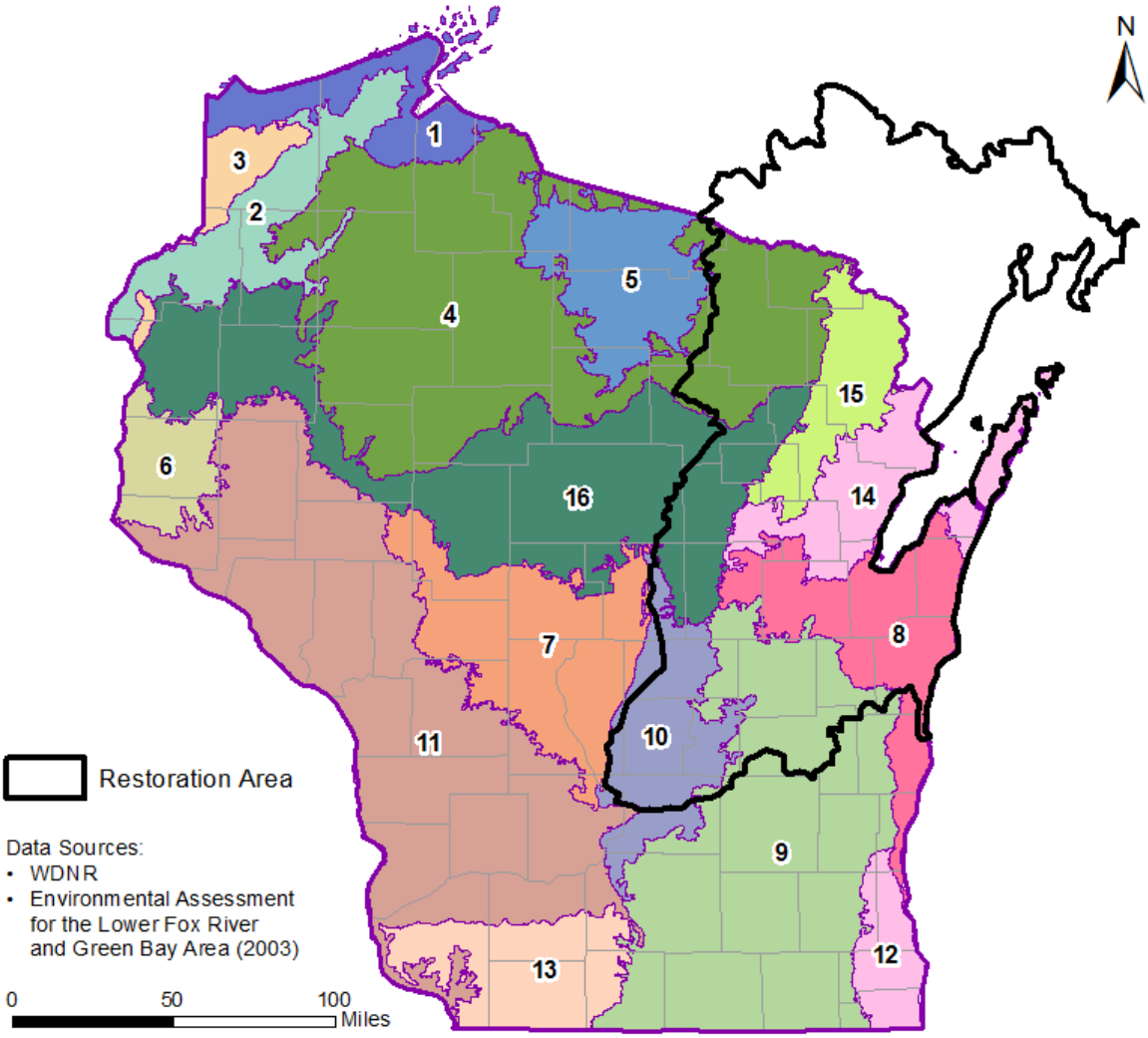
RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Aquatic, Nearshore, and Riparian Improvements	Habitat Restoration in Bay Shore Blufflands and Shivering Sands Preserves	$20,000	$20,000	$0
	Lake Puckaway Aquatic Habitat Enhancement	$23,939	$16,400	$7,539
	Allouez Habitat Protection and Restoration	$500,000	$500,000	$0
	Gilson Creek Glades Reserve Habitat Protection	$236,614	$118,307	$118,307
	Green Bay and Gravel Island National Wildlife Refuge Habitat Management (Part 1)	$358,000	$358,000	$0
	Green Bay and Gravel Island National Wildlife Refuge Habitat Management (Part 2)	$188,000	$188,000	$0
	Cat Island Chain Restoration Project	$18,100,000	$1,100,000	$17,000,000
	Oneida Lake Habitat Creation	$472,000	$472,000	$0
	Wild Rice Reintroduction on the Menominee Indian Reservation	$58,827	$58,827	$0
	Bald Eagle Nesting Habitat Restoration on the Oneida Reservation	$25,269	$18,000	$7,269
	Forster's Tern Nesting Platform Installation in the Green Bay West Shores Wildlife Area	$6,080	$2,400	$3,680
	Forster's Tern Nesting Enhancement Pilot Project on Lake Poygan	$200,792	$200,792	$0
	Common Tern Nesting Habitat Enhancement and Nest Island Construction on Lake Butte des Morts	$126,208	$126,208	$0
	Piping Plover Population Enhancement	$206,698	$21,698	$185,000

RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Aquatic, Nearshore, and Riparian Improvements	Door County Land Preservation	$498,682	$95,200.00	$403,482.00
	Harbor Lights Preserve	*	$103,000	*
	5 Islands Creek Brook Trout Restoration	*	$20,000	*
	Silver Creek Water Quality Enhancement	*	$130,000	*
	Wetland Preservation on the Oneida Reservation	*	$280,000	*
	St. Martin's Island	$1,500,000	$200,000.00	$1,300,000.00
Fisheries Enhancement	Lake Trout Population Enhancement	$1,657,526	$300,000	$1,357,526
	Spotted Musky Population Enhancement	$1,053,270	$715,400	$337,870
	Lake Sturgeon Habitat and Population Enhancement (Part 1)	$42,000	$42,000	$0
	Lake Sturgeon Habitat and Population Enhancement (Part 2)	$149,763	$69,500	$80,263
	Brook Trout Population Enhancement	$113,800	$80,000	$33,800
	Duck Creek Dam Removal and Fish Passage Installation	$119,000	$15,000	$104,000
	Yellow Perch Limiting Factors Analysis	$406,608	$381,108	$25,500
	Bluegill Stocking in Green Bay and the Suamico River	$12,000	$6,000	$6,000
	Wild Rose Fish Hatchery Renovation	$17,757,903	$6,000,000	$11,757,903
	Fisheries Enhancement on Lake Butte des Morts	*	$27,000	*
	Wolf River Trout Enhancement	*	$36,986	*
	Walleye Rearing Pond construction	$61,000	$50,000	$11,000

RESTORATION CATEGORY	PROJECT TITLE	TOTAL FUNDS	NRDA FUNDS	LEVERAGED FUNDS
Public Use	L.H. Barkhausen Waterfowl Preserve Facilities Expansion	$375,000	$375,000	$0
	Leicht Memorial Park Facilities and Porlier Fishing Pier Improvements (Part 1)	$600,000	$600,000	$0
	Leicht Memorial Park Facilities and Porlier Fishing Pier Improvements (Part 2)	$200,000	$200,000	$0
	Ashwuabomay River Trail Construction	$500,000	$500,000	$0
	Brown County Fairgrounds Boat Launch Improvements	$766,000	$766,000	$0
	Allouez Park Development and East River Trail Extension (Part 1)	$214,946	$179,000	$35,946
	Allouez Park Development and East River Trail Extension (Part 2)	$20,000	$20,000	$0
	East River Trail Improvement and Expansion (Part 1)	$220,000	$220,000	$0
	East River Trail Improvement and Expansion (Part 2)	$50,000	$50,000	$0
	Sunset Park Fishing Wharf Construction in Kimberly	$28,690	$12,475	$16,215
	Nature Park Development at the Gordon Nauman Conservation Area	$10,000	$10,000	$0

APPENDIX C | HABITATS WITHIN THE RESTORATION AREA

EXHIBIT C-1 THE ECOLOGICAL LANDSCAPES OF WISCONSIN[23]



[23] The ecological landscapes are: (1) Superior Coastal Plain, (2) Northwest Sands, (3) Northwest Lowlands, (4) North Central Forest, (5) Northern Highland, (6) Western Prairie, (7) Central Sand Plains, (8) Central Lake Michigan Coastal, (9) Southeast Glacial Plains, (10) Central Sand Hills, (11) Western Coulees and Ridges, (12) Southern Lake Michigan Coastal, (13) Southwest Savanna, (14) Northern Lake Michigan Coastal, (15) Northeast Sands, and (16) Forest Transition.

EXHIBIT C-2 SUMMARY OF THE ECOLOGICAL LANDSCAPES OF NORTHEASTERN WISCONSIN

LANDSCAPE	MAP NO.	DESCRIPTION	TYPES OF HABITATS	EXAMPLE SPECIES
Central Sand Hills Landscape	10	This landscape has a mixture of farmland, woodlots, wetlands, small kettle lakes, and cold-water streams. Forested areas are largely oak-hickory. The landscape is primarily agricultural, despite dry, sandy soils.	• Dry forest • Oak savanna • Wetlands and marshes • Surrogate grassland • Floodplain forest • Large rivers • Cold water streams • Coastal plain marsh	• Pileated woodpecker • Red-headed woodpecker • Scarlet tanager • Eastern wood-pewee • Ovenbird • Ringed boghaunter dragonfly • Sand snaketail dragonfly • Ornate box turtle • Slender glass lizard • Gray wolf • Bald eagle • Karner blue butterfly • Swamp metalmark butterfly • Brook trout
Forest Transition Landscape	16	The Forest Transition landscape is partially forested, with much of the area covered by cropland. Forested areas are mostly dominated by northern hardwood and aspen. Other features include coniferous and deciduous swamps and small kettle lakes.	• Northern cedar swamp • Conifer swamp • Emergent aquatic wetland • Cold water streams • Lakes	• Winter wren • Hermit thrush • Nashville warbler • Canada warbler • Wild rice
North Central Forest Landscape	4	Covering a large portion of northern Wisconsin, this landscape is dominated by hardwood forest, and has many wetlands, streams and lakes. Population density is low and there is little agricultural cover.	• Oligotrophic seepage lakes • Warm water streams • Cold water streams	• Gray wolf • American marten

LANDSCAPE	MAP NO.	DESCRIPTION	TYPES OF HABITATS	EXAMPLE SPECIES
Northeast Sands Landscape	15	Located in the northeastern part of the state, this landscape is mostly forested. Aspen and northern hardwood forests are dominant, and jack pine forests are common on the outwash plains. The topography of the area includes knolls, ridges, cliffs, canyons, and waterfalls. There are several important river systems (including the Menominee) and large wetlands. The Northeast Sands area is sparsely populated, with the forestry industry contributing most to the economy.	• Upland dry forest • Lowland conifer forest • Hardwood forest • Northern white cedar swamp • Cold water streams • Cliff • Glade • Talus slope • Alkaline wetland • Marl lake • Bracken grassland	• White-tailed deer • American black bear • Fisher • American beaver • North American river otter • Bobcat • Northern harrier • Brown thrasher • Chestnut-sided warbler • Eastern towhee
Northern Lake Michigan Coastal Landscape and Central Lake Michigan Coastal Landscape	8 and 14	This landscape includes the shorelines of Lake Michigan and Green Bay, the Door County Peninsula, and the Grand Traverse Islands stretching from Door County to the Garden Peninsula in Michigan. The Oneida Indian Reservation is located within these areas. The Central Lake Michigan Coastal area is more densely populated than most of the ecological landscapes in Wisconsin. In terms of land use, both landscapes have a high percentage of agricultural lands.	• Beach • Ridge and swale • Alvar • Coastal/floodplain forest • Marsh • Warm water streams • Dune • Bedrock shore • Coastal fen • Boreal forest • Sedge meadow • Black ash swamp • Niagara Escarpment	• Forster's tern • Lake sturgeon • Golden-winged warbler • Northern goshawk • Dwarf lake iris • Western sand darter • Pugnose minnow • River redhorse • Red-shouldered hawk • Prothonotary warbler • Bobolink • Cerulean warbler • Ram's head lady's slipper • Hine's emerald dragonfly
Southeast Glacial Plains Landscape	9	This landscape covers much of the non-coastal area in the southeastern Wisconsin. The region is densely populated compared with other areas in the state. Agricultural and residential developments have impacted the local vegetation. The majority of land cover is cropland, with limited areas of prairie,	• Winnebago Pool Lakes • Prairie pothole lakes • Sedge meadow • Marsh • Prairie	• Red-necked grebe • Lake sturgeon

LANDSCAPE	MAP NO.	DESCRIPTION	TYPES OF HABITATS	EXAMPLE SPECIES
		savanna, and fragmented forest. There are important river systems in the area, though riparian zones are largely degraded. Aquatic habitats consist of several large lakes, including the Winnebago Pool lake system, and wetlands including Horicon Marsh.		

Notes.
Source: Wisconsin Department of Natural Resources 2012a.

APPENDIX D | THREATENED AND ENDANGERED SPECIES WITHIN THE RESTORATION AREA

PLANTS

Dwarf lake iris

The dwarf lake iris, a miniature iris with showy, deep blue flowers, was federally listed as threatened in 1988. Occurring close to Great Lakes shorelines in cool, moist lakeshore air, the dwarf lake iris is found on sand or in thin soil over limestone-rich gravel or bedrock. This habitat is along old beach ridges or behind open dunes. The threatened plant is found only on the shoreline of Lakes Michigan and Huron. Specifically, the dwarf lake iris is found within the assessment and restoration areas in Door and Brown Counties, WI and in Delta and Menominee County, MI.

Pitcher's thistle

The Pitcher's thistle is a native thistle that grows on the beaches and grassland dunes along the shorelines of Lake Michigan, Lake Superior, and Lake Huron. It is most often found in nearshore plant communities, but it can grow in all non-forested areas of a dune system. The thistle was federally listed as threatened in 1988 due to dune habitat destruction from shoreline development, road maintenance and construction, and shoreline recreational activities. This plant can be found along the shoreline in counties that overlap with the restoration area in Door and Manitowoc Counties, WI and in Delta County, MI.

Eastern prairie fringed orchid

The eastern prairie fringed orchid is a long-lived perennial plant found in moist to wet tallgrass prairie or wet sedge meadows. The orchid's tuber rootstalk helps it survive grass fires. Fires and rain stimulate the plant to grow and flower. This plant was federally-listed as threatened in 1989. The major factor in the decline of this species has been a loss of habitat due to grazing, fire suppression, and agricultural conversion. The eastern prairie fringed orchid has been documented within the assessment and restoration areas in Green Lake and Winnebago Counties, WI.

Fassett's locoweed

Fassett's locoweed is a federally-listed threatened plant that is found on gravel and sand lakeshores with partial shade where waves and fluctuating water levels keep shrubs and grasses from crowding out the locoweed. The seeds of the plant germinate on lakeshores as water levels drop during the summer. The locoweed is found within the restoration area in Portage and Waushara Counties, WI.

INSECTS

Hine's emerald dragonfly

The Hine's emerald dragonfly lives in calcareous spring-fed marshes and sedge meadows overlaying dolomite bedrock. This species was federally-listed as endangered in 1995. Habitat loss or degradation is the greatest threat to the Hine's emerald dragonfly. Within the restoration area, the dragonfly can potentially be found in Menominee County, MI and Door and Kewaunee Counties, WI.

Karner blue butterfly

The Karner blue butterfly, federally-listed as endangered in 1992, is a small butterfly that lives in habitat with wild lupine, including prairie, oak savanna, and jack pine areas. Karner blue butterflies are dependent on wild lupine as its exclusive larval food plant. Wild lupine is dependent upon open sunny habitats that are maintained by periodic disturbance such as fire. Karner blue butterflies can be found in the following Wisconsin counties that overlap with portions of the restoration area: Adams, Green Lake, Menominee, Marquette, Oconto, Portage, Shawano, Waupaca, and Waushara.

Poweshiek skipperling

The Poweshiek skipperling is a small, brownish butterfly that occupies native tallgrass prairie and prairie fen habitat and was federally-listed as endangered in 2014. This butterfly species utilizes native prairie flowers for nectaring and likely uses native prairie grasses for a larval food source. The Poweshiek skipperling occurs, along with its critical habitat, in an area that overlaps with the restoration area in Green Lake County, WI.

MUSSELS

Snuffbox mussel

Snuffbox mussels are freshwater mussels that were federally-listed as endangered in 2012. The species is typically found in small- to medium-sized creeks in areas of swift current. They are suspension feeders, and burrow deeply in cobble, gravel, and sand substrate. Snuffbox mussels are located in the Wolf River, Embarrass River, Little Wolf River, and Willow Creek in the following Wisconsin counties that overlap with the restoration area: Outagamie, Shawano, Waupaca, and Waushara.

BIRDS

Kirtland's Warbler

The Kirtland's warbler, federally-listed as an endangered species in 1973, inhabits pine and oak forests. This small, insect-eating songbird will only nest on the ground near the lower branches of large stands of young jack pines. This species occurs or has the potential to occur in the following counties that overlap with the restoration area: MI: Alger, Delta, and Marquette, and in WI: Adams and Marinette.

Piping plover

Piping plovers are small, stocky shorebirds that use wide, flat, open, sandy beaches with very little grass or other vegetation. Nesting territories often include small creeks or wetlands. The Great Lakes population of the piping plover was listed as an endangered species in 1986. In 2001, critical habitat was designated for this population. Critical habitat is a specific geographic area that is essential for the conservation of the species

and may require special management and protection. It may include an area that is not currently occupied by the species but will be needed for its recovery. Piping plovers occur and have critical habitat within the restoration area in Manitowoc and Marinette counties; multiple nesting attempts have occurred in the designated critical habitat. Predation and weather events have disrupted these attempts, however, the current designated critical habitat is presently in public domain and therefore protected. Piping plovers have also been observed on dredge spoils within cells of the Cat Island Dredge Disposal area in Brown County; habitat restoration on Cat Island that would benefit this species is being explored.

Rufa Red Knot

The rufa red knot is a medium-sized shorebird that was federal-listed as threatened in 2014. Rufa red knots migrate south to as far away as southern South America for the winter. Rufa red knots are regular spring migrants through areas that overlap with the restoration area, usually along the shores of the Great Lakes, where they feed on hard-shelled mollusks. The birds also use both Great Lakes shore habitat and potentially inland shoreline sites as fall migrants. Rufa red knots may occur in areas that overlap with the restoration area in the following counties: MI: Alger, Delta, Marquette, and Menominee and in WI: Brown, Manitowoc, and Oconto.

Whooping crane

The whooping crane was federally-listed as endangered in 1967, and a nonessential experimental population in the eastern U.S. was established in 2001. These omnivorous, migratory birds utilize wetland nesting habitat in Wisconsin, typically marsh areas with bulrush for nesting. Whooping cranes may occur in the following Wisconsin counties that overlap with the assessment and restoration areas: Adams, Calumet, Columbia, Fond du Lac, Green Lake, Marathon, Marquette, Oconto, Shawano, Waushara, and Winnebago.

MAMMALS

Canada Lynx

The Canada lynx is a rare forest-dwelling cat of northern latitudes, federally listed as threatened in 2000. Canada lynx require extensive coniferous forests with downed trees and windfalls that provide cover for denning sites, escape, and protection from severe weather, as well as habitat for its primary prey, snowshoe hares. The Canada lynx occurs in the following counties that overlap with the restoration area: MI: Alger, Delta, Dickson, Iron, Marquette, and Menominee and in WI: Florence, Forest, Marinette, and Oneida.

Gray Wolf

The gray wolf is a large canid which was originally federally-listed in 1967, and after being delisted, was relisted as endangered in Wisconsin and Michigan in 2014. Gray wolves occupy northern forested areas and mainly prey upon white-tailed deer and beaver. Wolves are known to occur in the following counties that overlap with the restoration area: MI: Alger, Delta, Dickson, Iron, Marquette, and Menominee and in WI:

Adams, Florence, Forest, Langlade, Marathon, Marinette, Menominee, Oconto, Oneida, Portage, Shawano, Waupaca, and Waushara.

Northern Long-Eared Bat

The northern long-eared bat was federally listed as threatened in 2015. Northern long-eared bats require hibernacula, such as caves, for their winter habitat. During the summer, these bats require forested areas that provide trees that serve as roosts. Northern long-eared bats occur in the following counties that overlap with the restoration area: MI: Alger, Delta, Dickson, Iron, Marquette, and Menominee and in WI: Adams, Brown, Calumet, Columbia, Door, Florence, Fond du Lac, Forest, Green Lake, Kewaunee, Langlade, Manitowoc, Marathon, Marinette, Menominee, Oconto, Oneida, Outagamie, Portage, Shawano, Waupaca, Waushara, and Winnebago.