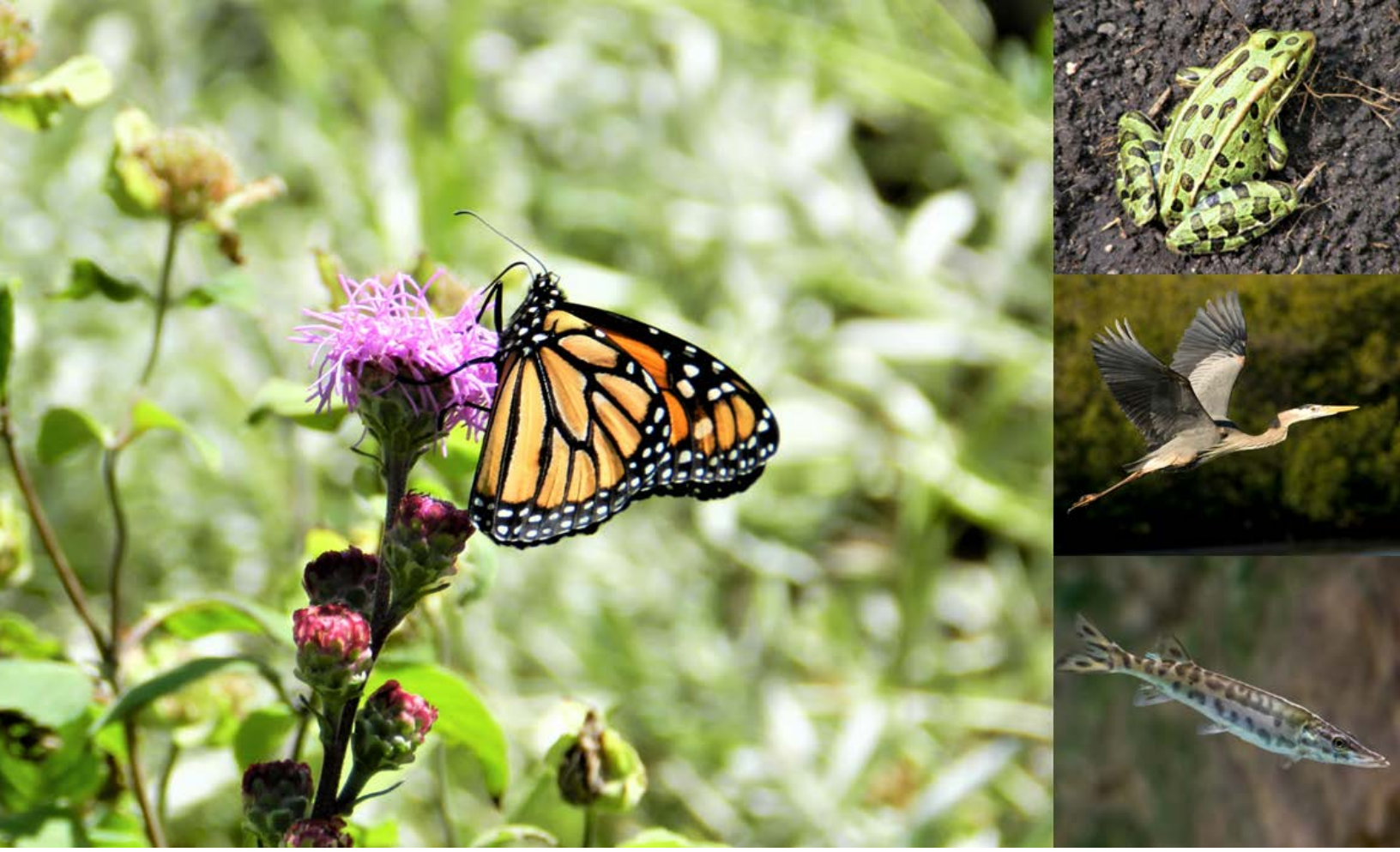

U.S. Steel Natural Resource Damage Assessment Plan

DRAFT | February 2023

prepared for:

Bois Forte Band of Chippewa
Fond du Lac Band of Lake Superior Chippewa
Grand Portage Band of Lake Superior Chippewa
National Oceanic and Atmospheric Administration
State of Minnesota
United States Fish and Wildlife Service

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TABLE OF CONTENTS

LIST OF EXHIBITS

LIST OF ACRONYMS

EXECUTIVE SUMMARY

CHAPTER 1 | INTRODUCTION

1.1. Purpose and Overview *1*
1.2. Site History *3*
1.3. Trusteeship and Authority *9*
1.4. Overview of Natural Resource Damage Assessment *10*
1.5. Use of Existing Information *13*
1.6. Coordination with the Responsible Party *13*
1.7. Coordination with the Public *14*
1.8. Plan Organization *15*

CHAPTER 2 | NATURAL RESOURCES AND RESOURCE SERVICES IN THE ASSESSMENT AREA

2.1. Geographic Scope *16*
2.2. Description of the Assessment Area *17*
2.3. Natural Resources *19*
2.4. Natural Resource Services *19*

CHAPTER 3 | INJURY DETERMINATION APPROACH

3.1. Hazardous Substances *24*
3.2. Confirmation of Exposure *25*
3.3. Pathway *25*
3.4. Injury to Natural Resources *29*
3.5. Injury Caused by Remedial Actions *35*
3.6. Summary of the Trustees' Approach to Injury Determination *36*

CHAPTER 4 | INJURY QUANTIFICATION AND DAMAGE DETERMINATION APPROACH

4.1. Baseline *37*
4.2. Natural Resource Injury Quantification and Damage Determination Approach *38*
4.3. Recreational Use Injury Quantification and Damage Determination Approach *39*

4.4. Tribal Loss Assessment Approach 40

4.5. Temporal Scope 41

CHAPTER 5 | ONGOING AND PROPOSED ANALYSES AND STUDIES

5.1. Analysis and Study Prioritization 43

5.2. Injury Assessment Analyses and Studies 43

REFERENCES

APPENDIX A | QUALITY ASSURANCE

LIST OF EXHIBITS

Exhibit 1-1	Map of the U.S. Steel Site and the Surrounding Area	2
Exhibit 1-2	Historic Map of the U.S. Steel Building Locations	4
Exhibit 1-3	Timeline of Major Events Related to Contamination and Remediation within the U.S. Steel Site to Date	7
Exhibit 1-4	Operable Units at the U.S. Steel Superfund Site	8
Exhibit 2-1	Map of the U.S. Steel Site with Approximate Aquatic, Terrestrial, and Building Footprints	17
Exhibit 2-2	Examples of Biota Found in the Duluth Area	20
Exhibit 2-3	Examples of Vegetation at the Site	21
Exhibit 3-1	Map of Contamination Sources at the U.S. Steel Site	26
Exhibit 3-2	Example Conceptual Site Model for U.S. Steel Showing Major Pathways	28
Exhibit 3-3	Sediment Concentrations of COCs at U.S. Steel Site and Sediment Quality Targets	31
Exhibit 3-4	Summary of Historical Bioassay Results (1993-1996)	32
Exhibit 3-5	Fish Consumption Advisory Timeline	33
Exhibit 3-6	Soil Concentrations of COCs at U.S. Steel and Example Thresholds	34
Exhibit 5-1	Ongoing and Planned Analyses and Primary Studies for Ecological Resources	45
Exhibit 5-2	Ongoing and Planned Analyses and Primary Studies for Recreational Losses	48
Exhibit 5-3	Ongoing and Planned Analyses and Primary Studies for Tribal Losses	49

LIST OF ACRONYMS

AOC	Area of Concern
AP	Assessment Plan
bgs	Below Ground Surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
DIVER	NOAA Data Integration, Visualizing, Exploration, and Reporting
DOI	U.S. Department of the Interior
Eco SSLs	U.S. EPA's Ecological Soil Screening Levels
EPA	U.S. Environmental Protection Agency
FCAs	Fish Consumption Advisories
FWS	U.S. Fish and Wildlife Service
GLLA	Great Lakes Legacy Act
GLNPO	Great Lakes National Program Office
MERLA	Minnesota Environmental Response and Liability Act
MDH	Minnesota Department of Health
MN DNR	Minnesota Department of Natural Resources
MOA	Memorandum of Agreement
MPCA	Minnesota Pollution Control Agency
NOAA	National Oceanic and Atmospheric Administration
NPC	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRDA	Natural Resource Damage Assessment
OU	Operable Unit
PAS	Preassessment Screen
PAHs	Polycyclic Aromatic Hydrocarbons
PCBs	Polychlorinated Biphenyls
Plan	Assessment Plan

ppb	parts per billion
ppm	parts per million
PRP	Potentially Responsible Party
QA	Quality Assurance
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	Quality Control
RCDP	Restoration Compensation Determination Plan
RI/FS	Remedial Investigation and Feasibility Study
ROD	Record of Decision
Site	U.S. Steel Superfund Site
SME	Subject Matter Expert
SQTs	Sediment Quality Targets
Trustees	U.S. Department of the Interior, U.S. Department of Commerce, the 1854 Treaty Authority, Fond du Lac Band of Lake Superior Chippewa, and the State of Minnesota
TWG	Trustee Working Group
U.S.	United States
USC	United States Code

EXECUTIVE SUMMARY

Located in Duluth, Minnesota, the U.S. Steel Superfund Site (Site) is bounded by the Morgan Park residential neighborhood to the north, the Canadian National Railway to the west and south, and the St. Louis River (Spirit Lake) to the east. From the early 1900s until 1986, operations at the Site included coke production, iron and steel making, casting, primary rolling and roughing, hot and cold finishing, and galvanizing. These activities released hazardous substances, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs), to the environment.

Natural resources (e.g., sediments, soil, invertebrates, fish, birds, and mammals) have been exposed to and adversely affected by these contaminants, resulting in a loss in ecological function. For example, concentrations of arsenic, cadmium, copper, lead, PCBs, PAHs, and zinc were measured in Assessment Area soil and sediment and exceed thresholds for the protection of biological resources. People are also connected to and use the natural resources of the Site. Native people have utilized the natural resources in and around the Site for centuries, and the cultural importance of this area continues through the present. Additionally, non-Native American members of the public also make direct use of the aquatic areas of the Site through activities such as recreational fishing and boating. However, contamination has affected people's ability to and preference for interacting with natural resources at the Site. In addition to warning signs posted in shoreline locations at the Site discouraging swimming, wading, boating and fishing in the area, fish consumption advisories issued for the St. Louis River estuary recommend that people limit their consumption of many species due to contamination.

Under the Comprehensive Environmental Response, Compensation, and Liability Act 42 United States Code (USC) §§ 9601 *et seq.* (CERCLA), and other applicable authorities, the U.S. Department of the Interior represented by the U.S. Fish and Wildlife Service (FWS) and the Bureau of Indian Affairs, National Oceanic and Atmospheric Administration, the Fond du Lac Band of Lake Superior Chippewa, the 1854 Treaty Authority governed by the Bois Forte Band of Chippewa and the Grand Portage Band of Lake Superior Chippewa, and the State of Minnesota represented by the Minnesota Pollution Control Agency and the Minnesota Department of Natural Resources (collectively, Trustees) are conducting a Natural Resource Damage Assessment (NRDA) for the Site.

The goal of NRDA is to restore, rehabilitate, replace, and/or acquire the equivalent of those natural resources injured by the release of hazardous substances. To achieve this goal, the Trustees will build on prior efforts and complete the steps outlined in the CERCLA NRDA regulations including developing this Assessment Plan (Plan). This Plan serves to ensure that the NRDA is conducted in an efficient and cost-effective manner and describes the Trustees' proposed approach to determining natural resource injury and appropriate compensation (i.e., damages; 43 CFR § 11.31).

To determine injury in a planned, systematic manner and at a reasonable cost (43 CFR § 11.31(c)), the Trustees identified parameters on which to focus assessment efforts. For example, the Trustees plan to focus on sediment, soil, and biological resources in and around the Site, including both the ecological and human (Tribal and general public) services provided by these resources.

Once injury to natural resources has been determined, quantification of that injury is undertaken to establish a basis for scaling restoration and determining damages. Injury to natural resources can be quantified in terms of the actual measured loss of specific natural resources and/or the services (to other natural resources and/or to the public) that the injured resources would have provided had the release not occurred. In the quantification phase, the extent of the injury is measured, the baseline condition and services are identified, the recoverability of the injured resource is determined, and the reduction in services – ecological, recreational, and tribal – resulting from the hazardous substances are calculated. Damages will be determined using methods described in the CERCLA NRDA regulations where applicable.

The Trustees' approach will also emphasize the use of existing information, identification of data gaps, and evaluation of potential methods for addressing those data gaps. Information compilation, data analyses, and primary studies[1] will be designed and implemented in phases to allow for subsequent adjustments in study design based on initial findings. Additionally, the Trustees will consider the relationship between injury and restoration to ensure that metrics used to assess each of these components are comparable and that restoration will provide resources of a type and quality that are consistent with what was lost.

During the NRDA process, the Trustees will produce and release several key documents, including this Plan, for public comment. The Trustees encourage active participation of the public in the assessment through the public comment process. This draft Plan will be available for review and comment for a period of 45 days in accordance with 43 CFR § 11.32 (c)(1). The Trustees will address public comments and respond to those comments as part of the final Assessment Plan.

[1] Primary studies are studies that collect new data.

CHAPTER 1 | INTRODUCTION

Located in Duluth, Minnesota, the U.S. Steel Superfund Site (Site) is bounded by the Morgan Park residential neighborhood to the north, the Canadian National Railway to the west and south, and the St. Louis River (Spirit Lake) to the east (Exhibit 1-1, U.S. Steel NRDA Trustees 2020). From the early 1900s until 1986, operations at the Site released hazardous substances into the environment, contaminating both aquatic and terrestrial habitats. In 1983, the Site was designated as a Superfund Site by the Environmental Protection Agency (EPA; U.S. Steel NRDA Trustees 2020) and the State, leading to the cleanup actions in several contaminated areas. These remedial actions, however, while beneficial, do not themselves compensate the public for past, present, and future contaminated-related injuries to natural resources and resource services.

WHAT IS NRDA?

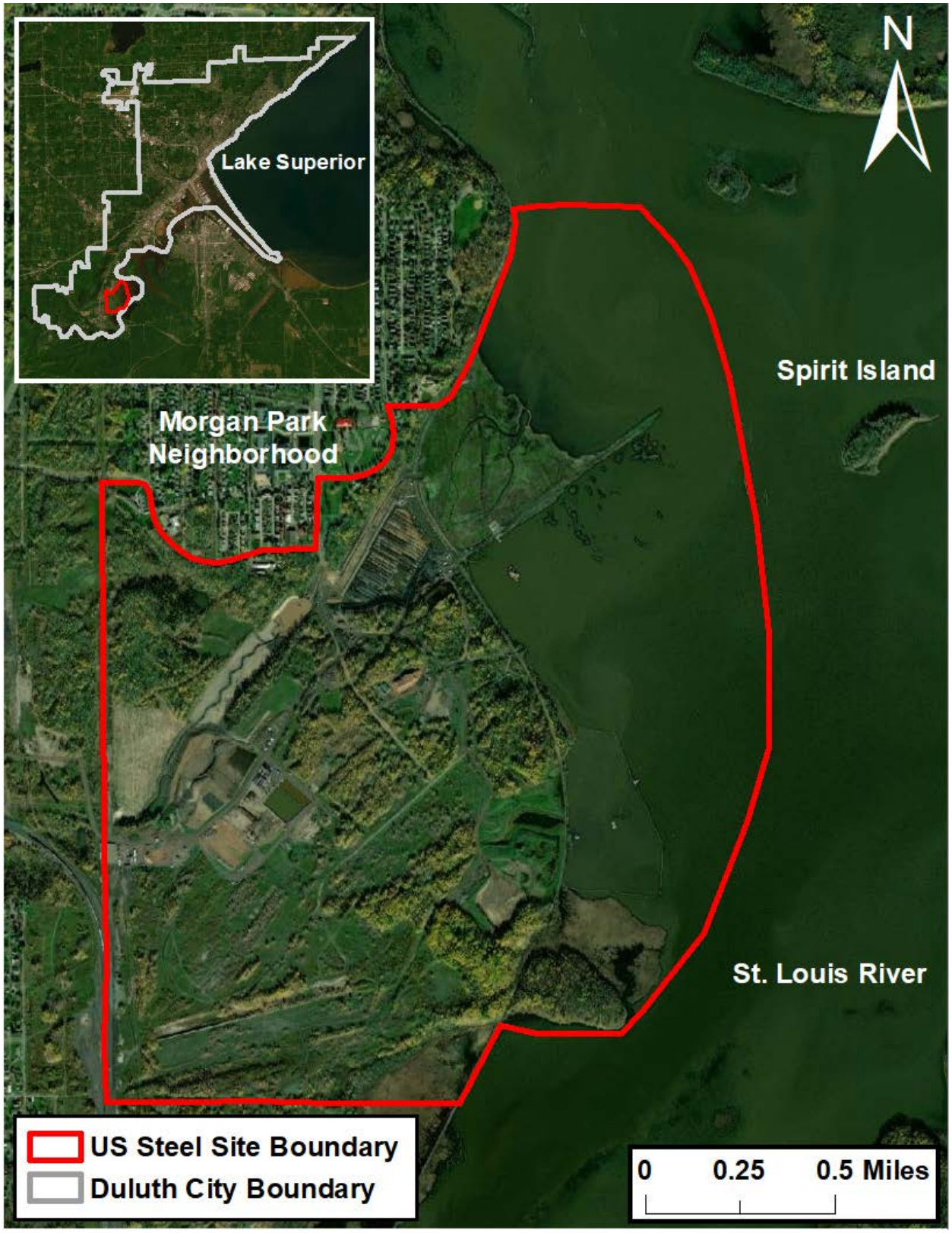
A Natural Resource Damage Assessment is a regulatory process to determine the appropriate amount and type of restoration and/or dollars needed to compensate the public for injuries to natural resources resulting from the release of hazardous substances into the environment.

Hazardous substances including metals and organic contaminants were released to the environment as a result of industrial activities at the Site. Natural resources (e.g., surface water (including sediments), soil, invertebrates, fish, birds, and mammals) have been exposed to and adversely affected by these contaminants, resulting in a loss in ecological function. People are also connected to and use the natural resources of the Site. Native people have utilized the natural resources in and around the Site for centuries, and the cultural importance of this area continues through the present. Treaty rights have been retained in ceded territories which include the St. Louis River estuary, and the exercise of these rights continues today. Additionally, non-Native American members of the public make direct use of the aquatic areas of the Site through activities such as recreational fishing and boating. This Plan describes the Trustee's approach to conducting a natural resource damage assessment (NRDA) for the Site, summarizes existing data, and outlines ongoing and proposed analyses and studies that may be used to evaluate Site-related contamination and its effects on natural resources and on the resource services they provide.

1.1 PURPOSE AND OVERVIEW

The Trustees developed this Assessment Plan (Plan) pursuant to the U.S. Department of the Interior's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) NRDA regulations (42 USC §§ 9601 *et seq.*, 43 CFR Part 11) to outline the approach they will take in determining and quantifying injury to natural resources affected by the release of hazardous substances, and quantifying corresponding damages. The purpose of this Assessment Plan is to ensure that the assessment is conducted in a planned and systematic manner and that assessment methodologies, including the Injury Determination, Quantification, and Damage Determination phases, can be conducted at a reasonable cost.

EXHIBIT 1-1 MAP OF THE U.S. STEEL SITE AND THE SURROUNDING AREA



A goal of the Plan is to create a comprehensive strategy for assessing natural resource injury and determining damages. The Plan will facilitate coordination between the Trustees and the public, including via a public comment period for this Plan. It will also assist with coordination between Trustee NRDA efforts and the remedial process conducted by the U.S. EPA and the State of Minnesota (43 CFR § 11.31(a)(2)). Appendix A of the Plan contains procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified potentially responsible parties and other natural resource trustees (43 CFR § 11.31(a)(4)).

This Plan represents a plan for a Type B assessment[2], focusing on those steps required for injury determination and quantification as well as damage determination (43 CFR § 11.31(b)). As the Trustees implement this Plan, it may be amended to include additional studies as necessary as new information becomes available (43 CFR § 11.32(e)).

WHAT IS INJURY?

In NRDA, injury refers to a decrease in a resource s ability to provide services due to contamination. Examples include, but are not limited to:

- Lower nesting success in birds,
- Groundwater exceeding drinking water contaminant thresholds,
- Wetlands unable to support vegetation and biota, and
- Decreased quality of fishing experience due to consumption advisories.

(Regulatory definition at 43 CFR § 11.14(v))

WHAT ARE SERVICES?

Natural resource services are the physical and biological functions performed by the natural resources including the human uses of those functions.

(Regulatory definition at 43 CRF § 11.14(nn))

WHAT ARE DAMAGES?

In NRDA, damages refer to the amount of money needed to restore resources to their baseline condition (i.e., condition without contamination) and compensate for interim losses. Trustees seek these monies from parties responsible for contamination.

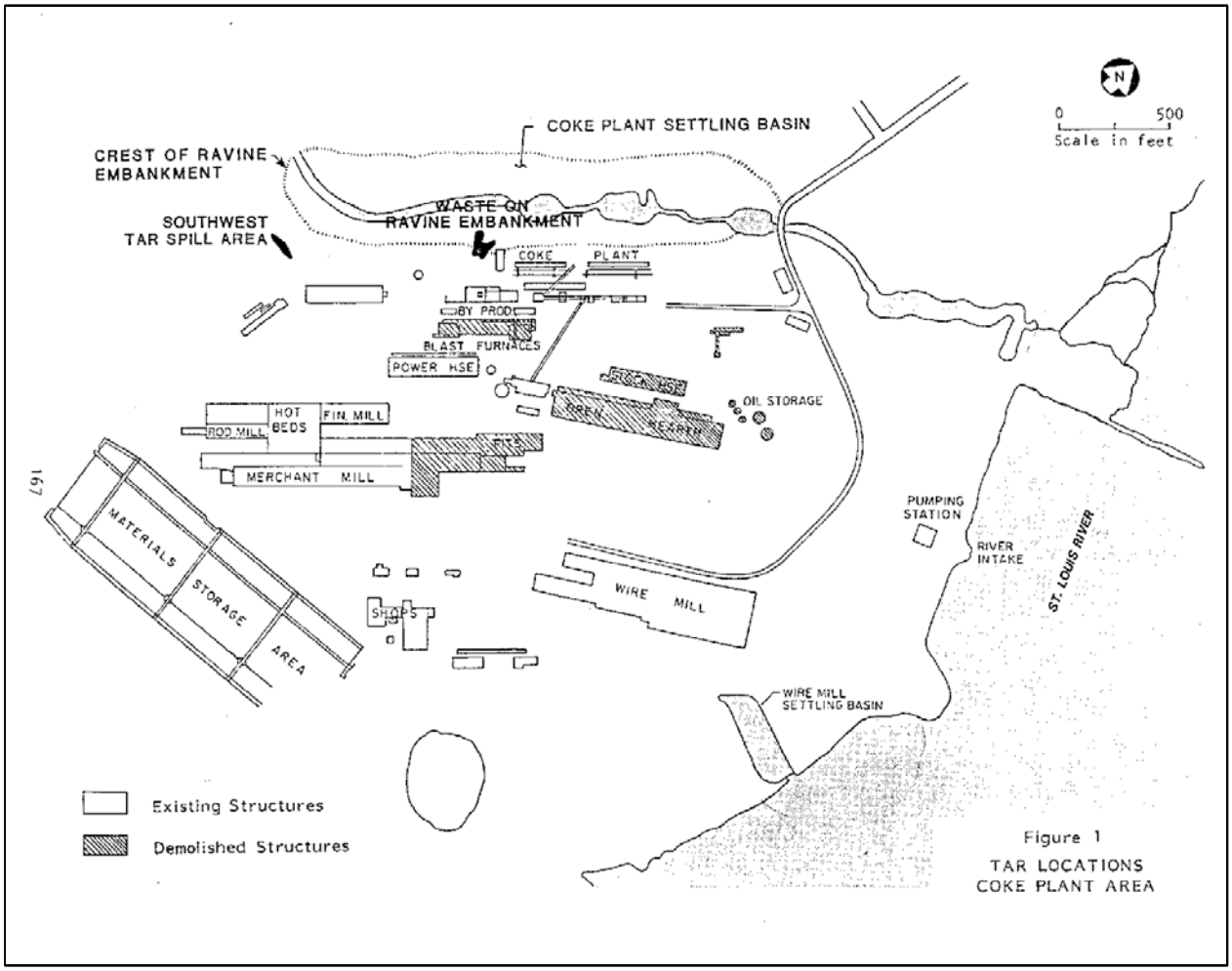
(Regulatory definition at 43 CRF § 11.14(l))

1.2 SITE HISTORY

In 1907, U.S. Steel began construction of site facilities, with operations beginning in 1915 (Exhibit 1-2; U.S. Steel NRDA Trustees 2020). Operations included coke production, iron and steel making, casting, primary rolling and roughing, hot and cold finishing, and galvanizing (MPCA, 2013). Starting in the mid-1970s, operations were slowly reduced. Steel making operations ended in 1975, coke production was halted in 1979, and the wire mill stopped operating in 1986. After coke production ceased, the blast furnaces, open heath furnaces, fuel storage tanks, and a portion of the rolling mill were demolished. In 1988, most of the remaining buildings were demolished and the final clean up and demolition of the coke plant was completed in 1992 (U.S. Steel NRDA Trustees 2020).

[2] A Type B assessment allows trustees to apply a variety of methodologies described in the CERCLA NRDA regulations to determine and quantify injury (43 CFR § 11.60). See Section 1.4.1 for details.

EXHIBIT 1-2 HISTORIC MAP OF THE U.S. STEEL BUILDING LOCATIONS (BARR ENGINEERING 1986)



During operations, hazardous substances such as polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc were produced and directly discharged to portions of the land as well as into settling basins as semi-solid and liquid wastes. Other sources of hazardous substances included by-product and operation waste tanks, oil-containing transformers and circuit breakers, and leaks and spills (U.S. Steel NRDA Trustees 2020, Barr Engineering 1986 [3]). Samples collected from the Site since the 1980s indicate elevated levels of these hazardous substances in soil and sediment. Due to these releases, the Site was placed on the federal National Priorities List[4] and listed as an EPA Superfund Site in 1983[5]; a year later the Site was also

[3] For more detailed information on each of the contamination sources and the time, duration, and frequency of releases, see the Preassessment Screen (PAS) Section 2 (U.S. Steel NRDA Trustees 2020).

[4] "The National Priorities List (NPL) is the list of sites of national priority among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation." (U.S. EPA 2022).

[5] The site is referred to as the St. Louis River/U.S. Steel Superfund site on the National Priorities List.

placed on the State of Minnesota's Permanent List of Priorities[6] (Exhibit 1-3; U.S. Steel NRDA Trustees 2020).

In response to the 1985 Response Order by Consent[7] (MPCA 1985), U.S. Steel began a Remedial Investigation and Feasibility Study (RI/FS) in 1985 (Barr Engineering 1986). Operable units (OU) throughout the Site were identified in the 1989 Record of Decision (ROD; Exhibit 1-4; MPCA 1989) and through other administrative decisions (e.g., explanation of significant differences). OU remedial actions include:

- Removing contaminated tar and tar-contaminated soils (OU-A, OU-J),
- Removing by-product tanks and pipelines (OU-D and OU-E),
- Capping contaminated soil and dredge spoil materials (OU-J and OU-K),
- Dredging and lining waterbodies (OU-P).

For more information on the OU cleanups and timelines, see Section 2 in the Preassessment Screen (U.S. Steel NRDA Trustees 2020).

Aerial image of remediation occurring near OU I

[6] Sites on Minnesota's Permanent List of Priorities (PLP) have known risks to human health and the environment, or the potential to pose these risks. Placement on the PLP enables the State of Minnesota to engage in investigation and cleanup of these sites.

[7] Response Order by Consent issued in 1985 by MPCA under the Minnesota Environmental Response and Liability Act of 1983. The order required U.S. Steel to conduct a remedial investigation and feasibility study, and develop and implement a response action plan for the Site.

Although remedial actions for many OUs were completed between 1988 and 1999, remediation is currently ongoing for several OUs. For example, RI/FSs were conducted for OU-P, OU-Q, and OU-S in 2013 and recent five-year reviews have deemed that further cleanup activities are necessary for OU-L, M, and N and the area between OU-I and OU-J (U.S. Steel NRDA Trustees 2020).

Additionally, sediment remediation is ongoing through the Great Lakes Legacy Act (GLLA)[8] and the 'Spirit Lake Legacy Act Cleanup' project as part of delisting the St. Louis River as an U.S. EPA Area of Concern (AOC). Through this cleanup project, the U.S. EPA Great Lakes National Program Office (GLNPO) and U.S. Steel Corporation have partnered to develop a remedial plan that includes sediment dredging and capping in Spirit Lake, the Wire Mill Pond area, the Unnamed Creek Delta, and associated wetland areas including OU-L, M, and N and the area between OU-I and J (Barr Engineering and AECOM 2015a, 2015b; EA Engineering, Science, and Technology 2018). The Trustees will consider any beneficial or adverse impacts to natural resources and their services as a result of remedial actions, including those under the GLLA and Spirit Lake Legacy Act Cleanup (see Section 3.5).

The Site has a long tribal history beyond its use as an industrial site. Native people have lived for thousands of years in and around the Site, on Spirit Island, and in nearby areas along the St. Louis River estuary. Archaeological evidence shows that the Ojibwe people's ancestors have lived in the Great Lakes area since A.D. 800. Ojibwe traditional stories tell of how their ancestors were told to migrate westward from the Atlantic coast until they found "the food that grows on water." Some of these ancestors came to the St. Louis River estuary, where they found manoomin (wild rice). They recognized it as the food they had been told to find, and so they settled along the estuary. In the Treaties of 1837, 1842, and 1854, the Ojibwe ceded most of their ancestral territory, including the Site and surrounding area, to the United States. However, through these Treaties, the Tribes reserved their sovereign rights to fish, hunt, and gather resources within their traditional territory. Currently, the Fond du Lac Band of Lake Superior Chippewa owns Spirit Island and adjacent areas within Spirit Lake. Tribal members continue to maintain profound connections to these places in and around the Site, and to rely on natural resources for many cultural, traditional, and spiritual practices.

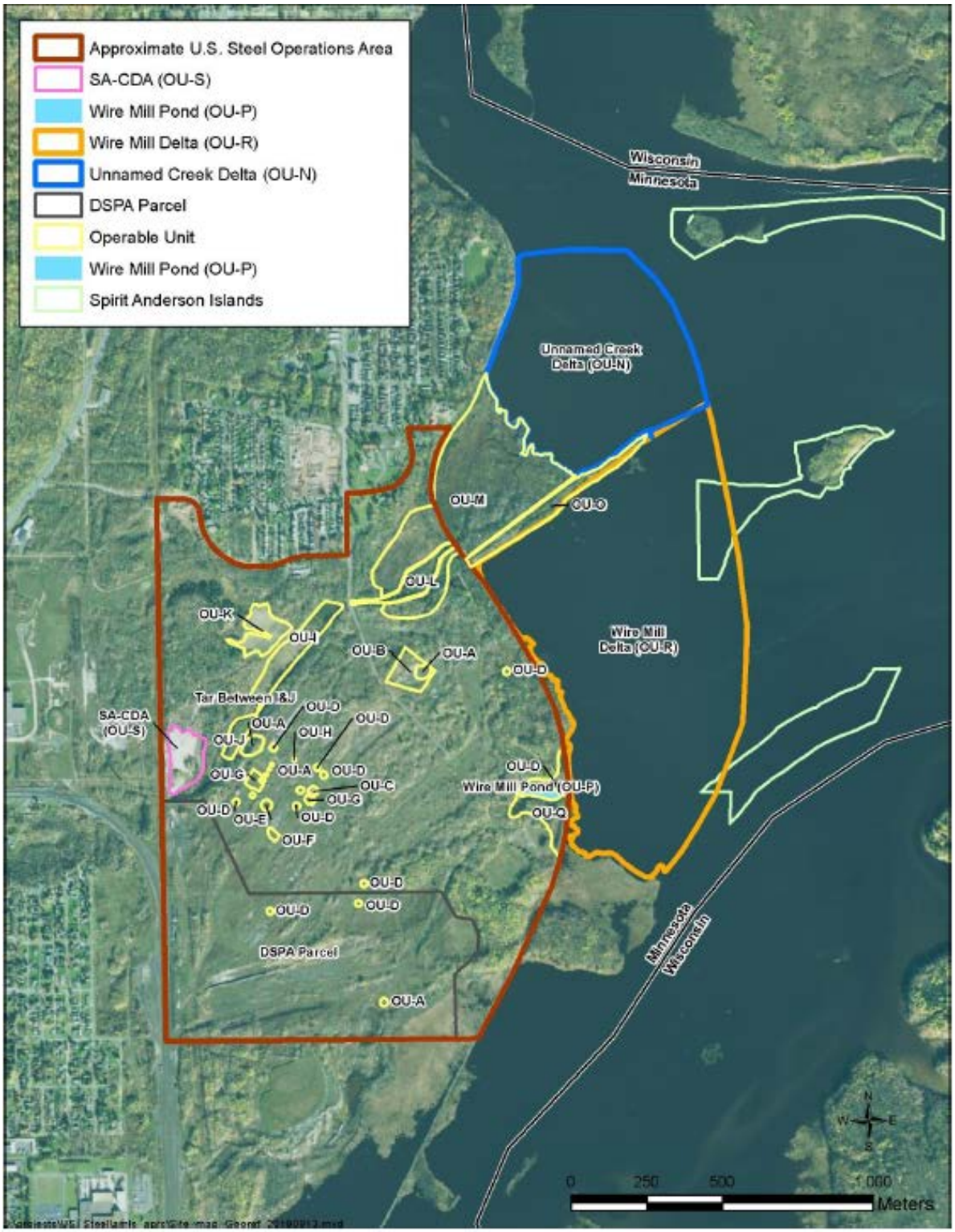
[8] The U.S.-Canada Great Lakes Water Quality Agreement (Annex 1 of the 2012 Protocol) defines AOCs as "geographic areas designated by the Parties where significant impairment of beneficial uses has occurred as a result of human activities at the local level." An AOC is a location that has experienced environmental degradation. See additional information from EPA on AOCs and beneficial use impairments: https://www.epa.gov/great-lakes-aocs and https://www.epa.gov/great-lakes-aocs/beneficial-use-impairments-great-lakes-aocs.

EXHIBIT 1-3 TIMELINE OF MAJOR EVENTS RELATED TO CONTAMINATION AND REMEDIATION WITHIN THE U.S. STEEL SITE TO DATE

YEAR	EVENT
1915	Site operations begin.
1981	Initial investigations begin at Site under direction of the MPCA.
1983	EPA designates as Superfund site; placed on NPL.
1984	Minnesota lists Site on PLP and assumes regulatory authority.
1985	Response Order by Consent between U.S. Steel and the State of Minnesota approved by MPCA. Operable unit remedial actions begin.
1986	All facility operations cease.
1987	St. Louis River is designated as an AOC.
1988	OU-D remedy complete.
1989	Minnesota releases ROD and Remedial Action Plan (RAP) for AOC is developed. OU-B and OU-F remediations are completed.
1992	Cleanup and demolition of coke plant is competed.
1993	OU-C, OU-G, and OU-H remedies completed.
1994	Remedial actions begin for OU-A (ongoing).
1995	St. Louis River RAP Progress Report released. U.S. Steel Safety Zone established by U.S. Coast Guard.[1]
1997	OU-J remedy completed. Initial OU-P remedy completed.
1999	OU-E remedy completed.
2003	First Remedial Five-Year Review.
2011	Additional investigation work by GLLA begins.
2013	RI for OU-P, OU-Q, OU-S completed; estuary FS completed.
2020	GLLA clean up begins.

Note:
1. The USCG safety zone is to protect the public from the effects of contaminated sediments at that site. Navigation of vessels through the zones is prohibited. Swimming and fishing are prohibited within the zones (33 CFR Part 165, FR 60(196):52861-52862).

EXHIBIT 1-4 OPERABLE UNITS AT THE U.S. STEEL SUPERFUND SITE (U.S. STEEL NRDA TRUSTEES 2020)



1.3 TRUSTEESHIP AND AUTHORITY

Under Federal and state regulations, designated Federal, state, and tribal governments are authorized to act on behalf of the public as trustees of natural resources. In accordance with 42 U.S.C. 9607(f)(2)(B) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), the Commissioners of the Minnesota Pollution Control Agency (MPCA) and the Minnesota Department of Natural Resources (MN DNR) have been designated as co-natural resource trustees by the Governor of Minnesota pursuant to Executive Order #99-17. In their capacity under CERCLA and under Minn. Stat. § 115B.17, subd. 7, the MPCA and MN DNR act on behalf of the State as trustees for natural resources, including their supporting ecosystems, within the boundary of Minnesota or belonging to, managed by, controlled by, or appertaining to Minnesota.

In accordance with the NCP, the Fond du Lac Band of Lake Superior Chippewa, the Bois Forte Band of Chippewa, and the Grand Portage Band of Lake Superior Chippewa serve as trustees for natural resources, including their supporting ecosystems, belonging to, managed by, controlled by, or appertaining to the tribes, or held in trust for the benefit of the tribes, or belonging to a member of the tribes if such resources are subject to a trust restriction on alienation.[9] The Chairman of the Fond du Land Band sits on the Trustee Council on behalf of the Fond du Lac Band while the Executive Director of the 1854 Treaty Authority has been delegated the authority to sit on the Trustee Council on behalf of the Bois Forte and Grand Portage Bands.

The NCP, 40 CFR § 300.600, and Executive Order 12580, dated January 23, 1987, designate federal natural resource trustees. Pursuant to the NCP, the Secretary of the DOI acts as a trustee for natural resources managed or controlled by the DOI. In this matter, the U.S. Fish and Wildlife Service (Service) and the Bureau of Indian Affairs (BIA) are acting on behalf of the Secretary of the DOI as trustees for the natural resources under its jurisdiction. The official authorized to act on behalf of the DOI at the Site is the Regional Director of the Region 3 U.S. Fish and Wildlife Service. The Secretary of Commerce acts as trustee for natural resources and their supporting ecosystems managed or controlled by the U.S. Department of Commerce and for natural resources managed or controlled by other federal agencies that are found in, under, or using waters navigable by deep draft vessels, tidally influenced waters, or waters of the contiguous zone, the exclusive economic zone, and the outer continental shelf. The Secretary of Commerce has delegated their authority to act as trustee to the Administrator of the National Oceanic and Atmospheric Administration (NOAA).

The legal framework for trustees' actions is provided by CERCLA 42 U.S.C §§ 9601 *et seq.*; the Clean Water Act, 33 USC § 1321; the NCP, 40 CFR Part 300, Subpart G; and Executive Orders 12580 (as amended by Executive Order 13016). In addition, the Minnesota Environmental Response and Liability Act (MERLA) (Minn. Stat. §§ 115B.04, subd. 1, and 115B.17, subd. 7) authorizes the State of Minnesota, as the trustee for the air, water and wildlife of the State, to recover damages for injury to, destruction of, or loss of natural resources. Under the authority of CERCLA and CWA, the DOI issued regulations (43 CFR Part 11) guide trustees in the assessment of natural resource injuries and damages to restore resources following the release of hazardous substances. The purpose of these regulations is "to provide standardized and cost-effective procedures for assessing natural resource damages" (43 CFR § 11.11). This Assessment Plan follows the regulations promulgated by DOI at 43 CFR Part 11 in order to most effectively restore natural resources at the Site.

[9] Alienation is the process of voluntarily transferring property ownership.

Under these legal authorities, natural resource trustees seek damages (see text box in Section 1.1) with the goal of ensuring that the resources, as well as the services that would have been provided by injured resources but for the release of site-related hazardous substances are restored, and that the public and environment are made whole for any interim losses.[10] Damages collected by the trustees from potentially responsible parties are then used to plan and implement restoration projects outlined in a restoration plan (described in Section 1.4.2). For example, restoration projects may be designed to improve habitat for native biota, create recreational opportunities for the public, and/or create key services that address tribal losses to compensate for injuries attributable to contamination.

In 2001, the Trustees entered into a Memorandum of Agreement (MOA), forming a Trustee Council. The MOA provides the framework for coordination and cooperation among the Site Trustees to enable the efficient conduct of their natural resource responsibilities. This includes assessment of damages arising from injuries to natural resources, restoration planning and implementation, and coordination of NRDA efforts with remedial processes.

1.4 OVERVIEW OF NATURAL RESOURCE DAMAGE ASSESSMENT

The objective of a NRDA and the ultimate goal of the Trustees is to restore natural resources that have been injured by a hazardous substance(s) to baseline, which is defined as the condition of the resource that would have existed if the hazardous substances were not released (43 CFR §11.14(e)), and obtain compensation for public losses pending restoration to that baseline condition. The Trustees intend to conduct a NRDA that follows the CERCLA NRDA regulations (43 CFR Part 11).

1.4.1 DETERMINATION TO PURSUE A TYPE B ASSESSMENT

Sections 11.34 through 11.36 of 43 CFR set forth two different assessment methods: Type A and Type B. Type A assessments rely on a computer model where certain site- related input parameters are required, such as mass or volume of the substance released, the duration of the release, the location of the release, air temperature, and wind conditions. These assessments are limited by the regulations to the evaluation of relatively minor, short duration discharges or releases. Type B assessments are conducted through the review of existing data and the collection of additional data to fill information gaps. Type B assessments are typically selected when a hazardous substance release occurs over a long timeframe, consists of multiple contaminants, or occurs in a complex system that cannot be simplified and accurately modeled by a computer program. They instead allow for a wider range of scientific and economic methodologies to fill data gaps.

The Trustees determined that a Type B assessment is most appropriate for this assessment, as there is no Type A model that can accurately calculate contaminant movement, natural resource exposure, and corresponding adverse effects at the Site. For example, Type A models are designed for coastal and aquatic environments, not upland environments, which would prevent assessment of injury and damages in the terrestrial habitats at the Site (43 CFR § 11.40 (a)). In addition, even if a Type A model could be applied for all Site habitats, the data inputs for that model are not available (e.g., mass or volume of the

[10] Interim losses are losses from the time the injury occurred until recovery to baseline conditions. Under CERCLA, losses prior to 1981 are not quantified in the calculation of interim losses if losses can be reasonable divided into pre- and post-1981.

released substance; 43 CFR § 11.41(a,b)), as the type and duration of hazardous substance releases have varied throughout Site history.

This Plan describes the information the Trustees expect to gather and the approaches the Trustees plan to apply in order to complete the three main steps of a Type B assessment identified in 43 CFR § 11.61, 11.70, and 11.80. These steps are described in Section 1.4.2 under Assessment Phase. This Plan also satisfies the specific requirements for Type B procedures listed in 43 CFR § 11.31(c):

1. Confirmation of natural resource exposure to Site-related hazardous substances is described in Sections 3.2 and 3.4.
2. A Quality Assurance Plan that satisfies the requirements listed in the NCP and applicable EPA guidance for quality control and quality assurance plans is provided in Appendix A;
3. The objectives of any testing and sampling for injury or pathway determination are described in Exhibits 5-1, 5-2, and 5-3.

At this time, existing data are not sufficient to develop the Restoration and Compensation Determination Plan (RCDP; see Section 1.4.2) as part of the Assessment Plan. Instead, it will be developed after the completion of the Injury Determination or Quantification phases and will be made available for public review and comment (43 CFR § 11.31 (c)(4)).

1.4.2 STEPS IN THE NATURAL RESOURCE DAMAGE ASSESSMENT PROCESS

The NRDA process includes three distinct phases: Preassessment Phase, Assessment Phase, and Post-assessment Phase. These phases are described generally below.

Preassessment Phase

During the Preassessment Phase, trustees review readily available information and existing data related to the release of hazardous substances and the potential impacts of those substances on natural resources. The review leads to a determination of whether there is evidence to support claims for natural resource damages against the parties responsible for releasing these substances to the environment. This step also documents the trustees' determination of whether further investigation and assessments are warranted (i.e., that a NRDA could and should be performed). This phase is a prerequisite to conducting a formal assessment. The Trustees have conducted a preassessment screen for the Site and discussed the results of the Preassessment Phase in their Preassessment Screen for the Site (U.S. Steel NRDA Trustees 2020). The Trustees determined that the criteria specified in the DOI regulations for proceeding to the assessment phase have been met and an assessment of natural resource damages is warranted. The Trustees issued a Notice of Intent (NOI) to perform a natural resource damage assessment for the Site to U.S. Steel on March 5, 2020.

Assessment Phase

Development of an Assessment Plan is often the first step in the Assessment Phase. The second step is implementation of the plan. The various stages of drafting this Plan and conducting the NRDA include:

Assessment Planning. The assessment planning step is encompassed in this Plan and may be amended in the future by the Trustees. This Plan sets forth the method for the determination and quantification of natural resource injury and damages.

Injury Determination. Determination of injury to natural resources under the CERCLA NRDA regulations consists of documentation that there is: (1) a pathway through which natural resources have been exposed to the released hazardous substance, and (2) that injury to a natural resource for which a Trustee is responsible (i.e., air, surface water, sediment, soil, groundwater, biota) has occurred, as defined in 43 CFR § 11.62. Generally, injury is defined as a measurable adverse change in the chemical or physical quality or viability of a natural resource resulting either directly or indirectly from exposure to a discharge of oil or release of a hazardous substance (43 CFR § 11.14(v)).

Injury Quantification. Once it has been determined that a resource or resources have been injured, the scope and scale of the injury is quantified for each resource for which damages will be sought. Quantification can use a wide range of metrics, depending on the injured resource and corresponding lost service (discussed further in Chapter 4). Baseline conditions must be determined and accounted for in this and all phases of the injury assessment.

Damage Determination. During damage determination, damages resulting from the release of hazardous substances are determined, relying upon the information obtained in the injury quantification phase. Damages are defined as "the amount of money sought by the natural resource trustee as compensation for injury, destruction, or loss of natural resources" (43 CFR § 11.14(l)). Damages can be quantified based on the cost of restoration that is capable of providing the same services as those that were lost, accounting for the interim loss of services (past and future); and/or the monetary value of lost resources and/or services. Damage determination often includes the development of a RCDP, which describes options for achieving the scale of restoration or replacement/acquisition of equivalent resources such that sufficient compensation for injuries is achieved. The RCDP may build upon previous restoration evaluation and implementation efforts.

Restoration of Injured Resources. Following completion of the assessment process and recovery of damages, a Restoration Plan may be developed based on the RCDP (if completed), or updated based on previously completed restoration planning documents to more fully develop the preferred restoration alternative to compensate for losses.

Post-Assessment Phase

The Post-assessment Phase may include a Report of Assessment if the assessment proceeds to that stage and requires project-specific Restoration Plan(s). The former describes the results of the Assessment Phase and includes all the documentation supporting the determinations that were made in the Assessment Phase (e.g., the Preassessment Screen Determination; the Assessment Plan and documentation used in the Injury Determination, Quantification, and Damage Determination phases; and the RCDP). Restoration Plans describing restoration project alternatives are released as draft documents for public review and comment. Once restoration plans are completed, restoration project implementation occurs.

In addition, trustees may identify early restoration opportunities, that is, chances to commence with a restoration project before the assessment has proceeded completely through earlier phases. Since these opportunities may be short-lived in duration, or there may be a benefit to earlier implementation (e.g., restoration of natural resources earlier than may otherwise be achieved), trustees may agree to pursue them. Using available information, trustees may estimate the benefits from any such potential restoration projects in relation to the injures to natural resources at the Site.

Therefore, trustees may develop a Restoration Plan and conduct appropriate environmental analyses under the National Environmental Policy Act and other authorities to address early restoration opportunities, provide a general framework for restoration actions, and fulfill the trustees' environmental compliance and public involvement obligations.

1.4.3 COMPARISON OF REMEDY AND NRDA

NRDA is a process that occurs *in addition* to the remedial (hazardous substance cleanup) process conducted by regulatory agencies like EPA and the State of Minnesota. These two processes have different goals. Remedial action objectives are risk-based and are developed to protect human health and the environment from further unacceptable harm. Remedies are selected based on evaluation criteria that are used to compare remedial alternatives and may result in contamination remaining in the environment above levels that existed prior to its release. In contrast, the goal of NRDA is to restore injured resources to their baseline condition. Losses resulting from natural resource exposure to hazardous substances are estimated over time, including past losses and, if post-remedy contaminant concentrations remain at levels sufficient to cause injury to natural resources, future losses.

There are components of NRDA and remedy however that overlap. For example, NRD-related restoration must account for remedial responses that are underway or planned. That is, the extent to which remediation returns natural resources and the services they provide to their baseline condition should be considered in the NRDA process. For example, work to remedy a site may partially or completely restore injured natural resources. In addition, remedial actions may injure natural resources (e.g., physical disturbance or destruction of habitat), and assessment and restoration of this remedy-induced injury is also evaluated within NRDA.[11]

1.5 USE OF EXISITING INFORMATION

Consistent with the CERCLA NRDA regulations, which require that the assessment be conducted in a planned, systematic manner and at a reasonable cost (43 CFR § 11.13(c)), the Trustees are prioritizing cost effectiveness in planning and implementing studies. As such, the Trustees will continue to review existing studies and data prior to undertaking any new data collection, including data collected as part of remedial and restoration efforts. Where existing data do not allow for the determination of the nature or extent of injuries, the Trustees will implement studies focused on filling those data gaps. These studies will be designed and implemented in phases to allow for subsequent adjustments in study design based on initial findings.

1.6 COOPERATION WITH THE RESPONSIBLE PARTY

Under CERCLA, the parties responsible for release of hazardous substances may be invited to participate cooperatively in the NRDA and restoration planning process (43 CFR §11.32(a)(2)). Cooperative assessments can act to reduce duplication of effort, expedite the assessment, and accomplish resource restoration earlier than might otherwise be the case. However, the final authority regarding determinations of injury and restoration rests with the Trustees.

[11] Injuries from remedial actions are distinct from impacts associated with actions that are permitted and/or that have been reviewed through a non-NRDA regulatory process (e.g., Clean Water Act) and have separate mitigation requirements or allowances for environmental impacts.

For this NRDA, the Trustees have identified U.S. Steel as the party responsible for releases of hazardous substances and corresponding natural resource damages. The Trustees met with U.S. Steel for the first time in 2019 to discuss NRDA efforts for the Site, completed a Preassessment Screen in January 2020, and issued a notice of intent to U.S. Steel in March 2020, formally initiating the NRDA for the Site and inviting their participation in the assessment. Trustee and U.S. Steel representatives are engaging in discussions to identify approaches for conducting a focused, cost-effective NRDA for the Site.

1.7 COORDINATION WITH THE PUBLIC

Public participation and review are an integral part of the assessment planning process and are required by the CERCLA NRDA regulations (e.g., 43 CFR § 11.32(c)). To facilitate public involvement in the planning process for potential ecological, recreational, and tribal assessment activities, the Trustees encourage the public to review and comment on this draft Assessment Plan. The review period is for 45 days (in accordance with 43 CFR § 11.32(c)(1)), from February 6, 2023 to March 23, 2023. Following comment submittal by the public, the Trustees will address any questions and recommendations on this Assessment Plan.

A copy of this document is available for review online at: https://www.fws.gov/project/st-louis-river-us-steel-duluth-minnesota-natural-resource-damage-assessment-and-restoration

Interested parties can obtain a hard copy of this Plan by submitting a written request to:

Ms. Reena Bowman
U.S. Fish & Wildlife Service
3815 American Blvd. East
Bloomington, MN 55425
or via email: USSteelNRDAR_comments@fws.gov

As the Trustees move forward with this NRDA, there will be additional opportunities for public participation. Examples include review of significant changes to the Plan, future restoration plans, and proposed settlements. For example, this Plan describes ongoing information review and analysis efforts and provides a list of potential additional analyses and studies with brief discussions of goals and objectives to describe the approaches the Trustees will follow in this assessment (Chapter 5). However, study-specific plans and associated Quality Assurance Project Plans (QAPPs) will be developed as needed by or on behalf of the Trustees. These study plans will be made public and the Trustees will determine whether individual studies constitute a significant modification to the Injury Assessment Plan subject to public comment (43 CFR § 11.32(c) and (e)).

Administrative Record

Pursuant to 43 CFR § 11.91(c), the Trustees are compiling information relied upon to plan and conduct the assessment, including this draft Plan, in a publicly available Administrative Record. The Administrative Record is available on NOAA's St. Louis River U.S. Steel webpage: https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/8002.

1.8 PLAN ORGANIZATION

This remaining chapters in this plan are organized as follows:

- **Chapter 2 – Natural Resources and Resource Services in the Assessment Area:** This chapter provides an overview of the natural resources at the Site, including the geographic scope and a summary of the Site's natural resources and the services they provide.
- **Chapter 3 – Injury Determination Approach:** This chapter outlines the potential pathways of hazardous substances released from U.S. Steel operations to natural resources, describes information demonstrating injury to natural resources, and provides an overview of the Trustees' approach to determining injury as a result of these releases.
- **Chapter 4 – Injury Quantification and Damage Determination Approach:** This chapter discusses the framework for quantifying injury to natural resources and services they provide (accounting for baseline) and the Trustees' proposed methods for determining damages.
- **Chapter 5 – Ongoing and Proposed Analyses and Studies:** This chapter discusses the prioritization and objectives of ongoing data review and analysis efforts and proposed primary studies.

CHAPTER 2 | NATURAL RESOURCES AND RESOURCE SERVICES IN THE ASSESSMENT AREA

The focus of a NRDA is to evaluate and restore the natural resources and resource services that are exposed to and injured by hazardous substances. This chapter provides information on the geographic scope within which exposure has likely occurred, the physical and biological characteristics of the area, and the natural resources and the types of services those natural resources provide. 43 CFR §11.31(a)(2).

2.1 GEOGRAPHIC SCOPE

The geographic scope for the Assessment Area is the area within which natural resources have been directly or indirectly affected by Site-related contaminants (43 CFR § 11.14(c)). Based on the CERCLA NRDA regulations, the industrial history of U.S. Steel, the proposed and ongoing remedial actions, and a review of available Site data, the Trustees have identified an Assessment Area for U.S. Steel within which ecological, recreational, and tribal losses will be evaluated (Exhibit 2-1), as well as additional areas within which tribal losses will also be considered. The Assessment Area includes over 900 acres of terrestrial and aquatic habitat (Exhibit 2-1):

- Approximately 530 acres of terrestrial habitat surrounding the former facilities, and
- Approximately 380 acres of aquatic habitat including Wire Mill Pond, Unnamed Creek, and portions of the St. Louis River.

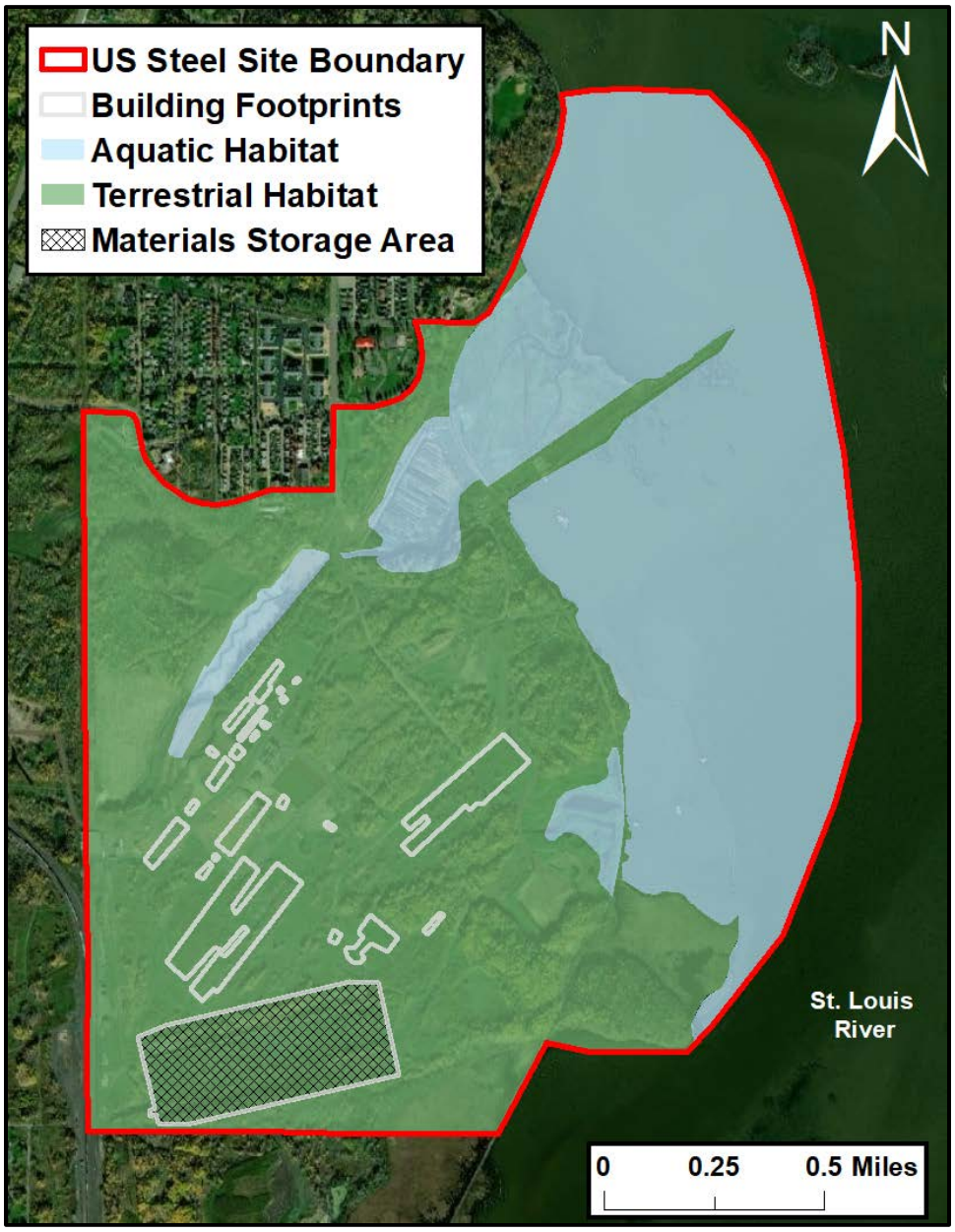
The Tribal loss assessment will consider a broader geographic scope (i.e., areas in addition to the Site boundary) due to the nature of Tribal services. For example, while Spirit Island and portions of Spirit Lake are not within the Site boundary, they are areas of Tribal concern.

The Trustees may expand or revise the geographic scope of their studies in the future as the assessment progresses.

2.2 DESCRIPTION OF THE ASSESSMENT AREA

Located in the southern part of Duluth, Minnesota, the climate in the Assessment Area is characterized by cold winters (average 15°F) and mild summers (average 63°F). Typical annual precipitation is 30 inches per year including an average of 50 inches of snow in the winter (MN DNR 2017). Elevation at the Site ranges from 600 feet above mean sea level in the estuary to 670 feet in the terrestrial areas. Native soils in the area were formed by glacial deposits and consist of thick lacustrine clay and silt deposits interbedded with sand (USGS 1979, MGS 1982). However, fill materials such as sand, clay, gravel, cinders, and coke fragments overlay much of the terrestrial portion of the Site at depths ranging from a few feet to 40 feet (MPCA 2013).

EXHIBIT 2-1 MAP OF THE U.S. STEEL SITE WITH APPROXIMATE AQUATIC, TERRESTRIAL, AND BUILDING FOOTPRINTS[12]



Depth to groundwater at the Site varies from zero to three feet below ground surface (bgs) near the St. Louis River to 20 – 25 feet bgs in terrestrial areas (URS 2002, U.S. Steel NRDA Trustees 2020). In the northern portion of the Site, groundwater flows towards the Unnamed Creek; across the rest of the Site groundwater flows towards the St. Louis River (Geragthy and Miller 1995, URS 2002, MPCA 2013, U.S. Steel NRDA Trustees 2020). Throughout the Site, a clay layer limits vertical upward flow from deeper groundwater, but the clay layer is not present everywhere and seeps at the ground surface are found along the lower portion of the terrestrial area near the St. Louis River (URS 2002). In addition, a vertical gradient for shallow groundwater movement exists in some places on the Site. For example, groundwater near the Unnamed Creek flows predominantly downward in the winter and upward from June to December (URS 2002, U.S. Steel NRDA Trustees 2020).

The primary habitat types within the Site include upland forest, grass and shrubs, wetlands, and freshwater aquatic habitat. The forested habitat makes up the largest portion of the terrestrial area with over 200 acres of coniferous and deciduous tree canopy that is dominated by early successional native species (e.g., young aspens). The only known mature forest in the Assessment Area is a white cedar stand in the northwestern portion of the Site. Grass and shrub habitats cover approximately 165 acres and are dominated by invasive species (approximately 60-70%) such as tansy, Canada thistle, and spotted knapweed with patches of native milkweed and goldenrod. Wetlands cover approximately 37 acres and are dominated by native plants (Exhibit 2-3, Barr Engineering 2013). The wetlands in the southern portion of the Site contain good to high quality mature canopy and are suitable habitat for the state-listed special concern species, discoid beggarticks (*Bidens discoidea*; SEH 2018). The habitats adjacent to the St. Louis River contain a mix of native plant communities and disturbed habitats where non-native, invasive species including cattails, buckthorn, and showy honeysuckle are prevalent.[13]

The freshwater aquatic habitat at the Site is comprised of the Unnamed Creek, the Unnamed pond, the pond embayment formed by the Wire Mill Pond, and the St. Louis River from the Wire Mill Delta to Spirit Island. Although the Spirit Lake area of the St. Louis River historically supported extensive wetland habitats, hydrological changes (e.g., resulting from industrial activities, sedimentation) have transformed the area to open water with limited wetlands (LimnoTech 2012).

[12] All buildings were demolished. The footprint outlines represent the historic building locations, some of which still contain building foundations.

[13] Vegetation information obtained through personal communication with Susan Johnson from MPCA and Marth Minchak and Pat Collins from MNDNR on May 27, 2021.

2.3 NATURAL RESOURCES

Under the CERCLA NRDA regulations, natural resources include the land, fish, wildlife, biota, air, water, groundwater, drinking water supplies, and other resources that belong to, are managed by, or held in trust by, appertaining to, or otherwise controlled by the United States, State or local governments, foreign governments, or Tribes (43 CFR § 11.14(z)). These resources are organized into five categories: surface water (including sediments), groundwater, air, geological (including soil), and biological resources.

This Plan focuses on the sediment, soil, and biological resources in the Assessment Area, including both the ecological and human services provided by these resources. While groundwater and air have been exposed to Site-related contaminants, at this time the Trustees do not anticipate quantifying distinct injuries to these resources.[14] Rather, this Plan considers these resources as pathways of hazardous substances to sediment, soil and biological resources.

Properly functioning soil and sediment are essential for a healthy ecosystem and directly or indirectly support numerous biological resources. The CERCLA NRDA regulations define "biological resources" to mean those natural resources referred to in section 101(16) of CERCLA as fish, wildlife, and other biota including marine and freshwater species, aquatic and terrestrial species, game, nongame, and commercial species, threatened and sensitive species (designated by Federal or state law), and other living organisms that are otherwise not listed in the definitions (43 CFR § 11.14(f)). Biological resources exposed or potentially exposed to releases from the Site include, but are not limited to, plants, invertebrates, reptiles and amphibians, fish, birds, and mammals that utilize the terrestrial and aquatic habitat in the Assessment Area. Examples of biota that are found within the general Duluth area, and therefore may also be found in the Assessment Area, are presented in Exhibit 2-2.

2.4 NATURAL RESOURCE SERVICES

Natural resource services are the physical and biological functions performed by the natural resources including the human uses of those functions and are a result of the quality of the resource (43 CFR § 11.14 (nn)).

2.4.1 ECOLOGICAL SERVICES

Each of the natural resources described above provides a variety of ecological services. For example, the St. Louis River area of the Site contains aquatic plants that provide habitat and food resources for benthic invertebrates and fish. The wetland and shoreline habitats contain vegetation that provides protective cover, spawning, and nursery habitat for aquatic and terrestrial biota; aids in nutrient cycling; maintains hydraulic flows; and improves water quality by promoting sedimentation of particulate matter. Microscopic plants and animals serve as prey for aquatic invertebrates and cycle nutrients. Fish,

[14] As more information and data on resource conditions and contaminant concentrations are compiled, the Trustees may decide to evaluate injury to groundwater.

amphibians, and reptiles help control insect populations and serve as prey for higher trophic level organisms such as birds and mammals. In the terrestrial habitats on-site, forest and grasslands support vegetation, which provides protective cover, breeding areas, food (e.g., berries and seeds), and nesting materials. Soil invertebrates in these areas are essential in nutrient cycling and serve as prey for small birds and mammals, who themselves are prey for larger animals. These organisms also serve as pollinators, scavengers, and seed dispersers.

EXHIBIT 2-2 EXAMPLES OF BIOTA FOUND IN THE DULUTH AREA[1]

SPECIES TYPE	COMMON NAME	SCIENTIFIC NAME
Aquatic Invertebrates	Midge Fly	*Chironomus dilutus*
	Scuds	Hyalella azteca
	Water Flea	*Ceriodaphnia dubia*
	Mayfly	*Ephemeroptera*
Terrestrial Invertebrates	Fork-tailed bush Katydid	*Scudderia furcata*
	Monarch Butterfly	*Danaus plexippus*
Fish	Black Crappie	*Pomoxis nigromacuatus*
	Lake Sturgeon[2]	*Acipenser fulvescens*
	Muskellunge	*Esox masquinongy*
	Northern Pike	*Esox lucius*
	Walleye	*Sander vitreus*
	White Sucker	*Catostomus commersonii*
Migratory Birds	Bald Eagle	*Haliaeetus leucocephalus*
	Nashville Warbler	*Leiothypis ruficapilla*
	Ovenbird	*Seiurus aurocapilla*
	Red-eyed Vireo	*Vireo olivaceus*
	Rusty Blackbird	*Euphagus carolinus*
Non-Migratory Birds	Barred Owl	*Strix varia*
	Great Blue Heron	*Ardea herodias*
	Red-tailed hawk	*Buteo jamaicensis*
Amphibians	Blue-spotted Salamander	*Ambystoma laterale*
	Green Frog	*Lithobates clamitans*
	Northern Leopard Frog	*Lithobates pipiens*
	Wood Frog	*Lithobates sylvaticus*
Reptiles	Common Garter Snake	*Thamnophis sirtalis*
	Red-bellied Snake	*Storeria occipitomaculata*
	Snapping Turtle	*Chelydra serpentina*
	Wood Turtle	*Glyptemys insulpta*

SPECIES TYPE	COMMON NAME	SCIENTIFIC NAME
Small Mammals	Mink	*Neovision vision*
	Northern Long-eared Bat[3]	*Myotis septentrionalis*
	River Otter	*Lontra canadensis*
	Striped Skunk	*Mephitis mephitis*
Large Mammals	Black Bear	*Ursus americanus*
	Coyote	*Canis latrans*
	White-tailed Deer	*Odocoileus virginianus*

Notes:

1. Species list compiled from: LimnoTech 2012, Barr Engineering 2013, U.S. ACOE 2013, MN DNR 2022a; 2022b; 2022c, U.S. FWS 2022.
2. Lake Sturgeon is a classified as a MN species of special concern. A species of special concern in Minnesota is one that is not endangered or threated but is extremely uncommon in MN and needs careful monitoring of its status.
3. Northern Long-eared bat is federally listed as a threatened species, meaning that is likely to become in danger of extinction in the foreseeable future.

EXHIBIT 2-3 EXAMPLES OF VEGETATION AT THE SITE (BARR ENGINEERING 2013)

VEGETATION TYPE	COMMON NAME	SCIENTIFIC NAME	ORIGIN
Aquatic Vegetation	American Bur-reed	*Sparganuim eurycarpum*	Native
	Broad-leaved Arrowhead	*Sagittaria latifolia*	Native
	Clasping-leaf Pondweed	*Potamogeton richardsonii*	Native
	Coontail	*Ceratophyllum demersum*	Native
	Eel-grass	Vallisneria americana	Native
	Narrow-leaved Cattail	*Typha angustifolia*	Invasive
	Nodding Naiad	Najas flexilis	Native
	Sago Pondweed	*Potamogeton pectinatus*	Native
	White Water Lily	*Nymphaea odorata*	Native
Terrestrial Vegetation	Balsam Poplar	*Populus balsamifera*	Native
	Canada Goldenrod	*Solidago canadensis*	Native
	Canada thistle	*Cirsium arvense*	Invasive
	Common Milkweed	*Asclepia syriaca*	Native
	Common Tansy	*Tanacetum vulgare*	Invasive
	Glossy Buckthorn	*Rhammus cathartica*	Invasive
	Nodding Beggartick	*Bidens cernua*	Native
	Scouring Rush	*Equisetum*	Native
	Willows	*Salix spp.*	Native

2.4.2 RECREATIONAL USE SERVICES

Areas adjacent to the Site provide a variety of recreational opportunities, including fishing, motorized and non-motorized boating, and wildlife observation. The St. Louis River Estuary is a significant recreational fishing resource, supporting 30,000 or more open water trips in-season, with the majority of anglers targeting walleye (MN DNR 2016). The St. Louis River Estuary National Water Trail was designated in late 2020 and includes a loop trail for paddlers that traces the shoreline of Spirit Lake.[15] Finally, improved portions of the Western Waterfront Trail (renamed the Waabizheshikana or Marten Trail) currently terminate near Riverside Park, and access to areas traversing the Site is prohibited.

2.4.3 TRIBAL SERVICES

Tribal members may use natural resources to an extent and in ways that are different from the general population. In addition, the role that natural resources play in the culture of Tribal communities may differ from that of the non-Tribal population. In this context, the term culture encompasses the lived experiences and all of the material and spiritual relationships that Indigenous peoples have with all of the elements of the natural world. Drawing on published anthropological research, the concept of culture in the context of this Plan incorporates practice, which consists of the everyday activities of the people on the land.

In general, natural resources provide provisioning, regulating, cultural and amenity, and supporting and habitat services to Tribal members (as defined by the Millennium Ecosystem Assessment (2005) and National Research Council (2005)). As a result, Tribal service losses can encompass adverse changes in three broad areas of the Tribes' natural resource-based uses, including but not limited to: 1) economies (e.g., food, money, and livelihoods); 2) traditional knowledge (e.g., languages, values, teachings); and 3) spiritual values (e.g., ceremonies, sacred histories, places).

As a result of differences in the nature and extent of services that Tribal communities derive from the environment — and differences in the way in which changes in these services affect these communities — it may be necessary to describe and quantify service losses for Tribal communities separately from service losses to the non-Tribal public. Given these differences, specific restoration actions may also be required to fully compensate for Tribal service losses.

The St. Louis River estuary and its natural resources are of paramount importance to the Ojibwe people, generally, and to the Tribal Trustees, specifically. For example, the surface waters of the St. Louis River estuary provide cultural and amenity services in the form of a water supply for ceremonial activities and river features for fishing and transportation; provisioning services in the form of a water supply for domestic uses; regulating services in the form of maintaining the cleanliness of water; and supporting and habitat services in the form of providing habitat for subsistence, utilitarian, and sacred animals and plants.

Key species of cultural significance to Tribal members that are or have historically been present within the Assessment Area include, but are not limited to: manoomin (wild rice), whitefish, walleye, sturgeon, sugar maple, birch, moose, deer, and waterfowl. Manoomin is essential to Tribal senses of identity and place, as reflected in its centrality to the traditional narrative of migration noted in Chapter 1. Tribal members' right to access and harvest manoomin is specifically protected in the language of the Treaty of

[15] https://www.stlouisriver.org/national-water-trail

1837. Manoomin is considered a sacred being and is essential to cultural activities including ceremonies, feasts, celebrations, initiations, and funerals (Vogt et al. 2020). Fish from the St. Louis River estuary have also been critical to the Ojibwe economy since before the nineteenth century (Kaups 1984).

The Assessment Area also includes or is adjacent to geographic areas of fundamental importance to Tribal communities. The portion of the St. Louis River estuary known as Spirit Lake and, within it, Spirit Island, play important roles in Tribal traditions and history. Spirit Island is a critical locale for traditional ceremonial practice. Spirit Island is also recognized for habitat that has historically supported abundant food and ceremonial resources, including manoomin.

Aerial image of Spirit Island

CHAPTER 3 | INJURY DETERMINATION APPROACH

The CERCLA NRDA regulations define natural resource injuries as generally falling into two categories (43 CFR § 11.62). One establishes injury based on physical, chemical, or biological changes to the resources as a result of contaminant exposure. Examples include changes in an organism's physical development, reproductive success, or survival. The other category establishes injury based on exceedance of a regulatory criteria. This includes the existence of state health advisories recommending limits on consumption of contaminated biota. The Trustees plan to evaluate both types of injuries within the Assessment Area.

To determine injury in a planned, systematic manner and at a reasonable cost (43 CFR § 11.30(b)), the Trustees identified parameters on which to focus assessment efforts. The Trustees' approach will also emphasize the use of existing information, identification of data gaps, and evaluation of potential methods for addressing those data gaps. Studies will be designed and implemented in phases to allow for subsequent adjustments in study design based on initial findings. Additionally, the Trustees will consider the relationship between injury and restoration to ensure that metrics used to assess each of these components are comparable and that restoration will provide resources of a type and quality that are consistent with what was lost.

This Chapter identifies the hazardous substances on which the Trustees plan to focus this assessment, details the confirmation of exposure, discusses pathways for contaminants to reach natural resources, describes proposed approaches for injury determination for natural resources and their human uses, and summarizes how the Trustees will evaluate the impacts of remediation.

3.1 HAZARDOUS SUBSTANCES

This NRDA will focus on injuries resulting from exposure to hazardous substances[16] released from U.S. Steel operations to the Assessment Area. These hazardous substances (also referred to as contaminants) include PAHs, PCBs, arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc. Samples collected since the 1980s indicate elevated levels of these contaminants in Assessment Area soil and sediment.

In order to conduct this NRDA efficiently and at a reasonable cost, the Trustees plan to select a subset of these contaminants on which to focus. At this time, the contaminants of highest concern include cadmium, chromium, copper, lead, mercury, zinc, PAHs, and PCBs due to their concentrations in Assessment Area groundwater, sediment, and soil sufficient to cause injury and persistence in the environment (more detail provided in the sections below). If the results of ecological, recreational, or tribal loss studies indicate connections between injuries and additional site-related contaminants, these

[16] Hazardous substances as defined in section 101(14) of CERCLA.

additional contaminants of concern may then be included in pathway and other studies necessary to connect releases, exposure, and injuries.

3.2 CONFIRMATION OF EXPOSURE

A natural resource has been exposed to a hazardous substance if all or part of it is, or has been, in physical contact with a hazardous substance, or with media containing a hazardous substance (43 CFR § 11.14(q)). Consistent with 43 CFR § 11.31(c)(1) and § 11.37, this Plan documents that natural resources have been exposed to hazardous substances, thereby supporting the Trustees' decision to implement a formal assessment. Numerous sources report measured contaminant concentrations in Assessment Area natural resources, confirming exposure of these resources to Site-related contaminants. Sediment samples from the Site available on DIVER (NOAA 2018) demonstrate detected concentrations of arsenic, cadmium, copper, lead, PAHs, and zinc. Additionally, soil data reported in remedial and investigation documents (UEC 1993, URS 2005, URS 2012), indicate measurable concentrations of arsenic, cadmium, copper, lead, PCBs, PAHs, and zinc throughout the terrestrial portion of the Site.

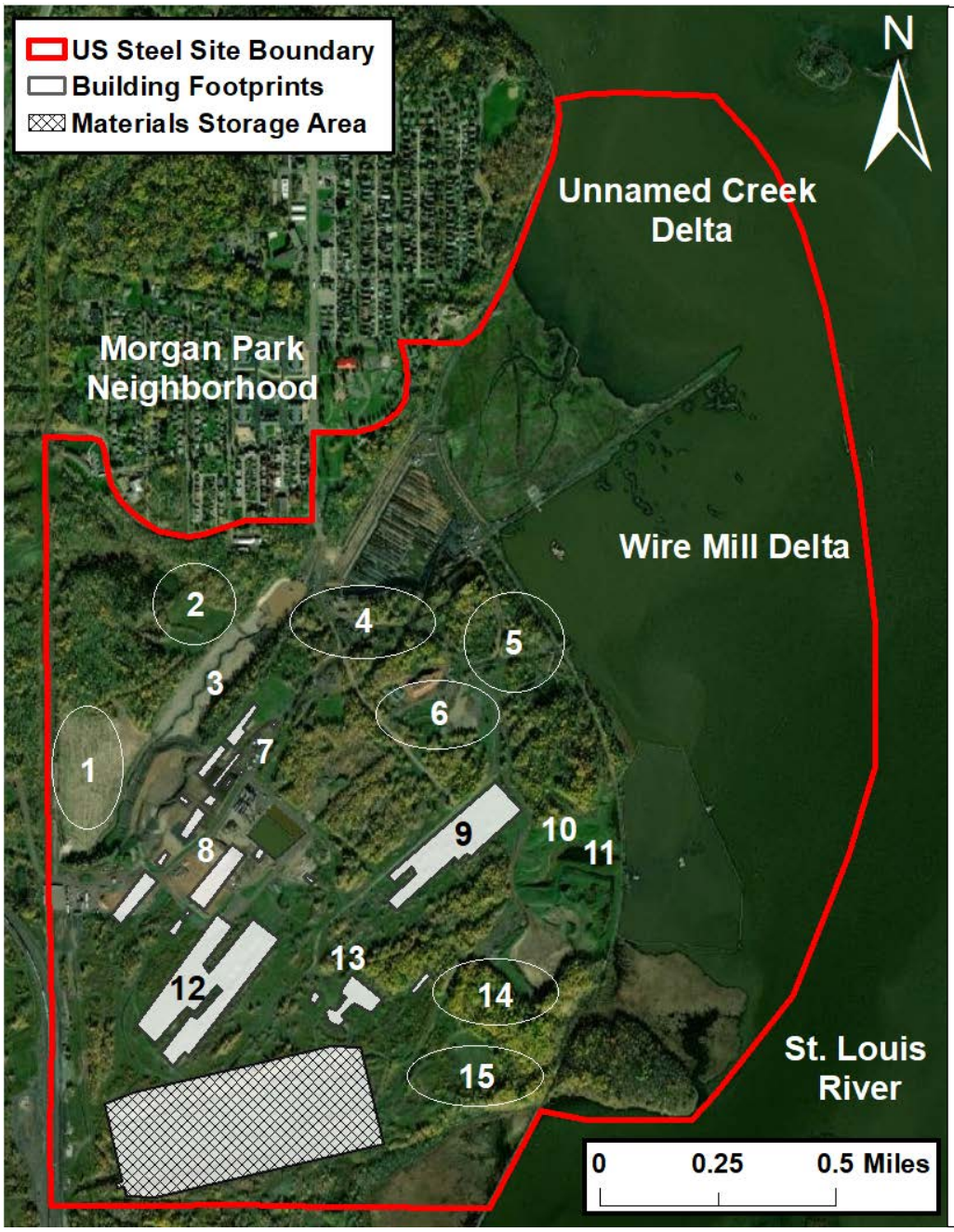
Based on these data, Site soil and sediment contaminant concentrations are higher than relevant guidelines and literature values. For example, sediment concentrations are greater than the State of Minnesota's sediment quality targets (SQTs) that have been set to protect sediment-dwelling organisms (Crane and Hennes 2007). Additionally, soil concentrations exceed the U.S. EPAs Ecological Soil Screening Levels (Eco-SSLs; U.S. EPA 2018), which are screening levels intended to be protective of plants, soil invertebrates, birds, and mammals. The contaminant concentrations greater than the screening levels and quality targets are indicative of exposure to natural resources on Site. The soil and sediment concentrations, the thresholds, and screening levels are further explained in Section 3.4 of this document and in Section 3.2 of the PAS (U.S. Steel NRDA Trustees 2020).

3.3 PATHWAY

An important step in determining injury to natural resources is to establish a pathway from a known release of a hazardous substance to exposure of the natural resources. Pathway is defined as the route or medium through which a hazardous substance is or was transported from the source of the release to the injured resource (43 CFR §11.14(dd)).

Metals, PAHs, and PCBs were both used and produced as part of U.S. Steel's historical manufacturing processes. The main sources of contaminants of concern (COCs) to the environment include facilities (e.g., Coke Plant), settling basins (e.g., Wire Mill and Coke Plant), dredge spoil areas, the oil and tar loading area, and underground fuel tanks (Exhibit 3-1). Contaminant releases from these source areas occurred via direct discharge of semi-solid and liquid waste products to the ground and unlined settling basins, as well as leaks and spills from operational processes (Barr Engineering 1986, U.S. Steel NRDA Trustees 2020). For example, during the 1986 RI/FS, hazardous wastes such as soft and hard tar, coke, coke breeze, oil residues and sheens, and coke fines and dusts were observed in dredge spoil and soil borings collected around various source areas (Barr Engineering 1986, U.S. Steel NRDA Trustees 2020). These wastes contained elevated concentrations of COCs.

EXHIBIT 3-1 MAP OF CONTAMINATION SOURCES AT THE U.S. STEEL SITE



SOURCE AREAS

1. Cement Disposal Area
2. Dredge Spoils Area
3. Coke Plant Settling Basin
4. Demolition Landfill #1
5. Water Pumping Station
6. Oil Storage Area
7. Coke Plant
8. Power House
9. Wire Mill
10. Dredge Spoils Area
11. Wire Mill Settling Basin
12. Rod and Merchant Mill
13. Shops
14. Demolition Landfill #2
15. Demolition Landfill #3

Once discharged or released, contaminants moved – and continue to move – through the environment via abiotic pathways.[17] Surface water, which includes water bodies and stormwater runoff overland, transports contaminants from on-Site sources to other areas of the Site and to the St. Louis River. For example, surface runoff in the northern part of the U.S. Steel Site drains to Unnamed Creek, which flows into the Unnamed Creek Delta. The remainder of the U.S. Steel Site drains to the Wire Mill Delta, farther south along the St. Louis River. Surface water can also infiltrate soil, moving contaminants into the subsurface and the underlying groundwater. Groundwater then carries the contaminants to surface water bodies (e.g., Unnamed Creek, St. Louis River). Contaminants can also adsorb (stick) to sediments and are transported along with sediment particles. The measured concentrations of COCs in Assessment Area sediment and soil, described in Section 3.2 and the PAS (2020), provide evidence of these pathways.

Once in the soil and sediment, COCs move through biological pathways. Based on the physical and chemical nature of the COCs, example biological pathways in the Assessment Area include, but are not limited to:

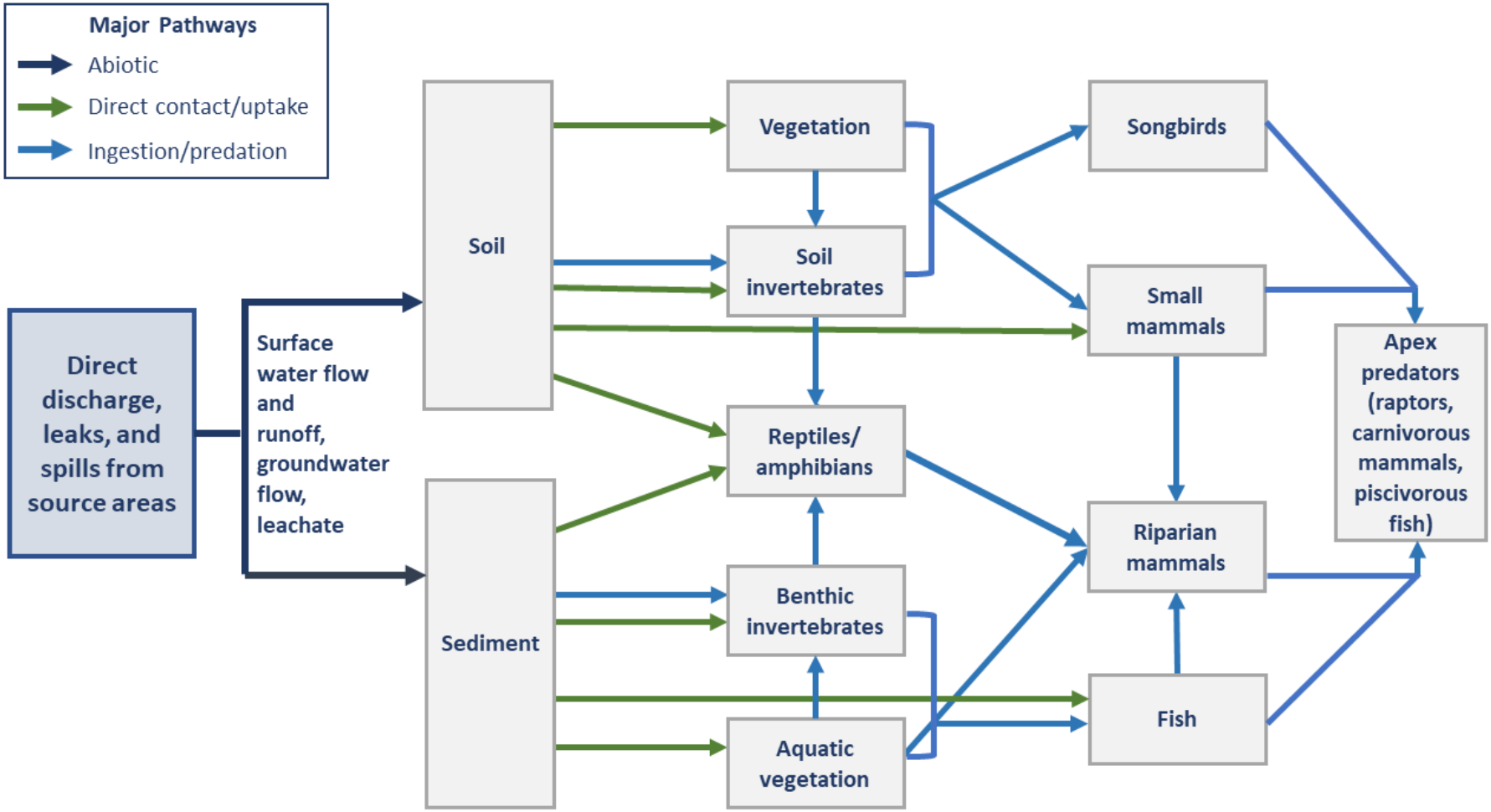
- Root uptake of COCs from contaminated soils and sediments by terrestrial and aquatic plants;
- Direct contact with and ingestion of contaminated soil and sediment by terrestrial and benthic invertebrates; and
- Consumption of contaminated plants and invertebrates by fish, birds, and mammals, exposing upper trophic level organisms.

Food web transfer is also an important factor at this Site due to the potential of some COCs to bioaccumulate and biomagnify.[18] For example, cadmium, lead, and copper can accumulate in plants through uptake (Khan et al. 2015), and invertebrates are likely to accumulate and become a pathway for cadmium, lead, copper, and PAHs (Heikens et al. 2001, Rodríguez-Seijo et al. 2017). Consumers of plants and invertebrates, such as fish, birds, and mammals, are then exposed to these COCs in their diet. Exhibit 3-2 shows a conceptual site model that presents examples of abiotic and biotic pathways that likely occur at the Site. As the NRDA proceeds, the Trustees may identify additional pathways of concern.

[17] While air is a potential pathway for contaminant transport, it is not considered a significant pathway at the Site and is not being evaluated at this time.

[18] Bioaccumulation occurs when contaminants build up in an organism's body over time. Biomagnification occurs when animals consume contaminated prey, exposing organisms higher in the food web.

EXHIBIT 3-2 EXAMPLE CONCEPTUAL SITE MODEL FOR U.S. STEEL SHOWING MAJOR PATHWAYS



3.4 INJURY TO NATURAL RESOURCES

Because the Trustees have confirmed exposure to hazardous substances and identified pathways, the Trustees will evaluate whether injury to natural resources has occurred. In this case, the Trustees are specifically focused on assessing injury to biological resources that utilize the Assessment Area, including the recreational and tribal services they provide. This includes injury to sediment (categorized as a surface water resource) and soil (categorized as a geologic resource) based on adverse impacts to biota exposed to contamination in those media. As the assessment progresses, the Trustees may also evaluate injury to resources based on exceedances of regulatory criteria, such as whether surface water contaminant concentrations are greater than federal water quality criteria.

3.4.1 SURFACE WATER RESOURCES (SEDIMENT)

An injury to a surface water resource has resulted from the release of a hazardous substance if concentrations and duration of substances measured in suspended, bed, bank, or shoreline sediments are sufficient to have caused injury to biological resources (43 CFR § 11.62(b)(1)(v)).

The Trustees intend to utilize existing Site data, as well as any additional data to be collected as part of this assessment, to document that concentrations of COCs in sediments in the Assessment Area are sufficient to injure biological resources, as described in Section 3.4.3. Other tests to further determine injury to sediment may be developed as necessary, and will be documented for public review and comment as a proposed modification to this Plan.

3.4.2 GEOLOGIC RESOURCES (SOIL)

An injury to a geologic resource has resulted from the release of a hazardous substance if concentrations and duration of substances measured in soil are sufficient to injure biological resources, such as causing a toxic response in soil invertebrates, or causing injury to other biological resources (43 CFR § 11.62(e)(9,11)).

The Trustees intend to utilize existing Site data, as well as any additional data to be collected as part of this assessment, to document that concentrations of COCs in Assessment Area soils are sufficient to injure biological resources, as described in Section 3.4.3. Other tests to further determine injury to soil may be developed as necessary and will be documented for public review and comment as a proposed modification to this Plan.

3.4.3 BIOLOGICAL RESOURCES

Injury to a biological resource has resulted from the release of a hazardous substance if the concentration of the substance is sufficient to cause adverse changes to the resource or its offspring, if the concentration in edible portions of the organisms exceeds action or tolerance levels established under section 402 of the Food, Drug, and Cosmetic Act (21 U.S.C 342), or if the concentrations exceed levels set by State health agencies for consumption (43 CFR § 11.62(f)(1)). Therefore, injury to biological resources can be assessed through documented toxicity, exceedances of effects thresholds, or the existence of a consumption advisory.

Information available for resources within the Assessment Area suggests that benthic invertebrates, fish, birds, and mammals have likely been injured due to the release of hazardous substances. Information

demonstrating injury or the potential for injury to these resources is presented below. Other resources (e.g., soil invertebrates, reptiles and amphibians) may also be considered by the Trustees as the assessment progresses.

The Trustees will prioritize the use of existing data and information to the fullest extent possible, including to establish metrics of injury. Additionally, the Trustees will consider a phased approach for developing studies or analyses, as necessary, to address data gaps in the assessment. These are cost effective strategies that are expected to satisfy the definition and standard of reasonable cost described in 43 CFR. § 11.14(ee).

BENTHIC INVERTEBRATES

Benthic invertebrates are primarily exposed to contaminants through direct exposure to sediment. The potential for injury to benthic invertebrates is demonstrated by two lines of evidence: (1) sediment COC concentrations in exceedance of MPCA's Sediment Quality Targets (SQTs; Crane and Hennes 2007) and (2) site specific sediment toxicity tests.

Sediment COC Concentrations Compared to SQTs

MPCA has set numerical SQTs for the protection of sediment-dwelling organisms in the St. Louis River AOC. As stated in their guidance:

- "The Level I SQTs are intended to identify contaminant concentrations below which harmful effects on sediment-dwelling organisms (i.e., benthic invertebrates) are unlikely to be observed.
- The Level II SQTs are intended to identify contaminant concentrations above which harmful effects on sediment-dwelling organisms are likely to be observed." (Crane and Hennes 2007)

These protective thresholds are based on harmful effects on benthic invertebrates and do not reflect the potential for bioaccumulation or impacts on consumers of benthic invertebrates. Site sediment concentrations exceed all of the metal and PAH MPCA SQTs (Exhibit 3-3).

EXHIBIT 3-3 SEDIMENT CONCENTRATIONS OF COCS AT U.S. STEEL SITE AND SEDIMENT QUALITY TARGETS

CONTAMINANT	YEARS OF DATA	NUMBER OF SAMPLES	CONCENTRATION RANGE	LEVEL I SQT	LEVEL II SQT
Metals (ppm DW)					
Arsenic	1993 - 2012	280	0 - 33.5	10	33
Cadmium	1993 - 2015	286	0 - 14.7	0.99	5.0
Chromium, total	1993 - 2015	286	3.3 - 226	43	110
Copper	1993 - 2016	303	0 - 727	32	150
Lead	1993 - 2016	308	1.7 - 1,830	36	130
Mercury	1993 - 2015	301	0 - 4.8	0.18	1.1
Nickel	1993 - 2015	286	0 - 265	23	49
Zinc	1993 - 2016	303	10.2 - 6,120	120	460
Polycyclic Aromatic Hydrocarbons (ppb DW)					
Acenaphthene	1993 - 2016	321	0 - 2,300,000	6.7	89
Acenaphthylene	1993 - 2016	321	0 - 4,100,000	5.9	130
Anthracene	1993 - 2016	321	0 - 2,200,000	57	850
Benzo(a)anthracene	1993 - 2016	321	0 - 2,400,000	110	1,100
Benzo(a)pyrene	1993 - 2016	321	0 - 1,900,000	150	1,500
Chrysene	1993 - 2016	321	0 - 1,900,000	170	1,300
Dibenzo(a,h)anthracene	1993 - 2016	321	0 - 540,000	33	140
Fluoranthene	1993 - 2016	321	0 - 8,200,000	420	2,200
Fluorene	1993 - 2016	321	0 - 3,200,000	77	540
Naphthalene	1993 - 2016	321	0 - 15,000,000	180	560
Phenanthrene	1993 - 2016	321	0 - 12,000,000	200	1,200
Pyrene	1993 - 2016	321	0 - 5,400,000	200	1,500
Total PAHs	1993 - 2016	321	0 - 59,900,000	1,600	23,000

Notes:
1. Sediment data were compiled from publicly available data on DIVER (NOAA 2018) within the Assessment Area. DIVER may not be inclusive of all historical and recent data collection actions and additional data may be made available during the assessment.
2. Data are from surface samples (top of sample is at 0 cm depth, bottom of sample is at depth less than 30 cm.
3. Total PAHs (PAH13) are the sum of the twelve individual PAHs shown in this table plus 2-methylnaphthalene, as specified in Crane and Hennes (2007).
4. Results below the detection limit are reported here as zero.
5. SQTs are the Minnesota Pollution Control Agency's Sediment Quality Targets (Crane and Hennes 2007).
6. ppm = parts per million, ppb = parts per billion, DW = dry weight.

Site Specific Benthic Toxicity Tests

Efforts to study the toxicity of sediment within the Assessment Area to benthic invertebrates were conducted in the 1990s, as well as more recently in 2020.

Regional sediment toxicity studies in 1993, 1995, and 1996 included samples collected from the Assessment Area. Chironomids (*Chironomus dilutus*), amphipods (*Hyalella azteca*) were exposed to the sediments and evaluated for contaminant effects on endpoints such as survival (Exhibit 3-4). Results indicate that sediment from the Assessment Area was over ten times more likely than samples in the overall St. Louis River region to have substantial reductions in survival compared to the laboratory control. Similarly, the average percent survival (not control-adjusted) within the Assessment Area is substantially lower than in the St. Louis River overall.

EXHIBIT 3-4 SUMMARY OF HISTORICAL BIOASSAY RESULTS (1993-1996)

	WITHIN U.S. STEEL ASSESSMENT AREA			WITHIN ST. LOUIS RIVER OVERALL		
TEST TYPE	COUNT OF RESULTS	PERCENT OF RESULTS SIGNIFICANTLY DIFFERENT FROM CONTROL	AVERAGE PERCENT SURVIVAL	COUNT OF RESULTS	PERCENT OF RESULTS SIGNIFICANTLY DIFFERENT FROM CONTROL	AVERAGE PERCENT SURVIVAL
Chironomid - Survival	6	83%	16%	159	7%	72%
Amphipod - Survival	5	60%	45%	124	6%	84%

Prior to remedial action in OU-M, NOAA undertook a sediment sampling and toxicity study in 2020 to collect ephemeral data related to the Assessment Area. That study collected sediments from sites in the Unnamed Creek Delta, in the upper Wire Mill Delta, and near Wire Mill Pond, as well as from two reference locations. The Trustees will evaluate study results as part of future assessment efforts, as described in Chapter 5.

FISH

While regional analyses of mercury and PCB concentrations in fish have been undertaken as part of the Minnesota Department of Public Health's (MN DPH) development of fish consumption advisories (discussed below), Site-specific studies on COCs, particularly metals or PAHs, in fish tissue are not available. However, COC concentration in Assessment Area sediment and surface water are indicative of potential injuries to fish. The PAS demonstrated that levels of PAHs in sediment exceed concentrations at which adverse effects are observed in literature studies of fish reproduction and growth. Similarly, the PAS demonstrated that maximum concentrations of metals in Assessment Area surface water (specifically cadmium, copper, and zinc) exceeded the concentrations shown to cause lethality in various species of trout, including brook, bull, cutthroat, and rainbow (U.S. Steel NRDA Trustees 2020).

Fish Consumption Advisory

Fish consumption advisories (FCAs) have been in place on the St. Louis River in some form since 1979 (Exhibit 3-5). The first was issued by the MN DPH in 1979 for mercury (MN DPH 1979). Additional FCAs were issued in the 1980s for walleye, northern pike, shorthead redhorse, and white sucker. Several FCAs were issued specific to the St. Louis River estuary in 1993 due to mercury and PCBs; the majority of these FCAs remain in place today (U.S. EPA 2019). These advisories are more stringent than those currently in effect on a statewide basis. For example, MN DPH's recommendation for consumption of walleye by the general population state-wide is 4 meals per month, but is only 1 meal per month for the estuary. The presence of FCAs constitutes an injury under the CERCLA NRDA regulations (43 CFR § 11.62(f)(1)(iii)).

EXHIBIT 3-5 FISH CONSUMPTION ADVISORY TIMELINE

AREA	ADVISORY	DATE
St. Louis River: East of Cloquet	Consumption limit on game fish due to mercury.	1979
St. Louis Bay and upstream of Cloquet	Consumption limit of walleye, northern pike, shorthead redhorse due to mercury and PCBs.	1983
St. Louis River Estuary	Consumption limit due to mercury and PCBs for 15 species. Presently active for 12 species.	1993 - Present
Statewide (MN)	Consumption limit on all MN caught fish due to mercury and PCBs.	2021

BIRDS AND MAMMALS

White tailed Deer

While Site-specific data on COC concentrations in birds and mammals are not available, the potential for injury to these resources is demonstrated by soil COC concentrations in exceedance of EPA's Ecological Soil Screening Levels (Eco-SSLs; U.S. EPA 2018) and literature-based toxicity studies. Derived by EPA and based on a set of literature that satisfies EPA's study acceptance criteria, Eco-SSLs are concentrations of contaminants in the soil considered protective of adverse effects on reproduction, survival, and growth for different ecological receptor groupings including birds and mammals. Although the EPA did not derive Eco-SSLs for mercury, literature-based toxicity studies report concentrations of mercury above which adverse effects on similar endpoints have been observed at other sites and can be used as screening thresholds (e.g., Opresko et al. 1994, Sample et al. 1996). Additionally, EPA has not developed an avian Eco-SSL for Total PAHs, but literature values on PAH soil concentrations that cause adverse effects on birds are available (e.g., Gonzalez 2003). Cadmium, chromium, copper, lead, zinc, and PAH soil concentrations at the Site exceed EPA Eco-SSL values for birds and mammals; mercury and Total PAHs concentrations exceed the literature derived thresholds, indicating potential injury (Exhibit 3-6).

EXHIBIT 3-6 SOIL CONCENTRATIONS OF COCS AT U.S. STEEL AND EXAMPLE THRESHOLDS

COC	YEARS OF DATA	NUMBER OF SAMPLES	RANGE[1] (PPM)	AVIAN THRESHOLD (PPM)	MAMMALIAN THRESHOLD (PPM)	THRESHOLD SOURCE
Arsenic	1993 – 2012	369	0 – 167	43	46	Eco-SSL (U.S.EPA 2005a)
Cadmium	2004 – 2012	317	0 – 452	0.77	0.36	Eco-SSL (U.S. EPA 2005b)
Chromium	1993 – 2009	175	0 – 65,000	26	34	Eco-SSL (U.S. EPA 2005c)
Copper	2004 - 2012	323	0 – 8,440	28	49	Eco-SSL (U.S. EPA 2007a)
Lead	1993 – 2012	392	0 – 183,000	11	56	Eco-SSL (U.S. EPA 2005d)
Mercury	1993 – 2012	370	0 – 138	5	25	Sample et al. 1996 (avian), Opresko et al 1994 (mammalian)

COC	YEARS OF DATA	NUMBER OF SAMPLES	RANGE[1] (PPM)	AVIAN THRESHOLD (PPM)	MAMMALIAN THRESHOLD (PPM)	THRESHOLD SOURCE
Nickel	1993 – 2012	370	0 – 2,000	210	130	Eco-SSL (U.S. EPA 2007b)
Zinc	1993 - 2012	371	0 – 66,400	46	79	Eco-SSL (U.S. EPA 2007d)
Total PAHs	1993 - 2012	343	0 – 48,818	98	100	Gonzalez 2003 (avian), Eco-SSL (mammalian; U.S. EPA 2007c)

Notes:

1. Soil samples were compiled from an MPCA database of sampling results from 2009 and 2010 (MPCA 2010), the EPA Five Year Review and Recommendation (URS 2005, as compiled by MPCA), the Report of Phase II Environmental Site Assessment (UEC 1993), and the Phase II Investigation Comprehensive Documentation Report (URS 2012).

3.5 INJURY CAUSED BY REMEDIAL ACTIONS

Remedial actions often do not fully return natural resources and/or lost services to baseline conditions because remedial actions are designed to managed unacceptable risks to human health and the environment (Section 1.4.3). Further, remedial actions that involve soil or sediment removal or capping, stream reconstruction, vegetation removal, or other physical alterations of the environment may also result in unavoidable, additional injury that is compensable under the CERCLA NRDA regulations (43 CFR § 11.15(a)(1)). The Trustees will identify and quantify the extent to which remediation affects natural resources by assessing both physical injuries and injuries resulting from residual contamination throughout the documented or expected timeframe of recovery. This evaluation will be based on a review of remedial documents, when available, including documents that describe what remedial actions have occurred or are planned and the timing of those actions, as well as the result, or expected result, in terms of residual contamination, habitat condition, or other relevant parameters (43 CFR §11.15(a)(1)).

Remedial actions have already occurred for several operable units within the Assessment Area (Section 1.2). Other remedial actions are ongoing or are planned for future implementation. The Trustees will use available information to identify remediation-related impacts in affected areas. The Trustees will also look for opportunities to coordinate remedial actions and restoration efforts to increase efficiencies (i.e., cost and time) as well as benefit the natural resources within the Assessment Area. Restoration work conducted in conjunction with the remedy and any proposed compensation for natural resource injuries will be reviewed for approval by the Trustees before compensation is accepted and will also be reviewed by the public as part of restoration planning.

3.6 SUMMARY OF THE TRUSTEES' APPROACH TO INJURY DETERMINATION

Currently available data demonstrate that natural resources in the Assessment Area have been exposed to and injured by the release of Site-related hazardous substances (e.g., soil and sediment contamination data in exceedance of adverse effects thresholds, presence of fish consumption advisories). The Trustees have identified specific categories of injury and corresponding resources that will be the focus of NRDA efforts, that is, effects of the COCs on biological resources. Additional research and analysis of existing information, as well as primary studies, may be conducted to further determine injury to natural resources within the Assessment Area. Potential efforts are described in Chapter 5.

CHAPTER 4 | INJURY QUANTIFICATION AND DAMAGE DETERMINATION APPROACH

Once injury to natural resources has been determined, quantification of that injury is undertaken to establish a basis for scaling restoration and determining damages (43 CFR § 11.70(a)). Injuries to natural resources can be quantified in terms of the actual measured loss of specific resources and/or the services that the injured resources would have provided had the release not occurred. In the quantification phase, the extent of the injury is measured, the baseline condition and services are identified, the recoverability of the injured resource is determined, and the reduction in services resulting from the hazardous substances are calculated (43 CFR § 11.70(c)). Damages will be determined using methods described in the CERCLA NRDA regulations where applicable (43 CFR § 11.80).

To quantify losses, select and scale (where feasible) restoration options, and determine damages, the Trustees anticipate using approaches tailored to the specific services that are affected by Site-related contamination. These include:

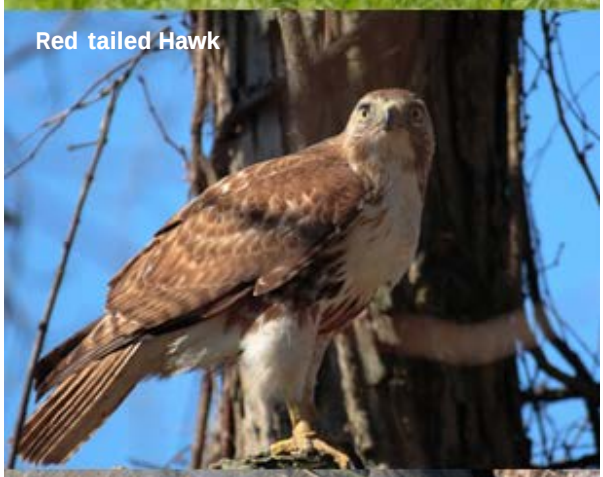
- Ecological losses may be quantified and scaled to restoration using equivalency analysis. Damages would be calculated as the cost of implementing the type and scale of restoration that is expected to generate additional, future ecological services equivalent to what was lost.
- Recreational losses would be quantified based on the nature and extent of lost recreational services (e.g., lost and diminished recreational fishing trips). Damages would be determined as the corresponding value lost to the public from that change in recreational trips.
- For Tribal service losses, the Tribes expect to select and potentially scale restoration options using one or a combination of injury assessment approaches, such as direct assessment of tribal use and perception and equivalency analysis.

The steps and approaches to quantify injury and determine damages are discussed below, including determination of baseline conditions and the temporal scope of the assessment.

4.1 BASELINE

Baseline is defined as the condition(s) that would have existed if the hazardous substances had not been released in the Assessment Area (43 CFR §11.14(e)). Therefore, baseline data should reflect expected conditions in the Assessment Area had the release of hazardous substances not occurred, taking into account natural processes and changes that result from human activities (e.g., structural alterations). Because site-specific historical data applicable to establishing baseline are not available for the Site, the Trustees plan to use, in order of priority, data from reference/control areas (43 CFR § 11.72(d)), relevant literature (43 CFR § 11.72(c)(2)), and/or Site-specific studies (43 CFR § 11.72(c)(5)).

4.2 NATURAL RESOURCE INJURY QUANTIFICATION AND DAMAGE DETERMINATION APPROACH



Losses to natural resources and the services they provide may result from effects of hazardous substances on natural resources. Losses reflect a reduction in the ability of a resource to provide the level and type of ecological services (i.e., functions) that would have been provided under baseline conditions.

For the purposes of injury quantification, the Trustees anticipate quantifying ecological service losses to representative resources for both aquatic and terrestrial habitat types. Fish and benthic organisms are the resources of focus for aquatic habitat while songbirds, small mammals, and riparian[19] animals represent the terrestrial habitat. For each species group in each habitat type, ecological injury quantification will focus on the endpoints that are considered the most biologically relevant such as growth, reproduction, and survival. The Trustees will also identify the area of habitat over which the injury has occurred in the past and/or is expected to occur in the future (43 CFR § 11.70(c)). Existing data, in combination with the analyses and studies described in Chapter 5, will generate data appropriate for quantifying losses for each resource and endpoint over time. The Trustees will consider each resource/endpoint combination as independent indicators of the losses to the Assessment Area. Studies may include field-based efforts (e.g., to confirm exposure to Site-related contaminants and assess the type and magnitude of injury resulting from that exposure), laboratory studies to confirm that Site-related contaminants cause the field-based observations on relevant endpoints, and studies to verify the completeness of contaminant pathways.

To determine damages required to compensate for ecological injures to resources within the Assessment Area, the Trustees intend to use equivalency analyses (e.g., habitat equivalency analysis, resource equivalency analysis, and/or habitat-based resource equivalency method) to scale restoration projects such that sufficient ecological benefit is provided to compensate for losses. Equivalency analyses quantify resource losses from contamination over the spatial extent and timeframe of injury and quantify resource gains from restoration over the spatial extent and timeframe of the restoration project(s). Where possible,

[19] Riparian refers to something that is related to or situated on the banks of a river or adjacent wetlands.

losses and gains will be measured in the same unit (e.g., number of organisms, biomass, acres of habitat). Damages will be calculated as the cost to implement that restoration.

The Trustees will ensure that there is no "double-counting" of losses in the quantification process (43 CFR § 11.83(c)(2)). This approach will require the evaluation of whether restoration scaled to the losses experienced by one resource will also compensate (fully or partially) for the losses associated with another injured resource.

4.3 RECREATIONAL USE INJURY QUANTIFICATION AND DAMAGE DETERMINATION APPROACH

As noted in Section 2.4.2, areas adjacent to the Site and within the estuary more broadly support a variety of recreational activities and uses. In addition to the FCAs described previously, warning signs were posted in several shoreline locations at the Site from 1994 through 2018 indicating the presence of contaminated sediments and that "swimming, wading, boating and fishing should be avoided in this area." The presence of FCAs constitute an injury under the CERCLA NRDA regulations. These FCAs along with the Site-specific warnings/restrictions suggest that there has been, and will continue to be, associated compensable losses. Recreational losses would be quantified based on the nature and extent of lost recreational services (e.g., lost and diminished recreational fishing trips; 43 CFR § 11.83(c)(2)). In this manner, damages may result from reduced use of the resources or a diminished experience due to the presence of the hazardous substances.

Based on an ongoing review of available information, the Trustees anticipate that existing data on angler effort and relevant economic values may be adequate to conduct a secondary (i.e., benefit transfer-based) analysis of recreational fishing damages (43 CFR § 11.83(c)(2)(vi)). Benefit transfer involves adapting research estimating economic values under one set of circumstances to an alternate situation. In this manner, existing valuation research is combined with estimates of recreational fishing to develop a damage estimate. Should this analysis reveal significant sources of uncertainty, or if additional information regarding the nature and extent of potential losses becomes available, the Trustees may consider designing and implementing a primary (i.e., stated, revealed or combined stated/revealed preference) valuation study to estimate damages.

Additional potential sources of recreational use losses include boating (paddling and otherwise) and birding and wildlife observation. The Trustees plan to continue gathering any available information on the nature, location, and levels of such activities in relation to the Site, as well as the extent to which releases from the Site have reduced or diminished use. To augment existing information, the Trustees may conduct targeted qualitative research in the form of interviews or focus groups to determine whether further evaluation and potential data collection related to these other uses is warranted.

4.4 TRIBAL LOSS ASSESSMENT APPROACH

In this Plan, "Tribal lost services" refers to losses in natural resource services of importance to the Tribal Trustees and/or the members of the Tribal communities they represent. As described above (Section 2.4.3), the nature and extent of services that Tribal members derive from natural resources differ from the non-Tribal public. Similarly, changes in natural resource services affect Tribal communities differently from the non-Tribal public. Consequently, it may be necessary to describe and assess service losses to Tribal communities separately from service losses to the non-Tribal public. Full compensation for service losses to Tribal communities may require restoration actions specific to those losses. Since such Tribal-specific restoration actions may also restore services for the non-Tribal public, the assessment approach will involve evaluation of potential double-counting.

The techniques available to assess changes in Tribal members' uses and perceptions of natural resources in the context of NRDA have been applied less frequently than the techniques used for other categories of natural resource services. Damage assessments involving Tribal service losses have typically relied on methods similar to those used for other service categories (modified and supplemented to reflect the particular characteristics of Tribal services), or on methods used to assess other impacts on Indigenous cultures (e.g., land claims, tribal impact assessment).

Examples of methods that have been applied to measure service losses to Tribal communities in the context of NRDA include:

- *Assessment of changes in Tribal services*. This includes assessment and analysis of changes in levels of traditional knowledge, cultural practices, and relationships resulting from shifts in the use of natural resources caused by the presence of contaminants. Such an analysis is generally based on applied anthropological approaches, and relies as fully as possible on existing documentation, including accounts by Tribal members, historical records, and ethnographic reports.
- *Direct assessment of loss of resource use*. This can involve application of revealed preference techniques, user surveys, and existing data. For example, assessment of the number of individuals who previously utilized a site, the nature and frequency of that use, substitution or alternative behaviors, and the expected recovery period for the activity.
- *Habitat and resource equivalency*. This involves the use of resource-based measures to calculate the level of service loss, as described earlier in this chapter, under the assumption that ecological service losses are a proxy measure of Tribal service losses.

These approaches, all of which are available to the Trustees, may be used individually or in combination to assess changes in Tribal services resulting from contamination.

Damages determination for Tribal lost services will be consistent with the injury assessment approach, or combination of approaches as described above, and based on the cost of identified restoration projects required to compensate for losses. Restoration projects will need to be identified and scaled accordingly to compensate Tribal communities with services of the same nature and scope as those services which are determined to have been lost.

4.5 TEMPORAL SCOPE

The temporal scope of this assessment is based on the determination of injury to natural resources and corresponding damages (43 CFR § 11.14(c)). Based on the industrial history of U.S. Steel, natural resources have likely been exposed to and injured by hazardous substances since operations began in 1915 and are likely to continue to be injured in the future. In accordance with the promulgation of CERCLA in 1980, to the extent injuries pre- and post-CERCLA are distinguishable, injury after the enactment of CERCLA will be quantified. Where injuries are not distinguishable, potentially for tribal losses, injury will be quantified for all years that injury occurred in the past and is expected to occur in the future.. All injury quantification calculations will include losses through the reasonable expected recovery of resource services. The rate of recovery will be based upon proposed or implemented remedial and restoration activities, natural attenuation, and expected resource recoverability. If a resource is not expected to fully recover, the injuries will be considered permanent.

CHAPTER 5 | ONGOING AND PROPOSED ANALYSES AND STUDIES

The previous chapters describe some of the key components of the U.S. Steel NRDA and discuss the framework and general approaches the Trustees plan to apply. The NRDA itself will be comprised of a series of iterative analyses aimed at assessing the severity and magnitude of natural resource injury resulting from hazardous substances released in the Assessment Area. Efforts will focus on natural resources that are commonly found in the Assessment Area and have likely been injured by the release of Site-related contaminants. These resources include, but are not limited to, benthic invertebrates, fish, songbirds, and riparian animals, and small mammals. In order to advance the injury assessment process outlined in Chapters 3 and 4, the Trustees plan to undertake additional review and analysis of existing data, as well as primary studies.[20] These efforts will enable the Trustees to determine and quantify injury to natural resources and lost services resulting from Site-related contamination and assist in identifying and scaling restoration projects that will compensate for natural resource injuries.

As described in Chapter 2, natural resources within the Assessment Area not only provide ecological services, but also provide human use services to both the general public and Tribal members. For example, recreational fishing has been affected by the contaminant-driven FCAs. The importance of Assessment Area resources to Tribal members, their connection to and use of those resources, and the impacts of contamination on tribal practices has also been documented. For example, manoomin is a staple food with deep cultural and spiritual importance to Tribal members. Harvesting manoomin is an essential community tradition that provides Tribal members not only with healthy food, but with opportunities for renewing intergenerational connections and ties with the land and spirits (Vogt et al. 2020).

Previous Trustee efforts have included the compilation of historical and recent Site environmental data and reports regarding the exposure of natural resources to Site-related contamination and corresponding effects on ecological, recreational, and tribal services. These were summarized in the PAS (U.S. Steel NRDA Trustees 2020). Additionally, the Trustees have undertaken a sediment toxicity study as described in section 3.4.3.

This Chapter describes efforts the Trustees are presently undertaking or considering to generate sufficient, targeted information to conduct the full assessment – injury determination, injury quantification, and damage determination. These efforts include: (1) ongoing review and analysis of existing information targeted to specific injury evaluations and resources of focus, and (2) primary studies designed to address data gaps such that when combined with existing information, the Trustees can determine and quantify injury and damages. The selected analyses and studies detailed in the following section represent the

[20] Primary studies are studies that collect new data.

Trustee's best understanding of the information that may be needed to further refine the determination and quantification of injury to Assessment Area natural resources and resource services. This Plan is not intended to limit additional or alternative studies that may be undertaken in the course of the assessment, as the Trustees recognize that other studies may become necessary or advisable as the assessment proceeds and new information becomes available, or new data gaps are identified. Additionally, the inclusion of a study within this Plan does not guarantee that it will be undertaken. The Trustees may decide that some studies are not needed if reasonable assumptions supported by expert opinion can be made, considering the cost of additional research or sampling against the expected gain in information from a particular study. As such, this Plan provides a starting point from which the Trustees will prioritize study efforts and implement the NRDA. As the efforts progress and additional information is generated, the Trustees may provide amendments to this Plan for public review.

5.1 ANALYSIS AND STUDY PRIORITIZATION

The Trustees identified and prioritized a list of discrete assessment activities that are expected to assist in determining and quantifying the scale of natural resource injury stemming from releases of hazardous substances to the Assessment Area. The prioritization considered that some efforts are dependent on others (e.g., exposure studies should come before effects studies), some information can be collected based on existing information whereas other information requires primary studies, and some studies may be relevant but require an adjustment in scope if they are implemented after other studies (e.g., if tribal interviews do not yield adequate information about changes in behavior, a survey could be designed to focus on that question).

Based on these considerations, assessment activities are grouped into one of three prioritization categories:

- Phase 1: Ongoing data collection and analyses and potential primary studies that are expected to generate prerequisite data for future studies.
- Phase 2: Studies that are dependent or building on the data collected in Phase 1 studies with the intent of more effectively determining injury.
- Phase 3: Studies that are dependent or building on the data collected in Phase 1 or 2, are needed to determine additional parameters, or that may be needed to evaluate injury and pathway for additional resources.

5.2 INJURY ASSESSMENT ANALYSES AND STUDIES

The Trustees' proposed analyses and studies are grouped by injury category, that is, ecological, recreational, or tribal, and are presented in Exhibits 5-1 to 5-3. These exhibits summarize the topic, data source (i.e., existing information, primary survey, primary field study, primary laboratory study), description and rationale for each effort, and recommended priority for implementation. The general approach to conducting the analyses and studies will be developed further in collaboration with subject matter experts.

Planned ecological assessment efforts build on the existing soil and sediment contamination data to establish baseline, confirm exposure and toxicity, and determine impacts of COCs on natural resources and ecological services (Exhibit 5-1). While a variety of natural resources utilize the Assessment Area,

the Trustees are currently focusing the potential analyses of existing information and primary studies on benthic invertebrates, fish, songbirds, riparian species, and small mammals - resources for which losses may be quantified. Vegetation, soil invertebrates, sediment, and soil may be assessed as pathways of COCs to those resources. Pathway analyses and assessment of injury resulting from remedial actions are described in Exhibit 5-4.

Planned recreational assessment efforts emphasize ongoing review and analysis of existing information to estimate losses. Primary data collection efforts in the form of surveys, for example, are included should priority research efforts indicate significant sources of uncertainty or categories of loss that cannot otherwise be addressed (Exhibit 5-2).

Ongoing efforts and proposed studies for Tribal losses include using existing information and primary surveys to establish baseline for tribal services and to better understand Tribal members' uses of and relationships with natural resources and the impacts of contamination on those uses and relationships (Exhibit 5-3).

EXHIBIT 5-1 ONGOING AND PLANNED ANALYSES AND PRIMARY STUDIES FOR ECOLOGICAL RESOURCES

TOPIC	DATA SOURCE	OBJECTIVE AND RATIONALE	PHASE
Sediment/Benthic Injury			
Aquatic Habitat Type and Condition	Existing Information	Document habitat types and physical condition over time to set baseline and determine habitat characteristics and quality, considering past and future remedial actions. The review will inform injury and recovery calculations over time.	Phase 1
Toxicity of COCs to Benthic Invertebrates	Existing Information	Use existing toxicity studies and sediment contaminant data to calculate the impacts of COCs on benthic invertebrates. This will inform the severity and magnitude of effect and corresponding service losses.	Phase 1
Quantify Effects of COCs on Benthic Invertebrates	Existing Information	Quantify the density of invertebrates on a biomass- or organism-basis to inform the loss to benthic invertebrates resulting from Site-specific contamination. Effort would be based on invertebrate community data and literature data for comparable areas. Community structure and population information are necessary if a resource equivalency analysis is used for injury quantification.	Phase 1
	Primary – Survey	Evaluate the invertebrate community in remaining non-remediated wetland areas or in similar wetland areas identified in estuary. Identify the species and, if possible, densities. This study will provide an additional basis for the Trustees' application of current toxicity study data to wetland areas.	Phase 3
Surface Water			
Surface Water Injury	Existing Information	Compile existing surface water data on concentrations of contaminants in the Assessment Area and compare to regulatory water quality criteria. Concentrations in exceedance of those criteria would indicate that injury to Assessment Area surface water has occurred.	Phase 3
Fish			
Species Prevalence	Existing Information	Document Site-specific fish presence and abundance, especially for sensitive life stages for wetland (from literature) and open water (from historical Site surveys). This effort will establish a basis for damages to fish resources.	Phase 1
Exposure of Fish to COCs	Existing Information	Compile and evaluate Site-specific water chemistry data to document exposure to fish, particularly sensitive life stages. The relationship of observed fish toxicity to water chemistry can be more straightforward than sediment chemistry and may help inform injury determination.	Phase 1

TOPIC	DATA SOURCE	OBJECTIVE AND RATIONALE	PHASE
Toxicity of COCs to Fish	Existing Information	Compile and evaluate literature-based toxicity thresholds for fish species relevant to the Assessment Area based on concentrations of contaminants in Site sediment and water to determine potential injury to fish at different life stages. Injury to fish is an important line of evidence for determining losses within the aquatic habitat, even if only assessed qualitatively.	Phase 1
	Primary – Laboratory Study	Evaluate the effects of field-related contamination (including mixtures) on biologically relevant endpoints (e.g., survival) on standard test species and site-specific species of interest through laboratory bioassays. This effort will help understand the direct impacts of Site contamination on fish.	Phase 3
Soil Invertebrates			
Invertebrate Exposure, Pathway, and Injury	Primary – Field Study	Confirm Site-specific invertebrates as a pathway and provide information on the levels of contamination to which Assessment Area invertebrates and their consumers are exposed. This will inform whether additional injury determination and quantification studies should be conducted.	Phase 1
Songbirds			
Toxicity of COCs to Songbirds	Existing Information	Use existing literature to demonstrate potential injury to Site songbirds. This effort will inform whether there are data gaps that should be addressed through a primary study(ies).	Phase 1
Songbird Habitat Use	Primary - Survey	Evaluate when, where, and how many breeding songbirds use the Site. This survey will provide information on focal species and identify the time periods that they are exposed to Site contamination.	Phase 2
Exposure and toxicity of COCs to Songbirds	Primary – Field Study	Confirm exposure levels of Site songbirds using tissue/blood/feather sampling. Determine differences in reproductive and survival endpoints compared to reference areas through concurrent studies. This study will help understand the direct impacts of Site contamination on songbirds and inform the current service loss at the Site.	Phase 2
Toxicity of COCs to Songbirds	Primary – Laboratory Study	Evaluate the effects of field-relevant contamination (including mixtures) on biologically relevant endpoints (e.g., reproduction and survival) in the laboratory. This study will confirm the field impacts of Site-specific contamination and exposure on similar endpoints.	Phase 3

TOPIC	DATA SOURCE	OBJECTIVE AND RATIONALE	PHASE
Riparian Species			
Exposure and Toxicity of COCs to Amphibians, Reptiles, and Aquatic-Dependent Mammals	Existing Information	Compile Site-specific sediment, soil, and water COC data and literature information to model exposure of aquatic-dependent species to COCs and compare exposure estimates to literature information on toxicity of COCs to riparian organisms. Riparian organisms include frogs, turtles, beaver, mink, and muskrat. Injury to aquatic-dependent resources is an important line of evidence to understand habitat-wide impacts of COC exposure, even if only assessed qualitatively.	Phase 3
Vegetation			
Vegetation Survey	Primary – Survey	Evaluate current habitat type, vegetation community composition, and habitat quality at the Site to inform baseline conditions and the biological community supported by the habitat. This study may include a specific focus on milkweed as a resource for the Monarch butterfly.	Phase 2
Vegetation Pathway and Exposure	Primary – Field Study	Confirm Site-specific vegetation as a pathway and provide information on the levels of contamination that consumers are exposed to via Assessment Area vegetation. This will inform whether additional injury determination and quantification studies should be conducted.	Phase 3
Small Mammals			
Toxicity of COCs to Small Mammals	Existing Information	Compile literature to demonstrate potential injury to Assessment Area small mammals by modeling the impacts of COCs on small mammals. This effort will inform whether there are data gaps that should be addressed through a primary study(ies).	Phase 1
Habitat Use of Small Mammals	Primary – Survey	Determine when, where, and how small mammals use the Site. The survey will provide information on the focal species and identify the habitats and areas used by small mammals.	Phase 2
Exposure, Pathway, and Toxicity of COCs to Small Mammals	Primary – Field Study	Confirm exposure levels of small mammals using tissue and/or blood sampling. Determine differences in reproductive and survival endpoints compared to reference areas through concurrent studies. This study will help understand the direct impacts of Site contamination on small mammals and inform the current service loss at the Site.	Phase 2
Toxicity of COCs to Small Mammals	Primary – Laboratory Study	Evaluate the effects of field-relevant contamination (including mixtures) on biologically relevant endpoints (e.g., reproduction and survival) in the laboratory. This study will confirm the field impacts of Site-specific contamination and exposure on similar endpoints.	Phase 3

TOPIC	DATA SOURCE	OBJECTIVE AND RATIONALE	PHASE
Soil			
Historical Soil Contamination Levels	Existing Information	Inform past contaminant levels through additional efforts to obtain historical data on Site-related soil contamination, waste disposal practices, and physical environmental processes. The historical data may fill some temporal and spatial gaps in Site contamination data, though some data gaps may remain.	Phase 1
Soil Contamination Levels	Primary – Field Study	Increase spatial coverage of Site-specific soil contamination data through targeted, efficient sampling (e.g., incremental sampling). This study will help fill the spatial gaps in soil contamination data and inform exposure of terrestrial biota.	Phase 2

EXHIBIT 5-2 ONGOING AND PLANNED ANALYSES AND PRIMARY STUDIES FOR RECREATIONAL LOSSES

STUDY	STUDY TYPE	OBJECTIVE AND RATIONALE	PHASE
Recreational Fishing			
FCAs and Recreational Use	Existing Information	Review available FCA and angler/creel survey information to document injury and characterize use levels. This study will establish basis for damages and potential magnitude of losses.	Phase 1
Benefit Transfer Analysis	Existing Information	Develop estimate of damages due to diminished and/or forgone use. This study will leverage existing fishing activity and valuation data and information.	Phase 1
Revealed and/or State Preference Valuation Study	Primary – Survey	Collect primary data to estimate change in fishing activity due to FCAs and associated monetary values. This study would provide a Site-specific estimate of losses.	Phase 3
Other Recreational Uses (Boating, Waterfront Trail, Birding and Wildlife Observation)			
Site Restrictions/Closures and Recreational Use	Existing Information	Review available Site restriction/closure and use information to document injury and characterize use levels. This study will establish basis for damages and potential magnitude(s) of losses.	Phase 1
Interviews and/or Focus Groups	Primary – Qualitative Research	Develop information on nature/extent of use and potential changes associated with Site restrictions and releases. This study would provide qualitative documentation of damages and/or inform scoping of primary study.	Phase 2

STUDY	STUDY TYPE	OBJECTIVE AND RATIONALE	PHASE
Revealed and/or Stated Preference Valuation Study	Primary – Survey	Collect primary data to estimate change in recreational activities and associated monetary values resulting from contamination-related restrictions in the Assessment Area. This study would inform Site-specific estimate of losses.	Phase 3

EXHIBIT 5-3 ONGOING AND PLANNED ANALYSES AND PRIMARY STUDIES FOR TRIBAL LOSSES

STUDY	STUDY TYPE	OBJECTIVE AND RATIONALE	PHASE
Impacts of Contamination on Cultural Uses and Perceptions of Natural Resources	Existing Information	Use literature to qualitatively characterize Tribal members' diverse uses and perceptions of natural resources in the Assessment Area and impacts of contamination on those uses and perceptions. This study will establish baseline for tribal services; establish the nature, timing, and intensity of changes in behavior; and describe service losses. Literature is a fundamental source of historical information.	Phase 1
	Primary – Survey	Conduct structured information collection to compile qualitative and quantitative information about Tribal members' long-term and traditional relationships with natural resources, the broader cultural context and significance of those relationships, perceptions of contamination, and changes in resource use and perception. Potential approaches include interviews, focus groups, or surveys. This study will help develop a detailed record of cultural activities, experiences, and changes in behavior specific to the impacted tribal communities, communicated through the voices of Band members and help understand the nature and extent of Tribal members' concerns about contamination to understand basis of changes in behavior and/or develop appropriate restoration projects.	Phase 1
Spatial Dimensions of Resource Use and Perceptions of Contamination	Primary – Survey	Conduct participatory mapping workshop(s) to elicit information from Tribal members about: (1) geographic areas of importance and/or concern, (2) locations of resource access and use, (3) spatial relationships connecting resources and cultural practices, and (4) changes in access to resources or perceived changes in availability/quality of resources. This study will provide spatial information to more fully understand Tribal members' relationships with resources and impacts of contamination and provide geographic context that reflects unique senses of place of impacted Tribal communities.	Phase 2

EXHIBIT 5-4 ONGOING AND PLANNED ANALYSES AND PRIMARY STUDIES FOR PATHWAY AND REMEDIAL INJURY

TOPIC	DATA SOURCE	OBJECTIVE AND RATIONALE	PRIORITY
Pathway	Existing Information	Compile and evaluate existing information on physical and chemical transport mechanisms within the Assessment Area to document contaminant pathways. Include spill histories and data on soil, sediment, surface water, groundwater, and flow-through infrastructure (i.e., outfalls).	Phase 2
	Primary- Field Study	Collect Site-related soil, sediment, overland surface water runoff, outfall discharge, seeps, and/or groundwater and analyze for COCs. This study will confirm contamination in various media and environmental connections between sources and Assessment Area resources.	Phase 3
Remedial Impacts	Existing Information	Compile information on remedial activities and evaluate the severity and magnitude of impacts to resources and resource services. Information should include timing, location, spatial extent, and type of remedial activities to inform injury and recovery calculations.	Phase 2

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APPENDIX A | QUALITY ASSURANCE PLAN

The CERCLA NRDA regulations require that trustees develop a Quality Assurance Plan that "Satisfies the requirements listed in the National Contingency Plan and applicable EPA guidelines for quality control and quality assurance plans" (43 CFR § 11.31(c)(2)). The Trustees recognize the importance of data quality, given the many management decisions involved in accomplishing the NRDA that ultimately require the use of environmental data. The collection, compilation, evaluation, and reporting of environmental data are necessary to perform the assessment. The Trustees must therefore properly document the origin and quality of the data used to make decisions so that data limitations may be identified; and assessments of the severity, location, and extent of injury are accurate. This assists the Trustees in making appropriate decisions regarding the type and scale of restoration actions necessary to compensate for natural resource injuries. Also relevant to this effort are the NOAA and U.S. Fish and Wildlife Service guidelines established under the Information Quality Act of 2001. All information developed and used in this NRDA will comply with these guidelines.

This Plan includes analyses that evaluate existing datasets as well as studies that generate new information. With respect to the evaluation of existing data, the subject matter expert (SME) for each analysis will carefully document the source(s) of all data, available information about quality assurance (QA)/quality control (QC) procedures used by the original investigator, and any data qualifiers or other information restricting application of the data. This approach will also be applied to new data and analyses developed by Federal and State agencies, academics, and information developed under the auspices of other activities or programs. For new studies that are specifically undertaken to support the NRDA process, appropriate study-specific Quality Assurance Project Plans (QAPPs) will be developed according to the general principles described below.

As noted by EPA (2001), QAPPs will "vary according to the nature of the work being performed and the intended use of the data" and as such, need to be tailored to match the specific data-gathering needs of a particular project (40 CFR § 300.5) The NRDA effort will entail a variety of widely-different data-gathering efforts; therefore, it is not appropriate to develop a single, detailed QAPP to cover all these activities. Instead, the Trustees will ensure that individual study plans adequately address project-specific QA issues. The discussion in this document therefore focuses on the required elements of an acceptable study plan.

In general, a study-specific QAPP must provide sufficient detail to demonstrate that:

- The project's technical and quality objectives are identified and agreed upon;
- The intended measurements, data generation, or data acquisition methods are appropriate for achieving project objectives;
- Assessment procedures are sufficient for confirming that data of the type and quality needed and expected are obtained; and
- Any limitations on the use of the data can be identified and documented (EPA 2001).

Accordingly, study-specific QAPPs developed for this assessment will include the four elements called for by EPA:

- **Project Management** – documents that the project has a defined goal(s), that the participants understand the goal(s) and the approach to be used, and that the planning outputs have been documented;
- **Data Generation and Acquisition** – ensures that all aspects of project design and implementation including methods for sampling, measurement and analysis, data collection or generation, data compiling/handling, and QC activities are documented and employed;
- **Assessment and Oversight** – assesses the effectiveness of the implementation of the project and associated QA and QC activities; and,
- **Data Validation and Usability** – addresses the QA activities that occur after the data collection or generation phase of the project is completed.

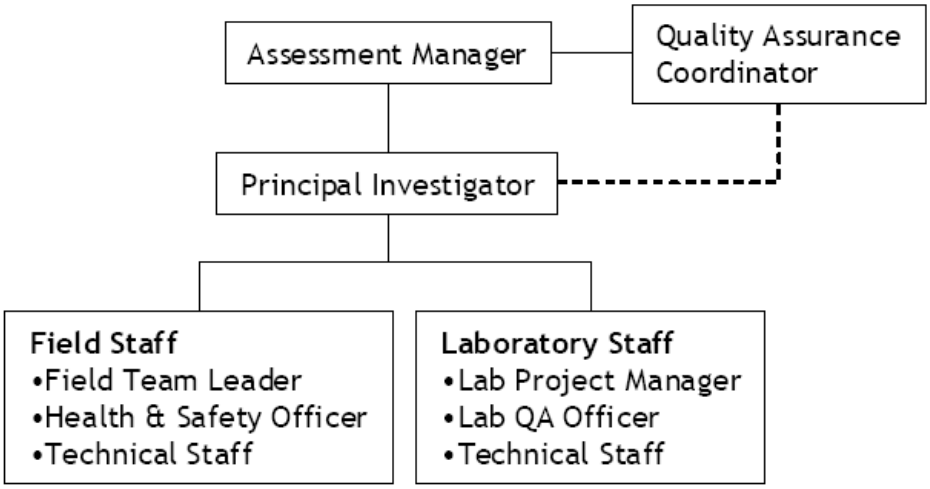
A.1 STUDY MANAGEMENT

Effective implementation of project objectives requires clear project organization, which includes carefully defining the roles and responsibilities of each project participant. Unambiguous personnel structures help ensure that each individual is aware of his or her specific areas of responsibility, as well as clarifying internal lines of communication and authority, which is important for decision-making purposes as projects progress. Individuals' and organizations' roles and responsibilities may vary by study or task, but each person's role and responsibility should be clearly described in the project's study plan. Exhibit A-1 below presents a generic personnel plan for a NRDA study.

The Assessment Manager is the designated Trustee representative with responsibility for the review and acceptance of the project-specific study plan. This individual is also responsible for ensuring that the project's goals and design will meet the broader requirements of this NRDA. The Assessment Manager coordinates efforts with the Quality Assurance Coordinator and oversees the SME for the study.

The QA Coordinator oversees the overall conduct of the quality system. Appointed by the Trustees, this individual's responsibilities include, but are not limited to: reviewing/assisting the SME with the development of project-specific study plans; conducting audits and ensuring implementation of both project-specific and overall plans; archiving samples, data, and all documentation supporting the data in a secure and accessible form; and reporting to the Trustees. To ensure independence, the person serving as QA Coordinator will not serve as either the Assessment Manager or as a SME for any NRDA study.

EXHIBIT A-1 PERSONNEL PLAN



Study-specific SMEs oversee the design and implementation of particular NRDA studies. Each SME has the responsibility to ensure that all health, safety, and relevant QA requirements are met. If deviations from the QAPP occur, the SME (or his/her designee) will document these deviations and report them to the Assessment Manager and the QA Coordinator.

The Field Team Leader supervises day-to-day field investigations, including sample collection, field observations, and field measurements. The Field Team Leader generally is responsible for ensuring compliance with all field quality assurance procedures defined in the study-specific QAPP. Similarly, the Laboratory Project Manager is responsible for monitoring and documenting the quality of laboratory work. The Health & Safety Officer (who may also be the Field Team Leader) is responsible for ensuring adherence to specified safety protocols in the field.

A.2 SHARING DATA, SPLIT SAMPLES, AND ANALYTICAL RESULTS

Section 11.31(a)(4) of 43 CFR states that, "The Assessment Plan shall contain procedures and schedules for sharing data, split samples, and results of analyses, when requested, with any identified potentially responsible parties and other natural resource trustees."

If the Trustees determine that a study should be implemented, a study plan will be developed in collaboration with a SME and will be made available to the public. These study plans will discuss study objectives, approaches for sharing and publishing data and analytical results with relevant parties and the public, and conditions and procedures for sharing split samples with PRPs.

A.3 DATA GENERATION AND ACQUISITION

All studies under the direction of the Trustees that are specifically undertaken in support of the NRDA will have a prepared QAPP that will be completed prior to the initiation of any work. These QAPPs will be submitted to, and approved by, the QA Coordinator or designee and generally include:

- Rationale for generating or acquiring the data;
- Proposed method(s) for generating or acquiring the data, including descriptions of (or references to) standard operating procedures for all sampling or data-generating methods and analytical methods;
- Types and numbers of samples required;
- Analyses to be performed;
- Sampling locations and frequencies;
- Sample handling and storage procedures;
- Chain-of-custody procedures;
- Data quality requirements (for instance, with respect to precision, accuracy, completeness, representativeness, comparability, and sensitivity);
- Description of the procedures to be used in determining if the data meet these requirements;
- Description of the interpretation techniques to be used, including statistical analyses; and
- Split sample protocols and procedures for archiving samples and management of residuals.

In addition, to the extent practicable, laboratories will be required to comply with Good Laboratory Practices. This includes descriptions and documentation of maintenance, inspections of instruments, and acceptance testing of instruments, equipment, and their components, as well as the calibration of such equipment and the maintenance of all records relating to these exercises. Documentation to be included with the final report(s) from each study will include field logs for the collection or generation of the samples, chain of custody records, and other QA/QC documentation as applicable.

A.4 ASSESSMENT AND OVERSIGHT

To ensure that the study plan for each project is implemented effectively, the QA Coordinator will review QAPPs for all Trustee studies that generate new environmental data. The QA Coordinator or designee will also audit all such studies. Audits will include technical system audits (e.g., evaluations of operations) as well as scrutinizing data and reports (e.g., evaluations of data quality and adequacy of documentation).

If, in the professional opinion of the QA Coordinator, the results of an audit indicate a compromise in the quality of the collection, generation, analysis, or interpretation of the data, the QA Coordinator has the authority to stop work by oral direction. Within two working days of this direction, the QA Coordinator will submit to the Trustee Working Group (TWG) a written report describing the necessity for this direction. The Assessment Manager will consult with the Trustees regarding measures to be taken in response to the QA Coordinator's report.

A.5 DATA VALIDATION AND USABILITY

In addition to the assessment and oversight activities described previously, analytical data will be considered for validation by an independent third party. Prompt validation of analytical data can assist the analyst or analytical facility in developing data that meet the requirements for precision and accuracy. If undertaken, it is expected that data validation will use the study-specific study plans and EPA Guidance on Environmental Verification and Validation (EPA 2002).

REFERENCES

EPA (U.S. Environmental Protection Agency). 2002. EPA Guidance on Environmental Data Verification and Data Validation (EPA QA/G-8). November.

EPA. 2001. EPA Requirements for Quality Assurance Project Plans (EPA QA/R-5). March. Reissued May 2006.