SOUTH CHARLESTON FACILITY
KANAWHA RIVER
NATURAL RESOURCE DAMAGE ASSESSMENT PLAN

Draft for Public Review and Comment

February 1, 2023

Prepared by:

United States Department of the Interior

West Virginia Division of Natural Resources

West Virginia Department of Environmental Protection

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LIST OF ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPCs	Contaminants of Potential Concern
CWA	Federal Water Pollution Control Act (Clean Water Act)
DOI	United States Department of the Interior
ESA	Endangered Species Act
HEA	Habitat Equivalency Analysis
HMW	High Molecular Weight
LMW	Low Molecular Weight
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NRDA	Natural Resource Damage Assessment
NRDAR	Natural Resource Damage Assessment and Restoration
QAP	Quality Assurance Plan
QA/QC	Quality Assurance/Quality Control
PAH	Polyaromatic Hydrocarbons
PAS	Preassessment Screen
PRP	Potentially Responsible Party
REA	Resource Equivalency Analysis
RCRA	Resource Conservation and Recovery Act
SGCN	Species of Greatest Conservation Need
SVOC	Semi-volatile Organic Compound
TDCC	The Dow Chemical Company
UCC	Union Carbide Corporation
USFWS	United States Fish and Wildlife Service
USEPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WVDEP	West Virginia Department of Environmental Protection
WVDNR	West Virginia Division of Natural Resources

1 INTRODUCTION AND BACKGROUND INFORMATION

The West Virginia Department of Environmental Protection (WVDEP), the West Virginia Division of Natural Resources (WVDNR), and the United States Fish and Wildlife Service (USFWS) acting on behalf of the U.S. Department of the Interior (DOI) are designated to act on behalf of the public as Trustees for natural resources in the State of West Virginia (40 CFR §§ 300.600-605). Natural resource trustees are authorized to pursue claims for natural resource damages under Section 107(f) of the Comprehensive Environmental Response, Compensation, and Liability Act as amended (CERCLA), 42 USC § 9607(f), and Section 311 of the Federal Water Pollution Control Act (also known as the Clean Water Act (CWA)), as amended, 33 USC § 1321. The Trustees undertake this task when natural resources have been, or may have been, injured by releases of hazardous substances. CERCLA regulations (43 CFR Part 11) establish an administrative process for conducting a natural resource damage assessment and restoration (NRDAR) to determine and quantify injury, determine the damages, and identify, select, and implement restoration to compensate the public for the injured natural resources and lost services. While following these regulations is optional (43 CFR § 11.10), trustees who conduct an assessment consistent with these regulations are entitled by law to a rebuttable presumption in any subsequent litigation concerning the natural resource damages claim (42 U.S.C. § 9607(f)(2)(C); 43 CFR § 11.10). This Assessment Plan is one of the documents identified in the CERCLA NRDAR regulations. Its purpose is "to ensure that the assessment is performed in a planned and systematic manner and that methodologies selected…can be conducted at a reasonable cost" (43 CFR § 11.30(b)). The Trustees are making this Assessment Plan available for public comment, including comment by the Potentially Responsible Party, for a period of thirty days (43 CFR § 11.32(c)).

The South Charleston Facility ("Facility") is located on both the southern bank and Blaine Island of the Kanawha River in South Charleston, West Virginia (Figure 1.1). The Facility, owned and operated by Union Carbide Corporation (UCC), is approximately 200 acres and consists of the Mainland and Blaine Island. The address for the Site is 437 MacCorkle Avenue, SW, South Charleston, WV 25303. The Facility has been in continuous operation since the early 1920s. Currently, most of the plants produce specialty chemicals, such as surfactants, de-icers, and lubricating fluids.

The Facility and the surrounding Kanawha River ("the Site") are undergoing corrective action through the U.S. Environmental Protection Agency's (USEPA) authority under the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. § 6901 *et seq*. Thus far, the RCRA actions have been focused on source control and groundwater contamination. In July 2017, a small intermittent sheen was observed on the back channel of the Kanawha River near the

Middle Island Area. A sediment investigation was completed in September 2017 and November 2018 to evaluate the extent of impacted sediments that are causing the sheen. UCC's 2020 draft ecological risk assessment, which is currently being updated with additional data at USEPA's request, determined risk to benthic invertebrates immediately adjacent to the Facility in two areas (Chlorohydrin Area and Middle Island Area) as a result of high concentrations of hazardous substances in the sediment. Initially, UCC proposed to address this risk via sediment removal/capping. At this time, exposure of upper trophic levels (e.g., fish feeding on benthic invertebrates, birds feeding on emergent insects) to the hazardous substances identified in the sediments has not been evaluated. For purposes of the NRDAR, the South Charleston Facility Kanawha River Assessment Area ("Assessment Area") includes the Facility and anywhere hazardous substances and/or oil released at and from the Facility ("Releases") have come to be located, including the Kanawha River.

The Trustee Council (TC), consisting of representatives from WVDEP, WVDNR, and USFWS (the "Trustees"), is proposing to gather ephemeral data at and from the Kanawha River. This early sampling and data collection (43 C.F.R. § 11.22), prior to the anticipated sediment removal action under RCRA, will be used to document the nature and extent of the injury to mussels and other natural resources as a result of releases at and from the Facility into the Assessment Area. The anticipated sediment removal actions to address contamination are not expected to fully restore or compensate for natural resource injuries. This NRDAR Assessment Plan (Assessment Plan) serves as the guiding document for all damage assessment activities related to the Releases at or from the Facility.

Figure 1.1 Map of Assessment Area (orange polygon) with UCC South Charleston Facility identified (red polygons).

1.1 Purpose of the Assessment Plan

The purpose of this Assessment Plan is to describe the Trustees' approach for conducting a damage assessment in a cost-effective manner. This Assessment Plan outlines the Trustees' proposed approaches for determining and quantifying natural resource injuries and damages associated with those injuries which includes two primary components of a damages claim: 1) the cost to restore, rehabilitate, replace, and/or acquire equivalent resources for the injured resources, and 2)"compensable value," or the monetary value of the natural resource services that were lost pending the restoration of injured resources to their "baseline" condition. *Injury* means a measurable adverse change, either long- or short-term, in the chemical or physical quality or the 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)). *Damages* is a legal term for the amount of money sought by Trustees as compensation for injury, destruction, or loss of natural resources; damages include the costs of assessing injuries, as well as the costs of restoration (42 U.S.C. §§ 9601(6), 9607(a)(4)(C); 43 CFR § 11.14(l) and §11.15). By developing an Assessment Plan, the Trustees ensure that the NRDAR will be completed at a reasonable cost relative to the magnitude of damages sought. The Trustees also intend for this Plan to communicate proposed assessment methodologies to the public, including the potentially responsible party (PRP), so that these groups can productively participate in the assessment process.

The Assessment Plan, as currently written, describes the Trustees' understanding of the studies (e.g., benthic invertebrate community survey, porewater toxicity testing) and identifies other processes (e.g., data review and analysis) that may be needed to confirm exposure to the Releases and quantify injury to natural resources and their services. Inclusion of a study within this Plan does not guarantee that it will be undertaken, and studies not included within the Plan may be deemed necessary at a later date. The Assessment Plan provides an initial prioritization of efforts the Trustees will take during the Injury Assessment process. Additional plans describing assessment studies, if any, will be tiered off this Assessment Plan, and made available for public comment prior to finalization.

1.2 Authority to Conduct a NRDAR

The NRDAR is being conducted jointly by the Trustees pursuant to their respective authorities and responsibilities as natural resource trustees. The Trustees have each been designated as a natural resource trustee pursuant to Section 107(f) of CERCLA, 42 U.S.C. § 9607(f); Section 311(f)(5) of the CWA, 33 U.S.C. § 1321(f)(5); and Subpart G of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR §§ 300.600 - 300.615. Under these authorities, the Trustees act on behalf of the public to seek damages for the injury, loss, or destruction of natural resources belonging to, managed by, controlled by, or appertaining to the State or United States, that resulted from releases of hazardous substances. This authority includes implementing a NRDAR to evaluate the injury, loss, or destruction of natural resources and their services due to releases of hazardous substances.[1]

The President has designated federal resource trustees in the NCP (40 C.F.R. § 300.600) and through Executive Order 12580, dated January 23, 1987, as amended by Executive Order 13016, dated August 28, 1996. Pursuant to the NCP, the Secretary of the DOI acts as a Trustee for natural resources and their supporting ecosystems, managed or controlled by the DOI. In this matter, the USFWS is acting on behalf of the Secretary of the DOI as Trustee for natural resources under its jurisdiction, including but not limited to migratory birds and endangered and threatened species and their habitats.

In addition to the NCP and CERCLA NRDAR regulations, the West Virginia Code 22: Water Pollution Control Act Natural Resources Game Fish and Aquatic Life Fund §22-11-25 provides for recovery of costs to replace lost game fish or aquatic life. Trustees are authorized to act on behalf of the public under state and/or federal law to assess and recover natural resource damages and to plan and implement actions to restore natural resources and their services that are injured or lost as the result of hazardous substances released at or from a Facility.

The Trustees decided to proceed with this NRDAR based on the results of a Preassessment Screen (PAS) dated May 17, 2021 (fully executed on 7/8/2021, Natural Resource Trustees 2021a); 43 CFR §§ 11.23-11.25).

[1] The trustees must use CERCLA NRDAR regulations for injuries resulting from a discharge or release of a mixture of oil and hazardous substances. 15 CFR 990.20.

In the PAS, the Trustees determined:

- A discharge of oil and/or a release(s) of a hazardous substance occurred;
- Natural resources the Trustees may assert trusteeship under CERCLA have been or are likely to have been adversely affected by the release;
- The quantity and concentration of the discharged oil or released hazardous substance is sufficient to potentially cause injury to natural resources;
- Data sufficient to pursue an assessment are readily available or likely to be obtained at a reasonable cost; and
- Corrective action carried out or planned do not or will not sufficiently remedy injury to natural resources without further action.

The Trustees therefore concluded that all preassessment screening criteria were met, natural resources over which Trustees may assert trusteeship have been or may have been impacted, and UCC is a viable PRP.

1.3 NRDAR Process Overview

It is the intent of the Trustees to conduct the South Charleston Facility Kanawha River NRDAR consistent with the CERCLA NRDAR regulations at 43 CFR Part 11. These regulations describe the process by which Trustees may conduct a NRDAR. This process includes the following three phases:

- Preassessment,
- Assessment (including the Assessment Plan, injury determination, quantification, and damages determination phases), and
- Post-Assessment (i.e., damages recovery and restoration planning and implementation).

To date, as noted above, the Trustees have completed the Preassessment Phase. The following administrative and preassessment planning documentation is available on the DOI NRDAR website for UCC Kanawha River.

- Notice of Intent. The Trustees sent a notice of intent (NRDAR 2021b) to initiate a NRDAR to UCC on August 2, 2021 (43 CFR § 11.32(a)(2)(iii)(A)-(B)).
- Preassessment Screen and Determination. The Trustees finalized a Preassessment Screen and Determination on July 8, 2021 which provided the basis for the Trustees' determination that further investigation was warranted based on review of readily available information of the effects of Releases associated with the South Charleston Facility (Natural Resource Trustees 2021a).
- Memorandum of Agreement Between the State of West Virginia and United States Department of the Interior Regarding Natural Resource Damage Assessment and Restoration for the South Charleston Facility and Kanawha River (Fully executed June 20, 2021).

The Trustees are now in the Assessment Phase, which may include, as necessary:

- Assessment Plan Phase (43 CFR §§ 11.30 - 11.38),
- Injury Determination Phase, including pathway determination (43 CFR §§ 11.61-11.70),
- Quantification Phase, including baseline services determination and resource recoverability analyses (43 CFR §§ 11.70-11.73), and
- Damages Determination Phase (43 CFR §§ 11.80-11.84).

1.4 Identification of the Potentially Responsible Party (PRP)

The UCC, which is a wholly owned subsidiary of The Dow Chemical Company (TDCC), is the owner and operator of the South Charleston Facility at and from which hazardous substances and oil have been released into the Assessment Area. Thus, pursuant to Section 107(a) of CERCLA, the Trustees are identifying UCC as the potentially responsible party. This is consistent with the USEPA, as the lead agency for the corrective action, and WVDEP, as the state agency providing responsible party oversight for corrective action activities.

1.5 Coordination with Other Activities

The CERCLA NRDAR regulations support the coordination of a damage assessment, to the extent possible, with corrective actions or other investigations being performed pursuant to the NCP (i.e., cleanup activities). Consistent with 43 CFR § 11.31(a)(3), the Trustees recognize the benefit of coordinating assessment activities associated with sites that may have significant contaminants of potential concern (COPCs). Integration of Trustee considerations into corrective action decisions may resolve certain natural resource damages liability or decrease the cost of assessment activities.

The Trustees intend to continue to coordinate with the corrective action activities for the Site. Trustee assessment activities discussed in this Plan make use of existing data generated through the corrective action process, and other research and data collection efforts.

1.6 Public Participation

Public participation is an important part of the NRDAR process. To that end, the Trustees are making this Assessment Plan available to the public, including the PRP, for review and comment for a thirty-day period (43 CFR § 11(c)). Interested individuals, organizations, and agencies may submit comments by April 8, 2023 via mail to:

Kathleen Patnode
US Fish and Wildlife Service
110 Radnor Road, Suite 101
State College, PA 16801

Or via email to: Kathleen_Patnode@fws.gov

The Trustees will review and consider all public comments and input on the Assessment Plan received during the public comment period prior to finalizing the Assessment Plan. The Trustees

will prepare a responsiveness summary to the comments that will be included as an appendix in the Final South Charleston Facility Kanawha River Assessment Plan. Development of the Assessment Plan, the public comment process, and finalization of the Assessment Plan is performed solely by the Trustees. Based on the public's comments or other information, the Trustees may modify the Assessment Plan at any time. In the event of a significant modification, the Trustees will provide the public with an opportunity to comment on that amendment (43 CFR § 11.32(e)).

1.7 Timeline

The activities in this plan are expected to take a reasonable amount of time to accomplish. If new information becomes available as this assessment progresses, and additional study is deemed warranted, updates to this plan and the timeline will be made publicly available.

2 ASSESSMENT AREA

Assessment Area is defined as:

> *The area or areas within which natural resources have been affected directly or indirectly by the discharge of oil or release of a hazardous substance and that serves as the geographic basis for the injury assessment* (43 CFR 11.14(c)).

The Assessment Area, also referred to as the Site, for the South Charleston Facility Kanawha River NRDAR includes the location of hazardous substances and oil after release from the Facility. The Facility had Releases into groundwater on Blaine Island and the river bank (Jacobs 2020). Based on the revised conceptual site model, groundwater beneath Blaine Island flows into porewater in the sediments of both the river main and back channels, while groundwater from the southern river bank flows into porewater in sediments located in the back channel (Figure 2.1). Porewater discharges into the back channel occur from two contaminated groundwater plumes on the river bank and three contaminated plumes on Blaine Island. Porewater discharges to the Main Channel emanate from three contaminated plumes on Blaine Island. Three historical outfalls (two on the river bank and one on Blaine Island) have been identified as potential direct sources of contamination in sediments.

The area for corrective action associated with the Releases was considered along with surface water, porewater, and sediment data, aerial photography, biological data, human use data, and other relevant information to determine the bounds of the Assessment Area (Figure 1.1). Additionally, the Assessment Area includes areas that may have suffered from losses to recreation and use of environmental resources, and locations of supporting habitat for natural resources which may have been exposed to hazardous substances and/or oil as a result of the Releases. Reference Locations have also been proposed to establish baseline conditions (Fig. 2.2)

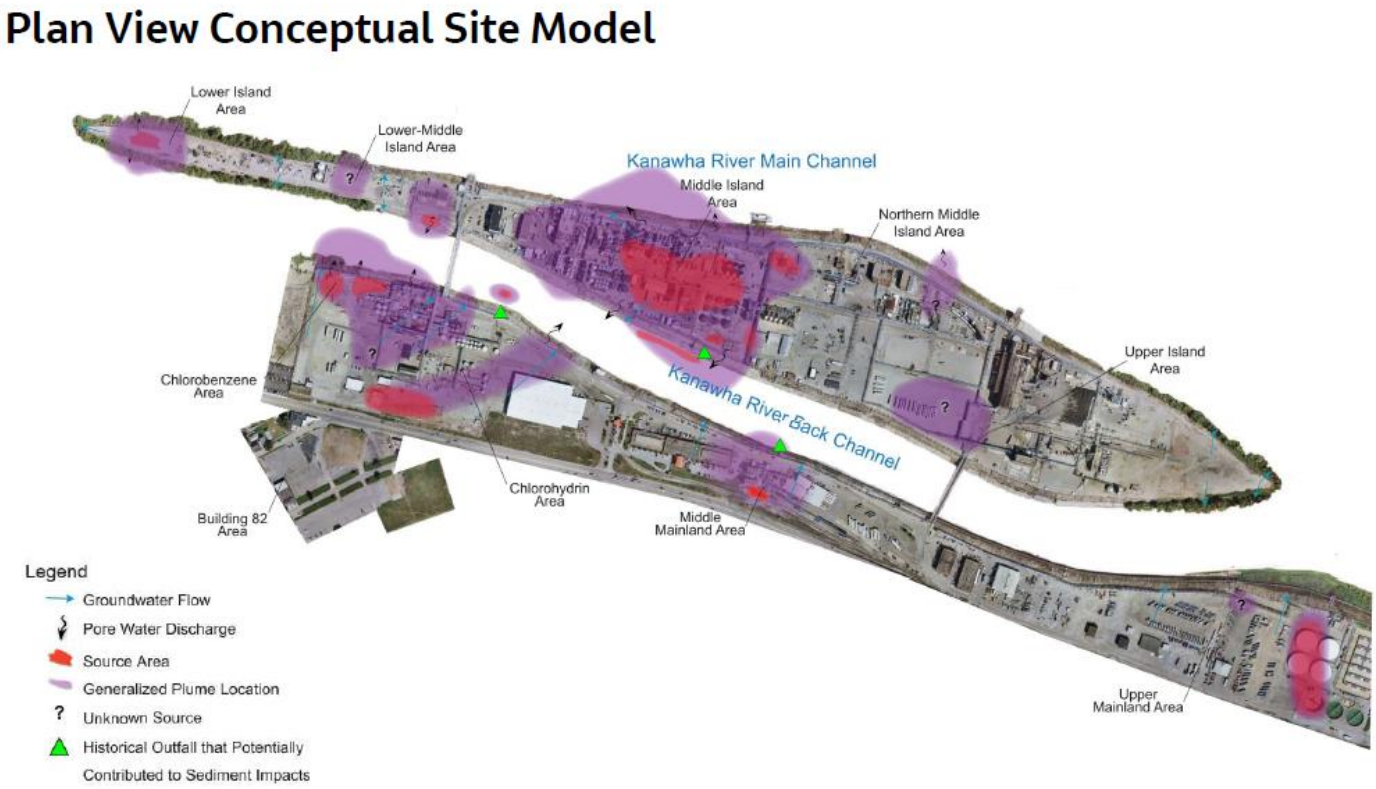

Figure 2.1 Revised Conceptual Site Model for Groundwater Discharges and Three Historic Outfalls (Jacobs 2020).

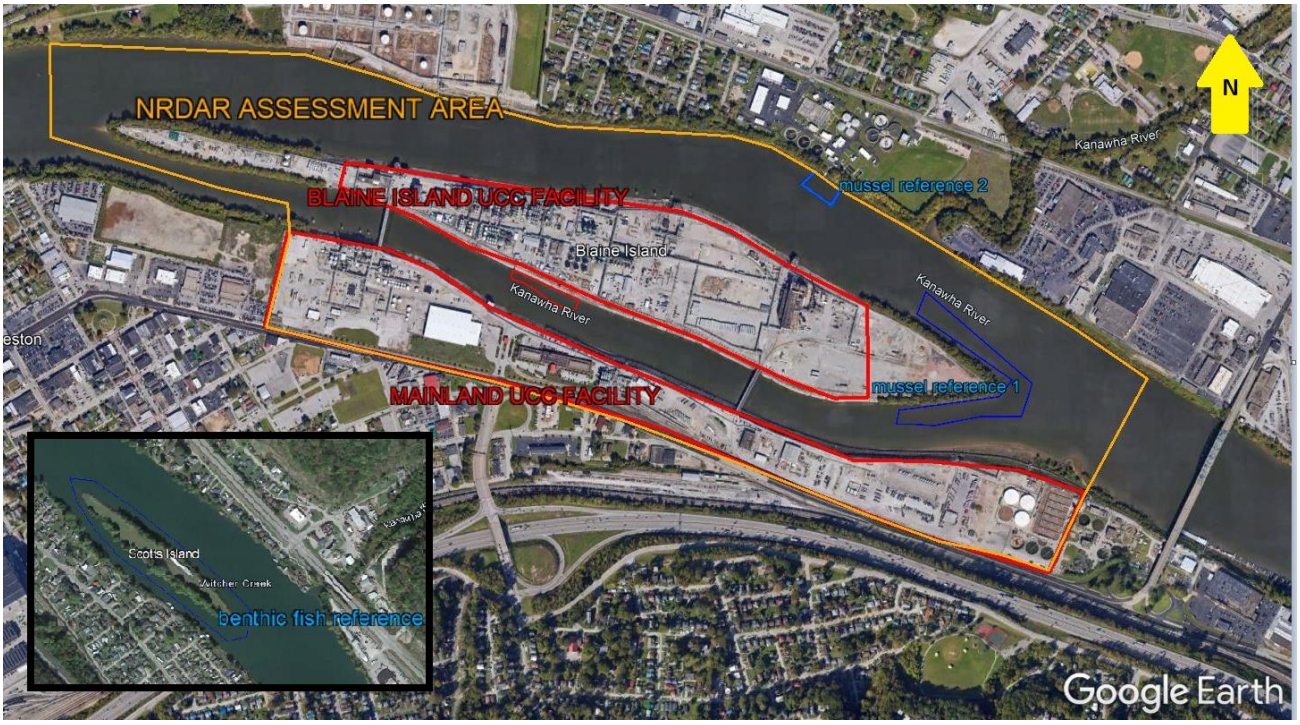

Figure 2.2 NRDAR Assessment Area (orange polygon) including reference locations (blue polygons).

2.1.1 Summary of Releases

The South Charleston Facility Kanawha River Natural Resource Damage Assessment (NRDA) will focus on direct and indirect injuries stemming from exposure to released hazardous substances and oils, including mixtures as defined in Section 101(14) of CERCLA. COPCs, as understood at the time of publication, which were released at and from the Facility include VOCs, SVOCs, and metals (APPENDIX A). The COPCs that will be the focus of the injury analysis will be chosen as part of the assessment process.

2.1.2 Confirmation of Exposure

Natural resources under the jurisdiction of the Trustees have been exposed[2] to hazardous substances and oil released at and from the Facility (Table 2.1)

[2] Exposed means "all or part of a natural resource is, or has been, in physical contact with oil or a hazardous substance, or with media containing oil or a hazardous substance" (43 CFR § 11.14(q)).

Table 2.1 Examples of resources that have been exposed to hazardous substances released at and from the Facility.

Resource Category	Description	Information Source
Surface Water	Releases at and from the Facility migrated into the groundwater which flows into porewater and surface water of the Kanawha River.	Facility-Wide Porewater Characterization Report (CH2M Hill 2013) and 2017 Porewater Follow Up Investigation Report (in Jacobs 2020a)
Sediment	Releases at and from the Facility migrated into the sediment of the Kanawha River.	2017 Middle Island Sediment Investigation Results (in Jacobs 2020b), Biological Assessment, Kanawha River Sediment Remediation (Jacobs 2018), and UCC SCF Back Channel Investigation (Jacobs 2020b)
Biological	Mussels located in the Kanawha River are exposed via filter and pedal feeding.	Mussel surveys documented the presence of 25 species, including one federally listed, one federally proposed, and two WV SGCN (Allstar Ecology 2018, 2019).
Biological	Benthic invertebrates located in the Kanawha River ingest contamination from water and sediment.	Benthic surveys have not been conducted in this reach of the river, but BMI are known to be present upstream and in tributaries (WVDEP unpublished data).
Biological	Fish located in the Kanawha River may be exposed directly or indirectly through prey.	Fish surveys have documented 53 species including 17 benthic fish species (Owens 2019).

3 AFFECTED NATURAL RESOURCES

Natural resources for which natural resource damages may be sought include land, sediment, biota, air, water, groundwater, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States… [or] State…" (43 CFR § 11.14(z)). The CERCLA NRDAR regulations group these natural resources into five categories: surface water resources, ground water resources, air resources, geologic resources, and biological resources.

The Assessment Area supports a variety of natural resources and services potentially affected by hazardous substances and oil released at and from the Facility. The following paragraphs briefly summarize select features of the natural resources that the Trustees are currently considering assessing for injury.

3.1 Surface Water Resources

Surface water resources in the Assessment Area include water, suspended sediment, and bed and bank sediments (43 CFR § 11.14(pp)). Surface water may be considered injured if, for example, there is an exceedance of an applicable water quality or drinking water standard as a result of an unpermitted release (43 CFR § 11.62(b)(1)) or if other resources (e.g., fish) are injured as a result of exposure to the concentrations in the surface water (43 CFR § 11.62(v)). Surface water supports other biological resources, so surface water has both direct and indirect impacts on the health of biological resources. For example, contaminated sediments can cause injury to benthic invertebrate populations, which in turn can result in injuries to resident fish populations for whom the invertebrates are a source of food. Similarly, injury to invertebrates and/or fish resulting from exposure to contaminated sediments and surface water can lead to injury in local insectivorous (insect eating) or piscivorous (fish eating) bird populations. In addition, contaminated sediments serve as a source of continuing Releases of hazardous substances to water.

Surface water resources provide a suite of ecological and human services. Ecological services include, but are not limited to, habitat for trust species, including food, shelter, breeding areas, and other factors essential to survival. Human use services provided by surface water resources include, but are not limited to, recreational fishing, boating, and canoeing.

3.2 Groundwater Resources

Groundwater resources include the water in a saturated subsurface zone and the rocks or sediments through which this water flows. Groundwater resources serve as a potential pathway for contaminants to migrate from their source to surface water resources. Groundwater may be determined to be injured if concentrations of substances are in excess of applicable water quality criteria for public water supplies or the contaminated groundwater causes injury to other resources (43 CFR § 11.62(c)).

3.3 Geologic resources

Geologic resources include soils and sediments that are not otherwise accounted for under the definition of surface water or groundwater resources. Geological resources, including soil and sediment resources in riparian and other wetland areas, provide habitat for natural resources such as migratory birds and also provide other services that regulate ecosystems and water quality, while also offering human services and access to recreational fishing. Geologic resources may be injured if, for example, concentrations of substances in the soil are sufficient to cause injury to groundwater or a toxic response to soil invertebrates (43 CFR § 11.62(e)).

3.4 Biological resources

Biological resources include natural resources, as defined earlier, and other biota, including, terrestrial and aquatic plants, threatened, endangered, or state sensitive species, other legally protected species, and other living organisms not listed (43 CFR § 11.14(f)). Insects, amphibians, reptiles, birds, mussels, fish, and small mammals serve as food sources for higher trophic level animals including raptors and predatory mammals. Biological resources also provide a range of human services including fishing and wildlife viewing. Among other causes, injury to a biological resource could occur if exposure to released hazardous substances and oil cause the biological resource death, disease, or reduction in reproduction or if there is a directive to limit or ban consumption (43 CFR § 11.62(f)). Additionally, the Trustees may choose to focus the NRDA on a few representative resources.

3.4.1 Aquatic Organisms

The Kanawha River near South Charleston provides habitat for 14 freshwater mussel species including one federally listed species, one species proposed for federal listing and two state Priority 1 species, 53 species of fish including seven state Priority 1 species, four amphibian species, six turtle species, snails, crayfish, and benthic macroinvertebrates. One federally listed fish, diamond darter, occurs in a tributary but surveys for this species in the river have not been conducted. Benthic macroinvertebrate organisms known to inhabit the river downstream of the assessment area include 11 genera (ORSANCO 2021), whereas at least 13 genera were observed upstream (Kirk and Perry 1994).

Important habitats for aquatic organisms found within the assessment area include island perimeters, gravel/sand substrates, riverbank shelves, and gravel/sand bars.

Table 3.1 Federally listed threatened or endangered aquatic species that may inhabit the Assessment Area.

Taxon	Scientific Name	Common Name	Federal ESA Listing Status
Bivalve	*Epioblasma triquetra*	Snuffbox	endangered
Bivalve	*Obovaria subrotunda*	Round Hickorynut	proposed threatened
Fish	*Crystallaria cincotta*	Diamond darter	endangered

3.4.2 Birds and Mammals

Birds and mammals are known to occur in the assessment area. Semi-aquatic and terrestrial species are exposed to aquatic contaminants primarily through consumption of contaminated prey. The contaminants associated with the Facility are not highly bioaccumulative, are metabolized by aquatic organisms, or are toxic only via direct exposure. Based on these characteristics, at this time, the Trustees have chosen to focus on injury to aquatic organisms. However, the Trustees may revise this determination if additional information or data becomes available indicating a higher level of exposure.

4 INJURY ASSESSMENT AND PATHWAY DETERMINATION APPROACH

This Assessment Plan sets forth assessment studies or activities the Trustees intend to pursue as part of the South Charleston Facility Kanawha River NRDA.

During the injury assessment, the trustees quantify the effects of the release(s) of hazardous substances and oil on the natural resources to determine whether there is a measurable adverse effect ("injury") to the resource as a result of the exposure. For purposes of NRDAR, the trustees measure the extent of the injury, estimate the baseline condition and/or baseline services of the injured natural resources, determine the recoverability of the injured natural resources, and estimate the reduction in services that resulted from the release(s) of hazardous substances (43 CFR § 11.70(c)). Baseline is defined as the condition or conditions that would have existed in the assessment area had the releases of the hazardous substances under investigation not occurred (43 CFR § 11.14(e)). Baseline conditions may be established based on the review of historical, pre-release data and information, or by control areas that exhibit similar physical, chemical, and biological conditions as the assessment area and lack exposure to the releases (43 CFR § 11.72).

At this time, the Trustees have determined that further assessment is appropriate for (1) surface water, sediment, groundwater and porewater resources; and (2) biological resources including benthic invertebrates, mussels, and fish.

4.1 Temporal

The temporal scope of this NRDA will be based on determining injuries to natural resources and corresponding reductions in natural resource services from the time of the initial release through the return of the injured resource to baseline conditions. This scope may change as more information is revealed through the corrective action process or other means discovered during the assessment.

4.2 Use of Available Data

The Trustees' general approach to the NRDA is to review the existing data, analyze gaps, and then undertake additional studies or activities including testing and sampling as needed. This approach minimizes the cost of the assessment and maximizes the use of existing information.

4.3 Intent to Perform a Type B Assessment

As part of the assessment planning process, the Trustees decide whether to conduct a simplified assessment (Type A) or a comprehensive assessment (Type B) (43 CFR §§ 11.33-11.36). The Type A procedures, which use minimal field observations and computer models to generate a damage claim, are limited to the assessment of relatively minor, short duration discharges or releases (43 CFR § 11.34). Considering the Releases and that additional site-specific data can be collected at reasonable cost, the Trustees have concluded that the use of Type B procedures is appropriate and justified.

The Trustees must confirm that at least one of the natural resources identified as potentially injured in the PAS has been exposed to released hazardous substance before including any Type B

methodologies in the Assessment Plan (43 CFR § 11.37). The PAS identified several resources and their services that were potentially exposed as a result of the Releases of hazardous substances from the Facility, including:

- Fish
- Freshwater mussels
- Aquatic invertebrates
- Surface water, including sediments
- Groundwater
- Supporting habitat for natural resources, including food, shelter, breeding, foraging, rookeries, and other factors essential for survival

Multiple natural resource categories are confirmed as exposed to hazardous substances (see Section 0, Confirmation of Exposure) released from the Facility. Information describing the methods that confirm additional resources have been exposed and potentially injured will be described in the sections below under Pathway Determination and Injury Assessment.

4.4 Pathway Determination

Pathway is defined as the "route or medium through which oil or a hazardous substance is or was transported from the source of the… release to the injured resource" (43 CFR § 11.14(dd)), Determinations involve identifying the sources of hazardous substances and tracing the fate and transport of the substances through the environment to the resources (e.g., through surface water, sediments, to mussels). Pathways may be determined by demonstrating the presence of a hazardous substance in a resource or by using a model that demonstrates that the route served as a pathway (43 CFR §11.63(a)(2)).

Abiotic media (i.e., groundwater, porewater and sediment) are known to be contaminated with hazardous substances released from the Facility based on analysis submitted to USEPA and WVDEP by UCC. As part of the assessment activities, the Trustees will trace contamination of biota (i.e., mussels and benthic fish) via tissue analysis for site-related hazardous substance. Aquatic-dependent biological resources within the Assessment Area may have been injured by direct contact with dissolved or suspended chemicals in the porewater or water column, direct contact with contaminated sediments, ingestion of contaminated surface water, porewater, and sediment during foraging or feeding, inhalation of chemicals, and/or indirect contact through ingestion of contaminated prey species.

5 INJURY ASSESSMENT

The Trustees expect to evaluate injury associated with the natural resources and services described below. The Trustees' defined injury assessment categories and combined multiple natural resources

that are defined in the regulations (43 CFR §11.14(z)) (i.e., surface water resources, geologic resources, and biological resources). Trustee assessment study plans and reports will be made available on DOI's Damage Assessment and Restoration Tracking System website.

5.1 Injury Assessment for Aquatic Resources

The Trustees anticipate focusing assessment of aquatic resources on porewater, sediment, and mussel and fish tissue analytical data to establish the pathway(s), and survey and in situ techniques for biological resources. The Trustees will review data and information gathered as part of the RCRA corrective action, data collected by the PRP, USEPA screening values, published injury thresholds, and other relevant published screening values, standards, and/or benchmarks. The Trustees will consider peer-reviewed literature on the harmful effects of COPCs released at and from the Facility on porewater, groundwater, sediment, and biological resources that reside in the river. During the NRDA, the Trustees will continue to evaluate any new or relevant data sources that may inform the injury assessment.

5.1.1 Aquatic Resources Evaluation

The Trustees will evaluate the concentrations of COPCs (APPENDIX A) in porewater, sediments, and fish and mussels to determine injury to aquatic-dependent biological resources and establish exposure pathways. To assess the degree to which these substances may be causing injury to biota, the Trustees will use standardized surveys and in situ testing. Specific assessment activities include:

A. Screening of chemical contaminants in surface waters, porewater, sediment, mussels and fish

This assessment activity will:

- Establish exposure pathways from groundwater, porewater, and sediment to biota.
- Apply ecological benchmarks and injury thresholds for COPCs to determine the spatial extent of contamination and injury to porewater, groundwater, and sediments relative to background;
- Collect fish and mussel samples for COPC analysis, respectively across a gradient of COPC concentrations in the assessment area and reference areas; and
- Compare the highest tissue concentrations to the lowest and most conservative applicable ecological benchmark or injury thresholds.

The Trustees will use a data quality objectives approach (USEPA 2000, 2006a, 2006b, 2006c) including, but not limited to:

- Identify the frequency of detection of chemical concentrations in surface water, sediment, mussels and fish, by geographic sub-areas and time;
- Analyze and apply appropriate statistics on selected data to compare chemical concentrations in the Assessment Area to baseline concentrations or other appropriate chemical observations;

- Visualize data using charts and graphs; and
- Describe and document analysis results.

B. Assessing trends in benthic fish communities, mussel, and benthic macroinvertebrates (Appendices B, C and D)

This assessment activity will evaluate mussel and benthic invertebrate communities via standardized survey methods.

- The mussel survey, conducted following the WV Mussel Survey Protocol (WVDNR 2022), will target Back and Main Channel areas not previously surveyed by AllStar Ecology (2018, 2019) focusing on areas with sediment and porewater contamination,
- Benthic macroinvertebrate communities will be assessed using Hester-Dendy traps following the Ohio River protocol (ORSANCO 2019) in the Back and Main Channel based on sediment and porewater contamination except for the removal area sediments already tested by USGS, and
- The benthic fish survey, conducted following the protocol outlined in Owens (2019), will target Back and Main Channel areas not previously surveyed focusing on areas with sediment and porewater contamination.

C. Assessing Caged Mussel Toxicity (Appendix E)

This assessment activity will provide data with which to determine toxicity to mussels across a range of contaminant exposures.

- Target areas spanning the contaminant mixtures and concentrations for porewater and sediment not previously tested by USGS.
- Silos will be paired with Hester-Dendy traps in Back and Main Channel locations.
- Comparisons in mussel survival, growth and biomass will be made between contaminated and reference areas.

D. Performing geospatial analysis

This assessment activity will delineate the geographic and temporal extent of injury and/or contamination using existing data and data generated from the proposed assessment studies. ArcGIS™ will be employed to perform data interpolation and visualization techniques that can quantify the geographical extent of injury.

5.2 Groundwater Resources

The RCRA corrective action investigation has indicated that COPCs associated with the Releases leached through the substrates and entered the groundwater. The groundwater resources in this area

have been shown to connect with sediments via porewater, thereby transporting COPCs from ground water to other resources. The Trustees will focus on assessing groundwater resources as a pathway for the Releases to make their way to porewater, sediment, and aquatic biota being evaluated as part of the injury assessment.

6 APPROACH TO DAMAGES DETERMINATION

In the damages determination phase, the Trustees determine the monetary value (damages) of the compensation for injuries to natural resources and their services resulting from the Releases of hazardous substances (CERCLA §§ 107(a)(4)(C), 107(f)(1); 43 CFR § 11.15). The measure of damages is the cost of (i) restoration, or rehabilitation of the injured natural resources to a condition where they can provide the level of services available at baseline, (ii) the replacement and/or acquisition of equivalent natural resources capable of providing such services, and/or (iii) the compensable value[3] of all or a portion of the services lost to the public for the time period from the release pending restoration to baseline (43 CFR § 11.80(b)). The CERCLA NRDAR regulations provides a non-exhaustive description of various methodologies the Trustees may use in their damages determination, including Habitat Equivalency Analysis (HEA), Resource Equivalency Analysis (REA), and Habitat-Based Resource Equivalency (HaBREM;) and travel cost (43 CFR § 11.83). REA is a resource-to-resource approach to injury quantification that assumes that services lost and restored are comparable, an approach similar to HEA (National Oceanic and Atmospheric Administration (Desvousges et al. 2018). REA generally refers to a stepwise replacement model for killed or injured species. HEA is a service-to-service or resource-to-resource approach that can account for changes in baseline services while estimating interim losses of services. The fundamental concept in HEA is that compensation for lost ecological services can be provided by restoration projects that provide comparable services. HaBREM refines the use of organism-based metrics to integrate injuries to multiple species (Baker et al. 2020). During the assessment process, the Trustees will determine the most appropriate method to determine damages which may include other models.

6.1 Baseline

In order to quantify injuries, the Trustees must quantify baseline conditions, which include the physical, chemical, and biological conditions and their associated services for natural resources. Baseline is “the condition or conditions that would have existed at the assessment area had the discharge of oil or release of the hazardous substance under investigation not occurred” (43 CFR § 11.14(e)). The baseline conditions for each resource and/or service will be taken into account when determining the level of injury and the amount of restoration required to offset the injury.

[3] Compensable value is the amount of money required to compensate the public for the loss in services provided by the injured resources between the time of the release and the time the resources are fully returned to their baseline conditions, or until the resources are replaced and/or equivalent natural resources are acquired (43 CFR §11.83(c)). This is also referred to as “interim loss.”

6.2 Aquatic Damages Determination

The Trustees are assessing exposure of natural resources to the Facility-related hazardous substances and oil and are determining whether natural resources or their services have been injured or lost. As part of the assessment, the Trustees determine the amount of restoration that is necessary to compensate the public for identified injuries to these resources and their associated services for the period between the onset of injury and the resource's return to baseline ("scaling").

Trustees will likely use models, such as HEA or REA, to scale losses associated with aquatic resources with restoration. The Trustees plan to use a restoration-based approach to determine damages for ecological injuries (43 CFR § 11.83(b)). This means that the damages sought would equal the costs associated with restoring the natural resource and associated services that were injured. For example, this could include costs associated with acquiring, preserving, and restoring habitat that supports the injured resource(s).

7 DATA MANAGEMENT

Assessments employing Type B methods are required to develop a Quality Assurance Plan (QAP) that adheres to the requirements of the NCP and guidance provided by USEPA (43 CFR § 11.31(c)(2)). The purpose of the QAP is to ensure that data are of sufficient quality to be used for injury assessment and damage determination. For any new Trustee-led data collections, there will be an associated QAP that will be made publicly available. The data management procedures described below are general and will pertain to existing data or data collection activities not led by the Trustees.

Data will be managed in compliance with USFWS procedures to ensure that it is accurate and accessible for this NRDAR. The final study plans and other documents for this case are housed on the DOI Damage Assessment and Restoration Tracking System website and are available to the public. Raw data will be housed within the USFWS network and will be available upon request to USFWS with concurrence by the DOI solicitor.

Various data sources are available to assess baseline conditions and inform understanding of natural resource injuries that occurred as a result of Releases from the Facility. Data sources will be screened to verify that supporting documentation is sufficient to allow for an evaluation of the reliability and usability of the information. Required information will differ with data and information types, but may include:

- Sampling methodology, including information on sample locations, environmental media sampled, and measurement units;
- Chemical analysis, including information on detection limits and methodology accompanying quality assurance/quality control (QA/QC) data or separate QA/QC report;
- Raw data or data tabulations (e.g., rather than figures only); and
- Agreement from a governing body that the data collection methods/analysis were appropriate (e.g., published in a peer reviewed journal; approved for use in the remedial process or by the Trustees).

The Trustees may compile data from multiple sources to assess injury. Quality checks will be made on all data that is keyed into an electronic format. Metadata will meet an acceptable metadata standard such as FGDC CSDGM or ISO 19115. Digital repositories will meet appropriate guidelines with persistent identifiers and machine-readable open formats.

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APPENDIX A

CONTAMINANTS OF POTENTIAL CONCERN RELEASED FROM THE SOUTH CHARLESTON FACILITY INTO THE ASSESSMENT AREA

CONTAMINANTS of POTENTIAL CONCERN	GROUNDWATER	SEDIMENT	POREWATER
VOCs			
Benzene	X	X	X
Carbon Disulfide		X	
1,1,2,2-Tetrachloroethane	X	X	X
1,1,2-Trichloroethane	X	X	X
1,2-Dichloropropane	X	X	X
Cis-1,2-Dichloroethylene	X	X	X
Tetrachloroethylene(PCE)		X	
Trichloroethylene (TCE)	X	X	X
1,1-Dichloroethene	X	X	X
Vinyl Chloride	X	X	X
Chlorobenzene	X	X	X
Trans-1,2-Dichloroethene	X	X	X
Xylenes, Total	X	X	X
1,2-Dichloroethane	X		X
Chloroform	X		X
1,4-Dichlorobenzene	X		X
1,2,4-Trichlorobenzene	X		X
1,2-Dichlorobenzene	X		X
1,3-Dichlorobenzene	X		X
1,4-Dichlorobenzene	X		X
Ethyl benzene	X		X
Toluene	X		X
SVOCs			
Bis(2-Ethylhexyl)phthalate		X	
Dibenzofuran		X	
Acenaphthylene		X	
Anthracene		X	
Benzo (g,h,i)perylene		X	
Benzo(a)anthracene		X	
Benzo(a)pyrene		X	
Benzo(b)fluoranthene		X	
Benzo(k)fluoranthene		X	
Chrysene		X	

CONTAMINANTS of POTENTIAL CONCERN	GROUNDWATER	SEDIMENT	POREWATER
Dibenzo (a,h)anthracene		X	
Fluoranthene		X	
Fluorene		X	
Indeno(1,2,3-cd)pyrene		X	
Naphthalene	X	X	X
Phenanthrene		X	
Pyrene		X	
Total LMW PAHs		X	
Total HMW PAHs		X	
Total PAHs		X	
INORGANICS			
Arsenic		X	
Barium		X	
Chromium		X	
Lead		X	
Mercury		X	
Nickel		X	

APPENDIX B

SOUTH CHARLESTON FACILITY KANAWHA RIVER NRDA: BENTHIC FISHES ASSESSMENT STUDY PLAN

BACKGROUND

Benthic fishes are a natural resource over which the West Virginia Division of Natural Resources (WVDNR) and FWS exercise trusteeship. Benthic fishes (BF) are an integral part of the aquatic community in large river systems. They fill a wide variety of ecological niches and provide integral functions to the persistence of other organisms such as acting as host species (Percina spp.) for freshwater mussels or as forage for other piscivores fish species. In addition to providing required ecological functions to the aquatic ecosystem, many of the species present around Blaine Island are recognized by the WVDNR as Species of Greatest Conservation Need (SGCN) due to their relative imperiled status. Many of these SGCN benthic fish are generally considered to be intolerant to anthropogenic perturbations to their physiochemical environment such as water pollution, sedimentation, and river modification (i.e., channelization). Contaminants present in porewater and sediment within the Kanawha River NRDAR assessment area are documented to cause lethal and sub-lethal effects to fishes in both laboratory and field testing (van Leeuwen et al. 1990, Le Bihanic et al. 2014, Hudson 2017). Benthic fishes inhabit the substrate on the river bottom, where they are directly exposed to contaminants in porewater and sediment. This study will generate data to evaluate if the relative abundance and diversity of benthic fishes have been altered by exposure to site-related contaminants. These data will inform the injury determination and quantification phases of the assessment, as well as provide some information about the pathway(s) and extent of contamination.

SAMPLING METHODS

Because of gear biases associated with the sampling of small bodied benthic fishes in deep waters in large rivers with traditional gears (i.e., seining and electrofishing), we will implement benthic otter trawling to sample within the industrialized zone in the Kanawha River including the areas of contamination around Blaine Island. We will use downstream trawling with a 2.4-meter-wide Gerken Siamese Trawl (Innovative Net Systems) with 3.2mm mesh to collect benthic fishes. This net and mesh size has been used during previous studies in the Kanawha River and other large systems because it allows for small benthic fishes (approx. ≥20mm) to be fully recruited to the gear. Each trawl haul will be treated as an individual sample with a target distance of 25 meters. Five hauls will be conducted within the nine available habitat types; main channel (MC), main channel border (MCB), island main channel border (IMCB), island head

(IH), island toe (IT), island side channel border (ISCB), side channel (SC), side channel border (SCB), and tributary (TRIB) (Table 1; Figure 1). Forty-five samples will be collected from Blaine Island. This data will supplement existing species and community information that the WVDNR collected in 2017 and 2018 with these methods at Blaine Island and Scotts Island (reference), to fill in data gaps in relation to porewater and sediment contamination. Each sample will be preserved as an independent sample on 10% formalin, later washed and placed on 45% isopropanol until laboratory identifications may take place.

Habitat variables to be collected as needed within each haul include but are not limited to: dominate and co-dominant substrate class; water depth; surface and bottom water velocity; surface and bottom water quality parameters including dissolved oxygen, oxygen concentration, conductivity, water pH, and bottom oxidation reduction potential (ORP); water turbidity (Secchi depth), and linear distance to nearest bank. GPS coordinates will be recorded at the start and completion of each trawl.

DATA QUALITY AND MANAGEMENT

All individuals will be identified to species level if ontogenetic state and physical condition allow by the WVDNR ichthyologist. When necessary, identifications will be discussed and verified by regional experts for identification QA/QC. The data will be used to derive information for both the contaminated and reference locations such as catch per unit effort both expressed by (#/time and #/distance or area sampled), species observed, average relative naïve abundance for each species by habitat type and contamination status, benthic species richness, and darter species richness. Data for each species, site, and sample will be compared to the reference location using both univariate and multivariate statistical techniques to evaluate if relationships between contamination status of sample and species catch per unit effort or benthic community structure is associated with the contaminate zones around Blaine Island. Univariate statistical approaches that may be used, but are not limited to, consist of two-way ANOVA, Kruskal-Wallis, or other suitable test based on data distribution. Multivariate techniques include, but are not limited to, ordination, clustering analyses, and associated hypothesis testing such as principal component analysis (PCA), conical correspondence analysis (CCA), or non-metric multidimensional scaling (nMDS), and multi-response permutation procedures (MRPP). These techniques will be used to evaluate if any differences observed in the community structure of the benthic fishes are associated with the contaminated areas around Blaine Island.

LOCATIONS

Sampling within the Kanawha River NRDAR assessment area is based on the Revised Conceptual Site Model (Figure 2.1) and targets porewater contamination or a combination of porewater and sediment contamination. Sampling locations will consist of the immediate area

around Blaine Island concentrated within the contaminated zone. This strategy will include the samples (collected in this effort or from the 2017/2018 survey) from all nine habitat types available near the island (Table 1). One upstream reference site (Scotts Island), surveyed in 2018, was selected to represent the nine habitat types available in the Kanawha River. Scotts Island was selected as it was the nearest comparable island in the Kanawha River, located approximately 24.5 river kilometers upstream of Blaine Island, that contained a reasonably similar benthic fish species assemblage and physical habitat to Blaine Island within each habitat type in the contaminated area (i.e., IT, ISCB, SC, SCB, IMCB; Table 1).

Table 1: Table containing habitat names, codes, and descriptions of sampled habitats.

Habitats Sampled	**Code**	**Description**
Main channel	MC	Not located within 30 meters of a bank normally associated with the navigation channel or thalweg
Main channel border	MCB	Located within 30 meters of a main channel bank that is not an island
Island main channel border	IMCB	Located within 0-30 meters from the island bank into the main channel; between the head (first 100 meters) and toe (most downstream 100 meters) of an island
Island head	IH	Located within 0-30 meters from the island bank within the first upstream 100 meters of an island
Island toe	IT	Located within 0-30 meters from the island bank within the downstream last 100 meters of an island
Island side channel border	ISCB	Located within 0-30 meters from the island bank into the side channel; between the head (first 100 meters) and toe (most downstream 100 meters) of an island
Side channel	SC	Secondary channel flowing around an island that is not within 30 meters from a bank (not main channel)
Side channel border	SCB	Area of the river extending up to 30 meters from the side channel bank (non-island)
Tributary	TRIB	Area located within 30 meters of the bank or confluence of a tributary; extending 100 meters upstream and downstream in the main river (Kanawha)

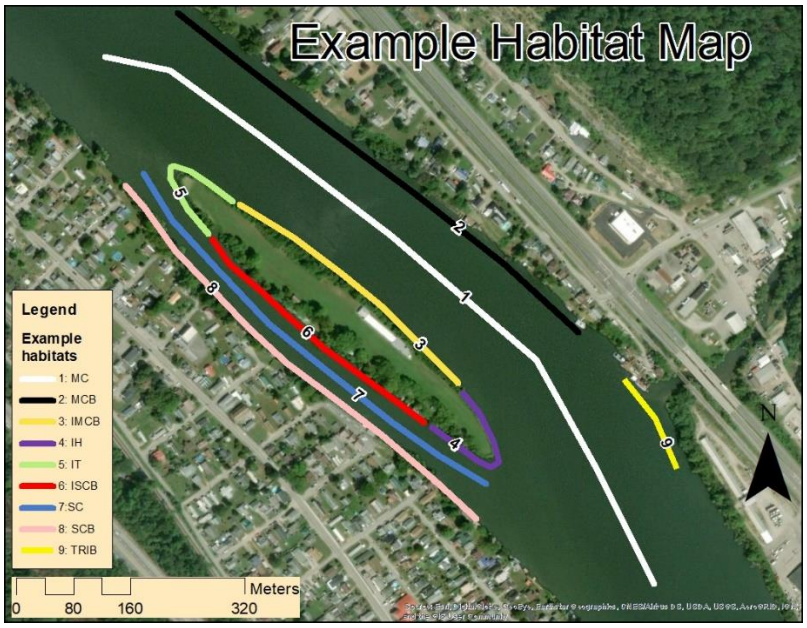

Figure 1: Map depicting various habitats to be sampled. These consist of: 1. Main Channel (MC), 2. Main Channel Border (MCB), 3. Island Main Channel Border, 4. Island Head (IH), 5. Island Toe (IT), 6. Island Side Channel Border (ISCB), 7. Side Channel, 8. Island Side Channel Border (ISCB), and 9. Tributary (TRIB). See table 1 for definition of habitat types.

APPENDIX C

SOUTH CHARLESTON FACILITY KANAWHA RIVER NRDA: MUSSEL SURVEY STUDY PLAN

BACKGROUND

Freshwater mussels are a natural resource over which the State and FWS exercise trusteeship. In addition, recent surveys have documented the presence of federally listed mussel (snuffbox; *Epioblasma triquetra*) and one mussel proposed for federal listing (round hickorynut; *Obovaria subrotunda*) in the Kanawha River NRDA assessment area. As freshwater mussels inhabit the substrate on the river bottom, they are directly exposed to contaminants in porewater and sediment. The contaminant mixture present in sediments within the DNAPL area of the Back Channel was documented to cause lethal and sublethal effects to a freshwater mussel in laboratory testing (USGS 2023). Surveys contracted by the South Charleston Facility were focused in the downstream and upstream areas of the Back Channel where sediment removal activities are planned. Survey data are lacking for the middle section of the Back Channel and the Blaine Island side of the Main Channel of the river. This study will generate data with which to evaluate if mussel diversity and abundance have been affected by exposure to site-related contaminant mixtures at other locations within the assessment area. The TC will use these data to inform the injury determination and quantification phases of the assessment as well as provide some information about the pathway(s) and extent of contamination.

SAMPLING METHODS

The mussel surveys will follow West Virginia Mussel Survey Protocols. The mussel survey window in West Virginia runs from May 1 to October 1. A WVDNR-approved surveyor that is familiar with the Kanawha River mussel assemblage and certified for diving in a hazardous waste area will be contracted to conduct a mussel survey following the WV protocol. The surveyor will obtain a scientific collector's permit from WV DNR. Surveys will be performed on 50 transects beginning on May 1 or as soon thereafter that river conditions permit. To demonstrate exposure to site-related contaminants, one composite sample of a common mussel will be collected at each sediment or porewater contamination area and a reference location. These seven composite samples will be analyzed for site-related contaminants at an FWS-approved laboratory following EPA analytical methods.

DATA QUALITY and MANAGEMENT

The surveyor will provide the verified quantitative spatially referenced data for 50 transects to the TC in report and spreadsheet formats. Analytical data will be verified by the FWS Analytical Control Facility and provided to the TC electronically. The TC will compare diversity, abundance, and analytical data in contaminated locations to the reference locations using one-way ANOVA, Kruskal-Wallis, or other suitable test based on data distribution. Data will be stored according to the case data management plan.

LOCATIONS

Mussel survey data are needed for the entire area within the Kanawha River NRDA assessment area and substrate-matched reference locations. Recent survey data exists for the upstream and downstream sections of the Back Channel. Data are lacking for the middle section of the Back Channel and the Blaine Island side of the Main Channel. The transects will target these locations as listed below and encompass documented areas with sediment and/or porewater contamination. Transects in the Back Channel will run from river bank to island bank. Transects in the Main Channel will extend 75 meters from the island bank into the channel. Partial transects will be used to address incomplete transects in 2018/2019 surveys in the Back Channel. Reference locations were selected based on substrate and known presence of a federally listed mussel. A gravel-cobble reference location at the head of Blaine Island will be surveyed. A second reference location (right descending bank of main channel) with finer sediments has recently been surveyed.

SAMPLING DESIGN

Location	**# Transects**
REFERENCE	
Island Head	13
BACK CHANNEL	
Middle Mainland/Northern Middle Island	11
Completion of Partial Transects (2018/2019)	5
MAIN CHANNEL	
Middle Island	17
Northern Middle Island	4
TOTAL	50

APPENDIX D

SOUTH CHARLESTON FACILITY KANAWHA RIVER NRDA: BENTHIC MACROINVERTEBRATE SURVEY STUDY PLAN

BACKGROUND

Benthic invertebrates are a natural resource over which the State and FWS exercise trusteeship. In addition, benthic macroinvertebrates (BMI) form the base of the aquatic food chain and emergent invertebrates are prey for birds and mammals. Contaminants present in porewater and sediment within the Kanawha River NRDA assessment area are documented to cause lethal and sublethal effects to BMI in both laboratory and field testing. As these invertebrates inhabit the substrate on the river bottom, they are directly exposed to contaminants in porewater and sediment. This study will generate data to evaluate if BMI abundance and diversity have been altered by exposure to site-related contaminants. These data will inform the injury determination and quantification phases of the assessment as well as provide some information about the pathway(s) and extent of contamination.

SAMPLING METHODS

BMI sampling in large rivers is best accomplished using artificial substrate devices. We will use Hester-Dendy plate samplers (HDs) with graduated spacing attached to a concrete block on the river bottom and cabled to the riverbank or a floating device. We will retrieve the HDs into submerged 5-gallon buckets after a 6-week exposure period. The organisms on each HD will be scraped from the plates, sieved with #30, and rinsed into a container of 70% ethanol for preservation. The organisms will be identified and quantified by an aquatic entomologist certified with Society for Freshwater Science. The data will be used to derive the Ohio River Macroinvertebrate Index (ORMIn) score used by the Ohio River Sanitation Commission (ORSANCO 2020) to evaluate benthic invertebrate community health in this basin. Scores for each location will be compared to the reference locations using one-way ANOVA, Kruskal-Wallis, or other suitable test based on data distribution and substrate-matched reference.

ORMIn METRICS

METRICS	METRIC DEFINITION
Taxa	Number of unique macroinvertebrate taxa
EPT Taxa	No. of taxa that belong to Ephemeroptera, Plecoptera, or Trichoptera orders
Predator Taxa	No. of taxa that are predators
% Collector	% of taxa that feed on fine particulate organic matter
% Caenids	% of individuals (ind) that belong to the pollution tolerant Ephemeropterans
% Odonates	% of ind that belong to the Odonata order
% Intolerants	% of ind intolerant to pollution and habitat degradation
% Clingers	% of ind that cling to instream habitat

LOCATIONS

Sampling within the Kanawha River NRDA assessment area is based on the Revised Conceptual Site Model (Figure 2.1) and targets porewater contamination or a combination of porewater and sediment contamination at seven locations. The Middle Island DNAPL area will not be sampled as these sediments were already demonstrated to be toxic to invertebrates in the USGS amphipod laboratory test (USGS 2023). In large plumes, one location will target the highest concentration and a second a lower concentration near the perimeter of the plume in deeper water with the objective of determining no effect and low effect concentrations. Three reference locations were selected to represent the two types of substrate within the industrial area and known presence of a federally listed mussel. The gravel-cobble reference location will be at the head of Blaine Island and the sand-silt reference location will be on the left descending river bank between the bridge and the South Charleston Facility property line. The right descending bank location will be on the mussel survey transect where a federally listed mussel was documented. HDs will be placed in close proximity to mussel silos, but sufficiently separated to enable ample flow through both. GPS coordinates will be recorded for each trap cluster.

SAMPLING DESIGN

Location	Target Media	#HD Samplers at Plume Center	#HD Samplers at Plume Perimeter
REFERENCE			
Island Head	NA	5	5 (to match depth)
LDB near UCC boundary	NA	5	5 (to match depth)
RDB Main Channel	NA	5	
BACK CHANNEL			
Lower Island	PW	5	
Lower-Middle Island	PW	5	
Middle Mainland	PW&SED	5	
Chlorohydrin	PW&SED	5	5
Chlorobenzene	PW	5	5
MAIN CHANNEL			
Middle Island	PW	5	5
Northern Middle Island	PW	5	

APPENDIX E

SOUTH CHARLESTON FACILITY KANAWHA RIVER NRDA: CAGED MUSSEL TOXICITY STUDY PLAN

BACKGROUND

Freshwater mussels are a natural resource over which the State and FWS exercise trusteeship. In addition, recent surveys have documented the presence of one state and federally listed mussel (snuffbox; *Epioblasma triquetra*) and one mussel proposed for federal listing (round hickorynut; *Obovaria subrotunda*) in the Kanawha River NRDA assessment area. As freshwater mussels inhabit the substrate on the river bottom, they are directly exposed to contaminants in porewater and sediment. The contaminant mixture present in sediment within the DNAPL area of the Back Channel was documented to cause lethal and sublethal effects to a freshwater mussel in laboratory testing (USGS 2023). However, toxicity data are not available for the other contaminant mixtures in sediment and porewater in the Back and Main Channels of the river. This study will generate data with which to evaluate if juvenile mussels placed in cages experience lethal or sublethal effects when exposed to site-related contaminant mixtures at other locations within the assessment area. The Trustee Council (TC) will use these data to inform the injury determination and quantification phases of the assessment as well as provide some information about the pathway(s) and extent of contamination.

SAMPLING METHODS

Mussel toxicity testing in rivers is best accomplished using flow-through cages within concrete silos. In Spring 2023, 20 juvenile mussels (~60d) will be tested randomly placed in each mussel silos cabled to the riverbank or a floating device. We will document mussel survival after 6 weeks and retrieve the silos after a 12-week exposure period. The mussels will be evaluated by two TC biologists to determine survival at 6 and 12 weeks, digitally photographed to verify survival and facilitate growth measurements, and weighed following USGS procedures. The TC will compare survival, growth, and biomass for each location (i.e., known contaminant mixture and concentration) to the reference locations using one-way ANOVA, Kruskal-Wallis, or other suitable test based on data distribution and substrate-matched reference.

LOCATIONS

Sampling within the Kanawha River NRDA assessment area is based on the Revised Conceptual Site Model (Figure 2.1) and targets seven areas with documented porewater or a combination of porewater and sediment contamination. In large plumes, one location will target the highest concentration and a second a lower concentration near the perimeter of the plume with the objective of determining no effect and low effect concentrations. Three references locations were selected to represent the two types of substrate within the industrial area and known presence of a federally listed mussel. The gravel-cobble reference location will be at the head of Blaine Island and the sand-silt reference location will be on the left descending riverbank between the bridge and the UCC property line. The right descending bank location will be on the mussel survey transect where a federally listed mussel was documented. Mussel cages will be placed in close proximity to Hester-Dendy samplers, but sufficiently separated to enable ample flow through both. GPS coordinates will be recorded for each mussel silo cluster.

SAMPLING DESIGN

Location	**Target Media**	**# Silos at Plume Center**	**# Silos at Plume Perimeter**
REFERENCE			
Island Head	NA	3	
LDB near UCC boundary	NA	3	
RDB of Main Channel	NA	3	
BACK CHANNEL			
Lower Island	PW	3	
Lower-Middle Island	PW	3	
Middle Mainland	PW&SED	3	
Chlorohydrin	PW&SED	3	3
Chlorobenzene	PW	3	3
MAIN CHANNEL			
Middle Island	PW	3	3
Northern Middle Island	PW	3	

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South Charleston Facility Kanawha River Assessment Area
01 February 2023
PREPARED BY THE
US Fish and Wildlife Service
United States Department of the Interior
REGARDING NATURAL RESOURCE DAMAGE ASSESSMENT & RESTORATION

State of West Virginia
Acting by and Through

West Virginia Department of Environmental Protection:

By: Harold W. Ward Date 2/12/2023

Harold Ward, Cabinet Secretary
601 57th Street SE
Charleston, WV 25304

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State of West Virginia
Acting by and Through

West Virginia Division of Natural Resources:

By:  Date 2/3/23

Brett W. McMillion, Director
324 4th Avenue
South Charleston, West Virginia 25303

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U.S. Fish and Wildlife Service

By: KYLA HASTIE Digitally signed by KYLA HASTIE Date: 2023.02.28 14:21:40 -05'00' Date_____

Kyla Hastie, Acting Regional Director
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Hadley, MA 01035

Approved as to legality and form
AMY HORNER HANLEY Digitally signed by AMY HORNER HANLEY Date: 2023.02.06 09:52:34 -05'00'

Amy Horner Hanley
Senior Attorney-Advisor
U.S. Department of the Interior