1. Introduction

The Director of the Michigan Department of Environmental Quality (MDEQ), the Attorney General of the State of Michigan, and the Secretary of the Interior as represented by the Regional Director of the U.S. Fish and Wildlife Service (U.S. FWS), in coordination with the Secretary of Commerce as represented by the National Oceanic and Atmospheric Administration (NOAA) (collectively referred to as the Trustees), are in the process of assessing damages resulting from injuries to natural resources in the Kalamazoo River Environment (KRE) resulting from releases of hazardous substances into the KRE.[1]

This report presents the methods and results of the Stage I economic assessment of damages resulting from natural resource injuries in the KRE. These injuries have resulted from releases of hazardous substances, which include polychlorinated biphenyls (PCBs), from potentially responsible party (PRP) facilities along Portage Creek and the Kalamazoo River.[2]

The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended, 42 U.S.C. §§ 9601-75, and the Federal Water Pollution Control Act (Clean Water Act, or CWA), 33 U.S.C. §§ 1251-1387, provide authority for the Trustees to seek such damages. Additionally, the State Trustees have authority to seek damages for the full value of the injuries to natural resources pursuant to Section 20126a(1)(c) of Part 201, Environmental Remediation, of the Natural Resources and Environmental Protection Act (NREPA), MCL § 324.20126, as well as Section 3115(2) of Part 31, Water Resources Protection, of NREPA, MCL § 324.3115(2).

The Trustees followed the U.S. Department of the Interior (DOI) natural resource damage assessment (NRDA) regulations in this Stage I economic assessment [43 CFR § 11.35, 11.82, 11.83, 11.84]. Following these regulations is not mandatory; however, assessments performed in compliance with these regulations have the force and effect of a rebuttable presumption in any

1. On September 29, 2004, the Michigan Department of Natural Resource (MDNR) was designated to serve as a natural resource co-trustee along with the MDEQ and the Attorney General of the State of Michigan. As of the date of publication of this report, efforts are underway to include the MDNR as a member of the Trustee Council to assure the coordination of future NRDA activities.

2. The U.S. Environmental Protection Agency (EPA) and the State of Michigan identified the following PRPs: Allied Paper, Inc. and its parent company, Millennium Holdings, Inc. (formerly HM Holdings, Inc./Allied Paper Inc., now owned by Lyondell Chemical Company); the Georgia Pacific Corporation; Plainwell, Inc. (successor to Plainwell Paper Inc. and Simpson Plainwell Paper Company); Weyerhaeuser Company; and the Fort James Corporation (formerly James River Company, now owned by Georgia-Pacific) (Blasland, Bouck & Lee, 1992; U.S. District Court, 2000).

administrative or judicial proceeding under CERCLA [42 U.S.C. § 9607(f)(2)(C)]. The DOI regulations also provide a useful context within which the various aspects of the assessment can be evaluated, and therefore have been followed in this document.

This report is part of a multistep process. First, the Trustees conducted a Preassessment Screen (see Michigan Department of Environmental Quality et al., 2000a). Next, the Trustees developed a Stage I Assessment Plan (see Michigan Department of Environmental Quality et al., 2000b). The approaches and methods of this Stage I economic assessment are based on that Assessment Plan. The Trustees designed the Stage I Assessment to develop preliminary conclusions regarding the types and magnitudes of injury and damages resulting from hazardous substance releases into the KRE (see also Michigan Department of Environmental Quality et al., 2005). The Trustees intend the Stage I Assessment to be preliminary, relatively rapid, based primarily on existing data, and highly cost-effective. The Stage I Assessment is based on data known and available to the Trustees through approximately 2003 and on additional information the Trustees were aware of as of the date of this writing. Consequently, while the Stage 1 Assessment is preliminary in nature, it was able to be completed relatively rapidly and is highly cost-effective. The Trustees will use the results of the Stage I Assessment to help define any additional focused work that could be conducted in the next stage and, if appropriate, to help evaluate any potential settlement options. If deemed necessary by the Trustees, the Trustees may conduct a more detailed Stage II Assessment in which the Trustees conduct focused NRDA studies to expand upon the Stage I Assessment. A companion report presents the Trustees' Stage I Injury Assessment Report (Michigan Department of Environmental Quality et al., 2005).

1.1 NRDA Concepts

Certain state and federal agencies that have been designated as Trustees are empowered to obtain compensation from PRPs for damages from injury to, destruction of, or loss of natural resources caused by hazardous substance releases. Trustees must use recovered funds to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and their services. In lieu of receiving funds for injuries to natural resources, the Trustees may allow PRPs to implement restoration activities directly.

A measurable adverse change, either long- or short-term, in the chemical or physical quality or the viability of a natural resource resulting from the release of a hazardous substance is known as an *injury* [43 CFR § 11.14(v)]. This report does not discuss the specific scientific nature or extent of natural resource injuries; these can be found in the Stage I Injury Assessment Report (Michigan Department of Environmental Quality et al., 2005). Rather, this report considers natural resource *services,* which are defined in the DOI regulations as the "physical and biological functions performed by the resource, including the human uses of those functions" [43 CFR § 11.14(nn)]. More specifically, this assessment focuses on the human services from natural

resources. Services might include the services members of the public receive from wildlife viewing, recreation, and aesthetics, for example.

The DOI regulations define the measure of damages as *restoration costs* plus, at the discretion of the Trustees, *compensable value for interim losses* [43 CFR § 11.80(b)]. Restoration costs are the costs of restoration actions that restore the injured resources and services to *baseline*, which is the condition that would have existed had the hazardous substance release(s) not occurred [43 CFR §§ 11.80(b), 11.14(e), and 11.14(ll)]. Compensable value for interim losses is the amount of money required to compensate the public for the loss in services provided by the injured natural resources. Compensable value includes the "value of lost public use of the services provided by the injured resources" and can include both past losses and losses that will occur until the injured resources and services are returned to baseline [43 CFR § 11.83(c)(1)]. Thus, the total amount of damages includes both the cost of restoration to baseline and the compensable value for interim losses.

1.2 Public Comment and Information Quality

The Stage I Economic Assessment Report presents the results of the Stage I NRDA that was conducted in accordance with the DOI NRDA regulations as set forth at 43 CFR Part 11.[3] Based upon the results of the Stage I NRDA, the Trustees may augment this evaluation with additional assessment activities to assure the public is appropriately compensated for the lost use of the injured resources. While the Stage I Economic Assessment Report is not subject to a public comment period under state or federal law, the Trustees recognize the benefits of public involvement. Consequently, the Trustees will consider written comments received by April 15, 2005 when planning and undertaking additional assessment activities. Written comments may be submitted to:

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Compliance and Enforcement Section
Remediation and Redevelopment Division
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3. 43 CFR Part 11 regulations were authored by the DOI, and are referred to as the DOI regulations in this document. Use of these regulations is not required. However, they must be used for the Trustees to gain rebuttable presumption [43 CFR § 11.11].

Information disseminated by federal agencies to the public after October 1, 2002, is subject to information quality guidelines developed by each agency pursuant to Section 515 of Public Law 106-554 that are intended to ensure and maximize the quality of such information (i.e., the objectivity, utility, and integrity of such information). This Economic Assessment Report is an information product covered by information quality guidelines established by NOAA and DOI for this purpose. The information contained herein complies with applicable guidelines.

1.3 Stage I Economic Damages Assessment Approach

As described in the Trustees' Stage I Assessment Plan, the Stage I economic assessment of damages resulting from PCB releases into the KRE consists of two separate components:

1. Assessment of the costs to restore injured resources and their services to baseline condition

2. Assessment of the compensable values for interim losses until the injured resources and services are returned to baseline condition.

The general approach of the Stage I economic damages assessment is to rely primarily on existing data and information, supplemented with newly collected data as necessary and appropriate. Thus, the Stage I economic assessment is not as comprehensive an assessment as described in the DOI NRDA regulations. If necessary, the Trustees may plan and conduct a more comprehensive Stage II economic damages assessment that includes additional site-specific studies.

1.3.1 Approach for estimating costs for restoring injured resources and services to baseline

At this time the Trustees are unable to determine precisely the costs required to restore injured resources and their services to baseline conditions. Changes in the lead agency responsible for the site remedial investigation/feasibility study (RI/FS) and other related delays have extended the schedule for completion of the RI/FS and selection of a remedial action to address KRE PCB contamination. Until a site remedy is selected, the Trustees are unable to define what restoration measures, if any, will be required to restore the injured resources and their services to baseline. The more completely the remedy addresses PCB contamination, the less restoration to restore resources and services will be required. Therefore, this Stage I economic damages assessment does not include an estimate of costs for restoration to baseline. Once a remedy is selected, the Trustees will be able to define the amount and type of restoration required to restore injured resources and their services to baseline, and will then be able to determine restoration costs.

However, the Trustees have begun the process of identifying and selecting natural resource restoration options. First, in the Stage I Assessment Plan the Trustees identified two general types of restoration actions: (1) sediment/soil restoration to eliminate or reduce ongoing exposure of the injured resources to PCBs (in addition to and coordinated with the PCB remedial cleanup), and (2) ecosystem-based restoration, which includes actions that address environmental stressors other than PCBs (e.g., habitat loss and nonpoint source pollution) that result in a loss of services similar to the losses caused by PCB releases.

The Trustees have developed criteria that they plan to use to evaluate potential restoration projects which could enhance or restore natural resources in the KRE. These criteria are based on the factors identified in the DOI regulations [43 CFR § 11.82(d)] and are presented in Chapter 4.

Following the development of the overall restoration framework as described in the Stage I Assessment Plan, the Trustees began soliciting, compiling, and analyzing information on environmental restoration projects that can improve and enhance the KRE natural resource services. State, regional, and local resource agencies, environmental nonprofit groups, and citizen groups provided ideas and specific project proposals for actions that would enhance or restore natural resources in the KRE. These projects have been summarized, categorized, and placed into a database for the Trustees to draw on in the future (see Appendix A).

The Trustees have also begun to identify what kinds of resource restoration actions are most preferred and valued by the public. The Total Value Scoping (TVS) focus groups conducted by the Trustees, described in detail in Chapter 3, provide the Trustees with valuable information about the general categories of potential restoration actions that may be highly valued. This information will be used by the Trustees in identifying and selecting the restoration actions to restore injured resources and services to baseline that provide the most benefit to the public.

The Trustees will continue to coordinate their activities with the ongoing RI/FS and remedy selection process. As that process progresses, the Trustees will re-evaluate their ability to develop more precise Stage I restoration costs. The Trustees will also continue to solicit, compile, and evaluate information on potential restoration projects that could be implemented in the KRE to restore injured resources and services to baseline.

1.3.2 Approach for determining compensable values for interim losses

The Stage I approach for determining compensable values relies on two components: (1) a quantitative estimate of monetized damages resulting from recreational fishing service losses (described in Chapter 2), and (2) a qualitative evaluation of public values and preferences regarding a broader range of service losses (described in Chapter 3). The Trustees also conducted

a preliminary hedonic property value study to determine if the PCB releases into the KRE are having a strong and obvious impact on property values.

At this stage, recreational fishing damages resulting from PCB fish consumption advisories (FCAs) are believed to be the largest and most significant active use damage category for the KRE NRDA. This category is believed to be the largest because recreational fishing typically is one of the most economically significant uses of natural resources in terms of expenditures and number of users. Experience at other sites also suggests that is a major active use category. Moreover, recreational fishing damages are the most easily and accurately quantified given the available information for the site and existing literature on Great Lakes recreational fishing. However, recreational fishing losses from FCAs represent only one service loss category of many that may be occurring in the KRE as a result of the PCB releases (Table 1.1). Therefore, the monetization of damages in this Stage I Assessment, which captures only FCA recreational fishing losses, represents only a portion of the total damages at the site.

Table 1.1. Injured resources and services monetized or addressed qualitatively in the Stage I economic damages assessment

Injured resource	Potentially reduced services	Monetized in Stage I recreational fishing assessment?	Addressed qualitatively in Stage I total value focus groups?
Groundwater	Drinking	No	No
	Agriculture	No	No
	Ecological services	No	No
Surface water	Drinking	No	No
	Water-based recreation	Indirectly/partially	Yes
	Agriculture	No	No
	Aquatic habitat	Indirectly/partially	Yes
	Assimilative capacity[a]	No	Yes
	Ecological services	Indirectly/partially	Yes
Sediments/ floodplains	Habitat	Indirectly/partially	Yes
	Recreation (e.g., camping)	No	Yes
	Assimilative capacity[a]	No	Yes
	Ecological services	Indirectly/partially	Yes
Biological	Recreational fishing	Yes	Yes
	Fish consumption	Yes	Yes
	Recreation (e.g., wildlife viewing, hunting)	No	Yes
	Ecological services	Indirectly/partially	Yes
Geological	Habitat	No	Yes
	Assimilative capacity[a]	No	Yes
	Ecological services	No	Yes

a. The ability of a resource to absorb low levels of contaminants without exceeding standards and without adverse effects to the resource.

As shown in Table 1.1, other service loss categories are addressed in the recreational fishing study (Chapter 2) indirectly and partially, to the extent that anglers are aware of and affected by them. For example, surface water habitat provides ecological services to fish, and therefore surface water ecological service losses are included indirectly in the quantification of recreational fishing losses. However, such services are taken into account only partially in the estimate of recreational fishing damages.

Other selected potential service losses were considered qualitatively through the TVS focus groups described in Chapter 3. The extent to which different categories were addressed in these focus groups is noted in Table 1.1. Not all service categories were addressed. The focus groups discussed only ecological and recreational services, so service categories such as drinking water and agriculture are not explicitly included.

This part of the Stage I Assessment provides information regarding the public's views of natural resource injuries in the KRE and the types of restoration options that could offset the losses resulting from the injuries. The TVS focus groups thus provide information relevant to the value of the broader suite of service losses (beyond recreational fishing losses alone) because they begin to identify the kinds and amount of ecosystem-based restoration activities that are required to offset many service losses caused by PCBs. The qualitative evidence about how the public may value the broader range of services lost, and what could be done to make the public whole without estimating compensable monetary damages for these additional categories, is summarized. The results of the TVS focus groups are important because they provide a link between many of the important biological injuries not addressed by the recreational fishing study and many of the restoration categories that the KRE Trustees anticipate will be most effective for making the public whole.

Finally, the Trustees also conducted a preliminary hedonic property value study as part of the Stage I Assessment. The purpose of the study was to determine if PCB releases into the KRE are having a strong and obvious impact on property values. The study did not find evidence of a substantial effect of PCBs on property values in the KRE.[4] Therefore, no further work on this issue was conducted in the Stage I Assessment.

4. Property values reflect not only the marketable attributes of homes, such as the number of bedrooms or square footage, but also the implicit values of nonmarket amenities and disamenities, such as proximity to a lake or level of contamination. This preliminary study did not detect a discernable impact on property values from PCB contamination in the KRE.

1.4 Summary of Stage I Compensable Value Determination Results

1.4.1 Recreational fishing compensable damages

The computation of compensable recreational fishing damages resulting from PCB FCAs is a major component of this Stage I evaluation. The first method for estimating compensable values for recreational fishing is the benefits transfer approach, which uses unit values from already existing (secondary) valuation studies from the Great Lakes region and elsewhere [43 CFR § 11.83(c)(2)(vi)]. Rather than focusing on collecting new primary valuation data, using data for similar areas and similar types of services and resource injuries results in a cost-effective, first-order estimate of damages. The unit value method requires selecting a unit value per fishing day and multiplying it by the number of fishing days lost or impaired as a result of natural resource injuries.

Because existing estimates of fishing use for the Kalamazoo River are not current, a new recreational angler survey was also conducted in 2001 to estimate the level of current recreational fishing use for the benefits transfer. In addition to obtaining data to estimate aggregate annual use of the river, the survey asked current Kalamazoo River anglers various questions about fishing patterns (e.g., location, frequency), attitudes about fishing the Kalamazoo River, and other socioeconomic variables.

A second, alternative method was also used. A simulation using the Michigan State University (MSU) recreation demand model was conducted to estimate recreational fishing damages resulting from PCB FCAs [43 CFR § 11.83 (c)(2)(iv)]. The MSU model is able to value recreational fishing resources statewide based on observed user behavior as a function of site characteristics (such as site quality) and travel costs.

The estimate of annual recreational fishing damages for the assessment area in 2001 ranges from $221,700 to $324,700. Aggregate damages over time are compounded and discounted following the guidance in the DOI regulations [43 CFR § 11.84(e)]. The present value (in 2003) of past recreational fishing damages from 1981 through 2002 ranges from $9.4 million to $19.8 million. The present value of future interim damages (starting in 2003) varies depending on the remediation scenario for PCB (and FCA) removal. With no cleanup, future damages range from $7.6 million to $10.9 million over a 100-year time horizon. With an intermediate, 40-year cleanup, future damages range from $5.1 million to $7.4 million. With an intensive, 20-year cleanup, future damages range from $3.6 million to $5.1 million. The ranges stem from consideration of alternative assumptions and uncertainty in the benefits transfer, which are required to be considered under the DOI regulations [43 CFR § 11.84(d)].

1.4.2 Total Value Scoping focus groups

The second major component of the Stage I compensable value assessment, the TVS focus groups, is useful for qualitatively evaluating a broader range of service losses and for restoration planning activities. The focus groups take a more comprehensive approach toward addressing multiple service categories simultaneously, such as ecological services and various types of consumptive and nonconsumptive recreation. Focus groups were conducted with the general public based on a short list of potential restoration actions already developed for the KRE by resource managers, which includes a variety of project types that have the potential to restore the range of KRE resources and their services [see 43 CFR § 11.83(b)(1)]. This study was designed to obtain information from the public about its knowledge, attitudes, and preferences for PCB removal and other programs. The results are qualitative only, and quantitative estimates of the monetary damages associated with the broader suite of service losses were not developed in the Stage I Assessment.

To offset service losses on a human-use value-equivalency basis, the correct *scale* of restoration actions, in terms of their types and levels (and subsequently their costs), would have to be determined using a statistical econometric model. While quantitative scaling of restoration programs to obtain value equivalency for losses from PCB contamination is not possible using the Stage I focus group data, rankings and ratings are indicative of the public's intensity of preferences. The focus groups were conducted using new survey instruments with a limited number of people, and, as a result, the findings represent only a preliminary attempt to infuse public preferences into the valuation of a broad range of service losses and the restoration planning process.

The results show clear evidence that residents are aware of and concerned about PCB contamination in the KRE, and that they would like to see those responsible for the PCB releases pay for cleaning it up. While PCB removal is preferred to other types of restoration programs, ecologically based actions such as wetlands restoration or nonpoint source runoff control are the most appealing compensatory restoration actions, on average, to the focus group participants. Recreational facilities are less appealing to them. Focus group respondents indicated that they value a wide variety of services that are impacted by PCBs, other than recreational fishing losses, including ecological services and nonfishing recreation such as beach and bank use.

1.5 Organization of Report

This report is organized as follows:

- Chapter 1 is this introduction, which contains summaries of the two major research efforts in this stage.

- Chapter 2 presents the Stage I estimates of compensable recreational fishing damages resulting from PCB FCA injuries.

- Chapter 3 presents the findings of focus groups exploring the general public's knowledge of and preferences for a variety of improvements to the KRE, including habitat restoration, water quality improvement/protection, recreational access improvements, and PCB cleanup.

- Chapter 4 presents the criteria for evaluating restoration projects that could enhance or restore natural resources in the KRE.

This report also contains six appendices:

- Appendix A contains a summary of potential KRE restoration projects proposed by various state, regional, and local resource agencies; environmental nonprofit groups; citizen groups; and private citizens.

- Appendix B reports the results from a new recreational fishing survey along with aggregate estimates of current (2001) recreational fishing use of the Kalamazoo River. This study is referred to as the Kalamazoo River Recreational Angler (KRRA) study.

- Appendix C presents tables containing current and past fish consumption advisories for various water bodies, including the Kalamazoo River and Lake Michigan.

- Appendix D provides the details of a recreation demand model simulation using the MSU model to obtain an alternative estimate of damages; this appendix was written solely by Dr. Frank Lupi at MSU.

- Appendix E contains all of the written materials for the TVS focus groups.

- Appendix F reports the preliminary opinions of a professional real estate appraiser on whether PCB contamination has had a substantive and measurable impact on property values in the KRE; this appendix was written solely by Steven Ritter, MAI, based on an on-site visit and other information.