**Cover Page**

**1. Funding Opportunity:** EPA-R5-GL2010-1
**Focus Area:** Habitat and Wildlife Protection and Restoration
**Program:** I.D.2. Habitat Restoration in Great Lakes Areas of Concern

**2. Name of Proposal: Integrated stream & wetland restoration; Lower Green Bay - Fox R. AOC**

**3. Points of Contact:**

Individual: Scott Thompson, Director of Freshwater Conservation
Organization: The Nature Conservancy
Business Address: 242 W. Michigan Street, Suite B103, Sturgeon Bay, WI 54235
Phone Number: 920-743-8695
Fax Number: 920-743-9068
E-mail Address: scott_thompson@tnc.org
DUNS number: 072656630

**4. Type of Organization:** Other public or non-profit private agencies, institutions, and organizations

**5. Proposed Funding Request:** $1,362,896

**6. Brief Project Description:** The Nature Conservancy with non-profit, government agency, tribal, and academic partners proposes a 2-year project to advance delisting of three impaired beneficial uses in the Duck–Pensaukee Watershed of the Lower Green Bay and Fox River Area of Concern. This project will improve habitats and populations of degraded fish and wildlife species and water quality through integrated inventory, research, analysis, design and restoration activities. The project will improve priority wetlands, tributaries, and riparian habitats, focusing on native migratory fish and wetland-associated wildlife.

**7. Project Location:** Lake Michigan Basin: Duck–Pensaukee Watershed. HUC 04030103. Lat 44°37'26.78"N, Long 88°4'34.58"W Wisconsin, Brown, Oconto, Outagamie and Shawano Counties. The watershed comprises approximately 490 square miles with about 35 miles of shoreline. This watershed flows into Green Bay near its southern extreme (Map 1).

**8. Full project description**

**Summary:** This will be a two year project. The Nature Conservancy (TNC) will work in partnership with the Wisconsin Department of Natural Resources (WDNR), Oneida Nation, Ducks Unlimited (DU), U.S. Fish & Wildlife Service (USFWS), U.S. Forest Service (USFS), University of Wisconsin (UW), and Environmental Law Institute (ELI), and U.S. Army Corps of Engineers (USACOE). Components of the proposal which will be described in further detail include:

- Conduct a survey and feasibility plan for restoration within the 1,210 acres at Sensiba State Wildlife Area and surrounding lands.
- Complete a survey of streams in the watershed for northern pike spawning activity, recruitment, and breeding site fidelity. This will allow us to 1) rank streams for next phase restoration or protection and 2) provide data for the road-stream crossing assessment.
- Complete an inventory and assessment of all road-stream crossings within the watershed in order to identify the most important barriers for fish passage. This will prioritize remediation and shape the restoration plans within the watershed.
- Measure impacts through biotic and abiotic monitoring at stream and wetland restoration, fish barrier removal, and riparian buffer projects.
- Develop a science-based, watershed approach to compensatory mitigation in the Duck-Pensaukee Watershed. The project team will develop a framework to guide Section 404 mitigation work toward sites that will maximize ecological outcomes and that have the greatest potential for success. The approach will be tailored to the needs of Section 404 regulatory agencies.
- Develop a framework for nutrient management for this watershed for implementation of the next phase of remediation actions. This project will build upon existing analysis of nutrient and sediment delivery in Duck Creek (WDNR TMDL) and expand the effort to other portions of the watershed.

**Site Significance: The emphasis of this proposal is on conservation and restoration of the river and stream network and the associated headwater, riparian and coastal wetland habitats, and biodiversity within an Area of Concern (AOC).** Hydrologic flow, water quality, and transport of material and energy are key attributes of this interconnected tributary, wetland and open water system. Ecological connectivity offers a framework for the development and implementation of restoration efforts that will ultimately lead to the delisting of species within the AOC.

The EPA's Great Lakes Restoration Initiative Action Plan specifically references Green Bay/Fox River as a geographic target for restoration activities. This project also lies within the Lower Green Bay and Fox River AOC. Native fish and wildlife populations and habitat have been listed as degraded. The 2009 delisting target document for this AOC specifically suggests implementing actions to restore fish passage on tributaries and wetland restoration and acquisition on the west shore of Green Bay (WDNR 2009). This focus on habitat connectivity and quality has led to the "headwaters to open waters" approach to conservation in the proposal. Specific actions that will identify and restore fish and wildlife populations and habitats are described later in the Full Project Description.

We have selected the Duck-Pensaukee Watershed for the following reasons:

1. A significant portion of this watershed drains to the Lower Green Bay and Fox River AOC. The Beneficial Use Impairment Delisting Targets (WDNR 2009) specifically address natural reproduction of northern pike, hydrologic connectivity between wetlands and the AOC, the protection or restoration of coastal wetland types, quality fish spawning habitat, and adequate habitat for coastal wetland associated birds and other wildlife. All of these delisting targets will be positively impacted by the proposed activities.
2. This watershed lies in an ecologically critical and threatened area, and it is experiencing the highest level of rural residential expansion due to its location adjacent to the city of Green Bay. The west shore of Green Bay is also estimated to have held 50% of the coastal wetlands in all of Lake Michigan (University of Wisconsin–Extension 2004), but as a result of habitat loss and

degradation, it is estimated that about 70% of the spawning habitat for northern pike has been lost in this area (Bosley 1978). If functional fish spawning and wildlife habitat is to be preserved along the west shore of Green Bay, conservation efforts must be focused on the Duck-Pensaukee watershed.

3. The west shore of Green Bay, including the Duck-Pensaukee watershed has been targeted as a high priority for habitat protection by state, local, tribal government agencies and non-profit conservation organizations. The WDNR currently owns and manages 2,450 acres as a state wildlife area in this watershed, with an additional 6,178 acres along the shore just north of this watershed. Brown County Land Conservation Department has initiated a wetland restoration program in this watershed focused on northern pike spawning habitat. The Oneida Nation has been engaged in stream and wetland restoration for several years working from the headwaters down towards the bay. DU and local conservation groups have assisted the above groups in local restoration and protection projects.
4. The coastal wetlands and tributaries of this watershed have been identified through previous inventories by WDNR as a critical source of northern pike recruitment to Green Bay, a key breeding area for wetland associated birds, and an important migratory stopover area for birds. It has been nominated as an *Important Bird Area* in the state of Wisconsin.
5. This watershed shares many characteristics of other similar sized watersheds in the lower Great Lakes Basin; e.g., mix of agriculture, woodlot, and rural residential land uses, a diversity of high gradient headwater streams and low gradient coastal stream reaches, changing land use due to urban or ex-urban development. Creating an integrated approach to prioritizing, implementing, and monitoring a set of restoration practices here would prove instructive in other watersheds. TNC is committed to this outreach/education aspect of the project.

We propose to implement and prove restoration, protection, and other conservation strategies that are measurable and advance the goals of the *Lower Green Bay and Fox River Area of Concern Beneficial Use Impairment Delisting Targets; Great Lakes Restoration Initiative: Great Lakes Multi-Year Restoration Action Plan 2009; Great Lakes Regional Collaboration Strategy to Protect and Restore the Great Lakes;* Plan; and *WI Great Lakes Strategy: Restoring and Protection our Great Lakes*.

The *Lower Green Bay and Fox River Area of Concern Beneficial Use Impairment Delisting Targets* report lists two Beneficial Use Impairments (BUI) that will be directly addressed by this project: 1) degraded fish and wildlife populations and 2) degraded fish and wildlife habitats. Within the *Great Lakes Restoration Initiative: Great Lakes Multi-Year Restoration Action Plan 2009,* this project will advance those strategies that advance goals of the Lakewide Management Plans and the AOC plans (Remedial Action Plan and Delisting Targets). In addition by restoring Great Lakes aquatic habitats and ecosystem functions, improving the conditions of native fish and wildlife and restoring access at fish passage barriers, this project will specifically advance long term goals such as restoring access of migratory fish species at fish passage barriers, and advance interim objectives of the GLRI plan such as reopening 3,000 miles of Great Lakes rivers and tributaries and collecting data on the health of 2,000 coastal wetlands and 500 critical spawning areas. In restoring coastal wetlands, improving fish passage in tributary streams and positively impacting a wide diversity of aquatic and wetland dependent species, this project advances several of the objectives of the *Great Lakes Regional Collaboration Strategy to Protect and Restore the Great Lakes.* Specific objectives contained in the Open/Nearshore Waters, Wetlands, Riverine Habitats, and Coastal categories of this plan such as restoring barrier-free access to cold and warm water tributary spawning and nursery habitats for migratory fishes will be advanced. Through the restoration of wetlands that will be utilized by migratory birds, this project will advance Subobjective 4.3.3 (Improve the Health of Great Lakes Ecosystems) of the *EPA's Strategic Plan.* This project will also advance the goals of the *Wisconsin Great Lakes Strategy*. Specifically this project will advance the goal of restoring access to breeding habitat for fish and wildlife through tributaries which currently lack such connectivity. In

addition this project will advance the goal of protecting and restoring 55,000 acres of coastal, riparian, and wetland habitat along the west shore of Green Bay which is listed as a priority in this plan.

**Project Description:**

The Lower Green Bay and Fox River Area of Concern (AOC) Remedial Action Plan (RAP) and its update in 1993 emphasize the goal of increasing biodiversity in the Area of Concern (WDNR 1988, WDNR 1993). Fish and wildlife populations and fish and wildlife habitat in the AOC were listed as degraded due to a lack of top predator fish, a limited diversity of forage fish, declining habitat amount and quality, and impacts from invasive species (WDNR 1993). This proposal will move conditions in the AOC towards a vision of a healthy population of top predatory fish and sufficient high quality coastal wetlands for the fish and wildlife that use them (WDNR 1989).

This proposal addresses two interrelated BUIs in the AOC: **Degraded Fish and Wildlife Populations,** and **Loss of Fish and Wildlife Habitat.** Additionally a third BUI**, Degraded phytoplankton / zooplankton populations,** is addressed through one component in the proposal. To advance delisting, specific actions will restore, improve or create habitat for fish and wildlife populations specifically noted in the delisting targets (WDNR 2009). Quality fish spawning habitats, hydrologic connectivity between interior and coastal wetlands and the AOC, and habitat diversity supporting multiple life stages of target fish and wildlife species were specifically listed as essential for the delisting of these use impairments (WDNR 2009) and will be restored through actions in this proposal. Fish and wildlife populations expected to benefit from this work include top predator fish (northern pike), native forage fish, native furbearers, amphibians, wetland associated reptiles, dabbling ducks and marsh nesting birds. Long term benefits will accrue through effective protection and restoration of priority habitats identified by this project. Degraded phytoplankton / zooplankton populations will be advanced through the development of a nutrient and sediment management framework for this watershed.

The components of this multifaceted proposal have been organized into two sections corresponding to the type of work performed - **Knowing Where to Restore** and **Knowing How to Restore**. Specific actions in this proposal that will serve to restore the BUIs are found within the specific project component descriptions.

- **Knowing Where to Restore** – Prioritizing conservation and restoration work in those places that will provide the largest return on the investment of conservation and restoration dollars and efforts. The questions we will ask are: 1) where do we need to restore functionality to a challenged system, and 2) where can we provide the most functional habitat? This section will explain the tools and processes that we will use to help us prioritize conservation action and involves research, inventory and assessment, and planning.
- **Knowing How to Restore**– Conservation and restoration efforts are numerous within this watershed. As we ask where we should restore ecological functionality to a system, we also need to ask which conservation and restoration strategies are most effective. Establishing new restoration efforts is an expensive undertaking. By reviewing ongoing restoration efforts, we are able to cost-effectively look at management practices and share those successful strategies and practices with other conservation practitioners. We are also able to determine where opportunities exist that will enhance those efforts and help to influence restoration at a system-wide scale. This section involves project design, implementation, stewardship, monitoring, and outreach.

**Knowing Where to Restore**

TNC and partners will initiate and complete several integrated components that will guide conservation of the tributary network and coastal wetlands in this watershed. These components include identifying areas of conservation importance for in-stream biota (represented by brook trout), migratory fish (represented by northern pike), coastal wetlands and coastal wetland associated fish and wildlife and ranking these locations for conservation action as the next phase of work in this watershed. These projects include: 1) **Tributary and Coastal Wetlands Decision Support Tool;** 2) **Fish Barrier Analysis and**

**Prioritization;** 3) **Northern Pike Spawning Habitat Assessment;** 4) **Watershed Wetland Mitigation Siting;** and 5) **Watershed Sediment and Nutrient Data Assessment.** Individual project descriptions are given below.

**1) Tributary and Coastal Wetlands Decision Support Tool**: Ranking coastal wetlands for acquisition and restoration based on their habitat value for fish spawning and wildlife usage will result in the protection of the most ecologically significant wetlands, and restoration of the most biologically productive wetlands. This will produce the largest benefit for the fish and wildlife populations and habitats degraded in this AOC.

Over the past two years, in conjunction with partners, TNC has been developing an integrated information tool to guide the identification of significant protection and restoration opportunities in the coastal wetlands and tributaries of Green Bay. This tool considers the functional hydrologic and biologic connectivity between these wetlands, tributaries, and waters of the Bay. The work described within this project proposal will be integrated to enhance this tool.

Components of the current model include 1) spatial and related attribute data including wetland polygons, tributary networks, infrastructure, protected lands, land ownership, quality indicators and threats within the Green Bay Basin, the Traverse Islands and the Door and Garden Peninsulas in their entirety; 2) wetland data including wetland type, class, and priority areas based on species and functioning ecological systems; 3) Migratory Bird Habitat Model identifying both migratory bird stopover and migratory bird nesting habitat within Green Bay's Coastal Wetlands; and 4) a developing database referencing research and conservation activity that has occurred within the Basin.

Enhancements to the model from this project will include:
- Fish barrier assessment and prioritization
- Watershed wetland mitigation siting
- Restoration sites with links to restoration management practices

**2) Fish Barrier Analysis and Prioritization:** Identifying the road-stream crossings and invasive species that restrict northern pike and other native migratory fish from the largest areas of high-quality spawning habitat will result in the removal or remediation of those barriers. Hydrologic connectivity is specifically cited in the Lower Green Bay and Fox River AOC as critical for the delisting of the Loss of Fish and Wildlife Habitat BUI.

The overall objective of this project is to guide the restoration of stream connectivity by identifying the most significant fish migration barriers in the Duck-Pensaukee Watershed. Partners who will be working on this project include a private contractor, USFWS, USFS and TNC.

The project will use an established GIS-based analytical approach that bases the value of barrier removal on both the amount and quality of reconnected habitat (Diebel 2009). The results of this project will include a detailed map of habitat suitability and accessibility for brook trout and northern pike and a list of barriers ranked on connectivity effect. Brook trout and northern pike have different habitat preferences and movement needs and represent umbrella species for a range of migratory and stream resident fishes. These products will provide a quantitative basis for prioritizing barrier removal and tracking the progress of connectivity restoration. Because fish passage barriers are ubiquitous in developed landscapes, the methods developed in this project will be useful throughout the Great Lakes basin. In particular, the USFWS, which will contribute field staff to this project, plans to use these methods to influence the development of a Lake Michigan basin-wide road-stream crossing database.

The project will consist of three main tasks:
1. Mapping potential migration routes and barriers to migration for both species.
2. Defining and mapping suitable spawning habitat for northern pike.
3. Combining information from tasks 1 and 2 in a model to map connectivity status and rank barriers for removal.

Because the invasive species *Phragmites sp*. can also block fish passage in shallow streams utilized by northern pike, the degree of impact by *Phragmites* will be assessed and mapped during the culvert assessment work. Findings from this survey will be shared with partners for coordinated control efforts.

**3) Northern Pike Spawning Habitat Assessment:** Identifying the tributaries that contribute most to northern pike populations in Lower Green Bay, as well as the fidelity of breeding pike to those sites, will set the stage for the next phase of restoration and conservation in the AOC. Conservation dollars can then be directed to protecting current high-productivity pike breeding habitat and restoring the most suitable tributaries and wetlands to enhance populations of this top predator.

Northern pike are an important native top predator in Green Bay but approximately 70% of the spawning habitat for this species has been lost in this area. Because the west shore coastal zone is where most of Green Bay wetlands are located, restoring connectivity is critical in maintaining northern pike populations.

Adult northern pike begin seeking spawning areas at ice-out and can travel up to 15 miles inland from Green Bay to lay their eggs (Schuette and Rost 1998). Relatively low winter-spring precipitation coupled with low water levels in Lake Michigan in recent years have further reduced the spawning habitat available for northern pike. Low water conditions restrict adult northern pike to utilize wetland complexes nearest the bay and its main tributaries because travel routes farther inland such as intermittent streams or ditches may not hold water.

The WDNR will lead the development of a northern pike habitat suitability model to identify priority wetland complexes. The spatial distribution of northern pike young-of-year recruitment will be assessed through field surveys. This work will be integrated with the Fish Barrier Analysis and Prioritization portion of the project, validating the model's identification of northern pike spawning wetlands. Knowing where the fish are spawning and where barriers prevent passage to potential spawning areas is critical to the ultimate goal of restoring a self-sustaining population of northern pike.

To enhance our understanding of northern pike spawning habitat selection, the team will include faculty and students from UW–Madison Limnology program. Their primary objective will be to utilize otolith microchemistry analysis to determine if pike exhibit natal homing that fosters population isolation. The sensitivity of otolith microchemistry for distinguishing among breeding grounds for Great Lakes fish stocks has been proven for sea lamprey, yellow perch, white bass, and walleye (Hand et al 2008, Ludsin et al 2006, Bartnik et al 2005, Farver and Miner 2007). If northern pike exhibit spawning site fidelity, then restoring tributary spawning habitat will not translate into expanding overall pike populations because migrating adults will not choose to reproduce in the restored area. Rather, additional management interventions (e.g. stocking of fry) will be required after habitat restoration in order to seed a new population that will home to the restored tributary. This information will guide the development of target strategies to provide the greatest return on northern pike restoration efforts. This work supports several objectives in the Lake Michigan Integrated Fisheries Management Plan 2003-2013 (Lake Michigan Fisheries Team 2004), including 1) protect, maintain, and enhance habitat for game and non-game fish species; 2) protect and restore native species; and 3) enhance nearshore fishing opportunities.

**4) Watershed Wetland Mitigation Siting:** Integrating wetland mitigation sites to achieve important fish and wildlife goals such as habitat connectivity and water quality improvement will support population viability of those wetland dependent species noted in the AOC including wetland associated fur bearers, amphibians, wetland associated reptiles, dabbling ducks and marsh nesting birds.

Wetland and stream alterations are regulated under Section 404 of the Clean Water Act, with $2.9 billion spent annually nationwide on compensatory mitigation to replace permitted losses. However, in the absence of science-based planning, wetland functions and services continue to be lost. In 2008, the US Environmental Protection Agency (EPA) and the USACOE issued a final rule that requires the USACOE to use a science-based "Watershed Approach" for approving and siting compensatory mitigation projects.

This provides an opportunity to strategically focus billions of mitigation dollars to maximize the likelihood of restoration success, contribute to overall watershed health and functionality, and align projects with the priorities of local conservation organizations and agencies.

This project will focus on the development of a science-based, watershed approach to compensatory mitigation that will have both local and national impacts. Locally, this approach will complement protection and restoration work within the watershed, aligning outcomes of mitigation efforts with watershed-specific conservation priorities. In addition, this project will serve as one of several pilots in a nationwide collaboration between TNC and ELI. Through this partnership, we are interacting with federal, state, and local agencies to develop a framework for a Watershed Approach that can be applied to Section 404 permitting throughout the United States. Work will be conducted in the Duck-Pensaukee Watershed because: 1) it provides Great Lakes representation in a larger suite of pilot projects nationwide, 2) it is subject to a high number of permits for wetland alteration, and 3) it is a focal area of numerous conservation interests with an existing strong partnership.

Partners participating in this project will include the USACOE and the WDNR. We will also work closely with local conservation practitioners, agencies, and organizations in the Duck-Pensaukee/Green Bay watersheds to ensure that project results will augment existing local conservation goals. At the national level, we will partner with the Environmental Law Institute, EPA, and USACOE to report these findings to regulatory agencies involved in developing a national Watershed Approach to compensatory mitigation.

Development of this approach will center on computer analyses of spatial data. Some field reconnaissance will also be conducted to complement spatial data analyses. The approach will be adapted from existing methodologies and will be tailored to the stated needs of our partner agencies responsible for wetland permitting. Analyses will build on WDNR's potentially restorable wetland inventory and will include:

- Identification and prioritization of restoration opportunities
- Identification and prioritization of high quality sites for protection
- Status and needs assessment of functions (e.g., flood abatement) within the watershed

**5) <u>Watershed Sediment and Nutrient Data Assessment:</u>** Nutrient enrichment has been cited as affecting several Beneficial Use Impairments in the Lower Green Bay and Fox River AOC including degraded fish and wildlife populations, loss of fish and wildlife habitat and degraded phytoplankton / zooplankton populations.

Excessive sediment loads and phosphorus have also been identified amongst the major threats to the wetlands and in-stream habitat quality of the Duck-Pensaukee Watershed (WDNR 2002, WDNR 2001, EPA 2006). Excessive sediment and phosphorus degrade fish and wildlife populations and habitats by causing low dissolved oxygen levels and poor water clarity resulting in loss of submerged aquatic plants, and harmful algal blooms. It also causes loss of recreational opportunities and decreased property values. In this proposal, TNC will initiate a program to ultimately develop site-specific strategies for reducing both nonpoint and point sources to improve water quality within the system. In the first year TNC, with the assistance of project partners, will find, assess, and synthesize the current knowledge available on sediment and phosphorus loadings in this watershed. Information from disparate sources such as the WDNR's historic priority watershed program for the Pensaukee River, the current TMDL information from Duck Creek, the recently initiated UW-Green Bay water quality monitoring effort on the Suamico River, and USGS Western Lake Michigan Drainage studies will be synthesized to develop an understanding of current knowledge and where information gaps exist. In the second year of the project, TNC will develop a coalition of partners through a series of working sessions whose purpose will be to set the foundation to create a sediment and phosphorus management plan for this watershed. TNC will work to create a collaborative effort to develop recommendations for an innovative, adaptive approach that will identify site-specific areas where strategies including buffers, nutrient management plans and engineered solutions will have the greatest likelihood of reducing sediment and nutrient loads.

**Knowing How to Restore**
We identified projects that would be representative of the restoration work that needs to be accomplished within the Duck-Pensaukee Watershed. Many of those opportunities are already in the planning phase and in some cases have been funded by various funding resources. These projects provided a platform from which we can begin to review, document, measure outcomes, and share replicable restoration strategies within the Great Lakes Basin.

These projects focus on restoration of coastal wetlands, habitat of perennial and intermittent streams, and riparian fish spawning wetlands. The projects include: 1) **Survey Plan and Wetland Restoration** and 2) **Documenting and Sharing Habitat Restoration Impacts**. Individual project descriptions are given below.

**1) Survey Plan and Wetland Restoration:** This survey and restoration work at the Sensiba State Wildlife Area (SWA) will provide direct benefits for wetland associated fish and wildlife species and habitats noted in the RAP including northern pike, native forage fish, wetland associated fur bearers, amphibians, wetland associated reptiles, dabbling ducks and marsh nesting birds. While lying just north of the AOC boundary, fish and wildlife benefiting from the Sensiba work will undoubtedly disperse into the AOC and support populations within the AOC.

The West Shore Green Bay Wetlands are significant due to both the extent of the wetland habitat and the use of the site by many native and rare animals. The Sensiba Unit of the SWA is 1,210 acres located along the shores of Lake Michigan and is the former site of where the Suamico River emptied into Lake Michigan (Map 2). Sensiba provides a sheltered wetland that is basically immune from the processes of Lake Michigan, resulting in an opportunity for more diversity of aquatic species.

Wetlands within the Sensiba unit are supplied with water from two drainages within the area covered in this proposed scope of work. Planned wetland creations within these drainages will complement the wildlife benefits and enhance the value of the impoundments on Sensiba. This area also has strong populations of marsh-dwelling birds and increases in the quantity and quality of a variety of marsh and sedge habitats will increase productivity. Opportunities to enhance spawning and nursery habitat for Green Bay fish species using coastal wetlands will be identified, and wetland restorations will be conducted in and adjacent to the Sensiba unit during this project.

DU will assume the responsibility for a perimeter survey of the proposed Sensiba SWA boundaries including impacts from a Wisconsin Department of Transportation (DOT) mitigation project. The survey will identify the habitat potential within the wetland and tributary system. DU will also be responsible for reconstructing portions of the infrastructure.

In coordination with activities funded with this proposal, the WDNR, with funding from another source, will take the lead on restoration of spawning ditches and preparation for permitting and restoration of impoundments and berms within Sensiba SWA. This work will include mowing, tree removal, surveying and scraping spawning ditches, removing and reinstalling culverts and water control structures, and assisting with the re-meandering of streams and re-engineering and preparing of water control structures.

The restoration component funded by this proposal will consist of three major elements:
- Upgrade current water control system which will facilitate management of water levels to enhance waterfowl and fish production.
- Provide spawning pike passage and habitat in old river channels currently blocked by a historic water control structure. This element will be designed to tie into a DOT mitigation project starting in 2010.
- Renovate the failing berm system created around 1959-60. This renovation will improve fish and wildlife habitat and be integrated into the surrounding restoration activities.

TNC will provide documentation of management practices and assist with the design of monitoring programs that will measure pre-restoration condition and post restoration results. We will also help the partners to design an outreach program that will help to inform the community and conservation organizations of the impending work and the eventual outcomes.

**2) Documenting and Sharing Habitat Restoration Impacts: Documenting the practices and impacts of the restoration projects of the Oneida Tribe, the WDNR and Brown County will be available for use by other conservation practitioners within the AOC and elsewhere throughout the Great Lakes Basin. This will benefit similarly impaired AOCs by providing knowledge of those methods which proved most effective for enhancement of habitat for species at this site.**

The effective assessment of ecological condition and response to restoration is best accomplished through an application of a tested documentation of baseline conditions, practices and outcomes. In this project the assumptions, hypothesis, designs, practices and outcomes of the restoration components (listed below) undertaken by the partners will be recorded in a format applicable for sharing with other practitioners in ecologically similar watersheds of the Great Lakes. If this proposal is funded, TNC will work with Brown County, the Oneida Nation and the WDNR to document management practices for their northern pike spawning habitat restorations, coastal wetland restorations and headwater stream restorations.

The restorations to be assessed include:

- Stream re-meander project – South Branch Suamico River (Oneida Nation)
- Two fish passage projects – South Branch Suamico River (Oneida Nation)
- Re-meandering of creek around a golf course pond – Duck Creek (Oneida Nation)
- Wooded wetland restoration – Trout Creek (tributary to Duck Creek) (Oneida Nation)
- Unnamed tributary and riparian wetland restoration (Brown County )
- Culvert removal – Lancaster Brook (tributary to Duck Creek) (Oneida Nation)
- Stream restoration at Sensiba Wildlife Area – Suamico River (WDNR and DU). This is the only restoration being funded through this proposal.

In conjunction with the documentation procedure outlined above, this project will utilize the Biological Condition Gradient (BCG) developed by the EPA, states, and tribal units as the scientific model to describe the biological response to the restoration projects comprising this proposal (EPA 2005; Davies and Jackson 2006). This assessment will then serve as a baseline to evaluate biological response to the restoration action over time.

**Adapting for Climate Change:** The UW-Green Bay, UW–Sea Grant, and TNC hosted workshops that outlined anticipated climate change impacts to the Green Bay ecosystem, anticipated impacts that climate change will have on species and systems of conservation concern, and adapted conservation strategies to mitigate potential negative impacts from climate change. This information will be integrated into our conservation work. For example road-stream crossings may be redesigned to accommodate predicted increased runoff from more intense storm events.

**Schedule of Work:** Due to the complexities of the schedule of work, attached is a chart (**Appendix 1**) which shows the **estimated schedule of events and milestones** for completing the proposed project.

**Effectiveness and Efficiency:** TNC will be responsible for ensuring that this project is performed in a cost effective manner. To increase efficiency of oversight for EPA and to increase conservation impact, all project proposals submitted by TNC under this request for proposals were coordinated by a senior TNC team and align with our Great Lakes Project goals and strategies. For the term of the project we will employ a project manager dedicated to working with partners. This manager will lead the TNC team to:

- Coordinate work between project partners to ensure that each process results in **meaningful and measurable conservation outcomes** to the overall health of the tributary, coastal wetland and Green Bay systems.

- **Integrate information from agencies and organizations** concerned with the health and restoration of the waters and wildlife into the strategies of the overall project to maximize conservation success.
- **Manage the timelines and coordinate budgets** with partners.
- **Assimilate information and learning into the Green Bay Tributary and Coastal Wetlands Decision Support Tool,** and share that tool with interested partners.
- **Lead the review and documentation of restoration management practices and measurable outcomes** being pursued in stream and stream barrier restoration efforts by the Oneida Nation, northern pike spawning habitat restoration by Brown and Oconto counties, and wetland restoration by the WDNR and DU.
- **Review existing data and data gaps in nutrient loading information for the watershed.** Convene a group to design a framework to implement on-the-ground conservation activities that result in reduced nutrient loading in watershed tributaries, coastal wetlands, and Green Bay.
- **Coordinate the production and sharing of documented management practices, outreach and education materials** with conservation partners and agencies, communities, and within TNC's Great Lakes-wide Learning Network.
- **Deliver quarterly progress reports and the final grant report to EPA.**

**Education and Outreach:** TNC will develop the education and outreach plan and materials for this project. The Conservancy's manager for this project shall assume accountability for the development of a plan that will engage and inform the local community, political community, and conservation organizations and agencies within the Great Lakes Basin where similar strategies may be applied.

Many of the components of the project will result in materials suitable for outreach and educational purposes. For example, the documentation of restoration practices and the associated ecological measures will be shared with conservation practitioners in similar ecological settings. Sharing this documentation will advance and supplement other conservation efforts in this region. Wetland and stream assessment for priority restoration and mitigation funding will allow for the creation of a transferrable framework that can guide the creation of these efforts in other watersheds. Road-stream barrier modeling that identifies restoration priorities will serve as information for workshops focused on the regulatory and road-building communities. Highly visible restoration projects will serve as sites for field events to engage, inform and educate the community as to the importance of conservation actions.

TNC is uniquely positioned to share knowledge gained from this project and encourage action within Green Bay and throughout the Great Lakes Basin. TNC has engaged with other conservation organizations around Green Bay and the watershed during conservation planning efforts and has relationships in place that will facilitate this information transfer. Expansion of similar integrated conservation work within Green Bay or to other AOC's in the Great Lakes will require that additional partners be engaged. TNC has the proven ability to do this.

In addition, the Conservancy has also established a learning network that includes the three major embayments within the Great Lakes Basin: Green Bay, Saginaw Bay, and Western Lake Erie. These three Great Lakes estuaries are all areas of high biological productivity and ecological significance that support open water systems in their respective lakes. These three estuaries also share similar problems. They drain large, highly modified watersheds with intense agricultural and industrial uses. By networking these sites, we are creating a platform to share lessons, innovations, and resources, including staff, expertise, tools, technologies and relationships.

**9. Outcomes, Outputs, and Expected Results**

Outcomes, outputs and expected results are described in **Table 1** below. Specific measurements to be tracked to evaluate the progress of this project are also included in Table 1.

**Table 1. Table of Project components, outputs/expected results and outcomes.**

| Project Components: Knowing Where to Work | Outputs/expected results | Short-term outcomes | Long-term outcomes | Progress Measures |
|---|---|---|---|---|
| **Tributary and Coastal Wetlands Decision Support Tool** | GIS-based decision support tool that prioritizes wetland and tributary protection and restoration opportunities. | Initiated restoration and protection of the most critical habitat for impaired fish and wildlife populations identified in Lower Green Bay – Fox R. AOC. | Increased acres of BUI coastal wetland fish and wildlife habitat protected and restored, and increased the populations of wetland associated BUI fish and wildlife. | Tool is peer-reviewed and shared with at least 5 partners and Great Lakes decision makers at introductory meeting. |
| **Fish Barrier Analysis and Prioritization** | Watershed connectivity planning tool that identifies the most critical barriers to fish passage and optimizes barrier remediation based on a benefit:cost criterion. | Advancement of goal to increase tributary connectivity and improve habitat for migratory and stream-resident fish id'ed as impaired in this AOC. | Most critical connectivity barriers remediated, stream miles reopened to BUI fish populations, and hydrologic flow improved in this and similar Great Lakes watersheds. | Inventory done of all road-stream crossings (culverts, dams) and *Phragmites* barriers. Prioritization model developed. |
| **Northern Pike Spawning Habitat Assessment** | Report of northern pike spawning activity and recruitment assessed in at least 50 wetland complexes.<br><br>Peer-reviewed papers on stream restoration strategies, pike habitat use, recruitment, and spawning site fidelity. | Prioritization of next phase stream restoration or protection opportunities.<br><br>Confirmation or refinement of assumptions of northern pike recruitment and habitat utilization. | Increased the acres/miles of productive pike spawning habitat by 25%.<br><br>N. pike fisheries restoration plan that takes into account habitat and reproduction strategies. Natal homing analysis replicated in other Great Lakes systems. | Northern pike otoliths collected and analyzed. Young of year surveys completed. |
| **Watershed Wetland Mitigation Siting** | A science-based mitigation conservation plan for this watershed, including cost:benefit analyses. | Framework to guide Section 404 mitigation work that maximizes ecological outcomes. | Increased acres of new, functional habitat for BUI listed fish and wildlife populations.<br><br>Nationwide alignment of mitigation dollars to watershed-specific conservation goals. | GIS data collected. Functional priorities for watershed established. Mitigation priorities id'ed.<br><br>Results reviewed with USACOE. |
| **Watershed Sediment and Nutrient Data Assessment** | Report synthesizing data and preferred sediment and nutrient management approach.<br><br>The formation of a partnership and commitment to implement the management approach. | A multi-stakeholder commitment to develop a sediment and nutrient management plan for the watershed. | Reduction in sediment and phosphorus loads entering the AOC from this watershed by 50% to achieve improved water quality in BUI fish and wildlife habitat. | Disparate data collected. Stakeholder meetings held. |

**Table 1. Table of Project components, expected outputs/results and outcomes (Continued).**

| Project Components: Knowing How to Work | Outputs/expected results | Short-term outcomes | Long-term outcomes | Progress Measures |
|---|---|---|---|---|
| **Survey Plan and Wetland Restoration** | Survey and plan for infrastructure restoration for the 1,210 acre Sensiba State Wildlife Area and WDOT mitigation site.<br><br>Restoration of 4,800 feet of embankment and water control structure at Sensiba SWA.<br><br>Restoration of 1,600 feet of northern pike spawning ditches resulting in 3,200 feet of contiguous pike spawning habitat.<br><br>Reopen 6 acres of new high quality pike spawning habitat. | Restored functional habitat by improving hydrologic and ecological connectivity over 1,210 acre wildlife area.<br><br>Improved waterfowl management on 20 acres of wetlands. | BUI listed fish and wildlife populations in Sensiba increased by 30-50%.<br><br>Replicated restoration methodologies at other sites in Green Bay and the Great Lakes basin. | Base map completed resulting in permitting and construction.<br><br>Restoration plan developed. Restoration implemented.<br><br>Fish and wildlife surveys completed to assess habitat usage. |
| **Documenting and Sharing Habitat Restoration Impacts** | Documentation of management and monitoring practices at stream and wetland restoration, fish barrier removal, and riparian buffer projects. This will include Biological Condition Gradient report of methods and results<br><br>Meetings, workshops, papers, etc. to educate and inform target audiences. | A consistent approach to measuring biological condition and response throughout the watershed.<br><br>Education and outreach components utilized in selected watershed projects throughout Great Lakes basin. | Watershed conservation projects in the Green Bay basin have a common format for measuring and reporting effects of conservation activities.<br><br>Other Great Lakes projects implemented the methods and/or results developed in this project at their location. | Coordinated with partners to document management work.<br><br>Utilized Biological Condition Gradient (BCG) and other monitoring methods to track improvements in 7 projects.<br><br>Created report for peer-review.<br><br>Workshop held to disseminate information gathered. |

**10. Collaboration, Partnerships and Overarching Plans**

There are many active and meaningful conservation efforts already taking place in the Green Bay Watershed. When TNC engaged in Watershed Conservation Planning (TNC 2007), it was important that we recognize the great work that was occurring while working with partners to integrate their conservation efforts. The Duck-Pensaukee Watershed has been the focus of a number of conservation projects over the past several years. By integrating those efforts we could move from managing parts and pieces of the system to managing the tributary and coastal wetland system as an integrated whole.

In this proposal many partners have been willing to integrate their work into a holistic conservation approach. In many cases partners are bringing already funded projects to the table, allowing us to minimize implementation costs while maximizing project outcomes and outputs. In development of this conservation framework, partners have met to integrate their work and develop creative, collaborative approaches that push us beyond traditional conservation approaches. In the end, the conservation framework that we are using directly reflects that collaboration.

While no official match is being offered, TNC and its partners are making substantial investments in this project that will leverage grant funds. Nearly $700,000 is being contributed in the 2-year project period.

Besides the relevance to EPA Great Lakes plans referenced earlier in this proposal, this project advances goals and objectives of several other related plans, listed below.

***Wisconsin's Great Lakes Strategy*:** Two areas of this plan are advanced by this project: Habitat and Species and Runoff Pollution. Within Habitat and Species, this project directly advances the goals by restoring coastal, riparian, and wetland habitat as well as restoring streams on the west shore of Green Bay. Efforts to promote proper nutrient management in runoff waters and the development of comprehensive phosphorus-based nutrient management plans on all Great Lakes drainage basins will be addressed in this project.

***Lake Michigan Lakewide Management Plan (LaMP)*:** Aside from the relevance of this project to objectives of the Lower Green Bay and Fox River AOC which is noted elsewhere in this proposal, this project advances other objectives for the Duck-Pensaukee River watershed included in the LaMP for Lake Michigan. These objectives include targeting the west shore of Green Bay as a high priority for habitat protection.

***The State of the Lakeshore Basin*:** Numerous tactics identified in this report will be advanced by this project, including identifying the most significant barriers to fish passage, improving or restoring in-stream habitat for fish, and protecting and restoring fish spawning and nursery habitat in the west shore of Green Bay.

***Great Lakes Regional Collaboration Strategy*:** This document reports on long term goals and short term actions needed to improve ecosystem conditions on the Great Lakes. Many of the goals identified for open/nearshore water, wetland, riverine, and coastal wetland habitats will be advanced by this project. Specifically, habitat restoration, fish passage improvement, and water quality improvement will occur by focusing on road-stream barriers, wetland mitigation siting, and northern pike spawning habitat, and site-based restoration projects.

**11. Programmatic Capability and Past Performance**

**Past Performance—**A few recent TNC federal and non-federal grant awards include:
Crooked Creek Dam Removal: TNC received three federal grant awards for a total of $50,000 to remove 2 dams and restore 15 acres of wetland habitat in southeast Wisconsin. Funding was received through USFWS/WDNR (State Wildlife Grant), USDA (Wildlife Habitat Incentive Program) and USFWS

(Private Lands Program). (i) The agreements were successfully managed and completed on time. TNC hosted a series of partner field trips to the restoration site and continues to use it as a demonstration site for successful small dam removal in ecologically sensitive habitat. (ii) All reporting requirements were met including submission of final reports. (iii) Regular partner meetings were held to ensure the project was completed on time. The entire restoration process was recorded via photos and shared with partners.

LaMP-based Biodiversity Conservation Strategy for Lake Ontario: TNC received a grant from EPA-GLNPO to conduct a biodiversity conservation strategy for Lake Ontario using the Conservation Action Planning process. (i) The agreement was successfully managed and four workshops, one more than originally promised, were held. A final report was issued in April 2009. (ii) All reporting requirements were met including budget reviews and required annual reporting. (iii) A website was established for the project that allows all participants and interested parties access to interim summaries of the workshops, materials compiled in preparation of the workshop, maps, and project overviews. In addition, numerous presentations have been made in relevant public forums.

Multi-partner wet prairie restoration and two-stage ditch construction: TNC received $1,700,000 from the Joyce Foundation to work with multiple partners on hydrologic recovery, wetland restoration, restoration of floodplain forests, and water quality improvement in tributaries of western Lake Erie. This grant was successfully completed, and all reports have been submitted. This demonstrates TNC's ability to manage and complete large, complex grants.

**Organizational experience**: TNC is a global conservation organization with the resources and expertise required to complete this project. Each government grant and cooperative agreement received by TNC is managed and administered internally by a team of professionals. This team includes TNC legal counsel, the Grants Service Network, and local program and finance staff. The Grants Service Network administers each government grant and cooperative agreement to assure compliance with all government regulations. The collaboration of team members enables us to successfully achieve the objectives of each grant. In addition, training is provided to all staff involved in the management and administration of government funds. Our annual A-133 audit highlights TNC's satisfactory record of performance. TNC is a low-risk grantee; we have had no findings in our A-133 audit for the past ten years. TNC receives grants and cooperative agreements from multiple U.S. Federal agencies each year, and for the year ended June 30, 2009, reported $82.7 million in U.S. Federal expenditures in our A-133 report, and $126.9 million in total government-funded expenditures.

The Nature Conservancy has been working across state and international boundaries throughout the Great Lakes since 1990 to identify, prioritize, and integrate implementation of the most critical conservation strategies for ensuring long-term viability of the Great Lakes Basin. The Nature Conservancy initiated the Great Lakes Project in 2007 to align our internal resources to greatly increase the scope and impact of our work in the Great Lakes region. The Great Lakes Project integrates TNC's capacity from its eight state programs in the Great Lakes Basin. Our objective is to help ensure that the Great Lakes ecosystem is among the most effectively managed ecosystems on Earth.

**Staff Expertise:** Project staff leading the proposed work have over 40 years of proven project, business and conservation management experience. Principal TNC staff involved have extensive conservation experience in partnership building, freshwater conservation and restoration, wetlands mitigation, land protection and restoration, conservation planning, invasive species management, and geographic information systems management. Much of this experience has occurred with a Great Lakes watershed focus. A qualified project manager will be hired in a timely manner to specifically manage this proposal. In addition, our Wisconsin team works in concert with other Great Lakes project teams and other Wisconsin-based TNC scientists with additional expertise in freshwater issues, coastal conservation and wildlife management. This knowledge increases the scope of our impacts through shared information

and provides additional project resources. These teams are also supported by coordinated legal, administrative and grants staff. Resumes and/or curricula vitae are available upon request.

TNC also has a strong background in catalyzing partners and stakeholders to plan and implement large-scale conservation and restoration projects. The history of successful cooperative projects amongst the key conservation partners (WDNR, USFWS, USFS, Oneida Nation, DU, and UW) is evidence of their collaborative intent and experience. Partner expertise includes freshwater conservation and restoration, hydrology and hydrologic engineering, wetland mitigation, protection and restoration, fisheries research and management, waterfowl management, sediment and nutrient management and biologic monitoring.

**12. Budget**

| Budget Category | Grant Amount |
|---|---|
| Personnel/Salaries* | $432,650 |
| Fringe Benefits | $173,060 |
| Travel | $12,000 |
| Supplies | $2,200 |
| Contractual | $485,685 |
| Other | $2,000 |
| Total Direct | $1,107,595 |
| Indirect @ 23.05% | $255,301 |
| Total Cost | $1,362,896 |
| Leveraged funds, not to be construed as match | $700,000 |

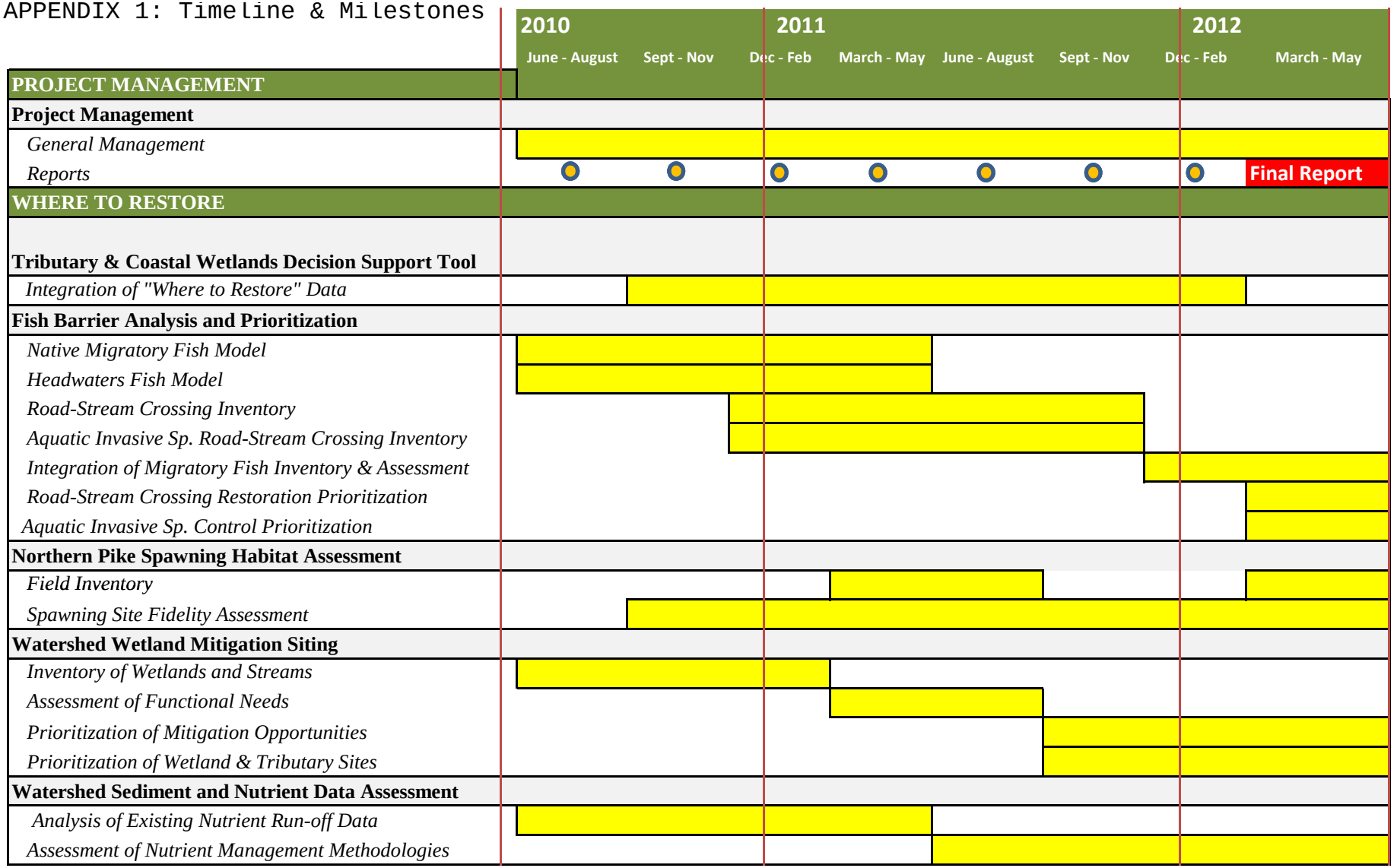
*Includes overtime when deemed necessary and approved by supervisor.

For indirect, TNC will charge its current federally-negotiated rate. Programmatic reporting expenses are incorporated in the budget above. Administrative and financial reporting expenses are included in our indirect costs.

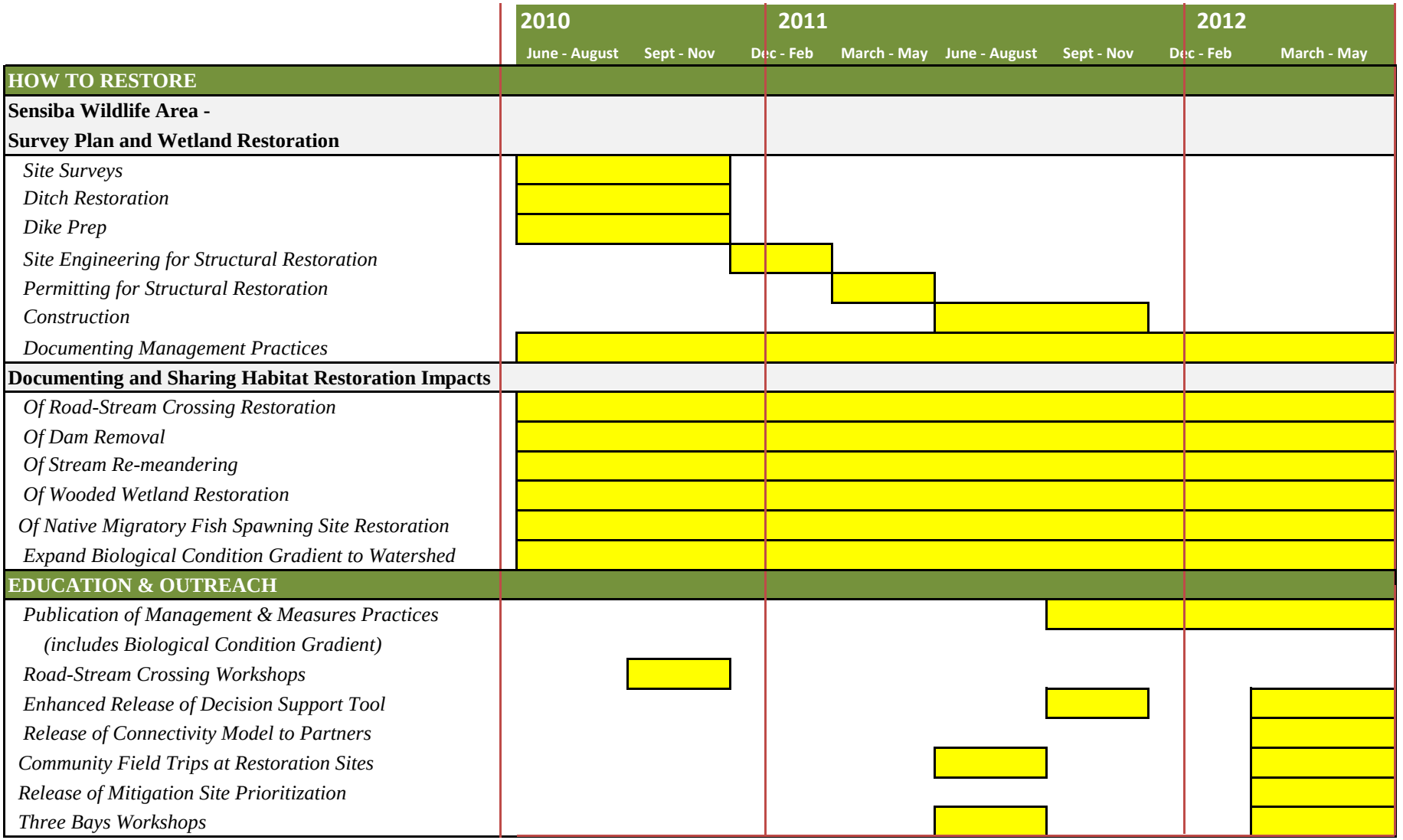
**13. ACORN Statement:** Neither TNC nor its named subawardees/contractors are subject to Congress' prohibition against federal funding for ACORN or any of its affiliates, subsidiaries, or allied organizations.

**14. Attachments (not counted toward page total)**
Map 1: Duck-Pensaukee Watershed
Map 2: Duck-Pensaukee Watershed Restoration Sites
Appendix 1: Timeline and Milestones for Proposal Activities

APPENDIX 1: Timeline & Milestones



Integrated Stream Wetland Restoration; Lower Green Bay - Fox River AOC



**REFERENCES:**


Bartnik, S.E., Johnson, T.B., Sale, P.F., and Fryer, B.J. 2005. Otolith microchemistry for percid production dynamics in Lake Erie. Great Lakes Fishery Commission - 2005 Project Completion Report.

Bosley, T.R. 1978. Loss of wetlands on the west shore of Green Bay. Wisc. Acad. Sci., Arts, and Letters 66: 235-245.

Davies S.P. and S. K. Jackson. 2006. The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems. Ecological Applications 16(4): 1251–1266.

Farver, J.R., and J.G. Miner. 2007. Evaluation of employing trace element contents of otoliths as a natural tag using Lake Erie white bass (*Morone chrysops*). Ohio Sea Grant, project completion report R/LR-006-PD.

Franklin D. R. and L. L. Smith, Jr. 1963. Early life history of the northern pike, Esox lucius L., with special reference to the factors influencing the numerical strength of year classes. Trans. Am. Fish. Soc. 92(2): 91-110.

Hand, C.P., Ludsin, S.A., Fryer, B.J., and J.E. Marsden. 2008. Statolith microchemistry as a technique for discriminating among Great Lakes sea lamprey (*Petromyzon marinus*) spawning tributaries. Can. J. Fish. Aquat. Sci. 65: 1153-1164.

Johnson, F. A. 1957. Northern pike year class strength and spring water levels. Trans. Am. Fish. Soc. 86: 285-293.

Lake Michigan Fisheries Team. 2004. Integrated Fisheries Management Plan 2003-2013. Wisconsin Dept. of Nat. Res., Bureau of Fisheries Management and Habitat Protection, Admin. Report No. 56, Madison, WI. http://dnr.wi.gov/fish/lakemich/LMIFMP_2003-2013.pdf

Ludsin, S.A., Fryer, B.J. and J.E. Gagnon. (2006) Comparison of solution-based versus laser-ablation ICP-MS for analysis of larval fish otoliths. Transactions of the American Fisheries Society 135: 218-231.

Schuette, P.A. and R.A. Rost. 1998. Spawning wetlands used by northern pike (*Esox lucius L.*) in the Pensaukee River Watershed, 1996 and 1998. Wisconsin Dept. of Nat. Res. unpub. report.

The Nature Conservancy. 2007. Green Bay Integrity Assessment Phase 3; Final Report. Unpublished report. The Nature Conservancy, Door Peninsula and Green Bay Project, Sturgeon Bay, WI.

USEPA. 2005. Use of Biological Information to Better Define Designated Aquatic Life Uses in State and Tribal Water Quality Standards: Tiered Aquatic Life Uses. United States Environmental Protection Agency. August 10, 2005.

University of Wisconsin – Extension. 2004. Green Bay's West Shore Coastal Wetlands; Jewels in the Lake Michigan Basin. University of Wisconsin – Extension, Wisconsin Coastal Management Program, Wisconsin Dept. of Natural Res. September 1, 2004.

Wisconsin Department of Natural Resources. 1988. Lower Green Bay Remedial Action Plan. PUBL-WR-175-87 REV 88. Wisconsin Dept. of Natural Res., Madison, WI.

Wisconsin Department of Natural Resources. 1993. Lower Green Bay Remedial Action Plan, 1993 Update for the Lower Green Bay and Fox River Area of Concern. Wisconsin Dept. of Natural Res., Madison, WI.

Wisconsin Department of Natural Resources. 2001. The State of the Lakeshore Basin. Report + Appendices. PUBL WT 667 2001. Wisconsin Dept. of Natural Res., Madison, WI.

Wisconsin Department of Natural Resources. 2002. A Data Compilation and Assessment of Coastal Wetlands of Wisconsin's Great Lakes. Final Report. PUBL ER-803 2002. Wisconsin Dept. of Natural Res., Madison, WI.

Wisconsin Department of Natural Resources. 2009. Lower Green Bay and Fox River Area of Concern Beneficial Use Impairment Delisting Targets. Wisconsin Dept. of Natural Res., Madison, WI. http://dnr.wi.gov/org/water/greatlakes/priorities/aocs.html