Preassessment Screen Determination
for
The Former New Jersey Zinc/Mobil Chemical
National Priorities List Site

Slag Pile on the Former Plant Site Area

The State of Illinois
The Illinois Department of Natural Resources
The Illinois Environmental Protection Agency
as Trustees of Natural Resources

With assistance from Stratus Consulting

September 2, 2015
SC13836

Approval Signatures:

12/9/15

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9/29/15

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Date

APPROVED FOR EXECUTION
Date: 9/25/2015
Legal Counsel:

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Appendices

Acronyms and Abbreviations

amsl	above mean sea level
Bluff Area	bluffs adjacent to the Former Plant Site Area
$CaCO_3$	calcium carbonate
CAMU	corrective-action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
Cr^{3+}	trivalent chromium
Cr^{6+}	hexavalent chromium
CWA	Clean Water Act
DAP	diammonium phosphate
DePue Group	CBS Operations and the ExxonMobil Corporation
DNA	deoxyribonucleic acid
DWMA	DePue Wildlife Management Area
EcoSSL	ecological soil screening level
EPA	U.S. Environmental Protection Agency
FPSA	Former Plant Site Area
FS	Feasibility Study
FYR	five-year review
G&W	Gulf & Western Industries, Inc.
GIS	geographic information systems
IAGO	Illinois Attorney General's Office
ICO	Interim Consent Order
IDNR	Illinois Department of Natural Resources
Illinois EPA	Illinois Environmental Protection Agency
ILWQS	Illinois Water Quality Standards
IRM	iron-rich material
ISGS	Illinois State Geologic Survey
ISWS	Illinois State Water Survey
IWTP	Interim Water Treatment Plant
Lake	Lake DePue

Mobil	Mobil Oil Corporation
MPZ	Mineral Point Zinc Company
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NJZ	New Jersey Zinc Company
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRDA	natural resource damage assessment
NRWQC	National Recommended Water Quality Criteria
OPA	Oil Pollution Act
OU	Operable Unit
PAH	polycyclic aromatic hydrocarbon
PAS	preassessment screen
PCB	polychlorinated biphenyl
PEC	probable effects concentration
PRP	potentially responsible party
RI	Remedial Investigation
RNA	ribonucleic acid
Site	the former New Jersey Zinc/Mobil Chemical NPL Site
SVOC	semi-volatile organic compound
TDS	total dissolved solids
TEC	threshold effects concentration
Trustees	Illinois Natural Resource Trustees
UPSEA	upland portion of the southeast area
UWBZ	Upper Water Bearing Zone
VOC	volatile organic compound
WWTP	wastewater treatment plant
ZCA	Zinc Corporation of America

1. Introduction

The New Jersey Zinc/Mobil Chemical National Priorities List (NPL) Site (the Site) includes a former primary and secondary zinc-smelting facility, sulfuric acid plant, lithopone paint pigment plant, and diammonium phosphate (DAP) fertilizer plant. Operations included zinc smelting, phosphoric and sulfuric acid production, manufacture of zinc dust, and recovery and refinement of other metals. Waste disposal and other activities at the Site released hazardous substances to the environment, including to Lake DePue (Lake), and to the Village of DePue, including residential properties. As a result of the contamination on the plant property and surrounding areas, the U.S. Environmental Protection Agency (EPA) listed the Site on the NPL in 1999 (Federal Register, 1999). The Illinois Environmental Protection Agency (Illinois EPA) is the lead agency for the cleanup of the Site (ICO, 1995).

The Illinois Department of Natural Resources (IDNR) and Illinois EPA, together the Illinois Natural Resource Trustees[1] (the Trustees), are assessing natural resource damages resulting from the hazardous substance releases at the Site. Releases of hazardous substances and oil into the environment can pose a threat to human health and natural resources such as plants, animals, land, air, water, groundwater, drinking water supplies, and other resources. When the public's natural resources are injured by a release of hazardous substances or oil, federal and state law provide mechanisms, which include natural resource damage assessment (NRDA) or NRDA-like processes, that authorize Trustees to seek compensation from potentially responsible parties (PRPs) for those injuries. Regulations outlining a process for conducting NRDAs for the release of hazardous substances have been promulgated and are set forth in 43 CFR Part 11 for CERCLA and CWA; and in 15 CFR Part 990 for the Oil Pollution Act (OPA). Relevant laws, authorities, policies, and guidance for such actions are summarized in Appendix A.

In 1995, Viacom International Inc.; Horsehead Industries, Inc.; and Mobil Oil Corporation (Mobil) formed an entity called "the DePue Group" and signed an Interim Consent Order (ICO) with the Illinois EPA and the Illinois Attorney General's Office (IAGO) for investigating the Site and evaluating possible remedial actions (Illinois EPA, 2012). Through various corporate mergers, acquisitions, and the bankruptcy of Horsehead Industries, Inc., the PRPs for the Site are now CBS Operations and the ExxonMobil Corporation, which currently comprise the DePue Group.

1. The Directors of Illinois EPA and IDNR have been designated as the Natural Resource Trustees for the State of Illinois, pursuant to Section 107(f)(2)(B) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLA, as amended, 42 USC 9601 et seq.; and the Clean Water Act (CWA), 33 USC 1251–1376, provide that natural resource Trustees may assess damages to natural resources resulting from a discharge of oil or a release of a hazardous substance covered under CERCLA or the CWA and may seek to recover those damages.

1.1 Preassessment Screen

When following the NRDA regulations in 43 CFR Part 11, the first step in the NRDA process is to complete a preassessment screen (PAS). The purpose of the PAS is to provide a rapid review of readily available information pertaining to an unpermitted release of hazardous substances to the environment and potential impacts of such a release to natural resources under the trusteeship of federal and state authorities. The intent is to ensure that a reasonable probability of making a successful claim exists, and thus to document that further investigation and assessment work are warranted.

This PAS addresses potential claims for natural resource damages associated with the Site. It examines currently available information about releases of hazardous substances into the environment, including the Lake and surrounding areas, and it evaluates the potential for natural resource injuries as a result of the releases. IDNR and Illinois EPA prepared this PAS, which documents the Trustees' conclusion that there is a reasonable probability of making a successful claim for natural resource damages. This PAS is not intended to be an assessment of injuries and damages, and it makes no specific conclusions about the nature of a claim.

The Trustees have evaluated the Site against all of the following criteria [43 CFR § 11.23(e)]:

1. A release of a hazardous substance has occurred

2. Natural resources for which the Trustees may assert trusteeship have been or are likely to have been adversely affected by the release

3. The quantity and duration of the released hazardous substances are sufficient to potentially cause injury to those natural resources

4. Data sufficient to pursue an assessment are readily available or likely to be obtained at reasonable cost

5. Response actions carried out or planned will not sufficiently remedy the injury to natural resources without further action.

The remainder of this document describes information about the Site pursuant to the NRDA regulations at 43 CFR Part 11. Section 2 provides information on the Site and the release of hazardous substances [43 CFR § 11.24], Section 3 is a preliminary identification of resources potentially at risk [43 CFR § 11.25], Section 4 documents the Trustees' determination that all of the PAS criteria [43 CFR § 11.23(e)] have been met, and Section 5 presents the Trustees' determination to proceed with an NRDA for the Site.

2. Information on the Site and on the Discharge or Release

This section includes Site information and documentation of releases of hazardous substances pursuant to the NRDA regulations. Section 2.1 identifies the PRPs [43 CFR § 11.24(a)(6)]; Section 2.2 describes the history of the current and past use of the Site [43 CFR § 11.24(a)(3)]; Section 2.3 presents a description of the Site and a summary of relevant operations occurring at the Site [43 CFR § 11.24(a)(4)]; Section 2.4 describes the time, quantity, duration, and frequency of the discharges or releases of hazardous substances [43 CFR § 11.24(a)(1)]; Section 2.5 presents the names of the hazardous substances released [43 CFR § 11.24(a)(2)] and describes other hazardous substances potentially discharged or released from the Site [43 CFR § 11.24(a)(5)]; and Section 2.6 provides the Trustees' determination regarding damages excluded from liability under CERCLA [43 CFR § 11.24(b)] and under the CWA [43 CFR § 11.24(c)].

2.1 Potentially Responsible Parties

Operators of the Site have included, at various points in time, the Mineral Point Zinc Company (MPZ); the New Jersey Zinc Company (NJZ); Mobil Oil Corporation (subsequently ExxonMobil Corporation); Gulf & Western Industries Inc. (G&W; subsequently Paramount Communications, Inc.; Viacom International Inc.; and CBS Operations); and Horsehead Industries, Inc. [later renamed Zinc Corporation of America (ZCA)] (ICO, 1995). As mentioned previously, the current PRPs at the Site are CBS Operations and ExxonMobil Corporation, which currently comprise the DePue Group.

2.2 History and Current/Past Use at the Site Identified as Sources of the Release of Hazardous Substances

The Village of DePue was the site of continuous industrial operations from 1903 to 1989. The area was developed in the late 1800s because of the abundance of local coal, railroad access, and the market demand for zinc products (Illinois EPA, 1992). During the height of operations, the zinc smelter covered approximately 860 acres[2] (Golder Associates, 1995, as cited in Cahill and Bogner, 2002).

2. Acreages are approximated based on an analysis of 2011 imagery using geographic information systems (GIS) software.

MPZ originally developed the Site as a primary zinc smelter,[3] producing slab zinc for use in the automobile and appliance industries. Beginning in 1903, MPZ produced slab zinc, zinc dust, and sulfuric acid at the primary zinc smelter (Illinois EPA, 1995; Environ, 2006). Between 1923 and 1956, MPZ also operated a plant producing lithopone[4] paint pigment. In 1938, NJZ purchased the operations from MPZ. In 1948, NJZ closed the sulfuric acid plant. In 1966, G&W purchased NJZ; however, the facility kept the NJZ name. In 1967, the NJZ facility constructed an integrated zinc smelting plant that included zinc concentrate roasting, sintering, zinc smelting, metal beneficiation, and casting facilities (Environ, 2014b). The NJZ facility produced DAP fertilizer between 1967 and 1987 and disposed of gypsum, a by-product of the DAP production, onsite.

In 1971, NJZ closed the primary zinc smelter plant and the roaster, although zinc dust operations continued. In 1972, Mobil began operating the DAP fertilizer plant, purchasing it in 1975. Horsehead Industries, Inc., forming a division known as NJZ Co., Inc. (later renamed ZCA), purchased the NJZ facility and operated it from 1981 to 1989, as a secondary zinc smelter.[5] In 1987, Mobil closed and later demolished the sulfuric acid and fertilizer plants. In 1989, ZCA ceased secondary zinc smelting and zinc dust processing at the Site. In 1991, ZCA demolished the zinc plant. By 1992, most of the buildings associated with the industrial operations had been demolished (ICO, 1995; Environ, 2006).

EPA made preliminary assessments in 1980 and 1983 and conducted Site Inspections in 1984 and 1987 (Illinois EPA, 1992), to determine a hazard ranking of the Site for the NPL. The Site did not meet the criteria for Superfund sites during that time period (Illinois EPA, 1995). In 1992, the Illinois EPA conducted an Expanded Site Inspection and submitted the results to EPA, which listed the Site on the NPL in May 1999 under new criteria (Federal Register, 1999). EPA noted that the Site had several contaminant sources, including a residue pile, a waste pile, lagoons, cooling ponds, and gypsum stack ponds, which contained elevated levels of metals, including zinc, lead, arsenic, cadmium, chromium, and copper (U.S. EPA, 1999). EPA also noted that there was contamination in residential soils, adjacent wetlands, and in the Lake (U.S. EPA, 1999).

The Illinois EPA is the lead regulatory agency for the Remedial Investigations (RIs) and Feasibility Studies (FSs) of the Site. In 1995, the DePue Group signed an ICO with Illinois EPA and the IAGO that addresses investigation, FS, and remedial design under certain conditions. During the RI, the Site was divided into five Operable Units (OUs) for further consideration (Figure 1):

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3. Primary smelting uses zinc ore as a feedstock.

4. This white pigment consists of zinc sulfide, barium sulfate, and zinc oxide; it was commonly used in paint.

5. Secondary smelting uses scrap zinc as a feedstock.

- OU-1. South Ditch (1,600 feet)
- OU-2. Phosphogypsum Stack (125 acres)
- OU-3. Former Plant Site Area (FPSA; 251 acres)
- OU-4. Off-Site Soils (265 acres; divided into the South, West, Northwest, Northeast, and East subareas)
- OU-5. The Lake (500 acres) and the Floodplain (1,000 acres).

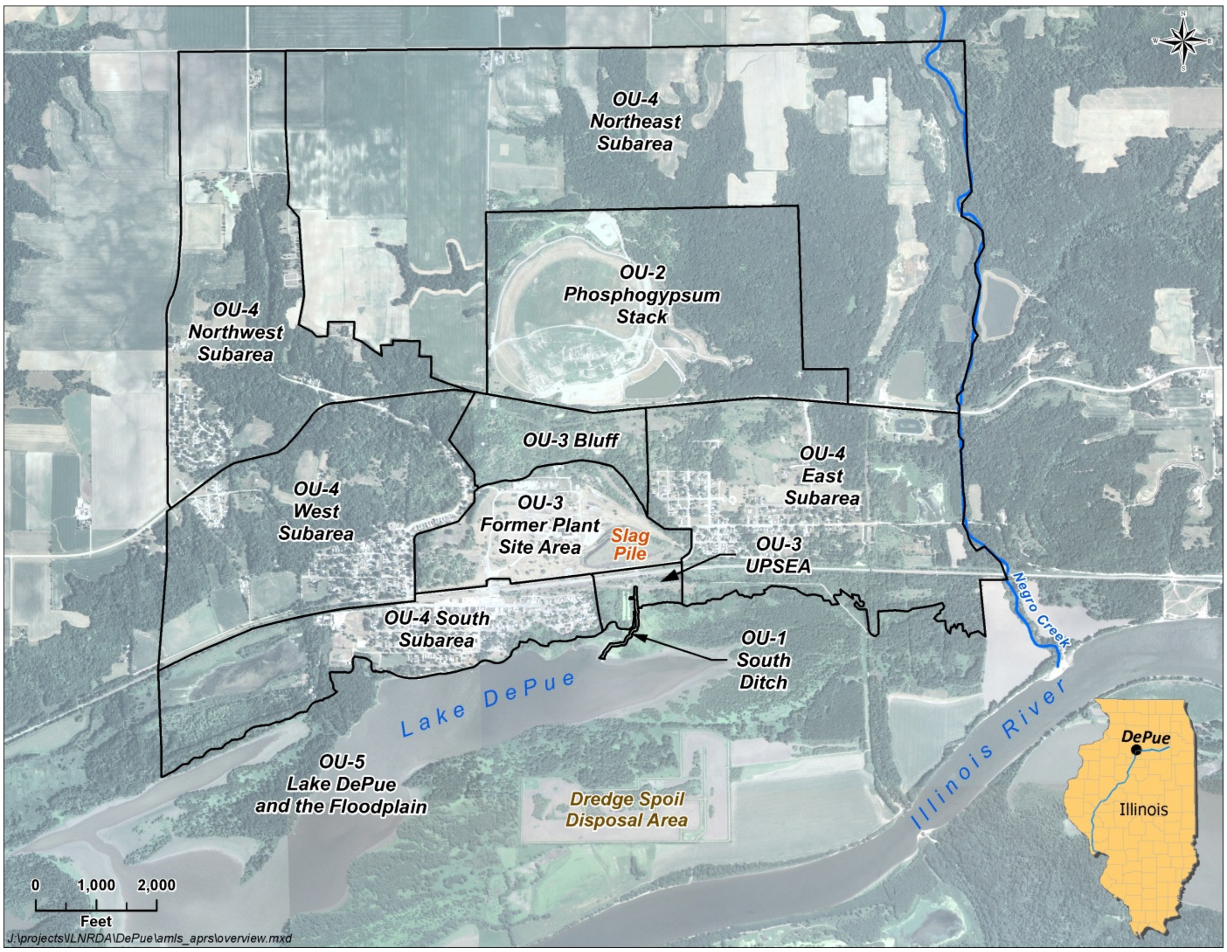

Figure 1. Overview of the Site.

Sampling studies and RI actions that have been completed to date include (Illinois EPA, 2012, 2013):

- Gibb and Cartwright (1982) studied the impact of the secondary zinc smelter on water quality in 1982. They noted that a 40-foot-high pile of metal-rich cinders covered approximately 12 acres, and a 1- to 5-foot-thick layer of cinder fill covered the remaining 90 acres of the main plant complex.
- Between 1994 and 1996, the DePue Group conducted a perimeter air monitoring study to evaluate if airborne metals were being released off-site (Terra, 1996).
- Between 1995 and 1997, the DePue Group conducted an RI/FS for the South Ditch.
- In 1999, the DePue Group developed a site-wide RI work plan, which Illinois EPA approved.
- In 1999, the DePue Group began conducting an RI of the plant area (OU-3).
- From 2000 to 2013, the DePue Group conducted hydrogeologic investigations of the Phosphogypsum Stack (OU-2).
- In 2002, the Site was organized into five OUs.
- In 2005, the DePue Group began conducting an RI of the Lake (OU-5), including evaluations of human health and ecological risks.
- In 2006–2007, the DePue Group conducted soil sampling of the DePue area to establish background conditions for an off-site soils investigation (OU-4).
- In December 2013, the DePue Group conducted a Pilot Study to support decision-making for OU-4, including sampling of 41 residential yards (Environ, 2014c).
- In August 2014, the DePue Group conducted soil sampling in bluffs adjacent to the FPSA, called the Bluff Area, to support the human health and ecological risk assessments for the plant area (Environ, 2014a).

2.3 Location and Description of the Site and Summary of Relevant Operations

The Site is located along the north side of the Village of DePue in Bureau County, Illinois (Figure 1), comprising roughly one-half of the village land mass. Parts of the Site are in the

Illinois River floodplain. The relevant operations include zinc smelting, sulfuric acid and fertilizer manufacturing, waste disposal, and other activities. The remainder of this section describes the features of and relevant operations at each of the OUs.

2.3.1 OU-1

OU-1, the South Ditch, is a 1,600-foot drainage canal that discharges into the Lake (Figure 1; Illinois EPA, 2003). A two-lane road (Route 29) and the FPSA are to the north, east is the Lake floodplain, and west is a residential area (Figure 1). The northern 120 to 150 feet of the ditch incises fill consisting of placed soil, slag material, and demolition debris that is considered part of OU-3 [see the upland portion of the southeast area (UPSEA) discussion in Section 2.3.3]. The remainder of the ditch traverses marshy lowlands adjacent to the Lake.

Contaminated groundwater and surface water from the FPSA discharged into the canal. In 2005–2006, as a time-critical removal action, the DePue Group removed contaminated sediment from the South Ditch and placed it in a corrective-action management unit (CAMU) on the FPSA (Apollo, 2006; see Section 2.3.3). A surface water diversion system, constructed in 1998 and expanded in 2000, diverts much of the stormwater in the Bluff Area before it reaches the FPSA. Most of the discharge to the South Ditch currently comes from two sources: contaminated groundwater that comes from the FPSA and that is not intercepted by the iron-rich material (IRM) walls and interceptor trenches south of the slag pile; and contaminated groundwater and stormwater from the UPSEA.

The South Ditch will likely require additional remediation and will be addressed with OU-5 (see below). OU-1 is currently subjected to CERCLA five-year reviews (FYRs). The first FYR was completed in July 2010; the second FYR is underway and is due for completion by the end of June 2015.

2.3.2 OU-2

OU-2, the Phosphogypsum Stack area, includes a 125-acre waste pile of phosphogypsum located approximately 1,300 feet to the north of the FPSA (Figure 1). The phosphogypsum was generated from the conversion of phosphate rock into DAP fertilizer. The 250-acre OU comprises the Phosphogypsum Stack and associated water-control structures, including drainage swales, a clearwater pond (previously used to clarify and cool process water), a dam, and a constructed treatment wetland. Forested tracts with patches of agricultural fields are immediately to the north and east of the Phosphogypsum Stack. Route 29 is south of OU-2, separating this area from the forested bluffs north of the FPSA. Agricultural fields are located to the west of the Phosphogypsum Stack.

In a multi-phased hydrogeologic report, Terra (2013) documented contaminated groundwater and soil in OU-2. The DePue Group began closure of the area in 1992, which included the management of runoff and seepage from the stack area (Terra, 2013). Since then, the DePue Group capped, regraded, and seeded portions of the Phosphogypsum Stack. The southern portion was capped with clay soils and native prairie grass and the northern portion with mushroom compost and fescue. Between 2005 and 2007, the DePue Group also developed a treatment wetland (> 2 acres) to passively treat seepage from the Phosphogypsum Stack; the group planted native shrub hedges around it as an alternative to traditional chain-link fencing (Terra, 2013). The Phosphogypsum Stack is being closed pursuant to the Illinois landfill regulations (35 IAC Part 807) and the closure plan (Terra, 2014) is currently under review.

2.3.3 OU-3

OU-3, the FPSA (Figure 1), includes the plant site property (~ 136 acres), adjacent bluffs (~ 90 acres), and the UPSEA, including the "municipal dump" (~ 25 acres) (Environ, 2006, 2014b). The area east and west of the FPSA is primarily residential. An additional residential area lies south of the FPSA, leading into the Lake and its floodplain.

Operations at the FPSA included a smelter, a sulfuric acid plant, paint pigment fabrication, cadmium distillation, and a DAP fertilizer plant. Associated waste includes 6 inches to several feet of industrial waste (metal-rich cinders) throughout the FPSA; a zinc slag pile (50-feet tall, covering a 23-acre area, which is equivalent to approximately 702,000 cubic yards or 570,000 tons of waste); ridges of lithopone paint pigment plant waste, equivalent to 60,000 tons and covering approximately 10 acres; and 750,000 tons of general fill material (i.e., general mix of slag, fill, and lithopone) throughout the FPSA (Illinois EPA, 2012; Environ, 2014b).

The Bluff Area is a steeply sloped area between the FPSA and Route 29, encompassing approximately 90 acres (Environ, 2014b). It is an undeveloped wooded property zoned as industrial and owned primarily by ExxonMobil and CBS Operations. ZCA or Bureau County may own other portions of the Bluff Area. Because of the steep terrain in the Bluff Area, the land use and industrial zoning is expected to remain unchanged, with little or no future development. The Trustees are only aware of limited industrial activity in the Bluff Area, related to an operating natural gas pipeline and pipelines previously used to transport process water between the fertilizer plant and the Phosphogypsum Stack area in a closed-loop piping system (Terra, 2013; Environ, 2014a). However, past evaluations documented areas of exposed site-related materials in the Bluff Area (Environ, 2014a; B. Whetsell, IDNR, personal communication, 2014).

The UPSEA is south of Marquette Street and south of the FPSA, and is bounded by the wetlands of OU-5 (see Figure 1). Features include the northernmost 150 feet of the South Ditch, the plant's two settling ponds, and the municipal dump. The settling ponds were formed out of slag and were used as G&W fertilizer ponds. It is the State of Illinois' understanding that ExxonMobil is planning to decommission or close the ponds and has requested that they be removed from the evaluation of ecological risks (Joe Abel, ExxonMobil Environmental Services Company, personal communication, March 19, 2015).The dump contains primarily plant residue, some general fill and construction debris, and relatively minor amounts of municipal trash. An estimated 203,000 tons of waste, including general fill and slag, are present in this area. The maximum depth of fill in the municipal dump is unknown and occurs below the water table.

The DePue Group constructed an Interim Water Treatment Plant (IWTP) in one of the FPSA buildings to collect and treat contaminated groundwater and runoff that previously flowed uncontrolled from the FPSA to the South Ditch. The IWTP discharges to the Illinois River. A permeable reactive barrier (the "IRM walls") and associated interceptor trenches were constructed south of the zinc slag pile to remove zinc, copper, and other metals from the groundwater. Surface water and stormwater from the Bluff Area is routed directly to the River Water Line and surface water/stormwater from the FPSA is routed to the lift station/IWTP and to the River Water Line after being treated. A 2.5-acre CAMU contains contaminated sediments from the South Ditch that were stabilized with power plant combustion ash (Apollo, 2006). This CAMU retains water on its surface and may be an attractive nuisance to some organisms, particularly birds.

The DePue Group recently completed an OU-3 RI, which focuses primarily on soil and groundwater contamination; risk assessments and an FS will follow. The human health risk assessment has been submitted and is under review; a work plan for the baseline ecological risk assessment, along with a completed screening assessment, was submitted to Illinois EPA in March 2015.

2.3.4 OU-4

OU-4, the Off-site Soils area, consists of five subareas in the Village of DePue that surround OU-2 and OU-3 to the south, west, northwest, northeast, and east (Environ, 2014c; Figure 1). These areas contain private residential properties, vacant lots, parks, and other village properties such as alleys. These soils have yet to be investigated systematically, although Illinois EPA (1992) collected samples from some of the properties, as did the Illinois Department of Public Health (ATSDR, 1999). The extent of contamination from deposited fill material and aerial deposition is unknown. If necessary, the DePue Group will conduct an investigation of agricultural property to the north. Other portions of OU-4 contain creeks and ponds. These areas will be addressed in a work plan after the yard soil removal action is well underway (Russ Cepko, CBS Corporation, personal communication, March 19, 2015).

The DePue Group conducted a Pilot Study which investigated 41 residential properties in December 2013 (Environ, 2014c). The Design Study (i.e., FS) is nearing completion. Illinois EPA intends to develop the Proposed Plan and Record of Decision for this OU in 2015.

2.3.5 OU-5

OU-5 is Lake DePue, a 524-acre backwater lake known more simply as the Lake (Figure 2). The Lake and its floodplain have been the focus of intense study in recent years. The accumulation of sediment from the Illinois River and surface runoff and discharges from the surrounding landscape – including the FPSA and other OUs – have degraded the recreational use of the Lake (Illinois EPA, 2012). The Lake and its floodplain partially make up the DePue State Fish and Wildlife Area, which IDNR owns and manages[6] (Appendix B). Illinois EPA (2005) identified a lowland portion of the Site up to an elevation of 450 feet above mean sea level (amsl) as the floodplain surrounding the Lake. Fluctuating water levels in the Lake seasonally inundate these lowland areas. The U.S. Fish and Wildlife Service classified areas of the lowland as emergent, scrub-shrub, and forested wetlands (USFWS, 1987; ARCADIS, 2009). Specific areas within OU-5, including the lowland portion of the unit, include (1) the Lowland Portion of the Southeast Area, (2) the Spring Area west of the former Settling Ponds, (3) the Division Street outfall, (4) the DePue Wastewater Treatment Plant (WWTP), and (5) the Southwest Drain and Unnamed Tributary (ARCADIS, 2009) (Figure 2). Some of the lowland areas to the south of OU-5 include agricultural areas and the Dredge Spoil Disposal Area, which is part of the DePue Wildlife Management Area (DWMA)[7] (Figure 2). To the north of the Lake is the FPSA and associated waste piles and the residential area of DePue. Surrounding the Lake is floodplain forest and marshy lowland habitat. Areas with site-related fill material have been identified along the northern shoreline of the Lake (ARCADIS, 2009).

The DePue Group has substantially completed an assessment of the nature and extent of contamination in OU-5, although it is planning additional focused sampling within the formerly dredged area of the Lake to support the ecological risk assessment. The human health risk assessment has been finalized.

6. Also included in the DePue State Fish and Wildlife Area is Spring Lake and the Hormel Landing, both to the southwest of the Lake (IDNR, 2013). See Appendix B for further detail.

7. The Dredge Spoil Disposal Area sits along a peninsula between the Lake and the Illinois River (Figure 2). In 1982, following the guidelines of a permit and legislative direction, IDNR dredged and pumped sediment from the Lake and deposited it on the peninsula, creating the Dredge Spoil Disposal Area. IDNR actively manages the DWMA for waterfowl habitat with diked fields planted with crops that are seasonally flooded.

Figure 2. Features of OU-5, the Lake.

2.4 Time, Quantity, Duration, and Frequency of the Discharges or Releases

The PRPs released hazardous substances to the environment throughout the operation of the Site (1903 to 1989). Releases continued after operations ceased and continue today. Although the RIs for OU-3 and OU-5 are ongoing, much of the nature and extent of contamination has been characterized. More focused efforts may need to be conducted in certain limited areas to support FS evaluations.

Waste disposal activities and discharges from the former smelter, sulfuric acid plant, lithopone plant, and DAP plant released hazardous substances to the environment. As discussed in

Section 2.3, these activities produced the following source areas (Environ, 2006, 2014b; ARCADIS, 2009):

- A primary zinc smelter slag pile in excess of 702,000 cubic yards or 570,000 tons
- Several ridges of paint pigment plant waste, sometimes referred to as the "lithopone ridges," containing in excess of 64,000 tons of paint waste
- Six inches to several feet of contaminated soil and fill throughout much of the 136-acre former plant site
- A Phosphogypsum Stack comprising more than 125 acres
- Contaminated groundwater beneath the Site
- A municipal dump comprising 25 acres of primarily FPSA-related waste material
- Areas of site-related fill material along the northern shoreline of the Lake and in other portions of the OUs.
- Many other impoundments and waste piles.

2.5 Names of Hazardous Substances Released, including Additional Hazardous Substances Potentially Discharged or Released from the Site

Zinc sulfide ores were smelted at the Site to produce pure zinc and zinc compounds for use in paint production (Illinois EPA, 1992). Cadmium, copper, mercury, and lead are metals that commonly occur with zinc and therefore would be expected to be concentrated in the slags and other wastes produced by the various FPSA operations (U.S. EPA, 1995; Environ, 2014b). Illinois soils generally contain these metals at background concentrations that are much lower than the concentrations found at the Site (Environ, 2014b).

Studies conducted by the PRPs and others have found elevated levels of metals in all of the source areas, as well as other areas affected by releases, including the Lake, the Dredge Spoil Disposal Area, and residential areas (Illinois EPA, 1992; Environ, 2006, 2014b; ARCADIS, 2009). The Phosphogypsum Stack has released the anions ammonia, fluoride, sulfate, and phosphorus; metals such as iron, manganese, and vanadium; and has contributed other regulated contaminants such as total dissolved solids (TDS) to groundwater (Terra, 2013).

2.5.1 Primary hazardous substances of concern

Primary hazardous substances of concern vary by OU and media. In general, metals and anions constitute the primary hazardous substances of concern. The primary hazardous substances of concern are listed by location below, with specific media in parentheses:

- OU-1: arsenic, cadmium, copper, lead, manganese, and zinc (sediments) (Illinois EPA, 1998)
- OU-2: ammonia, sulfate, TDS, phosphorus (Intermediate Sand Aquifer groundwater); ammonia, sulfate, iron, manganese (Lower Aquifer groundwater) (Terra, 2013)
- OU-3: aluminum, ammonia, arsenic, cadmium, chromium, cobalt, copper, fluoride, iron, lead, manganese, nickel, silver, sulfate, vanadium, and zinc (soil and groundwater) (Environ, 2006, 2014b)
- OU-4: arsenic, cadmium, and lead, as well as cobalt, iron, and manganese (soil) (Environ, 2011, 2014c)
- OU-5: aluminum, arsenic, beryllium, cadmium, chromium, cobalt, copper, cyanide, iron, lead, manganese, nickel, selenium, silver, thallium, vanadium, and zinc (floodplain soil and/or sediment and/or surface water) (ARCADIS, 2009, 2012).

Appendix C presents descriptions of several of these hazardous substances.

2.5.2 Additional hazardous substances

Other metals

Slag produced in refining can contain significant concentrations of barium, which is a toxic element. Likewise, barium is a component of lithopone, which was also produced on the Site. It has been found in OU-1, OU-3, and in the Lake (Illinois EPA, 1998; Environ, 2006, 2014b; ARCADIS, 2009, 2012). Mercury commonly occurs with zinc and would be expected to occur in the slags and other Site-related wastes. Mercury has been found in the Lake (ARCADIS, 2009). However, Illinois EPA does not consider the Site to be a significant contributor of mercury (Illinois EPA, 2012).

Polychlorinated biphenyls

Researchers also have found polychlorinated biphenyls (PCBs) in the Lake. However, based on the results of the OU-5 RI (ARCADIS, 2009), Illinois EPA does not consider the Site to be a significant contributor of PCBs (Illinois EPA, 2011). The Lake fish advisory includes a fish advisory for PCBs, the same fish advisory that exists for the Illinois River. Although the Site cannot be definitively ruled out as a source of concentrations of PCBs, PCBs were not a significant contaminant at the FPSA or in the known source areas.

Other organic and inorganic substances

The PRPs and Illinois EPA are working to characterize the types and distribution of organic compounds associated with the Lake sediments. ARCADIS (2012) measured elevated concentrations of benzo(a)pyrene and other semi-volatile organic compounds (SVOCs) in floodplain soil collected near the Lake; ammonia and phosphorous concentrations in some Lake surface-water samples exceeded Illinois EPA standards. Ammonia is also present in OU-3 groundwater; fluoride and sulfate occur in OU-3 soils. Uranium and radium naturally occur in phosphate ore, and are therefore byproducts of Phosphogypsum Stacks; however, present sampling efforts have not yet detected the presence of uranium and radium at the Site at levels above relevant screening criteria or regulatory standards (Terra, 2013). Volatile organic compounds (VOCs) have generally not been detected at concentrations above relevant screening criteria (Environ, 2006). There may be other organic and inorganic compounds, which have not yet been detected at the Site, that may be identified before all investigations and assessments are complete.

2.6 Damages excluded from Liability under CERCLA and CWA

The NRDA regulations at 43 CFR §§ 11.24(b) and (c) require that Trustees determine whether the damages being considered are barred by specific defenses or exclusions from liability under CERCLA or the CWA. The Trustees are not aware of any relevant application of any of these exclusions at this Site. The specific determinations of possible exclusion of liability are as follows:

- The Trustees must determine whether the damages:
    - Resulting from the discharge or release were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement or other comparable environmental analysis, that the decision to grant the permit or license authorizes such commitment of natural resources, and that the facility or project was otherwise operating within the terms of its permit or license, so long as, in the case of damages to an Indian tribe occurring pursuant to a Federal permit or license, the issuance of the permit or license was not inconsistent with the fiduciary duty of the United States with respect to such Indian Tribe; or

  - Resulted from releases of a hazardous substance from which such damages resulted have occurred wholly before the enactment of CERCLA; or

  - Resulted from the application of a pesticide product registered under the Federal Insecticide, Fungicide, and Rodenticide Act, 7 USC 135–135k; or

  - Resulted from any other federally permitted release, as defined in Section 101 (10) of CERCLA; or

  - Resulted from the release or threatened release of recycled oil from a service station dealer described in Section 107 (a)(3) or (4) of CERCLA if such recycled oil is not mixed with any other hazardous substance and is stored, treated, transported or otherwise managed in compliance with regulations or standards promulgated pursuant to Section 3014 of the Solid Waste Disposal Act and other applicable authorities.

- The Trustees must also determine whether the discharge meets one or more of the exclusions provided in Section 311 (a)(2) or (b)(3) of the CWA.[8]

The Trustees have determined that none of the potential injuries referred to herein meet one or more of the above exclusion criteria, nor are they subject to the exceptions to liability provided under Section 107 (f), (i), and (j), and 114(c) of CERCLA.[9]

3. Preliminary Identification of Resources Potentially at Risk

In this section, we present a preliminary identification of natural resources potentially at risk from the hazardous substances released from the Site pursuant to the NRDA regulations. Section 3.1 describes pathways of exposure [43 CFR § 11.25(a)]; Section 3.2 summarizes the areas that have been exposed to hazardous substances [43 CFR § 11.25(b)] and presents estimates of concentrations of hazardous substances in these areas [43 CFR § 11.25(d)], including in exposed water [43 CFR § 11.25(c)]; and Section 3.3 describes resources and services that are potentially affected by exposure to hazardous substances [43 CFR § 11.25(e)].

8. The CWA exclusions generally cover permitted discharges.

9. These exceptions include permitted releases, application of a registered pesticide product, and the acceptance of used motor oil by a service station dealer.

3.1 Preliminary Identification of Pathways

Because of their physical and chemical properties, contaminants currently identified onsite have the potential to exist in or be transported to areas where natural resources could be exposed to contaminants. Exposure pathways that may transport site-related contaminants to natural resources may include soil, surface water and sediment, groundwater, air, and the food chain.

3.1.1 Soil pathway

A large quantity of waste is exposed at the soil surface at various locations throughout the Site. The FPSA, residential, and floodplain soils contain site-related contamination and the Bluff Area includes visibly stressed vegetation (ARCADIS, 2012; Environ, 2014a, 2014c). Some of the waste exists in piles, while other waste is spread out over large areas. The FPSA, for example, is covered with 6 inches to several feet of contaminated soils and fill, including metal cinder fill (Environ, 2006). Areas with site-related fill material have been identified along the northern shoreline of the Lake (ARCADIS, 2009). The DePue Group leveled the top of the 23-acre slag pile and it is currently vegetated; the sides of the pile are exposed (i.e., no cover) and are not contained or controlled (Illinois EPA, 1992). The 125-acre Phosphogypsum Stack is capped with prairie grass plantings and fescue.

Soils serve as a pathway to surface water through erosion and during floods. They can also serve as a pathway to groundwater through leaching and infiltration. Biological resources can be exposed to hazardous substances through direct contact with waste and contaminated soil. Surface soil contaminants may pose a threat to organisms through incidental ingestion, particularly to birds that eat soil to use as grit or that eat food such as earthworms that are covered with contaminated soil (King and Bendell-Young, 2000). Contamination at various depths may expose burrowing organisms to soil contamination below the surface.

3.1.2 Surface water and sediment pathway

Discharges of wastewater to the Lake, site impoundments, and other features in the surrounding area have occurred over the years (Environ, 2006, 2014b; ARCADIS, 2012). ZCA's 1992 Discharge Monitoring Reports indicated that discharges to the South Ditch exceeded 1982 and 1988 discharge limits pursuant to National Pollution Discharge Elimination System (NPDES) Permit No. IL0052183, including variances granted by the Illinois Pollution Control Board in 1988 (ICO, 1995).

Additional exposure pathways for site-related contaminants from source areas to surface water resources include the combination of stormwater drainage, surface water, seep, and spring pathways. For example, stormwater runoff and surface-water flow over the FPSA, residential areas, and floodplains of the Lake and the Illinois River can occur (Illinois EPA, 1992). Some sources at the Site lie within the 100-year flood boundary (Illinois EPA, 1992). Under the terms of the ICO, some of these migration pathways have been controlled to varying degrees. In OU-3, the slag pile includes various drains, inlets, and ditches on the top and at the toe of the pile. Water is directed to the lift station and the IWTP for treatment and discharge. A berm along the south side of the slag pile prevents stormwater and runoff from the slag pile from exiting the Site. Depending on conditions, 16–86% of the contaminated groundwater is captured by the interceptor trenches and IRM walls (Environ, 2014b), routed to the lift station for treatment at the IWTP, and discharged to the Illinois River.

However, during extreme precipitation events or extended periods of flooding, these systems may fail or become overwhelmed. Events that bypass the lift station, while rare, have occurred; during these events, contaminated groundwater and surface water are released to the Lake (Environ, 2014b).

Because of their physical and chemical properties, contaminants currently identified at the Site have a high affinity to associate with particulate organic matter and charged inorganic substances, such as clays found in the water column and sediments. Resuspension of particulates and sediment in the surface water may allow for the transport of contaminants, serving as a pathway to biota.

The Lake contains elevated concentrations of metals, ammonia, and sulfate, as a result of releases from the Site (ARCADIS, 2009). Because the Lake and its floodplain are located in the floodplain of the Illinois River, contaminants and contaminated media such as sediments may be carried downstream via the river. However, as a backwater lake, the Lake is characterized as a depositional environment. Based on available data, there is limited evidence that site-related contamination has migrated beyond the Lake itself. Remnant deposits of contaminated sediments may exist in the Illinois River. Former depositional areas may be exposed through scouring of the river bed during flood events. Contaminants from the Site may have settled in depositional areas. When a flood event of sufficient magnitude occurs, clean deposits may scour away overlying clean sediments, exposing a new source of contaminants to biota.

Negro Creek is located east of the Lake and enters the Illinois River (Figure 1). In approximately 1945, the creek was re-routed to enter the eastern end of the Lake. However, re-routing the creek increased the turbidity levels in the Lake; in 1976, the Village of DePue, with the assistance of a state grant, rerouted discharge of Negro Creek back to the Illinois River. Although unlikely, it is possible that contaminants from the Site were released to the surface water and sediments of Negro Creek while it entered the Lake.

3.1.3 Groundwater

Groundwater flow at the Site is generally southward toward the Lake (Cahill and Bogner, 2002; Environ, 2006, 2014b). Significant discharges of metals to groundwater via leaching and surface water runoff have occurred (Illinois EPA, 2012). Groundwater occurs beneath the OU-3 in two water-bearing zones: an Upper Water Bearing Zone (UWBZ) within surficial alluvial soils and fill materials, and a deeper Lower Aquifer (Environ, 2006). In OU-2, the UWBZ is not present. The hydrostratigraphic units include an upper till, intermediate sand, lower till, and lower sand aquifer. The lower sand aquifer is the same lower aquifer unit in OU3. (Terra, 2013). Hydrogeologic research demonstrated that water infiltrates the Phosphogypsum Stack, where it entrains sulfate, ammonia, phosphorus, fluoride, and other constituents, and then percolates downward to the Intermediate Sand Aquifer under the stack (Terra, 2013). Some of this water is captured in swales and pumped to a pond for management. However, in the eastern portion of the Phosphogypsum Stack, some contaminants are migrating downward to the Lower Aquifer and are moving downgradient to the south toward the Lake. Seeps and springs that could serve as groundwater pathways to surface water have been identified along the Lake’s north shoreline. Many of these seeps contain metals and other Site-related constituents that have been attributed to the FPSA or Phosphogypsum Stack (Terra, 2013; Environ, 2014b).

3.1.4 Air

Smelter emissions may have exposed soils, surface water, and biota of the Lake; residential areas; and the Illinois River to site-related contaminants. Dust may have provided a pathway for these contaminants. Before the Site was listed on the NPL, Illinois EPA (1992) noted that uncovered and uncontrolled sources, such as the slag pile, lithopone ridges, and the Phosphogypsum Stack, represented threats to the air pathway and that releases of airborne particulate matter from operations at the smelting facility likely contaminated the residential soils in DePue. Illinois EPA (1992) reported that, on at least one occasion, the fertilizer plant accidentally released an airborne substance that disfigured the paint of cars in the surrounding areas.

Based on an air monitoring program that the DePue Group conducted pursuant to the ICO between 1994 and 1996, ongoing continuous releases of particulates from the slag pile are not likely to occur (Terra, 1996). In 2006, the Phosphogypsum Stack was partially covered with vegetation, which reduced its potential impact to air quality (Illinois EPA, 2012). However, community members have continued to informally report to Illinois EPA that particulate matter and dust are visible from the slag pile under windy conditions. The FPSA has been vegetated in accordance with the ICO to reduce particulate and dust migration; however, the sides of the slag pile remain uncovered, and other waste areas, such as the lithopone ridges, have not been covered.

3.1.5 Food chain

Fish and wildlife may be exposed to Site contaminants directly or indirectly through the food chain. Some of the hazardous substances presently identified at the Site, such as zinc, cadmium, copper, and lead, bioaccumulate in tissues (Eisler, 1985, 1988, 1998). Lower trophic-level organisms like invertebrates and plants may be directly exposed to metals from sediments, surface waters, soils, waste piles, or air. These organisms serve as prey for higher trophic-level animals, like mammals, birds, reptiles, and amphibians. Food chain exposures can occur when contaminants accumulate in the tissues of prey and are subsequently consumed by predators. For terrestrial and semi-aquatic organisms, metal concentrations in tissues were highest in specimens collected adjacent to OU-1 (ARCADIS, 2009).

3.2 Exposed Areas

3.2.1 Areas of direct exposure

This section briefly summarizes areas of direct exposure by OU. It is not a comprehensive discussion of all exposed areas. Concentrations are presented in comparison to screening criteria in the source documents or ecological screening criteria to provide context.

OU-1. South Ditch

The South Ditch received discharges of contaminated groundwater and surface water from the FPSA. In 1996, the DePue Group collected sediments from the South Ditch and found the following elevated concentrations in comparison with concentrations in sediments from a reference location (*in italics*): cadmium [up to 910 mg/kg (*8 mg/kg*)], zinc [up to 204,000 mg/kg (*370 mg/kg*)], lead [up to 3,440 mg/kg (*56 mg/kg*)], and copper [up to 97,700 mg/kg (*46 mg/kg*)] (Illinois EPA, 1998). The DePue Group found that these sediment samples were acutely toxic to benthic organisms in laboratory exposure tests (Illinois EPA, 1998).

OU-2. Phosphogypsum Stack

Elevated sulfate and ammonia have been found in surface water and groundwater samples beneath the Phosphogypsum Stack compared to Class II groundwater quality criteria (*in italics*) (Terra, 2013). Terra (2013) measured ammonia at concentrations of up to 650 mg/L (*35 mg/L*) and sulfate at concentrations of up to 6,420 mg/L (*400 mg/L*) in the Intermediate Sand Aquifer at wells surrounding the Phosphogypsum Stack (Terra, 2013). Terra (2013) also found elevated ammonia and sulfate in the Lower Aquifer formations beneath the Intermediate Sand Aquifer; and elevated metals, including arsenic, iron, manganese, and vanadium, in groundwater samples collected during the OU-2 investigation.

OU-3. Former Plant Site Area

Metal concentrations in soils and groundwater are elevated in OU-3 (Environ, 2006, 2014b). Soils collected for the Phase II RI contained elevated concentrations compared to human health screening criteria (*in italics*) of arsenic [up to 139 mg/kg (*0.39 mg/kg*)], barium [up to 7,460 mg/kg (*5,400 mg/kg*)], cadmium [up to 105 mg/kg (*37 mg/kg*)], iron [up to 45,600 mg/kg (*23,000 mg/kg*)], lead [up to 9,480 mg/kg (*400 mg/kg*)], manganese [up to 3,070 mg/kg (*1,800 mg/kg*)], mercury [up to 7.7 mg/kg (*6.1 mg/kg*)], and thallium [up to an estimated 67.1 mg/kg (*5.2 mg/kg*)] (Environ, 2014b). The groundwater beneath OU-3 generally flows to the south and east, and samples collected for the Phase I and Phase II RIs contained elevated concentrations in comparison to human health screening criteria (*in italics*) of aluminum [up to 105,000 μg/L (*3,500 μg/L*)], arsenic [up to 202 μg/L (*10 μg/L*)], cadmium [up to 63,000 μg/L (*5 μg/L*)], cobalt [up to 14,300 μg/L (*1,000 μg/L*)], copper [up to 339,000 μg/L (*650 μg/L*)], iron [up to 342,000 μg/L (*5,000 μg/L*)], lead [up to 3,520 μg/L (*5 μg/L*)], manganese [up to 979,000 μg/L (*150 μg/L*)], nickel [up to 16,100 μg/L (*100 μg/L*)], zinc [up to 9,950,000 μg/L (*5,000 μg/L*)], ammonia [up to 506 mg/L (*35 μg/L*)], and sulfate [up to 28,000 mg/L (*400 μg/L*)] in shallow monitoring wells installed in the FPSA (Environ, 2014b).

OU-4. Off-site Soils

Off-site soils may have been contaminated from the direct placement of material from the FPSA as fill, from surface runoff from the FPSA, and from air transport of site emissions (Environ, 2014c). Metals exceed residential-based screening criteria throughout this area (Environ, 2014c). In November and December 2013, Environ (2014c) conducted a pilot study in advance of a full-scale soil investigation. This work was intended to address several issues pertinent to a full-scale investigation and remediation, such as the use of X-ray fluorescence, the potential presence of hexavalent chromium (Cr^{6+}), and the need for sampling the 0- to 1-inch depth interval, among others. Environ (2014c) collected composite and discrete samples from 41 properties in the West, Northwest, South, and East subareas of OU-4 (see Figure 1). Arsenic (up to an estimated 87.3 mg/kg) and lead (up to 4,960 mg/kg) concentrations exceeded residential soil screening criteria across the sampling area of 11.6 mg/kg and 400 mg/kg, respectively; cadmium (up to 127 mg/kg), cobalt (up to 56.4 mg/kg), iron (up to 198,000 mg/kg), and manganese (up to 4,650 mg/kg) also exceeded residential soil screening criteria [which are cadmium (70 mg/kg), cobalt (23 mg/kg), iron (55,000 mg/kg), and manganese (1,800 mg/kg)] in some samples.

OU-5. Lake DePue and the Floodplain

The ecological risk assessment for OU-5 (ARCADIS, 2012) identified metals as the primary contaminants of concern in the Lake and its floodplain, and found elevated risks, particularly to benthic invertebrates, in some areas. The risk assessment also identified other contaminants, including some polycyclic aromatic hydrocarbons (PAHs), PCBs, pesticides, and herbicides at concentrations above screening criteria.

Cahill and Steele (1986) found elevated cadmium (up to 116 mg/kg) and zinc (up to 5,000 mg/kg) in Lake sediments. Lake and seep sediment samples collected by the Illinois State Geologic Survey (ISGS) and the Illinois State Water Survey (ISWS) in 1998 (Cahill and Bogner, 2002), and subsequent sampling in 2007 by ARCADIS (2009) in support of the OU-5 RI, contained elevated concentrations of metals such as cadmium (up to 1,420 mg/kg), lead (up to an estimated 12,900 mg/kg), and zinc (up to 95,600 mg/kg). Figures 3–5 show the concentrations of these metals measured in Lake sediments in comparison to probable effects concentrations (PECs) developed by MacDonald et al. (2000) using a large database of paired invertebrate toxicity test results and sediment contaminant concentrations. These concentrations greatly exceed the PECs, indicating the potential for adverse effects to benthic invertebrates.

Similarly, samples of the soils in the Lake’s floodplain, collected in 1998 by the Illinois Institute of Technology (Anderson et al., 2002) and in 2006 and 2007 by ARCADIS (2009) for the OU-5 RI, contain elevated concentrations of metals such as cadmium (up to 2,490 mg/kg) and lead (up to an estimated 12,500 mg/kg), as well as zinc (up to an estimated 181,000 mg/kg). Figures 6 and 7 show the concentrations of cadmium and lead, respectively, in comparison to ecological soil screening levels (EcoSSLs) developed by U.S. EPA (2005a, 2005b). These thresholds are screening-level thresholds, below which adverse effects in birds, mammals, invertebrates, and plants would not be expected. Concentrations of lead and cadmium in the Lake floodplain soils greatly exceed these benchmarks, with the highest concentrations near the former plant site and in the Dredge Spoil Disposal Area. All of the soil samples contained concentrations of zinc in excess of all of the zinc EcoSSLs (U.S. EPA, 2007).

These metals are also found in biota. For example, ARCADIS (2009) measured elevated concentrations of cadmium (up to 17 mg/kg), lead (up to 28 mg/kg), and zinc (up to 2,420 mg/kg) in benthic invertebrates collected from the Lake. ARCADIS (2009) also measured elevated concentrations of cadmium (up to 10 mg/kg), lead (up to 34 mg/kg), and zinc (up to 856 mg/kg) in whole-body and gizzard shad tissue samples collected from the Lake.

In addition, IDPH (2014) issued a fish advisory in the Lake for carp, white bass, and channel catfish because of detections of PCBs in fish tissue samples, as well as a state-wide fish advisory for methyl mercury in predator fish. However, the Site is not thought to be a significant contributor of PCBs and methyl mercury to the Lake (Illinois EPA, 2011). The same fish advisories exist for the Illinois River. IDPH does not typically issue fish advisories for metals other than mercury. To IDNRs knowledge, metals, other than mercury, were not considered as part of the IDPH fish advisory effort.

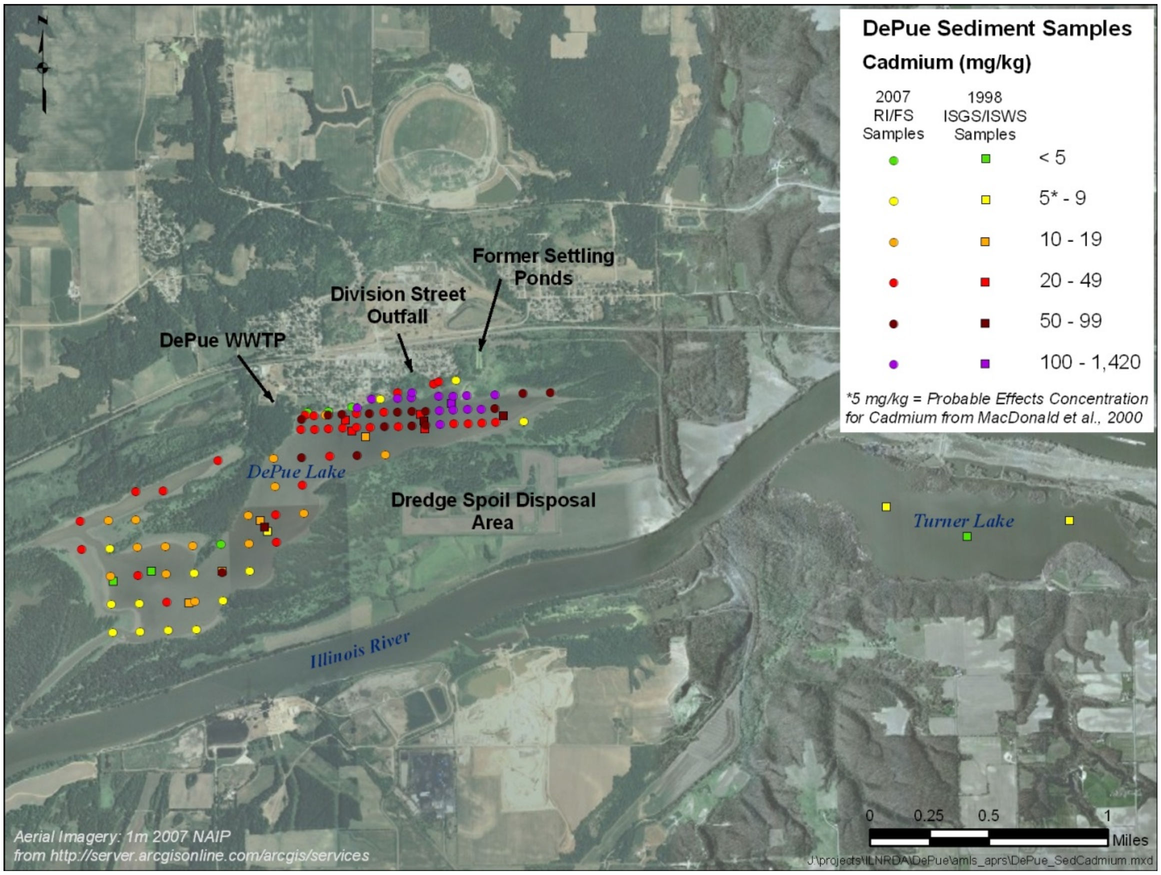

Figure 3. Concentrations of cadmium (mg/kg) in Lake sediment. Data include all depths sampled; the maximum value at each location is shown.

Data sources: Cahill and Bogner, 2002; ARCADIS, 2009.

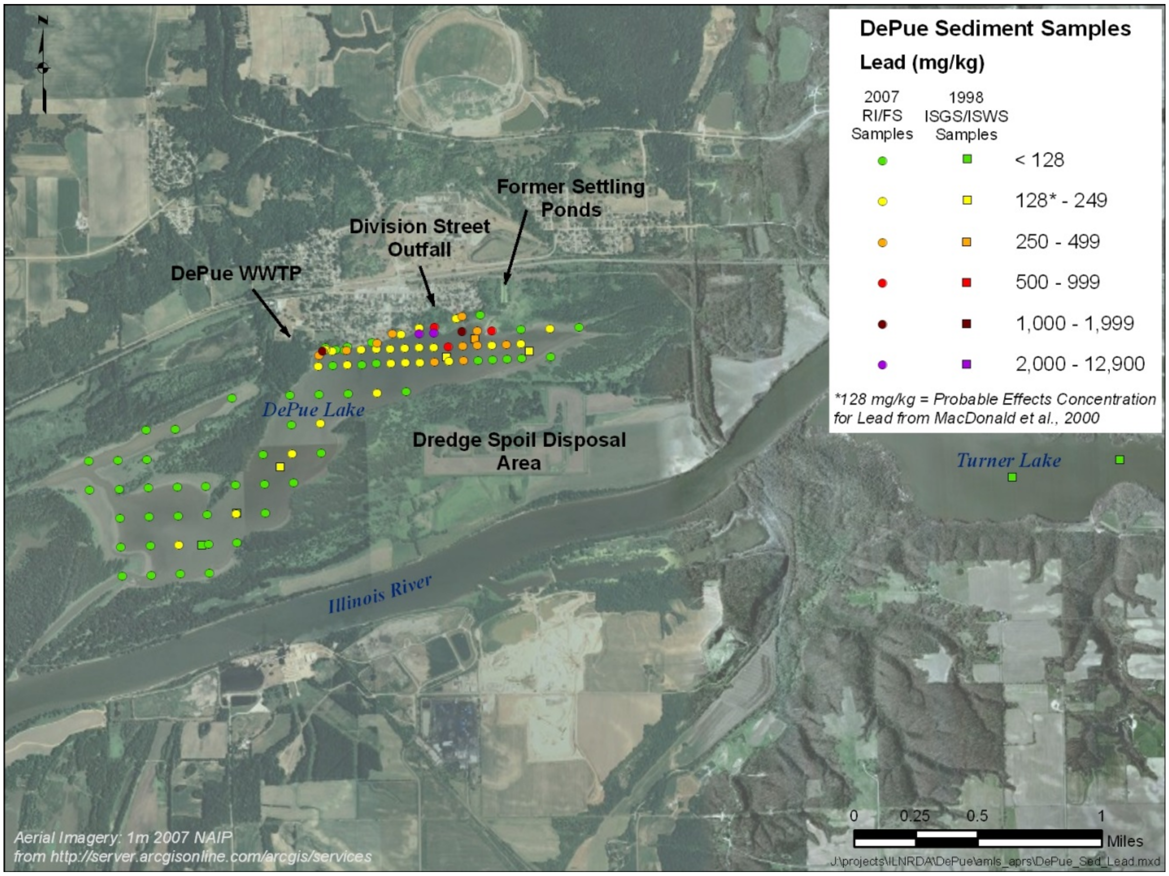

Figure 4. Concentrations of lead (mg/kg) in Lake sediment. Data include all depths sampled; the maximum value at each location is shown.

Data sources: Cahill and Bogner, 2002; ARCADIS, 2009.

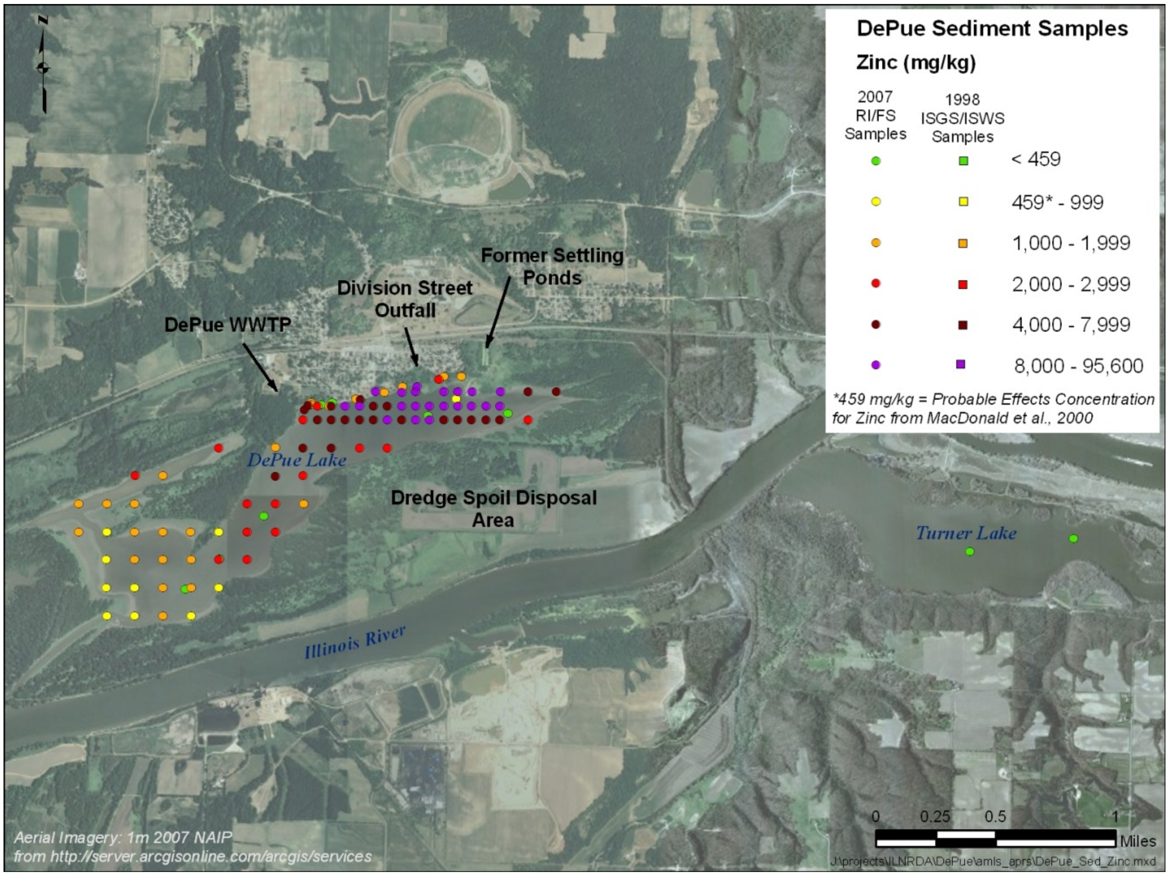

Figure 5. Concentrations of zinc (mg/kg) in Lake sediment. Data include all depths sampled; the maximum value at each location is shown.

Data sources: Cahill and Bogner, 2002; ARCADIS, 2009.

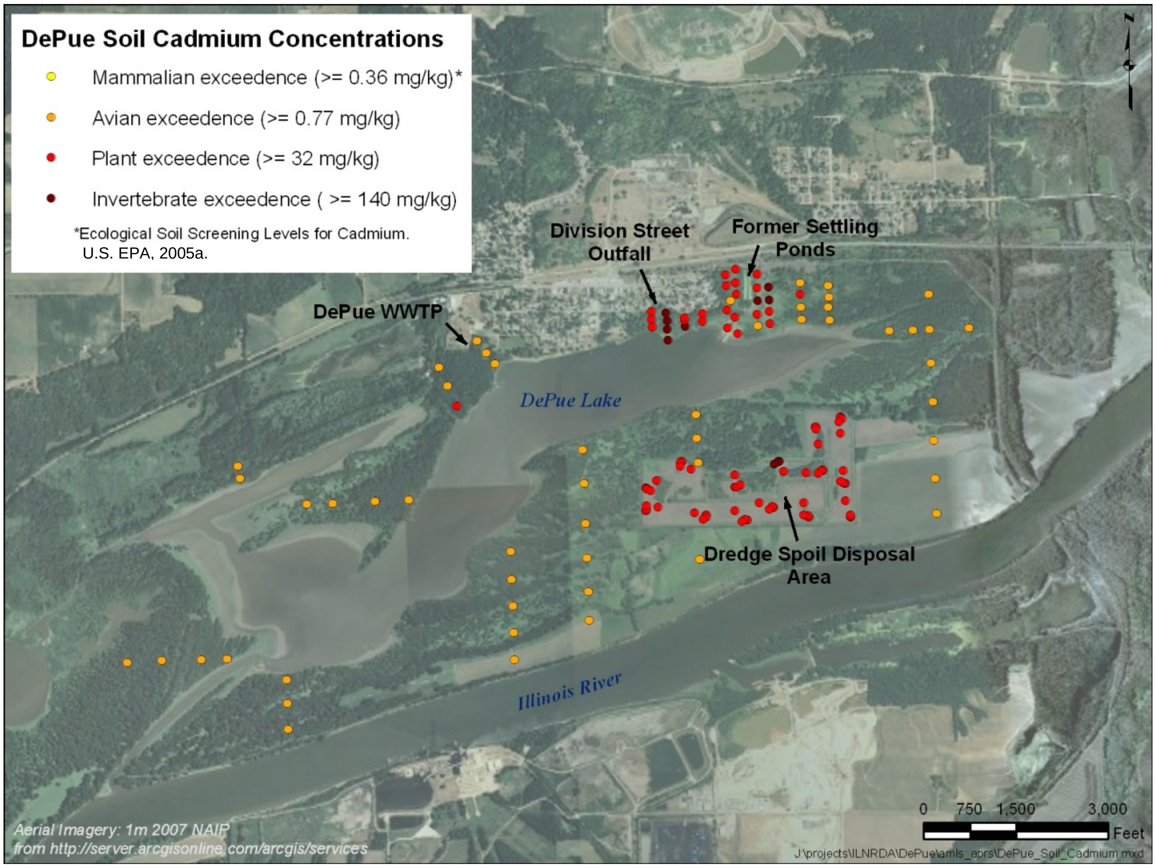

Figure 6. Concentrations of cadmium (mg/kg) in Lake floodplain soils. Data include all depths sampled; the maximum value at each location is shown.

Data sources: Anderson et al., 2002; ARCADIS, 2009.

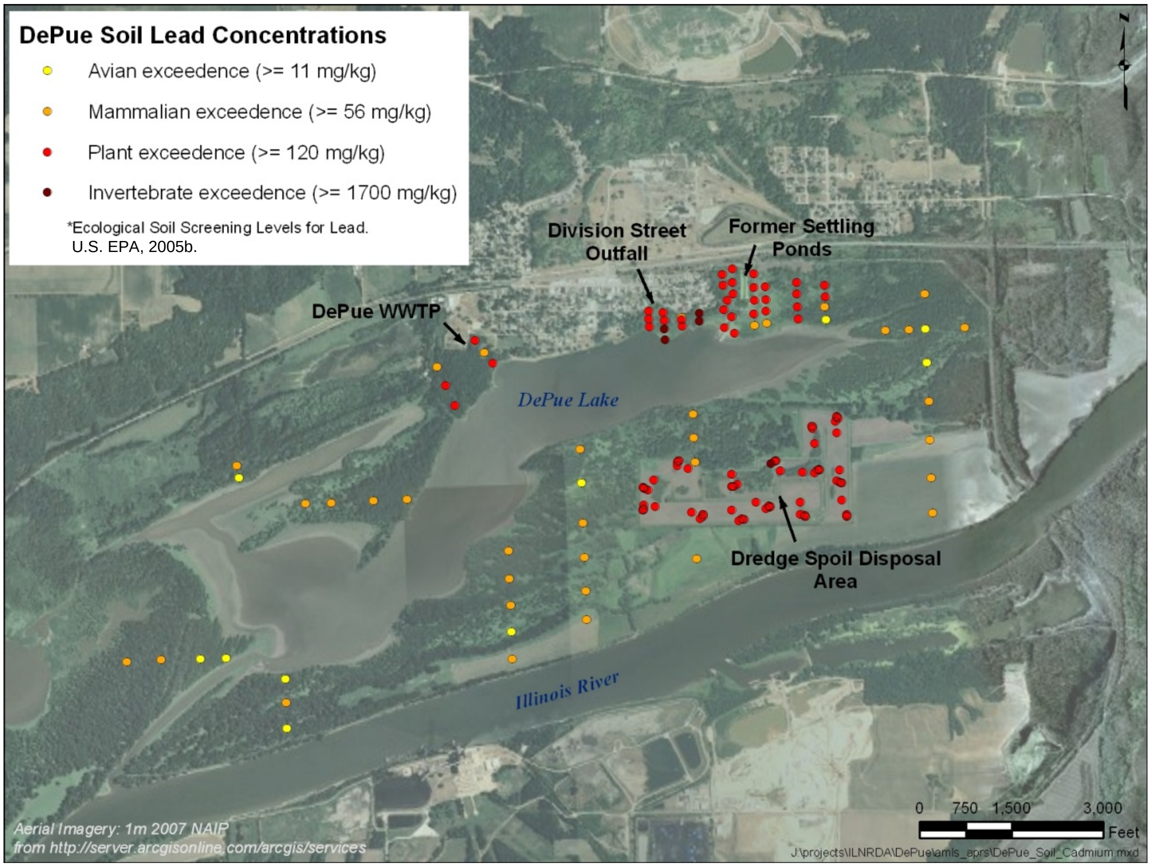

Figure 7. Concentrations of lead (mg/kg) in Lake floodplain soils. Data include all depths sampled; the maximum value at each location is shown.

Data sources: Anderson et al., 2002; ARCADIS, 2009.

3.2.2 Areas of indirect exposure

Areas of potential indirect exposure include the Illinois River, the DePue Fish and Wildlife Area, and surrounding properties such as Spring Lake (Appendix B). Flooding of the Illinois River and the Lake could potentially expose these areas to contaminated sediment. The permitted and legislatively directed dredging and disposal of Site-contaminated Lake sediments to the DWMA resulted in subsequent contamination of the DWMA.

3.3 Potentially Affected Natural Resources and Resource Services

Natural resources and related services that have been affected or potentially affected by releases of hazardous substances from the Site include, but are not limited to:

- Surface-water resources
- Sediment resources
- Groundwater and aquifer resources at and down-gradient of contaminant sources
- Soil resources, including floodplain soils adjacent to the Lake, Negro Creek, and the Illinois River
- Aquatic resources, including several species of fish and benthic invertebrates
- Terrestrial resources, including several species of mammals and birds
- Habitat for fish and wildlife, including food, shelter, breeding and rearing areas, and other factors essential for long-term survival
- Consumptive and non-consumptive outdoor recreation, including fishing, hunting, trapping, wildlife viewing, and photography
- Primary and secondary contact recreation, including swimming, boating, and other activities
- Use, option, and bequest values related to all of the above services
- Other nonuse values, including existence values, related to all of the above services.

This preliminary identification should be used to direct further investigations, but is not intended to preclude consideration of other resources later found to be affected. Further descriptions of potentially affected resources and services appear in Appendix D.

4. Preliminary Determinations Regarding Preassessment Screen Criteria

Based on the information presented in this PAS, the Trustees have made a preliminary determination that the criteria at 43 CFR § 11.23(e) have been met.

4.1 Criterion 1 – A Release of Hazardous Substance Has Occurred

Releases of hazardous substances to soils, surface water and sediments, and groundwater have been documented. Currently, uncontrolled waste products are present at the soil surface of the Site and are potentially released to Lake sediments and surface water as well as the Illinois River during flood events. The RI and Site characterization activities are ongoing, and further contaminant sources may yet be discovered.

4.2 Criterion 2 – Natural Resources for Which the Trustees May Assert Trusteeship under CERCLA Have Been or Are Likely to Have Been Adversely Affected by the Release

Surface waters, soils, sediment, and groundwater have been and continue to be affected by releases of contaminants associated with the Site. A number of trust resources are found or are likely to be found in the vicinity of the Site. Chemical transport pathways to these resources exist at the Site. Trust resources have been and continue to be adversely affected by releases of hazardous substances from the Site.

4.3 Criterion 3 – The Quantity and Concentration of the Released Hazardous Substance is Sufficient to Potentially Cause Injury to Natural Resources

The RI at the Site is ongoing. Based on data used for the scoring of the Site for inclusion on the NPL and collected for the RI thus far, there are contaminant sources of sufficient quantity and concentration to potentially cause injury to natural resources.

4.4 Criterion 4 – Data Sufficient to Pursue an Assessment Are Readily Available or Are Likely to Be Obtained at a Reasonable Cost

Data with which to pursue an assessment are already available. Under the ICO, the DePue Group is currently performing RIs of the Site, which are generating much of the data. Additional studies and data collection efforts that may be necessary to adequately characterize and quantify injury at the Site can be obtained at a reasonable cost.

4.5 Criterion 5 – Response Actions Carried out or Planned Do Not or Will Not Sufficiently Remedy the Injury to Natural Resources without Further Action

Response activities at the Site have not yet mitigated for natural resource injuries and have concentrated on implementing engineering controls (fences, public education, etc.) to prevent people from exposure to Site contaminants. Past injuries of natural resources in areas affected by interim actions at the Site have still not been addressed, and the Trustees are unaware of any plan to mitigate them. The information available at this time suggests the possibility of off-site impacts to natural resources, which are not currently being investigated or planned to be investigated under the RI and FS. Rehabilitation, restoration, or replacement of natural resources is needed to completely address injuries to and losses of natural resources within the trusteeship of the State of Illinois.

5. Conclusions

Following the review of the information as described in this PAS, the Trustees have made the determination that the criteria specified in 43 CFR Part 11 have been met. The Trustees have further determined that there is a reasonable probability of making a successful claim for damages with respect to natural resources over which the Trustees have trusteeship. Therefore, the Trustees have determined that an assessment of natural resource damages is warranted.

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A. Laws, Authorities, and Guidance Associated with NRDA and Natural Resource Injuries

Overview

The major federal laws guiding the restoration of the injured resources and services are OPA, CERCLA, CWA, NRDA, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). Overall these statutes provide the basic framework for NRDA and restoration. In addition, the state laws relevant for guiding the restoration of injured resources are the Illinois Environmental Protection Act (415 ILCS 5/1, et seq.), the Illinois Natural Areas Preservation Act (525 ILCS 30/1, et seq.), the Illinois Endangered Species Protection Act (520 ILCS 10/1, et seq.), the Interagency Wetland Policy Act of 1989 (20 ILCS 830/1-1, et seq.), and the Comprehensive Environmental Review Process, and Rivers, Lakes, and Streams Act (615 ILCS 5/18). Trustees must comply with other applicable laws, regulations, and policies at federal and state levels such as the Rivers and Harbors Act of 1899 (Sections 9 and 10).

Key statutes, regulations, policies, and guidance

There are a number of federal and state statutes, regulations, policies, and guidance that govern or are relevant to NRDA and/or natural resource injury evaluations and associated restoration. The potentially relevant laws, regulations, policies, and guidance are set forth below.

Oil Pollution Act of 1990, 33 USC §§ 2701, et seq.

The OPA establishes a liability regime for oil spills that injure or are likely to injure natural resources and/or the services that those resources provide to the ecosystem or humans. Federal and state agencies and Indian tribes act as trustees on behalf of the public to assess the injuries, scale restoration to compensate for those injuries, and implement restoration. The National Oceanic and Atmospheric Administration promulgated regulations for the conduct of NRDAs under OPA at 15 CFR Part 990. NRDAs are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services.

Clean Water Act (Federal Water Pollution Control Act), 33 USC §§ 1251, et seq.

The CWA is the principal law governing pollution control for water quality of the nation's waterways. Section 404 of the law authorizes a permit program for the disposal of dredged or fill material into navigable waters. The U.S. Army Corps of Engineers administers the program. In general, restoration projects that move significant amounts of material into or out of water or wetlands (e.g., hydrologic restoration of marshes) require Section 404 permits. Under

Section 401 of the CWA, restoration projects that involve discharge or fill to wetlands or navigable waters must obtain certification of compliance with state water quality standards (Section 401).

Comprehensive Environmental Response, Compensation and Liability Act, 42 USC §§ 9601, et seq.

This act provides the basic legal framework for cleanup and restoration of the nation's hazardous-substances sites. Generally, parties responsible for contamination of sites and the current owners or operators of contaminated sites are liable for the cost of cleanup and restoration. CERCLA establishes a hazard ranking system for assessing the nation's contaminated sites with the most contaminated sites being placed on the NPL. The U.S. Department of the Interior promulgated regulations for the conduct of NRDAs under CERCLA at 43 CFR Part 11. NRDAs are intended to provide the basis for restoring, replacing, rehabilitating, and acquiring the equivalent of injured natural resources and services.

Oil Spill Responders Liability Act, 740 ILCS 113/1, et seq.

This act protects oil spill responders from liability for damages that may result from action taken or action omitted in the course of rendering assistance in an oil spill incident that is consistent with the NCP. This protection does not apply to the responsible party, or the entity which caused the oil spill incident. Under this act, the responsible party is liable for removal costs and damages to natural resources resulting from a discharge or spill of oil of any kind or in any form, including but not limited to, petroleum, fuel oil, sludge, and oil refuse.

Illinois Environmental Protection Act, 415 ILCS 5/1, et seq.

The Environmental Protection Act is the state law that prohibits most forms of pollution occurring on land, in water, or in the air. It also establishes a liability regime, including enforcement and penalties, for entities that violate the provisions of the act. It was developed for the purpose of establishing a unified state-wide program for environmental protection and cooperating with other states and with the United States in protecting the environment. It was also developed to restore, protect, and enhance the quality of the environment and to assure that adverse effects upon the environment are fully considered and borne by those who cause them.

Illinois Natural Areas Preservation Act, 525 ILCS 30/1 et seq.

This act serves to protect any area in Illinois that has been designated as a nature preserve, including the species of plants and animals in each habitat. Any endangered plant and animal species found in designated nature preserves are also protected under this act. Dedicating and holding an area for natural preserves is also encouraged under this act.

Illinois Endangered Species Protection Act, 520 ILCS 10/1 et seq.

This act gives protection to any plant and animal species on the endangered or threatened list from being moved or destroyed. Any species that the Secretary of the Interior of the United States lists as endangered or threatened is also included on the Illinois endangered and threatened species list. The act also provides rules of law for searching any premises suspected of illegally keeping goods or merchandise, animals or plants, or animal or plant products subject to the act and seizing such products.

Illinois Fish and Aquatic Life Code, 515 ILCS 5/5-5 et seq.; and Illinois Wildlife Code, 520 ILCS 5/1.10 et seq.

These codes state that IDNR shall take all measures necessary for the conservation, distribution, introduction, and restoration of aquatic life and wildlife, and they provide protection for aquatic life and wildlife from any person who causes waste, sewage, thermal effluent, or any other pollutant to enter into the waters of the state or habitat supporting the wildlife, which causes the death of aquatic life or wildlife. The IDNR, acting through the IAGO, has the authority to bring action against such persons to recover the value of any and all aquatic life or wildlife that is destroyed, related costs in determining such value, and any other fines or penalties provided for by these codes.

Interagency Wetland Policy Act of 1989, 20 ILCS 830/1 et seq.

This act provides state agencies with the responsibility for preserving, enhancing, and creating wetland areas for the purpose of increasing quality and quantity of the state's wetland resource base. The goal is no overall net loss of the state's existing wetland acres or their functional value due to state-supported activities.

Rivers, Lakes, and Streams Act 615 ILCS 5/18

No person is allowed to fill or deposit rock, earth, sand, or other material, or any refuse matter of any kind or description, or build or commence the building of any wharf, pier, dolphin, boom, weir, breakwater, bulkhead, jetty, causeway, harbor, or mooring facilities for watercraft, or any other structure, with the exception of duck blinds, in a public water body of the state without first submitting plans, data, and other important information to the Illinois IDNR and receiving a permit signed by the Director of the Department. Under this act, no person is allowed to build, deposit, or discharge any materials into Lake Michigan unless the Illinois EPA permits one to do so under Subsection (a) of Section 39 of the Illinois Environmental Protection Act.

Rivers and Harbors Act of 1899, Sections 9 and 10

Section 9. It is unlawful to build any structure in or across waters of the United States until plans are submitted and approved by the Secretary of Transportation, the Chief of Engineers, and the Secretary of Army and consent is given by Congress. Under permission of the legislation of the state, a person may build in or across waters whose navigable parts lie wholly in that state. The approval required by this section of the location and plans or any modification of plans of any bridge or causeway does not apply to any bridge or causeway over waters that are not subject to the ebb and flow of the tide, and that are not used and are not susceptible to use in their natural condition or by reasonable improvement as a means to transport interstate or foreign commerce.

Section 10. It is unlawful to build obstacles that prohibit navigation, unless authorized by Congress, and building of any structure outside harbor lines or where no harbor lines have been established is prohibited unless authorized by the Chief of Engineers and the Secretary of War. It is also unlawful to fill or modify any plan or structure within limits of breakwaters or the channel of any navigable waters of the United States unless approved by the Chief of Engineers and the Secretary of War.

40 CFR Part 300.605 – National Oil and Hazardous Substances Pollution Contingency Plan

State trustees shall act on behalf of the public as trustees for natural resources, including their supporting ecosystems, within the boundary of a state or belonging to, managed by, controlled by, or appertaining to such state. The governor of a state is encouraged to designate a state lead trustee to coordinate all state trustee responsibilities with other trustee agencies. The state lead trustee should have ready access to appropriate state officials with environmental protection, emergency response, and natural resource responsibilities. The EPA Administrator or the U.S. Coast Guard Commandant or their designees may appoint the state lead trustee as a member of the Area Committee. Response strategies should be coordinated between the state and other trustees for specific natural resource locations in an inland or coastal zone and should be included in the Fish and Wildlife and Sensitive Environments Plan Annex of the Area Contingency Plan.

43 CFR Part 11 – Natural Resource Damage Assessment

These regulations provide guidance for conducting an NRDA under CERCLA. CERCLA and CWA provide that natural resource trustees may assess damages to natural resources resulting from a discharge of oil or a release of hazardous substance covered under CERCLA and/or CWA. Trustees may seek to recover those damages and under NCP trustees can seek compensation for injuries to natural resources that may not be addressed by response actions of NCP.

15 CFR Part 990 – Natural Resource Damage Assessment

These regulations provide guidance for conducting an NRDA under OPA; they are very similar to those at 43 CFR Part 11, but focus on oil spills rather than hazardous substances. The OPA of 1990 provides the designation of federal, state, and, if designated by the Governor of the state, local officials to act on behalf of the public as trustees for natural resources and for the designation of Indian tribe and foreign officials to act as trustees for natural resources on behalf of, respectively, the tribe or its members and the foreign government. This part may be used by these officials in conducting NRDAs when natural resources and/or services are injured as a result of an incident involving an actual or substantial threat of a discharge of oil. This part is not intended to affect the recoverability of natural resource damages when recoveries are sought other than in accordance with this part.

B. Description of Property Owned and Managed by IDNR near DePue, IL

Donnelley/DePue State Fish and Wildlife Area

The Donnelley/DePue State Fish and Wildlife Area complex is owned and managed by the Illinois Department of Natural Resources. The state wildlife areas contain a variety of wetland habitats that have always been critical to migratory waterfowl. The 3,015-acre complex is managed primarily for waterfowl feeding, nesting, resting, harvesting and viewing. The Donnelley/DePue complex is home to a $1 million State Duck Stamp Project, which was funded through State Duck Stamp dollars, State of Illinois Capital Development Board funds and Ducks Unlimited M.A.R.S.H. contributions (IDNR 2008).

The complex includes many parcels including (Figure 1):

Donnelley State Wildlife Area

In 1982, Windblown Bottoms Duck Club, containing Coleman Lake, came under state management through the gifts and efforts of Gaylord and Dorothy Donnelley and was renamed Donnelley State Wildlife Area. Located in Putnam County, Donnelley Wildlife Area is open to the public during waterfowl season and open to school and study groups by appointment. Most of the year it is managed for wildlife needs, and is therefore closed to public use.

DePue State Fish and Wildlife Area

The DePue Rod and Gun Club was organized in the early 1900s. The state acquired the property in 1970. Lake DePue and Spring Lake lie within the boundary of DePue State Fish and Wildlife Area.

Before World War II, Lake DePue was a highly popular boating lake, especially attractive to boat racing and sailing regattas. According to local residents, the former lake depth was about 18 to 20 feet (Lee and Stall 1976).

Lake DePue and Spring Lake in Bureau County have rich histories of commercial hunting and fishing, attesting to the wildlife bounty of the area. Lake DePue is the current home of the annual American Power Boat Association's Pro Natural Boat Races and other hydroplane boat racing events.

Spring Lake is part of the Illinois Natural Area Inventory (INAI) site, Spring Lake INAI. Spring Lake INAI was designated as such due to the occurrence of Bald Eagles and an unusual concentration of Great Blue Herons, Double-crested Cormorants, and Snowy Egrets (J. Wilker, pers. comms).

The DePue Wildlife Management Area impoundment (DWMA) was created in 1982. The DWMA sits along a peninsula between Lake DePue and the Illinois River.

Hormel Landing and Miller-Anderson Nature Preserve

Hormel Landing is located adjacent to the village of Bureau Junction in Bureau County. Originally, the Hormel Company had built three impoundments as processing ponds for a meat-packing plant. When Hormel selected a different plant site, the land and ponds were transferred to the State. The ponds are nestled in a secluded basin surrounded by wooded bluffs, marshland, the Hennepin Canal and a bottomland woods that beavers have flooded. A state fish-stocking program supplements the ponds' natural restocking resulting from Illinois River flood events.

Along Route 29, at the Bureau-Putnam County border, wooded bluffs rise above the broad Illinois River Valley to create Miller-Anderson Woods Nature Preserve. Much of the preserve was donated to the State and dedicated to Dorothy Anderson in 1969. The preserve protects old-growth upland forest, ravines, valley forest and a floating bog. The majority of the bluff area consists of old-growth oak-hickory upland forest with maple-basswood forest occurring in the eroded ravines. Other communities such as sedge meadow, seep spring and hill prairie add unique vegetation to the already rich diversity. Notable plants include showy orchid and Schreber's aster. Seep areas with large accumulations of peat support marsh marigold and skunk cabbage. Ohio buckeye and queen-of-the-prairie also inhabit the site.

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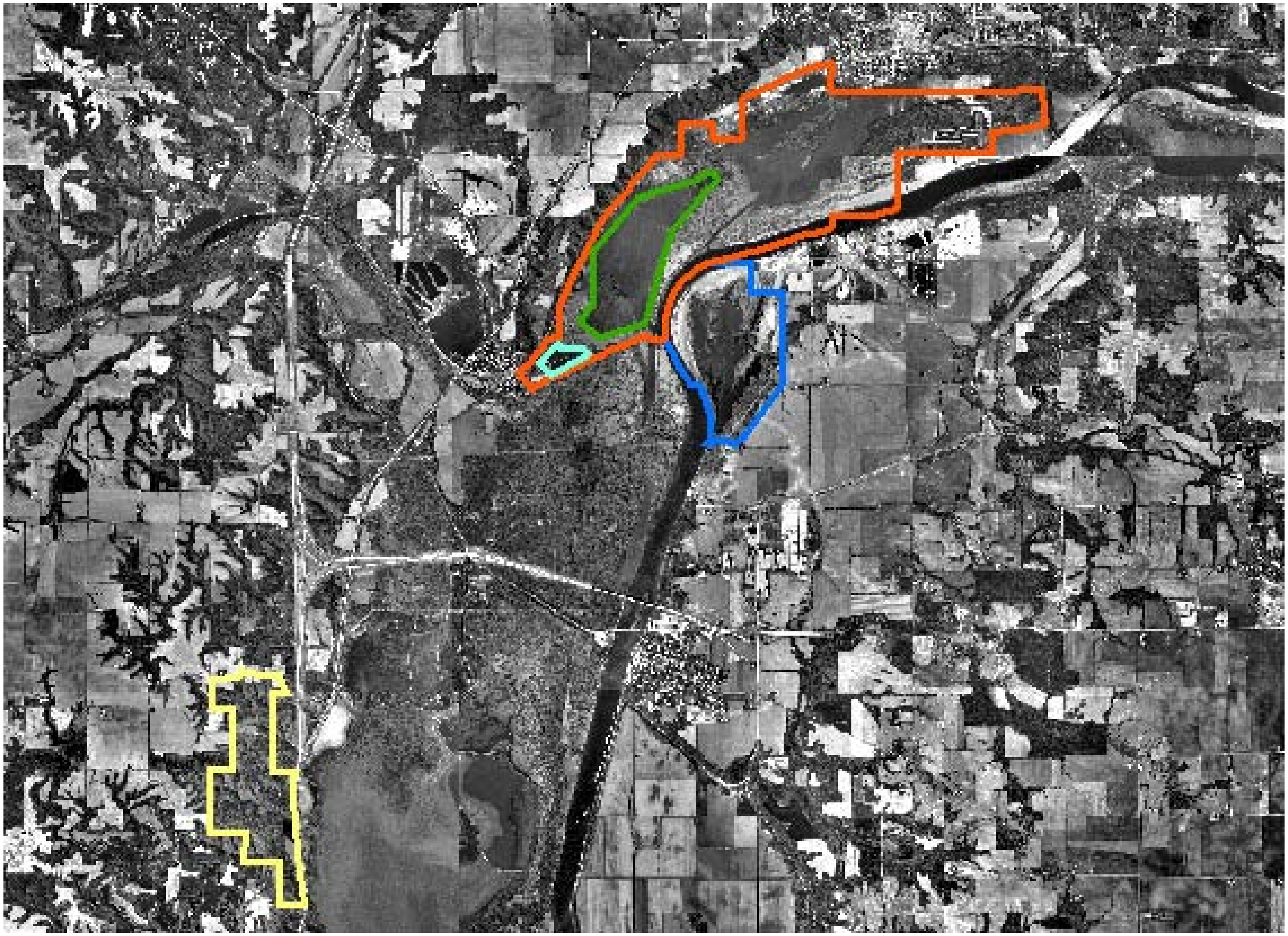
Figure 1. Donnelley/DePue State Fish and Wildlife Area complex is divided in to the following areas: Donnelley State Wildlife Area (blue); DePue State Fish and Wildlife Area (orange); Spring Lake (green); Hormel Landing (turquoise); and Miller-Anderson Nature Preserve (yellow).



C. Descriptions of Hazardous Substances of Concern at the New Jersey Zinc/Mobil Chemical Superfund Site

Metals

Zinc

Zinc is ubiquitous in the tissues of plants and animals. Zinc composes 0.004% of the Earth's crust and is 25th in order of abundance of the elements. Zinc is normally found in association with other base metals such as copper and lead in ores. Major uses of zinc are in the production of brass, noncorrosive alloys, and white pigments; in galvanization of iron and steel products; and in agriculture as a fungicide and as a protective agent against soil zinc deficiency. Anthropogenic sources of zinc include electroplaters, smelting and ore processors, mine drainage, domestic and industrial sewage, combustion of solid wastes and fossil fuels, road surface runoff, corrosion of zinc alloys and galvanized surfaces, and erosion of agricultural soils (Eisler, 1993).

Zinc is an essential trace element for all living organisms. Zinc has its primary effect on zinc-dependent enzymes that regulate ribonucleic acid (RNA) and deoxyribonucleic acid (DNA). The pancreas and bone are primary targets in birds and mammals; the gill epithelium is a primary target site in fish. Zinc interacts with many chemicals to produce altered patterns of accumulation, metabolism, and toxicity; some interactions are beneficial to the organism and others are not depending on the organism, its nutritional status, and other variables. Knowledge of these interactions is essential to the understanding of zinc toxicokinetics. Zinc bioavailability and toxicity to aquatic organisms are highest under conditions of low pH, low alkalinity, low dissolved oxygen, and elevated temperatures. Soluble chemical species of zinc are the most bioavailable and most toxic. Most of the zinc introduced into aquatic environments is eventually partitioned into sediments (Eisler, 1993).

The zinc National Recommended Water Quality Criteria (NRWQC) for the protection of aquatic life (U.S. EPA, 2009) of 120 µg/L (for both acute and chronic) are based on surface water concentrations of dissolved metals with water hardness at 100 mg/L calcium carbonate ($CaCO_3$). Some studies (specifically fish toxicity studies) indicate that the harder the water,[1] the less toxic

1. General hardness ranges: soft: 0–60 mg/L; moderately hard: 61–120 mg/L; hard: 121–180 mg/L; and very hard: > 181 mg/L.

metals such as zinc are to the fish.[2] The softer the water, the more toxic metals will be to aquatic life, specifically fish. The Illinois Water Quality Standards (ILWQS) are the same as the NRWQC [Title 35, Part 302].

MacDonald et al. (2000) report a threshold effects concentration (TEC)[3] of 121 mg/kg and a probable effects concentration (PEC)[4] of 459 mg/kg for zinc in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for zinc include:

- Water: 65.7 µg/L
- Sediment: 121 mg/kg
- Soil: 6,620 µg/kg.

EPA Ecological Soil Screening Levels (EcoSSLs) (U.S. EPA, 2007c) for zinc include:

- Plants: 160 mg/kg
- Soil invertebrates: 120 mg/kg
- Avian: 46 mg/kg
- Mammals: 79 mg/kg.

Cadmium

Cadmium is a relatively rare metal, and is commercially obtained as an industrial by-product of the production of zinc, copper, and lead. Major uses of cadmium are in electroplating, in pigment production, and in the manufacture of plastic stabilizers and batteries. Anthropogenic sources of cadmium include smelter fumes and dusts; the products of incineration of cadmium-bearing materials and fossil fuels; fertilizers; and municipal wastewater and sludge discharges (Eisler, 1985).

Cadmium has no known biological function. It may be taken into the body through respiration or ingestion where it may gradually accumulate in target organs resulting in eventual tissue dysfunction (Beyer et al., 1996). Cadmium is a known teratogen and carcinogen, a probable mutagen, and has been implicated as the cause of deleterious effects on fish and wildlife. For example, cadmium exposure in small mammals has been demonstrated to produce kidney and

2. Hardness cations (calcium and magnesium) can reduce the toxicity of certain metals by competing for binding sites at gill or cell membranes.

3. TEC is defined as the level below which harmful effects are unlikely to be observed.

4. PEC is defined as the level above which harmful effects are likely to be observed.

liver damage; alter blood chemistries; behave as an immunosuppressant; and reduce milk production, weight gain, and survival of offspring (Levengood et al., 2003). In sufficient concentration, it is toxic to all forms of life, including microorganisms, higher plants, animals, and humans. Teratogenic effects on animals appear to be greater for cadmium than for other metals, including lead, mercury, copper, indium, and arsenic (Eisler, 1985).

Toxicity can be influenced by pH, dissolved oxygen, temperature, and other factors.

The cadmium NRWQC for the protection of aquatic life (U.S. EPA, 2009) of 2.0 µg/L (acute) and 0.25 µg/L (chronic) are based on surface water concentrations of dissolved metals with water hardness at 100 mg/L $CaCO_3$. The ILWQS are the same as the NRWQC [Title 35, Part 302].

MacDonald et al. (2000) report a TEC of 0.99 mg/kg and a PEC of 4.98 mg/kg for cadmium in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for cadmium include:

- Water: 0.15 µg/L
- Sediment: 990 µg/kg
- Soil: 2.22 µg/kg.

EPA EcoSSLs (U.S. EPA, 2005b) for cadmium include:

- Plants: 32 mg/kg
- Soil invertebrates: 140 mg/kg
- Avian: 0.77 mg/kg
- Mammals: 0.36 mg/kg.

Copper

Copper is plentiful in the environment, and is probably the first metal worked by humans some 70 to 80 centuries ago. Most of the copper produced is used to manufacture electrical equipment, pipe, and machinery. Copper releases to the global biosphere, which may approach 1.8 million metric tons per year, come mostly from anthropogenic activities such as mining and smelting, industrial emissions and effluents, and municipal wastes and sewage sludge (Eisler, 1998).

Copper is essential for the normal growth and metabolism of all living organisms. However, copper is also among the most toxic of the heavy metals in freshwater and marine biota, and often accumulates and causes irreversible harm to some species at concentrations just above levels required for growth and reproduction (Eisler, 1998).

Toxicity can be influenced by pH, dissolved oxygen, temperature, and other factors.

Some studies (specifically fish toxicity studies) indicate that the harder the water, the less toxic metals such as copper are to the fish. The softer the water, the more toxic metals will be to aquatic life, specifically fish.

The copper NRWQC for the protection of aquatic life (U.S. EPA, 2007a, 2009) are calculated using site-specific data based on the Biotic Ligand Model. This model was developed to incorporate metal speciation and the protective effects of competing cations into predictions of metal bioavailability and toxicity. The ILWQS are calculated as a function of hardness [Title 35, Part 302].

In regards to the toxicity of metals in freshwater mussels, the NRWQC criteria apply as well. Studies of glochidia and juvenile mussels indicate that mussels may be more sensitive to metals than commonly tested fish and aquatic insects (Keller and Zam, 1991).

MacDonald et al. (2000) report a TEC of 31.6 mg/kg and a PEC of 149 mg/kg for copper in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for copper include:

- Water: 1.58 µg/L
- Sediment: 31.6 mg/kg
- Soil: 5,400 µg/kg.

EPA EcoSSLs (U.S. EPA, 2007b) for copper include:

- Plants: 70 mg/kg
- Soil invertebrates: 80 mg/kg
- Avian: 28 mg/kg
- Mammals: 49 mg/kg.

Chromium

Chromium is used widely in domestic and industrial products. In North America, thousands of tons of chromium ore and concentrates are imported annually for the production of stainless steels, chrome-plated metals, pigments for inks and paints, and a wide variety of chemicals. It has been documented that land dumping of wastes from chromate production and electroplating operations have been responsible for groundwater contamination, that discharge of chromium wastes into streams and lakes has caused damage to aquatic ecosystems, and that large amounts of hexavalent chromium (Cr^{6+}) and trivalent chromium (Cr^{3+}) are reintroduced into the environment as sewage and solid wastes by the disposal of consumer products containing chromium. Some of chromium's chemical forms, primarily Cr^{3+} and Cr^{6+}, are toxic. Although the natural mobilization of chromium by weathering processes is estimated at 32,000 tons/year, the amounts of chromium added to the environment as a result of anthropogenic activities are far greater (Eisler, 1986).

Chromium is an essential trace element in humans and some species of laboratory animals. Chromium is essential for normal metabolism of insulin and glucose in humans and for regulating carbohydrate metabolism in mammals. At high environmental concentrations, chromium is a mutagen, teratogen, and carcinogen. Toxic and sublethal properties of chromium are modified by a variety of biological and abiotic factors; and sensitivity to chromium varies widely, even among closely related species (Eisler, 1986).

Toxicity can be influenced by pH, dissolved oxygen, temperature, and other factors.

The dissolved Cr^{6+} NRWQC for the protection of aquatic life (U.S. EPA, 2009) are 16 µg/L (acute) and 11 µg/L (chronic). The Cr^{3+} NRWQC for the protection of aquatic life of 570 µg/L (acute) and 74 µg/L (chronic) (U.S. EPA, 2009) are based on surface water concentrations of dissolved metals with water hardness at 100 mg/L $CaCO_3$. The ILWQS are the same as the NRWQC [Title 35, Part 302].

MacDonald et al. (2000) report a TEC of 43.4 mg/kg and a PEC of 111 mg/kg for total chromium in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for total chromium include:

- Water: 42 µg/L
- Sediment: 43.4 mg/kg
- Soil: 400 µg/kg.

EPA EcoSSLs (U.S. EPA, 2008) for chromium include:

- Avian: Cr^{3+} -26 mg/kg
- Mammals: Cr^{3+} -34 mg/kg; Cr^{6+} -130.

Lead

Lead is ubiquitous and is a characteristic trace constituent in rocks, soils, water, plants, animals, and air. More than 4 million metric tons of lead is produced worldwide each year, mostly for the manufacture of storage batteries, gasoline additives, pigments, alloys, and ammunition. The widespread broadcasting of lead through anthropogenic activities, especially during the past 40 years, has resulted in an increase in lead residues throughout the environment. Lead is neither essential nor beneficial to living organisms; all existing data show that its metabolic effects are adverse (Eisler, 1988b).

Lead is toxic in most of its chemical forms and can be incorporated into the body by inhalation, ingestion, dermal absorption, and placental transfer to the fetus. It is an accumulative metabolic poison that affects behavior, as well as the hematopoietic (blood formation), vascular, nervous, renal, and reproductive systems. Lead damages nerve cells and ganglia, and alters cell structure and enzyme function. It adversely affects survival, growth, reproduction, development, and metabolism of most species under controlled conditions, but its effects are substantially modified by numerous physical, chemical, and biological variables. Lead is toxic to all phyla of aquatic biota, though effects are modified significantly by various biological and abiotic variables (Eisler, 1988b). Lead is especially toxic to fish and can lead to excess mucous formation, which can coat the gills and impact respiration (Irwin et al., 1997). Lead is not essential for plants, and excessive amounts can cause growth inhibition, as well as reduced photosynthesis, mitosis, and water absorption (Eisler, 1988b).

Toxicity can be influenced by pH, dissolved oxygen, temperature, and other factors.

The lead NRWQC for the protection of aquatic life of 65 µg/L (acute) and 2.5 µg/L (chronic) (U.S. EPA, 2009) are based on surface water concentrations of dissolved metals with water hardness at 100 mg/L $CaCO_3$. The ILWQS are the same as the NRWQC [Title 35, Part 302].

MacDonald et al. (2000) report a TEC of 35.8 mg/kg and a PEC of 128 mg/kg for lead in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for lead include:

- Water: 1.17 µg/L
- Sediment: 35.8 mg/kg
- Soil: 53.7 µg/kg.

EPA EcoSSLs (U.S. EPA, 2005c) for lead include:

- Plants: 120 mg/kg
- Soil invertebrates: 1,700 mg/kg
- Avian: 11 mg/kg
- Mammals: 56 mg/kg.

Arsenic

Arsenic is a relatively common element that occurs in air, water, soil, and all living tissues. Most arsenic produced is used in the manufacture of agricultural products such as insecticides, herbicides, fungicides, algicides, wood preservatives, and growth stimulants for plants and animals. Exposure to arsenic can happen by way of atmospheric emissions from smelters, coal-fired power plants, and arsenical herbicide sprays; from water contaminated by mine tailings, smelter wastes, and natural mineralization; and from diet. All such exposures may pose potent ecological dangers (Eisler, 1988a).

Arsenic is a teratogen and carcinogen that can traverse placental barriers and produce fetal death and malformations in many species of mammals. Since the substance is ubiquitous, it is present in the living tissue and is constantly being oxidized, reduced, or otherwise metabolized. In soils, insoluble or slightly soluble arsenic compounds are constantly being resolubilized, and the arsenic is presented for plant uptake or reduction by organisms and chemical processes (Eisler, 1988a).

Toxicity can be influenced by pH, dissolved oxygen, temperature, and other factors.

The total dissolved arsenic NRWQC for the protection of aquatic life (U.S. EPA, 2009) are 340 µg/L (acute) and 150 µg/L (chronic). The ILWQS for trivalent dissolved arsenic are 360 µg/L (acute) and 190 µg/L (chronic) [Title 35, Part 302].

MacDonald et al. (2000) report a TEC of 9.79 mg/kg and a PEC of 33 mg/kg for total arsenic in sediment, based on a meta-analysis of many different sediment toxicity studies.

EPA, *Region 5, RCRA Ecological Screening Levels* (U.S. EPA, 2003) for total arsenic include:

- Water: 148 µg/L
- Sediment: 9,790 µg/kg
- Soil, 5,700 µg/kg.

EPA EcoSSLs (U.S. EPA, 2005a) for total arsenic include:

- Plants: 18 mg/kg
- Avian: 43 mg/kg
- Mammals: 46 mg/kg.

Waste

Slag

Until the late 1990s, slag, the glassy material left over when metals are refined from ore, was considered ugly but harmless. Because slag was considered chemically inert historically, it was mixed with cement and used to construct roadways and railroad beds. It has been used for sand blasting, as an additive to roofing shingles, and to sand roads in the winter. However, slag produced in refining copper, zinc, cadmium, and other base metals can contain significant concentrations of a number of potentially toxic elements, including arsenic, lead, cadmium, barium, zinc, and copper. It has also been shown that slag can release these elements into the environment under natural weathering conditions and cause pollution of soils, surface waters, and groundwater (Stanford News Service, 1998).

Lithopone

Lithopone is a mixture of barium sulfate and zinc sulfide (O'Brien, 1915). Lithopone waste (i.e., lithopone ridges at OU-3) is a contaminant source for potential natural resource injuries.

Phosphogypsum, ammonia, and sulfate

Fluoride and antimony are trace elements that may be found in phosphogypsum sites. Trace metals such as these (as well as the metals listed in Section 2.2) may leach from Phosphogypsum Stacks and migrate to nearby surface and groundwater resources. Constituents identified as "typically associated with Phosphogypsum Stack systems" include fluoride, phosphorus, nitrate as nitrogen, ammonia as nitrogen, sulfate, and TDS. Uranium and radium naturally occur in phosphate ore, and are therefore byproducts of Phosphogypsum Stacks.

Polycyclic aromatic hydrocarbons

PAHs are a group of organic contaminants that form from petroleum products or the incomplete combustion of hydrocarbons, such as coal and gasoline (USGS, 2013). They are ubiquitous environmental pollutants and are formed from both natural and anthropogenic sources, the major contributor being anthropogenic (Eisler, 1987). Natural sources include forest fires, volcanic eruptions, and degradation of biological materials, which has led to the formation of these compounds in various sediments and fossil fuels. Major anthropogenic sources include the burning of coal refuse banks, coke production, automobiles, commercial incinerators, and wood gasifiers (USGS, 2013).

Weathering processes occurring in aquatic environments include evaporation, photochemical oxidation, microbial degradation, dispersion and dissolution in the water, and deposition on sediments. PAHs are generally hydrophobic, and thus they tend to be found in higher concentrations in sediments than in the water column. PAHs in the water column are usually found in suspended material rather than in the water itself (Beyer et al., 1996). PAHs are an environmental concern because they are toxic to aquatic life and because several are suspected human carcinogens (USGS, 2013).

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D. Potentially Affected Natural Resources and Resource Services

Natural resources and related services that have been affected or potentially affected by releases of hazardous substances from the Site include, but are not limited to:

- Surface water resources
- Sediment resources
- Groundwater and aquifer resources at and downgradient of contaminant sources
- Soil resources, including floodplain soils adjacent to the Lake, Negro Creek, and the Illinois River
- Aquatic resources, including several species of fish and benthic invertebrates
- Terrestrial resources, including several species of mammals and birds
- Habitat for fish and wildlife, including food, shelter, breeding and rearing areas, and other factors essential for long-term survival
- Consumptive and non-consumptive outdoor recreation, including fishing, hunting, trapping, wildlife viewing, and photography
- Primary and secondary contact recreation, including swimming, boating, and other activities
- Use, option, and bequest values related to all of the above services
- Nonuse values, including existence values, related to all of the above services.

Further descriptions of potentially affected resources and services follow. The statements below are supported by various RI work plans and reports, some of which are specifically referenced in the following sections.

Surface water resources

Contaminants in surface waters pose a threat to aquatic species such as fish, mussels, and invertebrates, which spend their entire lifecycle in these waters. Releases to surface waters may also adversely affect species such as amphibians and emergent insects that have a portion of their lifecycles dependent on surface waters. Species that depend on aquatic resources for their food or water supply, such as piscivorous birds, insectivorous birds, and migratory waterfowl, may also be adversely affected by contaminants in surface waters.

The Lake has received and continues to receive discharges from the Site (ARCADIS, 2009). Other surface water resources potentially impacted by Site-related constituents are Negro Creek and the Illinois River.

Sediment resources

Given the nature of many of the chemical constituents associated with the Site, discharges to surface waters have most likely resulted in adverse effects on the floodplain soils, sediments, and the services associated with them. Services associated with sediments include energy and nutrient transport pathways and habitat for many benthic species, including benthic finfish and shellfish.

The *DePue Lake Remedial Investigation Report* (ARCADIS, 2009) and the draft baseline ecological risk assessment for the Lake (ARCADIS, 2012) documented the existence of contaminated lake sediments.

Groundwater resources

Significant releases of Site-related contaminants to groundwater have occurred (Environ, 2006, 2014; Terra, 2013). Services provided by groundwater in this area include recharge of surface water systems and drinking water through residential wells.

A detailed groundwater investigation report documented groundwater contamination specifically related to OU-2 (Terra, 2013). An investigation of the groundwater at OU-3 was reported in the Phase II Remedial Investigation Report, OU-3: On-site Soils and Groundwater, DePue Site, DePue, IL (Environ, 2014).

Soil resources

Upland and floodplain soils have been affected by Site-related contaminants. Contaminant sources have been identified at the soil surface and subsurface in various locations throughout the Site (ARCADIS, 2009, 2012; Environ, 2014).

Services associated with soils include energy and nutrient transport, habitat for terrestrial biota, and surface-water filtration associated with groundwater recharge.

Threatened and endangered resources

Several threatened and endangered species potentially occur in the vicinity of DePue, Illinois (Table D.1). These state and federal threatened and endangered species are present in Bureau County and may be on the Site or in its vicinity (IDNR, 2014; USFWS, 2014).

Table D.1. State and federally listed threatened and endangered species in Bureau County, Illinois

Plants	Birds	Fish	Herps	Insects	Mammals
Eastern prairie fringed orchid (FT)	Yellow-headed blackbird (SE)	Starhead topminnow (ST)	Blandings turtle (SE)	Regal fritillary (ST)	Indiana bat (FE, SE)
Decurrent false aster (FT, ST)	Cerulean warbler (ST)	Blacknose shiner (SE)	Plains hog-nosed snake (ST)		Northern long-eared bat (proposed FE)
Queen-of-the-prairie (SE)	Loggerhead shrike (SE)	Weed shiner (SE)			
Tall sunflower (SE)					
Ear-leafed foxglove (ST)					
Broomrape (ST)					
Jack pine (SE)					

E = Endangered; F = Federal; S = State; T = Threatened.

Sources: IDNR, 2014; USFWS, 2014.

Contaminant effects and services for endangered species will be discussed in the following subsections under the general species type.

Aquatic resources

Benthic and epibenthic species

The area around the Site has both lentic and lotic surface-water habitats; therefore, several benthic and epibenthic species are likely to occur in the vicinity of the Site. The following benthic macroinvertebrates were observed during the Lake RI sampling (ARCADIS, 2009) and other survey efforts: leeches; worms; beetles, such as water scavenger beetle; true flies, such as biting midge; mayflies, such as burrowing mayfly; true bugs, such as water boatmen; snails; and crayfish (Levengood et al., 2002, 2003).

Invertebrates play a key role near the base of the food chain as prey. These lower trophic level organisms are sensitive to contaminants identified at the Site. For example, testing of benthic organisms within the Lake was conducted and results indicated that some samples were toxic to the organisms (ARCADIS, 2012). Sediments within the South Ditch were acutely toxic to the test organisms (Illinois EPA, 1998). Following these findings, the DePue Group removed some contaminated sediments from the South Ditch in 2005; however, remaining sediments may have become recontaminated by groundwater discharges and bypass from the IWTP during periods of high flow.

Contamination may potentially have affected and continue to affect the relative abundance and diversity of these prey organisms needed by second-order consumers such as fish and birds. Such organisms also play a key role in energy and nutrient transport cycles.

Fish

Located in the waters of the Lake and the Illinois River are several game and non-game fish species. These include walleye, sauger, white bass, smallmouth bass, largemouth bass, channel catfish, drum, crappie, bullhead, and carp (IDNR, 2013b). During the Lake RI sampling, approximately 21 fish species were observed, including (ARCADIS, 2009) bigmouth buffalo, smallmouth buffalo, black bullhead, brown bullhead, black crappie, channel catfish, common carp, freshwater drum, green sunfish, orangespotted sunfish, shortnose gar, smallmouth bass, white bass, white perch, and emerald shiner (see the attachment to this appendix).

Many site-related contaminants can be toxic to fish. These contaminants can bioconcentrate and bioaccumulate and be stored in tissues and reproductive organs. They may adversely affect the growth, survival, and reproduction of the affected organism, which in turn may reduce biodiversity and relative abundance in the community. Contaminant concentrations that exceed appropriate benchmark values and results from fish surveys in the Lake indicate possible impacts to fish (ARCADIS, 2012).

Reptiles and amphibians

The Site is potentially used by several species of reptiles and amphibians (herpetofauna, or herps). Herps typically found in the habitat associated with the Site include turtles, snakes, and frogs (Levengood et al., 2002). During the Lake RI sampling, the following 11 herp species were observed: American toad, blue racer snake, bullfrog, Fowler’s toad, garter snake, green frog, leopard frog, pickerell frog, red-eared slider, snapping turtle, and spiny softshell turtle (ARCADIS, 2009; see the attachment).

Because of the unique physiology of herps, especially amphibians, they are susceptible to toxicity from Site-related contaminants. They may be exposed to contaminants through contact with soils and water, and through ingestion of food items, water, or soils. Contaminants may bioaccumulate in tissues where they can interfere with growth, survival, and reproduction.

Reptiles and amphibians provide important ecological services as prey items for higher trophic level organisms such as birds, mammals, and fish.

Terrestrial resources

Plants

Site-related contaminants also potentially adversely affect plants. Such effects include growth reduction, leaf wilting, discoloration, root damage, and inability to photosynthesize.

During the RI, habitat characterization was completed for different portions of the Site. Such characterizations were generally based on the Illinois Gap Analysis and field reconnaissance (ARCADIS, 2009), which identified such community types as hardwood forest, scrub shrub and wetlands.

The Trustees are unaware of any Site-specific comprehensive quantitative survey results for plant species at the Site. The Lake RI included a qualitative survey, indicating areas of stressed vegetation near the South Ditch and Division Street outfall (ARCADIS, 2009). Areas of stressed vegetation have also been observed in the Bluff Area north of the former plant site (Environ, 2014; B. Whetsell, IDNR, personal communication, 2014).

Birds

The Site is used for foraging and feeding by waterfowl, colonial waterbirds, and songbirds. The surrounding floodplain of the Lake to the east, south, and west is a known bald eagle nesting location (IDNR, 2013a). To the west is also a rookery with 600 to 1,000 great blue heron nests, and a lesser number of cormorants, great egrets, and snowy egrets (IDNR, 2013a). During the Lake RI sampling, approximately 100 bird species were observed, including the blue-winged teal, American white pelican, bald eagle, great blue heron, red-tailed hawk, Cooper’s hawk, belted kingfisher, Canada goose, great crested flycatcher, scissor-tailed flycatcher, great egret, prairie warbler, yellow warbler, mallard duck, wood duck, and great horned owl (ARCADIS, 2009; see the attachment).

Birds may feed on contaminated prey and some, including waterfowl such as mallard ducks, could directly ingest contaminated sediments. The CAMU of South Ditch sediments located in the FPSA retains water on its surface and may be an attractive nuisance to some biota, particularly birds. The draft Lake DePue ecological risk assessment indicates possible low-level impacts to avian receptors, particularly in the area of the South Ditch and Division Street outfall (ARCADIS, 2012).

Mammals

The Site is potentially used by several species of mammals. Some representative species of include the white-footed mouse, voles, short-tailed shrews, raccoons, mink, and river otters (Levengood et al., 2002, 2003). During the Lake RI sampling, approximately 19 mammal species were observed, including beaver, coyote, Eastern cottontail, opossum, Eastern chipmunk, fox, grey squirrel, masked shrew, muskrat, woodchuck, and whitetail deer (ARCADIS, 2009; see the attachment).

Larger mammals are particularly susceptible to toxicity from chemicals that biomagnify; large mammals are generally the top-level consumers in the ecosystem, ingesting large numbers of organisms with lower concentrations of contamination. The Lake ecological risk assessment indicates possible low-level impacts to mammals, particularly in the area of the South Ditch and Division Street outfall (ARCADIS, 2012).

Insects and nematodes

Site-related contaminants may adversely affect insects, arachnids, and nematodes. Some representative species at the Site may include grasshoppers, crickets, butterflies, moths, beetles, spiders, and earthworms. Effects could include growth reduction and declining lifespan (Butler et al., 2009).

Insects are an essential component of both riverine and terrestrial ecosystems.

The Trustees are unaware of any Site-specific comprehensive quantitative or qualitative survey results for terrestrial insect, arachnid, and nematode species at the Site.

Habitat for fish and wildlife

For purposes of this section, habitat services for fish and wildlife include food, shelter, breeding and rearing areas, and other factors for long-term survival.

The Site provides valuable habitat services for bird breeding and rearing of broods. The Site is located in a major migratory bird flyway.[1] With its diverse ecological settings, including its many surface water areas, it is an attractive stopover for migratory waterfowl during their spring

1. Frank C. Bellrose, world-renowned waterfowl expert, designated this area as the entry point to the lower Illinois River valley, an important North American waterfowl migration corridor (IDNR, 2013b).

and fall migrations. The floodplain and Bluff Area provide attractive stopover areas for passerine species as well.

The surface water areas also provide habitat services for fish, shellfish, amphibian, and reptile species. The floodplain and Bluff Area also provide habitat services for mammal, amphibian, reptile, and plant life.

Consumptive and non-consumptive outdoor recreation

Migratory birds provide consumptive and non-consumptive recreational opportunities, such as bird watching, nature photography, and waterfowl hunting.

Some mammalian species associated with the Site are game species that provide recreational hunting. Additionally, there are many furbearing species located near the Site, which may provide supplemental income to commercial trappers.

Surface waters within and near the Site also support recreational and commercial fishing and wildlife viewing (IDNR, 2013b).

Primary and secondary contact recreation

Recreational boating, including national competition racing, swimming, and other activities, are common uses of the Lake.

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Attachment. Excerpt from the Draft OU-5 Baseline Ecological Risk Assessment for DePue Lake, June 2012

Table 2-1
Wildlife Survey Results - Birds

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4				Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Non-Survey	Fall	Winter	Spring	Fall	Winter	Spring
Corvus	*brachyrhynchos*	American Crow			x		x			x	x		x			x	x		x		
Carduelis	*tristis*	American Goldfinch	x		x	x	x	x	x	x	x	x		x		x	x	x	x	x	x
Setophaga	*ruticilla*	American Redstart	x		x						x										x
Turdus	*migratorius*	American Robin		x	x	x		x	x	x	x	x		x				x			x
Pelecanus	*erythrorhynchos*	American White Pelican													x			x	x		
Haliaeetus	*leucocephalus*	Bald Eagle				x							x		x					x	
Icterus	*galbula*	Baltimore Oriole			x									x	x			x			x
Hirundo	*rustica*	Barn Swallow									x								x		
Strix	*varia*	Barred Owl	x						x	x	x										
Ceryle	*alcyon*	Belted Kingfisher	x	x			x			x			x			x			x		
Mniotilta	*varia*	Black-and-White Warbler							x												
Coccyzus	*erythropthalmus*	Black-billed Cuckoo	x		x	x															
Poecile	*atricapillus*	Black-capped Chickadee	x	x	x	x	x	x	x	x		x	x				x		x		x
Anas	*rubripes*	Black Duck					x														
Coragyps	*atratus*	Black Vulture			x																
Cyanocitta	*cristata*	Blue Jay	x		x		x		x	x			x	x		x			x		x
Polioptila	*caerulea*	Blue-gray Gnatcatcher	x		x	x		x			x	x		x				x			
Anas	*discors*	Blue-wing Teal		x												x					
Vermivora	*pinus*	Blue-winged Warbler									x							x			
Molothrus	*ater*	Brown-headed Cowbird			x			x			x			x				x			x
Bucephala	*albeola*	Bufflehead Duck													x						
Branta	*canadensis*	Canada Goose			x			x	x		x		x	x		x					

See notes on Page 5.

Table 2-1
Wildlife Survey Results - Birds

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4			Non-Survey	Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring		Fall	Winter	Spring	Fall	Winter	Spring
Thryothorus	*ludovicianus*	Carolina Wren				x					x								x		
Bombycilla	*cedrorum*	Cedar Waxwing			x	x		x	x		x										x
Chaetura	*pelagica*	Chimney Swift			x	x		x													x
Spizella	*passerina*	Chipping Sparrow		x		x			x												
Petrochelidon	*pyrrhonota*	Cliff Swallow	x			x															
Quiscalus	*quiscula*	Common Grackle	x	x	x	x	x	x		x	x	x	x	x		x	x	x			x
Gallinago	*gallinago*	Common Snipe		x																	
Geothlypis	*trichas*	Common Yellowthroat							x												x
Accipter	*cooperii*	Cooper's Hawk											x								
Phalacrocorax	*auritus*	Double-crested Cormorant							x			x						x	x	x	
Picoides	*pubescens*	Downy Woodpecker			x	x		x			x							x			x
Sialia	*sialis*	Eastern Bluebird						x							x						
Tyrannus	*tyrannus*	Eastern Kingbird			x	x								x							
Sayornis	*phoebe*	Eastern Phoebe	x								x								x		
Pipilo	*erythrophthalmus*	Eastern Towhee							x			x									
Contopus	*virens*	Eastern Wood-Pewee	x		x	x	x		x					x		x		x			x
Passer	*domesticus*	English Sparrow									x										
Sturnus	*vulgaris*	European Starling		x	x		x	x		x	x		x	x			x				x
Spizella	*pusilla*	Field Sparrow			x			x			x										
Dumetella	*carolinensis*	Gray Catbird				x		x			x					x					x
Ardea	*herodias*	Great Blue Heron	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	
Myiarchus	*crinitus*	Great Crested Flycatcher			x			x	x		x			x							x

See notes on Page 5.

Table 2-1
Wildlife Survey Results - Birds

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4				Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Non-Survey	Fall	Winter	Spring	Fall	Winter	Spring
Ardea	*alba*	Great Egret	x			x	x		x			x				x			x		
Bubo	*virginianus*	Great Horned Owl				x															
Tringa	*melanoleuca*	Greater Yellowlegs		x						x		x									
Butorides	*virescens*	Green Heron							x							x					
Anas	*crecca*	Green Wing Teal													x						
Picoides	*villosus*	Hairy Woodpecker		x	x	x	x	x		x		x	x	x		x	x	x	x		
Ammodramus	*henslowii*	Henslow's Sparrow			x																
Carpodacus	*mexicanus*	House Finch									x										
Passer	*domesticus*	House Sparrow								x	x										
Troglodytes	*aedon*	House Wren			x	x			x		x	x		x		x		x	x		
Passerina	*cyanea*	Indigo Bunting	x		x	x					x	x		x				x			x
Charadrius	*vociferus*	Killdeer	x		x		x	x			x	x		x					x		
Empidonax	*minimus*	Least Flycatcher	x																		
Aythya	*affinis*	Lesser Scaup													x						
Tringa	*flavipes*	Lesser Yellowlegs	x			x	x					x	x								
Anas	*platyrhynchos*	Mallard	x	x		x	x	x		x			x	x		x		x			x
Zenaida	*macroura*	Mourning Dove	x			x			x	x	x	x				x					x
Cardinalis	*cardinalis*	Northern Cardinal	x	x	x	x		x	x	x	x					x	x				
Colaptes	*auratus*	Northern Flicker	x	x	x		x		x	x	x	x	x	x		x	x	x	x		x
Circus	*cyaneus*	Northern Harrier									x										
Mimus	*polyglottos*	Northern Mockingbird				x	x														
Anas	*acuta*	Northern Pintail		x			x						x								

See notes on Page 5.

Table 2-1
Wildlife Survey Results - Birds

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4				Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Non-Survey	Fall	Winter	Spring	Fall	Winter	Spring
Stelgidopteryx	*serripennis*	Northern Rough-winged Swallow	x		x	x		x	x		x	x		x		x		x	x		x
Icterus	*spurius*	Orchard Oriole													x			x			
Pandion	*haliaetus*	Osprey													x						
Podilymbus	*podiceps*	Pied-billed Grebe								x			x								
Dryocopus	*pileatus*	Pileated Woodpecker	x	x		x							x	x		x		x	x	x	
Dendroica	*discolor*	Prairie Warbler						x													
Protonotaria	*citrea*	Prothonotary Warbler			x			x			x			x				x			x
Melanerpes	*carolinus*	Red-bellied Woodpecker			x			x						x				x			x
Vireo	*olivaceus*	Red-eyed Vireo			x	x												x			
Melanerpes	*erythrocephalus*	Red-headed Woodpecker				x		x	x	x					x		x	x	x	x	
Buteo	*lineatus*	Red-shouldered Hawk											x								
Buteo	*jamaicensis*	Red-tailed Hawk		x	x	x	x	x				x	x			x			x		
Agelaius	*phoeniceus*	Red-winged Blackbird			x	x		x			x			x				x		x	x
Larus	*delawarensis*	Ring-billed Gull				x	x		x	x		x	x			x	x	x	x	x	
Archilochus	*colubris*	Ruby-throated Hummingbird			x	x		x	x			x			x	x					x
Tyrannus	*forficatus*	Scissor-tailed Flycatcher						x													
Pipilo	*erythrophthalmus*	Rufous-sided Towhee			x									x							
Oxyura	*jamaicensis*	Ruddy Duck													x						
Cistothorus	*platensis*	Sedge Wren									x			x							
Junco	*hyemalis*	Slate-colored Junco		x			x			x							x				
Melospiza	*melodia*	Song Sparrow	x	x	x	x	x	x	x	x	x	x		x		x	x	x			
Actitis	*macularius*	Spotted Sandpiper	x					x				x									
Melospiza	*georgiana*	Swamp Sparrow						x													

See notes on Page 5.

Table 2-1
Wildlife Survey Results - Birds

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4			Non-Survey	Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring		Fall	Winter	Spring	Fall	Winter	Spring
Tachycineta	*bicolor*	Tree Swallow	x		x	x		x			x			x				x			x
Baeolophus	*bicolor*	Tufted Titmouse	x								x	x									
		Unknown Warbler												x							x
Empidonax		Unknown Flycatcher																x			
Cathartes	*aura*	Turkey Vulture			x	x		x			x										
Sitta	*carolinensis*	White-breasted Nuthatch		x	x	x	x		x	x	x	x	x			x	x	x	x	x	x
Vireo	*griseus*	White-eyed Vireo						x						x							
Zonotrichia	*albicollis*	White-throated Sparrow		x		x	x				x						x				
Meleagris	*gallopavo*	Wild Turkey						x			x				x						
Aix	*sponsa*	Wood Duck		x			x				x		x	x	x	x					x
Dendroica	*petechia*	Yellow Warbler	x		x			x										x			x
Coccyzus	*americanus*	Yellow-billed Cuckoo	x		x	x		x	x			x		x					x		x

Notes:
1. Observations include auditory calls, nests, and visual sightings.
2. Non-survey observations were recorded during other activities (e.g., biological sampling).

Table 2-2
Wildlife Survey Results - Reptiles and Amphibians

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4				Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Non-Survey	Fall	Winter	Spring	Fall	Winter	Spring
Bufo	*americanus*	American Toad	x		x										x						
Coluber	*constrictor*	Blue Racer Snake						x													
Rana	*catesbeiana*	Bullfrog						x													
Bufo	*fowleri*	Fowler's Toad	x																		
Thamnophis	*sirtalis*	Garter Snake													x						
Rana	*clamitans*	Green Frog				x		x	x						x						x
Rana	*pipiens*	Leopard Frog	x		x	x			x						x				x		
Rana	*palustris*	Pickerell Frog													x						
Chrysemys	*scripta*	Red-eared Slider																			x
Chelydra	*serpentina*	Snapping Turtle	x			x		x				x									
Apalone	*spinifera*	Spiny Softshell Turtle													x						

Notes:
1. Observations include auditory calls, tracks, and visual sightings.
2. Non-survey observations were recorded during other activities (e.g., biological sampling).

Table 2-3
Wildlife Survey Results - Mammals

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Genus	Species	Common Name	DePue Lake													Goose Lake					
			Location 1			Location 2			Location 3			Location 4				Background 1			Background 2		
			Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Fall	Winter	Spring	Non-Survey	Fall	Winter	Spring	Fall	Winter	Spring
Castor	*canadensis*	Beaver				x	x	x	x				x								
Canis	*latrans*	Coyote			x			x			x						x			x	
Tamias	*striatus*	Eastern Chipmunk													x						
Sylvilagus	*floridanus*	Eastern Cottontail					x														
Felis	*domesticus*	Feral Cat														x					
Sciurus	*niger*	Fox Squirrel													x						
Peromyscus	*maniculatus*	Deer Mouse													x						
Sciurus	*carolinensis*	Grey Squirrel				x	x		x	x	x	x			x	x			x		
Sorex	*cinereus*	Masked Shrew													x						
Microtus	*pennsylvanicus*	Meadow Vole													x			x			
Mustela	*vison*	Mink										x									
Ondatra	*zibethica*	Muskrat				x	x	x					x	x							
Didelphis	*virginiana*	Opossum																			
Procyon	*lotor*	Raccoon	x		x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x
Lontra	*canadensis*	River Otter													x						
Blarina	*brevicauda*	Shorttail Shrew													x						
--	--	Small Mammals [1]				x			x						x						x
Odocoileus	*virginianus*	Whitetail Deer	x	x	x	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x
Marmota	*monax*	Woodchuck						x													

Notes:

Observations include tracks, signs such as burrows or feed piles, and visual sightings.

1. Small mammals such as mice, shrews, and voles were included in this category when a positive species level identification could not be determined.
2. Non-survey observations were recorded during other activities (e.g., biological sampling).

Table 2-4
Benthic Macroinvertebrate Survey Results

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobile Chemical Site
DePue, Illinois

	DePue Lake										
Station	**L3**	**M-1.5**	**N-1.5**	**N3**	**O1**	**P.5-1**	**P-1.5**	**R-1.5**	**G8**	**J4**	**J6**
Annelida											
Oligochaeta											
Tubificida											
Naididae											
Naididae	0	0	0	0	1	0	0	0	0	0	0
Nais variabilis	0	0	0	0	1	0	0	0	0	0	0
Tubificidae											
Branchiura sowerbyi	0	0	0	0	0	2	0	2	12	0	0
Ilyodrilus sp.	0	0	3	0	0	0	0	0	0	0	0
Ilyodrilus templetoni	11	20	6	2	0	0	0	2	5	0	1
Limnodrilus cervix	0	0	0	0	0	0	0	0	68	36	71
Limnodrilus hoffmeisteri	0	0	0	0	0	0	0	0	26	9	8
Limnodrilus maumunsis	0	0	0	0	0	0	0	0	1	23	23
Limnodrilus sp.	44	58	38	50	91	53	46	52	64	44	50
Limnodrilus udekemianus	0	0	0	0	0	0	0	0	0	0	0
Tassekidrilus americanus	2	0	0	0	0	0	0	0	0	0	0
Tubifex tubifex	0	0	0	0	0	0	0	0	1	0	0
Tubificidae	182	130	68	69	61	48	59	110	324	136	224
Arthropoda											
Insecta											
Coleoptera											
Hydrophilidae	0	0	0	0	0	0	0	0	0	0	0
Diptera											
Ceratopogonidae											
Bezzia sp.	0	0	0	0	0	1	0	1	0	0	0
Ceratopogon sp.	0	0	0	0	0	0	0	1	0	0	0
Ceratopogonidae	1	0	0	0	1	0	0	0	0	0	0
Culicoides sp.	0	0	0	0	0	0	0	0	0	0	0
Mallochohelea sp.	0	0	0	0	0	0	0	0	0	0	0
Sphaeromias sp.	5	4	3	1	20	4	16	25	23	49	37
Chaoboridae											
Chaoborus sp.	0	0	0	0	0	0	0	0	0	0	0
Chironomidae											
Chironomid pupa	0	0	1	1	3	2	2	1	0	0	0
Chironomidae	0	0	0	0	0	0	0	0	0	0	0
Chironomus sp.	8	7	16	36	25	17	58	15	26	4	35
Cryptochironomus sp.	1	3	8	9	5	4	14	4	11	8	7
Glyptotendipes sp.	1	0	0	0	0	0	0	0	0	0	0
Harnischia sp.	0	0	0	0	0	0	0	0	0	0	0
Microchironomus sp.	0	2	2	1	8	0	10	8	4	2	24

Table 2-4
Benthic Macroinvertebrate Survey Results

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobile Chemical Site
DePue, Illinois

	DePue Lake										
Station	**L3**	**M-1.5**	**N-1.5**	**N3**	**O1**	**P.5-1**	**P-1.5**	**R-1.5**	**G8**	**J4**	**J6**
Chironomidae *(continued)*											
Paratendipes sp.	0	0	0	0	0	0	0	0	0	0	0
Polypedilum flavum	0	0	0	0	0	0	0	0	0	0	0
Polypedilum halterale	0	0	0	0	0	0	1	0	0	0	0
Polypedilum scalaenum	0	0	0	0	0	0	0	0	0	0	0
Polypedilum sp.	0	0	0	0	0	0	0	0	0	0	0
Pseudorthocladius sp.	0	0	0	0	0	0	0	0	0	0	0
Nanocladius sp.	0	0	0	0	0	0	0	0	0	0	0
Coelotanypus sp.	17	14	25	0	10	0	10	100	41	19	40
Procladius sp.	14	24	39	54	116	28	65	53	57	23	52
Tanypus neopunctipennis	1	0	0	1	9	2	0	3	2	1	1
Tanypus sp.	0	0	0	0	0	0	0	3	0	0	2
Ephemeroptera											
Caenidae											
Caenis sp.	0	0	0	1	0	0	0	0	0	0	0
Ephemeridae											
Hexagenia sp.	0	0	0	1	0	0	0	1	5	0	2
Hemiptera											
Corixidae											
Corixidae	0	0	0	0	0	0	0	0	0	0	0
Trichoptera											
Leptoceridae											
Oecetis sp.	0	0	0	0	0	0	0	0	0	0	0
Mollusca											
Gastropoda											
Basommatophora											
Physidae											
Physa sp.	0	0	0	0	0	0	0	0	0	0	0
Pelecypoda											
Prionodesmacea											
Sphaeriidae											
Musculium sp.	0	0	0	0	0	0	0	0	3	0	5
Pisidium compressum	0	0	0	0	0	0	0	0	0	0	0
Pisidium sp.	0	0	0	0	0	0	0	0	0	0	0
sphaeriidae	0	0	0	0	0	0	0	0	12	0	0
Nematoda	0	0	0	1	0	0	1	0	0	0	0
Total Organisms	**287**	**262**	**209**	**227**	**351**	**161**	**282**	**381**	**685**	**354**	**582**

Table 2-4
Benthic Macroinvertebrate Survey Results

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobile Chemical Site
DePue, Illinois

	DePue Lake					Goose Lake				
Station	D5	D7	F7	K-1.5	D9	GL-SDT-01	GL-SDT-02	GL-SDT-03	GL-SDT-04	GL-SDT-05
Annelida										
Oligochaeta										
Tubificida										
Naididae										
Naididae	0	0	0	0	0	0	0	0	0	0
Nais variabilis	0	0	0	0	0	0	0	0	0	0
Tubificidae										
Branchiura sowerbyi	4	12	13	0	0	12	12	25	28	17
Ilyodrilus sp.	0	0	0	0	0	0	0	0	0	0
Ilyodrilus templetoni	0	0	1	1	1	0	0	2	0	2
Limnodrilus cervix	0	0	0	0	0	0	0	0	2	0
Limnodrilus hoffmeisteri	0	0	0	0	0	0	0	0	0	0
Limnodrilus maumunsis	0	0	0	0	0	0	0	0	0	2
Limnodrilus sp.	10	15	84	8	23	13	49	113	131	79
Limnodrilus udekemianus	1	1	9	0	5	0	0	0	4	0
Tassekidrilus americanus	0	0	0	0	0	0	0	0	0	0
Tubifex tubifex	0	0	0	0	0	0	0	0	0	0
Tubificidae	24	22	85	24	25	41	116	86	60	255
Arthropoda										
Insecta										
Coleoptera										
Hydrophilidae	0	1	0	0	0	0	0	0	0	0
Diptera										
Ceratopogonidae										
Bezzia sp.	0	0	0	0	0	0	0	0	0	0
Ceratopogon sp.	0	0	0	0	0	0	0	0	0	0
Ceratopogonidae	3	1	0	0	0	0	1	0	0	0
Culicoides sp.	0	1	1	0	0	0	0	0	0	0
Mallochohelea sp.	0	0	0	0	0	0	0	0	5	0
Sphaeromias sp.	0	4	25	0	3	2	17	1	12	2
Chaoboridae										
Chaoborus sp.	0	0	0	0	0	0	0	1	0	0
Chironomidae										
Chironomid pupa	1	5	6	1	0	1	0	2	2	4
Chironomidae	0	0	0	0	1	0	0	0	0	0
Chironomus sp.	60	39	47	8	22	57	53	100	24	87
Cryptochironomus sp.	11	21	28	2	26	1	2	4	5	2
Glyptotendipes sp.	0	0	0	0	0	0	0	0	0	0
Harnischia sp.	2	1	0	0	2	0	0	0	0	0
Microchironomus sp.	1	3	5	3	4	0	7	1	29	6

Table 2-4
Benthic Macroinvertebrate Survey Results

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobile Chemical Site
DePue, Illinois

	DePue Lake					Goose Lake				
Station	**D5**	**D7**	**F7**	**K-1.5**	**D9**	**GL-SDT-01**	**GL-SDT-02**	**GL-SDT-03**	**GL-SDT-04**	**GL-SDT-05**
Chironomidae *(continued)*										
Paratendipes sp.	0	0	0	1	0	0	0	0	0	0
Polypedilum flavum	0	0	0	0	1	0	0	0	0	0
Polypedilum halterale	0	0	0	8	8	0	0	0	0	0
Polypedilum scalaenum	0	0	0	1	0	0	0	0	0	0
Polypedilum sp.	0	0	0	1	1	0	0	0	0	0
Pseudorthocladius sp.	0	0	0	0	1	0	0	0	0	0
Nanocladius sp.	0	0	0	0	1	0	0	0	0	0
Coelotanypus sp.	2	1	0	1	0	80	74	35	14	54
Procladius sp.	19	37	72	6	34	5	25	3	11	14
Tanypus neopunctipennis	6	4	3	0	1	0	1	0	5	0
Tanypus sp.	1	0	0	0	0	0	1	0	0	0
Ephemeroptera										
Caenidae										
Caenis sp.	0	0	0	0	0	0	0	0	0	0
Ephemeridae										
Hexagenia sp.	0	0	1	0	0	0	0	1	2	0
Hemiptera										
Corixidae										
Corixidae	0	0	0	1	0	0	0	0	0	0
Trichoptera										
Leptoceridae										
Oecetis sp.	0	0	0	0	0	0	0	0	1	0
Mollusca										
Gastropoda										
Basommatophora										
Physidae										
Physa sp.	0	1	0	0	0	0	0	0	0	0
Pelecypoda										
Prionodesmacea										
Sphaeriidae										
Musculium sp.	0	0	0	0	0	5	2	7	19	1
Pisidium compressum	0	0	0	1	0	0	0	0	0	0
Pisidium sp.	0	0	0	0	0	1	0	0	0	0
sphaeriidae	0	1	2	0	0	12	3	11	6	5
Nematoda	0	1	5	0	0	0	0	8	1	3
Total Organisms	**145**	**171**	**387**	**67**	**159**	**230**	**363**	**400**	**361**	**533**

Table 2-5
Fish Community Survey Results

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Species	Total Number of Individuals				
	DePue Lake Location 1	DePue Lake Location 2	DePue Lake Location 3	DePue Lake Total	Goose Lake Location 1
Bigmouth Buffalo	0	1	1	2	0
Black Bullhead	3	1	0	4	8
Black Crappie	0	1	0	1	0
Bluegill	0	32	13	45	2
Bowfin	0	1	0	1	0
Brown Bullhead	0	0	4	4	1
Channel Catfish	2	0	2	4	5
Common Carp	4	15	7	26	2
Emerald Shiner	9	0	24	33	0
Freshwater Drum	25	20	26	71	20
Gizzard Shad	218	181	175	574	22
Goldfish	0	3	0	3	0
Green Sunfish	0	14	0	14	0
Orangespotted Sunfish	8	47	2	57	0
Quilback Carpsucker	0	10	0	10	0
River Carpsucker	4	8	4	16	4
Shortnose Gar	2	8	2	12	2
Smallmouth Bass	0	1	1	2	1
Smallmouth Buffalo	3	3	0	6	0
White Bass	0	2	1	3	0
White Perch	0	1	1	2	2
TOTAL	**278**	**349**	**263**	**890**	**69**

Table 2-6
Threatened/Endangered Species Information for Bureau County, Illinois

DePue Lake Baseline Ecological Risk Assessment
New Jersey Zinc/Mobil Chemical Site
DePue, Illinois

Common Name	Scientific Name	T/E Status [1]	General Habitat Requirements [2]	Potential to Occur in DePue Lake Area? [3]
Cerulean Warbler	*Dendroica cerulea*	S-T	mature deciduous forest (mesic)	Yes
Blanding's Turtle	*Emydoidea blandingii*	S-E	wetlands to slow-moving rivers/lakes	Yes
Starhead Topminnow	*Fundulus dispar*	S-T	wetland backwaters to clear lakes	Yes
Plains Hog-nosed Snake	*Heterodon nasicus*	S-T	sand-gravel soils in prairie/floodplain/desert/woodland	No
Loggerhead Shrike	*Lanius ludovicianus*	S-E	open woodland to grassland	Yes
Indiana Bat	*Myotis sodalis*	F-E, S-E	caves to riperian areas	Yes
Blacknose Shiner	*Notropis heterolepis*	S-E	sandy, weedy rivers/lakes	No
Weed Shiner	*Notropis texanus*	S-E	sandy small-medium rivers	No
Regal Fritillary	*Speyeria idalia*	S-T	prairie and grassland	No
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	S-E	cattail, tule or bulrush marsh	Yes
Decurrent False Aster	*Boltonia decurrens*	S-T, F-T	natural floodplains & disturbed lowlands	Yes
Queen-of-the-Prairie	*Filipendula rubra*	S-E	moist prairies/meadows	Yes
Broomrape	*Orobanche ludoviciana*	S-T	sandy prairie/savana	No
Jack Pine	*Pinus banksiana*	S-E	sandy soils, dunes, outcrops	No
Eastern Prairie Fringed Orchid	*Platanthera leucophaea*	F-T	mesic to wet prairie/meadow	Yes
Ear-leafed Foxglove	*Tomanthera auriculata*	S-T	mesic to dry prairie/meadow	Yes

Notes:

1. Threatened/Endangered Status: S-T = State Threatened, S-E = State Endangered, F-T = Federal Threatened, F-E = Federal Endangered.
2. General habitat requirements for each species were derived from the Nature Serve Explorer (2011).
3. The potential occurrence for T/E species in DePue Lake floodplain is based on species-specific habitat requirements and the general observation of whether these habitats are present within OU5.