LOWER FOX RIVER/GREEN BAY NRDA

INITIAL RESTORATION AND COMPENSATION DETERMINATION PLAN

Prepared for:

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Region 3
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*The division responsible for preparation of this report is under contract to be divested to Stratus Consulting Inc.

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ACRONYMS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
C.F.R.	Code of Federal Regulations
CWA	Federal Water Pollution Control Act
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
FCAs	Fish Consumption Advisories
Fed. Reg.	Federal Register
FWS	U.S. Fish and Wildlife Service
MITW	Menominee Indian Tribe of Wisconsin
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPL	National Priorities List
NRDA	natural resource damage assessment
OTIW	Oneida Tribe of Indians of Wisconsin
PCB	polychlorinated biphenyl
PRPs	potentially responsible parties
RCDP	Restoration and Compensation Determination Plan
RI/FS	remedial investigation and feasibility study
SMU	sediment management unit
WDNR	Wisconsin Department of Natural Resources

LOWER FOX RIVER/GREEN BAY NRDA:
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1. INTRODUCTION AND OBJECTIVES

The Department of the Interior (Department) acting through the U.S. Fish and Wildlife Service (FWS), the National Oceanic and Atmospheric Administration (NOAA) of the Department of Commerce, the Menominee Indian Tribe of Wisconsin (MITW), and the Oneida Tribe of Indians of Wisconsin (OTIW) (collectively, the Trustees[1]) are conducting an assessment of damages to natural resources that have resulted from releases of hazardous substances to the Lower Fox River, Green Bay, and Lake Michigan and other areas containing natural resources potentially injured by hazardous substances released to the Lower Fox River (collectively known as the assessment area). Section 107 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) [42 U.S.C. § 9607], Section 311 of the Federal Water Pollution Control Act (CWA) [33 U.S.C. § 1321], and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) [40 C.F.R. Part 300] provide authority to the Department, NOAA, the MITW, and the OTIW to seek such damages.

This initial Restoration and Compensation Determination Plan (RCDP) follows the August 1996 Assessment Plan for the Lower Fox River/Green Bay natural resource damage assessment (NRDA), as noticed in the Federal Register (61 Fed. Reg. 43,558), and the December 1997 Assessment Plan Addendum (62 Fed. Reg. 67,888). The August 1996 Assessment Plan addressed the Trustees' overall assessment approach and included:

- background information on the natural resources and the assessment area
- Trustee authority
- coordination and previous actions of Trustees
- decision to perform Type B assessment
- confirmation of exposure
- recovery period
- injury assessment approaches
- damage determination approaches
- quality assurance project plan.

1. In addition to the federal and tribal trustees, the State of Wisconsin is a trustee for natural resources. Wisconsin has not formally joined with the federal and tribal trustees in performing the NRDA. Therefore, for the purposes of this initial RCDP, the term "Trustees" does not include the State of Wisconsin.

The December 1997 Assessment Plan Addendum described several planned assessment activities in addition to those in the August 1996 Assessment Plan. The Assessment Plan and Addendum and the initial RCDP have been prepared in accordance with NRDA regulations promulgated by the Department at 43 C.F.R. Part 11.

The purpose of this initial RCDP is to provide the public with additional details and opportunity to comment regarding two aspects of the Trustees' NRDA: restoration planning and damage determination. This information supplements the damage determination methods presented in Chapter 9 of the August 1996 Assessment Plan in which information was presented on both compensable damage determination and restoration planning.

1.1 ORGANIZATION OF INITIAL RCDP

This initial RCDP is organized as follows: Section 2 provides an overview of the restoration planning and damage determination process. Section 3 describes the coordination between the Trustees and ongoing remediation planning activities in the Fox River Valley. Section 4 discusses the restoration planning process being undertaken by the Trustees. Section 5 provides additional detail on compensable value damage determination methodologies for interim human use losses. References cited are provided in Section 6.

1.2 PUBLIC REVIEW AND COMMENT

This initial RCDP is available for review and comment by potentially responsible parties (PRPs), other natural resource Trustees, other affected federal or state agencies or Native American tribes, and any interested members of the public for a period of 30 days.

Comments may be submitted in writing to:

Frank J. Horvath
U.S. Fish and Wildlife Service
Region 3 (attn: ES/EC-NRDA)
B.H.W. Whipple Federal Building
1 Federal Drive
Fort Snelling, MN 55111

Comments must be received no later than 30 days after the date the notice of availability is published in the Federal Register.

2. RESTORATION PLANNING AND DAMAGE DETERMINATION: OVERVIEW

2.1 DEFINITION OF KEY TERMS AND CONCEPTS

To provide perspective on the restoration planning and damage determination methodologies presented in this initial RCDP, key terms and concepts are defined and discussed.

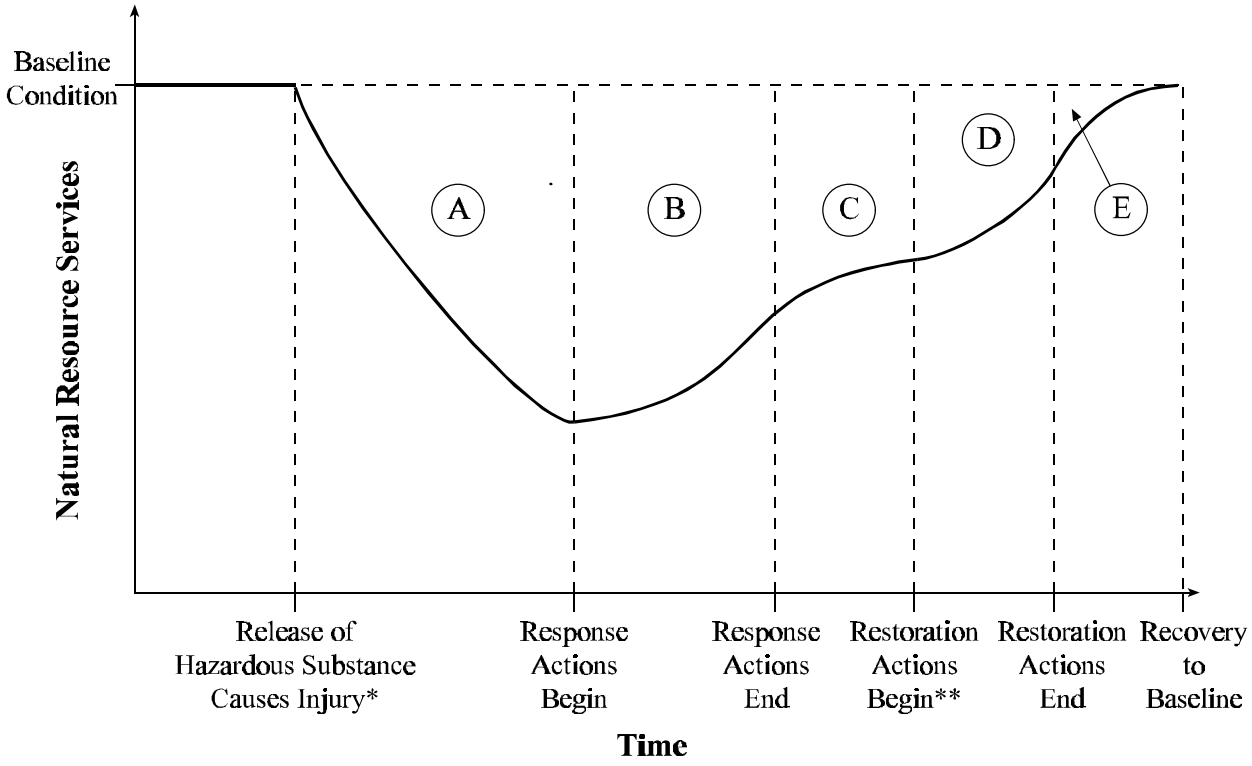
First, as described in the NRDA regulations promulgated by the Department, a damage determination is intended to "establish the amount of money to be sought in compensation for injuries to natural resources resulting from a . . . release of a hazardous substance" [43 C.F.R. § 11.80 (b)]. The measure of damages is defined as *restoration costs* plus, at the discretion of the Trustees, *compensable values for interim losses* [43 C.F.R. § 11.80 (b)].

Restoration refers to actions undertaken to return an injured resource to its baseline condition as measured by the services provided by that resource [43 C.F.R. § 11.14 (ll)]. Restoration includes rehabilitation, replacement, or acquisition of resources or services. *Baseline* refers to the conditions that would have existed in the assessment area had the release of hazardous substances not occurred [43 C.F.R. § 11.14 (e)] and *services* are defined as the "physical and biological functions performed by the resource, including the human uses of those functions" [43 C.F.R. § 11.14 (nn)]. Restoration can be accomplished by restoring or rehabilitating resources or by replacing or acquiring the equivalent of the injured natural resources and their service flows. Restoration should be distinguished from *remediation* or *response actions* undertaken pursuant to CERCLA or to the NCP.

Compensable values include "the value of lost public use of the services provided by the injured resources." [43 C.F.R. § 11.83 (c)(1)]. Under CERCLA, the compensable values for interim services lost to the public ("interim losses") accrue from the time of discharge or release or 1980, whichever is later, until restoration is complete [see 43 C.F.R. § 11.80 (b)].

Figure 2-1 demonstrates the relationship between response, restoration, and the different elements of interim loss. In the figure, area A represents losses suffered prior to initiation of any remediation or response at the site. Area B represents losses suffered while response actions are ongoing. Area C represents losses suffered after completion of response actions but prior to initiation of restoration actions. Area D represents losses suffered while restoration actions are ongoing. Area E represents losses after restoration actions have been completed until all services have recovered to baseline conditions. Thus, the total interim losses are represented by the areas A+B+C+D+E.

Figure 2-1
Conceptual Diagram Showing Interim Losses and Relationships between Response and Restoration

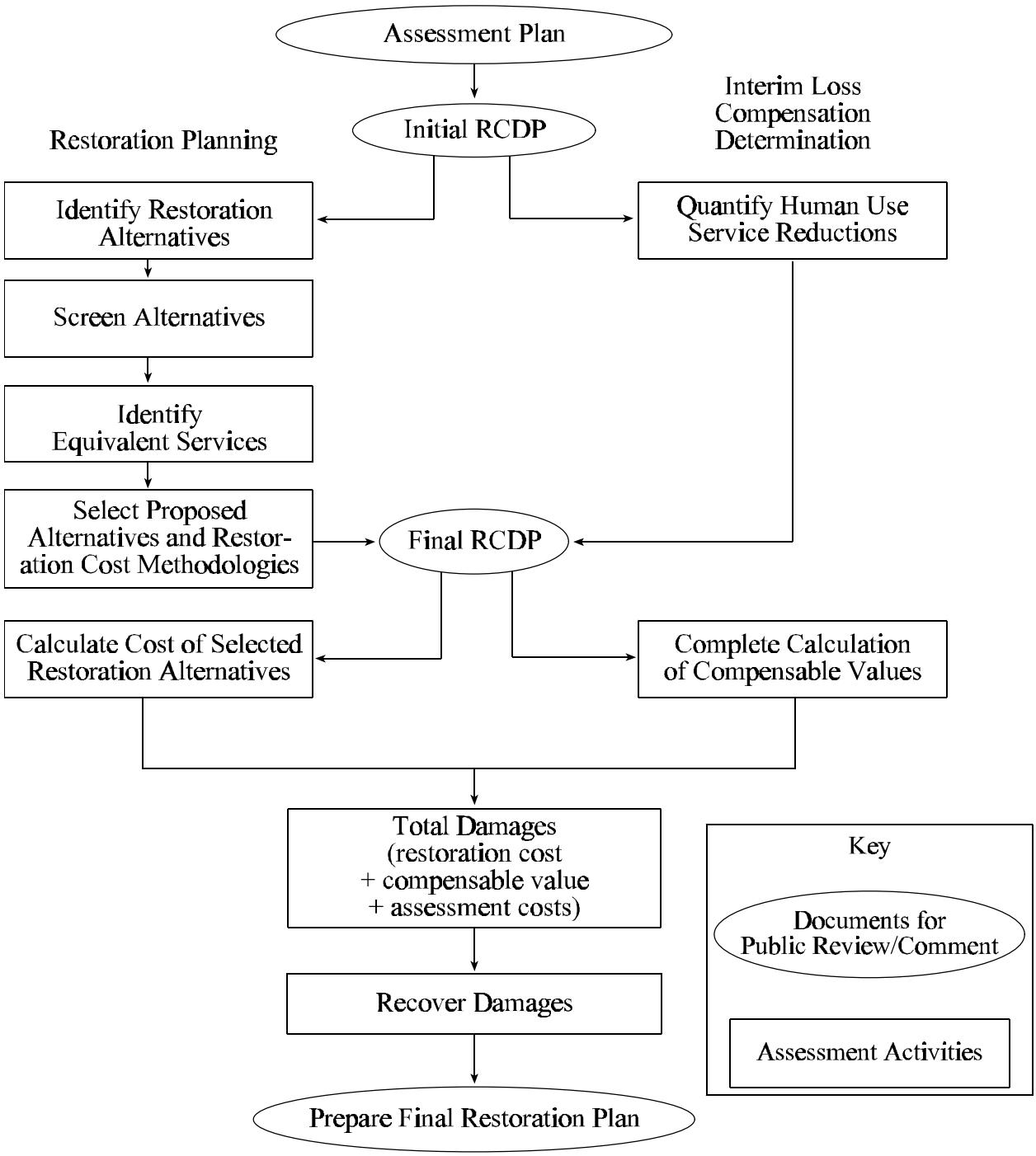


* Under CERCLA, the Trustees recover only for interim losses after 1980 if the release occurred before 1980.
** In some circumstances, restoration could begin earlier and be conducted concurrently with response actions.

2.2 OVERVIEW OF THE RESTORATION AND COMPENSATION DETERMINATION PROCESS

Figure 2-2 presents a summary flowchart of the overall restoration and compensation determination process. This process was initiated with preparation of the NRDA Assessment Plan that described the methods to be used for injury determination and quantification, and provided information on restoration planning and compensable damage determination. Based on that Assessment Plan, the Trustees are conducting injury assessment and damage determination studies, and have initiated restoration planning.

Figure 2-2
Restoration/Compensation Determination Flowchart



As described previously by the Trustees, the objective of the restoration planning phase is to develop a "reasonable number of possible alternatives for the restoration, rehabilitation, replacement, and/or acquisition of the equivalent of the injured natural resources," as measured by the services those resources provide [43 C.F.R. § 11.82 (a)]. These alternatives will then be evaluated by the Trustees, and a preferred alternative[2] will be selected. The costs to perform the preferred alternative become the restoration cost component of total damages.

The NRDA regulations indicate that a Restoration and Compensation Determination Plan (the RCDP) shall be prepared that lists a reasonable number of alternatives for restoration, rehabilitation, replacement, and/or acquisition of equivalent resources; selects one of the alternatives; gives the rationale for selecting that alternative; and identifies methodologies to be used to determine the cost of the selected alternative and the compensable value of services lost to the public [43 C.F.R. § 11.81 (a)(1)]. However, in the event that information is not available to select an alternative, an initial RCDP may be prepared to keep the public informed and to help inform restoration planning and damage determination (59 Fed. Reg. 14,280). Thus, the purpose of this initial RCDP is to provide the public with additional information and opportunity to comment regarding the Trustees' restoration planning process. In addition, the Trustees are providing additional information and detail regarding the relationship between restoration and remediation planning and the determination of compensable values.

Following completion of the assessment activities described in this initial RCDP (including identification, screening, and selection of restoration alternatives), the Trustees anticipate preparing a final RCDP that evaluates the restoration alternatives and selects one. Based on that final RCDP, the Trustees will proceed to calculate the costs of implementing the selected alternative(s) and will calculate compensable values. These elements (together with the Trustees' assessment costs) will comprise the claim for natural resource damages. Following recovery of damages, the Trustees anticipate preparing a final restoration plan that describes in detail the use of the recovered damages.

3. COORDINATION WITH REMEDIAL PLANNING

At the time the August 1996 Assessment Plan was published, no formal remedial planning process was being undertaken in the assessment area. However, several actions have taken place which have resulted in formal remedial planning, pursuant to CERCLA and the NCP. On June 17, 1997, the U.S. Environmental Protection Agency (EPA), in a letter to Governor Thompson of Wisconsin, announced its intent to pursue remediation at the site and to seek coordination with the State. On July 11, 1997, FWS, EPA, NOAA, the MITW, the OTIW, and the Wisconsin Department of Natural Resources (WDNR) signed a memorandum of agreement to work together on the cleanup and restoration of the site. In the fall of 1997, the WDNR, in cooperation with

2. An alternative can consist of single actions or combinations of actions [43 C.F.R. § 11.82 (b)(1)].

EPA, commenced work on a Remedial Investigation/Feasibility Study (RI/FS) at the site. On July 28, 1998, EPA proposed that the releases of PCBs into the Lower Fox River, extending at a minimum 21.5 miles into Green Bay, be added to the NPL. The remedy selection is scheduled for 1999.

The Trustees believe that coordination between the remediation planning process and the NRDA is desirable. Close coordination between the various parties involved in the two processes helps ensure consistency and avoid duplication in the following ways:

- Data that support both remedy and NRDA needs will be collected without duplication, and will be shared among response agency and Trustee representatives. To support this objective, the Trustees provided WDNR and EPA with copies of data, data summary tables and graphs, and indexes of all relevant data and documents. In addition, the Trustees met with WDNR and EPA personnel to discuss data availability and use, and provided comments on RI/FS workplans.

- The human health and ecological risk assessments being conducted as part of the RI should benefit from data and conclusions developed in the NRDA injury determination and service quantification phases. To support this objective, the Trustees met with WDNR and EPA personnel and contractors, discussed NRDA studies and activities, and provided briefings on data and approaches.

- Polychlorinated biphenyl (PCB) fate and effects models developed to examine pathway linkages and sediment removal scenarios will be developed without duplication and shared between the RI/FS and the NRDA. To support this objective, Trustees participated in a model development technical working group with WDNR and EPA aimed at cooperative model development planning, and shared model code and input data.

- Consistent approaches to sample analysis and interpretation will be used. To support this objective, the Trustees provided WDNR and EPA personnel with copies of NRDA quality assurance plans, laboratory analytical plans, and documentation of other quality assurance approaches.

All the above coordination elements will help ensure that restoration actions for the NRDA are consistent with response actions and that information developed through the NRDA will be utilized to promote the selection of cleanup alternatives that are protective of natural resources.

3.1 EVALUATION OF SEDIMENT REMEDIATION PILOT PROJECTS

To ensure full coordination among remediation and restoration activities, the Trustees will review and comment on all sediment remediation pilot projects, as well as on all remedial decisions. Pilot projects will be reviewed as part of the NRDA. The purpose of the review will be to evaluate project effectiveness (in terms of reductions in PCB concentrations and loads, as well as potential reductions in injuries in the Lower Fox River and in Green Bay), project costs, and potential collateral injuries caused by the technique. This review will facilitate quantification of interim losses and selection of the preferred restoration alternative.

There are currently two sediment remediation projects on which the Trustees will provide comments. The first is a pilot project to remediate contaminated sediments near the Fort James Turning Basin in the Lower Fox River (designated as Sediment Management Unit, or "SMU," 56/57). This project is being conducted pursuant to an agreement between the State of Wisconsin and certain companies identified by the Department as potentially responsible parties (PRPs) under CERCLA and CWA (Fort Howard Corporation, P.H. Glatfelter Company, Appleton Papers Incorporated, NCR Corporation, Wisconsin Tissue Mills, Incorporated, Riverside Paper Corporation, and U.S. Paper Mills, Incorporated, collectively known as the Fox River Group). The WDNR has indicated that the purpose of this project is to begin remediation of the river. The PRPs have indicated that the purpose of this project is to evaluate the effectiveness of dredging techniques. The Fox River Group currently is selecting dredging and disposal contractors, and has applied for relevant permits. The WDNR has indicated that it expects dredging to commence this Autumn. Permit applications indicate that between $7 million and $8 million are available for this project, but that removal of all PCB contaminated sediments within SMU 56/57 may require additional funding.

The second project to be reviewed by the Trustees is being conducted by the EPA and the WDNR at Deposit N near Kimberly, Wisconsin. WDNR currently is selecting dredging and disposal contractors, and has applied for relevant permits. The WDNR has indicated that approximately $4.5 million is available and that the entire deposit is expected to be removed with this funding.

3.2 COORDINATION BETWEEN INJURY ASSESSMENT AND ECOLOGICAL RISK ASSESSMENT

An important aspect of coordination between the NRDA and the RI/FS involves coordination between the NRDA injury determination and the RI/FS ecological risk assessment (ERA). The NRDA injury determination and the RI/FS ERA have similarities in that both involve evaluating the effects that released hazardous substances (i.e., PCBs) have had, are having, and are likely to have on natural resources such as fish and birds. However, the two processes are distinct. The purpose of the ERA is to provide information on risks to ecological receptors to inform selection of remedial alternatives, including estimates of risks that may remain following the completion of

different alternatives. The injury determination informs restoration of the injured resources to baseline and estimation of interim losses. Despite these differences, the similarities between the two makes coordination an important component of the NRDA.

Coordinating the injury determination and ERA will help ensure consistency between the two evaluations and will help to prevent duplicative efforts. The coordination will focus on the following:

- Working to ensure that the measures of ecological risk used in the ERA and the types of injuries evaluated in the NRDA are consistent. Since the endpoints are defined in part by the types of adverse ecological effects that may be occurring, ensuring consistency between endpoints (such as impaired lake trout or bird reproduction) will help ensure that both evaluations consider the same types of adverse effects.

- Working to ensure that the ERA uses the same biological and chemical data that are used in the injury assessment.

- Coordinating models used to predict residual injury and risk, as described in Section 3.3.

The Trustees have initiated the following activities to support the above coordination objectives:

- providing EPA and WDNR with briefings on injury study approaches and data

- providing EPA and WDNR with data collected by the Trustees and an inventory of biological samples

- providing technical comments on draft ERA documents

- maintaining regular contacts with EPA and WDNR scientists and project managers.

3.3 COORDINATION ON MASS BALANCE MODEL DEVELOPMENT AND APPLICATION

An important area of overlap between the NRDA and the RI/FS is the evaluation of how the selected remedy will affect natural resources. The NRDA will determine how much injury will remain after completion of the remedy to determine what restoration projects will be appropriate to restore the resources, as measured by their services, to baseline conditions and to fully evaluate interim losses. The RI/FS will determine how much ecological risk will remain at the site for different remedial alternatives to evaluate their effectiveness. Both the NRDA and the RI/FS will use mass balance models to complete their evaluations, and coordinating model development and application will help provide consistency between the two approaches.

Mass balance models developed for the Lower Fox River/Green Bay system model the movement, fate, and bioaccumulation of PCBs in the aquatic system (Beltran, 1992). These models can be used to predict PCB concentrations in the Lower Fox River and Green Bay under different sediment cleanup scenarios, including the no-action alternative. Thus the models can be used to evaluate the effectiveness of different sediment cleanup scenarios at reducing PCB concentrations in biota, to evaluate natural recovery under a no-action alternative or following various remedial alternatives, and to evaluate residual injury/risk after the selected remedy is implemented. Additional mass balance model development is being undertaken to make them more accurate and reliable. These models will be used in both the RI/FS and the NRDA. Thus, coordinating mass balance model development and application will benefit both processes.

The coordination of mass balance model development and application between the NRDA and the RI/FS includes the following activities:

- Providing the WDNR with computer code (and training in use of the code) for implementing improved sediment dynamic modeling for the Fox River, as well as sharing technical knowledge and modeling approaches with WDNR and EPA modeling experts.

- The Trustees are sharing important model input data such as historical solids and PCB loads (used to conduct model hindcasts) and recent Green Bay fish tissue PCB concentration data that were collected to evaluate model performance (see August 1996 Assessment Plan, Section 8.6.1). These data will be important in evaluating the performance of the models in accurately predicting future fish tissue PCB concentrations.

- The Trustees, WDNR, and EPA initiated a technical working group to maintain regular communication between project managers on modeling progress, developments, and results.

4. RESTORATION PLANNING

The Trustees have initiated a process to identify a broad set of possible alternatives to restore, rehabilitate, replace, and/or acquire the equivalent of lost resources, as measured by the services they provide. This process is discussed in the following sections.

4.1 OVERVIEW OF PROCESS FOR EVALUATING ALTERNATIVES

The Trustees anticipate developing a range of alternatives [43 C.F.R. § 11.82 (c)] that will include selected restoration projects designed to restore or replace injured resources, as measured by their services. One alternative that will be considered is no action, or natural recovery.

The RI/FS may conclude that partial removal of PCB contaminated sediments from the Fox River/Green Bay ecosystem is the most feasible remedial alternative. Therefore the Trustees are pursuing the development of a broad suite of restoration projects that could be combined with partial sediment removal alternatives. These restoration projects would be aimed at performing activities that would either restore, enhance, replace, or acquire similar resources/services to those lost. These potential projects will be evaluated and ranked using criteria specifically developed by the Trustees for the Lower Fox River/Green Bay NRDA. These criteria are based on factors identified in the Department NRDA regulations [43 C.F.R. § 11.82 (d)]. The evaluation criteria have been grouped by the Trustees into four evaluation categories:

- ***Project acceptability.*** These evaluation criteria relate to whether a proposed project is feasible, addresses the resources that were injured, and complies with applicable and relevant laws. A project must meet each of these criteria to be considered further.

- ***Project focus.*** These evaluation criteria relate to whether the project meets the goals and objectives of the Trustees for restoration of the Fox River/Green Bay environment.

- ***Project implementation.*** These evaluation criteria relate to project implementability, feasibility, and cost-effectiveness.

- ***Project benefits.*** These evaluation criteria relate to the types, timing, and permanence of benefits provided by the project.

Tables 4-1 through 4-4 describe the evaluation criteria being used by the Trustees in the restoration planning process. Figure 4-1 presents the overall process that will be used to apply the criteria, rank the projects, and select the alternatives.

Table 4-1
Acceptability Criteria for Restoration Planning
(projects are evaluated using acceptability criteria on a pass/fail basis)

Criteria	Interpretation
A1: Complies with applicable/relevant federal, state, local, and tribal laws and regulations.	Project must be legal and must protect public health and safety.
A2: Addresses resources injured by hazardous substances, or services[1] lost because of injuries, in the Fox River/Green Bay environment.	Projects must restore, rehabilitate, replace, or acquire the equivalent of injured natural resources, as measured by their services.[1]
A3: Is technically feasible.	Projects must be feasible.
1. The term "services" includes ecological and human-based services.	

Table 4-2
Focus Criteria for Restoration Planning

Priority	Criteria	Interpretation
Higher	F1: On-site restoration	On-site projects (within or adjacent to the Fox River/Green Bay) are preferred to off-site projects. Restoration/rehabilitation is preferred to replacement/acquisition.
Medium	F2: Addresses/incorporates restoration of "preferred" trust resources and services as evidenced in legislatively prescribed Trustee mandates and priorities.	Trustee priorities include recreation areas, wetlands, specific habitats, endangered species, living resources, native species, navigation channels, and resources of particular cultural importance.
Lower	F3: Targets resources or services that are unable to recover to baseline without restoration, or that will require a long time to recover naturally (>25 years).	Projects that target resources/services that will be slow to recover will be favored over projects that target resources/services that will recover quickly naturally.

Table 4-3
Implementation Criteria for Restoration Planning

Priority	Criteria	Interpretation
Higher	I1: Benefits can be measured for success by evaluation/comparison to baseline.	Projects will be evaluated in terms of whether the benefits can be quantified and the success of the project determined. Projects can be scaled to provide restoration of appropriate magnitude. Small projects that provide only minimal benefit relative to lost services or larger projects that cannot be appropriately reduced in scope are less favored.
Medium	I2: Is cost effective, including planning, implementation, and long term operation, maintenance, and monitoring.	Project with a high ratio of expected benefits to expected cost are preferred. This may be assessed relative to other projects that benefit the same resource.
Medium	I3: Uses established, reliable methods/technologies known to have a high probability of success.	Projects will be evaluated for their likelihood of success given the proposed methods. Factors that will be considered include whether the proposed technique is appropriate to the project, whether it has been used before, and whether it has been successful. Projects incorporating wholly experimental methods, research, or unproven technologies will be given lower priority.
Lower	I4: Is consistent with regional planning	Project is consistent with regional planning such as species recovery plans, and is administratively feasible.

Table 4-4
Benefit Criteria for Restoration Planning

Priority	Criteria	Interpretation
Higher	B1: Provides the greatest scope of ecological, cultural, and economic benefits to the largest area or population.	To the degree that a bigger project results in greater good, bigger projects are better. Projects that benefit more than one injured resource or service will be given priority. Projects that avoid or minimize additional natural resource injury, service loss, or environmental degradation will be given priority.
Higher	B2: Provides benefits not being provided by other restoration projects being implemented/funded under other programs.	Preference is given to projects, or aspects of existing projects, that are not already being implemented or have no planned funding under other programs. Although the Trustees will use restoration planning efforts by other programs, preference is given to projects that would not otherwise be implemented without NRDA restoration funds.
Medium	B3: Aims to achieve environmental equity and environmental justice.	Low-income and ethnic populations (including Native Americans) may suffer from pollution, and sometimes benefit the least from restoration programs. Therefore, a restoration program should not have disproportionate high costs or low benefits to low-income or ethnic populations. Further, where there are specific service injuries to these populations, such as subsistence fishing, restoration programs should target benefits to these populations.
Lower	B4: Maximizes the time over which benefits accrue.	Projects that provide benefits sooner are preferred. Projects that provide longer term benefits are preferred.

4.2 IDENTIFICATION AND RANKING OF PROJECTS

To develop a suite of restoration projects, the Trustees are compiling a Potential Restoration Projects Database. This database draws heavily on work completed by several earlier groups that developed and in some cases evaluated potential restoration projects for the Lower Fox River/Green Bay area. This database merges the specific project recommendations made in the 1988 Lower Green Bay Remedial Action Plan for the Lower Fox River and Lower Green Bay Area of Concern (WDNR, 1988), projects from the 1994 Green Bay Habitat Restoration Workshop Summary (WDNR, 1994), and projects that were in various documents developed, gathered by, and presented to the WDNR Habitat Restoration Workgroup (the Boronow Group), which worked during 1997 and 1998.

The current draft Potential Restoration Projects Database contains over 600 individual projects or ideas. In April 1998, these projects were screened for the A2 Acceptability criterion (see

Figure 4-1
Restoration Planning Process

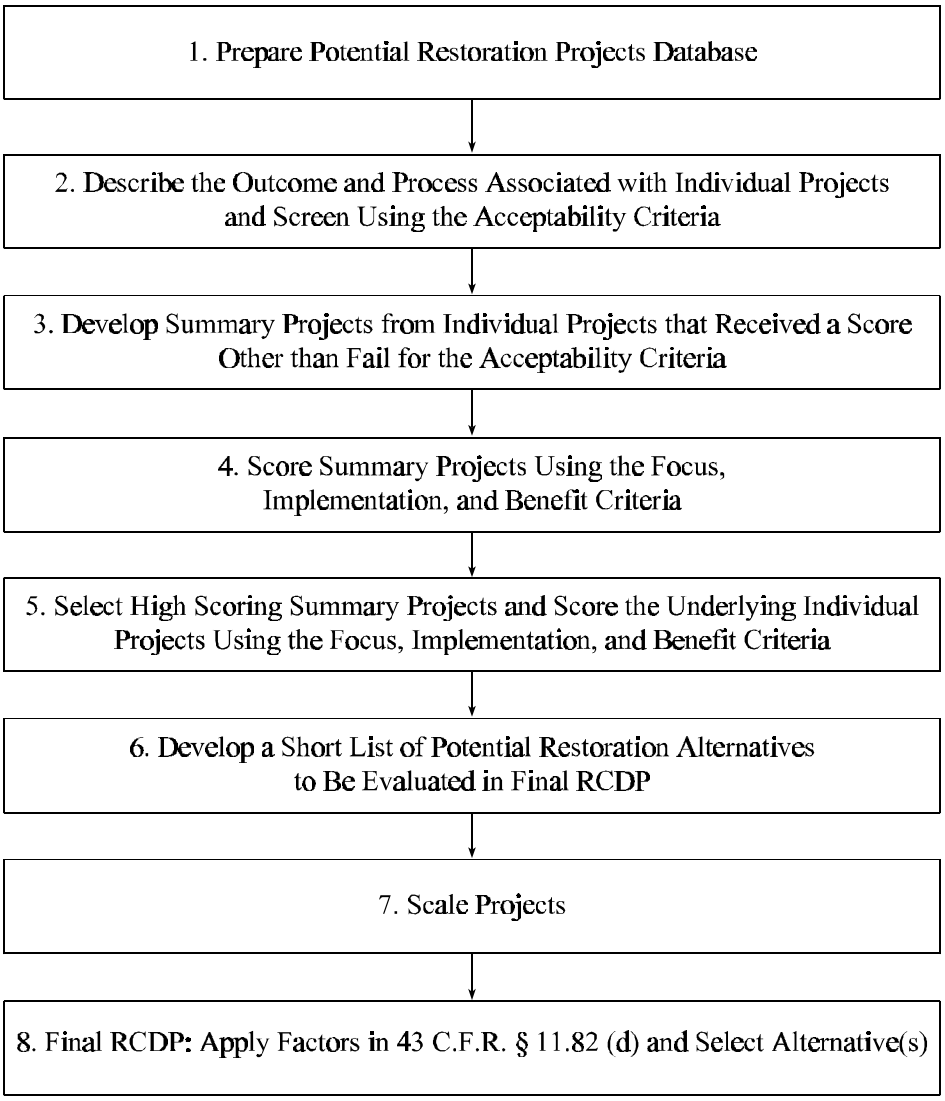


Table 4-1). Of these, 471 projects received a score of pass (P), more information/pass (MI/P), or more information (MI). To apply the focus, implementation, and benefits criteria (Tables 4-2 to 4-4) in an efficient and informative way, a smaller set of summary projects was developed by grouping by three classes. The three broad project classes were nonpoint source pollution control, habitat restoration, and water related human use services. Within these broad classes additional subcategories were created to characterize projects. Ultimately, a list of 23 distinct summary projects was developed. The specific categories and subcategories that define the 23 summary projects are presented in Table 4-5.

Numerical scores were assigned to enable initial ranking of summary project types. Based on the distribution of total scores, summary projects were reassigned a qualitative relative ranking of high, medium, or low. This ranking is shown in Table 4-6.

Summary projects that address nonpoint source pollution control and habitat restoration (modification or improvement of existing habitat) scored highest. Summary projects associated with water related human use scored lower.

Additional project inventory (including identification of additional projects and project categories), project evaluation, and project ranking will be performed using the methods described above to develop a final set of ranked restoration alternatives.

4.3 RESTORATION SCALING METHODS

Once projects have been identified and preliminary selection of preferred alternatives has been completed, restoration projects will need to be "scaled." "Scaling" is the process of determining the appropriate size of a restoration project.

Projects that restore or rehabilitate injured resources are scaled so that they provide the same quantity of services lost. This approach is known as "service-to-service" scaling. Projects that involve replacement or acquisition of equivalent resources, as measured by their services, can be scaled the same way if the equivalent resources provide the same type and quality of services. However, sometimes it makes sense to consider replacement or acquisition projects that provide services of a similar but different type or quality than those lost. For example, projects that restore the same or similar services as those still impaired may be technically infeasible or prohibitively expensive. When a replacement or acquisition project provides services that are similar to, but not the same as, those lost, a different scaling mechanism is needed to determine when the project has produced "equivalent" resources as measured by the services. The NRDA regulations for hazardous substances allow for consideration of such replacement or acquisition projects, but do not specify a method for making this equivalency determination. The method selected by the Trustees for this assessment is to use the approach described in the Oil Pollution Act NRDA regulations, which provide that when service-to-service scaling cannot be performed for acquisition alternatives, "value-to-value" scaling will be used [see 15 C.F.R. § 990.53(d)].

Table 4-5
Summary of Types of Restoration Projects Being Evaluated
(projects types are organized by class and subcategory)

Category	Subcategory
Class A: Nonpoint Source Pollution Control	
Creation of riparian buffer zones	—
Shoreline stabilization	—
Improved land use practices	—
Animal waste management	—
Class B: Habitat Restoration	
Land acquisition	—
Modification or improvement of existing habitat	Creation of new or enhancement of existing wetlands
	Creation or repair of dikes and/or bulkheads to preserve or enhance wetlands
	Softening of shorelines hardened by linear rip-rapped surfaces by creating headlands, bays, beaches, spawning beds, wetlands, and offshore reefs
	Drainage improvements to create or enhance wetlands
	Creation of island habitats (above and below water surface) for birds and fish
	Revegetation
	Creation of artificial habitats for fish and birds
	Restoration of potential (rehabilitation) existing habitat
Species programs	Endangered species protection
	Species reintroduction
	Species stocking
	Protection of sensitive habitat
	Exotic species control
Class C: Water Related Human Use Services	
Waterfront parks	—
Waterfront trails	—
Shoreline improvements, fishing piers, and boat docks/ ramps	—
Interpretive centers	—
Additional studies of affected areas and/or public education campaigns	—

Table 4-6
Summary of Preliminary Project Rankings

Relative Rank	Restoration Project Category	Restoration Project Subcategory
High	Nonpoint source pollution control: Creation of riparian buffer zones	—
	Habitat restoration: Modification or improvement of existing habitat	Creation or repair of dikes and/or bulkheads to preserve or enhance wetlands
		Creation of island habitats (above and below water surface) for birds and fish
		Restoration of potential of (rehabilitate) existing habitat
		Creation of new or enhancement of existing wetlands
		Drainage improvements to create or enhance wetlands
		Creation of artificial habitats for fish and birds
Medium	Habitat restoration: Land acquisition	—
	Habitat restoration: Species programs	Protection of sensitive habitat
		Endangered species protection
	Habitat restoration: Modification or improvement of existing habitat	Softening of shorelines hardened by linear rip-rapped surfaces by creating headlands, bays, beaches, spawning beds, wetlands, and offshore reefs
	Nonpoint source pollution control: Improved land use practices	—
	Nonpoint source pollution control: Shoreline stabilization	—
	Habitat restoration: Modification or improvement of existing habitat	Revegetation
	Habitat restoration: Species programs	Species reintroduction
Low	Water related human use: Waterfront parks	—
	Water related human use: Waterfront trails	—
	Nonpoint source pollution control: Animal waste management	—
	Habitat restoration: Species programs	Exotic (problem) species control (e.g., carp removal, zebra mussel control)
		Species stocking
	Water related human use: Interpretive centers	—
	Water related human use: Additional studies of affected areas and/or public education campaigns	—
	Water related human use: Shoreline improvements, fishing piers, and boat docks/ ramps	—

Thus, for any replacement or acquisition alternatives that provide services different in type or quality than those lost, the Trustees will scale the project so that it provides services with an economic value equal to the economic value of the services lost. The Trustees use of value-to-value scaling for such projects supports the selection and scaling of restoration of human use services. Combined with selections and scaling of restoration of ecological services using nonvalue-based ecological equivalency methods, this will ensure that any replacement or acquisition projects considered provide "equivalent" resources, as required by the NRDA regulations for hazardous substances. The Value Equivalency Assessment described below will assist the Trustees in both service-to-service and value-to-value scaling.

4.3.1 Value Equivalency Assessment

Objectives

The Trustees intend to conduct a Value Equivalency Assessment, which will assist restoration planning by:

- identifying and quantifying lost public services to be restored
- evaluating the required scale of restoration alternatives, based on value-to-value scaling, so that restoration alternatives provide human service benefits of equivalent value to the human service losses
- measuring the relative benefits of restoration alternatives (for 43 C.F.R. § 11.82(d)(2)).

Approach

The Value Equivalency Assessment will be performed using two sets of information: (1) surveys of residents of the assessment area and (2) existing literature and data. Survey methods will serve as the primary basis for the Value Equivalency Assessment. The surveys are expected to address:

- What are the human service losses and which human service losses, or characteristics of the human service losses, are most important?
- What human services (and/or characteristics of the services) provided by restoration options are most important?
- What types and levels of preferred restoration projects provide human services that are equivalent to the human services that would have been provided by the resources under baseline conditions?

The Value Equivalency Assessment surveys are expected to address restoration planning through a broader view of equivalency than addressing individual restoration project details. For example, the quality of recreational fishing services has been injured because of PCB contamination of fish and the need for fish consumption advisories. The equivalent quality of recreational fishing services may be restored through removing PCBs and/or through other activities such as increasing catch rates or by providing enhanced facilities (e.g., increased and improved parks, boat launches, etc.). The equivalency assessment will focus on addressing the amount of improvements in catch rates, or the overall amount of facility improvements, that would be required for value-to-value equivalency to the human service losses. The Value Equivalency Assessment is not intended to select or design individual projects, such as individual recreational facilities.

The Value Equivalency Assessment is expected to address all aspects of human service losses associated with natural resource injures to fish, birds, wildlife, and other resources. Multiple survey instruments may be used to address different aspects of the assessment, and to develop value-to-value equivalency for different restoration options.

The surveys will be implemented with random samples of the general population in the counties adjacent to and surrounding the assessment area. Individuals from these counties will be selected because their familiarity with the site can be expected to result in more clearly formed preferences and will provide for more reliable assessments of the relative values of human service losses vis-a-vis human service benefits from various restoration alternatives. Telephone, mail surveys, and small group in-person surveys may be used to address various aspects of the Value Equivalency Assessment. The final approaches and sample sizes will depend on the number of restoration alternatives addressed.

Existing literature and data also will be used to support the survey analysis by:

- providing information on the expected types, levels, and relative significance of affected services and of the services that may result from restoration alternatives, and on how restoration alternatives affect the provision of services

- providing supporting information on the relative values of public losses and on public benefits from restoration alternatives

- providing population statistics for sampling and extrapolating results from survey respondents to the population as a whole.

4.3.2 Tribal Assessment

Tribal natural resources and resource services have been, and continue to be, injured by PCB contamination in the assessment area. Such injuries may have resulted in, and continue to result in,

cultural, recreational, and commercial losses associated with injuries to resources. The assessment includes the resources and resource services of the Oneida Tribe of Indians of Wisconsin and the Menominee Indian Tribe of Wisconsin. The following steps will be performed to support restoration planning:

1. ***Identify linkages between injured natural resources and tribal services. Identify and characterize the importance of these services to the tribes.*** What types of cultural, spiritual, recreation, commercial, and other services are affected by injuries to natural resources?

2. ***Quantify the service flow impacts.*** Quantification will be made consistent with the service losses being measured. Quantification may include both units of impacts and, where more appropriate, characterization of impacts such as cultural losses.

3. ***Identify, select, and scale restoration.*** In some cases, economic values of tribal impacts may be able to be quantified and included in estimates of compensable values, but generally the focus will be on restoration alternatives that restore, rehabilitate, replace, or acquire the equivalent of the injured tribal resources, as measured by ecologic and public service flows. The tribes will participate in the restoration planning process identified in Section 4 of this document. Restoration alternatives that are specific to injuries to tribal resources and service flows will be identified and prioritized. It is anticipated that service-to-service scaling of restoration alternatives to provide restoration equivalent to the injuries will be used. However, where service-to-service scaling is not readily feasible, value-to-value scaling of restoration alternatives may be used as input to the restoration selection and scaling.

These steps will be accomplished through the following:

- Coordination with other Trustees to determine injury to natural resources and natural resource service flows.

- Review of tribal historical and cultural documents to document linkages between injuries and tribal ecologic and public service flows, and identify the significant characteristics, nature, and quantity of service flow injuries.

- Surveys of tribal members regarding water uses, land uses, and recreation and other behaviors that may be affected by PCB-caused natural resource and natural resource service injuries. Surveys are anticipated to be used to address restoration priorities and scaling, consistent with the approaches identified in the Value Equivalency Assessment in Section 4.3.1.

5. COMPENSABLE VALUE DETERMINATION METHODS

The August 1996 Assessment Plan provided information on concepts related to compensable value damages, on the linkages between potentially injured resources and public use service flows and damages, the use of economic studies to support restoration planning, and information supporting the existence of compensable values for several damage categories. Also addressed was the treatment of double counting, uncertainty, and discounting. This initial RCDP does not repeat that information here. Rather, it provides additional detail on the approaches to be used for assessment of recreational fishing damages.

5.1 RECREATIONAL FISHING ASSESSMENT

5.1.1 Background

Discovery of PCBs and other contaminants in sport fish led to the establishment of fish consumption advisories (FCAs) in 1976 for the Wisconsin waters of Green Bay and Lake Michigan, and for the Fox River below Lake Winnebago. Through time, these advisories have become increasingly specific and in some cases more restrictive. Table 5-1 provides a summary of the PCB advisories for the assessment area waters in Wisconsin for 1997. Most sport-caught fish have restrictive consumption advisories that vary by species and size of fish. The advisories are more restrictive for the Lower Fox River because of higher concentrations of PCBs. Even with aggressive remedy and restoration, the FCAs may remain for many decades. PCBs also may have reduced populations of some of the species (e.g., lake trout), which is being investigated in the injury assessment. Reductions in fishery populations can affect recreation because expected catch rates of the affected species could be reduced.

As reflected in the August 1996 Assessment Plan, there is ample literature to suggest the following types of recreational fishing losses can be expected to result in the assessment area from the existence of FCAs and/or reduced catch rates:

1. ***Losses to anglers currently active at the assessment site.*** Anglers active at the assessment site may experience losses from reduced enjoyment of the trips they take to the site because they change the species type and size they target to catch in response to FCAs; and/or because they change behavior regarding keeping, preparing, and consuming fish to reduce potential health risks associated with consuming fish with PCBs; and/or because they take fewer trips to the assessment area and instead go to other, less desirable fishing sites or substitute nonfishing activities.

2. ***Forgone trips to the site by anglers who are not now currently active at this site.*** Because of FCAs and/or reduced catch, some anglers may not take any trips to the

Table 5-1
1997 Wisconsin Fish Consumption Advisories for the Assessment Area

Waterbody/Fish Species	Unlimited Con-sumption	Eat No More than One Meal a Week, or 52 Meals/Year	Eat No More than One Meal a Month, or 12 Meals/Year	Eat No More than One Meal Every Two Months, or Six Meals/Year	Do Not Eat Fish
Fox River from the mouth up to DePere Dam					
Bluegill, Rock Bass, Yellow Perch		All Sizes			
Northern Pike			Less than 25"	Larger than 25"	
Black Crappie			Less than 9"	Larger than 9"	
Walleye			Less than 16"	16" to 22"	Larger than 22"
Sheepshead			Less than 10"	10"-13"	Larger than 13"
White Sucker, Smallmouth Bass				All sizes	
White Bass, Carp, Channel Catfish					All sizes
Green Bay south of Marinette and its tributaries (except the Lower Fox River) including the Menominee, Oconto, and Peshtigo Rivers from their mouths up to the first dam					
Yellow Perch		All Sizes			
Northern Pike		Less than 22"	Larger than 22"		
Chinook Salmon		Less than 29"	Larger than 29"		
Smallmouth Bass, White Sucker, Rainbow Trout			All sizes		
Walleye			Less than 17"	17" to 26"	Larger than 26"
Splake			Less than 16"	16"-20"	Larger than 20"
Brown Trout			Less than 14"	14"-21"	Larger than 21"
Channel Catfish, Whitefish				All sizes	
White Bass, Carp, White Perch, Sturgeon					All sizes
Source: WDNR, 1997.					

assessment area, even though they would do so in the absence of FCAs and/or if catch rates increase.

3. ***Forgone trips by individuals who are not currently anglers.*** Individuals who currently do not fish at any sites might choose to fish in the assessment area if the FCAs were reduced or eliminated.

5.1.2 Objectives and Approaches

The primary objectives of the recreational fishing damage assessment are to identify and quantify the impacts of FCAs, now and through time, on recreational fishing, and to quantify economic damages for these active use impacts. Further, to the degree that the injury assessment determines that injuries to fish have reduced expected catch rates, the assessment also will quantify economic values for these impacts. The assessment provides information that can also be used to support the evaluation of the benefits of restoration alternatives that would provide recreational fishing services.

The recreational fishing assessment is designed to focus on the losses experienced by anglers who are currently active in the assessment area. The assessment design includes a survey version to address losses for anglers who are not currently active at the site, but who might otherwise be active at the site in the absence of FCAs and/or reduced catch rates. Losses are not addressed for individuals who currently do not fish, but who might become active in the absence of PCB contamination and/or reduced catch rates. Therefore, not all losses are included in the estimated compensable values.

The objectives will be accomplished using two sets of information: (1) data from a new survey of recreational anglers, and (2) existing literature and data. The recreation survey will serve as the primary basis for the recreation damage assessment because it will be designed to be specific to the assessment site and circumstances of interest. The survey is discussed in Section 5.1.3.

Existing literature and data will be used to:

- Obtain use statistics, angler data, and other data required to calibrate and extrapolate the survey results to the population of relevant anglers through time. Based on available literature and state and federal data, the average recreation use of the Wisconsin waters of Green Bay (including the Lower Fox River and other tributaries up to the first lake or obstruction) from 1986 through 1996 is approximately 1.2 million angling hours per year (about 300,000 angling days at an average of 4 angling hours/day). About 10% of this effort is in the Lower Fox River downstream of the dam at DePere. Recreational fishing is also potentially affected in the Michigan waters of Green Bay, where angling effort is about 600,000 angling hours per year.

- Provide information on the expected type and amount of impacts in response to FCAs, and on the valuation of FCA impacts and of changes in expected fishing catch. This information provides additional evidence, along with the survey results, and may be used to develop a supplemental "benefits transfer" approach for computing damages based on existing literature. A benefits transfer approach is where results from prior study sites and situations are used to address the damages at the assessment site and situation of interest by adjusting the prior study results to account for differences between the prior study site and circumstances and the assessment site and circumstances of interest. The benefits transfer method is an accepted method identified in the Department regulations as the unit value method [43 C.F.R. § 11.83 (c)(2)(vi)].

5.1.3 Recreation Survey

The recreation survey will collect data on trip-taking to the assessment area, on how FCAs affect anglers, if at all, and on how anglers value changes in FCAs and catch rates. The survey will be carried out with anglers who are currently active in the assessment area.

The recreation survey includes three major components:

1. ***Sample selection.*** The target population is anglers who are most likely to fish at the assessment site under current and baseline conditions. These anglers are most concentrated in the counties near to the assessment site. Therefore, anglers will be identified and randomly selected for participation in the telephone screening step (discussed next) by obtaining a random sample of anglers' names and addresses, as registered on fishing license records in county courthouses in eight counties neighboring the assessment area (courthouse copies of licenses will be used because Wisconsin does not maintain an electronic database of fishing licenses). The counties and target sample sizes in each county are listed in Table 5-2. The sample sizes in each county reflect the population of the total number of license holders in each county so as to provide a stratified random sample.

   The licenses registered in the target counties can be expected to include most anglers who reside in or work in those counties and who are likely to fish at the assessment area, as well as some anglers from other locations who purchase licenses in the local area, because they intend to fish in the local area. Based on data from the WDNR (Penaloza 1991, 1992), the 1991 National Survey of Hunting and Fishing (Department, 1993), and other literature, this sample is estimated to represent 80% or more of the total fishing effort at the assessment area. The sample coverage will be confirmed using data from an ongoing 1998 WDNR creel survey on the waters of Green Bay, which will collect information on home address ZIP code and on the number of days fishing the waters of Green Bay since the start of the season.

Table 5-2
Recreation Survey Sample by Target County

County	1996 License Sales*	Target Sample	Skip Interval to Select Licenses
Selected Counties Adjacent to Assessment Area			
Brown	35,110	2,340	15
Door	21,561	1,437	15
Kewaunee	10,972	731	15
Marinette	18,951	1,263	15
Oconto	12,436	829	15
Other Selected Counties			
Manitowoc	15,701	1,046	15
Outagamie	26,753	1,783	15
Winnebago	31,064	2,070	15
8 County Total	**172,548**	**11,500**	

* Source: WDNR Report of 1996 Fishing License Sales.

2. ***Telephone screening survey.*** A telephone survey will be conducted to screen the anglers identified in Step 1 into two groups: (1) those who have been active in assessment area fishing in the last 12 months, and (2) those who have not been active in assessment area fishing in the last 12 months. A sample of the active anglers will be included in a follow-up mail survey. A sample of anglers who are not active may be followed up in Step 3. The telephone survey will include basic questions regarding attitudes about fishing, FCAs, and catch rates in the assessment area, and about fishing activity, including number of trips to date in 1998 to the assessment area and to other sites.

   The telephone survey will be implemented with a minimum of seven callback attempts per sample point to ensure a high response rate, with calls varied throughout weekday evenings and weekend days. From the 11,500 anglers identified in Step 1, we anticipate completing the screening telephone survey with about 900 active anglers and about 2,700 anglers who are not active. For those anglers for whom a telephone number cannot be identified, a mail contact procedure will be used.

3. ***Mail survey(s).*** About 800 anglers who have been recently active in fishing in the assessment area will receive a mail survey. Similarly, the assessment allows for the option to include anglers who have not recently been active in fishing in the assessment area. The mail survey will use a repeat mail/telephone contact procedure to achieve a cooperation rate of about 70%, or more than 500 completed surveys of anglers recently active in the assessment area.

All survey instruments and implementation methods will be pretested and peer reviewed before final implementation. Additional discussion of the mail survey instrument and the estimation of damages follows.

The mail survey includes questions on fishing trips to the assessment area and to other sites. It also addresses the impact of FCAs on the angler's fishing at the assessment area (e.g., reduced or substituted trips, changes in target species, and changes in keep and cooking behaviors), and collects information on knowledge of FCAs, as well as data on catch rates and fishing costs. The survey includes stated preference questions, where respondents state their preference among two choices (A or B), and each choice has a specified level for each of six fishing characteristics. Based on the levels of the attributes presented, the respondent states a preference for choice A or choice B. In each choice question, the attributes of fishing that are varied are the catch rates for four target species groups (which account for over 90% of the fishing activity in the assessment area); FCA levels (ranging from current levels down to no FCA); and the angler's share of boat launch (or similar) fees. In each choice question the levels of the characteristics are varied to represent combinations relevant to actual and potential conditions in the assessment area and reflecting econometric estimation requirements. Up to nine questions are presented to each respondent, and the questions vary across respondents. The survey also directly addresses substitution of fishing trips to and from other sites under the selected alternative [43 C.F.R. § 11.84(f)]. The survey concludes with standard socioeconomic and attitudinal questions that are used to extrapolate the survey sample to the population of anglers.

Responses to the choice questions will allow estimation of willingness-to-pay of damages for changes in FCAs and for changes in catch rates by species for the four species groups most relevant to recreational fishing.

These choice-based damage computation methods, which are referred to as conjoint methods, are consistent with 43 C.F.R. § 11.83(c)(2) and 43 C.F.R. § 11.83(c)(3), because they measure willingness-to-pay.

The survey results will be used to calculate recreational damages in the Wisconsin waters of Green Bay, and will support a benefits transfer computation of damages for Michigan waters of Green Bay. In addition, the survey will allow direct evaluation of value-based trade-offs between FCA levels, catch rates, and fishing access fees. As such, the survey will help inform the scaling and evaluation of restoration options that would result in enhancements in fishery stocks and

expected recreational fishing catch rates (which could be achievable through habitat enhancement programs and stocking programs), or result in changes in fishing access fees.

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