Draft Programmatic Damage Assessment and Restoration Plan
and
Draft Programmatic Environmental Assessment
for the
ExxonMobil Pipeline Company July 1, 2011 Yellowstone River Oil Spill

Prepared by State and Federal Trustees
State of Montana and U.S. Department of the Interior

August 2016

Draft

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Response: Montana DEQ
Oil at Confluence: Larry Mayer
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EXECUTIVE SUMMARY

On or about July 1, 2011, a 12-inch diameter pipeline (Silvertip Pipeline) owned by ExxonMobil Pipeline Company ruptured near Laurel, Montana, resulting in the discharge of crude oil into the Yellowstone River and floodplain.

The discharge is estimated to have been approximately 63,000 gallons (about 1,500 barrels) of oil. The discharge occurred during a high-flow event, with oil affecting approximately 85 river miles and associated floodplain. The discharge, along with associated response activities, adversely affected natural resources within the jurisdictions of the United States and the State of Montana, the Yellowstone River and adjoining shorelines, including, but not limited to, the floodplain, shoreline, wetlands and other riparian areas, islands, fields, pastures, bottomlands, grasslands and shrublands.

This draft Programmatic Damage Assessment and Restoration Plan and Environmental Assessment for the ExxonMobil Pipeline Company July 1, 2011 Yellowstone River Oil Spill (draft restoration plan) has been prepared by the State of Montana and the U.S. Department of the Interior, collectively acting as Trustees for the restoration of natural resources and public use services that were exposed and/or injured by the Yellowstone River oil spill. This document is intended to inform the public about the natural resource injuries caused by the oil spill and potential restoration projects that could compensate for those injuries. The natural resource damage assessment is being performed pursuant to the Oil Pollution Act of 1990 (OPA) (33 USC §§ 2701, *et seq.),* by the U.S. Department of the Interior (DOI), represented by the Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service (USFWS), and the Governor of the State of Montana, collectively known as the Trustees. The BLM and State of Montana are co-lead administrative Trustees.

This draft restoration plan includes several restoration project types to be undertaken on the Yellowstone River and related area. This draft restoration plan also serves as an environmental assessment under the National Environmental Policy Act (NEPA) (42 USC §§ 4321, *et seq.*) and the Montana Environmental Policy Act (MEPA) (75-1-102, MCA, *et seq.*). This document addresses the potential impact of the Trustees' proposed restoration actions on the quality of the physical, biological, and cultural environment.

INJURED RESOURCES AND RESTORATION ALTERNATIVES

Oil from the spill, along with spill response and cleanup activities, harmed fish, wildlife and their habitats and other natural resources in and around the Yellowstone River. The spill also impacted the recreational use of the river and public sites along the river. Categories of injuries include:

- Injuries to terrestrial/riparian habitat and supported biota, through exposure to oil and disturbance caused by response activities.
- Injuries to large woody debris piles, through exposure to oil and disturbance by response activities.
- Injuries to riverine aquatic habitat and supported biota, including fish injuries, caused by exposure to oil.

- Injuries to birds through exposure to oil and disturbance by response activities, specifically injuries to cavity-nesters and American white pelican.

- Human service losses, including recreational angling and park use.

The Trustees evaluated a range of restoration alternatives comprised of primary and/or compensatory restoration components that address specific injuries associated with the oil spill, and in total would make the environment and public whole. Primary restoration actions directly restore the natural resources and services to pre-spill conditions on an accelerated timeframe compared to natural recovery. Compensatory restoration actions would provide resource services to compensate the public for losses pending recovery of resources injured by the oil spill. The Trustees have identified preferred restoration alternatives designed to address the resource injuries. Project types include:

- Acquiring terrestrial/riparian bottomland to conserve terrestrial habitat and bird resources

- Acquiring and restoring terrestrial/riparian habitat

- Controlling invasive woody species on state and federal lands

- Acquiring channel migration or other easements or fee title land acquisitions to provide areas for large woody debris recruitment

- Removing flanked riprap from the river

- Removing side channel blockages

- Providing fish passage around fish barriers

- Restoring and stabilizing river banks using soft bank restoration techniques

- Increasing American white pelican production through improvement of breeding and nesting areas

- Improving city parks and public lands bordering the Yellowstone River

- Improving urban fishing opportunities adjacent to the Yellowstone River

- Developing additional access locations or preserving existing access on the Yellowstone River

Table ES-1 summarizes the injuries and restoration alternatives considered by the Trustees.

DOCUMENT SUMMARY

This draft restoration plan presents information about the release, response, legal authorities, proposed settlement with the responsible party ExxonMobil Pipeline Company, and public involvement (Chapter 1), information about the affected environment (Chapter 2), the Trustees'

estimates of exposure and/or injury and service losses to natural resources caused by the oil spill (Chapter 3) and the Trustees' proposed preferred restoration alternatives (Chapter 4). Analysis of the restoration alternatives under OPA selection criteria is in Chapter 5. Analysis of the proposed Trustee actions pursuant to NEPA and MEPA is provided in Chapter 6. Once the Trustees receive and consider public comments on the restoration alternatives proposed in this draft restoration plan, they will make the final selection of restoration project types. A project implementation plan is included in Chapter 7. Preparers and entities consulted are listed in Chapter 8, applicable laws and policies are listed in Chapter 9. References are included in Chapter 10. Maps are located after the references.

Five technical appendices are also attached: Appendix A is an environmental assessment checklist template; Appendix B is a list of scientific and common names of species on the Yellowstone River, including Montana species of concern; Appendix C summarizes terrestrial/riparian, large woody debris, and riverine aquatic injuries; Appendix D summarizes bird injuries; and Appendix E provides analysis of the lost recreational uses.

PUBLIC COMMENT

Public review of this draft restoration plan is an integral component of the restoration planning process. The Trustees encourage public input on the draft restoration plan. The public comment period is for a minimum of thirty days, and will be announced when the plan is released. The public comment period will be announced via a press release, and the document will be posted on the Montana Department of Justice web page (https://dojmt.gov/lands/yellowstone-river-oil-spill/) and BLM web page (http://www.blm.gov/mt/st/en/fo/billings_field_office.html).

The Trustees will host a public meeting to summarize key components of the restoration plan and receive oral comment. Oral comments can be provided at the public meeting.

Written comments on the draft restoration plan should be sent via e-mail to: NRDP@mt.gov with "Yellowstone restoration plan comment" in the subject line.

Or by U.S. mail to:

Natural Resource Damage Program
Attn: Yellowstone Restoration Plan
PO Box 201425
Helena, MT 59620-1425

The Trustees will review and consider comments received during the public comment period while preparing the final restoration plan. All comments submitted during the period for public comment will be considered by the Trustees prior to finalizing the restoration plan.

Before including your address, phone number, email address or other personal identifying information in your comment, be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

Table ES-1
Summary of Preferred Restoration

Project Type	Project Example	Allocation*
Damage Category: Terrestrial / Riparian Habitat (includes habitat restoration for cavity nesting birds)		
Conservation easements or fee title land acquisitions	Individual or multiple easements or fee title land acquisitions to protect and restore terrestrial/riparian areas and cottonwood bottomlands and areas with complex understory for cavity nesting birds.	$3,560,000
	Restoration of properties within or adjacent to BLM recreation areas or State lands	
Control of invasive woody species	Removal on nearby BLM lands such as Bundy Island, Pompeys Pillar, Sundance and FWP or DNRC state-owned lands	
Damage Category: Large Woody Debris Piles		
Channel migration or other easements or fee title land acquisition	Recruit large woody debris through channel migration zone or other easements or fee title land acquisitions on cottonwood bottomland	$2,090,000
River function restoration	Remove flanked riprap from mid-channel areas	
	Remove non-functional bank riprap	
	Remove side channel blockages	
Damage Category: Riverine Aquatic Habitat		
Fish passage improvement	Restore fish passage in Yellowstone River tributaries	$2,640,000
Soft bank stabilization	Soft bank stabilization rather than hard stabilization to protect infrastructure on State land	
Restore riverine habitat	Remove flanked riprap and side channel blockages	
Damage Category: American white pelican		
Fencing, and water level management for predator control at National Wildlife Refuges	Actions on American white pelican breeding areas (Bowdoin National Wildlife Refuge and Medicine Lake National Wildlife Refuge)	$400,000

Project Type	Project Example	Allocation*
Damage Category: Recreational Human Use		
Develop and improve boat launch sites	Motorized boat launch at Billings Riverfront Park, hand launch site at Billings Riverfront Park, install vault toilet at Laurel Riverside Park boat launch	$2,410,000
Nature trails	Pave a hiking and biking nature trail at Billings Riverfront Park	
Other park improvements	Develop a Master Plan for Laurel Riverside Park to identify and prioritize additional projects	
	Implement projects in Riverside Park Master Plan	
Recreation area improvements	Repair facilities at Sundance Recreation Area and Pompeys Pillar National Monument	
Urban fishing opportunity improvement	Lake Josephine – develop and implement a fish management plan and habitat improvements at Billings Riverfront Park	
	Laurel Pond – dredge and improve habitat features, develop handicapped access and shoreline fishing opportunities	
Develop a new fishing access site or preserve access to existing sites	Acquire and develop a fishing access site between Laurel and the Huntley Diversion or preserve infrastructure to existing fishing access sites	
Provide safe access to the river	Huntley Diversion access across railroad tracks or in other areas	
		Total: $12,000,000

Notes:
*An additional $900,000 is allocated to Trustee natural resource damage assessment costs.

ABBREVIATIONS and ACRONYMS

BLM	Bureau of Land Management
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cfs	cubic feet per second
COE	U.S. Army Corps of Engineers
CWA	Clean Water Act
DEQ	Montana Department of Environmental Quality
DOI	U.S. Department of the Interior
DNRC	Montana Department of Natural Resources and Conservation
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FWP	Montana Department of Fish, Wildlife and Parks
HEA	Habitat Equivalency Analysis
MBTA	Migratory Bird Treaty Act
MCA	Montana Code Annotated
MEPA	Montana Environmental Policy Act
NCP	National Contingency Plan
NEPA	National Environmental Policy Act
NPL	National Priorities List
NRDA	Natural Resource Damage Assessment
NRDP	Montana Natural Resource Damage Program
OPA	Oil Pollution Act
PAH	Polycyclic aromatic hydrocarbons
ROD	Record of Decision
REA	Resource Equivalency Analysis
SCAT	Shoreline Cleanup and Assessment Team
USC	United States Code
USFWS	United States Fish and Wildlife Service
YRCDC	Yellowstone River Conservation District Council

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1.0 INTRODUCTION

1.1 Purpose and Need for Restoration

This Draft Programmatic Damage Assessment and Restoration Plan and Draft Environmental Assessment for the ExxonMobil Pipeline Company July 1, 2011 Yellowstone River Oil Spill (draft restoration plan) is intended to inform the public about the natural resource injuries caused by the July 1, 2011 Yellowstone River oil spill and potential restoration projects that could address and compensate for those injuries. This document is part of a natural resource damage assessment being performed pursuant to the Oil Pollution Act of 1990 (OPA) (33 USC §§ 2701, *et seq.),* by the U.S. Department of the Interior (DOI), represented by the Bureau of Land Management (BLM) and the U.S. Fish and Wildlife Service (USFWS), and the Governor of the State of Montana, through the Montana Department of Justice, Natural Resource Damage Program (NRDP), collectively known as the Trustees. The State of Montana also has natural resource damage authority pursuant to the Comprehensive Environmental Cleanup and Responsibility Act, 75-10-701, MCA, *et seq*.

OPA regulations provide that if an incident affects the interests of multiple trustees, the trustees should act jointly to ensure that full restoration is achieved without double recovery of damages. For joint assessments, Trustees must designate one or more lead administrative trustee(s) to act as coordinators. The DOI and State of Montana are co-lead administrative trustees. The Trustees invited the Crow Nation to participate in the natural resource damage assessment, but the tribe has not participated to date.

The restoration plan includes several restoration project types to be undertaken on the Yellowstone River and related area. This draft restoration plan also serves as an environmental assessment under the National Environmental Policy Act (NEPA) (42 USC §§ 4321, *et seq.*) and the Montana Environmental Policy Act (MEPA) (75-1-102, MCA, *et seq.*). This document addresses the potential impact of the Trustees' proposed restoration actions on the quality of the physical, biological, and cultural environment.

The purpose of this restoration plan is to make the public whole for injuries to natural resources and natural resource services resulting from the oil spill by returning the injured natural resources and natural resource services to their "baseline" condition (i.e., the condition that would have occurred but for the spill) and compensating for associated interim losses.

The regulations for conducting a natural resource damage assessment to achieve restoration are found at 15 Code of Federal Regulations (CFR) Part 990. These regulations were promulgated pursuant to the OPA to determine the nature and extent of natural resource injuries, select appropriate restoration projects, and implement or oversee restoration. This draft restoration plan presents information about the affected environment (Chapter 2), the Trustees' estimates of exposure and/or injury and service losses to natural resources caused by the oil spill (Chapter 3) and the Trustees' proposed preferred restoration alternatives (Chapter 4). Analysis of the restoration alternatives under OPA selection criteria is in Chapter 5. Analysis of the proposed Trustee actions pursuant to NEPA and MEPA is provided in Chapter 6. Once the Trustees receive and consider public comments on the restoration alternatives proposed in this draft restoration plan, they will make the final selection of restoration project types. A project implementation plan is included in Chapter 7. Preparers and entities consulted are listed in Chapter 8, applicable laws and policies are listed in Chapter 9. References are included in Chapter 10.

1.2 Summary of ExxonMobil Pipeline Company Silvertip Oil Discharge

On or about July 1, 2011, a 12-inch diameter pipeline (Silvertip Pipeline) owned by ExxonMobil Pipeline Company ruptured near Laurel, Montana, resulting in the discharge of crude oil into the Yellowstone River and floodplain (Map 1-1).The discharge is estimated to have been approximately 63,000 gallons (about 1,500 barrels). It occurred at the peak (70,600 cfs) of an extended period of high water which lasted through the third week of July, 2011, with oiling affecting approximately 85 river miles and associated floodplain (Map 1-2). This size of flood event is estimated to occur only once every 35 years. The discharged oil affected the Yellowstone River and its adjoining shorelines including the floodplain, wetlands and other riparian areas, islands, fields, pastures, bottomlands, grasslands and shrublands and oiling approximately 5,500 acres of terrestrial/riparian habitat and supported biota, large woody debris piles, riverine resources such as fish, and birds. Human service losses also occurred by preventing park and fishing access site use and preventing angling.

Montana Department of Fish, Wildlife, and Parks (FWP) was unable to obtain fish samples from the Yellowstone River for fish consumption analysis until July 18, 2011, due to hazardous flow conditions. FWP issued a fish consumption advisory on July 21, 2011, advising anglers to be cautious about eating fish between the Buffalo Mirage fishing access site and the mouth of the Bighorn River. The fish consumption advisory was lifted on August 24, 2011.

1.3 Summary of Response Actions

Immediately after the spill, response actions were initiated to remove oil from the floodplain and river. The U.S. Environmental Protection Agency (EPA) led the response, in accordance with the OPA and National Contingency Plan, which was undertaken by the responsible party ExxonMobil Pipeline Company under EPA order, and in coordination with other federal agencies and the State of Montana. A unified command consisting of EPA, ExxonMobil Pipeline Company, and the State of Montana was established at the beginning of the spill. An incident command center was operated in Billings to manage and coordinate response activities from July through September 2011.

Response activities involved over 1,000 personnel at the height of cleanup activities and shoreline assessment of approximately 11,000 acres along 85 river miles. In addition, approximately 60 boats, including four airboats, were in use on the Yellowstone River associated with the cleanup and shoreline assessment activities. The airboats were used for a short period of time because of the noise and disturbance they created.

ExxonMobil Pipeline Company established numerous staging areas along the river to provide boat launching capability and access for the cleanup and shoreline assessment crews. During response activities, a number of public properties, including parks and fishing access sites were used as staging grounds or experienced cleanup activities and were closed to the public, some for significant periods of time.

Within the floodplain, response actions included cutting and removing oiled live vegetation and deadwood (including large woody debris), cleaning oiled surfaces with sorbent pads or by flushing with water, covering oiled surfaces with dust, and leaving the oil to attenuate naturally. Mechanized equipment (all-terrain vehicles, skidsteers, excavators, etc.) was used, and staging grounds, footpaths, temporary roads, and vehicle tracks were also created throughout the surveyed 11,000 acres as part of the spill response activities (ARCADIS 2011). Main resources

deployed for response include 52,380 feet of sorbent boom, and 217 sorbent rolls, 314 viscous sweeps, 1,372 bales of individual sorbent pads, and 300 oil booms.

In September 2011, the site transitioned from EPA emergency cleanup into long-term monitoring, assessment and reclamation, under the direction of the Montana Department of Environmental Quality (DEQ). Pursuant to a DEQ administrative order on consent, the ExxonMobil Pipeline Company performed revegetation, monitored ground water in certain locations along the river, monitored for natural attenuation of remaining residual oil staining, and additional tasks. Response activities effectively ended in mid-October 2011, though some cleanup occurred in November 2011. ExxonMobil tracked volumes of waste (used sorbent materials, cut vegetation, and others) generated during response, but did not track the overall volume of oil recovered, which is expected to be a relatively small amount of the total spill volume.

1.4 Oil Pollution Act (OPA)

The primary goal of OPA is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving an oil discharge. OPA makes each party responsible for a vessel or facility from which oil is discharged liable (among other things) for removal costs and for damages for injury to, destruction of, loss, or loss of use of, natural resources, including the reasonable cost of assessing the damage. Under OPA regulations (15 CFR Part 990), the natural resource injuries for which responsible parties are liable include injuries resulting from the oil discharge and those resulting from response actions or substantial threat of a discharge. OPA specifies that Trustees responsible for representing the public's interest (for example, state and federal agencies) must be designated to act on behalf of the public to assess the injuries and to address those injuries.

Under OPA (15 CFR 990.10), Trustees with jurisdiction over resources affected by an oil release may conduct a natural resource damage assessment to determine whether natural resources have been injured and then plan restoration to address those injuries. The natural resource damage assessment consists of three phases:

1) preassessment;
2) restoration planning; and
3) restoration implementation.

The natural resource damage assessment includes assessment of natural resources that may have been injured and assessment of natural resource services impaired as a result of the discharge of oil.

Trustees are authorized to:

- Assess natural resource injuries resulting from a discharge of oil or the substantial threat of a discharge and response activities, and

- Develop and implement a plan for restoration of such injured resources pursuant to Section 1006 of the OPA, 33 USC §§ 2701, *et seq.,* § 311(f) of the Clean Water Act, 33 USC § 1321(f), and other applicable Federal and State statutory and common law, including but not limited to, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300, Subpart G, and the OPA Natural Resource Damage Assessment Regulations (Regulations), 15 CFR Part

990, as well as Executive Order 12580, 52 Federal Register (Fed. Reg.) 2923 (January 23, 1987), as amended by Executive Order 12777, 56 Fed. Reg. 54757 (October 19, 1991), Executive Order 13016, 61 Fed. Reg. 45871 (August 28, 1996), and Executive Order 13286, 68 Fed. Reg. 10619 (February 28, 2003), and applicable State laws and authorities, including, without limitation, the Comprehensive Environmental Cleanup and Responsibility Act, 75-10-701, MCA, *et seq.*

Trust resources include those that belong to, are managed by, held in trust by, appertain to, or are otherwise controlled by the U.S., a State, an Indian Tribe, or a foreign government. *See* Section 1001(20) of the OPA, 33 USC § 2701(20).

By undertaking a natural resource damage assessment, the Trustees consider the extent of injuries to natural resources, including the functions and services provided by the injured resource, while determining the appropriate ways of restoring the injured resources and compensating for these injuries. Trustees use the information obtained during the natural resource damage assessment to develop and implement plans for the "restoration, rehabilitation, replacement, or acquisition of the equivalent of the natural resources under their trusteeship." The Trustees may seek damages for these injuries, including the reasonable costs of the assessment. (*See* OPA § 1002(b)(2)(A), 33 USC § 2702(b)(2)(A)).

Federal Trustees are designated pursuant to the NCP, 40 CFR § 300.600 and Executive Orders 12580 and 12777. For this incident, the federal Trustee is the DOI, as represented by the BLM and the USFWS. The State trustee is the Governor of the State of Montana, in accordance with 40 CFR 300.605.

OPA regulations provide specific definitions for the following terms:

- "Injury" is "an observable or measurable adverse change in a natural resource or impairment of a natural resource service";

- "Natural resources" are "land, fish, wildlife, biota, air, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States, any state or local government or Indian tribe"; and

- "Natural resource services" are "functions performed by a natural resource for the benefit of another resource and/or the public."

During the preassessment phase, the Trustees determined that the provisions and determinations of OPA applied to this discharge including:

1) one or more incidents had occurred;
2) the discharge was not from a public vessel
3) the discharge was not from an onshore facility subject to the Trans-Alaska Authority Act;
4) the discharge was not permitted under federal, state, or local law; and
5) public trust natural resources and/or services may have been injured as a result of the discharge.

On the basis of those determinations, on October 31, 2013, the Trustees issued a Notice of Intent to Conduct Restoration Planning for the natural resource damage assessment associated with the oil spill (Montana and BLM 2013).

In the restoration planning phase, the Trustees evaluated and quantified the nature and extent of injuries to natural resources and services, and determined the need for, type of, and scale of appropriate restoration actions.

State and Federal agencies were engaged through contact with the Trustees and the Trustees' technical work groups established under the natural resource damage assessment process. The technical work groups evaluated the categories of injuries and extent of injury and service losses. They also developed a suite of restoration projects and project types for each injury category to address injury and compensate for the service losses due to the oil spill. Many of the projects are consistent with the locally developed plans discussed below. Using the information developed during the restoration planning phase, the Trustees developed this draft restoration plan.

The injuries from the oil spill are divided into the following categories:

1) terrestrial/riparian habitat and biota (including cavity nesting birds)
2) large woody debris piles
3) riverine aquatic habitat and biota
4) American white pelican, and
5) human recreational uses.

A description of injuries to each category of natural resources is presented in Chapter 3. Although additional assessment work may have assisted in confirming the extent of injuries to natural resources and natural resource services, the Trustees decided to move more expeditiously toward the goal of restoration.

The Trustees' assessment used validated data from the Trustees, ExxonMobil Pipeline Company, U.S. EPA and other sources. The Trustees' assessment produced relevant information that the Trustees considered in determining the nature and extent of injuries to natural resources. This information is provided in Chapters 2 and 3.

Considering the nature and extent of exposure and injuries to natural resources caused by the spill, the Trustees developed a plan for restoring the injured resources and services, set forth in this draft restoration plan. In this plan, the Trustees identify a reasonable range of restoration alternatives, evaluate those alternatives, and using the criteria at 15 CFR § 990.54, select a preferred alternative.

Chapter 4 describes the restoration alternatives the Trustees analyzed for returning the resources injured by the oil spill to their baseline condition and to compensate the public for the interim losses. Chapter 4 also describes how these alternatives were developed under OPA and NEPA/MEPA. A summary of the restoration alternatives, project goals, project types, project examples, and allocated costs is included in Table 1-1.

In proposing their preferred restoration alternative, the Trustees considered all of the criteria outlined in the OPA regulations (See Chapter 5). As a part of this process, the Trustees considered the extent to which the restoration alternatives would provide benefits to more than one natural resource and/or service. As described in more detail in Chapter 5 of this draft

restoration plan, many of the preferred restoration alternatives proposed by the Trustees benefit multiple resources and/or resource services. Overall, the Trustees are proposing selection of the least expensive, most practicable alternatives that are expected to provide the restoration benefits required by these criteria.

1.4.1 National Environmental Policy Act and Montana Environmental Policy Act Compliance

Any restoration of natural resources under OPA must comply with NEPA, as amended (42 USC 4321 et seq.), and its implementing regulations (40 CFR § 1500-1508) with respect to federal actions that may significantly impact the human environment. In addition, restoration actions undertaken in the State of Montana must comply with MEPA (75-1-102, MCA, et seq.). NEPA and MEPA require:

- A statement of the purpose and need for the proposed action
- A description of the environment that could be affected
- A description of the proposed action and a set of alternatives
- An analysis of the direct, indirect, and cumulative environmental impacts of each alternative and appropriate mitigations.

MEPA requires that State agencies conduct thorough analysis and disclosure of State actions that impact Montana's human environment. NEPA requires that the environmental impacts of a proposed federal action be considered before implementation. Generally, under both NEPA and MEPA, if it is uncertain whether an action would have a significant impact, agencies begin the planning process by preparing an environmental assessment (EA). State and federal agencies may then review public comments prior to making a final determination. Depending on whether an impact is considered significant, an environmental impact statement (EIS) or a Finding of No Significant Impact (FONSI) is issued.

In undertaking their analysis, the Trustees evaluated the potential significance of proposed actions, considering both context and intensity. For the actions considered in this draft restoration plan, the appropriate context for considering potential significance of the action is at the local or regional level, as opposed to national, or worldwide. This draft restoration plan is intended to accomplish NEPA and MEPA compliance by summarizing the current environmental setting of the proposed restoration, describing the purpose and need for restoration action, identifying alternative actions, assessing the preferred action's environmental consequences, and providing opportunities for public participation in the decision process. This draft restoration plan is designed to allow the Trustees to meet the public involvement requirements of OPA, NEPA, and MEPA concurrently.

None of the proposed preferred types of projects to be implemented by the Trustees has highly uncertain impacts or risks or is likely to violate any environmental protection laws. Environmental analyses for similar projects in the Yellowstone drainage (channel migration easements, boat ramp or fishing access development, fish passage, or control of woody invasive species, for example) have all been addressed in similar contexts with an EA.

Further, the Trustees do not believe the preferred types of projects would adversely affect the quality of the human environment. Instead, habitat restoration would benefit species by restoring natural habitat functions. Likewise, the selected restoration actions would provide positive benefits for human recreational use. Thus, unless new information is made available during the

public review process, the Trustees expect to be able to make a Finding of No Significant Impact for the suite of proposed preferred types of projects described in Chapter 4. More information on the Trustees' analysis of the proposed actions relative to NEPA and MEPA is provided in Chapter 6.

In this document, the Trustees are providing a specific environmental assessment for some projects that are already defined. This document also provides a programmatic environmental assessment that evaluates broad (as opposed to project-specific) restoration alternatives for prioritized projects that are still in development. This programmatic document describes the process for subsequent restoration planning to select specific projects for implementation. Additional specific restoration plans will be consistent with this draft restoration plan and integrated with supplemental NEPA or MEPA analysis, as needed, tiered from this EA. A tiered environmental analysis is a project-specific analysis that focuses on project-specific issues, and summarizes or references (rather than repeats) the broader issues discussed in this EA. A template for a tiered EA is included in Appendix A. Because they are part of existing plans, some projects have already completed NEPA or MEPA compliance.

In compliance with NEPA and MEPA, this draft restoration plan describes the purpose and need for action, summarizes the current environmental setting in the areas of the proposed restoration, identifies alternative actions, assesses their applicability and environmental consequences, and summarizes opportunities for public participation in the decision-making process. The draft restoration plan will be finalized after public comment has been received and considered and any required responses are provided.

If there is a major change to any of the restoration project types proposed for selection in this draft restoration plan, the Trustees will consider the need to develop additional environmental analysis in accordance with NEPA and MEPA requirements. These requirements typically require a supplemental analysis be prepared if new information arises that would substantively impact on previous decision-making or if there is a significant change to a selected restoration project (40 CFR § 1502(9)(c)). The decision as to whether a change is significant considers both the context and intensity of the proposed change (40 CFR § 1508.27). Project changes that are not deemed significant could be outlined in a supplemental information report for posting to the administrative record.

1.4.2 Coordination with Responsible Party

The identified responsible party for this oil spill, as defined by OPA, is the ExxonMobil Pipeline Company. The OPA regulations require the Trustees to invite the responsible party to participate in the damage assessment process. Accordingly, the Trustees worked with the responsible party to participate in the damage assessment process. The Trustees and ExxonMobil Pipeline Company signed a Letter Agreement, dated September 30, 2011, by which the company agreed to provide initial funding for natural resource damage assessment activities. The OPA regulations also provide that the Trustees and responsible party should consider entering into agreements to facilitate their interactions and resolve disputes during assessment. In August 2012, the Trustees and ExxonMobil Pipeline Company entered into a Memorandum of Agreement (MOA) to provide a framework for the development of natural resource damage assessment cooperative tasks, and to provide for further funding. The Trustees and ExxonMobil Pipeline Company coordinated certain data collection activities, and provided each other collected data and related information. The MOA was extended to the end of March 2013 by mutual agreement, after which time the company declined to extend the MOA, and it expired.

In October 2013, the Trustees formally invited the company's participation in the natural resource damage assessment, in a letter to ExxonMobil Pipeline Company enclosing the Trustees' "Notice of Intent and an invitation for ExxonMobil Pipeline Company to Participate in the Natural Resource Damage Assessment." In November 2013, ExxonMobil Pipeline Company wrote to the Trustees noting its interest in participating in the natural resource damage assessment, and proposing that the Trustees and the company should discuss the company's potential involvement. In June 2014, after unsuccessful discussions following the notice to participate, the Trustees presented ExxonMobil Pipeline Company with a partial claim for past and future natural resource damage assessment costs. In September 2014, ExxonMobil Pipeline Company declined to pay these costs, but encouraged the continuation of discussions between the Trustees and ExxonMobil Pipeline Company for settlement of natural resource damages. A proposed settlement was reached contemporaneously with the completion of this draft restoration plan, which would allow the Trustees to receive the funding needed to implement the restoration plan. The potential settlement is discussed in Section 1.5.

1.4.3 Public Participation

The Trustees have engaged the public, local groups and organizations, and State and Federal agencies since starting this natural resource damage assessment. The Trustees established and periodically updated websites which describe the spill and natural resource damage assessment activities. http://www.blm.gov/mt/st/en/info/yellowstonespill.html and https://dojmt.gov/lands/yellowstone-river-oil-spill/ The BLM web site also contains the administrative record for preassessment, restoration planning, and natural resource damage assessment data.

Shortly after the spill, the Trustees met with the Yellowstone River Conservation District Council (YRCDC) during their August 2011 public meeting, to explain the natural resource damage assessment process. The Trustees then had several meetings with representatives of the City of Billings and the City of Laurel and other interested parties to discuss the spill's impacts to Riverfront Park, Coulson Park and Norm's Island in Billings and Riverside Park in Laurel. Representatives from several user groups associated with Riverside Park were contacted individually to determine the extent and type of loss. These user groups included the local 4-H club, the Laurel Trap Club, the Horseshoe Club, Hunter Education Instructors, and the Laurel Rod & Gun Club. The Montana Audubon Center immediately adjacent to Riverfront Park in Billings was also contacted. The Trustees conducted a phone survey of area anglers to determine the effect of the oil spill on their angling activities on the Yellowstone River in the vicinity of the oil spill during summer and fall 2011. Representatives from the City of Billings and City of Laurel were again contacted in 2016 as the Trustees analyzed restoration projects to compensate the public for the public human use service losses that occurred at the affected park sites.

A Notice of Intent to Conduct Restoration Planning was issued on October 31, 2013. Public notice and a press release accompanied the release of the Notice of Intent, and were posted on the Trustee websites. A Presentment letter and partial claim for natural resource damage assessment costs were issued on June 24, 2014, and posted on Trustee websites. Public notice and a press release for this restoration plan were also issued, with notice provided in local papers.

1.4.4 Watershed and Master Plans

The Trustees had the benefit of reviewing several existing local master plans and watershed plans in the development of the draft restoration plan. The Trustees have adapted several of the project types specified in the plans, and included them as part of the restoration alternatives analysis. The Trustees limited inclusion in the restoration plan alternatives to those project types which would return the injured resources and services to baseline condition and compensate for interim losses, as well as comply with other requirements of OPA, NEPA, and MEPA, and provide for actions for which a non-federal governmental agency would normally not be responsible or that would receive funding in the normal course of events. The Trustees also paid attention to scaling the project types to the expected natural resources or services that will be provided. Some project types and projects identified in this draft restoration plan are from the City of Billings Riverfront Park Master Plan prepared in 2009. The master plan went through an extensive public participation and review process during its development and adoption. Other project types and projects were identified from the U.S. Army Corps of Engineers (COE) and YRCDC Cumulative Effects Analysis (COE and YRCDC 2016) and Yellowstone River Recommended Practices (YRCDC 2015). The cumulative effects analysis and recommended practices also went through an extensive public review process. Throughout the development of the document, the COE and YRCDC held council meetings and technical advisory meetings to discuss all aspects of the development of the analysis. During the development of the recommended practices, meetings were held in each of the counties along the river. The COE and YRCDC held three public meetings in October 2015 to accept comments on the draft cumulative effects analysis and recommended practices. In March 2016, the COE and YRCDC held an end-of-study symposium to hear an overview of the cumulative effects analysis and recommended practices development process and invite discussion about the product.

1.4.5 Public Comment

Public review of this draft restoration plan is an integral component of the restoration planning process. The Trustees encourage public input on the draft restoration plan. Public review will be consistent with all federal and State laws and regulations that apply to the natural resource damage assessment process, including Section 1006 of OPA, 42 USC §2706; the OPA regulations (15 CFR Part 990); NEPA, as amended (42 USC §4371, *et seq.*); and its regulations (40 CFR Parts 1500-1508); and the Montana Environmental Policy Act (MEPA) (75-1-102, MCA, *et seq.*) and its regulations. Under OPA, the Trustees are seeking public comment on the methods proposed to restore injured resources or replace lost resource services. This draft restoration plan provides the public with information about the nature and extent of the natural resource injuries and the restoration alternatives proposed to address them, as well as the environmental consequences of the alternatives. The NEPA/MEPA analysis in this document describes the expected direct, indirect and cumulative impacts on the human environment of actions proposed for implementation by federal and State agencies.

The public comment period is for a minimum of thirty days, and will be announced when the plan is released. The public comment period will be announced via a press release, and the document will be posted on the Montana Department of Justice web page (https://dojmt.gov/lands/yellowstone-river-oil-spill/) and BLM web page (http://www.blm.gov/mt/st/en/fo/billings_field_office.html).

The Trustees will host a public meeting to summarize key components of the restoration plan and receive oral comment. Oral comments can be provided at the public meeting.

Written comments on the draft restoration plan should be sent via e-mail to: NRDP@mt.gov with "Yellowstone restoration plan comment" in the subject line.

Or by U.S. mail to: Natural Resource Damage Program
Attn: Yellowstone Restoration Plan
PO Box 201425
Helena, MT 59620-1425

The Trustees will review and consider comments received during the public comment period while preparing the final restoration plan. All comments submitted during the period for public comment will be considered by the Trustees prior to finalizing the restoration plan. An additional opportunity for public review will be provided in the event that the Trustees decide to make significant changes to the document based on public comments.

Before including your address, phone number, email address or other personal identifying information in your comment, be advised that your entire comment, including your personal identifying information, may be made publicly available at any time. While you can ask us in your comment to withhold from public review your personal identifying information, we cannot guarantee that we will be able to do so.

1.4.6 Administrative Record

The Trustees have maintained records to document the information considered by the Trustees in developing this draft restoration plan. These records are compiled in an administrative record, which is available to the public online and at the address listed below. The administrative record facilitates public participation in the assessment process and will be available for use in any future administrative or judicial review of Trustee actions to the extent provided by federal or state law. Additional information and documents, including public comments received on the draft restoration plan, and other related restoration planning documents will become a part of the administrative record. The administrative record for this document consists of the references cited in Chapter 10 along with the administrative record for the oil spill natural resource damage assessment case as a whole that is available for inspection online at:
http://www.blm.gov/mt/st/en/info/yellowstonespill.html
or at the BLM Billings Field Office, 5001 Southgate Drive, Billings, MT 59101.

1.5 Proposed Settlement

The Trustees have used available information, field data, focused studies, and expert scientific judgment to arrive at their best estimate of the injuries. The funding for injured resources and services contained in the draft restoration plan is based on the Trustee determinations for making the public whole for loss of natural resources and services. The Trustees and ExxonMobil Pipeline Company have had ongoing discussions about the possibility of reaching a potential settlement, within the parameters set forth by OPA. A proposed settlement was reached contemporaneously with the completion of this draft restoration plan, which would allow the Trustees to receive the funding needed to implement the restoration plan.

Under OPA, there are different possible scenarios for the Trustees to receive the funding needed to implement restoration. In one scenario, the Trustees can prepare a draft and final restoration plan and present a written demand to the responsible parties to either implement the restoration or provide the funding necessary for restoration implementation (15 CFR § 990.62).

If the responsible parties reject the demand, the Trustees can then file a lawsuit in an attempt to win a judgment for the cost of restoration, or the Trustees can seek funding for restoration from the federal government's Oil Spill Liability Trust Fund (15 CFR § 990.64). This litigation scenario typically results in long delays and has an uncertain outcome with respect to the amount of funding that may be gained for restoration.

A second scenario under OPA is a settlement scenario. The OPA regulations provide that "Trustees may settle claims for natural resource damages . . . at any time, provided that the settlement is adequate in the judgment of the trustees to satisfy the goal of OPA and is fair, reasonable, and in the public interest" (15 CFR 990.25). A settlement avoids the risks and delays of litigation and provides the Trustees with certainty about the amount of funding available for restoration. This is the Trustees' preferred scenario.

A proposed consent decree between the Trustees and ExxonMobil Pipeline Company was filed in federal district court in Billings concurrently with issuance of this draft restoration plan. In that proposed consent decree, ExxonMobil Pipeline Company commits to pay $12 million in order to resolve its liability for natural resource damages, including assessment costs, associated with the oil spill. The proposed consent decree is subject to its own public comment process regarding the sufficiency of the settlement or other terms. Upon conclusion of the public comment process, if both Trustees and then the Court find the decree to be is fair, reasonable, and furthering the objectives of OPA, the Court would officially enter the consent decree.

The Trustees believe that both the settlement and the draft restoration plan are appropriate for the following reasons. The Trustees have jointly examined and assessed the extent of injury and the proposed restoration alternatives with particular consideration of approaches to restoring, replacing, rehabilitating, or acquiring the equivalent of the injured natural resources and services. If the proposed decree becomes final, and if the funding available for restoration is expended in conformance with the draft restoration plan, the Trustees will be satisfied that the resulting efforts will make the public whole for the loss in natural resources and services suffered. The Trustees paid particular consideration of the adequacy of the settlement to restore, replace, rehabilitate, or acquire the equivalent of the injured natural resources and services. Sums recovered in settlement, other than reimbursement of Trustee costs, may only be expended in accordance with the restoration plan.

The Trustees have considered, among other things: the nature and extent of the specific injuries that have been identified and studied and the uncertainties attached to those injuries; the uncertainties as to other injuries not fully studied; the potential benefits (and detriments) of ecosystem-level habitat restoration, and the uncertainties attached to those restoration options; the remoteness of the possibility of unknown conditions significantly impacting the natural resources in the future; the further degradation to the environment that would occur as restoration is delayed while further study is undertaken to narrow uncertainties; the further degradation to the environment that would occur as restoration is delayed during the litigation process; and the benefits of starting restoration sooner rather than litigating.

1.6 Trustee Preferred Restoration Alternatives

Chapter 4 describes the restoration alternatives the Trustees analyzed for returning the resources injured by the oil spill to their baseline condition and to compensate the public for the interim losses. Chapter 4 also describes how these alternatives were developed under OPA and NEPA/MEPA. A summary of the restoration alternatives, project goals, project types, project examples, and allocated costs is included in Table 1-1.

Based on the Trustees' experience implementing restoration projects and resource management programs, the Trustees believe that the $12,000,000 in restoration funds, as allocated, would provide appropriate and sufficient restoration to compensate for the natural resource injuries described in Chapter 3.

1.7 Implementation

Should the settlement be approved by the Court, and the restoration plan finalized, the Trustees would proceed with implementation of the restoration plan. OPA regulations provide that upon settlement, Trustees should consider certain actions to facilitate implementation of restoration, including establishing a memorandum of understanding to coordinate between the Trustees, developing more detailed work plans to implement restoration, monitoring and overseeing restoration, and evaluating restoration success and the need for corrective action. The Trustees would separately manage implementation of the project types and projects contained in the final restoration plan, but would coordinate their activities on a programmatic level, and would seek State, federal, local, and private partners to help develop, design, manage, provide additional funding, and/or implement identified projects. Restoration plan implementation is discussed in Chapter 7. Preparers and entities consulted are listed in Chapter 8, applicable laws and policies are listed in Chapter 9, and references are included in Chapter 10. Maps are located after the references.

Five technical appendices are also attached: Appendix A is an environmental assessment checklist template; Appendix B is a list of all scientific and common names of species on the Yellowstone River, including Montana species of concern; Appendix C summarizes terrestrial/riparian, large woody debris, and riverine aquatic injuries; Appendix D summarizes bird injuries; And Appendix E provides analysis of the lost recreational uses.

Table 1-1
Summary of Restoration Alternative 2 Preferred Alternative

Project Goal	Project Type	Project Example	Allocation*
Damage Category: Terrestrial / Riparian Habitat (includes habitat restoration for cavity nesting birds)			
Conserve and restore terrestrial/ riparian habitat (includes habitat restoration for cavity nesting birds)	Conservation easements or fee title land acquisitions	Individual or multiple easements or fee title land acquisitions to protect and restore terrestrial/riparian areas and cottonwood bottomlands and areas with complex understory for cavity nesting birds.	$3,560,000
		Restoration of properties within or adjacent to BLM recreation areas or State lands	
	Control of invasive woody species	Removal on nearby BLM lands such as Bundy Island, Pompeys Pillar, Sundance and FWP or DNRC state-owned lands	
Damage Category: Large Woody Debris Piles			
Restore losses to large woody debris piles and natural river function	Channel migration or other easements or fee title land acquisitions	Recruit large woody debris through channel migration zone or other easements or fee title land acquisitions on cottonwood bottomland	$2,090,000
	River function restoration	Remove flanked riprap from mid-channel areas	
		Remove non-functional bank riprap	
		Remove side channel blockages	
Damage Category: Riverine Aquatic Habitat			
Enhance aquatic habitat for fish production and other aquatic organisms	Fish passage improvement	Restore fish passage in Yellowstone River tributaries	$2,640,000
	Soft bank stabilization	Soft bank stabilization rather than hard stabilization to protect infrastructure on State land	
	Riverine habitat restoration	Remove flanked riprap and side channel blockages	

Project Goal	Project Type	Project Example	Allocation*
Damage Category: American White Pelican			
Replace pelican populations	Fencing, and water level management for predator control at National Wildlife Refuges	Actions on American white pelican breeding areas (Bowdoin National Wildlife Refuge and Medicine Lake National Wildlife Refuge)	$400,000
Damage Category: Recreational Human Use			
Improve public parks and recreation areas	Develop and improve boat launch sites	Motorized boat launch at Billings Riverfront Park, hand launch site at Billings Riverfront Park, install vault toilet at Laurel Riverside Park boat launch	$2,410,000
	Nature trails	Pave a hiking and biking nature trail at Billings Riverfront Park	
	Other park improvements	Develop a Master Plan for Laurel Riverside Park to identify and prioritize additional projects	
		Implement projects in Riverside Park Master Plan	
	Recreation area improvements	Repair facilities at Sundance Recreation Area and Pompeys Pillar National Monument	
Improve urban fishing opportunities	Urban fishing opportunity improvement	Lake Josephine – develop and implement a fish management plan and habitat improvements at Billings Riverfront Park	
		Laurel Pond – dredge and improve habitat features, develop handicapped access and shoreline fishing opportunities	
Increase and maintain fishing access to the Yellowstone River	Develop a new fishing access site or preserve access to existing sites	Acquire and develop a fishing access site between Laurel and the Huntley Diversion or preserve infrastructure to existing fishing access sites	
	Provide safe access to the river	Huntley Diversion access across railroad tracks or in other areas	
			Total: $12,000,000

Notes:
*An additional $900,000 is allocated to Trustee natural resource damage assessment costs.

2.0 AFFECTED ENVIRONMENT

NEPA requires a description of the existing environment that has the potential to be affected by the alternatives under consideration, with emphasis commensurate with the importance of the impact on those resources (40 CFR 1502.15). This chapter presents an overview of the ecosystem setting. The main geographic focus of this natural resource damage assessment is the Yellowstone River from the spill site near Laurel to below Pompeys Pillar because this is the area that was most heavily impacted by the spill (injured area) (Map 1-2). Initial surveys continued past Pompeys Pillar, as far downstream as the mouth of the Big Horn River. Restoration projects will take place in an area greater than the injured area and will include the Yellowstone River upstream, within and downstream of the injured area, tributaries to the Yellowstone River, and Medicine Lake and Bowdoin National Wildlife Refuges (affected environment or restoration area). Chapter 3 describes the injured resources and resource services affected by the oil spill and provides important information on the existing environment in which proposed restoration will be conducted. Implementation of this draft restoration plan would have the greatest impact on these resources.

2.1 Physical Environment

The Yellowstone River originates in northwest Wyoming in Yellowstone National Park and flows 678 miles in a generally north eastward direction before entering the Missouri River at Buford, North Dakota. The river drains over 70,000 square miles of land. The Yellowstone River enters Montana at Gardiner and leaves Montana at the North Dakota border 543 miles downstream (Map 1-1). The nearly 700-mile long Yellowstone River is the largest tributary to the Missouri River. Its mean annual discharge at Billings is 6,944 cubic feet per second (cfs) (USGS 2016). While roughly half of the land area drained by the Yellowstone lies in Wyoming, the Yellowstone River itself is contained almost entirely within Montana (COE and YRCDC 2016).

As a national and State resource, the Yellowstone River is without parallel (COE and YRCDC 2016). The Yellowstone River is unique in that it is the longest free flowing river in the lower 48 states, as there are no major dams or reservoirs on the mainstem river. As such, it retains its natural hydrograph and the fluvial geomorphology and ecology associated with free flowing rivers. The Yellowstone River has an active channel migration zone, the floodplain area where the river moves side to side in its floodplain. The COE and YRCDC (2016) mapped the channel migration zone for the Yellowstone River. An important feature of the Yellowstone River is the production of large woody debris and accumulation in large woody debris piles that influence channel morphology and provide fish and wildlife habitat. The injury to large woody debris from the oil spill is discussed in more detail in Chapter 3. In addition to an abundance of fish and wildlife, the Yellowstone River supports a wide variety of agriculture, domestic, industrial and recreational uses.

The Yellowstone River is in a wide agricultural valley near the City of Laurel. The river valley then narrows due to rimrock exposures near Billings and can become heavily urbanized. Near Huntley the valley widens and then narrows again near Pompeys Pillar (COE & YRCDC 2016).

Major tributaries to the Yellowstone River in Montana include the Shields, Boulder, Stillwater, Clarks Fork, Bighorn, Tongue and Powder rivers. Two major tributaries enter the Yellowstone in the injured area: the Clarks Fork River and Pryor Creek. The spill occurred in the Yellowstone River approximately 2.5 miles upstream from the mouth of the Clarks Fork River near Laurel. Pryor Creek enters the Yellowstone River near the town of Huntley. Cities immediately adjacent to the Yellowstone River include Gardiner, Livingston, Big Timber, Columbus, Laurel, Billings,

Forsyth, Miles City, Glendive and Sidney. The city of Billings, located close downstream to the spill site, is the largest metropolitan area in the state. The majority of the injured area is located within an area identified as the middle Yellowstone (COE and YRCDC 2016). The river in the middle Yellowstone area includes extensive urban development by Billings.

2.2 Biological Environment

The Yellowstone River is one of the last free-flowing large rivers in the continental U.S. The river is one of the most important fish and wildlife habitats in Montana (FWP and MARS 2016). The riparian and wetland communities support high concentrations of plants and animals. These animals are identified in Montana's Comprehensive Fish and Wildlife Conservation Strategy (FWP 2015). Biologic resources in the affected environment are discussed below. Injuries to those resources are described in more detail in Chapter 3.

2.2.1 Riparian/Floodplain Habitat

The Yellowstone River has various habitat types including cottonwood forest, riparian shrub, gravel bar, and grassland, each of which supports different wildlife species with different habitat preferences. Different habitat types in the floodplain are created and sustained by the movement of the river within its floodplain. In general, the riverside vegetation is dominated by riparian cottonwood forest wherever the river meanders and forms sand bars and other land forms that are near water level. Flood events in the basin nfluence cottonwood establishment on the floodplain (Jean and Crispin 2001). The mainstem riparian plant community transitions from narrowleaf/black cottonwood to plains cottonwood to green ash (COE and YRCDC 2016).

In the injured and restoration areas, the Yellowstone is a braided river with riparian habitat heavily vegetated with herbaceous scrub shrub understory with hundred year old cottonwoods. The riparian area includes the banks of the river and many vegetated islands. Some of the key habitat types found in the Yellowstone River floodplain include bottomland cottonwood gallery forests, and riparian grasslands and shrublands, sedge meadows, willow bottoms, wet aspen, and large woody debris piles. These habitats support a diverse array of multiple species that rely on riparian habitats (USGS 1999; Jean and Crispin 2001). Because the Yellowstone River has remained un-dammed and historical ecosystem processes continue to function, most of the habitat types and wildlife that would have been present before European settlement in the area are still present today (Abt Associates 2016).

The reaches of the river immediately above and at the spill site contain more cottonwood forest that most other reaches in the same area, and are likely important forest habitat within the area (COE and YRCDC 2016). Surveys conducted during the response actions to delineate the distribution of oil in the floodplain showed that the dominant habitat type in the injured area is riparian/forested wetland, followed by grassland/shrubs.

The Yellowstone River riparian zone and floodplain in the injured and restoration areas support a wide variety of terrestrial and riparian wildlife species. Wildlife include game species such as elk, white-tail deer, mule deer, antelope, and black bear as well as game birds, non-game birds, waterfowl, pelicans, and small mammal species (see Appendix B for a complete list). Riparian habitat and associated bird resources injured by the oil spill are described in more detail in Chapter 3. Flooding influences the Yellowstone River landscape and provides habitats for species adapted to these disturbances. The processes that influence population persistence function today for most species because the landscape is still relatively intact. Wide-ranging animals continue to move between populations and influence the population dynamics of local

populations that might have been isolated in a more altered landscape. (Jean and Crispin 2001). The cottonwood gallery forests and terraces are important habitat for bald eagles and great blue heron (Jean and Crispin 2001). Two important nesting areas for pelicans from this area are Medicine Lake National Wildlife Refuge and Bowdoin National Wildlife Refuge in northeast Montana.

Riparian cottonwood forests, shrubs, and grassy meadows are all key components of terrestrial habitat in the Yellowstone River riparian area. The COE & YRCDC (2016) analysis of riparian cover along the Yellowstone River between 1950 and 2001 shows that the classes of riparian cover have changed over time, in part due to the changes in riparian vegetation succession caused by natural channel migration and development. In the injured area, since the 1950s, about 8% of the woody riparian land cover has changed to urban, exurban, transportation, or irrigated uses (COE & YRCDC 2016). In the riparian areas near Billings, in the injured area, the analysis shows that almost 50% of the woody riparian acres have been converted to these other uses (COE & YRCDC 2016) since the 1950s. If past development trends continue, the remaining terrestrial/riparian lands in this reach are at risk of further development.

2.2.2 Riverine Aquatic Habitat and Fish Resources

The Yellowstone River riverine aquatic habitat and resources included in this environmental assessment are the Yellowstone River main stem and side channels and tributaries and fish, aquatic insects, amphibians, and reptiles. The Yellowstone River enters Montana at Gardiner and joins the Missouri River 558 river miles downstream. Over this length, the fish populations change from predominantly cold water fish species in the upper reaches above Laurel to those dominated by warm water species in the lower reaches below the mouth of the Bighorn River.

In the injured area, between the Clarks Fork confluence and the Bighorn River confluence, the river is within a biological transition zone, with both cold and warm water fish species present (COE and YRCDC 2016)(Map 2-1). The transition zone contains a mix of both warm and cold water fish species with the cold water species becoming less abundant as one goes downstream and the warm water species becoming more abundant. The spill occurred in the Yellowstone River approximately 2.5 miles upstream from the mouth of the Clarks Fork River near Laurel. A major change occurs when the Clarks Fork River enters the Yellowstone at river mile 379 with warmer water and an increase in sediment and turbidity and contributes significantly to the change in fish species composition (Ann Marie Reinhold pers. comm.). Once the Clarks Fork River enters the Yellowstone River, the number of cold water species rapidly declines. The fish species injured by the spill in the Yellowstone River were largely warm water species in the transition zone of the Yellowstone River. The fish species assemblage found in the lower Clarks Fork River is very similar to the Yellowstone River fish assemblage in the transition zone below its confluence with the Clarks Fork River.

The predominantly cold water species in the upper reach include Yellowstone cutthroat, rainbow and brown trout, mountain whitefish and mottled sculpin. The warm water reach includes a much more diverse fish assemblage including such fish as channel catfish, shovelnose and pallid sturgeons, paddlefish, sauger, walleye, smallmouth bass, goldeye, ling, freshwater drum, blue sucker, river carpsucker and others. Pallid sturgeons are not in the injured area. Some species such as the longnose, white, mountain and short head redhorse suckers and a variety of minnow species are found in both the cold and warm water reaches and throughout the transition zone with both numbers and diversity increasing as one progresses downstream. Warm water fish in large river systems like the Yellowstone River frequently travel long distances to reach spawning, feeding and overwintering areas (L. Peterman, personal

communication). Spawning can take place in the mainstem, in side channels or in tributary streams, depending on the species and habitat suitability. In the Yellowstone River, fish frequently use tributary streams for spawning. Further discussion of riverine aquatic habitat and fish and injuries from the oil spill is included in Chapter 3.

Some projects for riverine aquatic habitat may take place in the Clarks Fork of the Yellowstone or Pryor Creek. The Clarks Fork River is located in southcentral Montana and northwestern Wyoming. The Clarks Fork of the Yellowstone River is located in south-central Montana and northwestern Wyoming (Map 2-1). The river drains an area of approximately 2,783 square miles extending from the northwestern corner of Yellowstone National Park northeastward to its confluence with the Yellowstone approximately 2.5 river miles below the highway 212 bridge near Laurel where the oil pipeline break occurred. The distance from the Montana-Wyoming border to the Yellowstone River is 72.6 river miles (Ruff et al. 1972). The Clarks Fork River has an average annual discharge of 934 cfs and contributes large amounts of sediment to the Yellowstone River. The stretch of the river in Montana had 18 species of cold and warm water fish when sampled in 1980s and 1990s. There are 11 irrigation structures in this stretch of the river (Thomas 1993).

Pryor Creek enters the Yellowstone River near the town of Huntley (Map 2-1). The creek drains about 600 square miles of land to the south of the Yellowstone River. For nearly 100 years, fish passage up Pryor Creek was blocked by man-made structures (Yellowstone Conservation District 2012). In the early 1900s, the Huntley Canal was constructed to carry water from the Yellowstone River to farms along the valley. The canal crossed nearly perpendicular to Pryor Creek just upstream of the confluence with the Yellowstone River. This canal has blocked upstream fish passage from the Yellowstone River into Pryor Creek since its construction. In 2011, the catastrophic flood caused significant channel changes and instability in lower Pryor Creek and breached the Huntley canal where it crossed Pryor Creek. The Bureau of Reclamation and the Huntley Project Irrigation District repaired the severely damaged irrigation infrastructure by replacing the canal crossing with a siphon. This removed a major fish barrier at the confluence of Pryor Creek and the Yellowstone River. Pryor Creek has a fish barrier several miles upstream from the confluence with the Yellowstone River (Yellowstone Conservation District 2012).

2.2.3 Bird Resources

Bird resources potentially impacted by the oil spill included 53 species that were identified in The Wildlife Response Plan for Yellowstone River, Silvertip Pipeline Incident, Laurel, Montana, 2011 (Wildlife Branch, Silvertip Pipeline Incident). This list of species includes a variety of passerines, raptors, waterfowl, and shorebirds. Many species breed along the Yellowstone River and some rely on the Yellowstone River as a foraging area. For example, American white pelicans feed and rest extensively on the Yellowstone River, though they do not breed on the river. Two important nesting areas for the American white pelicans in Montana are the Medicine Lake National Wildlife Refuge and the Bowdoin National Wildlife Refuge, located in northeast Montana (USFWS 2016 a; 2016b). Radio-band studies of pelicans show that a portion of the birds breeding at Medicine Lake use the Yellowstone River for feeding (Restani and Madden, 2005). Restoration projects for pelican recovery are proposed to take place at Medicine Lake and Bowdoin National Wildlife Refuges. Additional restoration projects for other bird species injured can take place near the spill site along the Yellowstone River. Further discussion of bird resources, injuries from the oil spill, and restoration approach is included in Chapter 3.

2.3 Threatened and Endangered Species and Montana Species of Concern

There are no federally listed endangered or threatened species in the Yellowstone River and its immediate floodplain from Laurel to the mouth of the Bighorn River (restoration area), nor in the locations of possible fish passage projects on the Clarks Fork of the Yellowstone or in Pryor Creek. Both Medicine Lake and Bowdoin National Wildlife Refuges have the following federally listed species: piping plover, threatened, whooping crane, listed endangered, and red knot shorebird, listed threatened. A complete list of fish, birds, mammals, and Montana Species of Concern in the restoration area is included in Appendix B.

2.4 Historic and Cultural Resources

Human hunter gatherers have lived in the Yellowstone River valley for approximately the last 11,000 years. They hunted wild game, fished in the rivers and lakes, and gathered wild plant foods from the mountains, prairies and river bottoms of the drainage. Those early hunters have living ancestors in the region today; the Crow, Northern Cheyenne, Sioux, Gros Ventre, Assiniboine, Blackfeet, Salish, Kootenai, Pend d'Oreille, Nez Perce and Shoshone Peoples all count the Yellowstone drainage as part of their homeland. The Crow, Northern Cheyenne, and Wind River Shoshone (in Wyoming) have reservations in the Yellowstone drainage today. The archaeological evidence of these people takes the form of stone circle sites, bison kills, rock art sites, campsites and burials, all common along the Yellowstone and its tributaries (Lahren 2006, Aaberg et. al 2011, Rasmussen et al 2014).

The Yellowstone River and its floodplain have provided human use services to tribal communities for generations. The river is known to both the Crow and the Northern Cheyenne as the Elk River. The river is an important part of tribal histories. The tribes view the Yellowstone River and its tributaries as interrelated through its water with the plants, wildlife and human cultural practices.

The first Euroamericans to traverse the region were with William Clark in early July 1806. Clark floated down the Yellowstone on the expedition's return from the Pacific Ocean (Devoto 1953). Pompeys Pillar bears the signature of William Clark, signed on his journey home following the expedition (National Park Service 2014b). Thereafter, the river saw use by a succession of fur traders, trappers, miners, soldiers, railroad employees and homesteaders (Malone and Roeder 1984).

2.5 Human Use Services

The Yellowstone River provides a variety of human use services to people along the river. Along the stretch of river impacted by the oil spill, there are traditional agricultural uses such as ranching and farming, and irrigated lands. The stretch also includes the towns of Laurel, Huntley, and Custer and the major urban area of Billings, an important economic center with industrial, municipal, and other land uses. The river is used for municipal water supplies and industrial uses in these urban areas. The river and floodplain provide important recreational services year round. Public land along the stretch include seven fishing access sites: Duck Creek Bridge (river mile 375), South Hills (river mile 366), East Bridge (river mile 361), Gritty Stone (river mile 337), Voyager's Rest (river mile 335), Bundy Bridge (river mile 328), and Captain Clark (river mile 311), Laurel Riverside Park, Billings Riverfront Park, Billings Coulsen Park, Yellowstone County Halfmoon Park, BLM Sundance Lodge Recreation Area, other BLM properties such as Tower Island and Bundy Island, and BLM's Pompeys Pillar National Monument. The Montana DNRC also owns land along the Yellowstone River (Map 2-2). In

addition, the public may use Montana rivers and streams for recreational purposes up to the high water mark.

Water-based recreational activities include fishing, motor-boating, paddling, floating, swimming and boat-based hunting and trapping. Shoreline-based activities include general recreational activities at parks or other recreational areas along the shoreline such as walking, running, cycling, nature and wildlife observation, photography, horsebackriding, environmental education, hunting, picnicking, camping, and sightseeing. Recreational fishing in this stretch of the river is primarily for warmwater species including sauger, ling, channel catfish, smallmouth bass, goldeye, largemouth bass, as well as the occasional rainbow trout, brown trout and mountain whitefish.

Transportation and utility corridors are an existing land use in the restoration area. Major transportation features are Interstate 90 and the railroad. In 2012, the YRCDC mapped 17 pipeline crossings of the Yellowstone River in Yellowstone County (YRCDC 2012).

3.0 INJURY ASSESSMENT AND QUANTIFICATION

The Trustees initiated preassessment activities in July 2011. Preassessment activities focused primarily on collecting needed ephemeral data. Preassessment activities, as defined by OPA, focused on collecting ephemeral data essential to determine whether: (1) injuries had resulted, or were likely to result, from the discharges of oil; (2) response actions adequately addressed, or were expected to address, such injuries; and (3) feasible restoration actions exist to address the potential injuries. Trustees assessed injuries to natural resources resulting from the discharges of oil into the Yellowstone River and the adjoining floodplain.

At the end of the preassessment phase, the Trustees determined that there were natural resources and services that were, or were likely to be, injured as a result of the incident. The Trustees next determined what injuries resulted from the oil spill. The Trustees evaluated whether injured natural resources had been exposed to the discharged oil, and whether a pathway could be established from the discharge to the exposed natural resource, and whether an injury to a natural resource or impairment of a natural resource service occurred as a result of response activities.

For injuries resulting from a discharge of oil, the Trustees evaluated and established that natural resources were exposed, either directly or indirectly, to the discharged oil from the oil spill, and estimated the amount and spatial and temporal extent of the exposure, as well as a pathway linking the oil spill to the injuries. For injuries resulting from response activities, the Trustees determined whether an injury or an impairment of a natural resource service occurred as a result of the incident.

In addition to determining injuries that resulted from the oil spill, the Trustees also quantified the degree, and spatial and temporal extent of the injuries relative to baseline. The Trustees also estimated the time for natural recovery without restoration, including any response activities.

Trustees assessed injuries to natural resources resulting from the discharges of oil. Based on information collected, the Trustees determined that natural resources and services have been injured and that response activities were not expected to fully address the injuries. In addition to the Trustees' surveys and studies described below, throughout the injury assessment and restoration planning process, the Trustees used available information, expert scientific judgment, information generated through response activities, shoreline assessments, and literature on the fate and effects of oil spills and the effects of the response to arrive at the best estimate of the injuries caused by the oil spill.

The Trustees assessed two broad categories of injuries and losses: 1) ecological and 2) human use service losses. For both of these categories, the Trustees evaluated injuries and service losses caused by the oil spill, as well as injuries and losses as a result of response activities undertaken because of the oil spill. Ecological injuries and service losses reviewed include terrestrial/riparian habitat and biota, large woody debris piles, riverine aquatic habitat and biota, and injuries to birds. Human use loss assessment focused on recreational service losses including those as a result of closure of river access sites and parks to all public use due to response activities, as well as issuance of a fish consumption advisory. Also, angling opportunities were lost as a result of response activities, closure of fishing access sites, and issuance of the fish consumption advisory.

As discussed throughout this section, the Trustees believe that the magnitude of the injuries caused by the spill has been sufficiently delineated so as to be sufficient to identify appropriate

restoration. While there is some uncertainty inherent in the assessment of impacts from oil spills, and while collecting more information may increase the precision of the estimate of the impacts, the Trustees believe that the type and scale of potential restoration actions would not substantially change as a result of more research. The Trustees have sought to balance the desire for more information with the reality that further research would be costly and would delay the implementation of the restoration projects.

3.1 Impact Surveys and Studies

The Trustees conducted surveys and studies and also gathered information relevant to natural resource damage assessment beginning shortly after the spill to support preassessment activities and ultimately, damage assessment and restoration planning. The Trustees also gathered information that was relevant to the natural resource damage assessment process from the EPA, DEQ, FWP, ExxonMobil Pipeline Company and others.

The Trustees conducted three fish health studies: one in September 2011, followed by a second study in April 2012 and a final study in September 2012. In September 2011, approximately 90 days after the spill, the Trustees collected fish to investigate general fish health and exposure to oil contaminants. This study was conducted in segments delineated during response, Divisions A through C, and at an upriver reference area located approximately 6 miles upstream of the spill site (Map 1-2). In April 2012, the Trustees conducted a second fish health study near the spill site (approximately 5 river miles downriver from the spill site) prior to the annual high-water flow. In September 2012, the Trustees conducted a cooperative fish health study with ExxonMobil Pipeline Company in Divisions A through C (extending approximately 50 river miles downriver of the spill site), and two reference sites, located 6 and 30 miles upriver from the spill site (Map 1-2).

For injuries to large woody debris the Trustees examined SCAT data, conducted field surveys of large woody debris piles and conducted two aerial flights to obtain detailed photographic documentation of injury to large woody debris. The Trustees conducted two large woody debris surveys in the spring and fall 2012 to document examples of the types of response activities that were taken at large woody debris piles. The Trustees also conducted a review of aerial imagery to identify piles that were affected by oiling and subsequent response activities, based on pre- and post- spill imagery.

The Trustees conducted several sediment and soil sampling surveys to characterize remaining oil constituents, rate of weathering and locations. These surveys were conducted during October, November and December 2011 and April 2012. A cooperative Trustee and ExxonMobil Pipeline Company sampling event was conducted during September 2012. In addition, the Trustees deployed semi-permeable membrane devices during May and June 2012 in river locations downstream of oiled large woody debris to see if high water resulted in oil getting into the river again.

The Trustees surveyed local, state, and federal representatives, surveyed anglers, and local groups and talked to members of the public to assess the impact of the spill on recreational human use activities. The Trustees specifically surveyed the cities of Billings and Laurel and various local groups to assess the impact of the spill on activities at their respective city parks adjacent to the river.

State and federal agencies were surveyed to determine the extent of public human use service losses which occurred at federal recreation areas and state fishing access sites. In addition,

FWP conducted a phone survey of area anglers on behalf of the Trustees to determine the effect of the oil spill on their angling activities on the Yellowstone River in the vicinity of the oil spill during summer and fall 2011.

3.2 Injury Assessment Methods

The Trustees assessed injuries to habitat in the injured portion of the Yellowstone River floodplain using standard natural resource damage assessment analysis techniques described here, including habitat equivalency analysis (HEA), resource equivalency analysis (REA), Trustees' best professional judgment, and other methods. In the case of fish and other aquatic riverine resources, it was not possible to assess the extent and magnitude of a fish kill resulting from the spill due to the indeterminate nature of fish kills and the extended period of high water which made fish sampling extremely hazardous. Instead, the Trustees relied on their best professional judgment to determine the extent and duration of injury to fish and riverine resources based upon oil in the aquatic environment and fish health studies.

3.2.1 Habitat Equivalency Analysis

HEA is a technique used by natural resource trustees to quantify the amount of restoration needed to compensate for injuries to natural resources (Unsworth and Bishop 1994). The Trustees assess injuries to natural resources and identify appropriate restoration techniques to compensate for them, and a HEA can then be used to determine how much restoration is needed for compensation.

In this technique, Trustees identify restoration type(s) that can appropriately compensate, or offset, the injuries and losses that have occurred, and the HEA is used to balance the gains from the restoration with the injuries and losses (NOAA 2000). Specifically, a HEA quantifies habitat injury in terms of geographical area, timeframe, and the severity of the impact that has occurred, discounted over time. Similarly, a HEA quantifies the amount of restoration needed to offset (or balance) the injuries, taking into consideration the ecological benefits of the restoration, the geographical extent, and timeframe over which the benefits occur, discounted over time. A commonly used unit of measurement for HEAs is the discounted service-acre year. Similarly, a HEA computes the value of a habitat restoration project in terms of discounted service-acre years to represent the geographic scope and duration of the benefits it provides, modified by the time the project requires to reach full function, and discounted over time. The Trustees used a HEA to ensure restoration projects chosen adequately address and compensate for the injuries.

The approach is briefly described here but full reports are contained in Appendices C and D. The Trustees used this approach for terrestrial/riparian habitat and biota (Appendix C) and cavity nesting birds (Appendix D).

3.2.2 Resource Equivalency Analysis

REA is a restoration scaling technique based on the same conceptual framework as HEA. A REA may be used for specific resources that recover at a significantly different rate than their habitat, or that may have had injuries that are not well represented by the level of injury to habitat, or that require unique restoration. Natural resource trustees can use REAs to estimate the amount of restoration needed to compensate for injuries to a single natural resource, in this case large woody debris, rather than a habitat or ecosystem. REA inputs that may be used include:

- Resource type injured and being restored
- Number or amount (e.g., volume in the case of large woody debris) of injured resource and number or amount (volume) provided by the restoration action(s)
- Timeframe of the injury and the restoration benefits
- Amount of loss (injury) and gain (restoration)
- Discount rate.

The REA calculations quantified the amount of injury that occurred to large woody debris and determined the amount of restoration that was required to restore the resource to pre-spill conditions. The Trustees used this approach for large woody debris injuries. The approach is briefly described here but the full report is contained in Appendix C.

3.2.3 Trustees' Informed Judgment

To make all the determinations required to fulfill their trust responsibilities, the Trustees must exercise informed judgment in light of expert opinion to address remaining uncertainties and unresolvable data gaps. The result, reflected in this document, is a series of critical decisions based on a combination of the best available scientific information, agency expertise, and extensive experience gained from other cases. These uncertainties are best addressed by restoration approaches that are designed to address the injuries.

3.2.4 Benefits Transfer Approach

A benefit transfer analysis transfers value estimates from one context to estimate economic values in a different context. For the recreational use losses, the Trustees used a benefits transfer approach (see Appendix E). Significant impact to human uses occurred because of the presence of the spilled oil and because of the closure of facilities and river access due to response activities. The Trustees used information developed by surveys of the cities of Billings and Laurel, various recreational/user groups, state and federal agencies, the FWP biennial angler pressure survey, and a targeted local angler survey to determine the amount of the lost recreational use due to the Yellowstone River oil spill. The number of user days lost was compiled and a benefits transfer method was used to estimate the value of the lost recreational use. Economic values used in the benefits transfer analysis were derived from a study conducted for the U.S. Department of Agriculture (Rosenburger and Loomis, 2001). This study examined over 1,200 estimates of recreational values collected from studies conducted over a period of about 35 years. The values are included in Appendix E.

3.2.5 Other Quantification Methods

For American white pelican losses, the Trustees used direct observations of dead and oiled pelicans and assumed an 85% mortality rate for oiled birds. Multipliers were applied for searcher efficiency, carcass persistence and unsearched areas to calculate an estimated total number of dead American white pelicans. Tagging data from previous studies (Restani & Madden 2005) was used to determine the natal origin of the Yellowstone River pelicans.

3.3 Injury Assessment Results

3.3.1 Injuries to Terrestrial/Riparian Habitat and Biota and Quantification

The Trustees developed a HEA for the oil spill to address injuries to terrestrial/riparian habitat. Appendix C includes a summary of the HEA. For the purposes of the Yellowstone River HEA, the Trustees measured loss in terms of the "services" provided by the injured habitat areas over time, where services refer to a collected set of ecological functions provided by the affected habitats. The Trustees used their best professional judgment and information available from the literature in their assessment of service losses and injury timeframes.

Two broad types of injuries and ecological service losses were caused by the oil spill in the terrestrial/riparian habitat:

1. Injuries and losses from the adverse effects of oil, and
2. Injuries and losses from response activities.

Two primary terrestrial/riparian habitat types were injured by the oil spill and response activities:

1. Bottomland/riparian habitat, which includes cottonwood stands (sometimes referred to as "galleries"), and open sand/gravel bars that serve as cottonwood regeneration habitat.
2. Grassland/shrubland habitat, which includes sedge meadows, willow bottoms, and wet aspen, in addition to riparian grasslands and riparian shrublands.

In addition, the Trustees identified two distinct time periods of injury related to the spill. The first period was from the time of the discharge and lasted for approximately four months after the discharge while active response activities occurred. The second time period followed the period of active response activities, and covered the time required for the affected habitats to recover to baseline. The post response time period varies from three to twenty years, depending on the level of oiling, type of habitat, and type of response activities (Appendix C).

Oil Distribution: The distribution of oil in the floodplain was delineated by the response team using modified shoreline cleanup and assessment technique (SCAT) surveys (Figure 3-1 – oil in inundated floodplain). The Trustees used information from these surveys to estimate the amount and degree of oiling in the floodplain. The SCAT process consisted of a standard methodology for the identification, documentation, and description of oiled shorelines. The SCAT results were used as part of response to develop a tailored shoreline cleanup plan for affected segments. As a part of the SCAT surveys, the floodplain was divided into three "divisions" – Divisions A, B, and C (Map 1-2):

- Division A started at the point of the spill and extended 10 miles downstream;
- Division B extended from approximately 10 to 28 miles downstream from the spill site; and
- Division C extended from approximately 28 to 85 miles downstream from the spill site to the mouth of the Big Horn River.

Areas or "zones" with different degrees of visible oiling were delineated within the divisions during the surveys. In total, approximately 5,500 acres of oiled habitat were categorized by the degree of oiling, with categories ranging from "no oil observed" to "heavy oil" (Table 3-1).

Figure 3-1. Oil in Inundated Floodplain Areas. Note visible oil on water and vegetation along water's edge. Photo credit: Larry Mayer

Table 3-1. Floodplain Oiling as Characterized by SCAT

SCAT oiling category	Oiled acres
No oil observed	5,495
Very light oil	4,282
Light oil	939
Moderate oil	255
Heavy oil	11
Total area impacted by oil	~ 5,500
Total area surveyed	~ 11,000

Source: Exxon database received February 2012.

Response Activities: Response activities started shortly after the spill to remove the oil from the floodplain and are described in Section 1.3 and Appendix C. Response activities adversely affected floodplain habitats by trampling and crushing of vegetation by mechanized equipment, cutting and removing grasses and woody vegetation, as well as the physical disturbance caused by the presence of crews and machinery.

Compiled treatment recommendations consisted of implementing one or more of ten approved treatment methods established for the response by the unified command (ARCADIS 2011b). The approved treatment methods were tailored to remediate each segment or group of river segments based on the material affected and degree of impact as determined by SCAT

surveys. The approved treatment methods consisted of: (1) cutting of vegetated and shrub/shrub shorelines, floodplains, and riverbanks (non-high use public access areas); (2) dead (unattached) oiled vegetation and small oiled debris removal; (3) large woody debris/other hard surfaces; (4) soil/sediment removal; (5) sorbent use guidelines; (6) mechanized equipment oiled debris removal; (7) natural attenuation; (8) reference cleanup recommendations or decision to Technical Advisory Group; (9) treatment with dust fixative; and (10) light mechanical equipment use in the riparian zone (Arcadis 2011).

Based on the Trustees' assessment, injury to natural resources occurred downstream of the spill site where oil and response activities affected terrestrial/riparian floodplain habitat. The injury occurred in all of Divisions A and B (2,884 acres). The injury also included the part of Division C where response activities occurred (approximately 6,112 acres, or roughly 75% of Division C; Table 3-2). The Trustees selected habitat types for restoration that were similar to these injured habitats. Additional information is provided in Appendix C.

Table 3-2. Terrestrial HEA Spatial Extent: Geographical areas that were injured as a result of oiling and response activities

Geographic area	Acres	Corresponding SCAT oiling categories
Oiled areas where response activities occurred, including vegetation removal and heavy foot and vehicular traffic	267	Heavy oil Moderate oil
Oiled areas where response activities occurred, including vegetation removal and moderate foot and vehicular traffic	4,984	Light oil Very light oil
Areas with no oil that were disturbed by lighter foot and vehicle traffic during response activities	3,745	No oil observed

The amount of restoration in terrestrial/riparian habitat required to offset injuries is summarized in Table 3-3.

Table 3-3. Amount of Restoration Required to Offset Injuries

Restoration concept	Acres of restoration required to offset injuries
Bottomland/riparian restoration	299
Grassland/shrubland restoration	42
Mature bottomland preservation	142
Total	**483**

Note: mature bottomland preservation also provides benefits for cavity-nesting birds.

3.3.2 Injuries to Large Woody Debris Piles

The oil spill occurred during a 35-year flood event (USGS 2011). As the longest undammed river in the continental U.S. (COE and YRCDC), the Yellowstone River is a natural river system that has retained much of the historical habitat characteristics and flows (National Research Council 2002). In an undammed river, such as the Yellowstone River, large woody debris is mobilized and distributed during flood events. The dynamic nature of large woody debris distribution is important to ecological, geomorphological, and fluvial dynamics of the river (see Section 2; Abbe and Montgomery 1996, and Appendix C).

Large woody debris piles are distributed throughout the reach of the Yellowstone River downstream of the spill site (Figure 3-2), and these piles play an integral role in geomorphic fluvial and ecological processes in large, free-flowing, braided river systems such as the Yellowstone River. The fluvial-geomorphic importance of large woody debris piles includes that they support island formation and help to reduce erosion on islands and along the riverbanks (Abbe and Montgomery 1996). Large woody debris piles are also an important and unique source of shelter and food for fish, invertebrates, small mammals (e.g., mink), birds, reptiles, and amphibians; and provide surface area for the growth of aquatic invertebrates, which are an important food source for fish (Culp et al. 1996; Jacobson et al. 1999). Large woody debris piles are also a source of organic material and nutrients in both aquatic and terrestrial settings, which are released as the debris breaks down and decomposes (Table 3-4; Bilby and Likens 1980; Hilderbrand et al. 1996). Finally, large woody debris piles provide depositional habitat exposed to sunlight that supports cottonwood regeneration and protection from ice-scouring in winter. All of these are important ecological functions on the Yellowstone River (Lytle and Merritt 2004; Mitchell et al. 2008).

Injuries due to Oiling and Response Activities

The presence of oil on large woody debris piles adversely affected the ecological functions they provide and directly harmed biota that used or came into contact with oiled large woody debris (Figure 3-3). Many of the biological receptors that rely upon these piles, including birds, reptiles/amphibians, and invertebrates, were exposed to oil from the spill. For example, most of the oiled toads that were collected during wildlife recovery were found at large woody debris piles.

A large number of large woody debris piles were oiled as a result of the spill, and these piles were subsequently targeted for removal and other cleanup activities during the response activities. Accordingly, the Trustees evaluated injuries to the large woody debris piles, focusing mainly on the impacts of response activities, because removal of debris and other cleanup activities likely had the most severe and long-lasting impact on the piles. The Trustees conducted two large woody debris surveys in the spring and fall 2012 to document examples of the types of response activities that were taken at large woody debris piles. The Trustees also conducted a review of aerial imagery to identify piles that were affected by oiling and subsequent response activities, based on pre- and post- spill imagery. Based on observations made by the Trustees during the surveys and from the aerial imagery, at least 28 piles between the spill point and the City of Billings (a distance of approximately 15 miles) were oiled and targeted during response activities.

Response disturbance ranged from cutting and hauling away oiled debris, to disassembling piles. Branches and debris were removed, and large logs were cut into smaller pieces, resulting in permanent damage (Figure 3-4). Debris was removed using helicopters, dump trucks, boats, UTVs and other equipment. Removing large woody debris material reduced the size and value of habitat provided by the remaining large woody debris. Dismantled and scattered piles provide less cover, and thus, lower quality habitat than intact piles; biota inhabiting these piles are more vulnerable to predation and other environmental stressors. Further, disassembling a pile changes its physical structure (e.g., anchoring, complexity, ability to trap/recruit new material, ability to remain anchored in place in subsequent events) and thus its geomorphological functions, such as ability to retain sediment and prevent erosion, and the creation of pools and velocity refugia.

Figure 3-2. Two Examples of Undisturbed Large Woody Debris Piles in the Area Affected by the Spill. Panel A shows a close-up of an undisturbed large woody debris pile, and Panel B shows an aerial view of an undisturbed large woody debris complex in the Yellowstone River.
Photo credit: Panel (A) USFWS, Panel (B) Response

(A)

(B)

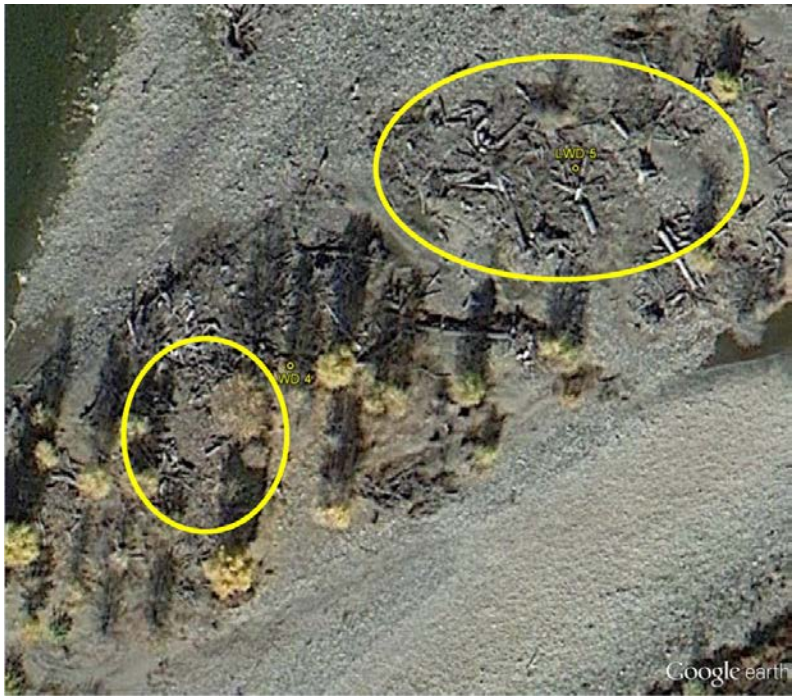
Table 3-4. Important Ecological Functions Provided by Large Woody Debris

Type of service	Services provided
Terrestrial ecological services	Shelter
	Food
	Organic material
	Habitat (small invertebrates and small mammals)
Aquatic ecological services	Fish-rearing habitat
	Surface area for aquatic invertebrates
	Organic material
	Flow refugia
	Shade/shelter
Geomorphological services	Water pools
	Island formation
	Cottonwood regeneration
	Erosion reduction
	Channel morphology alteration

Figure 3-3. Heavily Oiled Debris Pile Near the Spill Site. This very large pile on an island just downstream of the pipeline break was cut and disassembled using mechanized equipment to remove pooled oil and oiled debris. Photo credit: Montana DEQ

Figure 3-4. Pre-response (Panel A, photograph from 2011 before the spill) and Post-response (Panel B, photograph from 2013) Aerial Photographs of the Same Large Woody Debris Piles. In the post-response image, materials from both piles in the yellow circles had been cut, scattered, or removed. Photo credit: Google Earth USDA Farm Services Agency, modified by Beau Downing, NRDP.

(A)



(B)

Finally, removing material and disassembling piles likely had a negative effect on cottonwood regeneration in 2011. The summer 2011 flood was a significant event for cottonwood regeneration, and while this injury was not formally quantified by the Trustees, the loss of large woody debris may have reduced the amount of suitable cottonwood regeneration habitat in the affected geographic area. A complete discussion of the large woody debris REA process and calculations can be found in Appendix C.

3.3.3 Injuries to Riverine Aquatic Habitat

The riverine aquatic habitat and supported biota were adversely affected as a result of the spill. Sediment and surface water sampling conducted by the Trustees and ExxonMobil Pipeline Company confirmed the presence of polycyclic aromatic hydrocarbons (PAH) and other oil constituents in the river system downstream of the spill site. Oil constituents such as PAHs can be toxic to fish. The Trustees used a different sample analysis method than the one used by the response crews to analyze the samples for PAHs. The Trustees' samples were analyzed using EPA Method 8270, with extended alkylated PAHs by selective ion monitoring (SIM), a method that provides high resolution measurements of 50 individual PAHs. Response samples were analyzed using methods that sample a much smaller number of PAHs and therefore concentrations measured in the samples collected by the response crews likely under-represented the total PAH exposure to affected natural resources.

Based on wildlife recovery data collected during response activities, 83 fish, 121 amphibians, 13 snakes, and 2 turtles were oiled or dead subsequent to the spill (DEQ 2012). Observations of external lesions on fish collected by state agency personnel after the spill prompted the Trustees to conduct fish health studies. Agency personnel and Montana State University researchers who have surveyed the river for multiple years had not previously made observations of such lesions when sampling fish in this stretch of the Yellowstone River. Three fish health studies were conducted: fall 2011, spring 2012, and fall 2012. For damage assessment purposes, the Trustees selected fish as a representative species for instream injuries. Fish were chosen because the Trustees have the most robust dataset for fish compared to other species. Based on a review of the literature, many of the adverse effects observed in collected fish are consistent with exposure to oil and oil constituents, such as PAHs. PAHs have also been associated with many other adverse effects, in addition to those that were observed in the field fish health studies. For example, toxicity studies have shown that exposure to PAHs decreases survival, increases mortality, deforms embryos, reduces swim performance, reduces fecundity, and causes other adverse effects contributing to increased mortality in fish (Deepwater Horizon Natural Resource Damage Trustees 2016; Brannon et al. 2006; Carls et al 2008; Carls et al. 2005; Carls et al., 1999; Mager et al 2014; Wu et al.2012; Marty et al. 1997; Heintz et al. 2000; Hoffmann and Oris 2006). Fish are a key component of the ecosystem, and fish are excellent indicators of instream ecosystem health.

Acute Event. The Trustees believe there was a significant fish kill as a result of the spill that could have easily gone undetected. Based on wildlife recovery data, 83 dead fish were recovered subsequent to the spill (DEQ 2012). The Trustees believe this represents only a small fraction of the total fish killed. Due to high flows, crews searching for fish and wildlife were not able to gain access to the river and begin searching for fish and other wildlife until two weeks after the spill. Flows in the Yellowstone River at the time of the spill were 70,000 cfs and high flows lasted for an extended period of time. Further, no formal fish kill survey was performed at the site. Even if a fish kill survey had been performed in the hours after the spill, only a fraction of the fish that were killed would likely have been found. According to Southwick and Loftus (2003, p. 18), "Estimates of losses based on countable dead fish will be

conservative. Very seldom will the counts represent more than a modest fraction of the fish killed." For example, in simulated fish kill tests conducted in the East Fork Poplar Creek, Oakridge, Tennessee, only to 5 to 30% of the fish were recovered after 24 hours, depending upon flow conditions, where the flow ranged from 3.5 to 28 cfs (Ryon et al., 2000). At the Beaver Butte Creek, Warm Springs, Oregon gasoline spill site, where 404 Chinook yearlings were recovered, the trustees for the site ultimately estimated that a total of 44,741 yearlings died as a result of the spill (NOAA 2004). At the Cantara spill near Dunsmuir, California, where 586 fish were found dead in fish kill surveys conducted starting four days after the spill, the total estimated number of killed fish was 312,508 (Hankin and McCanne 2000) (see Appendix C).

Hence, given the very high flows and long interval between the spill and the time fish recovery would have begun, and the fact that only a small fraction of fish are typically ever recovered at fish kills, the 83 recovered fish likely represents only a small fraction of the total fish that died. The total number of dead fish could very reasonably have been several orders of magnitude higher.

Long-term injury to fish. The results of the three fish health studies conducted by the Trustees in fall 2011, spring 2012, and fall 2012 confirmed that the spill resulted in adverse effects to fish in the year after the spill. The Trustees also conducted a literature review on the histology factors. The literature review confirmed that the gross external abnormalities and pathology changes observed in fish collected after the oil spill are consistent with exposure to PAHs in laboratory and field exposure studies. In particular, abnormalities were observed in skin (e.g., external lesions), gill, kidney, liver, and blood samples (see Appendix C).

Significant findings from histopathological assessments include:

- *External lesions and scars*: In fall 2011, lesions were observed at greater frequency at downriver sites than upriver sites (see Figure 3-5). Other fish sampling conducted by FWP in September 2011 observed that approximately 20% of all fish captured contained lesions (Peterman 2013). Lesion formation is associated with fish exposed to oil (Sved et al., 1997; Steyermark et al., 1999; Hargis, 2000; Aas et al., 2001; Khan, 2003, 2013). The lesions were deep with underlying skin inflammation, and were not associated with bacteria, viruses, or fungi. By fall 2012, lesions were rare and mostly small. Scars (i.e., dark to light grey blotches or areas of abnormal, regenerating scales on the bodies of collected fish) were observed on fish in the spring and fall 2012 studies, suggesting that these fish may have been exposed to oil and were recovering.

- *Kidneys*: There was widespread destruction of red blood cells and cellular debris within kidney tissues in downstream samples in fall 2011. Degeneration of kidney tubules and other tissues was also observed and more prevalent in downstream samples than upstream samples. These tubule changes have been associated with slight increases in mortality and significant decrease in growth and condition factors after exposure to polycyclic aromatic hydrocarbons (PAH) (Vethaak et al., 1994; Kakkar et al., 2011) or other toxicants (Tashjian et al., 2006). By fall 2012, red blood cell destruction and degenerative kidney changes were not observed.

- Liver: Necrosis (tissue death) of liver bile ducts was observed in fish collected in the fall of 2011. The liver is the primary organ for metabolism and excretion of toxic components of oil; PAHs (Tuvikene 1995). Other cellular changes were also observed that previous studies have associated with oil exposure in fish livers

(Agamy 2012; Biuke et al. 2013). In fall 2012, bile duct necrosis was no longer observed in the collected fish samples.

- Blood: In spring 2012 (blood samples were not collected in fall 2011), hemocytoblasts and high numbers of immature red blood cells were observed. Hemocytoblasts are not observed in healthy fish (Clauss et al., 2008) and were not observed in any upriver fish. There were significantly fewer immature red blood cells and no hemocytoblasts observed in fall 2012.

- Gills: Observations of fused gill filament tips were documented in fish at downriver sites in the fall of 2011. Fusion of the gill filaments in fish is a known response to exposure to toxicants such as oil (Pacheco and Santos 2002; Nero et al. 2006; Camargo and Martinez 2007; Santos et al. 2011; Khan 2013). In fish, gill filaments are the primary surface where respiration (intake of oxygen) occurs. Fish with fused filament tips have a compromised respiratory system, which may result in reduced growth and reproduction (Khan 2013).

These results are consistent with a response in fish health to the spill event. During the summer and fall 2011 the presence of lesions and the results of the fish health survey indicated fish injury. During the fall 2012 fish health survey, there was evidence of fish recovery and far fewer lesions observed. See Appendix C for additional details on fish sampling and results. Additionally, as discussed previously, many of these factors have also been associated with adverse effects such as reduced survival, growth, and reproduction in peer-reviewed toxicology literature (Deepwater Horizon Natural Resource Damage Trustees 2016; Brannon et al. 2006; Carls et al 2008; Carls et al. 2005; Carls et al., 1999; Mager et al 2014; Wu et al.2012; Marty et al. 1997; Heintz et al. 2000; Hoffmann and Oris 2006).

Figure 3-5. Photograph of External Lesion on Redhorse Sucker - collected in fall 2011 downriver from the spill site. Photo credit: Montana FWP

3.3.4 Injuries to Birds (includes cavity nesting birds and American white pelican)

During response, a total of 28 birds were found dead (Table 3-5), 51 were observed oiled (Table 3-6), and four oiled birds were captured, cleaned and released. Some of the birds that died or observed oiled included waterfowl and other aquatic-dependent species. These species were likely oiled as they fed and rested on the spill-impacted section of the Yellowstone River. Other species of birds, such as passerines and raptors, were also oiled and were likely exposed to oil in the aquatic or terrestrial environment, or both. Since much of the floodplain was inundated with water during the spill, large areas of Yellowstone River riparian corridor were oiled; this included inundated vegetation, large woody debris piles and numerous backwater channels. As the river receded after high flows, a line of oil vegetation was evident in many areas. Birds such as black-capped chickadees, downy woodpeckers, and white-breasted nuthatches that utilize the riparian area of the Yellowstone River were likely oiled as they foraged, collected nest materials, and rested among oil covered vegetation. Similarly, raptor species were exposed to oil as they foraged throughout oiled vegetation, and in the case of bald eagles, they could have also been exposed in the aquatic environment as they fished in oil-impacted sections of the river. Exposure to oil can cause a number of adverse effects in birds that may include, but are not limited to, hypothermia due to impaired thermoregulation,

inflammation of the gastrointestinal lining, liver and kidney disorders, and impaired reproduction (Friend and Frason 2001).

Table 3-5. Dead birds collected during the ExxonMobil Silvertip Pipeline Break

SPECIES	SEGMENT A	SEGMENT B	TOTAL
American robin		1	1
American white pelican	1		1
Bald eagle		2	2
Canada goose	1	1	2
Cedar waxwing	1		1
Coopers hawk		2	2
European starling*	1		1
Great blue heron	2		2
Great horned owl	2		2
Catbird	2		2
Lazuli bunting	1		1
Mallard	1		1
Mourning dove		1	1
Ring-billed gull		1	1
Red-tailed hawk		1	1
Bird (unidentified)	1		1
Duck (unidentified)	1		1
wild turkey	3	1	4
Wood duck		1	1
TOTAL	**17**	**11**	**28**

Notes:
* Introduced species, but included in estimates as a small bird.
Source: IEc analysis of database of wildlife field observations from the ExxonMobil Silvertip pipeline break, collected July 4 to September 22, 2011; provided to IEc by the USFWS.

Table 3-6 Oiled Birds, by Species and River Division Where Observed

Species	Division A	Division B	Division C	Unknown	Total
American robin		1		1	2
American white pelican	1		4		5
Bald eagle	3				3
Black-capped chickadee	2				2
Canada goose	6	6			12
Downy woodpecker	1				1
Duck (unidentified)	1	3			4
Great blue heron		1			1
Mallard	1	2			3
Pheasant		2			2
Red-tailed hawk	1				1
Shoveler	1				1
Song sparrow	1				1
Spotted sandpiper	3				3
White-breasted nuthatch		1			1
Wood duck	3				3
Yellow warbler	2				2
Common merganser		4			4
TOTAL	**26**	**20**	**4**	**1**	**51**

Source: IEc analysis of database of wildlife field observations from the ExxonMobil Silvertip pipeline break, collected July 4 to September 22, 2011; provided to IEc by the Service.

The numbers of observed birds affected by the spill are an underestimation of the birds actually injured as a result of the spill. Aerial wildlife search operations did not begin until seven days after the spill and due to unsafe river conditions, limited boat operations did not begin until eight days after the spill. A dedicated Wildlife Operations boat was not provided until 14 days after the spill. Moreover, it is generally recognized that the actual number of birds injured exceeds the number of bird carcasses collected for several reasons including, but not limited to: movement by oiled birds away from the area; transport of dead birds by winds and current; sinking of dead birds; frequency of searches; searchers' ability to locate birds (searcher efficiency); and the length of time a bird carcass is available to be observed by searchers (carcass persistence). For example, bird carcasses can disappear due to scavenging, either in the water body where the spill occurs or wherever the carcass subsequently becomes stranded along the shore. The Trustees also assumed that 85% of the oiled birds died as a result of coming into contact with oil. Because of these reasons, a multiplier was developed and applied to the number of birds collected or observed oiled to estimate the total number of birds injured as a result of the spill. The formula for calculating the actual number of birds that died as a result of the spill is provided below.

Where *SE* is searcher efficiency rate, *CP* is carcass persistence rate, (*SE* x *CP*) is the probability a carcass will be found, or *SE-CP Factor*, and *SF* is the frequency of searches,

Total Dead Birds = (Observed Dead Birds ÷ SE-CP Factor x SF Multiplier) + (Observed Oiled Birds x % Oiled Birds Estimated Dead x SF Multiplier)

The Trustees developed projects for injuries to birds focusing on projects that would benefit breeding habitat. For those species that breed along the Yellowstone River, several require tree cavities for nesting and roosting. The death of cavity-nesting birds has created a natural resource debit that that Trustees choose to express in terms of lost natural resource services: bird production in cottonwood bottomland habitat. The Trustees have calculated that the preservation of similar habitat with its associated services would offset the natural resource debit caused by the oil spill. This type of habitat is at risk of development (Thatcher, T., B. Swindell and K. Boyd 2008). The cavity-nesting habitat targeted for this restoration, mature cottonwood bottomland, will also benefit most of the remaining bird species not addressed by the American white pelican projects (described below).

The only species of bird injured as a result of the spill that does not breed within the Yellowstone River basin is the American white pelican. The Trustees proposed a separate project to benefit pelicans on their nearest known nesting areas in northeast Montana (Medicine Lake National Wildlife Refuge and Bowdoin National Wildlife Refuge). These projects will benefit American white pelicans through predator reduction using fencing on a peninsula at Medicine Lake NWR and water purchases to add water to Bowdoin Lake to minimize land bridges to nesting areas that would otherwise form in dry years. In addition to replacing the lost American white pelicans, these projects will also benefit injured species that share similar habitat requirements like great blue herons, Canada geese, mallards, northern shovelers, and ring-billed gulls. A more detailed discussion of injury quantification and restoration scaling for both of these bird projects can be found in Appendix D.

3.3.5 Injuries to Human Use/Recreational Use

The Trustees identified several categories of injury and human and ecological service losses that occurred as a result of the spill and response activities. Major impacts to human uses occurred for several months because of the presence of the spilled oil and because of the closure of facilities and river access due to response activities. Recreational activities considered in the analysis included recreational fishing, city parks use, and other recreational activities conducted along the river, such as boating and camping. Map 2-2 shows public lands along the Yellowstone River in the spill affected area.

Fishing: The Yellowstone River downstream from the spill site near Laurel begins a transition zone from a cold water fishery to a warm water fishery and provides a variety of fishing opportunities. Every two years the State of Montana conducts a statewide fishing effort survey and produces estimates of fishing pressure by water body and month. Of particular interest is the reach of the Yellowstone River beginning at the mouth of the Stillwater River, approximately 25 miles above the spill site, and extending to the mouth of the Bighorn River, approximately 70 miles below the spill site. Within this reach are three sections. The first section extends from the mouth of the Stillwater River and extends downstream to the mouth of the Clarks Fork River. The second section extends from the mouth of the Clarks Fork River and downstream to the Huntley Diversion. The third sections extends from the Huntley Diversion to the mouth of the Bighorn River.

The total fishing pressure for the months of July, August, and September 2007, 2009, and 2011 for these three river reaches was estimated by the State of Montana at 17,399, 27,839, and 14,547 angler days, respectively. While the high flows during the spill event may have discouraged fishing for a short period, the presence of response activities and the closure of fishing access sites even after the river returned to lower flows is likely to have reduced fishing pressure.

Fishing efforts on the Yellowstone River between the mouth of the Stillwater River and the mouth of the Bighorn River dropped by 13,292 angler days between 2009 and 2011. However, if we assume that the high flows in July 2011 precluded fishing for a period, lost fishing trips could be confined to the months of August and September. The fishing pressure estimates for these months only indicate that fishing pressure dropped by 7,409 angler days between 2009 and 2011.

Billings' parks: The City of Billings has several parks located along the Yellowstone River downstream from the spill site. Several of these parks were closed either because of the spill or response activities. Managers for these parks estimated that closures of various lengths at Coulsen Park, Riverside Park, and Norm's Island resulted in the loss of 7,320 visits. These parks are used for a variety of recreational activities, including hiking, biking, picnicking and dog walking.

Bundy Bridge River access: The Bundy Bridge River access was closed to the public for 20 days. This site provides public access to the Yellowstone River and a ramp for launching boats. Car count data collected by the State of Montana indicate that this site averages 40.4 visitors per day during the months of July–September. A closure of 20 days is estimated to result in a loss of 808 visitor days.

East Bridge River access: The East Bridge River access was closed to the public for a period of 20 days. This site provides a concrete ramp for boat launching. Car count data collected by the State of Montana indicate that this site is estimated to average 55.5 visitors per day during the months of July–September. A closure of 20 days is estimated to result in a loss of 1,111 visitor days.

Duck Creek River access: The Duck Creek River access was closed to the public from the beginning of the spill through the end of September 2011. This site also provides a ramp for boat launching. Based on car count data, it is estimated that this site would normally provide 4,403 visitor days during the months of July-September 2011. The closure of this site during those three months is therefore estimated to have resulted in a loss of 4,403 visitor days.

Sundance Lodge Recreation Area: This area is operated by the Bureau of Land Management (BLM) and is located about 2 miles downstream of the spill site. BLM staff reported that public access to this site was not available for about 30 days because of the oil spill. BLM staff also report that about 25 visitors normally use the area each day. The 30 days of closure are estimated to have resulted in about 750 lost visitor days.

Riverside Park in Laurel: The historic Riverside Park is located on the northwest bank of the Yellowstone River immediately adjacent to and downstream from the spill site. The park was closed from July 1, 2011 through January 15, 2012 because it was used as a staging area for response activities and was used to remove the old pipeline and for boring, and connecting the new pipeline. The Yellowstone River flows on the north side of the park and offers fishing opportunities. The park is shaded with large cottonwood trees. Over time, the park has offered

RV camping, tent camping, fishing, horseshoes, picnicking and a playground. The buildings have been used for civic events, 4H activities and private functions. Because of its location, this park typically receives substantial use by people passing through the area. City personnel familiar with usage patterns estimated that general recreation users would have made 17,033 visits to the park. Also, the park would have likely hosted approximately 784 campers in the absence of the spill. The park is used for activities by several specific local user groups. The closure of the park was estimated to have resulted in the loss of 1,000 days of youth 4-H activities, 879 user days at a trap shooting range, 144 days of hunter education activities, and 198 days of recreation by participants in an annual horseshoe tournament. Combined, the closure of Riverside Park in Laurel resulted in the loss of 20,038 days of various types of recreational activities. See Appendix E for further discussion.

Table 3-7 summarizes recreational use losses.

Table 3-7 Summary of Recreational Use Losses

Activity	Lost user days
Fishing	7,409
Parks General Recreation	26,882
Parks Camping	784
State River Access Sites General Recreation	1,821
State River Access Sites Floating/Canoeing/Kayaking	1,541
State River Access Sites Power Boating	389
BLM General Recreation	750
Total	**39,576**

4.0 RESTORATION OF NATURAL RESOURCES: ALTERNATIVES

This chapter describes the restoration alternatives the Trustees analyzed for restoring, replacing, and acquiring the equivalent natural resources injured by the oil spill to their baseline condition and to compensate the public for the interim losses. As discussed in Chapter 3, the five natural resources most impacted by the oil spill were: terrestrial/riparian habitat (including habitat for cavity nesting birds), large woody debris piles, riverine aquatic habitat, American white pelican, and recreational resources. This chapter includes a brief outline of the OPA requirements and restoration project selection criteria (discussed in detail in Chapter 5). NEPA and MEPA also apply to restoration actions taken or directed by the federal and state Trustees, respectively. To reduce transaction costs and avoid delays in restoration the OPA regulations encourage the Trustees to conduct the NEPA process concurrently with the development of the draft restoration plan. A brief introduction to the purpose and need for analysis under NEPA and MEPA is presented here and discussed in detail in Chapter 6. Chapter 7 describes the Trustees' proposed project implementation plan.

4.1 Restoration Strategy for Primary and Compensatory Restoration

The goal of restoration under OPA is to compensate the public for injuries to natural resources and their associated services from an oil spill. OPA requires that this goal be achieved by returning injured resources to their baseline condition and compensating for any interim losses of natural resources and services during the period of recovery to baseline.

To develop restoration alternatives, the Trustees must consider both primary and compensatory restoration options (15 CFR 990.53). Active primary restoration actions work to directly restore injured natural resources and services to baseline on an accelerated time frame (15 CFR 990.53). Compensatory restoration actions are intended to compensate the public for the loss of natural resources and services during the "interim" time period between the start of injury and the eventual recovery of the resource or service (15 CFR 990.53).

Several of the restoration alternatives included in this section are based on designs that may require additional detailed engineering design work or operational plans. Therefore, details of specific projects may require additional refinements or adjustments to reflect site conditions or other factors. Restoration project designs also may change to reflect public comments and further Trustee analysis. If a proposed project becomes infeasible for some reason, the Trustees will consider substituting a similar project and evaluate whether this decision requires additional public review under OPA, NEPA or MEPA.

4.2 OPA Requirements and Restoration Project Selection Criteria

NRDA regulations under OPA require consideration of six criteria when evaluating restoration options (15 CFR 990.54(a) and (b)).

1) **Project cost and cost effectiveness**
   The cost of a project, both implementation cost, long term maintenance, and monitoring will be considered against the relative benefits of a project to the injured natural resources and service losses. Projects that return the greatest and longest lasting benefits for the cost will be preferred. The Trustees will also consider the time necessary before the project benefits are achieved, and the sustainability of those benefits. Projects will be reviewed for their public acceptance and support, and additional consideration given to projects that leverage the financial resources of partner organizations.

2) **Project goals and objectives**
This criterion considers the extent to which each restoration project helps to return injured natural resources and services to at least baseline conditions that were present prior to the oil spill or compensate for interim service loss. Projects should demonstrate a clear relationship to the resources and services injured. Projects located within the area affected by the spill are preferred, but projects located within the Yellowstone River watershed that provide benefit to the resources injured in the affected area will also be considered. With regard to the American white pelican, projects located outside of the Yellowstone River watershed will be considered if they provide benefits to the American white pelicans that use the affected area of the Yellowstone River.

3) **Likelihood of project success**
The Trustees will consider the technical feasibility of each project in achieving the restoration project goals and the risk of failure or uncertainty that the goals can be met and sustained. The Trustees will generally not support projects or techniques that are unproven or projects that are designed primarily to test or demonstrate unproven technology.

4) **Avoidance of Adverse Impact**
Projects will be evaluated for the extent to which they prevent future injury as a result of the oil spill and avoid collateral injury as a result of implementing the alternative. All projects shall be lawful and likely to receive any necessary permits or other approvals prior to implementation.

5) **Multiple Resource and Service Benefits**
Projects that provide benefits that address multiple resource injuries or service losses, or that provide ancillary benefits to other resources or resource uses are preferred.

6) **Public Health and Safety**
This criterion is used to ensure that the projects will not pose unacceptable risks to public health and safety.

Information supporting the Trustees' selections of restoration alternatives is provided throughout the remainder of this chapter.

4.3 NEPA/MEPA Statement of Purpose and Need

The purpose of the restoration is to make the public whole for injuries to natural resources and natural resource services resulting from the oil spill. To meet the purpose of restoring extensive and complex injuries to natural resources and services resulting from this spill, the Trustees identified the need for a comprehensive restoration plan consistent with OPA to restore these injured natural resources and services (see 15 CFR 990.10). The purpose and need for this document is outlined in more detail in Section 1.1.

4.4 Approach to Developing and Evaluating Alternatives under OPA and NEPA/MEPA

The Trustees started meeting with members of the public, local governments, State agencies, and federal agencies affected by the spill immediately after it occurred. Public involvement is

described in detail in Section 1.4.4. The Trustees considered comments and input from these entities, together with OPA and NEPA and MEPA considerations outlined above, to develop goals for the restoration of each of the Yellowstone River resources that was injured by the oil spill. These goals will guide the future restoration actions and selection of the alternatives like those outlined below.

Certain projects within project types have been identified as priority projects by local resource managers. If these projects cannot move forward at this time, the Trustees, in consultation with local resource managers, may select other projects that achieve the same goals.

4.5 Restoration Alternative 1 Description: No-Action/Natural Recovery

MEPA and NEPA require the Trustees to evaluate an alternative in which no actions are taken by a State or Federal agency to restore the Yellowstone River affected by the oil spill. Under the no-action alternative, the Trustees would not prepare a restoration plan nor implement restoration projects under NRDA. The Trustees would allow natural recovery processes to occur, which could result in one of four outcomes for injured resources: 1) gradual recovery, 2) partial recovery, 3) no recovery, or 4) further deterioration. Although injured resources could presumably recover to at or near baseline conditions, recovery would take much longer compared to a scenario in which restoration actions were undertaken. Additionally, the interim losses of natural resources would not be compensated under a no-action alternative. If Trustees selected this alternative, the public would not be compensated for the substantial losses in natural resources and services caused by the oil spill. OPA establishes Trustee authority to seek compensation for such interim losses, which would continue during the extended recovery periods associated with this alternative. Given that technically feasible restoration approaches are available to compensate for interim natural resource and service losses, the Trustees would reject the no-action alternative.

4.6 Restoration Alternative 2 Description: Projects Addressing All Injury Categories

4.6.1 Terrestrial/Riparian Injuries (includes cavity-nesting bird habitat) Project Types

Three possible primary and compensatory restoration types were identified for terrestrial/ riparian resource losses including: 1) acquiring and preserving mature bottomland forest habitat, which will address terrestrial habitat injury and provide benefits to cavity-nesting birds, 2) acquiring and restoring cottonwood regeneration habitat in the bottomland/riparian areas, and 3) acquiring and restoring degraded grasslands/shrublands.

GOAL: Conserve and restore terrestrial/riparian habitat (includes habitat for cavity-nesting birds)

OBJECTIVES:

- Obtain conservation easements and/or fee title land acquisitions on mature cottonwood bottomland to compensate for the bottomland habitat and cavity nesting birds injured by oil and response activities
- Restore injured terrestrial/riparian and grassland/shrubland to compensate for bottomland impacted by oil and response activities
- Remove invasive woody plants to restore bottomland to a more native suite of plants for improved habitat

4.6.1.1 Terrestrial/Riparian Habitat Conservation Easements and Fee Title Land Acquisitions

Mature cottonwood bottomland with intact complex understory would be protected through one or more conservation easements and fee title land acquisitions in the Yellowstone River valley in and near the injured area. The preservation of these habitats will provide benefits for the terrestrial habitat and cavity nesting birds that were injured both as a result of the spill and as a result of response activities. The properties would be selected in mature cottonwood bottomland habitat that meet the habitat requirements of primary excavators, those birds that create cavities in trees. About 142 acres of cottonwood bottomland habitat would be sought for these primary excavator birds. These acquisitions would be spatially distributed along the Yellowstone River to protect multiple bird territories. Required acreage was based on known rates of habitat loss due to development along the Yellowstone River (COE & YRCDC 2016). Acreage required was calculated based on the habitat requirements for primary excavator birds and the number of impacted cavity dependent species discussed in Chapter 3.

The projects may include conservation easement or fee title land acquisition. The title would likely be held by one of the Trustees or a third party. Conservation easements or fee title land acquisitions are an accepted method used to conserve important habitat areas and protect them from development or overgrazing. A monitoring plan will be developed with the implementation of each project. Monitoring will be used to ensure that the restoration project performance criteria will be met. The party that holds the land title or easement would likely be responsible for monitoring, reporting, and enforcement of habitat preservation, although those responsibilities may be shared among the partners. The duration and frequency of monitoring will be detailed at the time of acquisition. Most likely inspections would occur on an annual basis through a combination of hiking and driving, but aerial monitoring or monitoring by boat may also be needed for areas with limited access. Habitats specifically preserved for cavity nesting birds would be monitored using point counts during the breeding season for population trend analyses or other methods. The land management will be compared to the easement provisions and management goals and documented with photographs.

Terrestrial/riparian land easements and fee title land acquisitions are consistent with the YRCDC's Yellowstone River recommended practices (YRCDC 2016). Possible project partners could include Montana FWP, USFWS, BLM, local government entities, and non-government organizations that are interested in or whose mission is land conservation and/or river restoration.

4.6.1.2 Terrestrial/Riparian Restoration of Altered or Developed Habitat

Terrestrial/ riparian habitat would be restored through one or more conservation easements or fee title land acquisitions along the Yellowstone River which contain developed or altered terrestrial and riparian lands. The altered riparian lands would be located either in the injured area or nearby and may be within or contiguous with other public property. Properties would be selected for the presence of injured habitat types: terrestrial/riparian habitat (including bottomland cottonwood galleries and riparian grasslands and shrublands, sedge meadows, willow bottoms, and wet aspen). The projects may include conservation easement or fee-title land acquisition. The title would likely be held by one of the Trustees or a third party. About 341 acres would be sought for restoration projects. The developed or altered riparian lands would be restored or habitat quality would be enhanced. Restoration might include installing fencing to reduce grazing pressure, planting and seeding riparian vegetation species, maintenance, wetland restoration, floodplain connecting projects, invasive woody species control, or other commonly accepted land restoration practices in riparian areas.

Terrestrial/riparian restoration is compatible with the YRCDC's recommended practices for the Yellowstone River (YRCDC 2016). The recommended practices document prioritizes areas with more than 5% of the floodplain isolated by dikes, berms or levees for restoration. These Yellowstone River recommended practices (YRCDC 2016) priorities would be one component considered in the project selection.

Possible project partners may include Montana FWP, USFWS, BLM, local government entities, and non-government organizations that are interested in or whose mission is land conservation and/or river restoration.

Controlled grazing, replanting, seeding, wetland restoration projects, floodplain connecting projects, and invasive woody species control are all accepted and common techniques of land management, so have a high likelihood of achieving the project goals. Monitoring will be used to ensure that the restoration project performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of acquisition. The party that holds the land title or easement would likely be responsible for monitoring, reporting, and enforcement of habitat preservation, although those responsibilities may be shared among the partners. Most likely inspections would occur on an annual basis through a combination of hiking and driving, but aerial monitoring or monitoring by boat may also be needed for areas with limited access. The land management will be compared to the easement provisions and management goals and documented with photographs.

4.6.1.3 Control of Invasive Woody Species

The YRCDC mapped over 494 acres of Russian olive (Elaeagnus angustifolia) within the injured area river stretch from Laurel to the Yellowstone County border in 2008. Salt cedar (genus Tamarix) has not been systematically mapped in this stretch, but FWP land managers have reported that it is present and may be contributing to degraded habitat conditions. Large invasive woody species can compete with native plants, reduce forage, impact wildlife habitat and influence the river channel. Yet infestation can be successfully limited through removal of invasive woody plants. The YRCDC identifies an invasive woody plant control prioritization approach (YRCDC 2016) in which they emphasize high priority sites as those with new infestations, upstream infestations, areas of special biological or historical concern, and public access areas. Secondary priorities are those areas with less than 5% infestation and areas with confined channel types.

Invasive woody plants pose a long-term threat to the ecological value to the Yellowstone River riparian and wetland plant communities (YRCDC 2016). Russian olive and salt cedar would be removed from federal and state lands located in the injured area or nearby. BLM has identified Bundy Island Special Recreation Management Area, Pompeys Pillar National Monument, and Sundance Lodge Special Recreation Management Area as high priority sites for invasive woody vegetation removal on federal lands along the river. Removal in these areas would be consistent with the BLM Billings Field Office Approved Resource Management Plan, Chapter 3 (BLM 2015). Locations for woody plant removal would be selected in consultation with local, state, and federal land managers. Project partners for invasive woody plant removal could include the BLM, the Natural Resources Conservation Service, FWP, DNRC, the Yellowstone County CD, the Yellowstone County Weed District, and the YRCDC.

Monitoring will be used to ensure that the restoration project performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of project implementation. For monitoring, project managers would take photographs each year, inspect contractor work

for meeting contract requirements and any non-target damage, and assess if previous treatments are meeting performance criteria before starting additional treatments in subsequent years. They would do this by walking the site, noting whether performance criteria for percent cover of native and invasive non-native species were being met. Contractors could then adjust their planned treatments accordingly.

4.6.2 Large Woody Debris Injuries Project Types

Easements and fee title land acquisition of property were identified as primary restoration to compensate for the lost and disturbed large woody debris.

GOAL: Recruit large woody debris to the river and restore natural river function to re-establish large woody debris piles in areas where they were dismantled or disturbed by response actions.

OBJECTIVES:

- Obtain easements/fee title land acquisitions on upstream cottonwood bottomland to produce a quantity of large woody debris to compensate for that removed by response actions.
- Further enhance the naturally functioning river system by removing unnatural or man-made restrictions to natural fluvial processes and/or channel migration and function.

4.6.2.1 Cottonwood Bottomland Acquisition in the Channel Migration Zone

Intact mature cottonwood bottomland would be acquired through one or more channel migration zone easements, other easements, or fee title land acquisitions in the Yellowstone River bottomlands in and above the injured area. These properties would be selected for their potential to erode and contribute large woody debris to the system. Purchase of these lands would allow for the recruitment of debris to the system through natural erosional processes to replace the 28 injured large woody debris piles. The rate of natural recruitment of large woody debris was estimated based on values from the literature for the rate of bank erosion in the area likely to erode and contribute large woody debris (the channel migration zone), and the density of trees and average tree volume in that area. Analysis in Chapter 3 and included in Appendix C determined that approximately 958 acres of restoration on cottonwood bottomland habitat would have to occur to offset the injuries. Therefore, approximately this much acreage would be sought.

The area targeted for easements or fee title land acquisition would have the habitat needed to replace the volumes damaged and removed in the injured area. Conservation easements or fee title land acquisitions of cottonwood bottomland in the channel migration zone would be sought from Reed Point to Billings to supply large woody debris to the impacted area.

Channel migration zone easements, other easements, and fee title land acquisitions are consistent with the YRCDC's Yellowstone River recommended practices (YRCDC 2016) and channel migration zone maps. Possible project partners could include Montana FWP, USFWS, BLM, YRCDC, Yellowstone CD, Carbon CD, and non-government organizations interested in river restoration.

Channel migration zone easements and fee title land acquisitions are an accepted method used to conserve riparian areas and allow the river's natural erosive processes to continue (FWP 2016; YRCDC 2016). Channel migration zone easements are already being employed along the

Yellowstone River for this purpose (FWP 2016). Monitoring will be used to ensure that the restoration project performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of property acquisition. The party that holds the land title or easement would likely be responsible for monitoring, reporting, and enforcement of habitat preservation, although those responsibilities may be shared among the partners. Most likely inspections would occur on an annual basis through a combination of hiking and driving, but aerial monitoring or monitoring by boat may also be needed for areas with limited access. The land management will be compared to the easement provisions and management goals and documented with photographs.

4.6.2.2 River Function Restoration

Projects would be conducted that would allow natural river function and erosion to occur. Several types of projects may be considered, such as flanked riprap removal, side channel blockage removal, or berm removal to restore river function.

Flanked Mid-Channel Riprap Removal

Failed bank armor and flanked flow deflectors sometimes end up as rubble in the active river channel. This rubble will often deflect the current into the bank, thereby accelerating the bank erosion it was originally intended to stop. It also creates a safety hazard for boaters and recreationists and is a potential liability for the landowner (YRCDC 2016). The YRCDC recommends that failed bank armoring and flow deflectors be removed from the active channel (YRCDC 2016).

There are several locations in the restoration area that contain failed bank armoring in active river channel areas. The Yellowstone River reach narratives published by the YRCDC identify at least seven of these in the spill-affected area (COE and YRCDC 2016). These would be identified and feasibility of removal from the active channel considered.

Side Channel and Flood Control Berm Removal

The active floodplain of the Yellowstone River is restricted through the blockage of numerous side channels and construction of flood control berms. The Yellowstone River reach narratives included in the YRDCD cumulative effects analysis (COE and YRCDC 2016) identify at least twelve locations in the spill-affected area with side channel blockages impacting more than 17 miles of side channels. Removal of these types of structures would increase the size of the active floodplain, allow for a more naturally functioning river system and encourage cottonwood regeneration. Removal of side channel blockages and flood control berms is consistent with the Yellowstone River recommended practices (YRCDC 2016).

Possible project partners could include Montana FWP, YRCDC, Yellowstone CD, Carbon CD, the Natural Resources Conservation Service, and non-government organizations interested in river restoration.

Removal of side channel blockages and flood control berms is an accepted practice to restore natural river function (YRCDC 2016). Monitoring will be used to ensure that the river function project performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of project implementation. For monitoring, project managers would take photographs, inspect contractor work for meeting contract requirements, review a construction completion report, and follow up with appropriate monitoring.

4.6.3 Riverine Aquatic Project Types

Fish passage projects and opening blocked side channels to increase access to additional habitat for warm water fishes and soft bank stabilization projects, where needed, were identified as primary compensation for injured riverine aquatic resources.

GOAL: Enhance aquatic habitat for fish production and other aquatic organisms

OBJECTIVES:

- Increase fish production by improving fish passage on tributaries
- Improve aquatic habitat by using soft bank stabilization techniques
- Increase aquatic habitat by opening blocked side channels

4.6.3.1 Fish Passage Improvement

Fish passage prevention associated with irrigation diversions is an issue in the Yellowstone River and many of its tributaries. Where irrigation water is derived by diversion structures spanning the entire river channel, it can affect the daily movements and seasonal migrations of various fish species. Fish may become entrained when water is withdrawn from the river either via gravity diversions or pumps. Researchers have established that the distributions and movements of many Yellowstone River fish species are affected by low-head irrigation diversions dams. Researchers have suggested that blockage of seasonal migrations for spawning and feeding may be a leading cause of the decline in fishes native to large river systems (Trenka 2000; Helfrich et al. 1999; Elser et al. 1977). Across the U.S. and locally, fish passage and entrainment protection measures have been used effectively to prevent loss of fish, restore connectivity with habitat, and increase fish abundance without negatively affecting agricultural practices. Examples of these types of projects in the Yellowstone Basin include the recently completed T & Y dam bypass project (Figure 4-1) (McKoy 2013), the DH dam removal on the Tongue River (FWP 2016), and the ongoing effort to improve fish passage at the Huntley Diversion on the Yellowstone River and improving fish passage on the lower portion of Pryor Creek (YRCDC 2012; COE and YRCDC 2016).

Tributaries to the Yellowstone River in the vicinity of the spill that have opportunities for increasing fish recruitment to the mainstem fish populations that were injured by the spill are the Clarks Fork of the Yellowstone and Pryor Creek. The Clarks Fork River has irrigation diversions that block fish movement and migrations from the Yellowstone River. Pryor Creek has a fish barrier several miles up from the confluence with the Yellowstone River.

Figure 4-1. Fish Passage Example (Montana FWP photograph)

The Clarks Fork River is the uppermost warm water tributary to the Yellowstone River and has significant potential as a spawning area for Yellowstone River fish; however, there are 11 irrigation diversions over its 73 mile length in Montana and several present significant fish passage problems. Currently, fish are prevented from migrating further than about 16 miles up the Clarks Fork River due to fish passage issues. If fish passage can be provided at key irrigation diversions, Yellowstone River fish could access an additional 42 miles of river for spawning and rearing.

Pryor Creek is a tributary to the Yellowstone River near the town of Huntley. Several miles upstream a barrier to upstream fish passage occurs at the Siewert Irrigation Diversion Dam. The weir style diversion dam is about 4 feet high and blocks upstream fish passage at all times. (Mefford 2007). Removing this fish passage barrier would provide fish access to the entire length of Pryor Creek and benefit several Montana species of concern found in this section of the Yellowstone River, either by providing spawning and rearing habitat in Pryor Creek itself or by improving forage fish production out of the creek (Yellowstone Conservation District 2012). Historically, this section of the Yellowstone River and possibly Pryor Creek itself, provided habitat for key native species such as burbot, sauger and channel catfish. If Pryor Creek can provide unlimited fish passage, it would likely become a key sauger and catfish spawning tributary for this section of the Yellowstone River. Many of the native fish species in this part of the Yellowstone River, such as white and longnose suckers, flathead chub, emerald shiners, and fathead and western silvery minnows depend on tributary streams for spawning and as

winter habitat to escape ice flows in the main river. Many of these species provide the forage necessary to maintain game fish populations in the main Yellowstone River. Now that the siphon is installed and Pryor Creek is reconnected to the Yellowstone River, providing fish passage at the Siewert Irrigation Diversion Dam would provide important spawning potential for Yellowstone River fish. The Yellowstone Conservation District has project final designs available and has been working to secure match funding for this project.

If the projects on Pryor Creek and the Clarks Fork River do not move forward, the State will consult with local government agencies and resource managers to identify similar projects that meet the same goals. Fish passage projects are consistent with the Yellowstone River recommended practices (YRCDC 2016). Project partners could include FWP, the YRCDC, Yellowstone Conservation District, Carbon Conservation District, DNRC, and irrigation companies.

Fish passage projects are recognized as a method to help fish to re-populate habitat that has been blocked. Warm water fish are already using portions of Pryor Creek that were formerly blocked after removal of another barrier. The benefits are long term because they remove a physical barrier. Monitoring will be used to ensure that the fish passage project performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of project implementation. Methods for monitoring fish barrier projects will use commonly accepted practices such as fish population surveys, fish tagging, and monitoring above and below the fish passage structure. The structures will likely be monitored for at least two years to determine if they are functioning as designed.

4.6.3.2 Soft Bank Stabilization

In areas where bank stabilization must occur to protect existing infrastructure, soft bank stabilization is preferred to provide improved habitat for fish (Figure 4-2). Soft bank stabilization techniques conserve riparian areas while still allowing infrastructure to be protected. Soft bank stabilization uses a bio-engineering technique called soil lifting. The method uses natural material (bank material and top soil) and vegetation (willows and riparian vegetation) to stabilize the bank. (Figure 4-2). Soft bank stabilization creates natural aquatic shoreline habitat as well as riparian vegetation.

FWP has identified possible soft bank stabilization project locations, although they are also exploring project ideas for moving the infrastructure at those locations so that bank stabilization would not be required. If a soft bank stabilization project moves forward, FWP could also use it as a demonstration project for other locations on private property along the Yellowstone River.

Figure 4-2. Example of Soft Bank Stabilization Project

Project partners include FWP. Soft bank stabilization is recognized as an accepted practice for conserving riparian areas while still allowing for active management. Monitoring will be used to ensure that the soft bank stabilization performance criteria will be met. The duration and frequency of monitoring will be detailed at the time of project implementation. Monitoring parameters will be determined when the projects are implemented, but will use commonly accepted practices such as photographs, monitoring of vegetation establishment, and bank stability.

4.6.3.3 Riverine Habitat Restoration

Projects would be conducted that would restore riverine habitat. Several types of projects may be considered, such as flanked riprap removal and side channel blockage removal to restore riverine habitat.

Flanked Mid-Channel Riprap Removal

Failed bank armor and flanked flow deflectors sometimes end up as rubble in the active river channel. This rubble will often deflect the current into the bank, thereby accelerating the bank erosion it was originally intended to stop and negatively impacting riverine habitat. It also creates a safety hazard for boaters and recreationists and is a potential liability for the landowner (YRCDC 2016). The YRCDC recommends that failed bank armoring and flow deflectors be removed from the active channel (YRCDC 2016).

There are several locations in the restoration area that contain failed bank armoring in active river channel areas. The Yellowstone River reach narratives published by the YRCDC identify at least seven of these in the spill-affected area (COE and YRCDC 2016). These would be identified and feasibility of removal from the active channel considered.

Removal of Side Channel Blockages

Removal of side channel blockages would be used to create more aquatic side channel habitat along the Yellowstone River. The COE and YRCDC (2016) mapped almost 17 miles of blocked side channels in the reach of the Yellowstone River between Laurel and the Big Horn River confluence. Monitoring will be used to ensure that the aquatic side channel habitat is functional. The duration and frequency of monitoring will be detailed at the time of project implementation. For monitoring, project managers would take photographs, inspect contractor work for meeting contract requirements, review a construction completion report, and follow up with appropriate monitoring.

4.6.4 American White Pelican Project Types

The Trustees identified the following project as primary compensation for injured pelican populations.

GOAL: Replace oiled pelicans that died as a result of the oil spill by increasing productivity through predator exclusion to breeding areas.

OBJECTIVES:

- Reduce predation of American white pelican chicks on breeding grounds to offset those pelicans that were oiled during the Yellowstone River oil spill

Medicine Lake National Wildlife Refuge: The American white pelican colony on Medicine Lake is the largest breeding colony in Montana, and in an effort to reduce mammalian predation activity on Bridgerman Point, a long narrow peninsula jutting out into Medicine Lake, a predator exclusion fence was constructed in 1988. This project would include tearing out the existing wire, but leaving the existing posts. Welded wire, mesh, electric wire and charger would be replaced following the design in Lokemoen and Woodward (1993). Modifying the fence design would significantly reduce maintenance costs and should ensure the fence works properly for many more years. In addition, weed mat would be installed and covered with gravel extending two feet on either side of the fence to prevent vegetation from grounding out the electric wire. Lastly, construction of additional fence extensions (wing fences) would be completed that could be pushed further out into the lake on years when the water is low.

Monitoring would include pelican breeding pair and nest numbers as well as predator use of the point using game cameras. Monitoring would take place the year before fence replacement and for 2 years following fence replacement, and modifications would be made to ensure that the project is meeting project goals and objectives.

Bowdoin National Wildlife Refuge: Bowdoin Lake on the refuge has a large colony of nesting pelicans with the average nests numbering over 1,300 and have ranged from a minimum of 272 (in 1972), and maximum 2882 (in 1993) nests. Over 95% of the pelicans at Bowdoin nest on Woody Island and South Woody Island. Island nesting is a breeding strategy used by pelicans to reduce predation when young are vulnerable. Water is a barrier to terrestrial predators, but

once water is shallow enough or absent (land bridge), access is uninhibited making young birds easy meals to primarily meso-predators (raccoon, coyote, skunk, etc.). In Lake Bowdoin a water level elevation below 2,209 feet creates land bridges out to Woody and South Woody islands. The refuge currently purchases excess water from the Malta Irrigation District at $7.00 per acre-foot. Water levels typically need to be raised to 2,210 foot stage, before 15 May of each year, which is the cut off to limit impacts to any over water nesters. Water purchases could vary, but to raise the lake two feet, 6,276 acre-feet of water would need to be purchased from the Malta Irrigation District at $7.00 per acre-foot, totaling $43,932 dollars (price based on 2012 data). The refuge does not have the funding necessary to buy needed water every year, so this funding would allow water purchases when normal allocations would not cover needs. This project would reduce predation in dryer years.

There are many predators that could exploit the American white pelican colonies at these refuges. Madden and Restani (2005) reported that predation was present in the American white pelican colony on Medicine Lake. The Trustees believe that these projects would have a high likelihood of meeting project goals, as the predator exclusion would boost pelican survival when chicks are young and vulnerable.

4.6.5 Recreational Human Use Project Types

Several project types were identified as compensatory restoration for interim losses of human use services due to the spill. The approach is to provide a suite of in-kind restoration projects to increase recreational opportunities similar to those that were lost due to the oil spill and subsequent response activities. These enhanced recreational opportunities would occur as close to the areas impacted by the spill as practicable, and provide for actions for which a non-federal governmental agency would normally not be responsible or that would receive funding in the normal course of events. The projects identified would be implemented as part of the restoration plan. However, if certain projects do not move forward, the State would meet with local government agencies and resource managers to identify similar projects with similar purposes. Project types would not include maintenance activities.

GOAL: Provide additional human use recreational opportunities to offset those lost due to the oil spill.

OBJECTIVES:

- Improve public parks and recreation areas
- Improve urban fishing opportunities
- Increase fishing access to the Yellowstone River

4.6.5.1 Public Parks and Recreation Areas Improvement

Riverfront Park: The Riverfront Park Complex is a City of Billings park located along the Yellowstone River adjacent to South Billings Boulevard (Map 4-1). With over 600 acres, it is one of the most popular parks in Billings. The city of Billings completed a Master Plan for Riverfront Park in December 2008 (Billings Parks and Recreation 2008). This plan identified several priority projects including:

> Water access: Water access is limited along the Yellowstone River. Riverfront Park has two different access points that may be viable for the development of water access. Both points are at locations along existing or former roadways.

Motorized boat launch project: The City of Billings would like to install a motorized boat launch at Riverfront Park and is exploring suitable locations.

Non-motorized Boat Launch Project: A hand boat launch at the South Billings Boulevard Parking lot would allow for an additional water access to the Yellowstone River. The launch would only be accessible to non-motorized water craft. The parking lot would serve as an additional trail head for the main park trail.

Trails: Another priority project for Riverfront Park is paving of a City of Billings loop trail that passes through the park. The base preparation is completed and with minor grading and preparation, the trail would be ready for paving.

Coulsen Park: Coulsen Park is an almost 50 acre City of Billings park located on the left (northwestern) bank of the Yellowstone River. The park presently has little development. The master plan for the park identified the need for parking and sanitary facilities as well as other park improvements (Billings Parks and Recreation 1995). The City Parks and Recreation Department has identified these as priority projects for Coulsen Park.

Projects that would take place at Riverfront Park and Coulsen Park would be consistent with the City of Billings Riverfront Park and Coulsen Park master plans and other City planning. Work could be implemented or overseen by the City of Billings Parks and Recreation Department.

Riverside Park: The City of Laurel's Riverside Park is located on the right (south) bank of the Yellowstone River immediately east of Highway 212 (Map 2-2). The pipeline ruptured along the boundary of Riverside Park and the park was not only impacted by oil, but also by the high water event of 2011 that resulted in flooding, bank erosion and the loss of the boat ramp. Several restoration projects could be done at Riverside Park to compensate for the lost recreational opportunities due the park closure.

The City of Laurel has identified installation of sanitation facilities as its first priority at Riverside Park. The park lacks sanitary facilities although it receives heavy use, especially at the boat ramp, a key location for river access. This boat ramp provides a take-out point for floaters coming from Columbus or Buffalo Mirage fishing access site and a launch site for those floating downstream to Duck Creek fishing access site or Billings. The boat ramp also accommodates access for motorized craft which can go either up or downstream. The addition of a vault toilet, similar to those used at other fishing access sites, would be a significant benefit to the river users and Riverside Park.

Laurel has also identified the need to prepare a master plan for park development. The master plan would consider any number of projects including:

- Development of an interpretive walking/biking trail through the riparian area and perimeter of the park. This would include a path for walking/ running/ biking and provide opportunities to interpret the history of the park, its natural areas and significant events.

- There is an old dump located within the perimeter of Riverside Park. A master plan would consider the feasibility of removal of the dump material and restoration of the site to provide additional natural area space within the park and opportunity for expansion of a trail system.

- Renovation of the youth recreational building that was damaged by the flood. Renovation of this structure would allow recreation-oriented community activities to resume.

Possible project partners could include the City of Laurel Public Works Department or local community organizations.

Recreation Area Improvements: Facilities at Sundance Recreation Area were closed during the spill. Pompeys Pillar National Monument is within the impacted reach. Funds would be used for improvements and maintenance of existing facilities to compensate for the loss of use during the oil spill.

Improvements in public parks and recreation would be demonstrated by completion of the projects as compensation for the lost recreational services and completion reports submitted by the project managers. Specific monitoring and reporting requirements would be determined at the time of project implementation.

4.6.5.2 Urban Fishing Opportunities Improvement

Lake Josephine – Riverfront Park, Billings: Lake Josephine supports a moderately used but important local fishery located in Riverside Park in Billings. It currently provides a mixed species fishery. The fishery in Lake Josephine is not providing maximum angling opportunities due to shallow water and poor shoreline habitat.

There are opportunities to enhance the fishery in Lake Josephine by deepening the pond, enhancing shoreline habitat and improving access. This can be accomplished through the development of a fisheries management plan and a habitat restoration plan. These plans would identify actions to improve the fishery and develop costs for implementation of habitat improvements and future management and implementation.

Projects that would take place at Riverfront Park would be consistent with the City of Billings Riverfront Park Master Plan. Work would likely be implemented by the City of Billings Parks and Recreation Department and FWP. Methods for monitoring urban fishery improvement projects for meeting project goals will be detailed when the projects are selected and would include a project implementation report.

Laurel Pond – Laurel: Laurel Pond is located on the west side of Laurel adjacent to Interstate 90. The pond suffers from a number of problems. The pond is shallow and frequently suffers fish kills during the fall turnover period, limiting the fishery potential and consistent fishing opportunities. The pond is managed as a rainbow trout and largemouth bass fishery.

The fish kill problems can be corrected by excavating pond-bottom sediments which would provide cooler water temperatures and improved fish habitat. Projects focused on enhancing shoreline habitat and spawning areas could be completed to improve fish production and survival. The Laurel Lions Club attempted a similar project in the past but was not able to complete it. Pond sediment could be excavated to improve fish habitat of the pond and spawning structures could be built on the bottom to facilitate largemouth bass production.

Improvements in providing access for anglers will also improve the angling experience. Fishing opportunities can be enhanced by providing a handicapped accessible fishing pier and providing fishing platforms at various locations around the pond. The fishery would be managed through

the development of a fishery management plan which would include fish species, stocking rates, stocking times, monitoring of the water quality and maintenance of the pond and structures.

Possible project partners could include FWP or local community organizations. Methods for monitoring urban fishery improvement projects and meeting project goals will be detailed when the projects are selected and will include a project implementation report.

4.6.5.3 Increase or Maintain Fishing Access to Yellowstone River

Acquire and Develop a Fishing Access Site: This project type includes acquisition of and development of a fishing access site between Laurel and the Huntley Diversion. This project could be implemented or overseen by FWP.

Maintain Fishing Access to the River. This project type may include projects such as access preservation. The Captain Clark fishing access location access road is eroding into the river. Preservation of this access would be implemented by FWP.

Provide Safe Access to the River: The Huntley Irrigation Diversion is located 15 miles downstream from Billings. The land below the diversion is managed by the U.S. Bureau of Reclamation. In the past, it has been a popular spot to fish for ling, channel catfish, sauger, smallmouth bass and goldeye. Access requires crossing two railroad tracks with limited site distance. Access has been controversial in the past. Currently the access is closed.

Access to the site below the Huntley Diversion would require agreement with the irrigation district, the U.S. Bureau of Reclamation and BNSF or Montana Rail Link. In addition, an improved crossing with lights and cross arms and modification of the approach would be required. There are implementation and cost-effectiveness concerns that would need to be addressed for this project to move forward.

4.7 Alternatives Considered But Dismissed

The Trustees convened technical working groups shortly after the spill occurred for each of the injured resources. The technical working groups met periodically and developed and vetted restoration project alternatives and made recommendations to the Trustees. The Trustees considered and analyzed the alternatives developed by the technical working groups further, which led to some of the alternatives being eliminated from further consideration.

Additional Terrestrial/Riparian Restoration projects

Wetland Development
The Trustees considered a wetland development project at Pompeys Pillar National Monument. This project was eliminated from further consideration when BLM determined that it would not be possible to acquire a water right needed for the project and therefore was unimplementable.

Additional Large Woody Debris Restoration Projects

Larger Acquisition Area
The Trustees considered looking for conservation easements and fee title land acquisitions over a greater area than the areas targeted in Alternative 2. Alternative 2 would look for properties from Reed Point to Billings. Analysis of the vegetation upstream from Reed Point showed that there is limited cottonwood forest habitat in the upper reaches of the Yellowstone River (COE & YRCDC 2016). Expanding the area for conservation easement or fee title land acquisitions up

stream of Reed Point would not meet the Trustees' project goal of providing a source of large woody debris because properties up stream do not have the needed debris sources. A greater selection area would not be as cost-effective as selecting projects for restoration close to the injured area.

Constructed Large Woody Debris
The Trustees considered construction of large woody debris piles. Lost and/or disturbed large woody debris piles would be rebuilt using logs and woody debris from off-site locations. The large woody debris piles mapped and labeled LWD1 and LWD2 were closest to the spill location and heavily injured. These locations would be prioritized for large woody debris pile construction.

This alternative was rejected because although the piles could be constructed more quickly than allowing natural river processes to rebuild them, the few examples of construction of large woody debris piles has been limited to small tributaries and not large rivers like the Yellowstone River, so likelihood of success is unknown. Construction of large woody debris piles would take place in the 100 year floodplain and would require floodplain permits for construction, requiring hard piles to be constructed to withstand 100 year flow forces thereby hindering natural flow processes. Access to the selected locations would pose challenges, perhaps requiring helicopters or boats to bring materials and equipment to the sites. In addition, constructed piles could fail and cause downstream damage. Construction of woody debris piles would also need to go through additional planning and NEPA or MEPA review, which could help reduce collateral impacts during construction.

Constructed woody debris piles would not be compatible with the flow processes on the river, so would not meet the project goal of restoring natural river function and would be an undesirable man-made influence on the Yellowstone River natural fluvial processes. In addition, constructed piles would not likely be as cost-effective as channel migration zone or other easement or fee title land acquisitions in the long term.

Larger area for riprap and channel blockage removals
The Trustees considered removing riprap and channel blockages from Greycliff to Reed Point but determined it would not be as cost effective as restoring river function in stretches closer to the injured area. Similarly, projects located further away would not meet the Trustees' goals because they are not close enough to injured area. Riprap removal or berm removal from side channel would require conventional construction practices so would likely be easy to implement. These project types are included in the Yellowstone River recommended practices (YRCDC 2016).

Additional Riverine Aquatic Habitat Restoration Projects

Tributary Rehabilitation
The Trustees considered rehabilitation of the tributary stream located at Pompeys Pillar National Monument, Canyon Creek. This project is technically feasible and is within the injured area, but it is not close to the oil spill location. The tributary restoration project discussed at Pompeys Pillar would cost between $1 million and $2 million (Sparks 2016). This project is not in the immediate area of the spill and was rejected as not cost-effective considering the degree of restoration to the spill-injured resources for the dollar amount. In addition, this project would not meet the project goal of restoring river fish losses due to warm water fish injury.

Fish Passage on cold water tributaries
The Trustees considered fish passage projects on tributary streams to the Yellowstone River with cold water fisheries. Fish passage projects on cold water fisheries are also demonstrated to be successful in restoring fish populations, but these projects would not directly address the injured populations of warm water fish on the Yellowstone River. In addition, this project would not meet the project goal of restoring river fish losses due to warm water fish injury.

Additional Pelican Restoration Projects
The Trustees considered building an island in Bowdoin Lake within Bowdoin National Wildlife Refuge. This is one of two breeding locations for American white pelicans that forage on the Yellowstone River reach impacted by the oil spill. The island proposal was removed from consideration when it was determined that risk of having the island taken over by species not impacted by the spill was too high. The island project would have likely ended up benefiting species other than pelicans.

5.0 EVALUATION OF ALTERNATIVES UNDER OPA

Natural resource damage assessment regulations under OPA require consideration of six criteria when evaluating restoration options (15 CFR 990.54). These OPA requirements and the restoration project selection criteria are discussed in more detail in Section 4.2. The selection criteria are:

1. Project cost and cost effectiveness
2. Project is expected to meet Trustees' goals and objectives
3. Likelihood of success
4. Project will prevent future injury and not cause collateral damage
5. Project will benefit more than one resource
6. Effect of alternative on public health and safety

After developing the range of restoration alternatives, the Trustees evaluated the alternatives according to the six evaluation criteria set out in OPA regulations. This comparison is supported by the Trustees' consideration of the environmental consequences of the alternatives, presented in Chapter 6. Table 5-1 presents the Trustees' evaluation of the alternatives and project types, according to OPA regulations and project selection criteria.

Table 5-1. Evaluation of Alternatives According to OPA Criteria

Alternative 1 No Action/Natural Recovery	
Damage Category	**OPA Evaluation Criteria**
Terrestrial/Riparian habitat (includes habitat for cavity nesting birds) Large Woody Debris Piles Riverine Aquatic Habitat American white pelican Recreational Human Use	**1. Cost effectiveness:** Would not cost anything because no active restoration nor compensation projects would be completed. Technically feasible and cost-effective project alternatives exist for all injured resources. **2. Meet goals and objectives:** Would not meet Trustee goals because recovery would take much longer compared to a scenario in which restoration actions were undertaken, and interim losses suffered by the natural resources would not be compensated. OPA establishes the Trustees' responsibility to seek compensation for interim losses pending recovery of the natural resources. **3. Likelihood of success:** Natural recovery would occur over a long period of time but would not successfully compensate for interim losses. **4. Prevent future injury:** No projects would be implemented to speed up recovery, so future injury during natural recovery would not be prevented. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would benefit the injured resources over the long term. No population sources would be improved to provide sources for injured fish or pelican populations. **6. Effect on public health and safety:** Would not affect public health and safety but would not improve fishing access safety nor remove unsafe flanked riprap in the river as in the preferred alternative.

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
Damage Category: Terrestrial / Riparian Habitat (includes habitat for cavity nesting birds) Project goals: Conserve and restore terrestrial /riparian habitat		
Conservation easements or fee title land acquisitions	Individual or multiple easements or fee title land acquisitions to protect and restore terrestrial/riparian areas, cottonwood bottomlands and areas with complex understory for cavity nesting birds	**1. Cost effectiveness:** Likely cost effective in the long term and sustainable. Easements and fee title land acquisitions would be in injured area and directly related to the injured resources to make the most effective use of available dollars. Conservation easements or fee title acquisitions would only be approved where the price to be paid for the property is equal to or less than the fair market value. Follow-up analysis of cost-effectiveness would be included in project selection. Some funds would be required for long-term management and monitoring. Restoration practices would use methods that are commonly accepted and easy to implement and maintain such as fencing, planting and seeding. Potential for funds and/ or in-kind services from the land manager (ex., BLM, DNRC, FWP or private). **2. Meet goals and objectives:** Since the habitat targeted for conservation easements and fee title land acquisitions is within the injured area, a close link exists between services lost and services restored. Would meet Trustees' goal of returning injured natural resources by conserving terrestrial/riparian habitat and mature cottonwood bottomland with intact complex understory habitat in and near the spill site. Past development trends indicate that these terrestrial/ riparian areas are at risk of being developed (see Chapter 6). Selection criteria for easements and fee title land acquisitions would include a variety of habitat services, including structurally diverse cottonwood bottomland habitats with complex understory for cavity nesting birds. Riparian easements are included in the YRCDC's recommended practices (YRCDC 2016). Some projects would include active restoration such as planting and seeding native

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
		vegetation, fencing, noxious weed control, invasive woody weed removal, and other methods that would be specified in a land management plan. **3. Likelihood of success:** Conservation easements or fee title land acquisitions to protect or restore terrestrial / riparian cottonwood bottomlands are likely to be successful because they would only be made with willing landowners and are flexible in what can be included in the easement. The area chosen for selecting easements or fee title land acquisitions is large enough to find suitable properties. Management plans or easement terms would include provisions to enhance the quantity, quality and character of terrestrial/ riparian habitat. Public ownership and management would maintain or enhance the terrestrial/riparian habitat and species through the implementation of these adaptive management plans. Restoration practices would use methods that are commonly accepted and easy to implement and maintain such as fencing, planting and seeding, or other recommended practices from the conservation districts (YRCDC 2016) or other land management agencies. Monitoring criteria would be developed for each site and management adapted to actual conditions to ensure that the project is trending toward overall project goals. **4. Prevent future injury:** Would speed up recovery, so would prevent future injury as a result of the incident. Short-term negative impacts from restoration actions would be minimized. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would benefit terrestrial/riparian habitat and cavity nesting birds. Some properties may also benefit large woody debris, riverine aquatic resources, or recreational human use. **6. Effect on public health and safety:** Would not affect public health and safety.
Control of invasive woody species	Invasive woody weed removal on BLM lands such as Bundy Island, Pompeys Pillar, Sundance and FWP or DNRC state-owned lands	**1. Cost effectiveness:** Likely cost effective in long term and sustainable. Restoration projects undertaken on public lands have the potential for match funding and/or in-kind services from the land manager (ex., BLM, DNRC, or FWP). **2. Meet goals and objectives:** Project methods would be specified in a weed removal plan to ensure project goals and objectives are met. **3. Likelihood of success:** The control of woody invasive plant species has been a focus area of the Yellowstone County Weed District since 2007. The weed district is knowledgeable about woody weed removal methods and locations needing treatment, so this project would have a high likelihood of being successful and meeting project goal of restoring terrestrial/riparian habitat. **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Short-term negative impacts from restoration action would be minimized. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would benefit terrestrial/riparian and riverine habitat **6. Effect on public health and safety:** Would not affect public health and safety.

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
Damage Category: Large Woody Debris Piles **Project goals: Restore losses to large woody debris piles and restore natural river function**		
Channel migration zone, other easements, or fee title acquisition	Recruit large woody debris through channel migration zone or other easements on cottonwood bottomland	**1. Cost effectiveness:** Channel migration zone, other easements, or fee title land acquisitions are likely to be cost effective in the long term and sustainable to provide large woody debris sources. Easements and fee title acquisitions would be upstream of the injured area in areas that would benefit recruitment of large woody debris to make the most effective use of available dollars. Conservation easements or fee title land acquisitions would only be approved when the price to be paid for the property is equal to or less than the fair market value. Follow-up analysis of cost-effectiveness would be included in project selection. Some funds would be required for long-term management and monitoring. Cost effective also because easements and fee title land acquisitions would provide a source area for material and then allow the river's natural processes to form the piles. **2. Meet goals and objectives:** Would meet Trustees' goal of returning injured natural resources by providing source areas for large woody debris in cottonwood bottomland in and above the injured area. Channel migration easements and other easements are included in the local conservation district recommended practices publication (YRCDC 2016). **3. Likelihood of success:** Channel migration zone easements, other easements, or fee title land acquisitions to protect channel migration zones are likely to be successful because they would only be made with willing landowners and are flexible in what can be included in the easement. A FWP analysis of a channel migration easement on the lower Yellowstone River, the first of its kind in Montana, listed multiple benefits for a variety of natural resources, including land resources, air quality, vegetation, fish and wildlife, and aesthetics, and others (FWP and MARS 2016). Conservation easements and fee title acquisition projects are likely to meet the project goals because they would include easement terms and conditions and establish management plans designed to allow the river to erode the mature cottonwood bottomlands and provide a source of large woody debris. Monitoring criteria would be developed for each site and management adapted to actual conditions to ensure that the project is trending toward overall project goals. The area chosen for selecting easements and fee title land acquisitions and restoration is large enough to find suitable properties. **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would benefit large woody debris piles. Properties that provide cottonwood bottomland for large woody debris sources may also include habitat to benefit terrestrial/riparian resources, riverine aquatic resources, and cavity nesting birds. May benefit recreational human use. **6. Effect on public health and safety:** Would not affect public health and safety.

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
Restore river function	Remove flanked riprap from mid-channel areas, remove non-functional bank riprap, and remove side channel blockages	**1. Cost effectiveness:** Would be cost effective in the long term since after the riprap or blockages are removed the restoration would be permanent. Possible match funds or in-kind services from YRCDC. **2. Meet goals and objectives:** Would meet Trustees' goal of restoring large woody debris piles by removing impediments to natural fluvial processes, so that large woody debris in the system can be moved and deposited naturally. **3. Likelihood of success:** Likely to be successful because riprap removal or berm removal from side channels requires conventional construction practices. Projects would use accepted engineering and construction techniques and standard practices. These project types are included in the local conservation district recommended practices publication (YRCDC 2016). **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Short-term negative impacts during construction would require permits and would minimize adverse impacts. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** In addition to benefiting large woody debris, would benefit riverine habitat for native fish as well as habitat for wildlife, amphibians, and reptiles. Would benefit recreational human use by restoring river flow. **6. Effect on public health and safety:** Would improve public health and safety by removing dangerous isolated riprap in the middle of the river and reducing the potential for future flanking.
Damage Category: Riverine Aquatic Habitat **Project goals: Enhance aquatic habitat for fish production and other aquatic organisms**		
Restore fish passage and habitat	Yellowstone River tributaries	**1. Cost effectiveness:** Cost effective in the long term by permanently removing physical barriers. Match funds or in-kind services could be possible from irrigation companies, FWP or conservation districts. Follow-up analysis of cost effectiveness would be included in specific project selection. **2. Meet goals and objectives:** Would meet the Trustees' goal of restoring habitat (spawning and rearing areas) for warm water fish to help Yellowstone River fish populations recover; is directly related to the resource injury to warm water fish. **3. Likelihood of success:** Fish passage projects have been demonstrated to be successful at increasing fish populations by increasing spawning and recruitment areas (FWP 2016). Likely to be successful as similar projects built on other tributaries to the Yellowstone River have been successful in returning warm water fish to habitat previously blocked (FWP 2016). Since removal of the block at the mouth of Pryor Creek in 2011, warm water fish have been repopulating the lower portions of Pryor Creek where they have not had access for close to 100 years (YRCDC 2012). Monitoring criteria would be developed to ensure that the project is trending toward overall project goals. Projects would use accepted engineering and construction techniques and standard practices. **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Short-term negative impacts during construction would require permits and would minimize adverse impacts. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Projects would benefit riverine aquatic habitat and ultimately benefit fishing recreation which was injured by the spill. **6. Effect on public health and safety:** Would not affect public health and safety.

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
	Soft bank stabilization rather than hard stabilization to protect infrastructure on state land, removal of flanked riprap and side channel blockages.	**1. Cost effectiveness:** Cost effective in the long term, possible match funds or in-kind services available from FWP for projects on state land or YRCDC. **2. Meet goals and objectives:** Would meet the Trustees' goal of repairing injury to riverine habitat by stabilizing banks using soft techniques and retaining fish habitat components; is related to the resource injury to warm water fish. Removal of flanked riprap and side channel blockages would increase fish habitat. **3. Likelihood of success:** Projects would use standard engineering and construction techniques. Likely to be successful on side channels to the Yellowstone as soft bank techniques have been demonstrated to be successful in preserving habitat where infrastructure protection must take place. Fish have been documented using reactivated side channels in other river restoration projects (Bureau of Reclamation and Bonneville Power Administration 2013). Approximately 17 miles of side channels have already been identified as blocked in the injured stretch of river. **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Short-term negative impacts during construction would require permits and would minimize adverse impacts. Would not cause collateral injury during implementation. Would benefit riverine habitat for fish in areas requiring infrastructure protection while developing habitat to benefit riparian wildlife species. **5. Benefit more than one resource:** Soft bank stabilization would also benefit terrestrial/ riparian habitat. Would benefit riverine habitat for fish in side channels by reactivating former habitat now blocked off from the main river and may benefit large woody debris. **6. Effect on public health and safety:** Removal of flanked riprap would improve safety for boaters.
Damage Category: American white pelican **Project goals: Replace pelican populations**		
Reduce nestling predation Predator control fencing, and predator control using water level management at National Wildlife Refuges	Actions on American white pelican breeding areas at Bowdoin National Wildlife Refuge and Medicine Lake National Wildlife Refuge	**1. Cost effectiveness:** Cost effective with in-kind services possible from USFWS. **2. Meet goals and objectives:** Would restore pelicans by protecting nestlings from predation at refuges outside the Yellowstone River Basin, but who use the Yellowstone River as a feeding area. **3. Likelihood of success:** Likely to succeed, uses methods successful at other locations with other bird species (Hall 1994). **4. Prevent future injury:** Would speed up recovery so would prevent future injury as a result of the incident. Bowdoin National Wildlife Refuge only purchases excess irrigation water. **5. Benefit more than one resource:** Would benefit pelicans and other waterfowl species. **6. Effect on public health and safety:** Would not affect public health or safety.

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
Damage Category: Recreational Human Use **Project goals: Provide additional recreational opportunities to compensate for those lost due to the spill by improving parks and recreation areas, improving urban fishing opportunities, and increasing and maintaining fishing access to the Yellowstone River**		
Develop and improve boat launch sites	Motorized boat launch at Billings Riverfront Park, hand launch site at Billings Riverfront Park, install vault toilet at Laurel Riverside Park boat launch	**1. Cost effectiveness:** Cost effective with potential for match funds or in-kind services from the cities of Billings and Laurel, BLM, State, or local nonprofit trails or other organizations. **2. Meet goals and objectives:** Would meet Trustees' goal of compensating for lost recreational use services that occurred during the incident. **3. Likelihood of success:** Projects would use accepted engineering and construction techniques and standard practices. Projects in Billings' parks have been included in City park master plans and other city planning efforts and vetted in the community. The City of Laurel may want to prepare a master plan at Riverside Park to prioritize other park improvements. At past meetings to discuss restoration, Billings, Laurel, and FWP expressed verbal support for completing the urban lake and pond improvement projects. Past plans that were never completed are available for Laurel Pond. **4. Prevent future injury:** Would compensate for losses during the spill and response period, but would not prevent future injury. Short-term negative impacts during construction would require permits and would minimize adverse impacts. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would compensate for lost recreational use. **6. Effect on public health and safety:** Some projects may improve public health and safety by building safe access points, improving sanitation, or other facilities.
Nature trails	Pave a hiking/biking nature trail at Billings Riverfront Park	
Other park improvements	Develop a Master Plan for Laurel Riverside Park to identify and prioritize additional projects	
	Implement projects in Riverside Park Master Plan	
Recreation area improvements	Repair facilities at Sundance Recreation Area and Pompeys Pillar National Monument	
Urban pond rehabilitation	Lake Josephine, Billings Riverfront Park -develop and implement a fish management plan and habitat improvements	
	Laurel Pond – improve habitat, develop ADA access and shoreline fishing opportunities	

Alternative 2 Preferred Alternative		
Project Type	**Project Example**	**OPA Evaluation Criteria**
Develop a new fishing access site and/ or preserve access to existing sites	Acquire and develop a fishing access site between Laurel and the Huntley Diversion and/ or preserve infrastructure to existing fishing access sites	**1. Cost effectiveness:** Would be cost effective with potential for match funding and in-kind services from FWP. **2. Meet goals and objectives:** Would meet Trustees' goal of compensating for lost recreational services. **3. Likelihood of success:** Likely to succeed in partnership with FWP. FWP has staff who work with fishing site acquisition. Projects would use accepted engineering and construction techniques and standard practices. **4. Prevent future injury:** Would compensate for losses during the spill and response period, but would not prevent future injury. Would not cause collateral injury during implementation. **5. Benefit more than one resource:** Would compensate for lost recreational use. **6. Effect on public health and safety:** Would improve safe access to the Yellowstone River for anglers.
Provide safe access to the river	Huntley Diversion access across railroad tracks	

Notes:
ADA =Americans with Disabilities Act
CEA = Cumulative Effects Analysis
FWP = Fish Wildlife and Parks
BLM = Bureau of Land Management
DNRC = Department of Natural Resources and Conservation
YRCDC = Yellowstone River Conservation District Council

6.0 EVALUATION OF ALTERNATIVES UNDER NEPA AND MEPA

This section addresses the potential overall impacts and other factors to be considered under the National Environmental Policy Act (NEPA) regulations (42 USC § 4321 et seq.; 40 CFR Parts 1500-1508) and the Montana Environmental Policy Act (MEPA) (75-1-102, MCA, *et seq.*). Some of the specific potential impacts were listed within each project description above in Chapter 4, but this chapter addresses the impacts and factors systematically by category under NEPA and MEPA. A table summarizing this information is included at the end of the chapter. A summary of the Trustees' analysis follows.

6.1 Direct and Indirect Impacts Considered by the Trustees

This analysis addresses direct, indirect and cumulative effects of conducting the restoration projects. Direct effects are those caused by the actions proposed and can occur at the same time and place of the action. Indirect effects are caused by the actions proposed and may include effects related to changes in patterns of land use, population density, or growth rate and related effects on air and water and other natural systems.

This draft restoration plan describes and evaluates both potential adverse and beneficial impacts on the natural and human environments. The analysis considers the magnitude of the potential impacts (minor, moderate, and major), the area of the impacts (context), and the likely intensity of the impacts. The analysis is based on a review of available data, reference material and professional judgment.

Minor impacts are generally those that might be detectable but, in their context, may nonetheless not be measurable because any changes they cause are so slight as to be impossible to detect. Moderate impacts are those that are more detectable and, typically, more quantifiable or measureable than minor impacts.

Major impacts are those that, in their context and due to their severity, have the potential to meet the thresholds for significance set forth in Council on Environmental Quality (CEQ) regulations (40 CFR 1508.27) and, thus, warrant heightened attention and examination for potential benefit of mitigation.

6.2 Injured Natural and Human Resources

For all injured resource areas, Alternative 1, the no action alternative would not meet project goals of restoring natural resources and compensating for natural resource losses from the oil spill. Losses of natural resources and their services were, and continue to be, suffered during the period of recovery from the oil spill. These losses would continue for decades under a scenario where natural attenuation is relied upon to recover injured natural resources and the services they provide. Technically feasible project alternatives exist to compensate for the natural resource losses including injuries and losses to terrestrial/riparian habitat, large woody debris, riverine aquatic resources, and both migratory and resident birds. Technically feasible project alternatives also exist to compensate for lost human recreational services due to the oil discharge. Therefore, the Trustees reject the "no-action" alternative and instead have selected the appropriately scaled restoration projects described in this draft restoration plan.

6.2.1 Terrestrial/Riparian Habitat

Under Alternative 2, conservation of terrestrial/riparian habitat through conservation easements, fee title land acquisitions, and restoration of land in the immediate area of and below the spill site would directly protect the riparian area.

Riparian cottonwood forests, shrubs, and grassy meadows are all key components of terrestrial habitat in the Yellowstone River riparian area. The COE & YRCDC (2016) analysis of riparian cover along the Yellowstone River between 1950 and 2001 shows that the classes of riparian cover have changed over time, in part due to the changes in riparian vegetation succession caused by natural channel migration and development. In the injured area, since the 1950s, about 8% of the woody riparian land cover has changed to urban, exurban, transportation, or irrigated uses (COE & YRCDC 2016). In the riparian areas near Billings, in the injured area, the analysis shows that almost 50% of the woody riparian acres have been converted to these other uses (COE & YRCDC 2016) since the 1950s. If past development trends continue, the remaining terrestrial/riparian lands in this reach are at risk of development.

The analysis of injuries summarized in Chapter 3 and included in Appendix C determined that approximately 483 acres of restoration on terrestrial/ riparian and grassland/shrubland habitat types would need to occur to offset the injuries. Over time, protection and management would indirectly improve the riparian area. All of the properties along the riparian area of the Yellowstone are at some risk of development. Some conservation easements and fee title land acquisitions would aim to preserve the mature cottonwood bottomland habitat with intact complex understory. By protecting habitat at risk of development, more primary excavator birds would remain on the landscape and create needed cavities for many species of cavity dependent birds. Some properties in the terrestrial/riparian areas may be selected for restoration projects. Restoration may include fencing, planting and seeding, or practices recommended by the local conservation district (YRCDC 2016) and would be expected to improve native vegetation. Removal of invasive woody species would also improve native vegetation. With these active restoration projects, the terrestrial/riparian habitat would recover more quickly than under Alternative 1. The Trustees' best professional judgment is that degraded conditions would take between 20 and 60 years to reach full benefits of repair (see Appendix B). Habitats that were injured and that would be conserved include terrestrial/riparian habitat, grassland/shrubland, and mature bottomland. Mature cottonwood bottomland acquisitions would protect intact mature cottonwood habitat required by primary excavator bird species and allow cavity nesting bird population recovery to occur more quickly due to the avoided loss (Appendix C). Properties would be selected in or near the injured area.

6.2.2 Large Woody Debris Piles

Under Alternative 2, acquisition of cottonwood bottomlands in the channel migration zone through channel migration zone easements, other easements, or fee title land acquisitions would provide sources for large woody debris to the system. Properties would be selected from Reed Point to Billings, up river and in the upper reaches of the impacted area, to provide sources for the large woody debris pile area that was most affected. The easements or fee title land acquisitions would focus on mature cottonwood bottomlands in the channel migration zone and be aimed at preventing bank stabilization and logging, but may not preclude grazing, farming or other agricultural practices.

Providing sources of large woody debris to the system would directly support faster recovery of large woody debris piles. Large woody debris piles provide multiple geomorphic and ecological services that include island formation, reduced erosion on islands and along river banks, providing shelter and food for fish, invertebrates, small mammals, birds, reptiles, and amphibians, and can serve as substrate for aquatic invertebrates, which are an important food source for fish. Moreover, large woody debris can provide organic material and nutrients in both aquatic and terrestrial environments. Lastly, restoration of large woody debris piles would provide depositional habitat exposed to sunlight that supports cottonwood regeneration and protection from ice-scouring in winter (See Appendix C).

Removal of other hindrances to natural fluvial processes on the river such as flanked riprap and channel blockages would also allow the natural riverine system to function in a manner that incudes recruitment and distribution of large woody debris.

6.2.3 Riverine Aquatic Habitat

Alternative 2 would result in improved access to spawning and rearing habitat for warm water fishes through fish passage projects and improved habitat in the river through soft bank stabilization in areas that need to protect infrastructure. Across the U.S. and locally, fish passage and entrainment protection measures have been shown to effectively prevent loss of fish, restore connectivity with habitat, and increase fish abundance, without negatively affecting agricultural practices (DOI and COE 2016; FWP 2016). Since removal of the blockage at the mouth of Pryor Creek in 2011, warm water fish have been repopulating the lower portions of Pryor Creek where they have not had access for close to 100 years (YRCDC 2012). Similar success is expected with the removal of other fish barriers on the Clarks Fork of the Yellowstone would expect to have similar success. Recovery of populations is anticipated to be quicker than under Alternative 1.

Soft bank stabilization in areas requiring infrastructure protection would benefit riverine habitat for fish while developing habitat to benefit riparian wildlife species. Removal of flanked riprap would preserve and create riparian habitat. Removal of channel blockages in side channels of the Yellowstone would create more aquatic side channel habitat along the Yellowstone River. Up to 17 miles may be reactivated.

6.2.4 American White Pelican

Under Alternatives 2, with protection of nests through predator reduction, water purchases, and fencing, pelicans would have greater likelihood of nesting success and thus successful replacement of the injured population and recovery of the Yellowstone River pelican population.

6.2.5 Recreational Human Use

Under Alternative 2, after recreation projects are completed, the public would expect to have greater recreational activity and fishing opportunities in city and urban parks and public recreation areas. The public would also have more and safer access points to the Yellowstone River.

6.3 Other Natural and Human Resources Considered by Trustees

Overall, the preferred restoration alternatives included in alternative 2, would enhance the functionality of the ecosystem by improving aquatic connectivity, water quality, and restoring native species. There could be some short-term, direct and localized negative impacts, though not significant, from the selected restoration projects, as described below.

6.3.1 Construction, Sound, and Air Pollution

Machinery and equipment used during construction and other restoration activities could generate sound that could temporarily directly disturb wildlife and humans near the construction activity. As discussed in more detail in the previous sections, there could be additional short-term negative impacts on fish and wildlife species as a result of construction activities. In accordance with State and Federal permit conditions, in-water work would be timed and conducted in a manner to minimize impacts to fish and other aquatic life. Impacts on mobile species (e.g., birds, mammals) are expected to be minor, consisting of short-term displacement and timing of construction would be considered regarding breeding and nesting periods of migratory birds. Overall, construction of fencing in terrestrial/riparian habitat, removal of invasive woody species, and the construction of the riverine aquatic habitat projects as part of the preferred alternatives would provide long-term benefits to fish and wildlife species that depend on these types of habitat. Construction of recreation projects would be short term and minor.

6.3.2 Federally Threatened, Endangered, and Candidate Species and Montana Species of Concern

Most projects would occur in Yellowstone County, and some in Carbon County, Phillips County, and Sheridan County. Federally listed endangered, threatened, and candidate species occur in Yellowstone, Carbon, Phillips and Sheridan counties but are unlikely to occur at the location of the proposed conservation easement, fee title land acquisition, fish passage, river function, pelican, and recreation projects. These proposed projects would be unlikely to affect candidate, threatened, and endangered species, including projects proposed for Bowdoin and Medicine Lake National Wildlife Refuges. However, coordination with the USFWS would be completed pursuant to Section 7 of the Endangered Species Act if it is determined that affects may occur. Montana species of concern may also be present in the restoration areas. When the projects are selected, coordination would occur with FWP.

6.3.3 Water Quality and Sediment

Temporary and localized direct adverse impacts may occur as a result of increases in erosion, turbidity and sedimentation related to construction activities associated with certain riverine restoration projects. However, the use of best management practices along with other avoidance and mitigation measures required by the regulatory agencies would be employed to minimize any adverse water quality and sedimentation impacts.

6.3.4 Visual Resources

There may be temporary and localized adverse direct minor visual impacts during construction of some of the restoration projects. Completion of the restoration projects is generally expected to result in improved viewscapes.

6.3.5 Archeological and Cultural Resources

Because the proposed projects occur in riverine systems or occur in existing road right-of-ways, and do not disturb terrestrial soils, the Trustees believe there are no known archaeological sites or sites of cultural significance that would be disturbed. As appropriate, the Trustees would work with project managers during the permitting process to ensure that they consult with the State Historical Preservation Office (SHPO) to confirm that there are no known archeological and cultural sites within the project areas. If sites are discovered, the Trustees would work with the project manager to redesign projects so as to minimize or not adversely affect any known archaeological sites or sites of cultural significance, or a similar project in a different location in the watershed would be substituted. Removal of invasive woody species and protection of native vegetation along the riparian area would protect any culturally important riparian areas. If the Pryor Creek fish passage project moves forward, native fish would have access to Pryor Creek on the Crow Reservation.

6.3.6 Other Resources (soil, geology, energy use, land use, transportation, pipeline crossings)

No significant adverse effects are anticipated to soil, geologic conditions, energy consumption, wetlands, or floodplains. The selected restoration projects would have minimal adverse social or economic impacts on local neighborhoods or communities, with restoration integrated with existing agricultural uses to the extent practicable. The Trustees expect that all of these projects would provide ecological benefits and some would also improve recreational use for hiking, biking, boating, fishing, and wildlife observation. The proposed restoration project types would not likely affect the existing Interstate 90 and railroad transportation corridors. During construction of some projects, traffic may temporarily be increased in the immediate area. For large woody debris project land acquisitions, consideration would be given to whether a proposed acquisition is near to a pipeline crossing.

6.3.7 Regulatory Restrictions Analysis

Although conservation or channel migration easements may restrict private land use, projects would only be undertaken with willing landowners and would not impose any additional regulatory restrictions.

6.3.8 Climate Change

CEQ released Final Guidance for Federal Departments and Agencies on Consideration of Greenhouse Gas Emissions and the Effects of Climate Change in NEPA National Environmental Policy Act Reviews (August 1, 2016). The guidance recommends that federal agencies should consider 1) the potential effects of a proposed action on climate change as indicated by assessing greenhouse gas emissions, including, where applicable, carbon sequestration; and 2) the effects of climate change on a proposed action and its environmental impacts. The Trustees believe it is possible that the net effect of ecosystem restoration actions resulting in short-term biogenic emissions may lead to long-term reductions of atmospheric greenhouse gas emissions concentrations through increases in carbon stocks or reduced risks of future emissions. For ecosystem restoration projects, agencies should include a comparison of estimated net greenhouse emissions, including biogenic emissions, and carbon stock

changes that are projected to occur with and without implementation of proposed actions. When agencies do not quantify an action's projected greenhouse gas emissions because tools, methodologies, or data inputs are not reasonably available to support calculations for a quantitative analysis, CEQ recommends that agencies include a qualitative analysis in the NEPA document and explain the basis for determining that quantification is not warranted. Reasonableness and proportionality would be used to determine the extent of the analysis. Due to the programmatic nature of this restoration plan, as additional planning proceeds, and subsequent NEPA review is necessary, quantitative estimates may be generated and made available in tiered restoration plans and NEPA analyses led by federal Trustees. As part of planning ecological restoration projects, the federal Trustees will use existing climate change planning tools during design, maintenance, and monitoring phases.

In addition, USFWS will follow the framework set forth in the USFWS document entitled "Rising to the Urgent Challenge: Strategic Plan for Responding to Accelerating Climate Change," to help ensure the sustainability of fish, wildlife, plants and habitats in the face of accelerating climate change (See: http://www.fws.gov/home/climatechange /pdf/CCStrategicPlan.pdf). As required, USFWS will use Stein (et al. 2014) to determine what constitutes "good" climate adaptation, how to recognize those characteristics in existing work, as well as how to design new interventions when necessary. USFWS policy requires offices to evaluate and address the impacts of climate change; by incorporating climate change adaptation measures in planning and decision-making so that the agency can more effectively manage fish, wildlife, plants, and associated ecological processes to achieve its mission.

6.4 Cumulative Impacts

Cumulative environmental impacts are those combined effects on the quality of the human environment that result from the incremental impact of the alternative when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7, 1508.25(a) and 1508.25(c)). In March 2016 the YRCDC completed a comprehensive cumulative effects analysis of the entire Yellowstone River corridor, including the restoration area (COE and YRCDC 2016). The study looked at past and ongoing human impacts to the Yellowstone River from agricultural development, transportation development, urban and exurban development. The cumulative effects analysis also included trends in impacts, if development continues similarly, and resulted in a number of recommended practices for activities on the river to address the major impacts identified (YRCDC 2016) and to promote an ecologically sustainable river for preserving the long-term economic viability of the communities who rely on the Yellowstone River. This restoration plan incorporates some of the recommended practices as project types.

The cumulative effects analysis (COE and YRCDC 2016) observes that agriculture has had the largest overall effect on the physical and biological condition of the river with riparian clearing, irrigation infrastructure and development, flow diversions and bank armoring. The proposed project types would not be expected to have major effects on agricultural land uses or operations in the restoration area.

Transportation land uses have resulted in floodplain isolation and bank armoring. In the restoration area, urban and exurban development near Billings has contributed substantially to bank armoring and reduced channel migration. In the reaches near Billings, 930 acres of the mapped channel migration zone are developed as urban or exurban (YRCDC 2016). The proposed project types would not be expected to have major impacts to transportation networks.

Overall, proposed preferred projects would result in a long-term net improvement in river ecosystem function in the Yellowstone River protecting terrestrial/riparian areas at risk of future development, by improving wildlife habitat with restoration projects, by providing fish passage and habitat, and by removing hindrances to natural fluvial processes in the injured area. The projects would also compensate for human recreational injuries that occurred because of the oil spill.

As the proposed preferred projects are intended to achieve recovery of injured natural resources, the cumulative environmental consequences would be largely beneficial for birds, wildlife, habitat, aquatic resources, and the human environment. All the anticipated adverse impacts would be short-term and localized, would occur during project construction, and would be minimized at the time of project implementation. For example, local effects at construction sites would be minimized by silt fencing and other erosion control techniques. The permit process required for work in streams, rivers, floodplains, and wetlands would ensure that these projects are reviewed in the context of any similar projects that might be implemented in the area, including those by the federal agencies, state, county, conservation districts, or others. Any unanticipated negative cumulative adverse effect identified before project implementation would result in reconsideration of the project by the Trustees.

Active habitat restoration or land transactions would be conducted with willing landowners. The overall quality of life for the surrounding communities would improve with these restoration alternatives, through increased economic and recreational opportunities, especially considering the improved opportunities for fishing and wildlife viewing.

6.5 NEPA/MEPA Comparison of All Restoration Alternatives Considered by Trustees

Table 6-1 outlines the impact of each restoration alternative on the injured resources and other natural and human resources considered by the Trustees.

Table 6-1 Environmental Impact Analysis Summary

Resource	Alternative 1 – No Action/Natural Recovery	Alternative 2 – Trustee Preferred Projects Addressing All Injury Categories
Terrestrial/Riparian habitat (includes habitat for cavity nesting birds)	Long-term recovery of riparian vegetation, no compensation for lost services during the recovery, no protection of complex understory for cavity nesting birds.	Terrestrial/riparian habitat would recover more quickly with protection of and restoration of terrestrial/riparian habitat, grassland/shrubland habitat, and cottonwood bottomland (includes protection of complex understory for cavity nesting birds) that are presently at risk of development or are currently degraded. Protection of these properties would be assured over the long term because the properties would be put into conservation easement or acquired. Some projects would include only habitat preservation, but others would include active restoration such as planting and seeding native vegetation, fencing, noxious weed control, invasive woody weed removal, and other methods that would be specified in a land management plan. Public ownership and management would maintain or enhance the terrestrial/riparian habitat and species through the implementation of these adaptive management plans. Conservation easements and land management plans will include terms and conditions to protect and enhance the quantity, quality and character of the terrestrial/riparian habitat. Some large woody debris projects may benefit terrestrial/riparian habitats.
Large Woody Debris Piles	Long-term recovery of large woody debris piles, but no protection of source areas.	Large woody debris piles would be formed by natural processes in the river. Faster recovery of piles and river functions they provide (supporting island formation and helping to reduce erosion on islands and along river banks, providing shelter and food for fish, invertebrates, small mammals, birds, reptiles, and amphibians, provide surface area for the growth of aquatic invertebrates, provide a source of organic material and nutrients in both aquatic and terrestrial settings, provide depositional habitat exposed to sunlight that supports cottonwood regeneration and protection from ice-scouring in winter). These benefits would be accomplished by securing a long-term source of wood for the large woody debris piles in suitable areas in and immediately upstream from the injured area. Restoring natural function through removal of non-functioning riprap and reactivating side channels would help large woody debris be distributed and re-establish piles.
Riverine/Aquatic Habitat	Long-term recovery of riverine/aquatic habitat. No mitigation of losses to warm water fish.	Improved access to spawning and rearing habitat for warm water fishes through fish passage projects, better habitat in river through soft bank stabilization in the immediate area. Recovery of populations is anticipated to occur sooner than under Alternative 1. Soft bank stabilization would benefit riverine habitat for fish requiring infrastructure protection while developing habitat to benefit riparian wildlife species. Removal of flanked riprap would preserve and create riparian habitat. Removal of side channel blockages would create more aquatic side channel habitat.
American White Pelican	No mitigation to improve nesting success of pelicans using the Yellowstone River.	Greater likelihood of nesting success and thus replacement of injured population.
Recreation	No improvement of Yellowstone River access, no improvement of urban parks or fishing opportunities.	After recreation projects are completed, the public would expect to have greater recreational activity and fishing opportunities in city and urban parks and at recreation areas along the Yellowstone River, and safer access points to the Yellowstone River.

Resource	Alternative 1 – No Action/Natural Recovery	Alternative 2 – Trustee Preferred Projects Addressing All Injury Categories
Construction, Sound and Air Pollution	No impacts	Short term noise from construction projects could negatively impact wildlife and humans near the activity. There could be short-term, minor, negative impacts on fish and wildlife species. Long-term benefits to fish and wildlife species would result from construction projects.
Threatened and Endangered Species and Montana Species of Concern	No impacts, no threatened and endangered species directly in the injured area.	No threatened and endangered species in injured area; construction projects would not likely affect threatened and endangered species or Montana species of concern, but selected projects would be coordinated with USFWS or FWP, as appropriate. Proposed projects would be unlikely to affect candidate, threatened, and endangered species, including projects proposed for Bowdoin and Medicine Lake National Wildlife Refuges. However, coordination with the USFWS would be completed pursuant to Section 7 of the Endangered Species Act if it is determined that affects may occur.
Water Quality and Sediment	No impacts	Local effects of construction projects would be minimized by use of best management practices.
Visual	No impacts	After projects requiring construction are completed, short-term visual resources are expected to improve.
Archeological and Cultural Resources	Native landscapes would not be restored with removal of invasive vegetation. Fish passage would not be improved for warm water fisheries in tributaries.	As appropriate, the Trustees will work with project managers during the permitting process to ensure that they consult with the State Historical Preservation Office (SHPO) to confirm that there are no known archeological and cultural sites that would be disturbed. If sites are discovered, the Trustees would work with the project manager to redesign projects so as to minimize or not adversely affect any known archaeological sites or sites of cultural significance, or a similar project in a different location in the watershed would be substituted. Removal of invasive woody species and protection of native vegetation along the riparian area would protect culturally important riparian areas. If the Pryor Creek project moves forward, fish passage for warm water fish would be opened on the Crow Reservation.
Economic, Historic, Land Use and Transportation Resources	Access to Yellowstone River and recreational areas would not be improved	Overall quality of life would improve through increased economic and recreational opportunities, especially through better opportunities for fishing, hiking, biking, recreation and wildlife viewing.
Regulatory Restrictions	No impact to regulatory restrictions.	Although easements may restrict land use, projects would only be undertaken with willing landowners and would not impose any additional regulatory restrictions.
Cumulative Impacts	No short term impacts during construction of projects because no projects would be completed. No long-term benefits to fish and wildlife, nor to recreational access.	As the proposed preferred projects are intended to achieve recovery of injured natural resources, the cumulative environmental consequences would be largely beneficial for birds, wildlife, habitat, aquatic resources, and the human environment. All the anticipated adverse impacts would be short-term and localized, would occur during project construction, and would be minimized at the time of project implementation. Implementation of proposed projects would result in long-term improvements to fish and wildlife habitat in the injured area. Overall quality of life should improve with increased aesthetics and recreational opportunities.

7.0 Implementation Plan

This section explains the process that would be followed in the development, design and implementation of the restoration plan.

General implementation process

OPA regulations provide that trustees should consider certain actions to facilitate implementation of restoration, including establishing a memorandum of understanding to coordinate between the trustees; developing more detailed work plans to implement restoration; monitoring and overseeing restoration; and evaluating restoration success and the need for corrective action.

The Trustees will separately manage implementation of the project types and projects contained in the final restoration plan, but will coordinate their activities on a programmatic level, and will seek State, federal, local, and private partners to help develop, design, manage, provide additional funding, and/or implement identified projects.

As described below, certain projects and project types will be implemented by either the State trustee or federal trustee, and will follow parallel implementation processes. The Trustees plan to work with project partners such as, but not limited to, local, state, and federal agencies, conservation districts, weed districts, nonprofit organizations, and landowners. The specifics of implementation will depend, in part, on particulars of each project type or project included in this restoration plan, and methods for project implementation will vary based on the type of project and identified project partners. Below are some general implementation categories, followed by some examples. Project-specific administration and oversight costs for project management will be included in project implementation budgets, and will be provided on a reimbursement basis to any partners.

Restoration plan projects can generally be divided into those that involve property acquisitions and those that involve construction. For property acquisitions and conservation easements, the Trustees will work with project partners and/or landowners to determine fair market value of the property. Acquisition can occur if the property interests are offered at or below fair market value and meet the goals and objectives of the restoration plan.

Project implementation which involves construction will generally be completed and reported in the following phases, where applicable: engineering and design, construction, monitoring, long-term maintenance, and project completion. Engineering and design will be completed by the implementing Trustee or its partner(s). When that phase is complete, the project will move into the construction phase. During construction, the implementing Trustee and/or its partner will monitor construction activities to assure consistency with the restoration plan and any scope of work, as well as monitor for compliance with any required regulatory permits and consultations in order to avoid environmental impacts. When the construction phase is complete, the project will move into the monitoring phase. Reports on the outcomes of construction and as-built documentation will be produced as applicable.

Specific monitoring and adaptive management plans will be developed for each project concurrent with its development and implementation. The project management and monitoring plans will include measurable restoration objectives that are specific to the injury and the Trustees' restoration goals, and performance criteria that will be used to determine project success or the need for corrective actions. Restoration project monitoring plans will address duration and frequency, sampling level, reference sites (as needed), and its reasonable costs. Adaptive management will include corrective actions, as needed, in order to adhere to the restoration plan.

The implementing Trustee will ensure that appropriate long-term maintenance activities likely to be required for each project are identified, and that appropriate budgets and agreements are established to maintain each project over its intended lifespan. The implementing Trustee may identify a partner as a long-term steward of a completed project, and project funds may be allocated for that involvement.

A project is complete after all activities and expenditures have been accomplished for that project per the restoration plan, including monitoring, long-term maintenance, and final reports. Any excess project funds will be returned to the account and will remain dedicated to the same restoration category as that associated with the completed project. If the implementing Trustee determines that a project should be terminated, the remaining funds that will have been spent on that project will remain dedicated to the same restoration category.

For Federal Lead Projects:

For conservation easements or acquisitions, the USFWS will focus on protecting or restoring habitat suitable for cavity nesting birds that were injured as a result of the spill. To accomplish this, the USFWS will develop a ranking table to help prioritize the selection of conservation easements and acquisitions so that the properties that are being pursued are achieving the most benefits and are protecting or restoring the injured resource. For instance, certain habitat features will be included in the ranking table to ensure that the appropriate cavity nesting habitat is preserved when selecting easement lands for cavity nesting bird projects.

In coordination with project partners such as DNRC and the Yellowstone County Weed District, BLM will implement invasive woody plant removal on BLM-managed properties.

For the American white pelican and associated waterfowl project, the USFWS will implement these projects at Bowdoin and Medicine Lake National Wildlife Refuges.

For State Lead Projects:

For State lead projects, the projects will be implemented through the Montana Natural Resource Damage Program (NRDP). For projects involving project partners and construction, NRDP will endeavor to negotiate a contract with the project partners to specify a scope, schedule and budget for completion of the project. NRDP may share some of the project tasks with the project partner, or may contract out some tasks. The contract must be completed before work can occur on the project. For projects with project partners:

- Costs for project administration activities will be capped at 5% of the total estimated project development and design costs.

- As part of the project development efforts, project partners should pursue opportunities to obtain matching funds or in-kind services for the full project to increase the project's cost-effectiveness.

- Procurement for all projects must meet or exceed State procurement requirements, including legal procurement for all environmental consulting, engineering and design activities.

- If a project is completed under budget, the remainder funds will be used for the same restoration project type. Some projects may not reach implementation phase, depending on the results of the project development phase.

- All restoration work on private land will require landowner agreement to protect projects for a specific length of time.

- Specific projects may require additional MEPA or NEPA review and public participation during project development and implementation.

- Entities contracted for project implementation must obtain all required permits.

The specifics of implementation will depend, in part, on particulars of each project type included in this restoration plan, and the methods for project implementation will vary on the type of project and any identified project partners.

For conservation easements or acquisitions, NRDP will develop a ranking table prior to significant purchases to help prioritize conservation easements and acquisitions so that properties achieving the most benefits are pursued. NRDP will work with project partners such as FWP and nonprofit organizations and with area landowners to help identify properties suitable to meet the project goals of conservation or restoration of cottonwood bottomland, or altered terrestrial riparian land and for large woody debris recruitment. NRDP may work with nonprofit land conservation organizations to secure the properties or easements. Acquisition may only be approved when the price to be paid for the property is equal to or less than the fair market value. An independent appraisal by a qualified appraiser which complies with the Uniform Standards of Professional Appraisal Practice will be required to verify the property's value.

For terrestrial/riparian restoration projects, NRDP will work with state, federal, local and private project partners to help identify potential sites for terrestrial/riparian restoration. For invasive woody plant removal, NRDP will work with project partners such as FWP, DNRC, and the Yellowstone County Weed District to help identify areas on State-owned lands.

NRDP will work with FWP and the local conservation districts to help identify projects to restore river function. NRDP will work with FWP and the local conservation districts or irrigation companies to help identify locations in tributaries to restore fish passage. NRDP will work with FWP and the local conservation districts or private entities to help identify locations to restore or create aquatic habitat.

NRDP will work with the City of Billings and other local entities to help identify priority projects in the Riverfront Park and Coulsen Park master plans in order to improve those urban parks. NRDP will work with the City of Laurel and other local entities to prepare a Riverside Park Master Plan to help guide selection of projects at the park. NRDP will work with both cities and local entities to improve urban fishing opportunities. NRDP will work with FWP and local entities to help develop additional access points or maintain existing access points to the Yellowstone River.

Public Outreach

Most projects will require additional NEPA/MEPA analysis tiered to the restoration plan, but focused on the specific project. The public will have an opportunity to comment on these project(s) when they are further developed. An EA checklist template is included in Appendix A.

As needed, the Trustee(s) will hold additional public meetings in the restoration area. The Trustees will also provide periodic notices and annual reports to the public on the progress of the restoration plan implementation.

8.0 PREPARERS, AGENCIES, AND PERSONS CONSULTED

8.1 Preparers

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8.2 Agencies and persons consulted

Federal Agencies
U.S. Fish and Wildlife Service, Helena, MT
Bureau of Land Management, Billings, MT

State Agencies
Montana Department of Environmental Quality
Montana Department of Fish, Wildlife and Parks
Montana Department of Natural Resources and Conservation

Local Government
City of Billings
City of Laurel
Yellowstone County Conservation District
Yellowstone River Conservation District Council

Tribes
Crow Nation

9.0 COMPLIANCE WITH OTHER AUTHORITIES

9.1 Laws

The following federal, state, and local laws, regulations, and policies may affect implementation of the restoration projects. Any project sponsors that receive natural resource damage funding will be responsible for obtaining necessary permits and complying with relevant federal, state, and local laws, policies, and ordinances.

9.1.1 Federal Laws and Policies

Bald and Golden Eagle Protection Act, 16 USC, 668-668c.
The Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c), enacted in 1940, and amended several times since then, prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The Act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." "Disturb" means: “to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior."

Federal Water Pollution Control Act, 33 USC,1251, *et seq*. (also known as the Clean Water Act or CWA)

The CWA is intended to protect surface water quality, and regulates discharges of pollutants into waters of the United States. All proposed restoration projects will comply with CWA requirements, including obtaining any necessary permits for proposed restoration actions. Restoration projects that move material in or out of waterways and wetlands, or result in alterations to a stream channel, typically require CWA Section 404 permits. Dam removal actions also require 404 permits. Projects will be required to obtain the appropriate permits before restoration work begins.

As part of the Section 404 permitting process, consultation under the Fish and Wildlife Coordination Act, 16 USC § 661, *et seq*. generally occurs. This act requires that federal agencies consult with the USFWS, the National Marine Fisheries Service (NMFS), and state wildlife agencies to minimize the adverse impacts of stream modifications on fish and wildlife habitat and resources. Consultation with NMFS is not applicable to this restoration plan for an inland watershed in Montana.

Compliance with the Rivers and Harbors Act, 33 USC § 401, *et seq*., generally occurs as part of the Section 404 permitting process. The Rivers and Harbors Act prohibits unauthorized obstruction or alteration of navigable waters. Any required permits under the Rivers and Harbors Act are generally included with the Section 404 permitting process.

Clean Air Act (CAA) of 1970, as amended, 42 USC § 7401, *et seq.*
The CAA regulates air emissions from stationary and mobile sources to protect human health and the environment. Any activities associated with the restoration projects that result in air emissions (such as construction projects) will be in compliance with the CAA and any local air quality ordinances.

Federal Endangered Species Act (ESA) of 1973, as amended, 16 USC §§ 1531, *et seq.*
The federal ESA was designed to protect species that are threatened with extinction. It provides for the conservation of ecosystems upon which these species depend and provides a program for identification and conservation of these species. Federal agencies are required to ensure that any actions are not likely to jeopardize the continued existence of a threatened or endangered species. Federally listed endangered, threatened, and candidate species occur in Yellowstone, Carbon, Phillips, and Sheridan counties but are unlikely to occur at the location of the proposed projects. Coordination with the USFWS will be completed pursuant to Section 7 of the ESA. Consultation is also incorporated into the CWA Section 404 and 401 permitting process noted above.

Fish and Wildlife Conservation Act, 16 USC § 2901, *et seq*.
The Fish and Wildlife Conservation Act authorizes financial and technical assistance to state governments to develop, revise, and implement conservation plans and programs for nongame fish and wildlife. The Trustees will seek to coordinate their restoration efforts with relevant conservation plans and programs in the State of Montana.

Fish and Wildlife Coordination Act, 16 USC § 661, *et seq.*
The Fish and Wildlife Coordination Act authorizes the involvement of the USFWS in evaluating impacts to fish and wildlife from proposed water resource development projects. Federal agencies that construct, license, or permit water resource development projects are required to consult with the USFWS, and in some instances with NMFS, concerning the impacts of a project on fish and wildlife resources and potential measures to mitigate these impacts. The Trustees will engage in coordination if relevant to any of their projects.

Information Quality Act of 2001 (guidelines issued pursuant to Public Law 106-554)
As the lead federal natural resources Trustee for this document, BLM confirms that this information product meets its Information Quality Act guidelines, which are consistent with those of the DOI and the Office of Management and Budget.

Migratory Bird Treaty Act of 1918, as amended, 16 USC §§ 703-712
The Migratory Bird Treaty Act protects all migratory birds and their eggs, nests, and feathers and prohibits the taking, killing, or possession of migratory birds. The proposed restoration actions would not result in the taking, killing, or possession of any migratory birds.

Migratory Bird Conservation Act, 16 USC § 715, *et seq*.
The Migratory Bird Conservation Act established a commission and conservation fund to promote the conservation of migratory waterfowl and offset or prevent serious loss of important wetlands and other waterfowl habitat. The Migratory Bird Conservation Fund could potentially provide a source of additional funding to expand on Trustee efforts to conserve or restore migratory waterfowl habitat.

National Historic Preservation Act (NHPA) of 1966, as amended, 16 USC §§ 470, *et seq*.
NHPA is intended to preserve historical and archaeological sites. Compliance with the NHPA would be undertaken through consultation with the Montana State Historic Preservation Office. If an eligible historic property is within the area of the proposed restoration project, then an analysis will be made to determine whether the project would have an adverse effect on this historic property. If the project will have an adverse effect on historic properties, then the agency proposing the restoration project will consult with the State Historic Preservation Office to minimize the adverse effect.

National Environmental Policy Act (NEPA) 42 USC § 4321, *et seq.*
Preparation of an environmental assessment will fulfill partial compliance with NEPA. Full compliance shall be noted at the time of Finding of No Significant Impact or Record of Decision is issued. The Trustees have integrated this draft restoration plan with the NEPA process to comply, in part, with those requirements. This integrated process allows the Trustees to meet the public involvement requirements of OPA and NEPA concurrently. The final restoration plan will accomplish compliance by summarizing the current environmental setting, describing the purpose and need for the restoration actions, identifying alternative actions, assessing the preferred actions' environmental consequences, and summarizing opportunities for public participation in the decision process.

Occupational Safety and Health Act (OSHA) of 1970, as amended, 29 USC §§ 651, *et seq*.
OSHA governs the health and safety of employees from exposure to recognized hazards, such as exposure to toxic chemicals, excessive noise, mechanical dangers, and unsanitary conditions. All work conducted on the proposed restoration actions will comply with OSHA requirements, where applicable.

Oil Pollution Act of 1990 (OPA), 33 USC 2701-2706, *et seq*., 15 CFR Part 990
OPA establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. OPA provides a framework for conducting sound natural resource damage assessments that achieve restoration. The process emphasizes both public involvement and participation by the Responsible Parties. The Trustees have conducted this assessment in accordance with OPA regulations.

Watershed Protection and Flood Prevention Act as amended, 16 USC 1001, *et seq.*
Floodplain impacts will be considered prior to selection of final projects plans.

The following federal policies and Presidential Executive Orders may be relevant to the proposed restoration projects in the proposed alternative:

USFWS Mitigation Policy (Fish and Wildlife Service Manual, 501 FW 2)
This policy of the USFWS seeks to ensure "no net loss" of fish and wildlife habitat as a result of USFWS actions. The Trustees do not anticipate that any of the proposed projects will result in adverse impacts to habitat.

Executive Order 11514 – Protection and Enhancement of Environmental Quality, as Amended by Executive Order 11911 Relating to Protection and Enhancement of Environmental Quality
These Executive Orders require federal agencies to monitor, evaluate, and control their activities to protect and enhance the quality of the Nation's environment. These Executive Orders also require agencies to inform the public about these activities and to share data on environmental problems or control methods, as well as to cooperate with other governmental agencies. The actions described in this restoration plan/environmental assessment address the intent of these Executive Orders.

Executive Order 11593 – Protection and Enhancement of the Cultural Environment

Coordination with the State Historic Officer will signify compliance. Consultation is incorporated into the CWA Section 404 and 401 permitting process.

Executive Order 11988, 24 May 1977 amended by Executive Order 12148, 20 July 1979 – Floodplain Management
This Executive Order directs federal agencies to avoid the occupancy, modification, and development of floodplains, when there is a practical alternative. For all projects, the Trustees will work to ensure that any floodplain impacts are minimized. Public notice of the availability of this report or public review fulfills the requirements of Executive Order 11988, Section 2(a) (2). Consultation is incorporated into the CWA Section 404 and 401 permitting process.

Executive Order 11990 – Protection of Wetlands
This Executive Order instructs federal agencies to avoid adverse impacts associated with destruction or modification of wetlands. The Trustees will work to ensure that projects minimize any wetlands impacts. Public notice of the availability of this report for public review fulfills the requirements of Executive Order 11990, Section 2 (b). Consultation is incorporated into Sec. 404 and 401 permitting process.

Executive Order 12898 – Environmental Justice
This Executive Order instructs federal agencies to assess whether minority or low-income populations would be disproportionately impacted by agency actions. The proposed projects are not expected to adversely affect the environment or human health for any environmental justice populations in the vicinity of the proposed projects.

Executive Order 12962 – Aquatic Systems and Recreational Fisheries
This Executive Order requires that federal agencies, where practicable and permitted by law, work cooperatively to improve the quantity, function, sustainable productivity, and distribution of aquatic resources for increased recreational fishing opportunities. The Trustee agencies worked cooperatively to identify potential projects that would benefit aquatic resources and recreational fishing opportunities, in compliance with the intent of this Executive Order.

Executive Order 13007 – Accommodation of Sacred Sites
This Executive Order is not applicable unless on Federal lands, then agencies must accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites.

Executive Order 13045 – Protection of Children from Environmental Health Risks and Safety Risks
The proposed projects in this draft restoration plan would not create a disproportionate environmental health or safety risk for children.

Executive Order 13112 – Invasive Species
This Executive Order requires that federal agencies, where practicable and permitted by law, should identify any actions that may affect the status of invasive species and take actions to address the problem within their authorities and budgets. Agencies also are required not to authorize, fund, or carry out actions that they believe are likely to cause or promote the introduction or spread of invasive species, unless a determination is made that the benefits of actions outweigh potential harms and measures are taken to minimize harm. None of the proposed preferred restoration projects would promote the introduction or spread of invasive species and several will reduce invasive species.

Executive Order 13186 – Protection of Migratory Birds
This Executive Order requires federal agencies to evaluate the effects of their actions on migratory birds, to take actions to avoid or minimize the impacts of their actions on migratory

birds, and to help promote conservation of migratory birds if actions are likely to have a measurable negative effect on migratory bird populations. None of the projects proposed here are expected to have a negative effect on migratory bird populations.

Executive Memorandum on the Analysis of Impacts on Prime or Unique Agricultural Lands in Implementing NEPA (11 August, 1980)
Not applicable since the proposed preferred projects do not involve or impact prime or unique agricultural lands.

DOI Departmental Manual, Parts 517 and 609 – Pesticides and Weed Control
Implementation of any of the projects described in this restoration plan/environmental assessment will be consistent with DOI policy to use integrated pest management strategies for control of insect and weed pests. Pesticides or herbicides will only be used after a full consideration of other control alternatives; the material selected and method of application will be the least hazardous of available options.

DOI Departmental Manual, Part 518 – Waste Management
If implementation of any alternatives generates waste, the Trustees will comply with all relevant DOI directives and policies.

DOI Departmental Manual, Part 602 – Land Acquisition, Exchange, and Disposal
If the federal government acquires any real property through implementation of these restoration projects, appropriate pre-acquisition standards – particularly the American Society for Testing and Materials standard for Environmental Site Assessments for Commercial Real Estate – will be complied with.

9.1.2 State Laws

Montana Floodplain and Floodway Management (76-5-100, MCA, *et seq*.)
Applicants proposing new construction within designated floodplains must obtain this permit. All required local, state, and federal permits must be issued before a floodplain permit can be issued. An applicant may be required to hire a professional engineer. Prior to submitting an application, the applicant must also contact the local floodplain administrator at the city or county office.

Montana Land Use License or Easement on Navigable Waters (77-1-11, MCA, *et seq*.)
Any entity proposing a project below the low water mark that includes construction, placement, maintenance, or modification of a structure or improvements in, over, below, or above a navigable river must apply for a land-use license or easement.

Montana Natural Streambed and Land Preservation Act (310 Permit) (75-7-101, MCA, *et seq*.)
Any private, nongovernmental individual, or entity that proposes to work in or near a stream on public or private land for any activity that will physically alter or modify the bed or banks of a perennially flowing stream must obtain a permit from the local conservation district office. Some of the project types proposed in this draft restoration plan may require a 310 permit.

Montana Water Quality Act (318 Authorization)(75-5-318, MCA, *et seq*.)

Any public or private entity initiating a construction activity that will cause short term or temporary violations of state surface water quality standards must get a permit. State water

includes any body of water, irrigation system or drainage system, either surface or underground, including wetlands, except for irrigation water where the water is used up within the irrigation system and the water is not returned to other state water. Some of the proposed project types in this draft restoration plan may require a 318 permit.

Montana Streambed Protection Act (124 permit)(75-7-101, MCA, *et seq*.)
Any agency or subdivision of State, county or city government proposing a project that may affect the bed or banks of any stream in Montana needs to get a permit. Federal agencies may comply with a MOU or a general agreement. This permit pertains to construction of new facilities or the modification, operation, and maintenance of an existing facility that may affect the natural existing shape and form of any stream or its banks or tributaries. Some of the proposed project types in this draft restoration plan may require a 124 permit.

Montana Water Use Act (Title 85, MCA, *et seq*.)
Any private or public entity intending to acquire new or additional water rights or change an existing water right in the state must apply for a water right permit or change authorization or be exempted. Any government entity may apply to reserve water for existing or future beneficial uses or to maintain a minimum flow, lever or quality of water. Water reservations were allocated in the Yellowstone River Basin in 1978.

Montana Pollution Discharge Elimination System (MPDES) General Permit (Title 75, MCA, *et seq*.)
Any person, agency or entity, either public or private, proposing an activity that has a discharge, including storm water, into surface waters must obtain a permit. Activities requiring permits include construction that will disturb one or more total acres, defined industrial activity with discharges, industrial activities, and small municipal systems.

The proposed restoration projects will consider and comply with other relevant state policy directives.

9.1.3 Local Laws

As appropriate, restoration actions will consider and comply with local plans and ordinances or policies and directives. Relevant local plans could include shoreline and growth management plans. Relevant ordinances could include zoning, construction, noise, and wetlands, or others.

City or County Floodplain Permit
Any project involving new development, placement of fill, roads, bridges, culverts, transmission lines, irrigation facilities, equipment storage, excavation, new construction or development, placement of manufactured homes, and construction work on residential and commercial buildings in the designated Special Flood Hazard Areas must get a permit.

10.0 REFERENCES

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Appendix A

EA Checklist

EA CHECKLIST

Applicant_____ Project Title _____

Project Description_____

Person Preparing Checklist_____ Phone_____

Please attach short, written comments to the checklist if you want to explain why you chose "Major, Moderate, Minor, None, or Unknown."

POTENTIAL IMPACTS ON THE PHYSICAL ENVIRONMENT

(Check the appropriate column. State whether the impact is adverse or beneficial.)

	MAJOR	MODERATE	MINOR	NONE	UNKNOWN	COMMENTS
Topography						
Geology: Stability						
Soils: quality, quantity, distribution						
Water: quality, quantity, distribution						
Air: quality						
Terrestrial, avian, and aquatic: species and habitats						
Vegetation: quantity, quality, species						
Agriculture, grazing, crops, production						
Unique, endangered, fragile or limited environmental resources						
Demands on environmental resources of land, water, air, and energy						
Historical and archaeological sites						
Aesthetics						

EACHECKLIST (cont.)

POTENTIAL IMPACTS ON THE HUMAN ENVIRONMENT

(Check the appropriate column. State whether the impact is adverse or beneficial.)

	MAJOR	MODERATE	MINOR	NONE	UNKNOWN	COMMENTS
Social Structures & more						
Cultural uniqueness, diversity						
Population: quantity and distribution						
Housing: quantity and distribution						
Human health and safety						
Community and personal income						
Employment: quantity, and distribution						
Tax base: local and state						
Government services: demand on						
Industrial, commercial, and agricultural activities						
Recreation and wilderness						
Environmental plans and goals, local and regional						
Demands for energy						
Transportation networks and traffic flows						

List all groups or agencies contacted and the contact person's phone number.

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_____

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Appendix B

Animals Species Along Yellowstone River

COMMON AND SCIENTIFIC NAMES

Fish Species found in the Middle Yellowstone River (from Region 5 FWP)

Goldeye	Hiodon alosoides
Shorthead Redhorse	Moxostoma macrolepidotum
White Sucker	Catostomus commersoni
Longnose Sucker	Catostomus catostomus
Mountain Sucker	Catostomus platyrhynchus
River Carpsucker	Carpiodes carpio
Common Carp	Cyprinus carpio
Longnose Dace	Rhinichthys cataractae
Lake Chub	Couesius plumbeus
Flathead Chub	Platygobio gracilis
Fathead Minnow	Pimephales promelas
Western Silvery Minnow	Hybognathus argyritis
Plains Minnow	Hybognathus placitus
Emerald Shiner	Notropis atherinoides
Rainbow Trout	Oncorhynchus mykiss
Brown Trout	Salmo trutta
Mountain Whitefish	Propopium williamsoni
Channel Catfish	Ictalurus punctatus
Stonecat	Noturus flavus
Burbot	Lota Lota
Smallmouth Bass	Micropterus dolomieu
Largemouth Bass	Micropterus salmoides
Freshwater Drum	Aplodinotus grunniens
Walleye	Stizostedion vitreum
Sauger	Stizostedion canadense

MONTANA BIRD AND MAMMAL SPECIES – YELLOWSTONE RIVER CORRIDOR
(Observations from 1960 or later)
Montana Natural Heritage Program (March 8, 2016)

COMMON NAME	SCIENTIFIC NAME
Common Loon	Gavia immer
Pied-billed Grebe	Podilymbus podiceps
Western Grebe	Aechmophorus occidentalis
American White Pelican	Pelecanus erythrorhynchos
Double-crested Cormorant	Phalacrocorax auritus
Great Blue Heron	Ardea herodias
Cattle Egret	Bubulcus ibis
Green Heron	Butorides virescens
White-faced Ibis	Plegadis chihi
Tundra Swan	Cygnus columbianus
Greater White-fronted Goose	Anser albifrons
Snow Goose	Chen caerulescens
Ross's Goose	Chen rossii
Canada Goose	Branta canadensis
Cackling Goose	Branta hutchinsii
Wood Duck	Aix sponsa
Green-winged Teal	Anas crecca
Mallard	Anas platyrhynchos
Northern Pintail	Anas acuta
Blue-winged Teal	Anas discors
Cinnamon Teal	Anas cyanoptera
Northern Shoveler	Anas clypeata
Gadwall	Anas strepera
American Wigeon	Anas americana
Canvasback	Aythya valisineria
Redhead	Aythya americana
Ring-necked Duck	Aythya collaris
Lesser Scaup	Aythya affinis
Common Goldeneye	Bucephala clangula
Barrow's Goldeneye	Bucephala islandica
Bufflehead	Bucephala albeola
Hooded Merganser	Lophodytes cucullatus
Common Merganser	Mergus merganser
Red-breasted Merganser	Mergus serrator
Ruddy Duck	Oxyura jamaicensis
Turkey Vulture	Cathartes aura
Osprey	Pandion haliaetus
Bald Eagle	Haliaeetus leucocephalus
Northern Harrier	Circus cyaneus

COMMON NAME	SCIENTIFIC NAME
Sharp-shinned Hawk	Accipiter striatus
Cooper's Hawk	Accipiter cooperii
Northern Goshawk	Accipiter gentilis
Broad-winged Hawk	Buteo platypterus
Swainson's Hawk	Buteo swainsoni
Red-tailed Hawk	Buteo jamaicensis
Ferruginous Hawk	Buteo regalis
Rough-legged Hawk	Buteo lagopus
Golden Eagle	Aquila chrysaetos
American Kestrel	Falco sparverius
Merlin	Falco columbarius
Peregrine Falcon	Falco peregrinus
Gyrfalcon	Falco rusticolus
Prairie Falcon	Falco mexicanus
Gray Partridge	Perdix perdix
Ring-necked Pheasant	Phasianus colchicus
Ruffed Grouse	Bonasa umbellus
Greater Sage-Grouse	Centrocercus urophasianus
Sharp-tailed Grouse	Tympanuchus phasianellus
Wild Turkey	Meleagris gallopavo
Virginia Rail	Rallus limicola
Sora	Porzana carolina
American Coot	Fulica americana
Sandhill Crane	Grus canadensis
Whooping Crane	Grus americana
Black-bellied Plover	Pluvialis squatarola
Semipalmated Plover	Charadrius semipalmatus
Killdeer	Charadrius vociferus
Black-necked Stilt	Himantopus mexicanus
American Avocet	Recurvirostra americana
Greater Yellowlegs	Tringa melanoleuca
Lesser Yellowlegs	Tringa flavipes
Solitary Sandpiper	Tringa solitaria
Willet	Tringa semipalmata
Spotted Sandpiper	Actitis macularius
Upland Sandpiper	Bartramia longicauda
Long-billed Curlew	Numenius americanus
Marbled Godwit	Limosa fedoa
Red Knot	Calidris canutus
Semipalmated Sandpiper	Calidris pusilla
Least Sandpiper	Calidris minutilla
Baird's Sandpiper	Calidris bairdii
Pectoral Sandpiper	Calidris melanotos

COMMON NAME	SCIENTIFIC NAME
Stilt Sandpiper	Calidris himantopus
Short-billed Dowitcher	Limnodromus griseus
Long-billed Dowitcher	Limnodromus scolopaceus
Wilson's Snipe	Gallinago delicata
Wilson's Phalarope	Phalaropus tricolor
Franklin's Gull	Leucophaeus pipixcan
Ring-billed Gull	Larus delawarensis
California Gull	Larus californicus
Caspian Tern	Hydroprogne caspia
Common Tern	Sterna hirundo
Forster's Tern	Sterna forsteri
Black Tern	Chlidonias niger
Rock Pigeon	Columba livia
Eurasian Collared-Dove	Streptopelia decaocto
Mourning Dove	Zenaida macroura
Black-billed Cuckoo	Coccyzus erythropthalmus
Yellow-billed Cuckoo	Coccyzus americanus
Eastern Screech-Owl	Megascops asio
Great Horned Owl	Bubo virginianus
Snowy Owl	Bubo scandiacus
Burrowing Owl	Athene cunicularia
Barred Owl	Strix varia
Long-eared Owl	Asio otus
Short-eared Owl	Asio flammeus
Northern Saw-whet Owl	Aegolius acadicus
Common Nighthawk	Chordeiles minor
Common Poorwill	Phalaenoptilus nuttallii
Chimney Swift	Chaetura pelagica
White-throated Swift	Aeronautes saxatalis
Calliope Hummingbird	Selasphorus calliope
Rufous Hummingbird	Selasphorus rufus
Belted Kingfisher	Megaceryle alcyon
Red-headed Woodpecker	Melanerpes erythrocephalus
Red-naped Sapsucker	Sphyrapicus nuchalis
Downy Woodpecker	Picoides pubescens
Hairy Woodpecker	Picoides villosus
Northern Flicker	Colaptes auratus
Northern Flicker (Yellow-shafted)	Colaptes auratus auratus
Northern Flicker (Red-shafted)	Colaptes auratus cafer
Olive-sided Flycatcher	Contopus cooperi
Western Wood-Pewee	Contopus sordidulus
Willow Flycatcher	Empidonax traillii
Least Flycatcher	Empidonax minimus

COMMON NAME	SCIENTIFIC NAME
Dusky Flycatcher	Empidonax oberholseri
Cordilleran Flycatcher	Empidonax occidentalis
Eastern Phoebe	Sayornis phoebe
Say's Phoebe	Sayornis saya
Western Kingbird	Tyrannus verticalis
Eastern Kingbird	Tyrannus tyrannus
Scissor-tailed Flycatcher	Tyrannus forficatus
Horned Lark	Eremophila alpestris
Tree Swallow	Tachycineta bicolor
Violet-green Swallow	Tachycineta thalassina
Northern Rough-winged Swallow	Stelgidopteryx serripennis
Bank Swallow	Riparia riparia
Cliff Swallow	Petrochelidon pyrrhonota
Barn Swallow	Hirundo rustica
Steller's Jay	Cyanocitta stelleri
Blue Jay	Cyanocitta cristata
Pinyon Jay	Gymnorhinus cyanocephalus
Clark's Nutcracker	Nucifraga columbiana
Black-billed Magpie	Pica hudsonia
American Crow	Corvus brachyrhynchos
Common Raven	Corvus corax
Black-capped Chickadee	Poecile atricapillus
Mountain Chickadee	Poecile gambeli
Red-breasted Nuthatch	Sitta canadensis
White-breasted Nuthatch	Sitta carolinensis
Pygmy Nuthatch	Sitta pygmaea
Brown Creeper	Certhia americana
Rock Wren	Salpinctes obsoletus
Canyon Wren	Catherpes mexicanus
House Wren	Troglodytes aedon
Marsh Wren	Cistothorus palustris
American Dipper	Cinclus mexicanus
Golden-crowned Kinglet	Regulus satrapa
Ruby-crowned Kinglet	Regulus calendula
Mountain Bluebird	Sialia currucoides
Townsend's Solitaire	Myadestes townsendi
Veery	Catharus fuscescens
Swainson's Thrush	Catharus ustulatus
Hermit Thrush	Catharus guttatus
Wood Thrush	Hylocichla mustelina
American Robin	Turdus migratorius
Varied Thrush	Ixoreus naevius
Gray Catbird	Dumetella carolinensis

COMMON NAME	SCIENTIFIC NAME
Sage Thrasher	Oreoscoptes montanus
Brown Thrasher	Toxostoma rufum
American Pipit	Anthus rubescens
Sprague's Pipit	Anthus spragueii
Bohemian Waxwing	Bombycilla garrulus
Cedar Waxwing	Bombycilla cedrorum
Northern Shrike	Lanius excubitor
Loggerhead Shrike	Lanius ludovicianus
European Starling	Sturnus vulgaris
Yellow-throated Vireo	Vireo flavifrons
Warbling Vireo	Vireo gilvus
Red-eyed Vireo	Vireo olivaceus
Plumbeous Vireo	Vireo plumbeus
Solitary Vireo	Vireo solitarius
Orange-crowned Warbler	Oreothlypis celata
Nashville Warbler	Oreothlypis ruficapilla
Yellow Warbler	Setophaga petechia
Chestnut-sided Warbler	Setophaga pensylvanica
Magnolia Warbler	Setophaga magnolia
Black-throated Blue Warbler	Setophaga caerulescens
Yellow-rumped Warbler	Setophaga coronata
Yellow-rumped Warbler (Audubon's)	Setophaga coronata auduboni
Palm Warbler	Setophaga palmarum
Blackpoll Warbler	Setophaga striata
Black-and-white Warbler	Mniotilta varia
American Redstart	Setophaga ruticilla
Ovenbird	Seiurus aurocapilla
Northern Waterthrush	Parkesia noveboracensis
Common Yellowthroat	Geothlypis trichas
Wilson's Warbler	Cardellina pusilla
Canada Warbler	Cardellina canadensis
Yellow-breasted Chat	Icteria virens
Summer Tanager	Piranga rubra
Scarlet Tanager	Piranga olivacea
Western Tanager	Piranga ludoviciana
Rose-breasted Grosbeak	Pheucticus ludovicianus
Black-headed Grosbeak	Pheucticus melanocephalus
Lazuli Bunting	Passerina amoena
Indigo Bunting	Passerina cyanea
Painted Bunting	Passerina ciris
Green-tailed Towhee	Pipilo chlorurus
Spotted Towhee	Pipilo maculatus
American Tree Sparrow	Spizelloides arborea

COMMON NAME	SCIENTIFIC NAME
Chipping Sparrow	Spizella passerina
Clay-colored Sparrow	Spizella pallida
Brewer's Sparrow	Spizella breweri
Field Sparrow	Spizella pusilla
Vesper Sparrow	Pooecetes gramineus
Lark Sparrow	Chondestes grammacus
Lark Bunting	Calamospiza melanocorys
Savannah Sparrow	Passerculus sandwichensis
Grasshopper Sparrow	Ammodramus savannarum
Le Conte's Sparrow	Ammodramus leconteii
Fox Sparrow	Passerella iliaca
Song Sparrow	Melospiza melodia
Lincoln's Sparrow	Melospiza lincolnii
White-throated Sparrow	Zonotrichia albicollis
White-crowned Sparrow	Zonotrichia leucophrys
Harris's Sparrow	Zonotrichia querula
Dark-eyed Junco	Junco hyemalis
Dark-eyed Junco (Slate-colored)	Junco hyemalis hyemalis / cismontanus
Dark-eyed Junco (Montana)	Junco hyemalis montanus
McCown's Longspur	Rhynchophanes mccownii
Lapland Longspur	Calcarius lapponicus
Snow Bunting	Plectrophenax nivalis
Bobolink	Dolichonyx oryzivorus
Red-winged Blackbird	Agelaius phoeniceus
Western Meadowlark	Sturnella neglecta
Yellow-headed Blackbird	Xanthocephalus xanthocephalus
Rusty Blackbird	Euphagus carolinus
Brewer's Blackbird	Euphagus cyanocephalus
Common Grackle	Quiscalus quiscula
Brown-headed Cowbird	Molothrus ater
Baltimore Oriole	Icterus galbula
Bullock's Oriole	Icterus bullockii
Northern Oriole	Icterus galbula
Black Rosy-Finch	Leucosticte atrata
Gray-crowned Rosy-Finch	Leucosticte tephrocotis
Pine Grosbeak	Pinicola enucleator
Purple Finch	Haemorhous purpureus
Cassin's Finch	Haemorhous cassinii
House Finch	Haemorhous mexicanus
Red Crossbill	Loxia curvirostra
White-winged Crossbill	Loxia leucoptera
Common Redpoll	Acanthis flammea
Hoary Redpoll	Acanthis hornemanni

COMMON NAME	SCIENTIFIC NAME
Pine Siskin	Spinus pinus
American Goldfinch	Spinus tristis
Evening Grosbeak	Coccothraustes vespertinus
House Sparrow	Passer domesticus
Masked Shrew	Sorex cinereus
Hayden's Shrew	Sorex haydeni
Myotis Spp	Myotis Spp.
Little Brown Myotis	Myotis lucifugus
Long-eared Myotis	Myotis evotis
Long-legged Myotis	Myotis volans
Western Small-footed Myotis	Myotis ciliolabrum
Silver-haired Bat	Lasionycteris noctivagans
Big Brown Bat	Eptesicus fuscus
Hoary Bat	Lasiurus cinereus
Spotted Bat	Euderma maculatum
Yellow-pine Chipmunk	Tamias amoenus
Yellow-bellied Marmot	Marmota flaviventris
Black-tailed Prairie Dog	Cynomys ludovicianus
Eastern Fox Squirrel	Sciurus niger
Beaver	Castor canadensis
Western Harvest Mouse	Reithrodontomys megalotis
Deer Mouse	Peromyscus maniculatus
White-footed Mouse	Peromyscus leucopus
Bushy-tailed Woodrat	Neotoma cinerea
Meadow Vole	Microtus pennsylvanicus
Montane Vole	Microtus montanus
Prairie Vole	Microtus ochrogaster
Muskrat	Ondatra zibethicus
Porcupine	Erethizon dorsatum
Coyote	Canis latrans
Red Fox	Vulpes vulpes
Black Bear	Ursus americanus
Raccoon	Procyon lotor
Badger	Taxidea taxus
Striped Skunk	Mephitis mephitis
Northern River Otter	Lontra canadensis
Canada Lynx	Lynx canadensis
Bobcat	Lynx rufus
Mountain Lion	Puma concolor
Mule Deer	Odocoileus hemionus
White-tailed Deer	Odocoileus virginianus
Pronghorn	Antilocapra americana

Montana Species of Concern in the Yellowstone River Corridor

Source: FWP Region 5

COMMON NAME	SCIENTIFIC NAME
Common Loon	Gavia immer
American White Pelican	Pelecanus erythrorhynchos
Great Blue Heron	Ardea herodias
White-faced Ibis	Plegadis chihi
Northern Goshawk	Accipiter gentilis
Ferruginous Hawk	Buteo regalis
Golden Eagle	Aquila chrysaetos
Peregrine Falcon	Falco peregrinus
Greater Sage-Grouse	Centrocercus urophasianus
Sharp-tailed Grouse	Tympanuchus phasianellus
Whooping Crane	Grus americana
Black-necked Stilt	Himantopus mexicanus
Long-billed Curlew	Numenius americanus
Franklin's Gull	Leucophaeus pipixcan
Caspian Tern	Hydroprogne caspia
Common Tern	Sterna hirundo
Forster's Tern	Sterna forsteri
Black Tern	Chlidonias niger
Black-billed Cuckoo	Coccyzus erythropthalmus
Yellow-billed Cuckoo	Coccyzus americanus
Burrowing Owl	Athene cunicularia
Red-headed Woodpecker	Melanerpes erythrocephalus
Pinyon Jay	Gymnorhinus cyanocephalus
Clark's Nutcracker	Nucifraga columbiana
Brown Creeper	Certhia americana
Veery	Catharus fuscescens
Varied Thrush	Ixoreus naevius
Sage Thrasher	Oreoscoptes montanus
Sprague's Pipit	Anthus spragueii
Loggerhead Shrike	Lanius ludovicianus
Green-tailed Towhee	Pipilo chlorurus
Brewer's Sparrow	Spizella breweri
Le Conte's Sparrow	Ammodramus leconteii
McCown's Longspur	Rhynchophanes mccownii
Bobolink	Dolichonyx oryzivorus
Black Rosy-Finch	Leucosticte atrata
Gray-crowned Rosy-Finch	Leucosticte tephrocotis
Cassin's Finch	Haemorhous cassinii
Evening Grosbeak	Coccothraustes vespertinus
Little Brown Myotis	Myotis lucifugus
Hoary Bat	Lasiurus cinereus
Spotted Bat	Euderma maculatum
Black-tailed Prairie Dog	Cynomys ludovicianus
Canada Lynx	Lynx canadensis

Appendix C

Yellowstone River Summary
of
Terrestrial HEA
Large Woody Debris REA
and
Fish Health Studies

memorandum

Environment and Natural Resources

Date: 5/26/2016

To: 2011 Yellowstone River Oil Spill Trustees

From: Kaylene Ritter, PhD; Allison Ebbets, MS; and Michael Carney, MEM;
Abt Associates

Subject: Summary of Terrestrial HEA, Large Woody Debris REA, and Fish Health Studies

The State of Montana (the State) and its co-Trustees, the U.S. Fish and Wildlife Service and the Bureau of Land Management, conducted a natural resource damage assessment (NRDA) for the July ExxonMobil Pipeline Company's (EMPCo's) 2011 pipeline rupture that discharged approximately 63,000 gallons of oil into the Yellowstone River near Billings, Montana. Abt Associates (Abt) provided support to the State on multiple aspects of the NRDA, and some of the NRDA activities were conducted cooperatively with EMPCo. We assisted with evaluating injury to habitat in the affected portion of the Yellowstone River floodplain, including developing a terrestrial Habitat Equivalency Analysis (HEA). We also assisted with evaluating injury to Large Woody Debris (LWD) piles that were oiled and dismantled during response cleanup activities, including developing a LWD Resource Equivalency Analysis (REA). In addition, we assisted the Trustees with designing and implementing three fish health studies, and analyzed the resulting fish health data to help evaluate injury to aquatic resources.

The Trustees are now preparing a Damage Assessment and Restoration Plan (DARP), and the State has requested that Abt prepare the following for inclusion in the DARP:

- A summary of the terrestrial HEA
- A description of the LWD REA
- An overview of the fish health injury studies and data analyses.

Accordingly, we provide these requested summaries in this memorandum. Section 1 summarizes the terrestrial HEA, Section 2 summarizes the LWD REA, and Section 3 summarizes the fish health injury studies and data analyses.

1. Terrestrial HEA

Here we describe the terrestrial HEA. We first briefly describe impacts of the oil spill and the subsequent response activities to terrestrial habitats in the floodplain (Section 1.1). We then provide a brief overview of HEA (Section 1.2), and describe the HEA's debit input parameters and injury quantification (Section 1.3), followed by the credit input parameters and scaling (Section 1.4).

1.1 Overview of Terrestrial Habitat Injuries due to Oil and Response Activities

Following the spill, the Trustees assessed injuries to habitats within the affected portion of the Yellowstone River floodplain. Some of the key habitat types found in the Yellowstone River

floodplain include bottomland cottonwood gallery forests, and riparian grasslands and shrublands, which include sedge meadows, willow bottoms, and wet aspen. These habitats support a diverse array of birds and other biota that rely on riparian habitats (USGS, 1999; Jean and Crispin, 2001). Because the Yellowstone River has remained un-dammed and historical ecosystem processes continue to function, most of the habitat types and wildlife that would have been present before European settlement are still present today.

Two broad types of injuries and ecological service losses occurred to the floodplain habitat as a result of the oil spill: (1) injuries and losses from the adverse effects of oil, and (2) injuries and losses from response activities.

As a part of the response actions, the distribution of oil in the floodplain was delineated using the modified Shoreline Cleanup and Assessment Technique (SCAT) surveys. The Trustees used information from these surveys to estimate the amount and degree of oiling in the floodplain. As a part of the SCAT surveys, the floodplain was divided into three "Divisions" – Divisions A, B, and C. Division A started at the point of the spill and extended 10 miles downstream; Division B extended from approximately 10–28 miles downstream from the spill site; and Division C extended from approximately 28–50 miles downstream from the spill site. Locations or "zones" with different degrees of visible oiling were delineated within the Divisions during the surveys.

Across the three Divisions, approximately 5,500 acres of oiled habitat were categorized by the degree of oiling, with categories ranging from "no oil observed" to "heavy oil" (Table 1). Figures 1 and 2 show examples of oiled habitat and biota. Generally, the heaviest oiling was observed in Divisions A and B, closest to the spill site, with less oiling in Division C. Oil may adversely affect vegetation and wildlife dependent on riparian habitats due to toxicological effects, as well as physical fouling (NPS, 1997; Douben, 2003; Pakova et al., 2006.)

Table 1. Floodplain oiling as characterized by SCAT

SCAT oiling category	Oiled acres – pre-response
No oil observed	5,495
Very light oil	4,282
Light oil	939
Moderate oil	255
Heavy oil	11
Total acres impacted by oil	~ 5,500
Total acres surveyed	~ 11,000

Source: Exxon database received February 2012.

Figure 1. Frog sitting in oiled water and vegetation following the spill. Photo credit: MT FWP**.**

Figure 2. Oil in the inundated floodplain coated the vegetation and floodplain soils as the floodwater receded. Note visible oil on water, as well as on vegetation along the water's edge. Photo credit: Larry, Mayer, provided by MT Natural Resource Damage Program.

Immediately after the spill, response actions were initiated to remove the oil from the floodplain and river (Figure 3). Response actions began on July 11, 2011 and ended in mid-October 2011 (though there was some cleanup that occurred in November 2011). Within the floodplain, response actions included cutting and removing oiled live vegetation and deadwood ("debris"), cleaning oiled surfaces with sorbent pads or by flushing with water, covering oiled surfaces with dust, and leaving the oil to attenuate naturally. Heavy equipment (all-terrain vehicles, bobcats, excavators, etc.) was used, and staging grounds, footpaths, temporary roads, and vehicle tracks were also created throughout the surveyed 11,000 acres as part of the spill response activities (ARCADIS, 2011). As a result, response activities adversely affected floodplain habitats, through, for example, trampling and crushing vegetation by heavy equipment, cutting and removing grasses and woody vegetation, as well as the physical disturbance caused by the presence of crews and machinery.

The Trustees considered both the adverse effects of oil, as well the impacts of response activities to floodplain habitats and vegetation, in developing the HEA described below.

1.2 HEA

HEA is a restoration scaling technique often used by natural resource Trustees to quantify the amount of restoration needed to compensate for injuries to natural resources. In this technique, Trustees identify restoration type(s) that can appropriately offset the injuries and losses that have occurred, and the HEA is used to scale (balance) the gains from the restoration with the injuries and losses (NOAA, 2000), using appropriate scaling metric(s), which are identified by the Trustees.

Although Trustees have discretion in the development of restoration scaling approaches depending on the specific conditions being assessed, and the context in which the assessment is being undertaken, parameters that are often incorporated into a HEA include:

- Habitat type injured and being restored
- Spatial extent of the injury and the restoration action(s)
- Time and duration of the injury and the restoration benefits
- Quantum of injury (sometimes referred to as "debit") and gains from restoration ("credit")
- Discount rate.

On the injury (i.e., debit) side, the spatial extent of the injured area may be comprised of different subareas, depending upon the need to distinguish between different habitat types and the nature and extent of the injuries. The time and duration of injury refers to the period of time from the onset of the loss until baseline (i.e., the condition of the resource or habitat but for the discharge of oil) conditions are achieved, whether through natural recovery or remediation/response activities, or a combination of the two.

Similarly, HEA "credit" quantification includes consideration of the spatial extent over which restoration benefits occur, and the time period required for restoration(s) to be achieved and the duration for which the restoration continues to provide the relevant natural resource benefits.

Figure 3. Response crews using sorbent pads to clean up oil visible in the water and floodplain. Photo credit: Response Team, provided by MT Natural Resource Damage Program.

Finally, HEA incorporates a discount rate (typically 3%) that allows for the compounding (in the past) and discounting (in the future) of losses and gains over time. The discount rate accounts for the fact that benefits from restoration conducted in the future are less valuable to the public than if they were available today, and vice versa for past losses from injury. One common unit of measurement for HEA that has been used by Trustees is a discounted-service-acre-year (DSAY), where service-acre-year refers to the quantum of injury that occurred over the spatial and temporal extent of loss. In order to quantify how much restoration is required to offset injuries, the HEA model balances the discounted debit with the discounted restoration credit that accrues through implementation of the Trustees' preferred restoration alternatives.

1.3 Terrestrial HEA Debit Input Parameters

This section presents the HEA debit input parameters, and summarizes the resulting quantification of injury (debit). Specifically, we describe the spatial extent, habitat types, timeframe, and service loss for injuries that occurred in the floodplain. The Trustees used the standard 3% discount rate for their HEA calculations.

Spatial Extent

Based on their assessment, the Trustees concluded that injury to natural resources occurred downstream of the spill site where oil and response activities affected floodplain habitat. This included all of Divisions A and B (2,884 acres). It also included the part of Division C where response activities occurred (approximately 6,112 acres, or roughly 75% of Division C; Table 2). Specifically:

- "Heavy oil" and "moderate oil" SCAT zones, where response actions included cutting oiled vegetation, heavy foot traffic, vehicular traffic, and heavy equipment use.
- "Light oil" and "very light oil" SCAT zones where response actions included some combination of vegetation cutting and moderate foot or vehicular traffic.
- "No oil observed" SCAT zones where response actions included light foot and vehicular traffic.

Table 2. Terrestrial HEA spatial extent: Geographical areas that were injured as a result of oiling and response activities

Geographic area	Acres[a]	Corresponding SCAT oiling categories
Oiled areas where response activities occurred, including vegetation removal and heavy foot and vehicular traffic	267	Heavy oil Moderate oil
Oiled areas where response activities occurred, including vegetation removal and moderate foot and vehicular traffic	4,984	Light oil Very light oil
Areas with no oil that were disturbed by lighter foot and vehicle traffic during response activities	3,745	No oil observed

a. These acres do not correspond to the acres reported in Table 1 because the Trustees only included a subset of Division C in the HEA, and there were slight differences in geographic information system (GIS) layers used during the response and the NRDA.

Habitat Types

Two primary habitat types were injured by the oil spill and response activities within the geographical areas described above:

1. Bottomland/riparian habitat, which includes cottonwood stands (sometimes referred to as "galleries"), and open sand/gravel bars that serve as cottonwood regeneration habitat

2. Grassland/shrubland habitat, which includes sedge meadows, willow bottoms, and wet aspen, in addition to riparian grasslands and riparian shrublands.

The Trustees selected habitat types for restoration scaling (described in Section 1.4) that were similar to these injured habitats.

Timeframe and Quantum of Injury

The Trustees identified two distinct time periods of injury related to the spill. The first period (Time period 1) is the period when active response activities occurred, which lasted for approximately four months after the spill. The second time period (Time period 2) follows the period of active response activities, and covers the time required for the affected habitats to recover to baseline. For the purposes of the Yellowstone River HEA, the Trustees expressed the quantum of loss in terms of the "services" provided by the injured habitat over time, where services refer to a collected set of ecological functions provided by the affected habitats. The Trustees used their best professional judgement and information available from the literature in their assessment of service losses and injury timeframes.

Time period 1: In the four months immediately after the spill, while response activities were underway, there was a very high level of injury and service loss due to the oil and the response actions. While the most severe impacts occurred in locations that were most heavily oiled and located nearer the spill site, there was a high level of disturbance across all the SCAT-surveyed habitat, due to the physical disturbances of human presence and the use of heavy equipment during response activities.

Accordingly, the Trustees concluded that the highest service loss occurred in Divisions A and B in heavily to lightly oiled habitats where there was the greatest oiling, as well as the greatest disturbance due to response activities (75% service loss; Table 3). This was followed by habitat with very light oil in Divisions A and B and habitat with moderate or light oiling in Division C (50% service loss; Table 3). Finally, the Trustees found that the least-severe impacts occurred in Division C in areas where there was very light oil or no oil observed, and were mainly associated with physical impacts and disturbances due to response activities (25% service loss; Table 3).

Table 3. Numerical values for the terrestrial HEA injury (debit) input parameters assigned by the Trustees

Degree of oiling	Division	Habitat type		Time period 1 (during 4 months of response activities)	Time period 2 (post-response)	
		Bottomland/ riparian acres[a]	Grassland/ shrubland acres[a]	Service level	Start-end service level	Years to reach end service level
Heavy oil	A/B	8	2.9	25%	25–100%	20
Moderate oil		145	104.1	25%	70–100%	20
Light oil		576.4	112.1	25%	90–100%	10
Very light oil		895.8	230.2	50%	95–100%	10
No oil observed		579.3	230	50%	95–100%	3
Moderate oil	C	6.4	0.4	50%	70–100%	20
Light oil		104.5	83.6	50%	90–100%	10
Very light oil		2,183.7	797.3	75%	95–100%	10
No oil observed		1,992.4	943.4	75%	95–100%	3

a. These acres do not correspond to the acres reported in Table 1 because the Trustees only included a subset of Division C in the HEA, and there were slight differences in GIS layers used during the response and the NRDA.

Time period 2: The change in services between the end of Time period 1 and the beginning of Time period 2 is sharply stepped, reflecting the abrupt cessation of physical disturbance (e.g., noise, human presence) related to response activities during Time period 1. After the response activities were completed, service levels and recovery trajectories varied across the identified habitat areas. This depended upon the type and severity of response activities that were undertaken, and the effects of any residual oil that was not cleaned up. While any remaining oil may have resulted in ongoing injury to natural resources, the Trustees focused on the impacts of response activities to set injury timeframes and service level trajectories in the HEA. This is because these impacts were widespread, and there was adequate information that could be used to readily evaluate injury:

- In locations where the main response impact was crushed grasses and other vegetation due to light foot traffic and some vehicular traffic (habitats with no oil), the Trustees concluded that these injuries would persist for three years (i.e., time anticipated for the vegetation to regrow and fully recover, based on information available from the literature on timeframes for grassland/shrubland habitats to recover from human trampling (Cole, 1988; Rury and Little, 1991).

- In very lightly- to lightly-oiled habitats, the time to recover from response impacts was based on the age of woody vegetation that was cut down during cleanup activities and time to recover from the impacts of foot and vehicular traffic in the floodplain. A range of tree species were cut down during response activities, including cottonwood, willow, buffalo berry, chokecherry, and snowberry bushes. Response crews were only allowed to cut woody

vegetation that was up to one inch in diameter as a part of the removal of oiled vegetation. Based on a review of the literature, a one-inch diameter tree may range in age from 7 to 20 years for the affected tree species (Marquis, 1990; Overton, 1990; Tahvanainen, 1996; Lesica and Miles, 2001; Willms et al., 2006; Agriculture and Agri-Food Canada, 2011; Garden Guides, 2013a, 2013b). The Trustees set the recovery period based on the time for woody vegetation to regrow to a 1-inch diameter trunk size and the time for vegetation and soils to recover from impacts caused by heavier foot and vehicle traffic (Cole, 1988; Efroymson et al., 2003 and references therein), and used an intermediate value of 10 years (Table 3).

- In moderate to heavy oiled habitats, the Trustees concluded that the more extensive response activities, including the impacts of multiple staging grounds, temporary roads, and vehicular tracks in floodplain habitats would require a longer recovery period, and accordingly set the injury timeframe to 20 years in the HEA, based on a review of the literature on these types of impacts in similar habitats (Table 3; Cole, 1988; Efroymson et al., 2003 and references therein).

Service levels at the start of Time period 2 were set based on the Trustees' review of the available response information and data, and their best professional judgement on the severity of the impacts to habitat vegetation (Table 3). The service level at the end of Time period 2 for all habitats was set to 100%, representing the Trustees' understanding that at this time, the habitats would return to baseline conditions. Given the service losses, acreages, and timeframes in Table 3, the total terrestrial debit associated with injuries in the Yellowstone River floodplain is 3,239 DSAYs.

1.4 Terrestrial HEA Credit Input Parameters

Here we describe the HEA credit input parameters and scaled restoration.

Restoration Types

The Trustees identified three types of restoration that could provide benefits to appropriately offset the losses that occurred in the Yellowstone River floodplain. These restoration types were used in the HEA to quantify how much restoration was needed to compensate for the habitat losses associated with the oil spill and response actions in the floodplain:

- ***Bottomland/riparian habitat restoration concept*:** Acquire and restore cottonwood regeneration habitat degraded by grazing practices and invasive species, with "moderate" and "high" intensity restoration options
  - High-intensity restoration includes installing fencing to reduce grazing pressure and noxious weed control
  - Moderate-intensity restoration includes noxious weed control (assumed to occur in locations where grazing does not affect cottonwood regeneration habitat)

- ***Grassland/shrubland habitat restoration concept*:** Acquire and restore habitat degraded by grazing practices and invasive species, with "moderate" and "high" intensity restoration options
  - High-intensity restoration includes planting and seeding riparian vegetation species, noxious weed control, and installing cattle-exclusion fencing
  - Moderate-intensity restoration includes installing cattle-exclusion fencing and noxious weed control

- ***Mature cottonwood gallery preservation:*** Acquire and preserve mature bottomland cottonwood gallery habitat
  - This restoration type addresses terrestrial habitat injury, and also provides benefits to cavity-nesting birds (the cavity-nesting bird assessment is discussed elsewhere).

Restoration Gains and Timeframe of Restoration

Bottomland/riparian habitat restoration: In the high-intensity bottomland/riparian habitat restoration scenario, the habitat is degraded by grazing and other human activities before restoration begins. Restoration actions would include acquiring and restoring appropriate habitat, installing fencing to reduce grazing pressure in bottomland habitat, and noxious weed control to reduce competition with native species. For the purposes of the equivalency analysis, the Trustees also characterized benefits of restoration actions in terms of habitat services. Through discussions with natural resource managers from Trustee agencies, the Trustees used their best professional judgement to determine that these actions would result in a 75% service uplift (Table 4) from the degraded conditions and take 60 years to reach full services.

Table 4. Terrestrial HEA credit input parameters for restoration concepts

Habitat to be restored	Restoration project concepts	Anticipated service gains	Years to maximum service gains
Bottomland/riparian habitat	Moderate-intensity restoration	45%	60
Bottomland/riparian habitat	High-intensity restoration	75%	60
Grassland/shrubland habitat	Moderate-intensity restoration	90%	20
Grassland/shrubland habitat	High-intensity restoration	90%	15

In the moderate-intensity bottomland/riparian habitat restoration scenario, the habitat is degraded but not affected by grazing. The main restoration activity is noxious weed control to allow cottonwood trees to become established and grow. Based on the Trustees' experience with natural resource management and their best professional judgement, these actions would result in a 45% service uplift (Table 4) from the degraded conditions and take 60 years to reach full services.

The time to reach full benefits for both scenarios was set at 60 years: this is the amount of time required for the cottonwood saplings to successfully become established (a flood event sufficient for cottonwood establishment occurs approximately once every 15 years), and grow to maturity (average age at maturity is 45 years).

Grassland/shrubland habitat restoration: For the high-intensity grassland/shrubland restoration scenario, the starting land condition is active or former agricultural land that provides minimal ecological services. The restoration actions would include acquiring and protecting land, planting and seeding native vegetation species, noxious weed control, and installing cattle-exclusion fencing. Based on their experience with natural resource management and best professional judgement, the Trustees concluded that these actions would result in a 90% service uplift (Table 4) from the starting conditions and take 15 years to achieve full restoration benefits.

For the moderate-intensity grassland/shrubland habitat restoration scenario, the starting land condition is active or former agricultural land that provides minimal ecological services. Restoration actions would include acquiring and protecting land, installing cattle-exclusion fencing, and noxious weed control. Based on the Trustees' experience with natural resource management and their best professional judgement, these actions will result in a 90% service uplift (Table 4) from the starting conditions. The Trustees concluded that without active vegetation planting, it will take 20 years to achieve full restoration benefits for this scenario.

Mature cottonwood gallery preservation: The Trustees based their quantification of benefits from preserving mature cottonwood gallery habitat on an avoided risk of development of 7%. The avoided risk of 7% over 41 years was based on the likelihood of timber harvesting, as reported by DTM Consulting and Boyd (2008). The recovery timeframe of 41 years is based on the time over which closed timber habitat degradation was observed along the affected reach of the Yellowstone River (DTM Consulting and Boyd, 2008). This restoration type was specifically included in the terrestrial HEA because the preservation of standing dead trees within mature cottonwood gallery habitat also provides benefits to cavity-nesting birds, and these benefits were quantified to offset avian injuries (described elsewhere).

Scaled Restoration

The amount of restoration required to offset injuries is summarized in Table 5. In the HEA, the Trustees applied a 50/50 mix of the moderate and high-intensity restoration scenarios for the bottomland and grassland/shrubland restoration options.

Table 5. Amount of restoration required to offset injuries

Restoration concept	Acres of restoration required to offset injuries
Bottomland/riparian restoration	299
Grassland/shrubland restoration	42
Mature cottonwood gallery preservation	142
Total	**483**

a. This restoration also provides benefits for cavity-nesting birds, which are discussed elsewhere.

Using the injury input parameters described in Section 1.3 (Table 3) and the restoration input parameters described in this section (Table 4), the Trustees' analysis showed that a total of 483 acres of restoration (299 acres of bottomland/riparian restoration, 42 acres of grassland/shrubland restoration, and 142 acres of mature cottonwood gallery preservation) is

needed to offset the terrestrial debit of 3,239 DSAYs associated with injuries in the Yellowstone River floodplain (Table 5). Specifically, the bottomland/riparian restoration offsets 2,160 DSAYs, the grassland/shrubland restoration offsets 865 DSAYs, and the mature cottonwood gallery preservation offsets 214 DSAYs.

2. LWD REA

Here we describe the LWD REA that the Trustees developed to quantify injuries to LWD and scale restoration. We briefly describe the role of LWD in the Yellowstone River system and the impacts of the spill and response activities to LWD piles (Section 2.1). We then provide a brief overview of REA (Section 2.2), followed by a description of the LWD REA debit input parameters and injury quantification (Section 2.3), and the credit input parameters and scaling (Section 2.4).

2.1 Overview of LWD and Injuries due to Oil and Response Activities

A large number of LWD piles were oiled as a result of the spill, and these piles were subsequently targeted for removal and other cleanup actions during response activities. Accordingly, the Trustees evaluated injuries to the LWD piles, focusing mainly on the impacts of response activities, because removal of debris and other cleanup actions likely had the most severe and long-lasting impact on the piles.

LWD piles are distributed throughout the reach of the Yellowstone River downstream of the spill site (Figure 4), and these piles play an integral role in geomorphic fluvial and ecological processes in large, free-flowing, braided river systems such as the Yellowstone River. The fluvial-geomorphic importance of LWD piles includes that they support island formation and help to reduce erosion on islands and along the riverbanks (Abbe and Montgomery, 1996). LWD piles are also an important and unique source of shelter and food for fish, invertebrates, small mammals (e.g., mink), birds, reptiles, and amphibians; and provide surface area for the growth of aquatic invertebrates, which are an important food source for fish (Culp et al., 1996; Jacobson et al., 1999). LWD piles are also a source of organic material and nutrients in both aquatic and terrestrial settings, which are released as the debris breaks down and decomposes (Table 6; Bilby and Likens, 1980; Hilderbrand et al., 1996). Finally, LWD piles provide depositional habitat exposed to sunlight that supports cottonwood regeneration and protection from ice-scouring in winter; these are important ecological functions on the Yellowstone River (Lytle and Merritt, 2004; Mitchell et al., 2008).

Injuries due to Oiling

The presence of oil on LWD piles reduced the quality of the ecological services they provide, and directly harmed biota that used or came into contact with oiled LWD (Figure 5). Many of the biological receptors that rely upon these piles, including birds, reptiles/amphibians, and invertebrates, were exposed to oil from the spill. For example, most of the oiled toads that were collected during wildlife recovery were found at LWD piles.

Figure 4. Two examples of undisturbed LWD piles downstream of the spill site. Panel A shows a close-up of an undisturbed LWD pile, and Panel B shows an aerial view of an undisturbed LWD complex in the Yellowstone River. Photo credit: USFWS (A) and Response Team (B), provided by MT Natural Resource Damage Program.

(A)

(B)

Table 6. Important ecological functions provided by LWD

Type of service	Services provided
Terrestrial ecological services	Shelter
	Food
	Organic material
	Habitat (small invertebrates and small mammals)
Aquatic ecological services	Fish-rearing habitat
	Surface area for aquatic invertebrates
	Organic material
	Flow refugia
	Shade/shelter
Geomorphological services	Water pools
	Island formation
	Cottonwood regeneration
	Erosion reduction
	Channel morphology alteration

Figure 5. Heavily oiled debris pile near the spill site. This very large pile on an island just downstream of the pipeline break was cut and disassembled using heavy equipment to remove pooled oil and oiled debris. Photo credit: MDEQ.

Injuries to LWD Related to Response Actions

LWD piles were also injured by response actions. The Trustees conducted two LWD surveys in the spring and fall of 2012 to document examples of the types of response actions that were taken at LWD piles. The Trustees also conducted a review of aerial imagery to identify piles that were affected by oiling and subsequent response activities, based on pre- and post- spill imagery. Based on observations made by the Trustees during the surveys and from the aerial imagery, there were 28 piles between the spill point and the City of Billings (a distance of approximately 15 miles) that were oiled and targeted during response activities.

Disturbance ranged from cutting and hauling away oiled debris, to disassembling piles. Branches were removed, and large logs were cut into smaller pieces, resulting in permanent damage (Figure 6). Removing LWD material reduced the size and value of habitat provided by the remaining LWD, and also caused adverse changes in the geomorphic and fluvial services provided by LWD piles, such as increased erosion, reduced sediment retention, and lost aquatic habitat (e.g., fewer pools or velocity refugia). Dismantled and scattered piles provide less cover and, thus, lower-quality habitat than intact piles; biota inhabiting these piles are more vulnerable to predation and other environmental stressors. Further, disassembling a pile changes its physical structure (e.g., anchoring, complexity, ability to trap/recruit new material, ability to remain anchored in place in subsequent events) and thus its geomorphological functions.

Finally, removing material and disassembling piles negatively affected cottonwood regeneration in 2011. The summer 2011 flood was a significant event for cottonwood regeneration, and while this injury was not formally quantified by the Trustees, the loss of LWD may have reduced the amount of suitable cottonwood regeneration habitat downstream of the spill site.

2.2 REA

REA is a restoration scaling technique based on the same conceptual framework as HEA, described in Section 1.2. Natural resource Trustees can use REAs to estimate the amount of restoration needed to compensate for injuries to a single natural resource rather than a habitat or ecosystem. REA calculations quantify injuries and restoration credits on a resource unit-basis, such as the number of injured individuals. Like HEA, REA can incorporate change in the conditions of a resource over time to address the temporal component of both injury debit and restoration credit.

REA inputs that may be used include:

- Resource type injured and being restored
- Number or amount (e.g., volume in the case of LWD) of injured resource and number or amount (volume) provided by the restoration action(s)
- Timeframe of the injury and the restoration benefits
- Quantum of loss (injury) and gain (restoration)
- Discount rate.

Figure 6. Pre-response (Panel A, photograph from 2011 before the spill) and post-response (Panel B, photograph from 2013) aerial photographs of the same LWD piles. In the post-response image, materials from both piles in the yellow circles had been cut, scattered, or removed. Photo credit: USDA 2009 Basemap, modified by Beau Downing, MT Natural Resource Damage Program.

(A)

(B)

In the case of the LWD REA, the Trustees based the REA on the volume of LWD injured and restored. Like with a HEA, on the debit side, the timeframe covers the full time period over which the injuries occur: losses accrue from the onset of the injury and continue until baseline conditions are achieved, whether through natural recovery, response activities, or a combination of the two. On the credit side, the timeframe covers the time required for restoration to be achieved and the duration for which the restoration continues to generate resources. Finally, like HEA, REA incorporates a discount rate (typically 3%) that compounds (past) and discounts (future) of losses and gains over time.

The typical unit of measurement for REA is expressed as a discounted-resource unit-year, where the "unit" is the quantified resource metric. In the case of LWD, the Trustees quantified the volume of LWD as 28 piles that were injured by the oil spill and response actions, and the unit of measure was a discounted-m^3-year (DMY). In order to determine how much restoration is required to offset injuries, the REA model balances the number of injury units with the number of units accrued by restoration projects.

2.3 LWD REA Debit Input Parameters

This section presents the LWD REA debit input parameters and summarizes the resulting injury quantification (debit). Specifically, we describe the amount of the resource (LWD) injured, the timeframe, and the service loss for injuries that occurred in the floodplain. The Trustees used the standard 3% discount rate for their REA calculations.

Amount (Volume) of Injured LWD

As described above, 28 LWD piles located downstream of the spill site were injured by the oil spill and by response actions. The Trustees calculated the amount of LWD injured based on the volume of LWD piles affected. Injuries were quantified based on two categories of LWD pile losses: (1) LWD material that was removed altogether from the system during response activities; and (2) LWD piles that were disassembled and cut up during response activities, and were therefore no longer able to function as piles.

Amount of LWD removed from the river system (m^3): The Trustees concluded that the LWD material removed from the piles and hauled away for offsite disposal was a 100% loss to the system. The amount of material permanently removed was estimated using available response data, which included the number and type of bags filled with oily debris that were hauled away for disposal. The removed volume of LWD was calculated for each bag type by multiplying the volume of the bag by the number of bags, and then summing across all bag types. The total estimated volume of removed LWD was 2,624 m^3 (Table 7). This amount represents the minimum amount of LWD materials that was removed, as the ARCADIS (2011) report that summarized response activities indicated that the records of bags of debris removed were incomplete. In particular, removals during the first few days of response activities were not recorded.

Table 7. Estimated minimum volume of LWD permanently removed during response actions

Bag type	Bag volume (m^3)	Total number of bags that contained LWD	Total volume (m^3)
Super sack	0.765	119	91
Oily debris bag	0.132	18,483	2,443
Woodchip bag	0.133	135	18
Contaminated wood bag	0.132	544	72
Total estimated volume removed			2,624

Amount of LWD that was affected by dismantling piles (m^3): In order to estimate the total volume of LWD that remained in the fluvial system but was adversely affected by response activities, the Trustees used information they gathered during their 2012 field surveys. During these field surveys, the field crews measured the dimensions of 13 disturbed LWD piles and used those observations to estimate the average volume for an individual pile (816.5 m^3). The average per-pile volume was multiplied by 28, which results in a total disturbed volume of 22,862 m^3.

Based on field observations and aerial imagery, the Trustees concluded that roughly 40% of the woody debris from the dismantled piles (9,145 m^3) would be reincorporated into LWD piles in the future, but that 60% of the debris (13,718 m^3) was cut into such short, "clean" pieces (short lengths, side branches cut off, etc.), that it would no longer function as pile material, and therefore was effectively a 100% loss to the system (see Figure 5).

Injury Timeframe

The LWD material that was hauled away for disposal and permanently removed from the river system (2,624 m^3) was treated as a permanent loss in perpetuity in the REA calculation.

The LWD in disturbed piles had two different fates. The 60% that was permanently lost was treated as a 100% loss in perpetuity in the REA. For the remaining 40%, the Trustees concluded, based on their observations from previous flood events on the river and a review of historical aerial photographs, that a 15-year flood event (corresponding to approximately 63,000 cfs; USGS, 2016) would be sufficient to transport and redistribute the disturbed debris back into LWD piles. The Trustees estimated that it would take two such events to ensure that all disturbed wood was recruited into piles, for a total recovery period of 30 years.

Given the LWD losses and timeframes described above, the total injury DMYs are 623,976: permanently removed material accounts for 84,756 DMYs and disturbed material accounts for 539,220 DMYs.

2.4 LWD REA Credit Input Parameters

The Trustees identified one primary restoration concept that would compensate for the lost and disturbed LWD. This concept includes obtaining erosion and logging conservation easements on cottonwood bottomland habitat. The purpose of the easement is to allow natural fluvial erosional

processes to occur that will provide a source of LWD pile material to the system through falling trees in the future. The easement could be placed on actively eroding shorelines to preserve the naturally occurring erosional process or on locations with hard armoring and rip-rap. In the latter case, the restoration would include removing the hard armoring and rip-rap to allow erosional processes to resume. These easements would specifically focus on erosion and logging; they would not preclude grazing, farming, or other agricultural practices, and thus would not be considered habitat easements.

The volume of LWD restored was determined by developing a LWD loading rate (volume of LWD/acre/year) for the floodplain. This loading rate was used to calculate the number of habitat acres required to produce (over time) the volume of LWD piles necessary to offset the injuries. The number of cottonwood trees that would fall into the river was calculated using a literature-based shoreline erosion rate and literature-based values for the density of cottonwood stands. The shoreline erosion rates are from the State of Montana Channel Mitigation Zone (CMZ) report for the reach upstream of Billings (Yellowstone River Conservation District Council, 2009). The cottonwood density calculation was based on data collected from the Missouri River in Montana, which supports cottonwood habitat similar to that along the Yellowstone River (Scott et al., 1997). Using this approach, the LWD loading rate used in the REA was 28 m^3/acre/year.

The restoration timeframe is based on the understanding that LWD will likely enter the river in a pulsed fashion, during flood events of a magnitude that occurs approximately every 15 years (corresponding to approximately 63,000 cfs; USGS, 2016). Thus, in the credit calculation, LWD material was added to the system in 7 discrete events: once every 15 years over 100 years (Swanson and Lienkaemper, 1980; Gottesfeld and Gottesfeld, 1990). The volume of material contributed was used to determine the number of acres of restoration required to offset the injuries.

Using these REA input parameters, the Trustees determined that 958 acres of restoration would be required to offset LWD injuries. This amount of restoration would offset the calculated debit of 623,976 DMYs.

3. Fish Health Injury Studies and Data Analyses

Based on wildlife recovery data collected during response activities, many aquatic biological resources were adversely affected by the spill. This included 83 fish, 121 amphibians, 13 snakes, and 2 turtles that were oiled or dead subsequent to the spill (MDEQ, 2012). The Trustees selected fish as a representative species for their instream assessment. Fish were chosen because the Trustees had the most robust dataset for fish compared to other species, and fish are a key component of the ecosystem and are excellent indicators of instream ecosystem health.

To assess injuries to fish, the Trustees completed three fish health study investigations. Section 3.1 summarizes the fish health studies and Section 3.2 summarizes the data analysis and results from those studies.

3.1 Summary of Fish Health Studies

The Trustees conducted three fish health studies: one in September 2011, followed by a second study in April 2012, and a final study in September 2012.

In September 2011, approximately 90 days after the spill, the natural resource Trustees collected fish to investigate general fish health and exposure to oil contaminants. This study was conducted in Divisions A through C and at an upriver reference area located approximately 6 miles upstream of the spill site. In April 2012, the Trustees conducted a second fish health near the spill site in Division A (approximately 5 river miles downriver from the spill site) prior to the annual high-water flow. In September 2012, the Trustees conducted a cooperative fish health study with EMPCo in Divisions A through C (extending approximately 50 river miles downriver of the spill site), and two reference sites, located 6 and 30 miles upriver from the spill site.

In the September 2011 study, fish were collected using boat-mounted electrofishing equipment. The species targeted for the study included:

- Brown trout (*Salmo trutta*)
- Goldeye (*Hiodon alosoides*)
- Longnose sucker (*Catostomus catostomus*)
- Mountain whitefish (*Prosopium williamsoni*)
- Rainbow trout (*Oncorhynchus mykiss*)
- Shorthead redhorse (*Moxostoma macrolepidotum*).

Gross observations (such as length, general condition, frayed fins, lesions) were made for all fish collected. Samples from the target species were collected and analyzed for bacteriology, virology, and histology. Specifically, gill, liver, kidney, gonad, skin, and muscle tissue samples were collected for histological assessments. Tissue samples were also collected from the liver, gonad, and bile for chemical analyses if there was enough remaining after the histology samples were collected.

The Trustees conducted the second fish health study between the ice-off and the spring high water, on April 25 and May 11, 2012. This was an abridged study that focused on two collection locations: one reach in Division A between the spill site to 5 miles downriver, and one reach upriver in a reference area 15 miles upstream of the spill site. This study targeted two fish species: shorthead redhorse and rainbow trout. For this sampling effort, the Trustees collected blood smears for hematology, otoliths for microchemistry, and liver tissue for CYP1A expression analysis in addition to the fish and tissue samples collected during the fall 2011 sampling effort described above.

The final fish health study was a cooperative effort between the Trustees and EMPCo conducted between September 19 and 27, 2012. This study encompassed a larger geographical extent than the two previous fish health studies and expanded on the types of samples collected. Fish were collected at a reference location approximately 30 miles upstream of the spill site and as far as 50 miles downstream of the spill site. During this study, adult and sub-adult fish were collected

using boat-mounted electrofishing equipment and small rough and forage fish were collected from shallow-water habitats using backpack electrofishing equipment. The same types of samples were collected and analyses were performed on the fish as in the spring of 2012.

3.2 Fish Health Studies Data Analysis and Results

Results of the three fish health studies confirmed that the oil resulted in adverse effects to fish in the Yellowstone River downstream of the spill site (Table 8).

In particular, abnormalities were observed in skin (e.g., external lesions), gill, kidney, liver, and blood samples that have been associated with exposure to oil in studies reported in the literature (Table 8). Significant findings from histopathological assessments include:

- ***External lesions and scars*:** In the fall of 2011, lesions were observed at a greater frequency at downriver sites than upriver sites (Table 8). The lesions were deep with underlying dermal inflammation, and were not associated with bacteria, viruses, or fungi (Figure 7). Fish exposure to oil has been shown to be associated with the formation of lesions in published toxicological studies (Sved et al., 1997; Steyermark et al., 1999; Hargis, 2000; Aas et al., 2001; Khan, 2003, 2013). Some studies have shown that fish with lesions may have compromised immune systems (Esteban, 2012); and fish with lesions may also have reduced survival, growth, and reproduction potential (Benejam et al., 2010; Khan, 2013). By the fall of 2012, lesions were rare and mostly small. Scars (i.e., dark to light grey blotches or areas of abnormal, regenerating scales on the bodies of collected fish; Figure 6) were observed on some fish in the spring and fall 2012 studies, suggesting that these fish may have been exposed to the oil, and were recovering.

- ***Kidneys*:** Observations in kidney histology samples from fish collected downstream of the spill site in the fall of 2011 included elevated macrophage aggregates and regeneration of kidney tubules (Table 8). An increase in macrophage aggregates indicates elevated red blood cell death. Kidney tubules are involved in ion exchange and are important in maintaining internal salt and water balance in freshwater fish (Jobling, 1995). Fish have the ability to regenerate new tubules when damaged or stressed. Therefore, an observation of increased tubule regeneration is consistent with exposure to toxicants like oil. Observations were also made of sclerotic glomeruli in the kidney nephrons. The presence of sclerotic glomeruli indicates damage to the nephrons. Damage to tubules and nephrons can interfere with ion exchange, reduce clearance of waste products from the bloodstream, and injure surrounding kidney tissues (McKee and Wingert, 2015). By the fall of 2012, these observations were rare. Tubule pathology changes have been associated with slight increases in mortality and significant decrease in growth and condition factors after exposure to polycyclic aromatic hydrocarbons (PAHs; Vethaak et al., 1994; Kakkar et al., 2011) or other toxicants (Tashjian et al., 2006).

Table 8. Summary of fish health study histology results

Effect	Fall 2011				Spring 2012		Fall 2012					
	Upriver, Buffalo Mirage	Div. A	Div. B	Div. C, East Bridge	Upriver, Park City	Div. A	Upriver, Columbus	Upriver, Buffalo Mirage	Div. A	Div. B	Div. C, East Bridge	Div. C, Bundy Bridge
External lesions	0.9%	12%	2.2%	21%	0.0%	2.2%	0.7%	0.5%	0.8%	1.3%	1.1%	3.0%
Kidney macrophage aggregates	8.7%	20%	50%	36%	11%	55%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Sclerotic glomeruli in kidney nephrons	4.3%	37%	25%	32%	0.0%	27%	33%	18%	67%	67%	25%	52%
Regenerating kidney tubules	4.3%	26%	42%	41%	0.0%	41%	8.3%	9.1%	13%	4.2%	8.3%	0.0%
Pleomorphic hepatocyte nuclei in the liver	0.0%	23%	36%	17%	0.0%	26%	0.0%	0.0%	0.0%	0.0%	4.2%	0.0%
Liver bile duct necrosis	4.3%	23%	7.1%	30%	4.8%	22%	0.0%	0.0%	0.0%	0.0%	8.3%	0.0%
Hemocytoblasts (average number of blast cells counted on blood smears)	Not sampled				0.0	5.4	0.0	0.0	0.0	0.0	0.0	0.0
Immature red blood cells (average number of cells counted on blood smears)	Not sampled				10	80	7.2	4.2	9.4	6.3	16	5.2

Figure 7. Photograph of an external lesion observed on a shorthead redhorse collected in summer 2011 downriver from the spill site (A), and scarring/regenerating scales observed on a shorthead redhorse collected in spring 2012 downriver from the spill site (B). Photo credit: MT FWP.

(A)

(B)

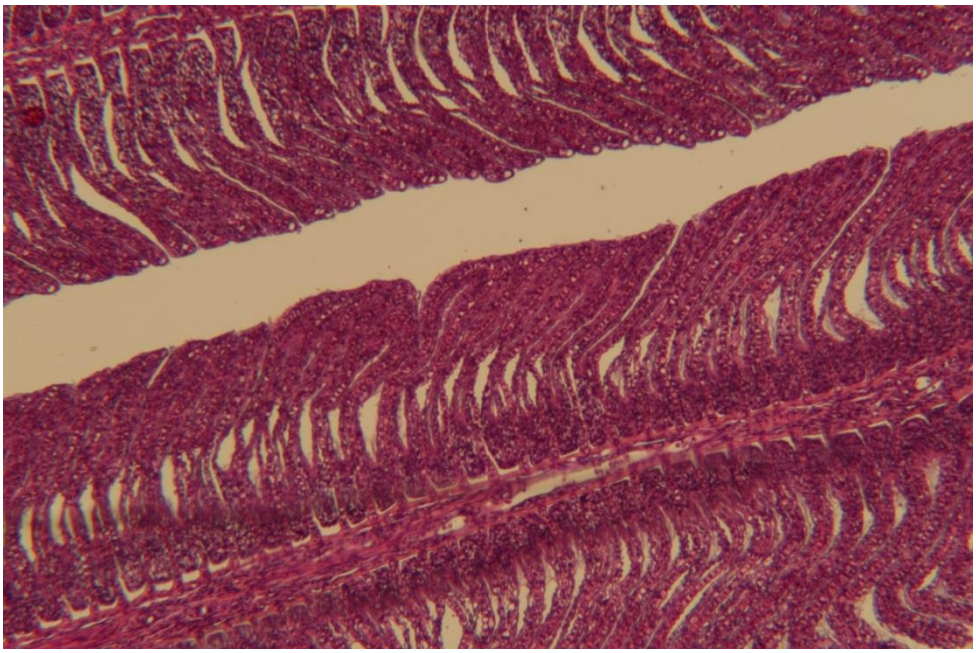
- ***Liver*:** Necrosis (tissue death) of bile ducts was observed in fish collected in the fall of 2011 (Table 8). The liver is the primary organ for metabolism and excretion of toxic components of oil; PAHs (Tuvikene, 1995). Tissue damage occurs during metabolism when PAHs are transformed into toxic metabolites and reactive oxygen species are produced. Changes in liver hepatocytes were also observed and included pleomorphic nuclei (variation in the size and shape of cell nucleus) and vacuolation (cellular swelling). These observations have been previously associated with oil exposure in fish livers (Agamy, 2012; Biuki et al., 2013). The lack of glycogen or fat storage was observed in all species. In the fall of 2012, bile duct necrosis was no longer remarkable in the collected fish samples.
- ***Blood:*** In the spring of 2012 (blood samples were not collected in fall 2011), hemocytoblasts and high numbers of immature red blood cells were observed (Table 8). These pathology changes indicate damage to blood cells. Hemocytoblasts in particular are not observed in healthy fish (Clauss et al., 2008). Hemocytoblasts were not observed in any upriver fish. There were significantly fewer immature red blood cells and no blast cells observed in the fall of 2012.
- ***Gills:*** Anecdotal observations of fused gill lamellae tips were also made at downriver sites in the fall of 2011 (Figure 8). This is significant, because fusion of the gill lamellae in fish is a known response to exposure to toxicants such as oil (Pacheco and Santos, 2002; Nero et al., 2006; Camargo and Martinez, 2007; Santos et al., 2011; Khan, 2013). In fish, gill lamellae are the primary surface where respiration (intake of oxygen) occurs. Fish with fused lamellae tips have a compromised respiratory system, and are therefore potentially less fit and may have reduced growth and reproduction potential (Khan, 2013).

Finally, while a major fish kill was not observed, 83 fish were collected subsequent to the spill, and it is possible that many more fish died but were not detected. Flows in the Yellowstone River at the time of the spill were 70,000 cfs and high flows lasted for an extended period of time. Due to these high flows, crews searching for fish and wildlife were not able to gain access to the river and begin searching for fish and other wildlife until two weeks after the spill.

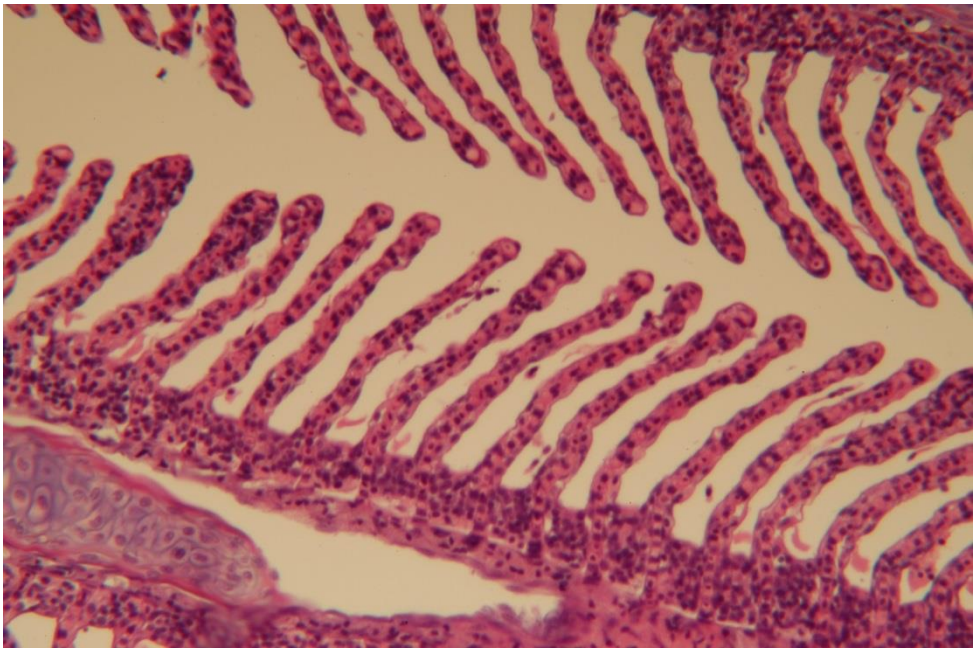
Further, no formal fish kill survey was performed at the site, though dead fish were recovered opportunistically. Even if a fish kill survey had been performed in the hours after the spill, only a fraction of the fish that were killed would likely have been found. According to Southwick and Loftus (2003, p. 18), “Estimates of losses based on countable dead fish will be conservative. Very seldom will the counts represent more than a modest fraction of the fish killed.” For example, in simulated fish kill tests conducted in the East Fork Poplar Creek in Oakridge, Tennessee, only 5–30% of the fish were recovered after 24 hours, depending upon flow conditions, where the flow ranged from 3.5 to 28 cfs (Ryon et al., 2000). At the Beaver Butte Creek, Warm Springs, Oregon gasoline spill site, where 404 chinook yearlings were recovered, the Trustees for the site ultimately estimated that a total of 44,741 yearlings died as a result of the spill (NOAA, 2004). At the Cantara spill near Dunsmuir, California, where 586 fish were found dead in fish kill surveys conducted starting 4 days after the spill, the total estimated number of killed fish was 312,508 (Hankin and McCanne, 2000).

Hence, given the very high flows and long interval between the spill and the time fish recovery began, and the fact that only a small fraction of fish are typically ever recovered at fish kills, the 83 recovered fish may represent only a small fraction of the total fish that died as a result of the oil spill.

Figure 8. Photomicrograph of fused gill lamellae from a fish collected downriver from the spill site in fall 2011 (a); and normal, non-fused gill lamellae collected upriver from the spill site in fall 2011 (b). Photo credit: Headwater Fisheries, LLC.



(a)



(b)

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Appendix D
Bird Injury Assessment

Appendix D

Bird Injury Assessment

After the oil spill, a total of 28 birds were found dead, 51 were observed oiled, and four oiled birds were captured, cleaned and released. Some of the birds that died or observed oiled included waterfowl and other aquatic-dependent species. These species were likely oiled as they fed and rested on the spill-impacted section of the Yellowstone River. Other species of birds such as passerines and raptors that were also oiled and were likely exposed to oil in the aquatic or terrestrial environment, or both. Since much of the floodplain was inundated with water during the spill, large areas of Yellowstone River riparian corridor was oiled, this included inundated vegetation, large woody debris piles and numerous backwater channels. As the river receded after high flows, a line of oiled vegetation was evident in many areas. Birds such as black-capped chickadees, downy woodpeckers, and white-breasted nuthatches that utilize the riparian area of the Yellowstone River were likely oiled as they foraged, collected nest materials, and rested among oil covered vegetation. Similarly, raptor species were exposed to oil as they foraged throughout oiled vegetation and in the case of bald eagles, they could have also been exposed in the aquatic environment as they fished in oil-impacted sections of the river. Exposure to oil can cause a number of adverse effects in birds that may include, but are not limited to hypothermia due to impaired thermoregulation, inflammation of the gastrointestinal lining, liver and kidney disorders, and impaired reproduction[1].

Because of the variety of species impacted by the oil spill, the Trustees developed two separate projects. One to address the only species of bird injured as a result of the spill that does not breed along the Yellowstone River corridor, the American white pelican and associated species. All other species of birds injured were addressed with another project for cavity nesting species.

The Trustees estimate that pelican injuries would be offset by reduced predation at breeding sites elsewhere in Montana, and propose a two or more year program of:

- Water purchases,
- Predator reduction through fencing, and
- Monitoring as specified in the DARP.

The Trustees estimate that the injury to cavity nesters and associated species would be offset by permanent protection of cottonwood bottomland habitat suitable for woodpeckers and propose a program of:

- Conservation easements of suitable habitat, and
- Restoration of degraded habitat.

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[1] Friend, M and J.C. Franson. (eds.) 1999. Field Manual of Wildlife Diseases: General Field Procedures and Disease of Birds. U.S. Geological Survey, Biological Resources Division Information and Technology Report 1999-2001, Reston Virginia

Pelicans

For the pelicans, the Trustees propose reducing predation at nesting areas in northeast Montana (Medicine Lake NWR, Bowdoin NWR) through fencing and water purchases. Water additions can prevent land bridges to islands from forming in dry years at Bowdoin Lake.

Only a portion of the pelicans produced in these nesting areas spend their second and subsequent years along the Yellowstone River. A radio-band study at Medicine Lake NWR[2] reported that two out of five radio-tagged birds fledged at Medicine Lake NWR (40%) later appeared along the Yellowstone.[3] Pelicans banded at Bowdoin NWR showed similar migratory patterns to those from Medicine Lake NWR, thus the Trustees assume that likewise 40% of Bowdoin NWR pelicans would appear along the Yellowstone River.

The Trustee data (shown for pelicans and associated birds in Table 1) include one collected dead pelican, and five observed oiled pelicans. Assuming an 85% mortality rate for oiled birds[4] and applying multipliers for searcher efficiency, carcass persistence and unsearched areas, the Trustees estimate a total of 36 dead pelicans.

Assuming that these 36 pelicans in the Yellowstone represent 40% of a cohort fledged elsewhere, the Trustees seek to replace a total of 90 adult pelicans at the breeding areas. Based on average reported hatching and fledgling success rates, it is estimated that 25% of nests will each produce an adult bird. [5] Thus, replacing 90 adult pelicans would require avoiding predation for 365 nests.

The Annual Narrative from Medicine Lake NWR[6] documented reduced American white pelican nesting from the presence of a coyote den. This resulted in a 75% reduction in nests, either through predation or nest abandonment. Thus, the Trustees assume that excluding large predators, such as coyotes from the colony during a given breeding season would avoid the 75% reduction in nests that would otherwise happen. A much smaller reduction in nests would be realized from removals of raccoons or skunks.

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[2] This colony has been breeding since 1939, and is the largest in Montana and an important contributor to the eastern metapopulation.
[3] Restani, M. and E.M. Madden. 2005. Movements of White Pelicans breeding at Medicine Lake National Wildlife Refuge, Montana. Refuge Report DCN: 61530-1-J026. 52 pp.
[4] Chalk Point – Final restoration plan and environmental assessment for the April 7, 2000 Oil Spill at Chalk Point on the Patuxent River, Maryland. November, 2002. pp86.
[5] Knopf, F., and R. Evans. 2004. American White Pelican (*Pelecanus erythrorhynchos*). The Birds of North America Online, 57: 1-20.
[6] U.S. Fish and Wildlife Service. 1979. Medicine Lake National Wildlife Refuge, Lamesteer National Wildlife Refuge, Annual Narrative Report, Medicine Lake, MT.

The number of nests at Bowdoin NWR varies widely from year to year. Comparing these potential avoided losses to the 365 nests required to produce 90 adult pelicans at the refuge indicates that for all but the lowest-occupancy years (years with fewer than 487 nests), a single season of coyote exclusion would achieve the restoration goal.[7] As available data show no periods of two consecutive years with fewer than 487 nests, the Trustees assume that a two-year program of water-purchases, predator exclusion as necessary, and monitoring would have a high likelihood of achieving the restoration goal of 90 adult pelicans at the refuge, of which 36 are expected to return to the Yellowstone River area. The proposed projects would likely benefit other injured species in addition to pelicans, including great blue herons, Canada geese, mallards, northern shovelers, and ring-billed gulls.

Table 1. Spill-Related Bird Mortality: Pelicans and Associated Species

Species	Collected Dead	Observed Oiled	Assumed Dead*
American white pelican	1	5	36
Great blue heron	2	1	37
Canada goose	2	12	79
Mallard	1	3	28
Northern shoveler	0	1	4
Ring-billed gull	1	0	17

* The Trustees assume an 85% mortality rate for oiled birds and apply multipliers for searcher efficiency, carcass persistence and unsearched areas.

Cavity nesters

Several of the individuals injured in the spill require tree cavities for nesting and roosting. Table 2 presents a summary of Trustee data on these birds.

Table 2. Spill-Related Bird Mortality: Cavity-nesting Species

Species	Collected Dead	Observed Oiled	Assumed Dead*
Downy woodpecker	0	1	4
Black-capped chickadee	0	2	8
White-breasted nuthatch	0	1	4
Great horned owl	2	0	33
Common merganser	0	4	15
Wood duck	1	0	28

* The Trustees assume an 85% mortality rate for oiled birds and apply multipliers for searcher efficiency, carcass persistence and unsearched areas. Only adult birds (and not their offspring were accounted for because the Trustees used a habitat equivalency analysis approach instead of a resource equivalency analysis, the latter approach typically accounting for both avian adult and offspring mortality).

[7] Excluding only predators smaller than coyotes would likely result in a lower number of avoided losses.

The Trustees propose restoring these lost individuals by preserving suitable habitat, assuming that additional acres of habitat will support increased numbers of these species. In particular, the proposed projects will preserve cottonwood bottomland areas at risk of being lost to development or agriculture. In addition, the Trustees know that several cavity-nesting trees were cut down during response, but do not know the extent of these activities. This additional loss of cavities was not included in calculating the injury.

Areas of interest would provide suitable habitat for "primary excavators" of tree cavities. Along the impacted reach of the Yellowstone River the main primary excavators include woodpeckers and the northern flicker (collectively, woodpeckers).[8] The Trustees assume that preserving habitat for primary excavators will allow these birds to create more cavities than would otherwise be available for the target species.

Model assumptions – Primary excavators

Habitat suitability information was most readily available for the downy and hairy woodpeckers as the Trustees developed an initial estimate of the number of preserved acres necessary to support the required number of primary excavators.

A pair of woodpeckers requires a territory of 4 hectares (about 10 acres). Each bird will likely produce two cavities annually in excess of its own needs, for a total of 4 available cavities per 4-hectare territory per year. The Trustees assume that 100% of the cavities created by woodpeckers are eventually suitable for use by other birds. The Trustees also assume that each territory is continuously occupied by a pair of woodpeckers; if one pair dies or moves away, a new pair will move in. The Trustees assume that once established, a fully functioning riparian cottonwood ecosystem will allow primary excavators to continuously produce new cavities.

The Trustees' assumptions imply that after one year, a territory would support approximately four cavity-nesting birds[9] of various species (in addition to the primary excavators), provided that these species' habitat requirements allow them to cohabitate within a 4-hectare area. Cavities will be enlarged over time, by the action of decay and the work of secondary excavators (e.g., chickadees, nuthatches). The Trustees assume that cavities sufficient for larger birds (owls, wood ducks, mergansers) take five years to form. This implies that during the initial years following restoration implementation, new cavities will be available for smaller birds, while larger birds will use cavities that were already in-place. Five years into a project, there will be new cavities for larger birds as well.

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[8] Jones and Hansen (2009); Montana Natural Heritage Program (2012) Divisions A and B.
[9] The Trustees have made the simplifying assumption that cavity decay rates are such that the average cavity persists for the lifetime of the cavity's inhabitant.

There are many cavity-nesting species along the Yellowstone River, both avian and mammalian. For simplicity, the Trustees ignore competition from mammalian species. On the basis of species richness, the target bird species represent 26% of all avian cavity nesters in the area. The Trustees assume that the target species will face competition for cavities from these other species, which must also be accommodated by the proposed projects.

Calculating a debit for cavity nesters

The death of the cavity-nesting birds listed in Table 2 has created a natural resource debit: certain birds missing from the Yellowstone River ecosystem for a certain period of time. The Trustees estimate this debit and express the result in terms of lost natural resource services: bird production in cottonwood bottomland habitat. This approach allows the Trustees to choose as a restoration project the preservation of similar habitat with its associated services, and to scale the project such that project-associated credits offset the size of the debit.[10]

The relatively large number of great horned owls injured, along with this species' habitat requirements suggest using owl habitat as a basis for estimating the injury to all cavity-nesting target species. The Trustees assume that restoring the missing owls would be sufficient to restore the rest of the missing cavity-nesting bird community. Conversely, an injury to cavity-nester habitat that removes these owls from the system would likely also remove the other species to the extent shown in Table 2.

Great horned owls are typically either part of a territorial, monogamous breeding pair, or non-territorial, non-breeding "floaters."[11] The Trustees modeled the 33 missing owls (from Table 2) as 16 pairs and one floater, all at the mid-point of an average 6-year lifespan.[12] The Trustees assume that the injury associated with removing these owls is equivalent to the injury associated with removing their required habitat.

The Trustees model these owls' required habitat as an area that supports primary excavators creating cavities that the owls can inhabit. As discussed in the previous section, a pair of woodpeckers requires a 10-acre territory. Thus, removing a pair of owls three years before the end of their lifespan is equivalent to removing a 10-acre woodpecker territory for three years. Owl territories are considerably larger than

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[10] Cottonwood bottomland habitat is in decline in the Yellowstone River area. Credits associated with proposed restoration projects arise from avoided loss of habitat and the associated services over time.

[11] The proportion of floaters in a population fluctuates with the availability of prey, from zero to over half (Rohner, 1997).

[12] Ohio Division of Wildlife reports that great horned owls in the wild have an average adult lifespan of 6 to 7 years. "Life History Notes; Great Horned Owl." Ohio Division of Wildlife. Publication 182 (1099).

woodpecker territories, so the Trustees model the relationship as a series of non-overlapping owl territories, each centered on a woodpecker territory.

Assuming a discount rate of removing the services associated with woodpecker habitat for a certain amount of time following the spill creates a debit of discounted service-acre years (DSAYs). This is, in effect, a habitat equivalency analysis approach, focusing only on the habitat services that supported the species of interest, rather than trying to tally bird-years associated with the various species killed (and their offspring). This approach assumes that the injury associated with the offspring is offset by the continued production of new cavities in the preserved areas.

Calculating a credit for avoided habitat loss

The Yellowstone River Conservation District Council report "Yellowstone River Riparian Vegetation Mapping"[13] used aerial photography from the 1950s, 1976-1977, and 2001 to describe the major vegetation types present along the river, and to evaluate general trends over time. The area injured in the spill falls within the report's Region B, which runs along the Yellowstone River from the confluence with the Clarks Fork of the Yellowstone River[14] to the confluence with the Bighorn River.[15] From 1950 to 2001 Segment B had a 5% reduction in areas with land cover classified as "Closed Timber." Reasons for loss of this habitat include agricultural development, road/Interstate development, and urban growth. [11] Of the four land cover types tracked in the report (Herbaceous, Shrub, Open Timber, and Closed Timber), only Closed Timber appears to match the habitat requirements of primary excavators and associated cavity-nesting birds, as described below in the section *Restoration project siting – Excavator habitat needs*.

Thus, the Trustees assume that in the area affected by the spill, habitat suitable for the target species declined over the 41 year time period and assumed that a portion of this service loss will continue into the future. The Trustees also assume that when applied over a relatively large area, a loss rate expressed as a proportion of habitat *acres* per year is equivalent to a loss rate of absolute habitat *services* per year. That is, on average, any given area in Segment B loses a portion of the area's ability to support primary excavators. Using these inputs, the Trustees determined the amount of suitable habitat (listed in Table 3-3 of the Restoration Plan) that would need to be protected from development to generate sufficient avoided-loss credits to offset the bird-kill debit.

Model assumptions – Number of restored cavities required

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[13] DTM Consulting, Inc. 2008. Yellowstone River riparian vegetation mapping. Bozeman, MT
[14] Upstream from Billings.
[15] At the border between Yellowstone County and Treasure County, midway between Billings and Miles City.

The Trustees assume that each cavity-nesting bird to be replaced will require its own cavity. Although a pair may share a cavity during nesting season, the Trustees assume that for most species each bird requires its own cavity for roosting, overwintering, avoiding predators and severe weather.[16] Although some of the target species are migratory, the Trustees assume that all species injured in the spill have individuals that visit the Yellowstone River year-round, and will therefore require all of the various services provided by tree cavities.

Some species (owls, wood ducks, mergansers) will use cavities formed by stochastic occurrences (e.g., lightning strikes, wind breaks), or nests abandoned by other species (crow, magpie, hawk, eagle). Owls may also use a ledge or large branch, but one study in Montana[17] located 18 great horned owl nests, 15 of which were in cottonwoods. This affinity for cottonwoods keeps owls in close proximity to water-sources like the Yellowstone River, where these trees are most plentiful.

As shown in Table 2, the Trustees seek to replace a total of 33 great horned owls, and assume a composition of 16 pairs and 1 non-territorial "floater." The Trustees assume that these owls could be accommodated by 16 primary excavator territories, with one excavator territory located within each owl territory. The Trustees also assume that these projects would benefit the other species listed in Table 2.

The Trustees assume that 25% (or 8.25) of the cavities required by the owls will be created by primary excavators, and the remainder will be natural cavities, stick-nests created by other birds, etc. As discussed above, primary excavators are assumed to create 4 cavities per year; this leaves 3 cavities per year within each owl territory to be occupied by floaters and other (non-owl) species.

Other species benefiting from primary excavators include wood ducks and mergansers. One study reports that 17% of wood duck cavities were created by primary excavators.[18] Mergansers are known to use similar habitat to what wood ducks use. The Trustees assume that as for wood ducks and mergansers, 17% of cavities are created by primary excavators. These species use one cavity per breeding pair. As shown in Table 2, the Trustees seek to replace a total of 43 wood ducks and mergansers (21.5 pairs), requiring 3.7 cavities to be created by primary excavators. The Trustees estimate that the 16 woodpecker/owl territories described above will have sufficient extra cavities to support these wood ducks and mergansers.

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[16] Wood duck and merganser breeding pairs will share a single cavity.
[17] Seidensticker, John C., IV, and Harry V. Reynolds III. The Nesting, Reproductive Performance, and Chlorinated Hydrocarbon Residues in the Red-Tailed Hawk and Great Horned Owl in South-Central Montana. The Wilson Bulletin, Vol. 83, No. 4 (Dec., 1971), pp. 408-418.
[18] Denton J.C., C.L. Roy, G.J. Soulliere, and B.A. Potter. 2012. Change in density of duck nest cavities at forests in the north central United States. Journal of Fish and Wildlife Management 3(1):76–88.

The Trustees also seek to replace 12 chickadees and nuthatches. Chickadees and nuthatches are weak excavators; they can enlarge a cavity to meet their needs, but cannot fully create their own roosting or nesting cavity, and so rely on primary excavators to start their cavities. Thus, the Trustees assume that 12 cavities for chickadees and nuthatches must be created by primary excavators, bringing the total to 24.[19] The Trustees estimate that the 16 woodpecker/owl territories described above will have sufficient extra cavities to support these chickadees and nuthatches.

As explained above in the section called *Model assumptions – cavity excavators*, only 26% of the supported birds would be from the target species, based on species richness among competing avian cavity nesters. Thus, the 24 primary-excavator cavities required for the target species represent 26% of 92.3 total cavities (rounded up to 93) required to support the full community of cavity-nesting birds expected to use the preserved habitat.

As shown above in the section *Calculating a credit for avoided habitat loss*, protection of suitable primary excavator habitat will occur through purchase of land or through conservation easements. The Trustees estimate that the area protected will be able to support the full community of cavity-nesting birds expected to use the preserved habitat. Thus, the required acreage developed with an owl-based injury assessment appears to be sufficient to offset the injury to all of the cavity-nesting birds affected.

Restoration project siting – Owl habitat needs

Studies[20,21], have reported that average great horned owl territories range from around 4.8 to 5.6 km^2. This suggests that the projects intended to develop owl territories must be spatially distributed along the Yellowstone River to avoid overlapping adjacent owl-pair territories. Assuming the average owl territory is 5 km^2 (1,300 to 1,400 acres), project areas should be at least 1.6 miles apart. Research has shown that vacant owl territories are readily re-colonized by other owls, typically by non-territorial, non-breeding "floaters." Before colonizing and beginning to defend a territory, floaters typically live secretive lives often venturing into the ranges of other territorial birds.[18] In southwestern Yukon, floaters made up a varying proportion of the population, from zero to over half, depending on cycles of prey availability.

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[19] 8.25 cavities for owls, 3.7 for wood ducks or mergansers, and 12 for chickadees or nuthatches.
[20] Rohner, C. 1996. The numerical response of Great Horned Owls to the snowshoe hare cycle: consequences of non-territorial 'floaters' on demography. Journal of Animal Ecology. 65: 359-370.
[21] Rohner, Christoph. (1997) Non-territorial Floaters in Great Horned Owls (*Bubo virginianus*). In: Duncan, James R.; Johnson, David H.; Nicholls, Thomas H., eds. Biology and conservation of owls of the Northern Hemisphere: 2nd International symposium. Gen. Tech. Rep. NC-190. St. Paul, MN: U.S. Dept. of Agriculture, Forest Service, North Central Forest Experiment Station. 347-362.

Restoration project siting – Excavator habitat needs

Each of the territories to be preserved must meet the habitat needs of the primary excavators expected to inhabit them. Primary excavators require canopy, structural complexity, and specific tree sizes and stand areas. Areas with sparse tree cover are less likely to develop the necessary cavities. Hairy woodpeckers, for example, require a wooded area at least 40 meters wide and downy woodpeckers reached highest densities in deciduous woodlands that included small trees with low canopy heights. [22,23,24] One study in Oregon estimated that downy woodpeckers require 7.4 snags per ha (3 snags/acre), 15.2 cm (6 inches) or more in diameter at breast-height (dbh).[25] This estimate is based on a territory size of 4 ha (10 acres), a need for two cavities per year per pair, and the presence of 1 useable snag with a cavity for each 16 snags without a cavity. A downy woodpeckers' optimal nest site is a live tree with a broken off dead top.[26]

Conclusions

The Trustees assume that the implementation of the projects outlined in the section will compensate for the injuries to birds resulting from the oil spill. These projects have a high probability of success, and will not have negative impacts.

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[23] Lemieux, S. 1996. Downy Woodpecker *Picoides pubescens*. Pages 648-649 in The breeding birds of Quebec: atlas of the breeding birds of southern Québec. (Gauthier, J. and Y. Aubry, Eds.) Assoc. québecoise des groupes d'ornithologues, Prov. of Quebec Soc. for the protection of birds, Can. Wildl. Serv., Environ. Canada, Québec Region, Montréal.

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[25] Thomas, J. W., R. G. Anderson, C. Maser, and E. L. Bull. 1979. Snags. Pages 60-77 in J. W. Thomas, ed. Wildlife habitat in managed forests—the Blue Mountains of Oregon and Washington. U.S. Dept. Agric, For. Serv. Agric. Handb. 553. 512 pp.

[26] Kilham, L. 1974. Early breeding season behavior of Downy Woodpeckers. Wilson Bull. 86:407-418.

Appendix E

Recreational Lost Use Analysis

memorandum

Environment and Natural Resources

Date: 5/31/2016

To: Doug Martin, Montana Natural Resource Damage Program

From: Kaylene Ritter, PhD, Abt Associates

Subject: Recreational Lost Use Analysis, for the 2011 Yellowstone River Oil Spill

This memorandum summarizes the assessment of recreational lost uses that staff at Stratus Consulting Inc. (now merged with Abt Associates) performed in 2012, on behalf of the State of Montana and co-Trustees for the Yellowstone River 2011 oil spill Natural Resource Damage Assessment (NRDA).

1. Background Information and Benefits Transfer Approach to the Assessment of Recreational Lost Uses

The State of Montana and co-Trustees conducted NRDA activities in the Yellowstone River and floodplain, as a result of the oil spill that occurred July 1–2, 2011. The spill occurred near Billings, Montana, and resulted in the discharge of approximately 63,000 gallons of oil to the Yellowstone River and floodplain. The spill occurred during a high flow event and, as a result, oil was distributed throughout the inundated floodplain, extending as far as approximately 70 miles downstream of the point of discharge (MT-DEQ, 2012). Response actions, including characterization of the extent of the discharged oil and cleanup activities, were initiated shortly after the spill and were completed by mid-October 2011 (MT-DEQ, 2012). The Trustees identified several categories of potential injury and human and ecological service losses that occurred as a result of the spill and response activities. Significant impacts to human uses occurred because of the presence of the spilled oil and because of the closure of facilities and river access due to response activities.

Recreational activities considered in the analysis include recreational fishing and other recreational activities conducted along the river, such as boating and camping. These losses occurred either because of the presence of oil and/or the closure of sites along the river. In each case, lost recreation activity is presented and then an economic value is attached to these lost recreational opportunities.

A benefit transfer approach was used in this recreational damage analysis. Benefit transfer can be defined as "the transfer of existing economic values estimated in one context to estimate economic values in a different context…. In the case of natural resource and environmental policies and projects, benefit transfer involves transferring value estimates from a 'study site' to a 'policy site' where sites can vary across geographic space and or time" (Bergstrom and De Civita, 1999, p. 79). The advantage of the benefit transfer methodology is that the costs of conducting an original study are avoided.

Benefit transfer is an accepted methodology under federal regulations and in the field of economics. Federal regulations at 43 CFR Part 11 include benefit transfer as a valuation

methodology that can be used in the damage determination phase for an NRDA. Furthermore, government agency guidelines for economic analyses discuss the application of benefit transfer (OMB, 2003; U.S. EPA, 2010). It is a widely used methodology in the field of economics, and there is a well-developed base of scientific literature on the topic (Rosenberger and Loomis, 2001).

We used economic values in the benefits transfer analysis from a study conducted for the U.S. Department of Agriculture (Rosenburger and Loomis, 2001). This study examined over 1,200 estimates of recreational values collected from studies conducted over a period of about 35 years. Table 1 provides an overview of the value per user day of activity for recreational activities reported by Rosenberger and Loomis (2001) for the Intermountain West region. These are the values we used in our analysis.

Table 1. Average economic value of recreational activities in the Intermountain West

Activity	Number of studies	Average economic value per trip (user day) (adjusted to 2012$)
Camping	21	43.25
Fishing	48	64.22
Float boating/rafting canoeing	22	84.34
General recreation	12	60.37
Motor boating	7	66.87

Source: Rosenberger and Loomis, 2001.

2. Results of the Benefits Transfer Analysis

Here we summarize the results of the performed analyses, including recreational fishing losses, municipal park use losses at parks in Billings and Laurel and at the Audubon Center, losses at state river access points, and losses at the Sundance Bureau of Land Management (BLM) recreational site. Finally, we provide a summary of the total damages resulting from these lost recreational uses.

2.1 Fishing

The Yellowstone River downstream from the spill site at Laurel begins a transition zone from a coldwater fishery to a warmwater fishery and provides a variety of fishing opportunities. Every two years the State of Montana conducts a fishing effort survey and produces estimates of fishing effort by water body and month. Of particular interest are three sections of the Yellowstone River beginning at the mouth of the Stillwater River, approximately 25 miles above the spill site, and extending to the mouth of the Bighorn River, approximately 70 miles below the spill site.

The total fishing pressure for the months of July, August, and September 2007, 2009, and 2011 for these three river reaches was estimated by the State of Montana at 17,399, 27,839, and 14,547 angler days, respectively. While the high flows during the spill event may have discouraged fishing for a short period, the presence of response activities and the closure of fishing access sites even after the river returned to lower flows are likely to have reduced fishing pressure.

Fishing efforts on the Yellowstone River between the mouth of the Stillwater River and the mouth of the Bighorn River dropped by 13,292 angler days between 2009 and 2011. However, if we assume that the high flows in July 2011 precluded fishing for a period, lost fishing trips could be confined to the months of August and September. The fishing pressure estimates for these months only indicate that fishing pressure dropped by 7,409 angler days between 2009 and 2011.

As shown in Table 1 the economic value of fishing is $64.22 per user day. Therefore, the 7,409 lost angler days results in a recreation fishing loss of $475,806.

2.2 Park Use: General Recreation and Camping

Here we provide a summary of lost general recreation and lost camping trips at local municipal parks in Billings and Laurel, and at the Audubon Center:

- **City parks in Billings:** The City of Billings has several parks located along the Yellowstone River downstream from the spill site. Several of these parks were closed either because of the spill or response activities, including closures of various lengths of time at Coulsen Park, Riverside Park, and Norm's Island.
- **Riverside Park, Town of Laurel:** Riverside Park is located immediately downstream from the spill site. This park was closed to all public uses from the time of the spill through January 15, 2012, because of its use as a staging area for response activities and activities related to the removal and replacement of the ruptured pipeline. Because of its location, this park typically receives substantial use by people passing through the area. In addition, Riverside Park also provides facilities for camping and, therefore, there were also lost camping days as a result of the spill.
- **Audubon Center:** This facility was not closed as a result of the spill or response activities. However, some of the programming for day camp attendees had to be relocated away from areas near the river where camp activities would have otherwise been conducted. While these user days were not lost, they were presumably of a lower quality since activities could not be conducted at the preferred locations. We estimated that the value of these user days was reduced to 25% of their full value (a 75% loss).

We obtained information from facility managers on the daily usage of these sites, and found there was a total loss of 26,882 general recreation trips and 784 lost camping trips as a result of the oil spill, with a value of $60.37 and $43.25 per trip, respectively (see Table 1). Of the general recreation trips, the losses at the Audubon Center (725 user days) were estimated to be a 75% loss (a user day value of $15.01). These user days were of decreased value because they were not fully lost, but were relocated to less-preferred locations. Therefore, total damages were found to be $1,590,040 for general recreation and $33,908 for camping.

2.3 State River Access Points: General Recreation, Floating/Canoeing/ Kayaking, and Power Boating

Here we summarize recreational losses at river access points managed by the State that were affected by the spill:

- **Bundy Bridge River access:** The Bundy Bridge River access was closed to the public for 20 days. This site provides public access to the Yellowstone River and a ramp for launching boats.
- **East Bridge River access:** The East Bridge River access was closed to the public for 20 days. This site provides a concrete ramp for boat launching.
- **Duck Creek River access:** The Duck Creek River access was closed to the public from the beginning of the spill through the end of September 2011, for approximately 90 days. This site also provides a ramp for boat launching.

These sites are used for general recreation, non-motorized boat trips (including floating, canoeing, and kayaking), and power boating trips. Based on information provided by the State on daily usage at these sites, we found that the closures resulted in a loss of 1,821 general recreation user days, 1,541 floating/canoeing/kayaking (non-motorized boat) user days, and 389 power boating user days. Based on the values per user day provided in Table 1, this resulted in damages of:

- General recreation: $109,934
- Floating/canoeing/kayaking: $129,968
- Power boating: $26,012.

2.4 BLM Site: General Recreation

Sundance Lodge recreation area: This area is operated by the BLM and is located about 2 miles downstream of the spill site. BLM staff reported that public access to this site was not available for about 30 days because of the oil spill. BLM staff also report that about 25 visitors normally use the area each day. The 30 days of closure are estimated to have resulted in about 750 lost visitor days. Valued at the general recreation value reported in the Rosenberger and Loomis (2001) study ($60.37; Table 1), the loss associated with these user days is $45,278.

2.5 Summary

Based on the information discussed above, total recreational losses due to the spill was found to be $2.41 million (Table 2).

Table 2. Summary of damages

Activity	Lost visits (user days)	Value	Damages
Fishing	7,409	$64.22	$475,806
Parks			
General recreation[a]	26,882	$60.37	$1,590,040
Camping	784	$43.25	$33,908
State river access sites			
General recreation	1,821	$60.37	$109,934
Floating/canoeing/kayaking	1,541	$84.34	$129,968
Power boating	389	$66.87	$26,012
BLM – general recreation	750	$60.37	$45,278
Total	39,576		$2,410,946

a. The 725 Audubon Center trips were estimated to be reduced to 25% (i.e., a 75% loss).

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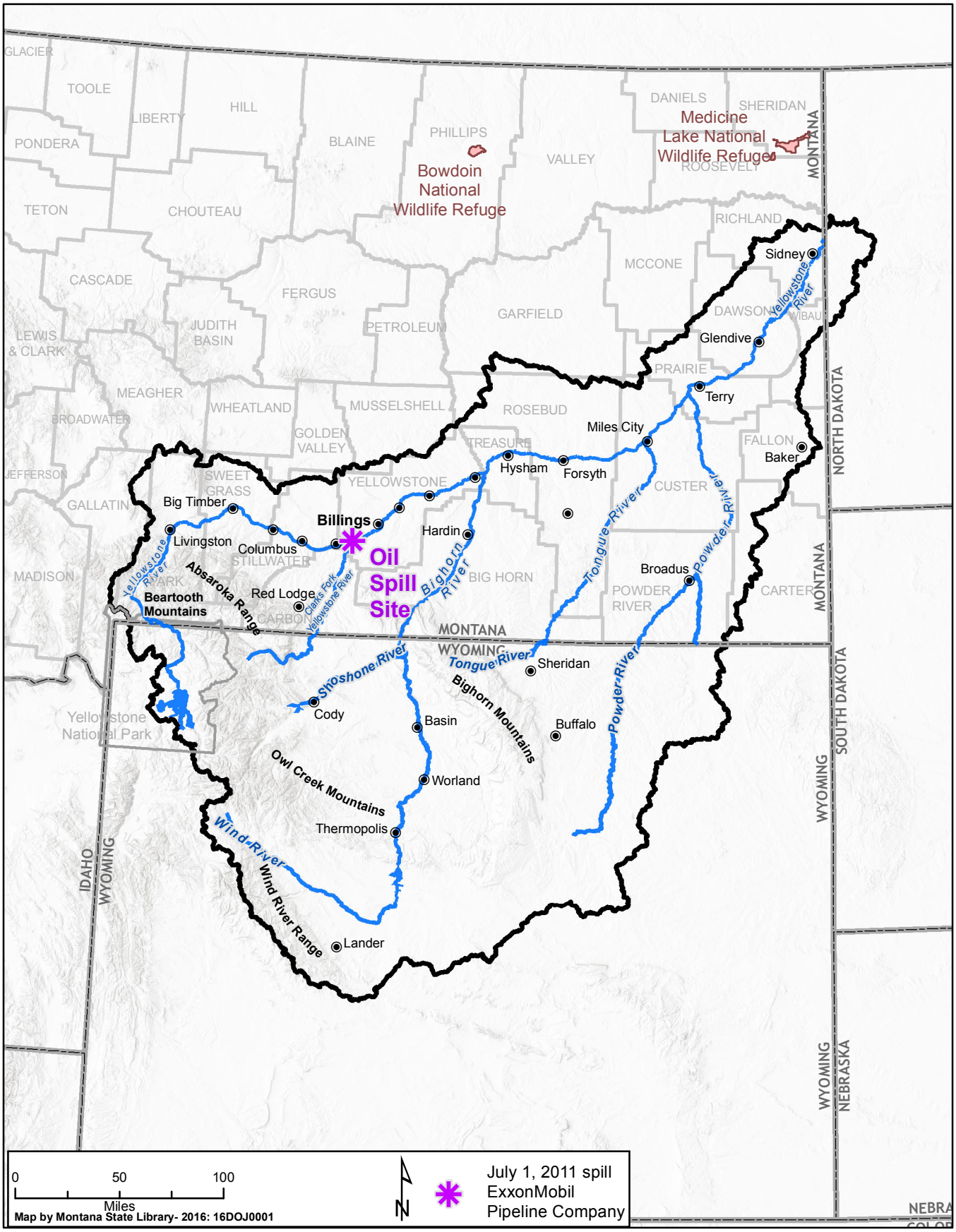
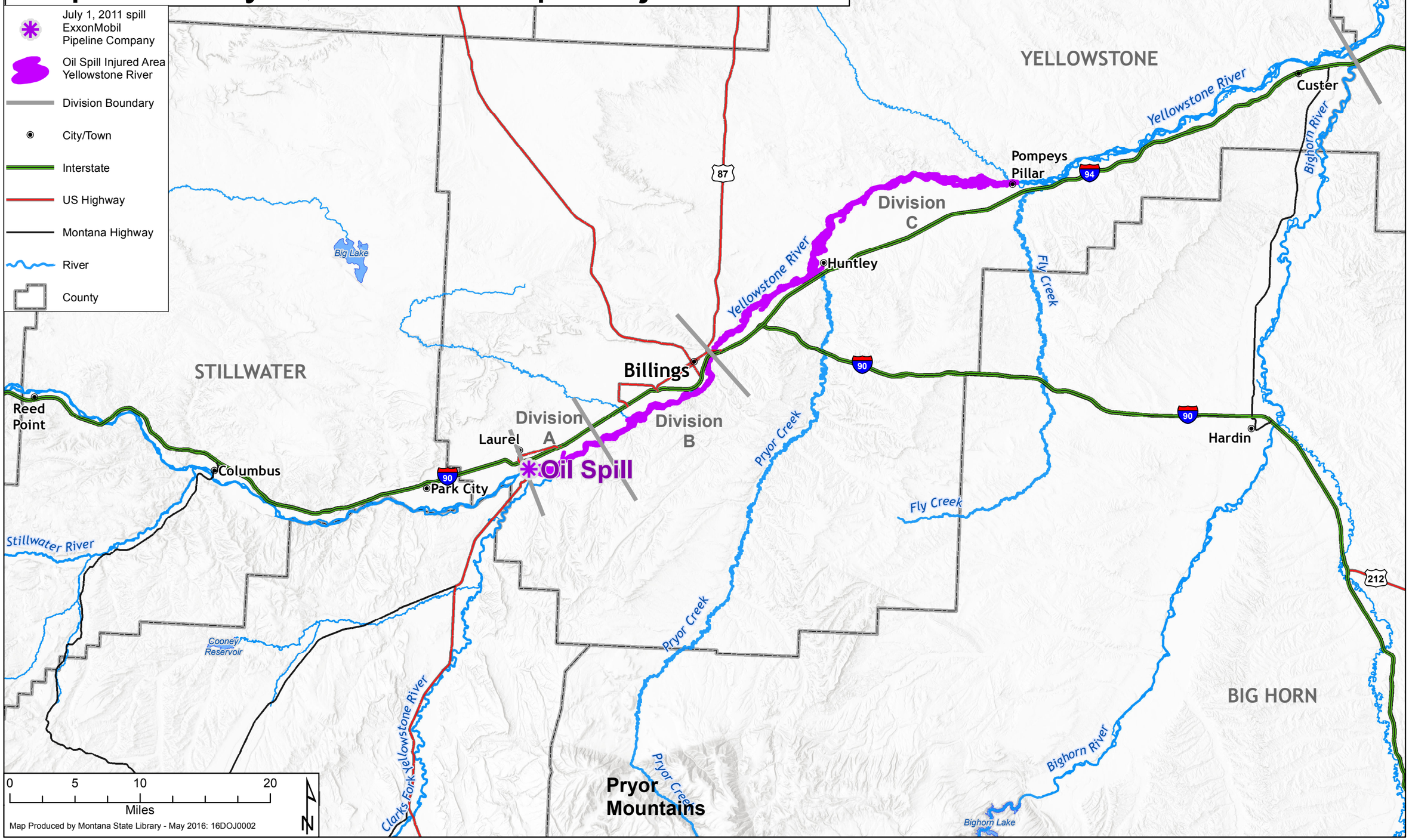
U.S. EPA. 2010. *Guidelines for Preparing Economic Analyses*. EPA 240-R-10-001. U.S. Environmental Protection Agency. December.

Maps

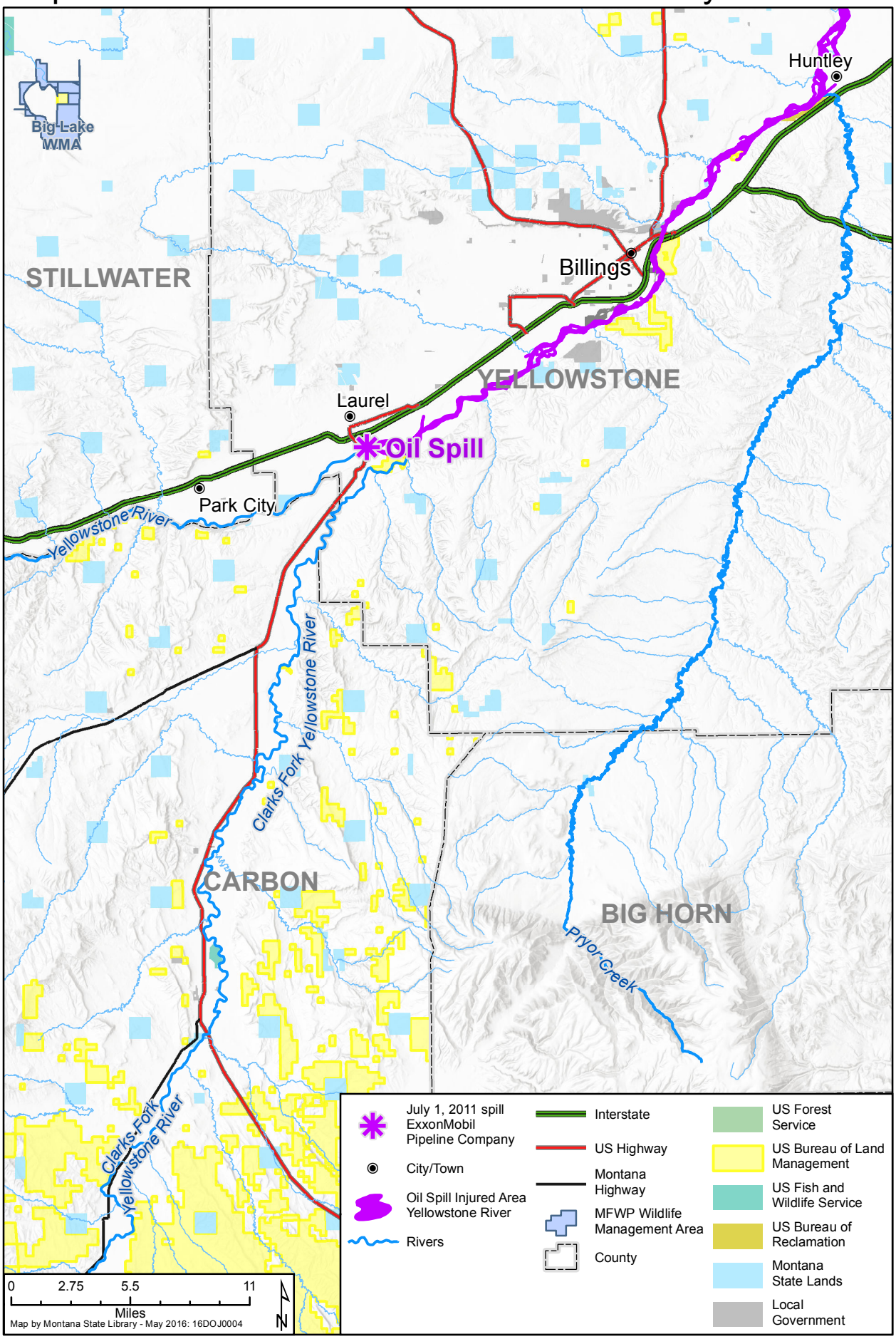
Map 1-1 Yellowstone River Basin



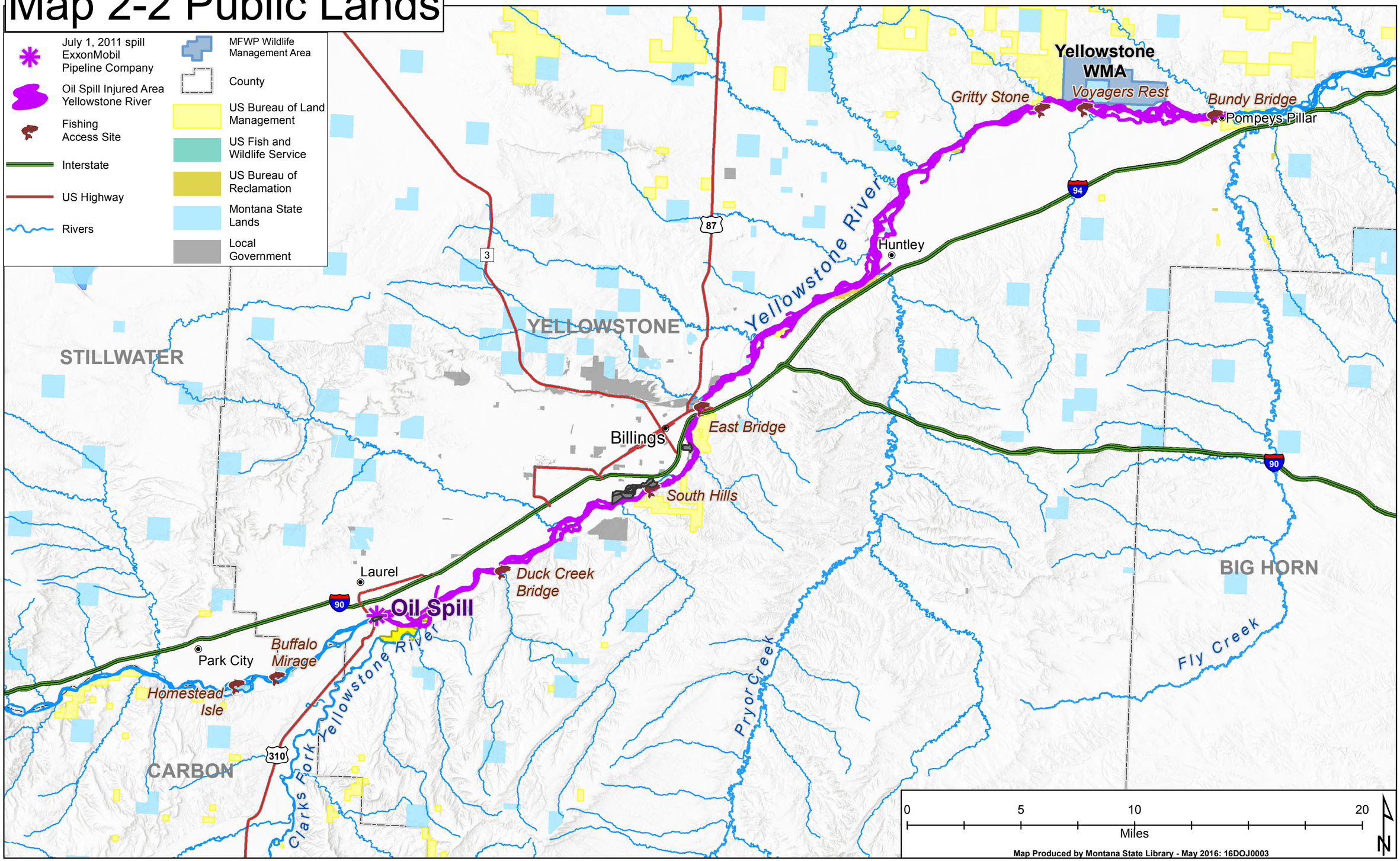
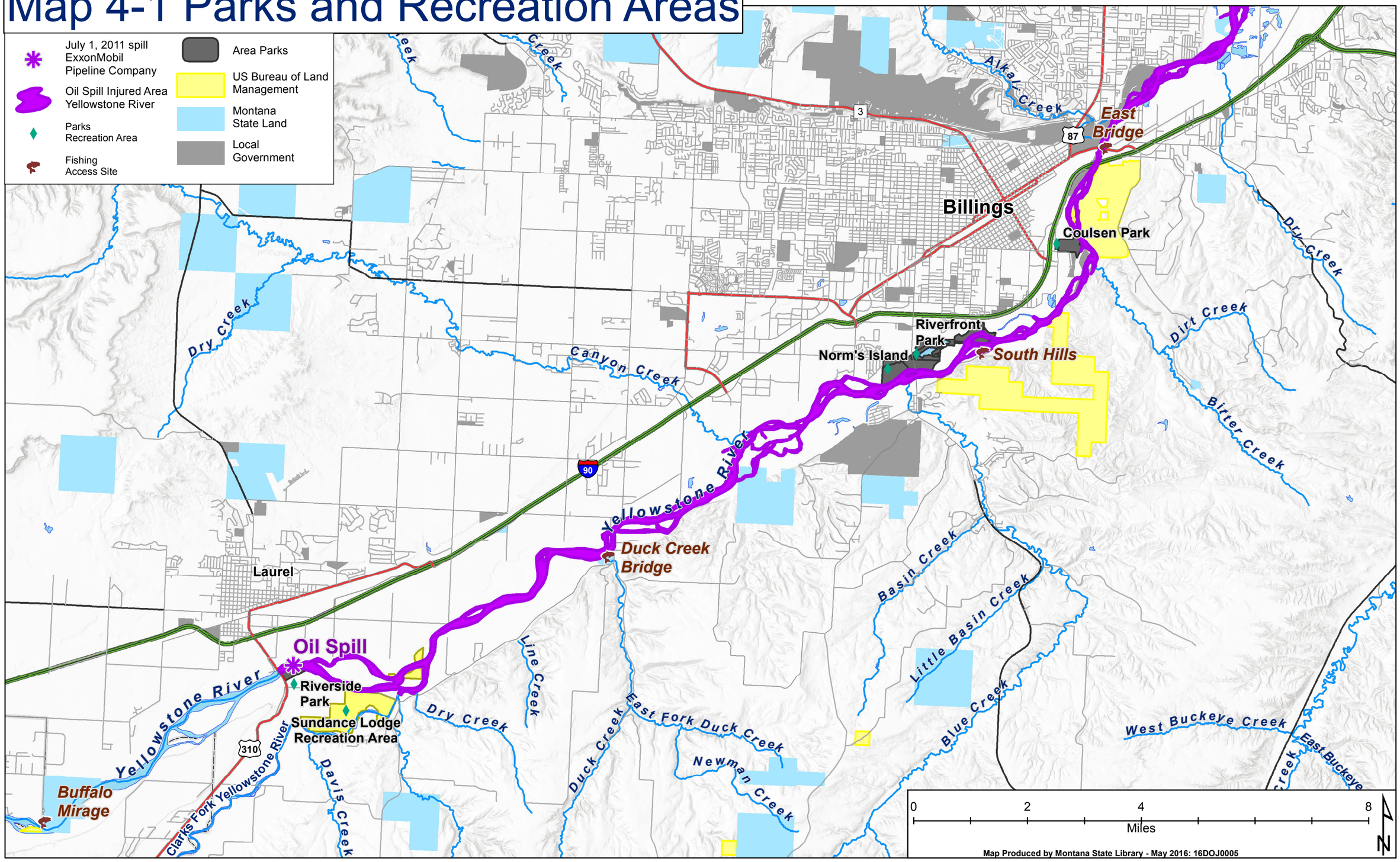
Map 1-2 July 1, 2011 Oil Spill Injured Area



Map 2-1 Clarks Fork Yellowstone River and Pryor Creek



Map 2-2 Public Lands



Map 4-1 Parks and Recreation Areas