Appendix 2: ROUGE RIVER 2002 MYSTERY OIL SPILL NRDA: SELECTION OF PREFERED RESTORATION ALTERNATIVES MEMORANDUM

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ROUGE RIVER 2002 MYSTERY OIL SPILL NRDA: SELECTION OF PREFERED RESTORATION ALTERNATIVES MEMORANDUM

Draft

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Selection of Restoration Alternatives for the 2002 Rouge River Mystery Oil Spill Natural Resource Damage Assessment

Introduction

On April 9, 2002 there was an oil spill on the Rouge River in Detroit Michigan. According to U.S. Environmental Protection Agency (EPA) reports, an estimated 255,544 gallons of mixed diesel and waste lubricating oil were visible on the waters of the Detroit River at or about mid-day on 10 April 2002 (Allen, 2002). The 255,544 gallons were identified as a portion of the 9 April oil spill that released oil into the Rouge River from an unknown source. Over the next few days, the spilled oil washed into the Detroit River, oiling 17 miles of the U.S. Detroit River coastline and 16 kilometers of the Canadian coastline. A second release of oil occurred from a similar release location on the night of 12 April 2002. Over the next two weeks, U.S. Coast Guard (USCG) pollution reports indicate that cleanup efforts removed 66,359 gallons of emulsion, which contained some lesser volume of oil, and much of the oiled coastal flora from the U.S. shorelines. A portion of the spill was contained within the Rouge River system with booms and most of the recovered oil was collected in this region. Oil was found in the nearby sewer system; thus, the source of the oil to the river was found to be the sewer system outfalls during and/or after a period of increased sewer flow during rain events in the area. The spill is classified as a mystery spill and a Natural Resource Damage Assessment is underway to compensate the environment and the public for natural resource losses associated with the impacts of the spilled oil.

Restoration Planning

Once injury assessment is complete or nearly complete, trustees develop a plan for restoring the injured natural resources and services. Under the Natural Resource Damage (NRD) Regulations implementing the Oil Pollution Act (OPA), 15 C.F.R. Part 990, the goal is to make the environment and public whole for injuries to natural resources and natural resource services resulting from a discharge of oil. This goal is achieved through the restoration, rehabilitation, replacement, or acquisition of equivalent natural resources and/or services. To achieve this goal, trustees must identify a reasonable range of restoration alternatives, evaluate and select the preferred alternative(s), and develop a Draft and Final Restoration Plan. Acceptable restoration actions include any of the actions authorized under OPA (restoration, rehabilitation, replacement, or acquisition of the equivalent) or some combination of those actions

Restoration actions under the OPA regulations are either primary or compensatory. Primary restoration is action taken to return injured natural resources and services to baseline, including natural recovery. Compensatory restoration is action taken to

compensate for the interim losses of natural resources and/or services pending recovery. Each restoration alternative considered will contain primary and/or compensatory restoration actions that address one or more specific injuries associated with the incident. The type and scale of compensatory restoration may depend on the nature of the primary restoration action, and the level and rate of recovery of the injured natural resources and/or services given the primary restoration action. When identifying the compensatory restoration components of the restoration alternatives, trustees must first consider compensatory restoration actions that provide services of the same type and quality, and of comparable value as those lost. If compensatory actions of the same type and quality and comparable value cannot provide a reasonable range of alternatives, trustees then consider other compensatory restoration actions that will provide services of at least comparable type and quality as those lost.

As part of the restoration planning process, the Trustees identify and evaluate a wide range of projects that are capable of restoring ecological services comparable to those lost as a result of the incident. For the 2002 Rouge River Mystery Oil Spill NRDA, these include injuries to wildlife, birds, fish, and associated shoreline and riverine habitats. These identified projects are then screened to narrow the field of reasonable restoration alternatives to those projects that meet the criteria set forth in the regulations as well as additional restoration goals as determined by the Trustee Council.

This memorandum presents the reasonable restoration alternatives that are selected by the Trustees. These selected restoration alternatives will be scaled to compensate for the incident injuries and to identify the preferred restoration strategy by the Trustees. The "No Action" alternative will also be included for consideration, as required by NEPA and the OPA regulations.

Restoration Alternatives Selection Criteria: Regulation Based

The OPA regulations identify a number of criteria which the trustees should consider when evaluating restoration options. The following regulatory-based criteria were used during the selection process as the trustees selected the preferred restoration projects for the 2002 Rouge River Mystery Oil Spill NRDA.

- **Costs and Cost-Effectiveness.** Consider the relationship of expected project costs to expected resource and service benefits. Seek the least costly approach to deliver an equivalent or greater amount and type of benefits.
- **Consistency with Trustees' Restoration Goals.** Projects must meet the trustees' intent to restore, rehabilitate, replace, enhance, or acquire the equivalent of the injured resources and resource services.
- **Technical Feasibility.** The project must be technically and procedurally sound. Consider the level of risk or uncertainty and the degree of success of projects utilizing similar or identical techniques in the past.

- **Likelihood of Success.** Consider the potential for success and the level of expected return of resources and resource services. Consider also the ability to evaluate the success of the project, the ability to correct problems that arise during the course of the project, and the capability of individuals or organizations expected to implement the project.
- **Relationship to Injured Resources and/or Services (nexus).** Projects that restore rehabilitate, replace, enhance, or acquire the equivalent of the same or similar resources or services injured by the spill are preferred to projects that benefit other comparable resources or services. Consider the types of resources or services injured by the spill, the location, and the connection or nexus of project benefits to those injured resources.
- **Time to Provide Benefits.** Consider the time it takes for benefits to be provided to the target ecosystem or public to minimize interim resource loss (sooner = better).
- **Duration of Benefits.** Consider the expected duration of benefits from the project. Long-term benefits are the objective.
- **Multiple Resource and Service Benefits.** Consider the extent to which the project benefits more than one natural resource or resource service. Measure in terms of the quantity and associated quality of the types of natural resources or service benefits expected to result from the project.
- **Avoidance of Adverse Impacts.** The project should avoid or minimize adverse impacts to the environment and the associated natural resources. Adverse impacts may be caused by collateral injuries when implementing, or as a result of implementing, the project. Consider avoiding future short-term and long-term injuries as well as mitigating past injuries.
- **Compliance with Applicable Federal, State, and Local Laws and Policies.** The project must comply with applicable laws and policies.
- **Public Health and Safety.** The project must not pose a threat to public health and safety.
- **Additional Consideration.** The Consistency; Relationship; and Compliance criteria, among others listed above, all presume that the Trustees will not include projects that are already legally mandated Federal or State Agency actions.

Restoration Alternatives Selection Criteria: Resource Injury Based

The OPA regulations call for trustees to consider the relationship to the injured resources and/or services when evaluating restoration options. The trustees have completed their assessment of the nature and extent of natural resource injuries for the 2002 Rouge River Mystery Oil Spill (*Rouge River 2002 Mystery Oil Spill SIMAP Injury Report, May 15 2009* and *Rouge River 2002 Mystery Oil Spill Revised Wildlife Injury Memorandum, October 18, 2009*). These injury assessment findings were included as criteria during the selection process to identify projects that best met the types of resources or services injured by the spill, the location, and the nexus of project benefits to the quantified injuries. Based on the biological injury modeling of the incident, the trustees have

identified potential impacts to the following natural resources and associated services (specific species and their relative injuries are found in the *Rouge River 2002 Mystery Oil Spill Revised Wildlife Injury Memorandum, October 18, 2009*):

For Wildlife:

- Waterfowl;
- Seabirds;
- Wading birds;
- Shorebirds;
- Scaup (listed separately due to the size of the injury to this species);
- Mammals (i.e., muskrats);
- Reptiles;
- Amphibians.

For Fish and Invertebrates:

- Small pelagic fish;
- Large pelagic fish;
- Demersal fish;
- Demersal invertebrates (i.e., worms and freshwater clams which will be put in littoral marshes, mudflats and aquatic beds).

For Shoreline (or riparian) Habitats:

- Rocky shore;
- Gravel beach;
- Sand beach;
- Mud flat;
- Marsh;
- Intertidal artificial.

Table One presents the preliminary wildlife injuries by wildlife group and Table Two presents the preliminary fish injury numbers. Tables Three and Four present the vegetation and invertebrate injuries by habitat type. The *Rouge River 2002 Mystery Oil Spill Revised Wildlife Injury Memorandum, October 18, 2009* presents the specifics of each of these wildlife groups.

Table 1. Estimated injuries (interim loss) as individual bird-years (all age classes combined) for the base case model scenario using a 1 percent slow release of the oil. ***Note that the number lost is based on a probability, and so mathematically can be < 1 animal. "-" indicates species was not present in region.***

Wildlife Group	Individual-years Lost in Detroit River and Lake Erie	Individual-years Lost in Rouge River	Total Individual-years Lost
Waterfowl	1,057	77.9	1,135
Seabirds	11,977	15.5	11,992
Wading birds	30.5	-	30.5
Shorebirds	351	-	351
Scaup	8,855	-	8,855
Total Bird Years			**22,365**
Total Mammal Years	398	-	**398**
Reptiles	1,238	-	1,238
Amphibians	9,448	-	9,448
Total Herptile Years			**10,690**

Table 2. Estimated injuries to fish in the Detroit River and Lake Erie using a 1 percent slow release of the oil and an LC50 value of 44ppb for species with average sensitivity to the Rouge River diesel and lubricating oil mix.

Fishery Group	Biomass Killed (kg)	Production Forgone (kg)	Total Injury (kg)
Total small pelagic fish	2.2	0	2.2
Total large pelagic fish	8.4	7.2	15.6
Total demersal fish	108	102	211
Total	**119**	**110**	**228**

Table 3. Estimated areas exposed by enough oil to injure vegetation (> 1.0 mm of oil swept through either while wet or dry), by habitat type; for the base case model scenario using a 1 percent slow release of the oil.

Vegetation Injury	Area Oiled with > 1 mm of Oil (acres)
Fringing Marsh	11.1
Extensive Wetland	28.6

Vegetation Injury	Area Oiled with > 1 mm of Oil (acres)
Total	39.7

Table 4. Estimated areas exposed by enough oil to injure invertebrates (> 0.1 mm of oil, while dry), by habitat type; for the base case model scenario using a 1 percent slow release of the oil.

Invertebrate Injury	Area Oiled with > 0.1 mm of Oil (acres)
Gravel Beach	4.4
Sand Beach	6.3
Mud Shore	4.7
Fringing Marsh	17.5
Extensive Mudflat	6.2
Extensive Wetland	111
Total	150

Rouge River NRDA Restoration Alternatives

A number of preliminarily-identified potential restoration alternatives were identified and they are presented in Table A1, Appendix A All of the restoration alternatives in Table A1 are also presented, with greater detail, in the Preliminary Restoration Alternatives Memorandum (*Rouge River 2002 Mystery Oil Spill NRDA: Preliminary Restoration Alternatives Memorandum Draft, August 28, 2009*)

The information used in the identification of the alternatives includes documents and communications with staff from the following agencies/organizations, among others:

- United States Fish and Wildlife Service;
- Michigan Department of Natural Resources;
- Michigan Department of Environmental Quality;
    - Including Detroit River Areas of Concern;
- United States Environmental Protection Agency;
    - Including Detroit River Western Lake Erie Basin Indicator Project;
- United States Geological Survey;
- Rouge River Watershed;
- Detroit River International Wildlife Refuge;
- Pointe Mouille State Game Area;
- Lake Erie Metropark;
- Detroit River Canadian Cleanup/RAP.

Rouge River NRDA Restoration Alternative Selection

The trustees identified 56 projects as potential restoration alternatives listed in Appendix A. These 56 projects were screened by the trustee council to narrow the list of projects to those projects most capable of restoring ecological services comparable to those lost as a result of the incident. The criteria used as part of the screening process include the regulatory requirements and the injury specific assessment quantification (discussed in the Restoration Alternatives Selection Criteria Sections above) to ensure that restoration is capable of completely and fully addressing injury.

The restoration alternative screening assessment results for each of the preliminarily-identified restoration alternatives are presented in Appendix B, Table B1. The resulting streamlined list includes 14 projects that have met the initial screening requirements and that are being retained as part of the restoration scaling analysis. These 14 projects are presented in Table Five.

Table 5. List of Screened Restoration Projects Selected for Restoration Scaling Analyses.

Project	Type of Project
Brancheau Tract Invasive Species Control	Invasive species control
Eagle Island Marsh Wetland Enhancement	Wetland restoration
Gibraltar Wetlands Habitat Improvement	Invasive species control
Grassy Island Shoal Restoration	Dike reconstruction
Great Lake Marsh Restoration	Invasive species control
Humbug Marsh Habitat Improvement	Habitat improvement; invasive species control
Lady of the Lakes Wetland Enhancement	Water control
Lake Erie Marsh Preserve Wetland Restoration and Enhancement	Water control; invasive species control
Lakeplain Prairie Restoration	Invasive species control; native plant restoration/re-vegetation
Managed Coastal Wetland Restoration	Wetland restoration
Pte. Mouillee State Game Area Projects	Water control; invasive species control
Rouge River Watershed Grow Zones: Habitat Restoration and Enhancement	Native plant restoration/re-vegetation; habitat enhancement
Strong Property Shoreline Enhancements	Dike reconstruction; invasive species control
Sturgeon Bar Restoration	Shoreline stabilization; native plant re-vegetation

It should be noted that these 14 projects may not all be represented in a final Preferred Alternative as selected by the trustees; rather, some combination of a subset of these projects likely will be selected by the trustees to compensate for injured resources from a set of restoration alternatives, including a "no-action" alternative.

Rouge River NRDA Restoration Next Steps

The potential restoration alternatives identified by the trustees have been narrowed to the 14 projects most likely to address the injuries resulting from the incident. These 14 screened projects, along with the "no-action" alternative will be evaluated so that the trustees can identify a preferred restoration alternative to address the 2002 Rouge River Mystery Oil Spill injuries. To accomplish that, the projects of interest will be scaled to the injuries and then grouped them into potential restoration options, each of which address the specific injuries to the resources and compensate for the interim losses of natural resources and/or services. Each of these restoration options can then be evaluated, along with the "no action" alternative to identify the final restoration strategy that the trustees will use to develop a Draft and Final Restoration Plan.

Appendix A: Rouge River 2002 Mystery Oil Spill NRDA: Preliminary Restoration Alternatives

Table A1. Preliminary Restoration Alternatives for the 2002 Rouge River Mystery Oil Spill NRDA

Restoration Option Name	Primary Resource Benefit	Description of Project
Manhattan Marsh Preservation, Restoration and Enhancement	Birds, Wildlife	The Manhattan Marsh property lies within the City of Toledo and is perhaps the only intact moderate- to high-quality emergent marsh wetland system within City's urban center. This Category 2 marsh drains directly into Maumee Bay through Detwiler Ditch. The marsh provides important habitat for resident and migratory birds and was home to a nesting pair of bald eagles for a brief time during the 1990s. Metroparks of the Toledo Area is in the process of acquiring the marsh property through the City of Toledo. Due to previous impacts to the site, removal of debris and waste material is required around the periphery of the marsh. There is a vacant structure previously used for commercial purposes which should be removed from the site. Additionally, a water control structure should be constructed to allow regulation of water levels to control populations of the invasive narrow-leaf cattail which occurs throughout the marsh.
Managed Coastal Wetland Restoration	Birds, Wildlife	There is currently no restoration design. The Detroit River International Wildlife Refuge envisions (long-term) 20-30 acres (or some portion thereof) restored to a managed coastal wetland with the remaining being planted as native prairie
Lady of the Lakes Wetland Enhancement	Birds, Wildlife	This site is currently in the process of being surveyed for restoration design. Currently the site has no water level management and restoration design will likely have a management component.
Eagle Island Marsh Wetland Enhancement	Birds, Wildlife	Currently no restoration survey or design work has been done.
Bay Creek Hunt Club Land Acquisition	Birds, Wildlife	Owner had been in negotiation with FWS for acquisition, wasn't interested. No plans for FWS ownership or for a cooperative agreement.
Strong Property Shoreline Enhancements	Birds, Wildlife	The project would repair/reconstruct the northern dike so that area can be burned for invasive control and provide vehicle access. The property is located just south of Pte. Mouillee

Restoration Option Name	Primary Resource Benefit	Description of Project
Gibraltar Wetlands Habitat Improvement	Birds, Wildlife	This site is a recent Detroit River International Wildlife Refuge acquisition. It is a good quality wetlands but is in need of some invasive species control.
Humbug Marsh Habitat Improvement	Birds, Wildlife	This marsh needs habitat improvement and invasive species control. Invasive species control has been undertaken in the past.
Brancheau Tract Invasive Species Control	Birds, Wildlife	Invasive species control to augment restoration plan currently being implemented.
Pte. Mouillee State Game Area Zone 13	Birds, Wildlife	Construct a new 1500 foot long dike in Zone 13.
Pte. Mouillee State Game Area Sump Dike	Birds, Wildlife	Complete the sump dike and raise it 2 feet.
Pte. Mouillee State Game Area Bad Creek Unit	Birds, Wildlife	Repair the Bad Creek Unit dikes and return them to fully functioning dikes for habitat enhancement.
Pte. Mouillee State Game Area Walpatich Repair	Birds, Wildlife	Repair the east/west dikes to connect to each other for better water control within the Walpatich Unit and for habitat enhancement.
Pte. Mouillee State Game Area Water Control Structures	Birds, Wildlife	Purchase of water control structures to enhance water control and habitat enhancement'
Pte. Mouillee State Game Area Zone 13 and Lautenschlager Unit	Birds, Wildlife	Phragmites control project covering 100 acres using aerial application.
Belle Isle Fish habitat construction: Augment Existing Spawning Reef	Fish	Project would augment an already existing artificial spawning reef. Research has shown that the spawning reef is working in that area. 14 species of native fish have been shown to spawn, including lake whitefish, walleye, and yellow perch
Fighting Island (Canada) Fish habitat construction	Fish	Project would add spawning substrates on which lake sturgeon and other high-value native fish prefer to spawn - this project builds on existing Belle Isle work. Last year, in a unique U.S.-Canada partnership, a lake sturgeon spawning reef was constructed off Fighting Island in the Detroit River. It has been confirmed that sturgeon are spawning on the reef. They have also found an endangered species -- the northern madtom.
Grassy Isle Fish habitat construction	Fish	Construct fish spawning beds at NE Grassy Island and immediately south of Grassy Island on Mamajuda Island Shoal to restore historic, reputed spawning runs of lake sturgeon and lake whitefish, respectively, to the Grassy Island area

Restoration Option Name	Primary Resource Benefit	Description of Project
Belle Isle Fish habitat construction: Spawning Beds	Fish	Construct fish spawning beds of rounded rock at the head of Belle Isle to augment and increase natural reproduction of walleye and white sucker at that location
Belle Isle Fish Rearing and Stocking Facility	Fish	Build and operate a stream-side lake sturgeon egg and larvae facility on Belle Isle for the culture and subsequent release of young of the year lake sturgeon originating from Detroit River lake sturgeon adults back into the Detroit River. (This project may not have MDNR support)
Round Island acquisition	Fish	This island sits on the western perimeter of a large bay located at the southern most end of Grosse Ile, known as the Gibraltar Bay. Gibraltar Bay is considered one of the most productive and ecologically important wetland/coastal emergent shorelines in the Detroit River. Much of the undeveloped and natural shoreline of the bay is contained on the eastern side of Round Island. The bay has become a very popular year-round fishing spot, holding large numbers of seasonal perch, bass and pike. Much of this is due to the large stable aquatic macrophyte beds that remain on the bottom all year round. Once used as duck hunting camp, it is currently in jeopardy of being developed for residential use. The impacts of hardening this shoreline and the infill of the internal lowlands would be catastrophic to the functionality of the bays wetland complex. The extent of this project proposal would be the acquisition of this island from its current private owner or at a minimum, the creation of wetland setbacks and conservation easements.

Restoration Option Name	Primary Resource Benefit	Description of Project
Sugar Island acquisition	Fish	The island's maple and oak hardwoods along with its dense bush cover provides important habitat for migratory birds to stage and roost. It is also frequented on a regular basis by the local eagle population. The surrounding shoreline sandy shoal areas once saw millions of spawning smelt fill its waters. Currently several species of suckers, log perch and other fish species use the island's shallows annually. In the deeper waters that can be found off the eastern side of the island, large numbers of migrating walleye pass through the area in the spring along with the many pike that traverse its shoreline shoals. Given the current owners interest in selling the island to land developers and the lack of interest in creating any conservation easements, the best solution to protect the island and its beaches for public access is an out right purchase.
US Steel Shoal Restoration	Fish	This site in particular, with it's naturally in cut bay shoreline and preexisting shoal area, has the potential to create the largest aquatic and emergent habitat site in this section of the river. The other important feature of this site is that is already has a preexisting and partially intact rock shoal that parallels the shoreline for several 100 feet. This feature is important because of the experiences learned from other emergent shoreline projects attempted in this part of the river. Because of the tremendous current and wave surges from the heavy boat traffic, that without a protected partially emergent shoal build in front of these areas as a breakwater, any attempt to soften the shoreline with aquatic emergent vegetation will fail due to the effects of wave driven erosion. An estimated 750' of shoal reconstruction work would be needed to fully protect the shoreline habitat.
Rouge River Watershed - Rouge River National Wet Weather Demonstration Project	Fish	Design and construction of combined sewer overflow controls, sanitary sewer overflow controls, storm water management; habitat restoration; public education; support to Alliance of Rouge Communities to support Community Grants for local municipalities, with an emphasis on Grow Zones and other habitat-focused restoration. Funding sought to augment Alliance of Rouge Communities budget for mini-grants for habitat restoration within watershed.

Restoration Option Name	Primary Resource Benefit	Description of Project
Rouge Gateway Partnership: Fordson Island; Planning/Feasibility Study	Fish	Implementation of Rouge River Gateway Partnership Master Plan: various projects to promote economic development, ecosystem restoration, heritage preservation, and increased recreation along the Rouge River corridor. Several "shovel-ready" projects have been identified by Rouge communities. Specifically the Fordson Island project to dredge debris from the channel and to enhance the riverine habitat.
Rouge Gateway Partnership: Detroit, and River Rouge Fish Habitat Enhancements Segment 1	Fish	Rouge River corridor improvements (upstream of spill site: Rotunda Dr. to I-94, MI): The project will provide for environmental enhancement of the Rouge River channel by partial removal of the existing concrete lining, widening of the river channel / cross section, providing fish habitat and restoring the river banks to a more natural condition with plantings instead of concrete.
Rouge Gateway Partnership: Detroit, and River Rouge Fish Habitat Enhancements Segment 2	Fish	Rouge River corridor improvements (upstream of spill site: Michigan Ave to Rotunda Dr., MI): The project will provide for environmental enhancement of the Rouge River channel by partial removal of the existing concrete lining, widening of the river channel / cross section, providing improved fish habitat and restoring the river banks to a more natural condition with plantings instead of concrete.
Restoration of Hines Park Wetland Mitigation Bank (Wayne County)	Fish	Restoration of Wayne County Wetland Mitigation Bank: Analysis, design: restoration and construction of wetlands in Hines Park
Cook and Gladding Drain Petition Project within the Alliance of Downriver Watersheds	Fish	Drain improvement projects in various Downriver communities, to improve storm water management and eliminate E. Coli contamination from urban waterways. 2 projects ready to go: Cook and Gladding Drain Petition Project, located in Flat Rock, Huron Township, Brownstown township. It includes cleaning out of the drain, replacement of all but 2 crossings and installation of "natural stream channel" design features including deep rooted native wildflowers and grasses. Project cost = $2,800,000. Wager and Pink Intercounty Drain (extends between Wayne and Monroe County): Project includes creating a detention area, replacing culverts, removing sediment, enclosing a section of the drain and installation of "natural stream channel" design features including deep rooted native wildflowers and grasses. Project cost = $850,000.

Restoration Option Name	Primary Resource Benefit	Description of Project
Rouge River watershed, Ecorse Creek watershed, Combined Downriver watershed, Detroit River watershed, Lake St Clair watershed: Habitat Rehabilitation	Fish	Illicit discharge elimination, storm water management, public education, riverine habitat rehabilitation, support to community-based Watershed Alliances
Henry Ford Estate Dam Fish Passage; Feasibility/Planning Study	Fish	Modification of the Henry Ford Estate Dam to include a fish passage.
Wayne Road Dam Removal; Planning and Design	Fish	Modification of the Wayne Road Dam. Lowhead dam removal
Concrete Channel Modifications: For Habitats and Fish Populations	Fish	Assorted projects restoring the natural riverine habitat and flow.
Grassy Island Shoal Restoration	Fish, Birds	In the mid part of the 1900's, as part of a ship navigation system, a long dike was constructed as part of a range light system. This dike started from the shore of the north west side of the island and proceeded out from the island in an angle towards the southwest for approximately 1,500 feet. This dike created a man made bay impoundment that protected the wetland that once existed on the western side of the island. Over the past few decades high water and erosion reduced the dikes to a submerging shoal area covered by 5 to 6 feet of water. Reconstruction of this dike system would recreate the protective bay and allow the re-emergent of wetlands and the regeneration of emergent shoreline plants to this area.
N. Hennepin Marsh restoration	Fish, Birds	The first project would reduce wave action erosion through construction of a series of several long and narrow emergent shoals that would run in an arc starting from the northern end of the wetland site and curve out towards the channel, then turning south to run parallel to the Grosse Ile shoreline. The combined length of these shoal islands would total approximately 2,500 feet. The second of the two projects would include elimination and continued control of phragmites and re-vegetation of native emergent plants along the adjacent shoreline.

Restoration Option Name	Primary Resource Benefit	Description of Project
S. Hennepin Marsh Land Acquisition	Fish, Birds	Bordered by a series of three small island dikes to the east and a large portion of undeveloped vacant land along the Grosse Ile shoreline to the west, the balance of this wetland contains a very shallow macrophyte and rush bed. Much of the shoreline along Grosse Ile is part of an undeveloped parcel of property that is currently for sale. Acquisition of this property would assure no further development and potential shoreline hardening in this area.
S. Hennepin Marsh Construction	Fish, Birds	These islands are rapidly eroding. Because of the shallow nature of the waters surrounding these island dikes, much of the rebuilding materials (sand, gravel and clay) could be dredged up from the area and then rebroadcast onto the islands to rebuild then up several feet above the current elevations of the river and improve the protection they provide to themarsh behind them. Additionally, this site has a phragmites problem along its shore.
Sugar Island Restoration	Fish, Birds	The southern end of the island extends out into Lake Erie. It was once protected by large stand of cattails that helped to break the impact of the lakes waves but now is exposed to the full force of the lake as a result of years of erosion. Hundreds of feet of the island and many of the large trees have eroded off the bluff that now dominates the lower 1/3 of the island. In order to stop further erosion two possible construction solutions could be employed to correct this problem. The first would be the placement of a course of limestone rock along the length of the southern end of the island, armoring the island against the forces of the lake. The second, more beneficial method would be to create an emergent shoal that parallels the southern shoreline approximately 100' off the island, creating a dike barrier protecting the island from the lakes waves. Both projects would require about 1300' of dike work, with the second proposal requiring more material than the first

Restoration Option Name	Primary Resource Benefit	Description of Project
Celeron Island Shoal construction	Fish, Birds	The loss of the protective shoreline has led to the loss of much of the wetlands that lined the outer shoreline and the inner bay, at the center of the island. Today the island is actually two separate islands due to decades of erosion. To address this problem the construction of an off shore emergent shoal would help to break up the force of incoming waves from the lake during seasonal storms and allow for the regeneration of the islands outer shoreline emergent vegetation. Such a shoal would also create additional fish habitat, provide additional hunting opportunities and provide a protected area for migratory waterfowl and shorebirds to roost.
Detroit River International Wildlife Refuge Educational/Outreach Activities	Fish, Birds, Wildlife	Expanding Refuge educational/outreach activities, such as guided tours of Hamburg Marsh Unit and interpretive programs
Rouge River Early Warning Detection System	Fish, Birds, Wildlife	This project would install an early warning system in the several outfalls along the Rouge that seem to be sources for ongoing release episodes. Stand alone systems are available at this time and LTCI can undertake an initial review of them if the Trustees are interested.
Stony island shoal reconstructions	Fish, Birds, Wildlife	The upper bay dike adjacent to Grosse Ile had been eroded down below the current water level over a length of approximately 750 feet. The shoal that protects the wetlands of the lower bay has also disappeared under the effects of decades of erosion. The remaining submerged shoal runs perpendicular to the southwest end of the island, in the lower bay, beginning at the islands old bridge crossing and extending out off the island approximately 1250 feet to the south. Reconstruction of these shoals would provide desirable protection to Stony Island.

Restoration Option Name	Primary Resource Benefit	Description of Project
Fort Wayne Shoreline Restoration	Fish, Birds, Wildlife	Historic Fort Wayne includes 1,270 feet of river frontage that is presently comprised of large concrete riprap. The upland area includes some native trees. The U.S. Geological Survey has recommended assessment for soft shoreline engineering. Opportunities are also present for a low channel or swale in the upland area with an intermittent connection to the Detroit River. Ideally, it would be seasonally accessible to native fish species and would also benefit other wetland species including small mammals, reptiles and amphibians. Its habitat value for migratory birds would be enhanced considerably by suitable wildlife plantings including oaks, dogwoods and other fruit-bearing native shrubs, grasses and a variety of pollinator-friendly wildflowers.
Rouge Gateway Partnership: Spillway Project; Feasibility Study	Fish, Birds, Wildlife	Implementation of Rouge River Gateway Partnership Master Plan: various projects to promote economic development, ecosystem restoration, heritage preservation, and increased recreation along the Rouge River corridor. Several "shovel-ready" projects have been identified by Rouge communities. Specifically the Spillway project to incorporate swales, a wetland and access to the River at an existing spillway cut through the concrete channel.
Erie State Game Area North Maumee Bay	Fish, Birds, Wildlife	Conduct a feasibility study in North Maumee Bay to look at restoration potential.
Lake Erie Marsh Preserve Wetland Restoration and Enhancement	Wildlife	This parcel is considered by the Detroit River International Wildlife Refuge to be a significant wetland habitat within the corridor as well as a key parcel for wildlife. A restoration plan has been submitted for NOAA funding/grant. FWS supports the plan.
Detroit River (former Chrysler site) Coastal Shoreline Restoration	Wildlife	Soft shore engineering for Refuge Gateway property (the former Chrysler site, property is not FWS owned). In 2008, USFWS retained Pheasants Forever and JF New to prepare architectural and engineering drawings for wetland and shoreline restoration at the Refuge Gateway. This architecture and engineering work will be completed in 2009. It is unclear if funding is in place for project completion.
Bennett Arboretum: Habitat Preservation and Enhancement		Implementation of master plan for restoration of Bennett Arboretum, Michigan's first publicly funded arboretum and home to over 475 species of trees (many rare) . Plans include tree plantings, native wildflower and grasses, wetland overlook, welcome kiosk, interpretive trail development and interpretive signage.

Restoration Option Name	Primary Resource Benefit	Description of Project
Rouge River Watershed Grow Zones: Habitat Restoration and Enhancement		Continue implementing "Grow Zones" across Wayne County: Replace 50 acres of mowed turf with native plant grow zones and plant 1000 trees on public lands within the Wayne County watersheds to minimize storm water pollution impacts, reduce air pollution, reduce fossil fuel consumption and create a healthier more biologically diverse natural environment throughout Wayne County. Restoration work may also include prescribed burning of grow zone areas.
North Branch Ecorse Creek Drainage District: Wetland Creation and Habitat Rehabilitation		Design and construction of improvements to North Branch Ecorse Creek: Storm water detention basins; drain widening; utility relocation; bridge expansion; wetland creation within greenway and installation of "natural stream channel" design features including deep rooted native wildflowers and grasses. This project augments existing mini-grants program.

Appendix B. Restoration Alternative Screening

Table B1. Results of restoration screening analysis for preliminary restoration alternatives

Project	**Does the project have the potential to compensate for one or more of the injured resources?**	**Is there sufficient information about the project available to: (a) evaluate the project and (b) satisfy feasibility requirements?**	**Does the project meet the Trustees restoration and screening criteria for injuries experienced as a result of the 2002 Rouge River Mystery Oil Spill**	**Retained for Restoration Scaling Analysis**
Manhattan Marsh Preservation, Restoration and Enhancement	Yes	No	No	No
Lake Erie Marsh Preserve Wetland Restoration and Enhancement	Yes	Yes	Yes	Yes
Managed Coastal Wetland Restoration	Yes	Yes	Yes	Yes
Detroit River (former Chrysler site) Coastal Shoreline Restoration	Yes	No	No	No
Lady of the Lakes Wetland Enhancement	Yes	Yes	Yes	Yes
Eagle Island Marsh Wetland Enhancement	Yes	Yes	Yes	Yes
Bay Creek Hunt Club Land Acquisition:	Yes	No	No	No
Strong Property Shoreline Enhancements	Yes	Yes	Yes	Yes
Gibraltar Wetlands Habitat Improvement	Yes	Yes	Yes	Yes
Humbug Marsh Habitat Improvement	Yes	Yes	Yes	Yes
Detroit River International Wildlife Refuge Educational/Outreach Activities:	Yes	No	No	No
Brancheau Tract Invasive Species Control	Yes	Yes	Yes	Yes
Belle Isle Fish habitat construction: Augment Existing Spawning Reef	Yes	No	No	No

Project	**Does the project have the potential to compensate for one or more of the injured resources?**	**Is there sufficient information about the project available to: (a) evaluate the project and (b) satisfy feasibility requirements?**	**Does the project meet the Trustees restoration and screening criteria for injuries experienced as a result of the 2002 Rouge River Mystery Oil Spill**	**Retained for Restoration Scaling Analysis**
Fighting Island (Canada) Fish habitat construction	Yes	No	No	No
Grassy Isle Fish habitat construction	Yes	No	No	No
Belle Isle Fish habitat construction: Spawning Beds	Yes	No	No	No
Belle Isle Fish Rearing and Stocking Facility	Yes	No	No	No
Rouge River Early Warning Detection System	Yes	No	No	No
Grassy Island Shoal Restoration	Yes	Yes	Yes	Yes
N. Hennepin Marsh restoration	Yes	No	No	No
S. Hennepin Marsh Land Acquisition	Yes	No	No	No
S. Hennepin Marsh Construction	Yes	No	No	No
Stoney island shoal reconstructions	Yes	No	No	No
Round Island acquisition	Yes	No	No	No
Sugar Island acquisition	Yes	No	No	No
Sugar Island Restoration	Yes	No	No	No
Celeron Island Shoal construction	Yes	No	No	No
Fort Wayne Shoreline Restoration	Yes	Yes	No	No
US Steel Shoal Restoration	Yes	No	Yes	No
Rouge River Watershed - Rouge River National Wet Weather Demonstration Project: Augmenting Existing Alliance of Rouge Community Pass-Through Mini Grants Program	Yes	No	No	No
Rouge Gateway Partnership: Spillway Feasibility Study:	Yes	No	No	No

Project	**Does the project have the potential to compensate for one or more of the injured resources?**	**Is there sufficient information about the project available to: (a) evaluate the project and (b) satisfy feasibility requirements?**	**Does the project meet the Trustees restoration and screening criteria for injuries experienced as a result of the 2002 Rouge River Mystery Oil Spill**	**Retained for Restoration Scaling Analysis**
Rouge Gateway Partnership: Fordson Island Planning/Feasibility Study	Yes	No	No	No
Rouge Gateway Partnership: Detroit, and River Rouge Fish Habitat Enhancements Segment 1	Yes	Yes	No	No
Rouge Gateway Partnership: Detroit, and River Rouge Fish Habitat Enhancements Segment 2	Yes	Yes	No	No
Restoration of Hines Park Wetland Mitigation Bank (Wayne County)	Yes	No	No	No
Bennett Arboretum: Habitat Preservation and Enhancement	Yes	Yes	No	No
Rouge River Watershed Grow Zones: Habitat Restoration and Enhancement	Yes	Yes	Yes	Yes
North Branch Ecorse Creek Drainage District: Wetland Creation and Habitat Rehabilitation: Augmenting Existing Mini Grants Program	Yes	No	No	No
Cook and Gladding Drain Petition Project within the Alliance of Downriver Watersheds	Yes	Yes	No	No
Rouge River watershed, Ecorse Creek watershed, Combined Downriver watershed, Detroit River watershed, Lake St Clair watershed: Habitat Rehabilitation	Yes	Yes	No	No
Henry Ford Estate Dam Fish Passage Feasibility/Planning Study	Yes	No	No	No
Wayne Road Dam Removal: Planning and Design	Yes	No	No	No
Concrete Channel Modifications: For Habitats and Fish Populations	Yes	No	No	No

Project	**Does the project have the potential to compensate for one or more of the injured resources?**	**Is there sufficient information about the project available to: (a) evaluate the project and (b) satisfy feasibility requirements?**	**Does the project meet the Trustees restoration and screening criteria for injuries experienced as a result of the 2002 Rouge River Mystery Oil Spill**	**Retained for Restoration Scaling Analysis**
Pte. Mouillee State Game Area Zone 13	Yes	Yes	Yes	Yes
Pte. Mouillee State Game Area Sump Dike	Yes	Yes	Yes	Yes
Pte. Mouillee State Game Area Bad Creek Unit	Yes	Yes	Yes	Yes
Pte. Mouillee State Game Area Walpatich Repair	Yes	Yes	Yes	Yes
Pte. Mouillee State Game Area Water Control Structures	Yes	Yes	Yes	Yes
Pte. Mouillee State Game Area Zone 13 and Lautenschlager Unit: Project completed 2009	Yes	Yes	Yes	Yes
Erie State Game Area North Maumee Bay	Yes	No	Yes	No
Great Lake Marsh Restoration	Yes	Yes	Yes	Yes
Lakeplain Prairie Restoration	Yes	Yes	Yes	Yes
Sturgeon Bar Restoration	Yes	Yes	Yes	Yes
Rouge River Watershed Streambank Stabilization and In-Stream Habitat Restoration: Targeted Wood Debris BMP Implementation	Yes	No	No	No
Friends of the Rouge Frog and Toad and Volunteer Monitoring Programs	Yes	No	No	No
Rouge River Watershed Targeted Fisheries Monitoring	Yes	No	No	No