Clean Water Act Section 404(b)(1) Contaminant Determination for Burns Waterway Harbor Dredging

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CONTAMINANT DETERMINATION
BURNS WATERWAY HARBOR DREDGING
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1. Introduction

1.1. Federal Clean Water Act Requirements

The Clean Water Act (CWA), specifically Section 404 (b)(1), requires the development and application of environmental guidelines covering a broad range of effects to human health and ecological systems. The 404(b)(1) guidelines, codified in 40 CFR 230, require that a contaminant determination be prepared for any discharge of dredged or fill material to the waters of the United States. "The term 'discharge of dredged material' means any addition of dredged material into waters of the United States. The term includes, without limitation, the addition of dredged material to a specified discharge site located in waters of the United States and the runoff or overflow from a contained land or water disposal area." The contaminant determination must address the degree to which the material proposed for discharge will introduce, relocate, or increase the levels of contaminants at the disposal site. The determination must consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants.

Section 404(b)(1) of the CWA contains a number of evaluation provisions applicable when proposing dredged material to disposal facilities. Section 230.10(b)(1) prohibits the disposal of dredged material that might violate applicable water quality standards, after consideration of disposal site dilution and dispersion. This provision is aimed at the effluent or runoff discharges from the upland disposal site. That same section requires consideration of "effects on municipal water supplies" and is reinforced at Section 230.50. This section specifically addresses municipal and private water supplies including groundwater, which is a potential concern for leachate pathway. Section 230.11(h) requires consideration of a broad range of secondary effects from proposed dredged material discharges. Pathways from an upland disposal site, such as plant or animal uptake, could be considered secondary effects under this section.

1.2. Approach

The U.S. Environmental Protection Agency (USEPA) and the U.S. Army Corps of Engineers (USACE) developed the *Great Lakes Dredged Material Testing and Evaluation Manual* in 1998, commonly referred to as the Great Lakes Testing Manual or GLTEM, as a resource document providing technical guidance for testing and evaluation for proposed discharges of dredged materials in to the United States waters of the Great Lakes Basin, including discharges of water from dredged material disposal operations for beach nourishment, upland, or confined disposal with return to waters of the United States. The GLTEM outlines a structured, sequential "tiered" approach to sediment evaluation and testing, to determine if dredged sediment from harbor and rivers tributary to the Great Lakes may be disposed in open waters of the Great Lakes. The objective of the tiered testing approach is to make optimal use of resources in generating the required information for a factual determination of compliance with Section 404(b)(1) of the Clean Water Act Section, using an integrated chemical, physical, and biological approach.

1.3. Project Description

The Port of Indiana-Burns Harbor is an industrial area located on the Lake Michigan shore of Indiana at the intersection of U.S. Highway 12 and Indiana 249. Burns Waterway Harbor (BWH), also known as Burns International Harbor and the Port of Indiana, is located in Porter County, Indiana, shown in **Figure 1**. The port is divided between the municipalities of Burns Harbor and Portage. BWH was authorized by the Rivers and Harbors Act of 1965, constructed by the U.S. Army Corps of Engineers in 1970, and is operated by the Indiana Port Commission (Port). The Corps constructed the north and west rubble mounds, breakwater, bulkhead, Approach Channel, Outer Harbor and East and West harbor arms. The Corps is authorized to maintain the Approach Channel to a depth of 30 feet, the Outer Harbor to a depth of 28 feet below the Low Water Datum (LWD) and the east and west harbor arms to a depth of 27 feet below LWD, within the Federal Channel as shown in **Figure 2**. Sediment accumulates in the harbor Approach Channel and Maintenance Area, and to a lesser degree in the Outer Harbor and East and West Harbor Arms, impeding commercial vessels' use of the harbor. It is expected that continued shoaling will need to be addressed to ensure safe navigation in BWH. USACE proposes to hydraulically or mechanically remove accumulated sediment within the harbor on an annual, or as-needed basis, to maintain the authorized depth of the harbor. The amount removed is dependent on sediment accumulation and available funding. The proposed dredged material placement sites are: 1) on the beach at Ogden Dunes and Portage Lakefront Park, 2) within the littoral zone of the beach at Ogden Dunes and Portage Lakefront Park, and 3) in the open waters of Lake Michigan at a deep lake placement site approximately one mile north of the Burns Small Boat Harbor.

2. Tier 1 Analysis

2.1. Tier 1 Objectives

The GLTM uses a four-tiered evaluation process for each of the five pathways. This tiered approach should be initiated at Tier 1 for each pathway and is designed to aid in generating appropriate and sufficient, but not more than necessary, information to make decisions regarding the need for management actions. The Tier 1 evaluation includes a scoping process and an evaluation of existing information to determine the need for pathway evaluations, identify relevant pathways for the project, and identify contaminants of concern (COCs). The existing information for each relevant pathway is evaluated to determine if a decision on the need for management actions can be made and identify which pathways require more detailed evaluations in higher tiers.

2.2. Contaminant Transport and Pathways

2.2.1. Land Use

The project area includes the following properties: BWH and associated structures, Indiana Dunes National Park (IDNP), *previously the Indiana Dunes National Lakeshore (IDNL)*, Indiana Port Commission, Burns Small Boat Harbor, Burns Waterway (also known as Burns Ditch), Portage Lakefront Park, and Ogden Dunes (see **Figure 3**). Properties adjacent to BWH are primarily industrial in nature. According to the Port, BWH users handle approximately two million tons of steel, 600 barges, 83,000 railcars, and 578,000 trucks every year. Products such as steel, grain, salt, fertilizer, cement, limestone, slag, and ethanol are shipped from the Port to markets across North America and the world. In addition, the harbor is surrounded by ArcelorMittal steel works to the east and U.S. Steel works to the west. The Port map is shown in **Figure 4**. A listing of service providers, steel production, processing & distribution companies; processing distribution & storage facilities; and development partners are provided in **Table 1**.

Table 1: Port of Indiana Users

Service Providers	Products/Services	Description
Aqua-Land Communications	Cell Tower Access	Cell tower with multiple service provider capability
Federal Marine Terminals	Stevedoring	Stevedoring of bulk, breakbulk, steel, containers, forest products
Franciscan Working Well	Medical Clinic	Onsite occupation healthcare
Indiana Harbor Belt Railroad	Railroad Switching	Largest switch carrier in the US
International Longshoreman's Association	Local 1969	Largest union of maritime workers
International Port of Operating Engineers	Local 150	Labor union representing more than 23,000

Service Providers	Products/Services	Description
Metro Ports	Stevedoring	Stevedoring of bulk materials
Norfolk Southern Railroad	Class I Railroad	Rail services to 24 seaports, 10 river ports, and 9 Great Lakes ports
Great Lakes Towing Co.	Harbor Towing	Tugboat, towing and barge services
Steel Production, Processing & Distribution		
ADS Logistics Co., LLC	Steel Logistics	Transportation, warehousing, inventory management
ArcelorMittal – Burns Harbor	Steel Mill	Flat-rolled and plate steel producer
Central Coil Processing	Steel Processing	Steel coil, sheet, plate producers
Feralloy Midwest Portage	Steel Processing	Heavy gauge carbon steel,, plate, and coils supplier/processor
Feralloy Processing	Steel Processing	Combination line
Indiana Pickling & Processing	Steel Pickling	Pickler service
Leeco Steel	Steel Service Center	Carbon and alloy steel supplier
Metro International Trade Services	Steel Storage	Non-ferrous metals holding facility
NLMK Indiana	Steel Producer	Hot-rolled pickled, oiled, coiled plate, carbon/alloy specialty products
Phoenix Services	Steel Slag Processing	Slag processing and distribution facility
Precision Strip	Coil Processing	Steel coil processing
Ratner Steel Supply Co.	Steel Processing	Hot/cold roll steel processor for sheet, pickle, oiled plates, galvanized and floor pates
Steel Warehouse	Steel Processing	Light-gauge carbon steel processing for use in stampers, fabricators
Tube City IMS – Division by NLMK Indiana	Steel Services	Steel services including scarp optimization and slag aggregates
U.S. Steel Corp., Gary Works-Midwest Plant	Finishing Mill	Tin mill products, hot-dip galvanized, cold-rolled steel producer
Processing, Distribution, Storage		
Cargill	Agriculture Products	Grain elevator
Carmeuse Lime & Stone	Limestone	Limestone processing, quicklime production for steel industry use
Frick Services	Dry/Liquid Bulk Storage	Dry and liquid bulk storage and distribution terminals
Mid-Continent Coal & Coke	Carbon Materials Supplier	Coal and coke processing and distribution for steel, allow and chemical industries
P.I. & I. Motor Express	Flatbed Trucking	Family-owned flatbed carrier
Tanco Terminals	Liquid Storage	Stevedoring, storage and handling for liquid products

**Information obtained from http://www.portsofindiana.com/burnsharbor/*

Potential for contaminant migration is present in areas of the harbor, especially the harbor arms, where bulk materials are loaded/unloaded and stored adjacent to the waters of the harbor. Most

of the materials are granular in nature and consist of roadway salt, limestone, slag, coke, pig iron, and/or gypsum. Materials are typically loaded/unloaded using a clamshell or conveyor system from a docked barge and placed upland in a covered confined storage area or stockpiled upland. Any contaminants present in the East and West Harbor Arms of the harbor that originate from loading and unloading operations conducted in the harbor arms, or from migration due to surface water runoff from stockpiled materials, are likely to remain confined to those portions of the harbor with limited transport to the Outer Harbor through sediment dispersion.

2.2.2. Tributary Flows

Within Lake Michigan, inland creeks and rivers are often a significant source of contaminants in the watershed; however, this is not the condition at BWH. There are no inland tributaries to BWH.

2.2.3. Water Current

Significant sediment deposition can be present in BWH during storm events due to the littoral drift patterns in Lake Michigan. Littoral drift in the area results in the deposition of sandy material from adjacent areas into the Harbor Approach Channel during a storm event. The littoral drift pattern of Lake Michigan in the vicinity of the Harbor is from east to west. The littoral pattern, however, is the net result of wave and wind induced sediment movement averaged over a long period of time. There is no current in Lake Michigan or Harbor resulting in a continuous unidirectional movement of water, although the area is highly dispersive due Lake Michigan wave action and the presence of barges transporting materials that may stir the sediment bed during transport.

2.3. Potential Sources of Sediment Contamination

This section discusses the land uses and potential point and non-point sources of contamination. The information is used to inform the sediment sampling process by determining the most likely contaminants that should be investigated further.

2.3.1. Storm Water Runoff

Storm water inflow may consist of runoff collected through storm sewers or sheet flow from paved areas originating from adjacent industrial and manufacturing facilities located within the Port. Storm water runoff can also transport contaminants from bulk material stockpiles located adjacent to the harbor. Review of facilities adjacent to the harbor suggest that contaminants may consist of metals, organics, polychlorinated biphenyl (PCBs), volatile organic compounds (VOCs) such as benzene, toluene, ethylbenzene, and xylene (BTEX), suspended solids, nutrients, and dissolved solids. These contaminants may deposit in the Harbor Arms and Outer Harbor after being discharged during a storm event.

2.3.2. Industrial and Municipal Discharges, Overflows, and Bypasses

BWH is located within a large industrial corridor. The harbor is surrounded by industrial facilities that discharge treated effluent from steel-finishing operations, non-contact cooling water, storm water, and industrial waste discharge to local waterways. **Figure 5** shows the permitted outfall locations in BWH for each of the nearby dischargers (*https://epa.maps.arcgis.com/apps/webappviewer/index.html)*. A listing of facilities with active NPDES permits, including upland sites with NPDES permits (construction site and/or storm water runoff), and facilities that direct discharge to local waterways are summarized in **Table 2**. Review of facilities that discharge to the harbor suggest that contaminants may consist of metals, organics, PNAs, PCBs, BTEX, suspended solids, nutrients, and dissolved solids.

Table 2: NPDES Dischargers within Project Area

NPDES Permit	Permit Name	Scope	Permit Type	Issue Date	Effective Date	Expiration Date
IN0059714	NLMK - INDIANA	Minor	NPDES Individual Permit	2/7/2018	5/1/2018	4/30/2023
IN0000175	ARCELORMITTAL BURNS HARBOR LLC	Major	NPDES Individual Permit		5/27/2016	7/1/2016
INRM01862	Frick Services	Minor	NPDES Individual Permit	10/1/2015	10/1/2015	9/30/2020
INRM02228	Great Lakes Stevedoring LLC	Minor	NPDES Individual Permit	6/30/2017	6/30/2017	6/29/2022
INRM00114	Feralloy Processing Company	Minor	NPDES Individual Permit	2/21/2016	2/21/2016	2/20/2021
INRM00092	Indiana Pickling & Processing Company	Minor	NPDES Individual Permit	11/7/2015	11/7/2015	11/6/2020
INRM00145	Feralloy Corporation Portage Midwest Division	Minor	NPDES Individual Permit	12/20/2015	12/20/2015	12/19/2020
INRM00582	On Minerals LLC Carmeuse Lime & Stone	Minor	NPDES Individual Permit	8/28/2018	8/28/2018	8/27/2023
INR10J521	Port of Indiana - 5 Acre Lease Site - Clearing clean fill piles	Minor	NPDES Individual Permit	12/30/2014	12/30/2014	12/29/2019
INR10L918	Former Scrap Metal Services Facility	Minor	NPDES Individual Permit	4/9/2016	4/9/2016	4/8/2021
INR10M651	Ratner Steel Expansion	Minor	NPDES Individual Permit	9/7/2016	9/7/2016	9/6/2021
INR10N470	Clearing leased property for closed facilities (lease termination)	Minor	NPDES Individual Permit	3/16/2017	3/16/2017	3/15/2022
ING340071	Tanco Terminals Inc	Minor	General Permit Covered Facility	8/31/2017	9/1/2017	10/31/2020
INP000027	INDIANA PICKLING & PROCESSING	Minor	Individual State Issued Permit (Non-NPDES)	12/13/2017	4/1/2018	3/31/2023

2.3.3. Previous Dredging or Fill Discharges

BWH was dredged in 1995-96, 2007 and 2008. Materials dredged in 1995-96 from the East Harbor Arm and Approach Channel were suitable for open water placement and the sediment from the West Harbor Arm was placed as near-shore beach nourishment (in the littoral zone) at Ogden Dunes. In 2007, materials dredged from the East Harbor Arm and Approach Channel were placed in open waters of Lake Michigan one mile north of the harbor. In 2008, materials dredged from the West Harbor Arm and Approach Channel were placed as near-shore beach nourishment at Ogden Dunes. In addition to dredging within BWH, USACE dredged the sediment surrounding the NIPSCO Bailly intake structure in 2006, 2007, 2008, and 2009 and placed the material within the littoral zone at Ogden Dunes.

USACE dredged the Approach Channel to BWH in 2013. The material was placed just westward of BWH, outside the breakwaters and north of the U.S. Steel property. This placement area preserves the material within the littoral zone, however, there is a potential that material placed in this location could migrate into the Burns Small Boat Harbor (Burns Waterway) Approach Channel and cause a blockage. Because of the potential for undesirable shoaling at Burns Waterway, this disposal location has limited capacity to accept material.

The Approach Channel was dredged in early 2014, and each year from 2015 through 2019. The quantity of dredged materials generated for each event ranges between approximately 50,000 and 140,000 cubic yards per year. Placement of dredged materials has consistently occurred in the near shore littoral zone at Ogden Dunes, with the exception of a portion of the material generated in 2014 from the Harbor Arms and/or Outer Harbor, placed in the Lake Michigan deep lake placement site.

USACE has placed clean quarried stone in BWH below the authorized depth of the Harbor in areas where scouring has occurred in the sediment bed of the Harbor Arms. Stone placement activities occurred in 2015, 2017, and 2019, resulting in the placement of approximately 48,000 tons of 0.25 to 1 ton stone below the authorized depth in the Federal Channel.

2.3.4. Landfill Leachate/Ground Water Discharge

ArcelorMittal (previously Bethlehem Steel) currently, or has previously, stored raw product or waste materials (such as used oil, blast furnace/basic oxygen furnace sludge and filter cake, mill scale, construction waste, coke oven dust, classifier sands, coal, coke, burnt lime, secondary sewage treatment sludge and filter cake) onsite using flow bins, containers, hoppers, tank, stockpiles, basins, impoundments, and landfills. The status of each of the facilities' material handling and waste management areas identified onsite in 2010 is presented in **Attachment 1** (obtained from https://www.in.gov/idem/landquality/files). Phase I and Phase II investigations, including groundwater and/or soil sampling, have been conducted in the majority of waste storage areas identified onsite; in most cases, results of sampling indicate that soil and/or groundwater concentrations met the most conservative screening levels at the time of sampling, and no further investigation or action was warranted. However, in a few areas, including Area

IA-3 (rectangular and circular tar impoundments) and Area IA-1 (wastewater pump station No. 2 surface impoundment) contaminants of concern continue to be monitored. Because of the distance between this facility and the project area, plus the lack of indication of significant contaminant migration from the facility to the BWH, it is unlikely that the ArcelorMittal Burns Harbor facility impacts the BWH. However, sediment and water sampling conducted as part of the Tier 2 investigation includes common contaminants of concern including lead, selenium, cadmium, benzene, toluene, and PNAs.

U.S. Steel currently, or has previously, stored similar waste products onsite through the use of solid waste management units and/or onsite landfills to manage the solid and hazardous waste generated onsite. In 2019, the facility was ordered to increase the frequency of groundwater sampling at the Midwest Plant after elevated concentration of hexavalent chromium were found in the groundwater during monitoring of the hazardous waste landfill present onsite. In addition, the facility has suffered from spill events and Clean Water Act violations for unauthorized discharges to the Burns Waterway, recent events are identified in paragraph 2.3.5 below. The most significant spill event occurred in April 2017 and resulted in beach closures in the area. Because the majority of the facility discharges occur to the Burns Waterway, it is unlikely that the facility impacts the BWH; however, Burns Waterway ultimately discharges to Lake Michigan via the Burn Small Boat Harbor and is upstream of the Portage Park and Ogden Dunes beach nourishment areas, and the reference sites.

2.3.5. National Response Centers Release of Oil Spill or Chemicals

The 2019 U.S. Coast Guard National Response Center (NRC) call report was reviewed for a listing of release incidences in the project area (*http://nrc.uscg.mil/*). The NRC serves as an emergency call center that fields initial reports for pollution and railroad incidents and forwards that information to appropriate federal/state agencies for response. The call report spreadsheet posted to the NRC website contains initial incident data that has not been validated or investigated by a federal/state response agency. Information for releases reported in 2019 are summarized in **Table 3**. Releases consisted of ammonia, iron, diesel fuel, cyanide, hydraulic oil, gasoline, and hexavalent chromium.

Table 3: NRC Oil or Chemical Spills Database Entries near Project Area, Calendar Year 2019

Date	Description of Incident	Cause	Incident Location
2/6/2019 2:00	CALLER IS REPORTING A RELEASE OF WASTE AMMONIA LIQUOR (FLUSHING LIQUOR) FROM COKE OVEN BATTERIES DURING OPERATIONS, DUE TO A BACK UP, ONTO SOIL AT THE STEEL MANUFACTURING FACILITY.	OTHER	MANUFACTURING FACILITY
5/9/2019 9:30	CALLER REPORTED THE OVERLOADING OF IRON INTO THE TREATMENT SYSTEM.	OTHER	-
5/27/2019 8:10	CALLER REPORTED WHILE A FUELING COMPANY WAS FILLING A BARGE, THE BARGE HOSE WAS DISCONNECTED FROM THE FUEL TANK WHICH CAUSED A RELEASE OF DIESEL FUEL ON LAKE MICHIGAN. CAUSE OF THE RELEASE WAS OPERATING ERROR.	OPERATOR ERROR	BURNS HARBOR
8/12/2019 12:30	CALLER REPORTED A VESSEL WAS FUELING AND THERE WAS AN OVERFLOW OF DIESEL FUEL ONTO THE VESSEL DECK AND INTO LAKE MICHIGAN.	UNKNOWN	ARCELORMITTAL STEEL PLANT
8/14/2019 6:54	CALLER STATED THAT THERE IS A SHEEN BEING OBSERVED COMING FROM THE FACILITY OUTFALL DUE TO AN UNKNOWN CAUSE AT THIS TIME.	UNKNOWN	STEEL MILL
8/14/2019 6:00	CALLER IS REPORTING A FISH KILL OF SEVERAL HUNDRED FISH IN THE LITTLE CALUMET RIVER FROM A STEEL MILL DUE TO UNKNOWN CAUSES AT THIS TIME. CALLER STATED THE RELEASE OF MATERIAL IS ALSO RUNNING INTO THE BURNS WATERWAY THAT LEADS TO LAKE MICHIGAN. CALLER STATED THE INCIDENT FIRST OCCURRED ON 12-AUG-2019 AROUND NOON AND IS STILL ONGOING AT THIS TIME. CALLER ALSO STATED THAT THIS SAME COMPANY HAS AN ACTIVE OIL SPILL ON THE RIVER AT THIS TIME AS WELL, BUT THIS CALL IS NOT IN RELATION TO THAT SPILL.	UNKNOWN	NEAR THE STEEL MILL ON THE LITTLE CALUMET RIVER
8/11/2019 15:00	CALLER IS REPORTING THE RELEASE OF UNKNOWN AMOUNT CYANIDE AND AMMONIA. CALLER STATED THAT THIS IS A FEDERALLY PERMITTED RELEASE UNDER THE NPDES PERMIT.	OTHER	-
8/20/2019 8:30	CALLER IS REPORTING A DISCHARGE OF AN UNKNOWN AMOUNT OF HYDRAULIC OIL INTO THE BURNS WATERWAY AT THE INCIDENT LOCATION. DISCHARGE IS FROM AN UNKNOWN SOURCE AT THIS TIME. INVESTIGATION IS UNDERWAY.	UNKNOWN	U. S. STEEL INC - MIDWEST PLANT
8/20/2019 12:15	CALLER REPORTING AN UNKNOWN SHEEN IN THE BURNS HARBOR OF LAKE MICHIGAN. CALLER STATED THE SOURCE OF SHEEN IS UNKNOWN. ABSORBANT BOOMS DEPLOYED IN ATTEMPT TO CLEAN UP.	UNKNOWN	UNKNOWN SHEEN INCIDENT

Date	Description of Incident	Cause	Incident Location
8/21/2019 17:00	CALLER IS REPORTING THAT THERE IS AN OIL SHEEN ON THE WATER NEAR THE DOCK. THE SOURCE IS BELIEVED TO BE A SPILL THAT OCCURRED AT THAT LOCATION THE DAY BEFORE THAT HAD NOT BEEN COMPLETELY CLEANED UP.	UNKNOWN	-
9/6/2019 12:15	CALLER REPORTS THAT THERE IS AN INTERMITTENT DISCHARGE OF AN UNKNOWN OIL FROM AN OUTFALL AT THE FACILITY. THE EXACT SOURCE WITHIN THE FACILITY IS UNKNOWN.	UNKNOWN	-
10/3/2019 1:00	FLUSHING LIQUOR RELEASED FROM A SUMP ON A PRIMARY COOLER DUE TO A POWER OUTAGE CAUSED BY AN UNKNOWN CAUSE AT THIS TIME.	UNKNOWN	STEEL MILL
10/17/2019 15:49	CALLER REPORTED A SUNKEN VESSEL ABOUT 30 FEET AWAY FROM THE DOCK THAT IS CAUSING OF GASOLINE IN THE HARBOR.	VESSEL SINKING	BURNS WATERWAY
10/30/2019 16:50	CALLER REPORTED A MANUFACTURING FACILITY PROCESSING UNIT RELEASED HEXAVALENT CHROMIUM TO THE WATERWAY.	UNKNOWN	-
11/21/2019 9:00	CALLER REPORTS FROM THE DISCHARGE OUTFALL TO THE BURNS WATER WAY THERE IS A SLIGHT DISCOLORATION IN THE WATER DUE TO IRON FLOC.	UNKNOWN	-

Owners/operators of facilities and modes of transportation are required to report all spills, including the total amount spilled, to IDEMs Office of Land Quality Emergency Response Program. All spills require a spill response, regardless of reportability, in accordance with the Indiana Spill Rule (327 Indiana Administrative Code (IAC) 2-6.1). A listing of spills reported to IDEM in Porter County from December 3, 2010 to December 31, 2019 were reviewed as part of this assessment (obtained from https://www.in.gov/idem/cleanups/2352.htm). Multiple spills have been reported within the Harbor, Lake Michigan, and Burns Waterway as well as upland at industries adjacent to the project area. The majority of the spills are listed as oil and grease, diesel and other petroleum products, industrial sewage, and releases of chemicals, such as hexavalent chromium, copper, ammonium sulfur, ferric chloride, and ammonia sulfite.

In addition to above reported releases and spills, additional information is provided for two spill events that occurred during the 2019 sediment and water sampling event while the USACE Contractor was deployed in the Harbor and reference sites in support of development of this document:

- ArcelorMittal report, Wednesday, August 14th: ArcelorMittal Burns Harbor was notified of an observed oil presence in the waters at the Port of Indiana. The quantity and source of the oil were unknown at the time of the report, though ArcelorMittal reported that the spill was contained in a timely manner. The company deployed a containment boom and a vacuum truck pulled material from the waterway. In addition, ArcelorMittal notified a third-party Oil Spill Removal Organization (OSRO), which surveyed for any potential release into open water and confirmed there was no oil outside of the port. Vessel traffic at the Port of Indiana was halted for a few hours and resumed once the spill was contained. The spill occurred in the East Harbor Arm one day after sediment and water sampling was completed in the East Harbor Arm management unit.

- ArcelorMittal report, Thursday August 15th: During the Week of August 12th, the Indiana Department of Natural Resources (IDNR) observed dead fish near Burns Waterway, located at the southern end of the Burns Harbor facility. Preliminary sampling indicated that ArcelorMittal discharged cyanide and ammonia in excess of NPDES permitted limits. ArcelorMittal discharges to the East Arm Little Calumet River, which is a tributary to Lake Michigan through Portage-Burns Waterway (Burns Waterway). Sediment and water samples were collected at the reference sites, downstream of the release, after the release was reported; the scope and scale of the release was unknown at the time of sampling. Portage Lakefront Park was closed after the release was reported.

2.3.6. Air Deposition

U.S. Steel, ArcelorMittal steel works, and other industries with Integrated Compliance Information System (ICIS) – AIR entries are located in the vicinity of the project area (see **Figure 6**). Facilities listed in the ICIS – AIR database are summarized in **Table 4**. While multiple industries in the area discharge contaminants under active or previous Title V permits, given the location of these industries and their distances from the Harbor and Lake Michigan,

Ogden Dunes, and Portage Lakefront Park, there should not be a significant difference between sediment quality for materials found in BWH compared to the reference sites due to deposition of contaminants in the project vicinity.

Table 4: ICIS – AIR Facilities near Project Area

Name	Regulatory ID	Address	City
American Iron Oxide Company	110058558010	6300 US HWY 12	PORTAGE
Arcelormittal Burns Harbor Llc	110000607558	250 W US 12	BURNS HARBOR
Calumite Company Llc	110029239571	915 SUN DR.	PORTAGE
Cargill Aghorizons	110064221881	6600 US 12 BURNS WATERWAY	PORTAGE
Cargill Aghorizons	110064221890	6640 SHIP DR	PORTAGE
Indiana Pickling And Processing Company	110002376964	6650 NAUTICAL DR	PORTAGE
Metal Services Llc Dba Phoenix Services Llc - Contractor(001)	110007566927	US 12 & SR 149	BURNS HARBOR
Mid-Continent Coal & Coke	110012619078	1150 EAST BOUNDRY ROAD	PORTAGE
Mid-Continent Coal & Coke - Contractor Of Arcelormittal(001)	110040627195	250 W US HWY 12	BURNS HARBOR
Mid-Continent Coal & Coke - Contractor Of Arcelormittal(001)	110040627195	250 W US HWY 12	BURNS HARBOR
Nipsco Bailly Generating Station	110000397730	246 BAILLY STATION ROAD	CHESTERTON
Nlmk Indiana	110000398212	6500 S. BOUNDARY RD.	PORTAGE
O-N Minerals (Portage) Company, Llc Dba Carmuese Lime & Stone	110007363138	165 STEEL RD	PORTAGE
Oil Technology, Inc - Contractor Of Arcelormittal (001)	110007573795	251 E US 12	PORTAGE
Portside Energy Corp	110006010583	6290 US HWY 12	PORTAGE
Sms Mill Services, Llc	110010430364	BETHLEHEM STEEL COMPLEX	BURNS HARBOR
Tanco Terminals Inc	110003135848	400 E BOUNDARY RD	PORTAGE
Tube City Ims Llc	110038021734	6500 US HIGHWAY 12	PORTAGE
Walsh & Kelly In	110007362807	965 SUN DR	PORTAGE
Walsh & Kelly, Inc.	110064350795	6600 US HWY 12	PORTAGE

2.4. Sources of Information Investigated

2.4.1. Historic Sediment Data

Sediment and water within the BWH breakwaters were characterized by USACE in 1993, 2001, 2006, 2012, and 2013. See **Table 5** for historic sediment sampling results. The 1993 sampling revealed a high percentage of fine-grained material (68.4% on average) within the East Harbor Arm and the Outer Harbor. The material from the West Harbor Arm contained 19.1% fines on average and was used for beach nourishment. Sediment bulk chemistry results indicated that metals and organics were not a concern. Arsenic concentrations exceeded the RISC standard but were less than the Chicago Metropolitan Statistical Area background concentration of 13.0 mg/kg and were not considered to be of concern. PCBs were non-detectable and polycyclic aromatic hydrocarbons (PAHs) were mostly non-detectable, with a few compounds measured at concentrations below 500 µg/kg. Elutriate ammonia nitrogen concentrations were found to be elevated throughout the harbor, however, mixing zone calculations indicated that highly dispersive conditions during the disposal operation would reduce the concentrations to below the water quality standard. While the material from the East Harbor Arm and Outer Harbor was too fine for beach nourishment, it was judged to be acceptable for open water disposal based on a lack of water quality and aquatic species impacts.

Sediment sampling at BWH in 2001 indicated results similar to the 1993 sampling event. Elutriate analyses indicated elevated concentrations of ammonia, phosphorus and total chromium. While dredging did not occur after the 2001 sampling event, the draft data and draft contaminant determination indicate that the material from BWH is acceptable for open water disposal at the deep lake placement area if a mixing zone is considered at the disposal site. The draft contaminant determination concluded that while sediment from the East Harbor Arm has the potential to cause adverse impact through secondary growth effect and static long-term acute toxicity, mixing would mitigate this potential due to the dynamic nature of the lake at the deep lake placement area. Sediment and elutriate testing at BWH in 2006 were also consistent with previous analyses. Elutriate results indicated that ammonia, phosphorus, TDS, copper, and selenium concentrations exceeded water quality standards. Bulk chemistry analysis from harbor sediments indicated concentrations of arsenic and chromium in excess of the RISC residential and default closure criteria, but less that the statistical background concentration for metropolitan Chicago (IEPA TACO).

Sediment sampling was conducted in the Approach Channel outside of the breakwaters at BWH in fall 2012. The source of the sediment in the area of the Approach Channel is from the east, near the previous NIPSCO Bailly generating station intake. Previous sampling in the area of the NIPSCO intake has been found to be free of contaminants. In May 2005, NIPSCO supplied USACE with historical data for sediment samples collected in the vicinity of their Bailly Generating Station intake structure from 1978, 1992, and 1995. The 1992 and 1995 data included grain size analyses and both indicated sand content greater than 90 percent. NIPSCO had the 1992 and 1995 sediment samples analyzed for potential contaminants of concern, including toxic metals, pesticide and PCB compounds, and the contaminant levels that were analyzed were all less than the corresponding Risk-Integrated

Table 5. Historic Sediment Chemistry at Burns Waterway Harbor

		1993						2001						2006						2012		2013							
		East Arm		West Arm		Outer Harbor		East Arm		West Arm		Outer Harbor		East Arm		West Arm		Outer Harbor		Harbor Approach		East Arm		West Arm		Outer Harbor		Harbor Approach	
Parameter	Units	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.	Range	Avg.
1-Methylnaphthalene	ug/kg													7.6 - 65	38	4.2 - 100	33.8	6.1 - 14	10.7										
2-Methylnaphthalene	ug/kg													16 - 130	76	7.6 - 45	24.9	26-Nov	19	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Acenaphthene	ug/kg													7.2 - 120	79	2.2 - 100	29.8	3.2 - 5.5	4.5	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Acenaphthylene	ug/kg													7.8 - 42	24	2.8 - 100	42.7	3.2 - 9.7	6.7	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Aluminum	mg/kg							2600 - 3200	2,900	2800 - 4000	3,367	1900 - 4500	2,800	4010 - 4970	4,627	3820 - 5640	4593	2190 - 6770	5113	560 - 660	590	2200-13006	6,000	1800-6100	3300	1300-6400	4233	1500-4900	2700
Anthracene	ug/kg													21 - 130	81	5.6 - 93	34.9	16-Sep	14	<330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Arsenic	mg/kg	5.5 - 6.5	5.8	4.8 - 5.9	5.22	1.6 - 2.1	3.84	3.4 - 4.3	4	2.6 - 4.1	4	2.6 - 3.6	3	5.26 - 7.92	7	4.32 - 6.17	5.48	2.43 - 6.73	5.12	1.2 – 1.3	1.23	3.3-5.7	4.33	2.5-5.9	4.1	1.4-5.2	2.4	2.4-4.6	3.1
Barium	mg/kg							19 - 23	21	15 - 25	21	23-Nov	16	29.8 - 51.4	40	23.9 - 36.4	30.2	13.8 - 41.2	31.3	4.0 – 5.3	4.5	16-67	35	12-41	22	9.1-36	25.7	12-42	22
Benzo(a)anthracene	ug/kg													62 - 290	174	13 - 200	84	17 - 48	35	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Benzo(a)pyrene	ug/kg													59 - 280	163	12 - 170	73	15 - 46	32	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Benzo(b)fluoranthene	ug/kg													51 - 310	170	13 - 200	86	23 - 57	43	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Benzo(g,h,i)perylene	ug/kg													40 - 220	127	9.3 - 120	54.6	14 - 39	28	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Benzo(k)fluoranthene	ug/kg													23 - 86	51	May-76	31	7.4 - 19	14.1			<330	<330	<330	<330	<330	<330	<330	<330
Cadmium	mg/kg	1.4 - 1.4	1.4	1.4 - 1.4	1.4	1.4 - 1.4	1.4	<1 - <1	<1	<1 - <1	<1	<1 - <1	<1	0.3 - 1.02	1	<0.002 - 0.153	0	<0.002 - <0.002	0	<0.20 - <0.20	<0.20	<0.20-0.22	0.21	<0.2-0.38	0.26	<0.22	<0.22	<0.20	<0.20
Chemical Oxygen Demand	mg/kg							18000 - 37000	29,333	11000 - 22000	17,333	11000 - 21000	15,667	60000 - 110000	90,000	20000 - 30000	26000	21000 - 31000	27000	<360 - 3700	2120	2300-6700	5,133	830-6600	3177	2000-9500	5667	2100-52000	21000
Chromium [1]	mg/kg	32.9 - 36	34.5	16.3 - 22.2	19.84	8.7 - 9.7	15.44	17 - 23	21	18-Oct	15	8.8 - 13	10	29.4 - 46	40	18.9 - 28.3	24.1	9.09 - 28.3	22	16-Mar	8.9	15-23	19	8-29	16	5.2-21	14	9.3-25	15.1
Chrysene	ug/kg							340 - 340	340			-		57 - 350	199	14 - 200	88	23 - 59	43	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Copper	mg/kg	47.1 - 65.5	58.45	15.9 - 20.1	17.2	6.3 - 7.6	13.2	19 - 38	30	15-Aug	12	5.6 - 8.8	7	51.7 - 103	85	20.5 - 28.5	24.3	11.2 - 32.3	24.7	<1 – 2.7	1.9	15-32	22	5.7-22	11.4	4.8-14	10	4.5-7.2	5.5
Dibenz(a,h)anthracene	ug/kg													11-59	34	7.1 - 100	37	3.2 - 9.1	6.5	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Fluoranthene	ug/kg							400 - 510	455					95 - 520	312	30 - 450	174	48 - 89	73	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Fluorene	ug/kg													10 - 130	83	5 - 100	43	7.7 - 12	9.8	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Indeno(1,2,3-c,d)pyrene	ug/kg													29 - 150	88	7.3 - 100	43.1	29-Nov	22	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Iron	mg/kg							10000 - 12000	11,333	6600 - 11000	9,067	6000 - 10000	7,533	19300 - 26700	23,700	12700 - 16500	14600	6420 - 18200	13907	2600 - 4800	3430	9500-17000	16,167	4400-14000	10467	6100-12000	8233	6000-10000	7700
Lead	mg/kg	20.9 - 29.6	24.1	9.8 - 22.4	17.08	5 - 7.2	13.12	12-17	15	11-21	17	7.9 - 11	9	14.4 - 21.2	19	9.61 - 18.4	14	7.01 - 19.6	15	2.5 – 2.9	2.7	7.6-11	9.5	5.8-24	12	4.6-14	9.5	7.6-8.2	7.9
Mercury Total	mg/kg	0.2 - 0.2	0.2	0.2 - 0.2	0.2	0.2 - 0.2	0.2	0.034 - 0.048	0	0.02 - 0.035	0	<0.02 - <0.02	0	0.026 - 0.08	0	0.024 - 0.045	0.034	0.022 - 0.13	0.08	<0.02 - <0.02	<0.02	<0.05	<0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
Naphthalene	ug/kg													34 - 500	308	12-61	37	11-27	21	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Nickel	mg/kg	14.9 - 20.4	16.75	12.2 - 23.2	16.5	6.2 - 7.4	13.6	11-Sep	10	7.8 - 11	10	5.4 - 11	8	15 - 20.1	18	9.99 - 15.1	12	6.27 - 17	13	2.4 – 3.2	2.7	9-30		5.9-18	10	4.3-18	7.8	4.9-7.3	5.9
Nitrogen, Ammonia (as N)	mg/kg	44.3 - 119	75.6	15.9 - 50.9	34.78	2.5 - 7	23.34	33 - 57	48	22 - 35	28	22 - 23	22	100 - 120	110	51 - 76	62	22 - 94	65	<1.0 – 2.5	1.5	<1.0-24		<1.0-5.7	2.5	<1.0-39	14	<1.0	<1.0
Oil & Grease	mg/kg							250 - 250	250	250 - 250	250	250 - 250	250	113 - 1240	753	<116 - 369	184	106 - 146	128	<510 - <540	<520	<630	<630	<690	<690	<630	<630	<540	<540
Percent Solids	%	50.5 - 59.9	56.7	53.3 - 61.2	58.5	76.4 - 78.7	65.78	64 - 70.7	67	48.3 - 74.1	61	68.4 - 76.3	73	60 - 69	65	54 - 65	61	53 - 75	61	78 - 82	80	66-79		61-81	70	66-82	76	77-82	80
pH	pH													7.99 - 8.72	8	7.37 - 8.06	7.56	7.4 - 7.75	7.5	8.35 – 8.68	8.54	8.03-8.67		7.71-8.05	7.83	7.72-7.92	7.84	7.69-8.87	8.41
Phenanthrene	ug/kg							330 - 390	360					57 - 500	312	23 - 320	122	36 - 62	50	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Pyrene	ug/kg							370 - 450	410					76 - 460	272	23 - 310	130	40 - 72	61	<330 - <330	<330	<330	<330	<330	<330	<330	<330	<330	<330
Selenium	mg/kg	0.2 - 0.2	0.2	0.2 - 0.2	0.2	0.2 - 0.2	0.2	<0.3 - <0.3	<0.3	<0.3 - <0.3	<0.3	<0.3 - <0.3	<0.3	0.845 - 1.18	1	1.3 - 2.4	1.9	1.25 - 2.2	2	<0.20 - <0.20	<0.20	1.2-2.8		1.1-2.2	1.5	0.86-1.9	1.5	0.65-2.1	1.2
Silver	mg/kg							<1 - <1	<1	1 - <1	1	<1 - <1	1	0.156 - 0.389	0	<0.0175 - 0.18	0.06	<0.0175 - 0.565	1	<0.10 - <0.10	<0.10	<0.1-0.1	0.1	<0.1-0.27	0.16	<0.10-0.14	0.11	<0.10	<0.10
Total Organic Carbon	mg/kg	28900 - 31100	30375	26100 - 31600	27820	410 - 1180	21300	4400 - 8100	6,267	3600 - 7600	5,933	2800 - 4300	3,567	9500 - 19000	14,167	8400 - 19000	12350	2800 - 17000	11933	<1000 - 1300	1100	8200-20000	13,067	14000-25000	17667	3500-10000	6900	2500-14000	8967
Volatile Solids	%	1.5 - 2.6	2.05	1.1 - 1.7	1.48	1-Jan	1.22	15-Oct	13	7.4 - 17	13	7.3 - 11	9	2.6 - 24	10	1.2 - 1.9	1.6	0.71 - 1.7	1	1.3 - 32	11.6	1.3-4	2.7	4.4-12	7.1	2-6.3	4.2	0.55-4.5	2.8
Zinc	mg/kg	124 - 158	141.25	50.8 - 90.7	73.08	31.8 - 34.4	57.66	49 - 75	65	36 - 61	50	28 - 36	32	95.5 - 159	137	59.1 - 87.9	73.4	50.4 - 98.3	81.9	9.2 - 16	13.1	44-69	54	30-98	54	21-63	43	31-38	34
Fines (p230)	%	57.4 - 82	66.775	44.2 - 99.6	69.62	16.2 - 23.7	52.58	45.6 - 60.3	54	32.7 - 92.3	67	22.3 - 49.9	38	47.5 - 62	56	34.5 - 64	46	14 - 64.5	48	2-Jan	1.3	24-77	53	26-80	52	12-58	34	1-15	6

System of Closure (RISC) residential default closure levels. Several of the toxic metals, and all the pesticide and PCB compounds that were analyzed were not detected in the samples. USACE Approach Channel sampling in 2012 indicated that sediment in the Approach Channel consisted of 92 to 96% fine sand. PAHs, semi-volatile organic compounds (SVOCs), BTEX and PCBs were not detected in the material collected within the dredging area, and detected metals were below RISC residential default closure values, similar quality to materials sampled at the NIPSCO Bailly intake structure. With the exception of copper and zinc, the elutriate data did not exceed state water quality criteria. A mixing zone evaluation was not conducted as part of the contaminant determination. USACE determined that copper and zinc would temporarily exceed background concentrations in open waters of Lake Michigan during dredging placement activities; however, the impacts were determined to be temporary and confined to a localized zone surrounding the discharge point.

Sediment sampling was conducted in BWH in 2013. No PCBs, PAHs, or volatiles were detected in any of the sediments collected from the dredging area or the reference sites. Metal concentrations in the sediment are similar to historical values, with the Approach and Outer Harbor having somewhat lower concentrations than the harbor arms. Metals of concern, such as arsenic, cadmium, and lead, were present in low concentration, with little difference between the concentrations of contaminants found at the reference sites versus the harbor material. The grain size of the sediment differs by harbor area: the Approach Channel contains the least amount of fines (6% on average), the Outer Harbor has an average fines content of 34%, and the Harbor Arms' fine content average over 50%. Though the elutriate constituents are low in the Harbor Arm material, because the sediment from the Harbor Arms are primarily fine-grained, it is not well suited for beach nourishment and has been disposed in the deep lake placement area. Outer Harbor and Approach Channel materials have been placed in the littoral zone near Ogden Dunes. Water samples collected in BWH exceeded the State of Indiana water quality criteria for several pollutants, including copper, selenium, and zinc. This is likely due to the stagnant conditions within the harbor, coupled with impacts from shipping activities. The elutriate samples prepared with the same background water also exceeded the water quality criteria for these three constituents.

2.4.2. Databases

The U.S. Environmental Protection Agency (USEPA) EnviroMapper for Envirofacts (https://www3.epa.gov/enviro/) online web-based application was used to obtain information on regulated sites that may be located on or adjacent to BWH. EnviroMapper is a single point of access to select USEPA environmental data. The web site provides access to several USEPA databases that provide information about environmental activities that may affect air, water, and land quality anywhere in the United States. Databases linked to the EnviroMapper include: Superfund sites (Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) database), toxic releases (Toxic Release Inventory (TRI)), hazardous waste generators (Resource Conservation and Recovery Act Information (RCRAInfo) database), and brownfield sites (Assessment, Cleanup and Redevelopment Exchange System (ACRES) database). A summary of findings is presented in **Figure 7** and summarized in **Table 6**.

Table 6: Enviromapper Waste and/or Chemical Management Facilities

Name	Regulatory ID	Address
Air Products & Chemicals Inco	110001235994	391 DUNES HWY
American Iron Oxide Company	110058558010	6300 US HWY 12
Arcelormittal Burns Harbor, llc	110000607558	250 W US 12
Beemsterboer Slag Corp-Burns Harbor	110067130223	250 WEST HIGHWAY 12
Bethlehem Steel Corp Burns Harbor	110015836238	US RTE 12
Bulk Transport Corp	110007570743	US HWY 12 (IN BETHLHEM STEEL MILL AT 15TH & F ST)
C S Environmental Inc.	110003094026	1 PINE TRAIL
Cargill Burns Harbor Grain El	110007362549	6640 SHIP DR
Conrail	110064151536	6512 US HWY 12
Continental Can Co USA Plant 17	110007564643	6000 US 12
Feralloy Processing Co	110009388117	6600 US HWY 12
Frick Services Site B	110003135900	570 E BOUNDARY
Gc Zarnas & Co Inc.	110003133047	247 STEEL DR
Great Lakes Processing	110003087917	345 SALMON DR
Houghton International Incorporated	110064096810	6300 US HWY 12 A&E9
Hunter Corp	110003126297	270 STEEL DR
In Port Commission	110009388171	6600 US HWY 12
Indiana American Water Northwest Operations	110038918865	84 DIANA RD
Indiana Pickling And Processing Company	110002376964	6650 NAUTICAL DR
ISG Burns Harbor	110035818657	250 WEST US HIGHWAY 12
Metal Services llc Dba Phoenix Services llc - Contractor(001)	110007566927	US 12 & SR 149
Nipsco Bailly Generating Station	110000397730	246 BAILLY STATION ROAD
Nlmk Indiana	110000398212	6500 S. BOUNDARY RD.
Oil Technology, Inc. - Contractor Of Arcelormittal (001)	110007573795	251 E US 12
Phoenix Services Llc	110020054590	900 GEORGE NELSON DR
Portside Energy Corp	110006010583	6290 US HWY 12
Precoat Metals	110000747862	6144 US HIGHWAY 12
Proposed City Marina	110008338165	KRIZMAN RD
Pure Air	110009568093	246 BAILLY STA RD
Steel Warehouse Of Portage	110043694188	6780 WATER WAY DRIVE

Name	Regulatory ID	Address
Tanco Terminals Inc.	110003135848	400 E BOUNDARY RD
Tube City Ims	110031019582	6500 S BOUNDARY RD
U. S. Steel - Midwest Plant	110064395453	5808 US HIGHWAY 12
United States Steel Corp Midwest Plant	110056963282	6300 US HWY 12
Us Steel Corp Midwest Plant	110066942278	6300 US HWY 12
USDA GIPSA FGIS	110006365245	6640 US 12

2.5. Tier 1 Conclusion

The westward littoral drift pattern and historic sediment data suggest that sediment in the Approach Channel are littoral sands and are likely suitable for unrestricted placement, although material within the Outer Harbor and Harbor Arms may be of a generally poorer quality. Based on an overall evaluation of the historic sediment data from BWH, and the potential sources of sediment contamination identified in the Tier 1 analysis, the Chicago District, U.S. Army Corps of Engineers concludes that the existing information is insufficient to make a factual determination regarding compliance with the Clean Water Act, Section 404(b)(1). As such, a Tier 2 evaluation is required, which will involve the analysis of representative sediment and elutriate samples.

2.5.1. Sediment Contaminant List

Based on the information obtained from the Tier 1 analysis, a list of potential contaminants of concern has been compiled and is included in **Table 7**. The constituents indicated in the list should be evaluated through analytical testing using the Tier 2 evaluation process. The sampling and analysis plan for Tier 2 evaluation is included as **Attachment 2**.

Table 7: Enviromapper Waste and/or Chemical Management Facilities

Parameter	Matrix	Source
Aluminum	Sediment and Elutriate	NPDES Discharges
Arsenic	Sediment and Elutriate	Historic Sediment
Barium	Sediment and Elutriate	NPDES Discharges
Cadmium, total	Sediment and Elutriate	Storm water runoff, NPDES Discharges
Chromium, total	Sediment and Elutriate	Storm water runoff, NPDES discharges
Chromium, hexavalent	Sediment and Elutriate	Spills/ERNS, NPDES discharges
Copper	Sediment and Elutriate	Storm water runoff, Historic Sediment

Parameter	Matrix	Source
Iron	Sediment and Elutriate	NPDES Discharges
Lead	Sediment and Elutriate	NPDES Discharges
Mercury	Sediment and Elutriate	Historic Data
Nickel	Sediment and Elutriate	Storm water runoff, Historic Data
Zinc	Sediment and Elutriate	Storm water runoff, Historic Data
Total Phosphorous	Sediment and Elutriate	Historic Data
Ammonia nitrogen	Sediment and Elutriate	Spills/ERNS, NPDES discharges, Historic Data
Oil and Grease	Sediment and Elutriate	Spills/ERNS, storm water runoff, NPDES Discharges
COD	Sediment and Elutriate	Standard
TOC	Sediment and Elutriate	Standard
PCBs	Sediment and Elutriate	Historic Data
BTEX	Sediment and Elutriate	Spills/ERNS, NPDES discharges, storm water runoff
PAHs	Sediment and Elutriate	Historic Data, storm water runoff
SVOC	Sediment and Elutriate	Storm water runoff
% Volatile, dissolved, suspended solids	Sediment	Standard
Grain Size	Sediment	Standard
E. Coli	Sediment	Beach nourishment evaluation, storm water runoff

3. Tier 2 Analysis

3.1. Introduction

This section constitutes the Tier 2 evaluation of sediments from Burns Waterway Harbor in order to make a factual determination regarding compliance with the Clean Water Act Section 404(b)(1) regarding disposal of dredged sediment into Lake Michigan. Sediment bulk chemistry will be analyzed to provide a relative comparison with reference site sediment, and elutriate analysis will be completed to assess the impacts associated with open water, beach, and littoral zone placement of the sediment. It is assumed, for the purposes of this assessment, that runoff from beach placement will result in return water to open waters of Lake Michigan, similar to littoral zone and deep lake placement area.

3.2. Tier 2 Objectives

Since the information assembled in Tier 1 was not sufficient to make a factual determination of compliance with the Clean Water Act Section 404(b)(1), a Tier 2 evaluation is required. The purpose of the Tier 2 evaluation is to make a contaminant determination using physical and chemical data collected from potential dredge material. Sediment bulk chemistry is analyzed to determine the concentrations of contaminants and nutrients found in the sediment. A second purpose of Tier 2 analysis is to determine if discharge of dredged water is in compliance with state water quality standards, in accordance with Section 401 of the Clean Water Act. Elutriate analysis will assess the quality of the discharge water associated with the dredging operation. Elutriate tests predict water column impacts from dredging operations.

3.3. Sediment Sampling and Analysis

Four dredged material management units were established for characterization of sediments from BWH. The sediment investigation was conducted in August 2019 and consisted of the collection of a series of sediment core, sediment grab, and site water samples. PARS Environmental, Inc., through contract with the USACE, conducted the sampling effort from August 13th through August 15th, 2019. The objectives of the sample collection and analysis effort include the following:

- To obtain physical and chemical data for the sediments to be dredged in order to determine the suitability of the material for beach nourishment, littoral zone, or open water placement, and
- To obtain chemical data for elutriate samples in order to determine water quality impacts related to sediment dredging and disposal.

The sampling activities consisted of the collection of sediment core samples, elutriate samples, sediment grab samples, and site water samples. PARS Environmental, Inc. subcontracted field sample collection efforts to Wood and sample analysis to CT Laboratories, LLC (CT Labs) in Baraboo, Wisconsin and Mi-Tech Services, Inc. (Mi-Tech) in Weston, Michigan. The Great Lakes Environmental Center (GLEC) provided and operated a 26-foot pontoon boat equipped

with a pneumatic drive core unit, submersible pump, and ponar sampler to aid in the collection of samples. Field sampling activities were completed from August 13 through August 16, 2019. Sediment and water samples were collected from within four (4) management units (MUs) within the dredging area (see **Figure 8**) and two (2) reference site (RS) locations (see **Figure 9**). A composite of equal volumes of sediment and site water were collected from each core within each MU which were used for preparation of one elutriate sample per MU. Background water samples from the RS were collected to compare the results of the elutriate tests.

A total of twelve (12) sediment core samples, six (6) sediment composite grab samples, four (4) elutriate samples and six (6) water samples, were collected at BWH. Results of sediment and water sampling and analysis are provided in **Attachment 3**. Sediment core sample locations within the MUs were adjusted in the field due to lack of shoaling at proposed sample locations specified in the scope of work; actual sample locations after field adjustment are presented in **Figure 10**. Sediment grab samples were collected from the RS and are presented in **Figure 11**. Sediment samples collected from each management unit and reference site were analyzed for the parameters shown in **Table 8**. Background water samples collected from each management unit and reference site, and elutriate samples, were analyzed for the parameters shown in **Table 9**. Modifications of the analytical methods were made by the laboratory during analysis: while the scope of work required elutriate preparation in accordance with the Inland Testing Manual's standard elutriate preparation, which specifies mixing 4 parts sediment to one part water, settling, and extraction of supernatant for analysis, the elutriate for samples from West Harbor Arm (MU1) and East Harbor Arm (MU2) were mistakenly prepared in the laboratory using the modified (aerated) elutriate preparation procedure and were aerated during the mixing process prior to settling. The elutriate samples from the Outer Harbor (MU3) and Approach Channel (MU4) were prepared using the standard elutriate preparation procedure. In addition, elutriate samples from MU1 and MU3 required additional settling time (4-hours) to obtain sufficient sample volume for analysis due to lack of settling in the elutriate column.

Table 8: 2019 Sampling – Sediment Bulk Chemistry List of Analyses

Parameter	Acceptable Method(s)	Practical Quantitation Limit (PQL) (mg/kg)
Aluminum	6010B	0.24
Arsenic	6010B	0.8
Barium	6010B	0.05
Cadmium, Total	6010B	0.04
Chromium, Total	6010B	0.14
Chromium, Hexavalent	7196A	0.32
Copper	6010B	0.4
Iron	6010B	1.8
Lead	6010B	0.25
Mercury	7471B	0.0083
Nickel	6010B	0.12
Selenium	6010B	0.40
Silver	6010B	0.1
Zinc	6010B	0.3
pH	9045C	0.05 std unit
Total Phosphorus	365.3/4500PE	5
Ammonia Nitrogen	350.2 / 4500B,C	6.5
Oil and Grease	413.1 / 5520B	100
Chemical Oxygen Demand	410.4 / 5220D	20
Total Organic Carbon	9060A	2000
Total PCBs	8082	0.33
BTEX	8260B	Varies – below RISC residential
PAHs	8270C	Varies – below RISC residential
% Volatile Solids	2540E	*
% Total Solids	2540E	*
Grain Size Analysis (with hydrometer)	ASTM D422	NA
E. coli	9222D	*

NA = not applicable

Table 9: 2019 Sampling – Site Water and Elutriate List of Analyses

Parameter	Method(s)	Required Detection Limit (mg/l)
Aluminum	6010B	0.05
Arsenic	6010B	0.0015
Barium	6010B	0.025
Cadmium	6010B	0.001
Chromium	6010B	0.01
Chromium, Hexavalent	7196A	0.0001
Copper	6010B	0.005
Iron	6010B	0.2
Dissolved Iron	6010B	0.2
Lead	6010B	0.001
Mercury	7471A	0.0002
Nickel	6010B	0.01
Selenium	6010B	0.005
Silver	6010B	0.0015
Zinc	6010B	0.05
Ammonia Nitrogen	350.1 / 4500G	0.1
Oil and Grease	413.1	5
Chemical Oxygen Demand	410.4	20
Total Phosphorus	365.2 / 4500F	0.025
pH	9040C	0.05 std unit
Hardness	130.2 / 2340	5
Alkalinity	2320B	20
Total Dissolved Solids	160.1 / 2540C	5
Total Suspended Solids	150.2 / 2540D	5
SVOCs	624/625	Varies
Total PCBs	625 0.1	0.00015
BTEX	624	Varies

All sediment and water samples collected were packaged in a cooler with ice, secured with a custody seal, and shipped under a chain-of-custody form on the same day to the laboratory for overnight delivery via common carrier (Federal Express). While the analytical laboratory was able to receive and analyze the majority of samples within the method required hold times, all sediment samples collected from MU4, RS1, and RS2 were analyzed for E. coli outside of the method hold times.

3.3.1. Sediment Physical Characteristics

Grain size analysis was conducted on sediment samples collected from each of the management units. The grain size results indicate that there is a relatively high percentage of fines in the sediments within the West Harbor Arm (MU1), East Harbor Arm (MU2) and Outer Harbor (MU3) ranging between 39.4 to 90.3 percent passing a #200 sieve (see **Table 10**). MU1 and

MU3 contain a higher fraction of fines on average (82% and 71%, respectively) than MU2 and MU4 (45% and 1.6%, respectively). The deep water reference site (RS2) also contains a higher fraction of fines than the littoral zone/beach placement reference site (RS1) (8% and 1.5%, respectively).

Table 10: USACE 2019 Sediment Grain Size Analysis Results

Sample Location		% Gravel	% Sand	% Silt	% Clay	Percent Passing #200
West Harbor Arm	MU1-C01	1.2	17.1	42.6	39.1	81.7
	MU1-C02	0.3	9.4	49.3	41	90.3
	MU1-C03	0	25.9	27	47.1	74.1
East Harbor Arm	MU2-C01	1.1	54.2	31.9	12.8	44.7
	MU2-C02	0.8	59.8	27	12.4	39.4
	MU2-C03	0	49	38.2	12.8	51
Outer Harbor	MU3-C01	0	28.9	41.4	29.7	71.1
	MU3-C02	0	20.8	26.5	52.7	79.2
	MU3-C03	0	37.6	33.5	28.9	62.4
Approach Channel	MU4-C01	0	98.2	0.5	1.3	1.8
	MU4-C02	0	97.9	0.8	1.3	2.1
	MU4-C03	0	99	< 1	< 1	1.0
Littoral Zone / Beach Reference Site	RS1-G1	0	99.7	< 0.3	< 0.3	0.3
	RS1-G2	1	96.3	1.9	0.8	2.7
	RS1-G3	0.4	98.2	0.3	1.1	1.4
Deep Water Reference Site	RS2-G1	0.5	92.9	4.6	2	6.6
	RS2-G2	0.6	83.8	13.8	1.8	15.6
	RS2-G3	0	98	0.7	1.3	2

The material sampled in the Approach Channel appears to be of similar grain size as material present in the littoral zone/beach reference site and may be suitable for use as beach nourishment based on the results of the grain size analysis. Sediment from West and East Harbor Arms, and the Outer Harbor, maybe not be ideal for beach or littoral zone placement due to high fraction of silts and clays present in the material, but may be suitable for deep water placement.

3.3.2. Sediment Elutriate Results

Section 401 water quality compliance is typically determined using elutriate test results. The standard elutriate test is used to anticipate water quality for hydraulically or mechanically dredged sediment that will be placed at an open water disposal site. The test consists of preparing and mixing a sediment sample with dredging site water to form a slurry, allowing the slurry to settle under quiescent conditions, then extracting an effluent elutriate sample for chemical analysis. The elutriate test is a conservative estimate of contaminant partitioning into the water column. The sediment and water collected from the MUs were mixed to a concentration approximately equal to the expected average field inflow concentration, in this case at 4:1

sediment to water ratio and mixed for 30 minutes prior to settling. While the standard elutriate preparation was specified for the 2019 sampling event, the elutriate samples from West Harbor Arm (MU1) and East Harbor Arm (MU2) were mistakenly prepared in the laboratory using the modified (aerated) elutriate preparation procedure and were aerated during the mixing process prior to settling. The elutriate samples from the Outer Harbor (MU3) and Approach Channel (MU4) were prepared using the standard elutriate preparation procedure. While the elutriate samples were mixed differently, there does not appear to be a large difference in the elutriate results reported for MU1, MU2, and MU3 that suggests that aerating the MU1 and MU2 samples impacted the reported results. With the exception of MU3, which historically contains clean sand, MU1, MU2, and MU3 results contain concentrations of contaminants in the elutriate results within the same level of magnitude.

Background water and elutriate samples were analyzed for the parameters given in **Table 9**. The elutriate, background, and reference site water quality results are summarized in **Table 11**. No BTEX or PCBs were measured in any of the water or elutriate samples. Overall the elutriate quality is consistent with past results. The Approach Channel demonstrates generally better elutriate quality, consistent with the coarser grained sediments in those areas. The Harbor Arms demonstrate somewhat lower elutriate quality, likely due to the sediment quality found in these areas of Burns Harbor. A review of the data in **Table 11** indicates that the concentrations of a few metals and water quality parameters (e.g., aluminum, barium, iron, zinc, ammonia-nitrogen, total suspended and total dissolved solids) in the elutriate samples prepared for the management units exceed the existing background water quality at the reference sites, while many of the contaminants of concern and water quality parameters detected in the elutriate samples are similar in quality to the background condition at the reference sites. A review of the data in **Table 11** indicates that several SVOCs and PNAs were also detected in elutriate samples; however, the reported concentrations are less than the practical quantitation limit (PQL) and are marked as estimated. It is assumed that though PNAs were detected in the elutriate samples, the concentrations reported are likely similar to background conditions. A direct comparison of the elutriate results with background water quality cannot be completed due to contaminants being detected below the PQL applicable the reference site samples.

Elevated concentrations of metals and nutrients in the elutriate samples may be related to the slow settling in the elutriate column, which is a historic problem with sediments obtained from MU1, MU2, and MU3, and is likely due to the high fraction of silts, clays, and organic carbon present in the sediment. During preparation of the elutriate test it was difficult for the laboratory to differentiate the line between settlable and unsettlable materials within the elutriate column; MU1 and MU3 were allowed to settle for 4-hours because of this condition. Because the suspended materials resulting from the elutriate test did not readily settle in the elutriate column, the elutriate results likely contain a higher fraction of suspended materials in the elutriate samples and may contribute to the elevated levels of metals and nutrients found in the water column.

Comparison of the elutriate results to the State of Indiana Lake Michigan water quality standards, identified in 327 IAC 2-1.5, suggests that total ammonia in elutriate samples from MU1, MU2, and MU3 is the only parameter that exceeds the criteria for chronic (Criterion Continuous

Concentration - CCC) levels of ammonia but not the acute standard (Criterion Maximum Concentration - CMC). The total ammonia criteria is a function of pH and temperature. For continuous discharges of dredged material, the CCC for ammonia for typical ranges of pH (7.0 – 9.0) and temperature (15-25 °C) during summer dredging operations falls between 0.1889 - 2.11 mg/L and the CMC for the same temperature and pH range fall between 0.8286 – 19.58 mg/L. Concentrations of ammonia in elutriate samples from each management unit range from 0.3 mg/L (in MU4) to 7.2 mg/L (in MU2).

Dredging and placement operations are not a continuous or long-term event. Typically, the dredging operation would be intermittent, and would occur about 8-10 hours per day, and last 1-3 months in duration. The water quality impact of dredged material placement would be short term and localized within the disposal area; elutriate results suggest that concentrations of ammonia in the disposal zone would meet the acute water quality standard for open water placement of sediment materials dredged from each management unit. The dynamic and dispersive nature of Lake Michigan in the deep lake and littoral zone placement areas would mitigate any potential negative long-term impacts associated with placement of dredged material in open waters. In addition, because the reported ammonia concentration in elutriate obtained from MU4 (Approach Channel) is relatively low (0.3 mg/L), negative water quality impacts from upland beach placement of sediments dredged from MU4 are not anticipated.

Table 11: 2019 Water Quality and Elutriate Results

Analyte	Location	Indiana Water Quality Standards		MU1 - West Harbor Arm		MU2 - East Harbor Arm		MU3 - Outer Harbor		MU4 - Approach Channel		RS1 (Littoral Zone/Beach Reference Site)	RS2 (Deep Water Reference Site)
	Sample ID	Criterion Continuous	Criterion Maximum	MU1-W1	MU1-E1	MU2-W2	MU2-E1	MU3-W3	MU3-E1	MU4-W4	MU4-E1	RS1-W1	RS2-W2
	Sample Type			Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Site Water
	Units												
Inorganics													
pH	S.U.	6 - 9		8.36 J	8.12 J	8.03 J	8.37 J	8.43 J	8.03 J	8.42 J	8.41 J	8.36 J	8.69 J
Oil and Grease	mg/L	-		2.9 U	3.2 U	2.8 U	1.5 J	1.8 J	3.1 U	1.9 J	2.9 U	2.8 U	1.7 B
Hexavalent Chromium	µg/L	10.98	16.02	12 U,M	12 U	12 U,M	12 U	12 U	12 U	12 U	12 U	12 U	12 U
Ammonia Nitrogen**	mg/L	0.1889-2.11	0.8286-19.58	0.1 U	4.3	0.1 U	7.2	0.1 U	6.5 J	0.1 U	0.3	0.1 U	0.1 U
Alkalinity	mg/L	-	-	120	120	120	160	120	160	120	130	120	120
COD	mg/L	-	-	35 U	21 J	35 U,M, Y	17 J	35 U	29 J	35 U	24 J	35 U	35 U
Phosphorus	mg/L	-	-	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U
Total Dissolved Solids	mg/L	750		170	240	180	270	180	200	150	190	180	170
Total Suspended Solids	mg/L	-	-	2 UJ	2 UJ	2 U	24	2 UJ	2.2 J	2 UJ	43	2 UJ	2 UJ
Mercury	µg/L	0.0013		0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U	0.06 U
Aluminum	µg/L	-	-	25.4 J	359	6.7 J	1490 J	23.5 J	192	12.6 J	451	14.4 B	11.9 B
Arsenic	µg/L	147.9	339.8	12 U	12 U	12 UJ	5.3 J	12 U	6.1 J	12 U	12 U	12 U	12 U
Barium	µg/L	-	-	20.8	56.4	12.2 J	50.3	21.5	64.9	21.2	61.1	20.6 B	21.4 B
Cadmium	µg/L	3	6	1 U	1 U	1 UJ	0.34 J	1 U	1 U	1 U	1 U	1 U	1 U
Chromium	µg/L		-	0.84 B	2 U	2 UJ	4.3	1.4 B	2 U	0.79 B	2 U	0.74 J	1.3 J
Copper	µg/L	11.7	17.9	3.5 U	4.5 J	3.5 UJ	5.8 J	4.3 J	2 J	1.2 J	5.6 J	3.5 U	3.5 U
Iron	µg/L	-	-	50 U	538	50 UJ	2090 M	16.8 J	260	50 U	357	50 U	50 U
Lead	µg/L	-	-	2 U	2.3 J	2 UJ	5.7	2 U	1.4 J	2 U	1.7 J	2 U	2 U
Nickel	µg/L	65	586	3 U	3 U	3 UJ	2.2 J	3 U	1 J	3 U	3 U	3 U	3 U
Selenium	µg/L	-	5	6.5 U	6.5 U	6.5 UJ	6.5 U	6.5 U	6.5 U	6.5 U	2.7 J	6.5 U	3.6 B
Silver	µg/L	-	-	2 U	2 U	2 UJ	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Zinc	µg/L	149.6		1.7 J	11.9	5 UJ	14.8	3 J	5 U	5 U	16.9	5 U	5 U
Total Hardness	mg/L	-	-	130	110	81 Y	160	140	140	140	140	130	140
Dissolved Iron	µg/L	300		50 U	33.3 J	50 UJ	50 UJ	50 U	50 U	50 U	50 U	50 U	50 U
VOCs													
Benzene	µg/L	12		1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Ethylbenzene	µg/L	-		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
m & p-Xylene	µg/L	-		1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
Methyl tert-butyl ether	µg/L	-		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
o-Xylene	µg/L	-		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
Toluene	µg/L	5600		0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U	0.6 U
PCBs													
Aroclor-1016	µg/L	8.6×10^{-9}		0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1221	µg/L			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1232	µg/L			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1242	µg/L			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1248	µg/L			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1254	µg/L			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U

Table 11: 2019 Water Quality and Elutriate Results

Analyte	Location	Indiana Water Quality Standards		MU1 - West Harbor Arm		MU2 - East Harbor Arm		MU3 - Outer Harbor		MU4 - Approach Channel		RS1 (Littoral Zone/Beach Reference Site)	RS2 (Deep Water Reference Site)
	Sample ID	Criterion Continuous	Criterion Maximum	MU1-W1	MU1-E1	MU2-W2	MU2-E1	MU3-W3	MU3-E1	MU4-W4	MU4-E1	RS1-W1	RS2-W2
	Sample Type			Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Site Water
	Units												
Aroclor-1260	**µg/L**			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1262	**µg/L**			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
Aroclor-1268	**µg/L**			0.3 U	0.31 U	0.3 U	0.3 U	0.3 U	0.3 U	0.3 U	0.29 U	0.3 U	0.3 U
SVOC - Semi-Volatile Organic Compounds													
1,1'-Biphenyl	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
1,2,4,5-Tetrachlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
1,2,4-Trichlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
1,2-Dichlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
1,3-Dichlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
1,4-Dichlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
2,3,4,6-Tetrachlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4,5-Trichlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4,6-Trichlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-Dichlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-Dimethylphenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-Dinitrophenol	µg/L	-	-	5 U	5.2 U	5 U	5.1 U	5 U	5.1 U	5.1 U	5 U	5 U	5 U
2,4-Dinitrotoluene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
2,6-Dichlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,6-Dinitrotoluene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
2-Chloronaphthalene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
2-Chlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2-Methylphenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2-Nitroaniline	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
2-Nitrophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3 & 4-Methylphenol	µg/L	-	-	3.6 U	3.7 U	3.6 U	3.6 U	3.6 U	3.6 U	3.7 U	3.6 U	3.6 U	3.6 U
3,3'-Dichlorobenzidine	µg/L	-	-	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ	1 UJ
3-Nitroaniline	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4,6-Dinitro-2-methylphenol	µg/L	-	-	5 U	5.2 U	5 U	5.1 U	5 U	5.1 U	5.1 U	5 U	5 U	5 U
4-Bromophenyl-phenyl ethe	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
4-Chloro-3-methylphenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
4-Chloroaniline	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
4-Chlorophenyl-phenyl ethe	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
4-Nitroaniline	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
4-Nitrophenol	µg/L	-	-	5 U, Y	5.2 U, Y	5 U, Y	5.1 U, Y	5 U, Y	5.1 U, Y	5.1 U, Y	5 U, Y	5 U, Y	5 U, Y
Acetophenone	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Aniline	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Atrazine	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Azobenzene & 1,2-Diphenyl	µg/L	-	-	0.8 U	0.82 U	0.8 U	0.81 U	0.8 U	0.81 U	0.82 U	0.8 U	0.8 U	0.8 U
Benzaldehyde	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U

Table 11: 2019 Water Quality and Elutriate Results

Analyte	Location	Indiana Water Quality Standards		MU1 - West Harbor Arm		MU2 - East Harbor Arm		MU3 - Outer Harbor		MU4 - Approach Channel		RS1 (Littoral Zone/Beach Reference Site)	RS2 (Deep Water Reference Site)
	Sample ID	Criterion Continuous	Criterion Maximum	MU1-W1	MU1-E1	MU2-W2	MU2-E1	MU3-W3	MU3-E1	MU4-W4	MU4-E1	RS1-W1	RS2-W2
	Sample Type			Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Site Water
	Units												
Benzidine	µg/L	-	-	50 R	52 R	50 R	51 R	50 R	51 R	51 R	50 R	50 R	50 R
Benzoic acid	µg/L	-	-	25 U, Z	26 U, Z	25 U, Z	25 U, Z	25 U, Z	25 U, Z	26 U, Z	25 U, Z	25 U, Z	25 U, Z
Benzyl alcohol	µg/L	-	-	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y
Bis(2-chloroethoxy)methane	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Bis(2-chloroethyl)ether	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Bis(2-chloroisopropyl)ether	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Bis(2-ethylhexyl)phthalate	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	**2.7**	1 U	1 U
Butylbenzylphthalate	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Caprolactam	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Carbazole	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Di-n-butylphthalate	µg/L	-	-	2 U	**2.6** J	2 U	2 U	2 U	2 U	2 U	**1.2** J	2 U	2 U
Di-n-octylphthalate	µg/L	-	-	1 U	1 U	1 U	**1.2** J	1 U	1 U	1 U	**0.67** J	1 U	1 U
Dibenzofuran	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Diethylphthalate	µg/L	-	-	1 U	**0.62** J	1 U	**0.6** J	1 U	1 U	1 U	1 U	1 U	1 U
Dimethylphthalate	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachlorobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Hexachlorobutadiene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Hexachlorocyclopentadiene	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Hexachloroethane	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Isophorone	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
N-Nitroso-di-n-propylamine	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
N-Nitrosodimethylamine	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
N-Nitrosodiphenylamine & D	µg/L	-	-	0.8 U	0.82 U	0.8 U	0.81 U	0.8 U	0.81 U	0.82 U	0.8 U	0.8 U	0.8 U
N-Nitrosopyrrolidine	µg/L	-	-	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Nitrobenzene	µg/L	-	-	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U	0.4 U	0.41 U	0.4 U	0.4 U	0.4 U
Pentachlorophenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Phenol	µg/L	-	-	2 U	2.1 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Pyridine	µg/L	-	-	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y	1 U, Y
1-Methylnaphthalene	µg/L	-	-	0.02 U	0.021 U	**0.0083** J	**0.0073** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
2-Methylnaphthalene	µg/L	-	-	0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acenaphthene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.022** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Acenaphthylene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.0077** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Anthracene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.017** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)anthracene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.076**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(a)pyrene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.056** B	0.02 U	0.039 B	0.02 U	**0.041** B	0.02 U	0.02 U
Benzo(b)fluoranthene	µg/L	-	-	0.02 U	**0.035** B	0.02 U	**0.067** B	0.02 U	0.033 B	0.02 U	**0.037** B	0.02 U	0.02 U
Benzo(g,h,i)perylene	µg/L	-	-	0.02 U	**0.057**	0.02 U	**0.067**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Benzo(k)fluoranthene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.016** J	0.02 U	0.02 U	0.02 U	**0.010** J	0.02 U	0.02 U
Chrysene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.036** B	0.02 U	0.02 U	0.02 U	**0.0086** B	0.02 U	0.02 U

Table 11: 2019 Water Quality and Elutriate Results

Analyte	Location	Indiana Water Quality Standards		MU1 - West Harbor Arm		MU2 - East Harbor Arm		MU3 - Outer Harbor		MU4 - Approach Channel		RS1 (Littoral Zone/Beach Reference Site)	RS2 (Deep Water Reference Site)
	Sample ID	Criterion Continuous	Criterion Maximum	MU1-W1	MU1-E1	MU2-W2	MU2-E1	MU3-W3	MU3-E1	MU4-W4	MU4-E1	RS1-W1	RS2-W2
	Sample Type			Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Elutriate	Site Water	Site Water
	Units												
Dibenzo(a,h)anthracene	µg/L	-	-	0.02 U	0.021 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Fluoranthene	µg/L	-	-	0.02 U	**0.014** J	**0.0098** J	**0.09**	0.02 U	**0.011** J	0.02 U	**0.012** J	0.02 U	0.02 U
Fluorene	µg/L	-	-	0.02 U	**0.010** J	0.02 U	**0.034** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Indeno(1,2,3-cd)pyrene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.062**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Naphthalene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.02** J	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Phenanthrene	µg/L	-	-	0.02 U	0.021 U	0.02 U	**0.063**	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U	0.02 U
Pyrene	µg/L	-	-	**0.012** B	**0.023** B	**0.017** B	**0.077** B	**0.022** B	**0.023** B	**0.014** B	**0.015** B	**0.015** B	**0.016** B

Notes:

Bold - Analyte detected above quantitation limit

Water Quality Standard Exceedance

B - A target analyte was detected in an associated blank QC sample. The detected sample result is less than five times the concentration detected in the blank.

J - The result is an estimated quantity. The associated numerical value is the approximate concentration in the sample.

M - Matrix spike and/or matrix Spike Duplicate recovery outside acceptance limits.

U - The analyte was analyzed for, but was not detected at a concentration greater than the reported sample quantitation limit.

UJ - The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.

Q - The result was both B and J flagged during validation.

Y - Replicate/Duplicate precision outside acceptance limits.

VOCs - Volatile Organic Compounds

S.U - Standard Unit

SVOC - Semi-Volatile Organic Compounds

PCBs - Polychlorinated Biphenyls

µg/kg - Microgram per Liter

mg/L - Milligram per Liter

* Water quality standards (327 IAC 2-1.5) are the most restrictive of aquatic life, human health, or wildlife standards, including consideration of special standards for Lake Michigan.

** Water quality standards for ammonia are based on temperature and pH. Range given for pH 7-9 and temperature 15-25°C.

3.3.3. Sediment Bulk Chemistry Results

Sediment samples were analyzed for all the parameters shown in **Table 8**. Results are summarized in **Tables 12 and 13**. In general, the concentrations of contaminants found in the sediment were similar when compared to historic values, with the exception of PCBs, which were not previously detected in historical sampling events. The practical quantitation limits for PCBs for the 2019 sampling event are lower than previous sampling events, resulting in detection of trace levels of PCBs that have not been previously detected.

3.3.3.1. Sediment Organic Contaminant Results

Various organic compounds were detected at low concentrations in the sediment samples collected from the management units and the reference sites:

- PCBs (Aroclor 1248) were detected in all sediment samples collected in the West Harbor Arm (MU1), East Harbor Arm (MU2), and Outer Harbor (MU3) at concentrations ranging from 29 – 100 ug/kg.
- PAHs were detected in all sediment samples, including the reference sites, at concentrations ranging between 0.809 – 1010 ug/kg. In general, the concentrations of PAHs found in samples obtained from each management unit exceed the concentrations of PAHs found in sediment at the reference sites.
- Toluene and benzene were detected in two management unit samples, one each from MU1 and MU2, at low concentrations (toluene maximum – 83.3 ug/kg and benzene maximum 17 ug/kg).

3.3.3.2. Sediment Metal Contaminant Results

Detected metal concentrations found in the sediment are similar to historical values. In general, the Approach Channel and/or sediment obtained from Reference Site 1 contain the lowest detected concentrations of metals when compared to the Outer Harbor and Harbor Arms. Sediments obtained from MU2 and MU3 exhibit the maximum concentrations of metals found in the sediment samples. In general, concentrations of metals found at Reference Site 2 are greater than metals found at Reference Site 1. Mercury, aluminum, arsenic, barium, chromium, copper, iron, lead, nickel, selenium, silver, and zinc were measured in most sediment samples. Iron concentrations are elevated in all four management units, and also at the reference areas. Iron can be naturally occurring and black iron containing particles are common in Great Lakes sands. In general, the quality of material in the Approach Channel is similar to the quality of material found at Reference Site 1, and better quality than material found at Reference Site 2, and MU1, MU2, and MU3.

Table 12 - 2019 Sediment Quality Results - PAHs, PCBs, VOCs

Analyte	Management Unit	IDEM Screening and Closure Level - Residential	MU1 - West Harbor Arm			MU2 - East Harbor Arm			MU3 - Outer Harbor			MU4 - Approach Channel			RS1 - Littoral Zone/Beach Reference Site			RS2 - Deep Water Reference Site		
	Sample ID		MU1-C1	MU1-C2	MU1-C3	MU2-C1	MU2-C2	MU2-C3	MU3-C1	MU3-C2	MU3-C3	MU4-C1	MU4-C2	MU4-C3	RS1-G1	RS1-G2	RS1-G3	RS2-G1	RS2-G2	RS2-G3
	Units																			
VOCs																				
Benzene	µg/kg	17,000	49 U	39 U	86 U	**17** J	27 U	25 U	39 U	53 U	63 U	29 U	33 U	29 U	29 U	27 U	32 U	28 U	32 U	26 U
Ethylbenzene	µg/kg	81,000	49 U	39 U	86 U	23 U	22 U	25 U	39 U	53 U	63 U	29 U	33 U	29 U	29 U	27 U	32 U	28 U	32 U	26 U
m & p-Xylene	µg/kg	390,000	97 U	78 U	170 U	45 U	54 U	50 U	77 U	110 U	130 U	58 U	66 U	57 U	58 U	54 U	64 U	56 U	64 U	51 U
Methyl tert-butyl ether	µg/kg	660,000	97 U	78 U	170 U	45 U	54 U	50 U	77 U	110 U	130 U	58 U	66 U	57 U	58 U	54 U	64 U	56 U	64 U	51 U
o-Xylene	µg/kg	430,000	49 U	39 U	86 U	23 U	27 U	25 U	39 U	53 U	63 U	29 U	33 U	29 U	29 U	27 U	32 U	28 U	32 U	26 U
Toluene	µg/kg	820,000	97 U	78 U	**83.3** J	**24.5** J	54 U	50 U	77 U	110 U	130 U	58 U	66 U	57 U	58 U	54 U	64 U	56 U	64 U	51 U
PAHs																				
1-Methylnaphthalene	µg/kg	250,000	**13.4**	**16.5**	**23.2**	**78.9**	**35.9**	**33.3**	**19.5**	**18.4** J	**24.0**	**1.4** J	**0.95** J	1.2 U	1.3 U	1.2 UJ	1.3 U	**1.38** J	**1.88** J	**0.703** J
2-Methylnaphthalene	µg/kg	340,000	**18.6**	**27**	**48**	**170**	**76.9**	**66.8**	**34.4**	**36.0** J	**45.0**	**2.76**	**1.23** J	1.2 U	1.3 U	1.2 UJ	**0.901** J	**1.83** J	**2.73**	**0.877** J
Acenaphthene	µg/kg	5,000,000	**6.83**	**10.2**	**16.4**	**96.1**	**27.2**	**40.4**	**13.8**	**13.1** J	**23.7**	**3.5**	1.3 U	1.2 U	1.3 U	1.2 UJ	1.3 U	**2.26** J	**3.36**	1.2 U
Acenaphthylene	µg/kg	-	**5.94**	**6.01**	**32.2**	**90.6**	**29.1**	**36.3**	**72.1**	**16.4** J	**25.7**	**0.827** J	**0.541** J	1.2 U	1.3 U	1.2 UJ	1.3 U	**0.783** J	**1.02** J	1.2 U
Anthracene	µg/kg	25,000,000	**18.5**	**21.7**	**71.9**	**243**	**108**	**118**	**157**	**42.9** J	**82.6**	**9.58**	**1.66** J	1.2 U	1.3 U	1.2 UJ	1.3 U	**5.77**	**8.72**	**1.29** J
Benzo(a)anthracene	µg/kg	-	**38.4**	**70**	**237**	**605**	**288**	**295**	**409**	**180** J	**216**	**27.6**	**9.51**	1.2 U	1.3 U	1.2 UJ	1.3 U	**16.3**	**25.5**	**9.21**
Benzo(a)pyrene	µg/kg	1,500	**35.5**	**60.1**	**210**	**469**	**230**	**230**	**373**	**144** J	**169**	**21**	**7.6**	1.2 U	**5.63**	**4.91** J	**5.01**	**10.8**	**16.3**	**7.38**
Benzo(b)fluoranthene	µg/kg	15,000	**60.6**	**94.8**	**342**	**605**	**308**	**299**	**506**	**227** J	**270**	**26.4**	**9.91**	**4.27**	**6.9**	**4.59** J	**5.28**	**14.8**	**25.7**	**8.06**
Benzo(g,h,i)perylene	µg/kg	-	**49.4**	**58.9**	**181**	**361**	**178**	**178**	**250**	**117** J	**143**	**14.7**	**8.16**	1.2 U	1.3 U	**6.84** J	1.3 U	**10.5**	**13.8**	**8.64**
Benzo(k)fluoranthene	µg/kg	1,500	**15.3**	**30.7**	**85.7**	**165**	**88.7**	**89.3**	**130**	**62.3** J	**68.2**	**10.2**	**2.46** J	**0.809** J	**2.48** J	**0.984** J	**1.21** J	**4.19** J	**7.45**	**2.31** J
Chrysene	µg/kg	1,500,000	**46.3**	**72.8**	**259**	**514**	**275**	**273**	**407**	**174** J	**218**	**21.9**	**4.49**	**1.13** J	**2.42** J	**1.03** J	**1.66** J	**19.1**	**31.3**	**5.28**
Dibenzo(a,h)anthracene	µg/kg	21,000	**11.5**	**8.32**	**45.1**	**108**	**47.6**	**58**	**70.1**	**32.8** J	**37.0**	1.2 U	1.3 U	1.2 U	1.3 U	1.2 UJ	1.3 U	1.2 U	**7.68**	**6.91**
Fluoranthene	µg/kg	3,400,000	**71.8**	**118**	**519**	**1010**	**444**	**478**	**410**	**291** J	**386**	**53**	**9.7**	**1.94** J	**3.98** J	**1.73** J	**3.28** J	**34.4**	**56**	**8.69**
Fluorene	µg/kg	3,400,000	**15.2**	**26.1**	**57.3**	**193**	**74.1**	**102**	**33.7**	**44.3** J	**51.9**	**4.43**	**1.36** J	1.2 U	1.3 U	1.2 UJ	1.3 U	**3.97**	**7.2**	1.2 U
Indeno(1,2,3-cd)pyrene	µg/kg	15,000	**31.1**	**44.5**	**159**	**300**	**148**	**152**	**232**	**104** J	**122**	**14.2**	**8.05**	1.2 U	1.3 U	**6.8** J	1.3 U	**8.99**	**12.5**	**8.51**
Naphthalene	µg/kg	53,000	**14.5**	**25.8**	**58.5**	**504**	**118**	**206**	**122**	**41.1** J	**83.5**	**10.9**	**1.86** J	**0.885** J	**1.02** J	**0.898** J	**1.14** J	**4.79**	**5.5**	**1.03** J
Phenanthrene	µg/kg	-	**62.3**	**87.3**	**337**	**876**	**394**	**439**	**174**	**186** J	**275**	**37.2**	**3.31** J	2.4 U	2.5 U	2.4 UJ	2.5 U	**16.9**	**29.3**	**1.75** J
Pyrene	µg/kg	2,500	**66.2**	**107**	**394**	**815**	**356**	**384**	**332**	**266** J	**284**	**40.4**	**8.25**	**2.46** J	**4.14** J	**2.36** J	**3.38** J	**34.2**	**51.4**	**9.66**
PCBs																				
Aroclor-1016	µg/kg	5,700	29 U	33 U,Y	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1221	µg/kg	2,800	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1232	µg/kg	2,400	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1242	µg/kg	3,200	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1248	µg/kg	3,200	**35.1** J	**71.4**	**54**	**100** J	**29** J	**38.3**	**42.9** J	**40.4** J	**46.4** J	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1254	µg/kg	1,700	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1260	µg/kg	3,400	29 U	33 U,Y	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1262	µg/kg	-	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U
Aroclor-1268	µg/kg	-	29 U	33 U	36 U	31 U	29 U	26 U	32 U	34 U	32 U	24 U	25 U	24 U	26 U	25 U	25 U	25 U	25 U	25 U

Notes:

Bold - Analyte detected above quantitation limit

J - The result is an estimated quantity. The associated numerical value is the approximate concentration in the sample.

U - The analyte was analyzed for, but was not detected at a concentration greater than the reported sample quantitation limit.

Y - Replicate/Duplicate precision outside acceptance limits.

VOCs - Volatile Organic Compounds

PAHs - Polycyclic Aromatic Hydrocarbons

PCBs - Polychlorinated Biphenyls

µg/kg - Microgram per Kilogram

Table 13 - 2019 Sediment Quality Results - Metals and General Chemistry

Analyte	Management Unit Sample ID Units	IDEM Screening and Default Closure Level - Residential	MU1 - West Harbor Arm			MU2 - East Harbor Arm			MU3 - Outer Harbor			MU4 - Approach Channel			RS1 - Littoral Zone/Beach Reference Site			RS2 - Deep Water Reference Site		
			MU1-C1	MU1-C2	MU1-C3	MU2-C1	MU2-C2	MU2-C3	MU3-C1	MU3-C2	MU3-C3	MU4-C1	MU4-C2	MU4-C3	RS1-G1	RS1-G2	RS1-G3	RS2-G1	RS2-G2	RS2-G3
% Total Solids	%	-	67.6	59.4	55.4	64.4	67.7	77	62	59.5	61.8	83	78.4	81.7	78.1	79.1	77.5	77.2	78.4	80.1
Total Volatile Solids	gVS/gTS	-	0.0228	0.0304	0.0324	0.0361	0.0255	0.0232	0.0238	0.0266	0.0281	0.024	0.0016	0.0026	0.0018	0.0031	0.0043	0.0059	0.0059	0.0063
pH	S.U.	-	7.25 J	7.32 J	7.39 J	8.44 J	7.93 J	8.16 J	6.89 J	7.48 J	7.29 J	9.66 J	8.94 J	7.81 J	8.87 J	8.56 J	8.94 J	8.47 J	8.33 J	8.42 J
E. Coli	MPN/g_TS	-	13.8	4 U	4 U	3 U	3 U	3 U	5.97	3 U	3 U	2 UJ	2240 J	2 UJ	1300 J	751 J	2270 J	11.2 J	64.5 J	330 J
Oil and Grease	mg/kg	-	360 U	410 U	363 J	1,320	548 J	449 J	269 J	420 U	559 J	300 U	214 J	169 J	165 J	310 U	320 U	320 U	310 U	300 U
Ammonia Nitrogen	mg/kg	-	33.5	39.5	66	8.7	70.7 J	4.16	80.6 J	83.9 J	68	6 U	6.3 U	6.1 U	6.4 U	6.3 U	6.4 U	6.3 U	2.57 J	6.2 U
COD	mg/kg	-	4,150	47,700 J	58,100	84,700 J	24,000	43,900	21,000	61,300	51,200	40,400	1,910	1,280	1,210	2,160	1,730	5,490	11,600	1,660
Phosphorus	mg/kg	-	198 J	202 J	229 J	148 J	175 J	111 J	235 J	268 J	236 J	44.4 J	65.8 J	92.7 J	91.5 J	133 J	175 J	185 J	176 J	68.4 J
Total Organic Carbon	mg/kg	-	25,300	45,100	32,200	51,600	45,400	34,200	33,300	30,700	33,300	6,010	614	2,230	5,940	5,490	15,300	17,700	20,700	4,210
Metals																				
Hexavalent Chromium	mg/kg	4.2	0.16 U	0.16 UJ	0.16 U	0.25 U	0.24 U	0.2 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U	0.16 U
Mercury	mg/kg	3.1	0.018	0.032	0.033	0.062 J	0.022	0.018	0.03	0.031	0.031	0.0051 U	0.0055 U	0.0054 U	0.0054 U	0.0058 U	0.0057 U	0.0039 J	0.0061 J	0.0054 U
Aluminum	mg/kg	100,000	5,730	5,950	5,180	3,190 J	2,680 M	2,480	6,840	7,360	4,630	14,600	711	496	572	658	642	943	1,130	507
Arsenic	mg/kg	9.5	4.5	4.9	4.4	4.3	3.2	3	5	5.4	4.4	0.49 U	1 J	1.2	1	1	0.95 J	3.8	4.4	2.6
Barium	mg/kg	21,000	34.8	36.6	34.2	28.4	21.4	19.4	39.5	44.4	30.7	124	6.3	4	4.7	4.5	4.2	11.5	12.2	7.3
Cadmium	mg/kg	99	0.03 U	0.034 U	0.038 U	0.21	0.056 J	0.21	0.033 U	0.035 U	0.033 U	0.025 U	0.027 U	0.025 U	0.026 U	0.026 U	0.027 U	0.027 U	0.025 U	0.025 U
Chromium	mg/kg	-	13.8	17.3	23.2	25.7	17.4	15.3	18.8	23.1	21.8	23.5	3	1.6	1.6	2.1	2.1	3.6	4.8	2.2
Copper	mg/kg	4,300	13.7	16.6	18.1	39.5	18.9 J	25.7	17.2	19.2	15.0	0.69 B	0.64 B	1.5 J	0.74 B	0.64 B	1.4	1.6	1.7	0.69 B
Iron	mg/kg	77,000	14,400	15,600 M	15,000	11,500 J	9,510 M	8,600	16,400	17,800	13,700	6,460	2,570	2,420 M	2,250	2,930	2,710	7,870	8,440	4,940
Lead	mg/kg	400	11.3	14.6 Y	18.1	25.1	10.7	11.2	14.5	17.6	18.4	6.6	2	2	1.7	2.2	2.2	8	9	5.3
Nickel	mg/kg	1,100	15.8	16.6 J	14.1	9.6 J	7.5	7.3	19	19.8	12.6	2.2	1.8	1.6	1.6	1.8	1.8	4.5	4.9	3.1
Selenium	mg/kg	550	0.3 U	0.15 Q	0.11 B	0.48 J	0.18 J	0.14 J	0.33 U	0.35 U	0.18 B	0.89 B	0.084 B	0.11 B	0.26 U	0.26 U	0.27 U	0.14 B	0.25 U	0.25 U
Silver	mg/kg	550	0.74	0.83	0.83	0.078 J	0.092 J	0.083 J	0.85	0.93	0.74	0.4	0.061 J	0.063 J	0.062 J	0.055 J	0.052 J	0.35	0.39	0.18
Zinc	mg/kg	32,000	46.3	60.8	81.2	87.7	54.9	57.4	57.4	71.4	71.6	13.2	12.1	9.2	9.6	8.3	10.9	37.5	44.1	26.5

Notes:

Bold - Analyte detected above quantitation limit

B - A target analyte was detected in an associated blank QC sample. The detected sample result is less than five times the concentration detected in the blank.

J - The result is an estimated quantity. The associated numerical value is the approximate concentration in the sample.

M - Matrix spike and/or matrix Spike Duplicate recovery outside acceptance limits.

Q - The result was both B and J flagged during validation.

U - The analyte was analyzed for, but was not detected at a concentration greater than the reported sample quantitation limit.

Y - Replicate/Duplicate precision outside of range.

COD - Chemical Oxygen Demand

% - Percent

MPN/gTS - Most probable number of viable cells per gram of solid.

gVS/gTS - Grams of Volatile Solids to grams of Total Solids.

mg/kg - Milligram per Kilogram

* E. coli Result is greater than result displayed

3.3.3.3. Sediment Miscellaneous Parameters

Results confirmed that the sediment contains elevated levels of ammonia-nitrogen, phosphorous, and total organic carbon (TOC), though maximum concentrations found appear to be lower than those found during previous sediment investigations. Sediments contain elevated concentrations of total organic carbon (TOC) ranging from 614 mg/kg to 51,600 mg/kg; phosphorous concentrations range between 44.4 and 268 mg/kg; ammonia nitrogen concentrations range between 2.57 and 83.9 mg/kg. Review of general chemistry suggests that sediment in MU4 and RS1 and RS1 contain the lowest concentrations of total ammonia found in the sediment (2.57 mg/kg) and MU4 contains the lowest concentrations of total phosphorous and total organic carbon found in the sediment samples (44.4 mg/kg and 614 mg/kg, respectively). Sediment in MU2 contains the maximum concentrations of total ammonia and total organic carbon found in the sediment (83.9 mg/kg and 51,600 mg/kg, respectively) and MU3 contains the maximum concentration of total phosphorous found in the sediment samples (268 mg/kg). E. coli samples collected from MU1, MU2, and MU3 contain the lowest concentrations of E. coli found in the sediment and were generally not detected. Elevated E. coli concentrations were found in MU4 and RS1 (2,240 and 2,270 MPN/g_TS).

3.4. Tier 2 Conclusions

Since the information assembled in Tier 1 was not sufficient to make a factual determination of compliance with the Clean Water Act Section 404(b)(1), a Tier 2 evaluation is required. The purpose of the Tier 2 evaluation is to make a contaminant determination using dredged material physical and chemical data. Elutriate analysis is conducted to determine the quality of the discharge water associated with the dredging operation for compliance with Section 401 of the Clean Water Act. Sediment bulk chemistry is analyzed for contaminants and nutrients found in the sediment to determine the placement options for dredged material.

3.4.1. Sediment Quality

In the absence of sediment criteria, the sediment quality data generated by the laboratory are compared to the most restrictive State of Indiana Screening and Default Closure Values. The default closure values for direct contact residential land use applications are presented in **Table 12 and 13;** the migration to groundwater screening levels are not included in the data comparison as groundwater exposure pathway is not a concern for the intended dredged material placement sites. All of the reported concentrations of PAHs, PCBs, VOCs, and metals are below the residential default closure values, which indicate that there is no increased risk to human health resulting from placement of dredged material at the beach nourishment, littoral zone, or deep lake placement areas. Sediment in MU4 is similar in quality physically and chemically to sediment in RS1. Sediment in MU1, MU2, and MU3 contain elevated concentrations of contaminants, but in general are within the same level of magnitude of contaminants found in sediment at RS2.

3.4.2. Water Quality

Comparison of the elutriate results to the State of Indiana Lake Michigan water quality standards, identified in 327 IAC 2-1.5, suggests that total ammonia in elutriate samples from MU1, MU2, and MU3 is the only parameter that exceeds the criteria for chronic (Criterion Continuous Concentration - CCC) levels of ammonia but not the acute standard (Criterion Maximum Concentration - CMC). Exceeding the water quality standards in the elutriate sample does not necessarily imply an adverse impact to water quality at the disposal area. Consistent with Section 230.10(b)(1) of the Clean Water Act and in accordance with the *Great Lakes Dredged Material Testing and Evaluation Manual*, and the *Inland Testing Manual*, dilution and dispersion should be considered prior to application of water quality standards. The water quality impact of dredged material placement would be short term and localized within the disposal area; allowing for mixing at the disposal site would mitigate potential impacts to a temporary and localized zone around the discharge point. The dynamic and dispersive nature of Lake Michigan in the deep lake and littoral zone placement areas would mitigate any potential negative long-term impacts associated with placement of dredged material in open waters, either in the littoral zone or deep water. In addition, because the reported ammonia concentration in elutriate obtained from MU4 (Approach Channel) is relatively low, negative water quality impacts from upland beach placement of sediments dredged from MU4 are not anticipated.

3.4.3. Tier 2 Findings and Recommendations

The Chicago District has completed a contaminant determination for hydraulically or mechanically dredging sediments from Burns Waterway Harbor in Portage, Indiana, as required by Section 404(b)(1) of the Clean Water Act (CWA). The contaminant determination used a tiered approach that includes an evaluation of contaminant sources, transport, and pathways, and physical and chemical tests, including an evaluation of sediment, site water, and elutriate results. Below are the findings:

- Sediment within the Approach Channel and Maintenance Area is suitable for unrestricted use, including placement upland for beach nourishment or within the littoral zone.

- Sediment within the Outer Harbor and Harbor Arms is suitable to for placement in deep lake placement site north of the harbor.

- Water quality impacts associated with dredged material placement would be short term and localized within the disposal area only; the dynamic and dispersive nature of Lake Michigan in the deep lake and littoral zone placement areas would mitigate any potential negative long-term impacts associated with placement of dredged material in open waters, either in the littoral zone or deep water.

No new potential sources of contamination were presented for the Approach Channel of Burns Waterway Harbor. Based on review of historic data for the Approach Channel, data collected from the previous NIPSCO intake, current sediment data, and existing conditions, it appears that sediments in the littoral zone (Approach Channel, Maintenance Area, and Reference Site 1)

exhibit consistent quality. Materials present in the Approach Channel and Maintenance Area contain clean sand, free of fines and contaminants, which make it suitable for unrestricted use. Based on this assessment, the Chicago District proposes that future sampling events do not include sampling within the Approach Channel or Maintenance Area. Conclusions from this evaluation and from past investigations have consistently deemed the Approach Channel material suitable for placement in the littoral zone. Reuse opportunities for clean littoral sand dredged from the Approach Channel and Maintenance Area should be extended to include upland beach placement.

References

35 Illinois Administrative Code Part 742. Tiered Approach to Corrective Action Objectives (TACO).

327 Indiana Administrative Code (IAC) 2-6.1. Indiana Spill Rule.

Indiana Department of Environmental Management, Office of Land Quality, Emergency Response. *https://www.in.gov/idem/cleanups/2352.htm*

Morang, Andrew, Ashley E. Frey, David F. Bucaro, Sara Brodzinsky, and Jeff A. Fuller. 2012. *Sediment Budget for the Indiana Shore from Michigan City Harbor to Burns Waterway Harbor*. Engineer Research and Development Center. US Army Corps of Engineers.

Ports of Indiana Port Overview and Port Map. *http://www.portsofindiana.com/burnsharbor/*

U.S. Coast Guard National Response Center CERCLA and EPCRA Reports. *http://nrc.uscg.mil/*

USEPA and USACE. 1998a. *Evaluation of Dredged Material Proposed For Discharge in Waters of the U.S. - Testing Manual, "Inland Testing Manual"*. U.S. Environmental Protection Agency, U.S. Army Corps of Engineers. http://el.erdc.usace.army.mil/elmodels/pdf/inlandb.pdf.

USEPA and USACE. 1998b. *Great Lakes Dredged Material Testing and Evaluation Manual*. U.S. Environmental Protection Agency, U.S. Army Corps of Engineers. http://www.epa.gov/glnpo/sediment/gltem/manual.htm.

USEPA Enviromapper for Envirofacts. *https://www3.epa.gov/enviro/*

Figures

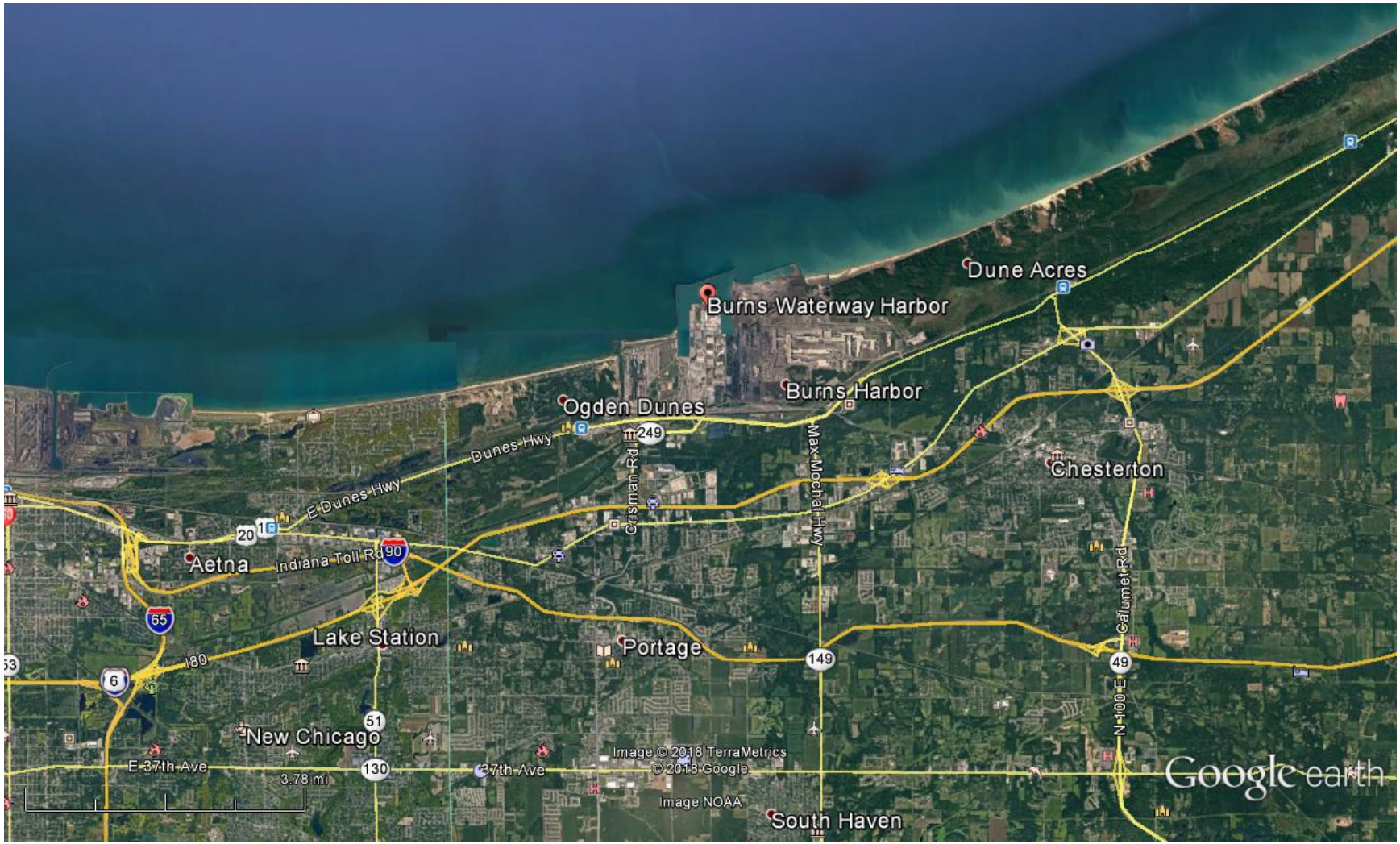


Figure 1 – Burns Waterway Harbor Location Map

Burns Waterway Harbor

U.S. Army Corps of Engineers
Chicago District

Figure 2. Burns Waterway Harbor Navigation Map

Legend

- U.S. Light
- Reef
- Revetment

Channel Area

- Currently Inactive

Authorized Depth

- 27 feet
- 28 feet
- 30 feet

Location Map

0 500 1,000
Feet

DISCLAIMER - While the United States Army Corps of Engineers, (hereinafter referred to USACE) has made a reasonable effort to insure the accuracy of the maps and associated data, its should be explicitly noted that USACE makes no warranty, representation or guaranty, either express or implied, as to the content, sequence, accuracy, timeliness or completeness of any of the data provided herein. The USACE, its officers, agents, employees, or servants shall assume no liability of any nature for any errors, omissions, or inaccuracies in the information provided regardless of how caused. The USACE, its officers, agents, employees or servants shall assume no liability for any decisions made or actions taken or not taken by the user of the maps and associated data in reliance upon any information or data furnished here. By using these maps and associated data the user does so entirely at their own risk and explicitly acknowledges that he/she is aware of and agrees to be bound by this disclaimer and agrees not to present any claim or demand of any nature against the USACE, its officers, agents, employees or servants in any forum whatsoever for any damages of any nature whatsoever that may result from or may be caused in any way by the use of the maps and associated data.

Notes

1. PROJECT DEPTHS ARE REFERRED TO LOW WATER DATUM 576.8 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC I.G.L.D (1955) (INTERNATIONAL GREAT LAKES DATUM).
2. PLANIMETRIC MAPPING WAS COMPILED FROM AERIAL PHOTGRAPHY TAKEN IN MARCH OF 2009.

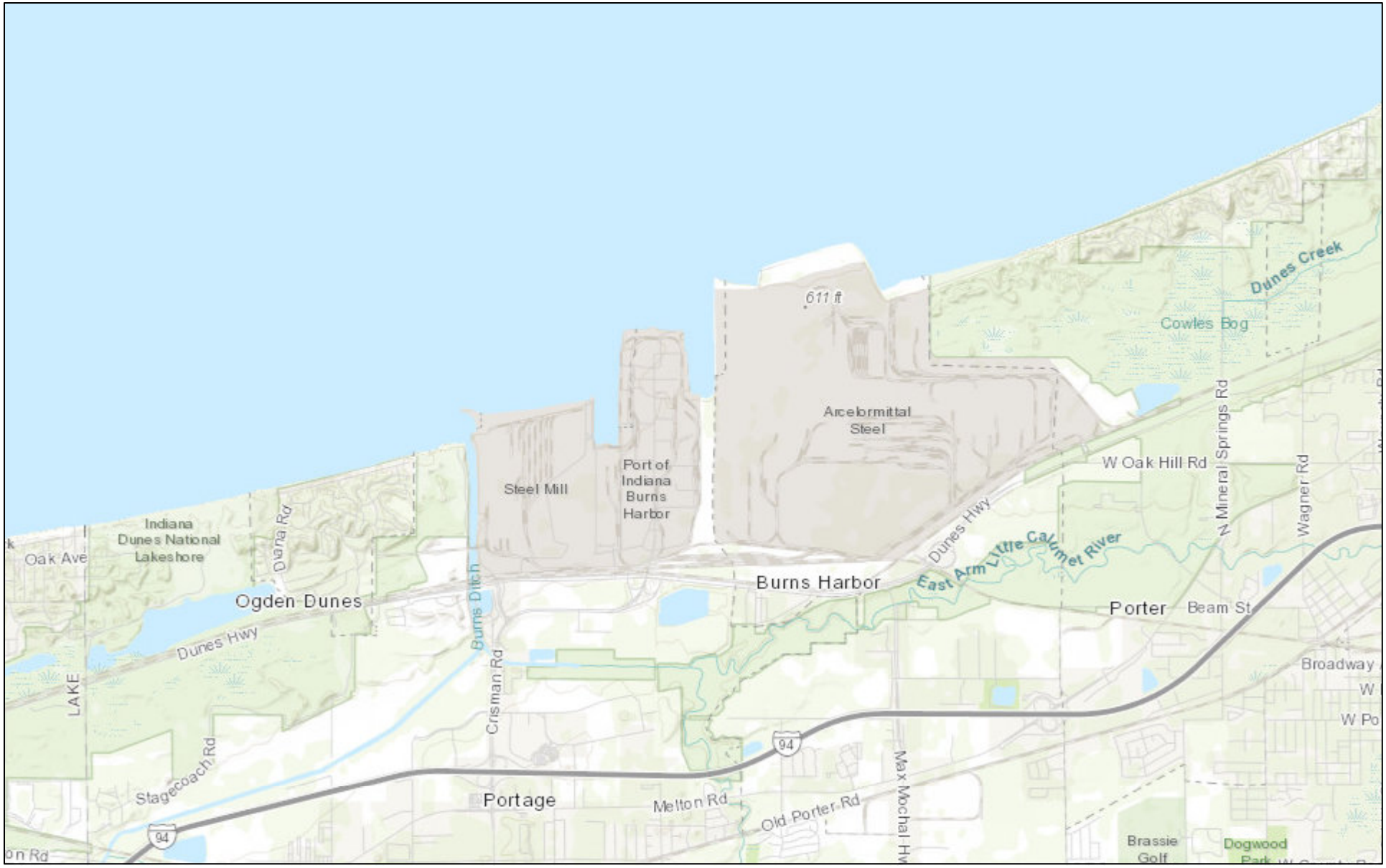


Figure 3 - Properties Adjacent to Burns Waterway Harbor

1:72,224

0 0.5 1 2 mi

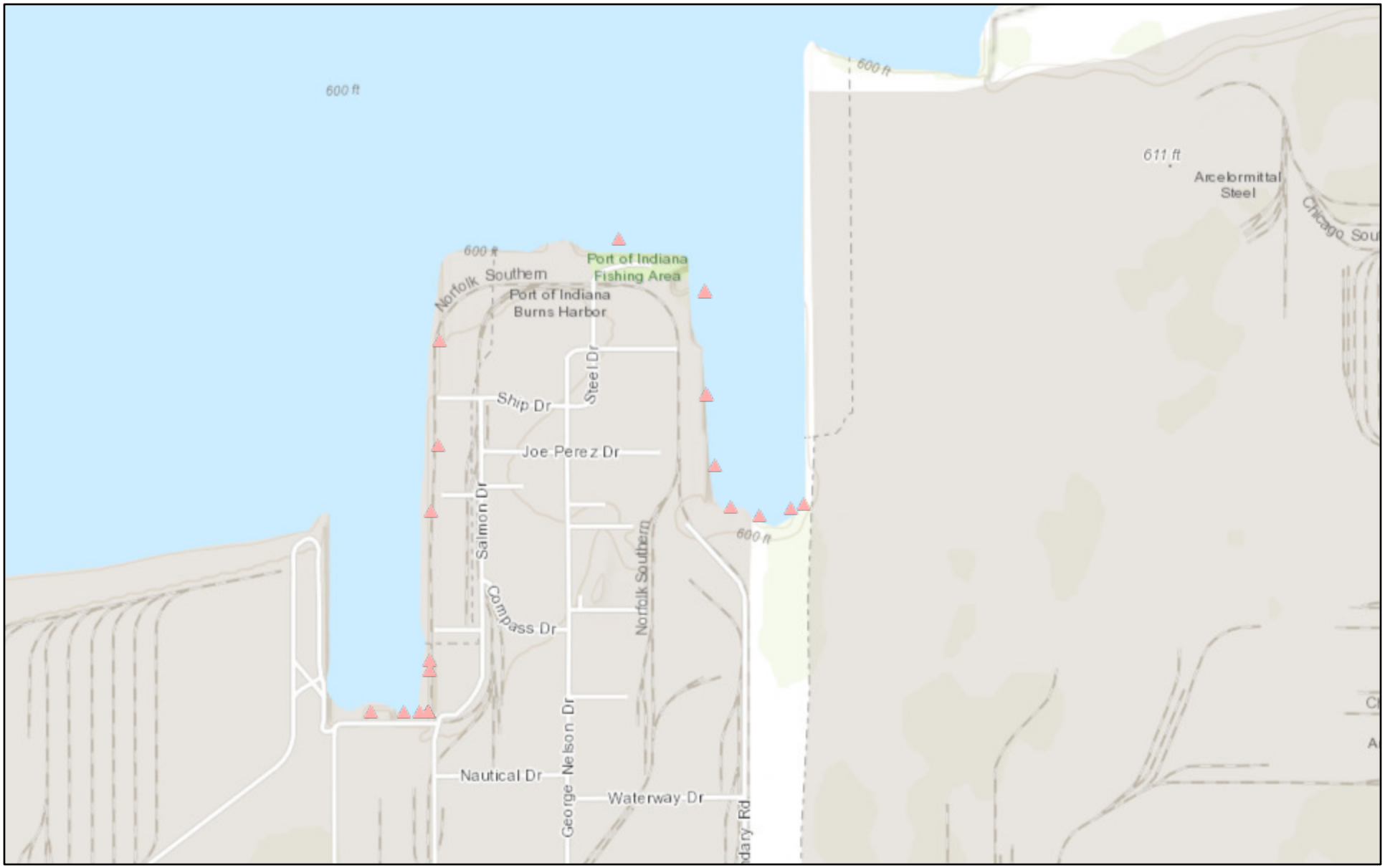
0 1 2 4 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri

PORT OF INDIANA - BURNS HARBOR

6625 S. Boundary Drive • Portage, IN 46368 • (219) 787.8636 • www.portsofindiana.com

Figure 5 - Burns Waterway Harbor NPDES Discharge Locations



12/23/2019, 10:38:00 AM

Facilities that Discharge to Water

Streams

1:18,056

0 0.1 0.2 0.4 mi

0 0.17 0.35 0.7 km

US EPA, Sources: Esri, HERE, Garmin, Intermap, increment P Corp.,

US Environment Protection Agency

Esri, HERE, Garmin, INCREMENT P, USGS, METI/NASA, EPA, USDA | US EPA |

Figure 6 - Adjacent ICIS Air Dischargers

U.S. Army Corps of Engineers
Chicago District

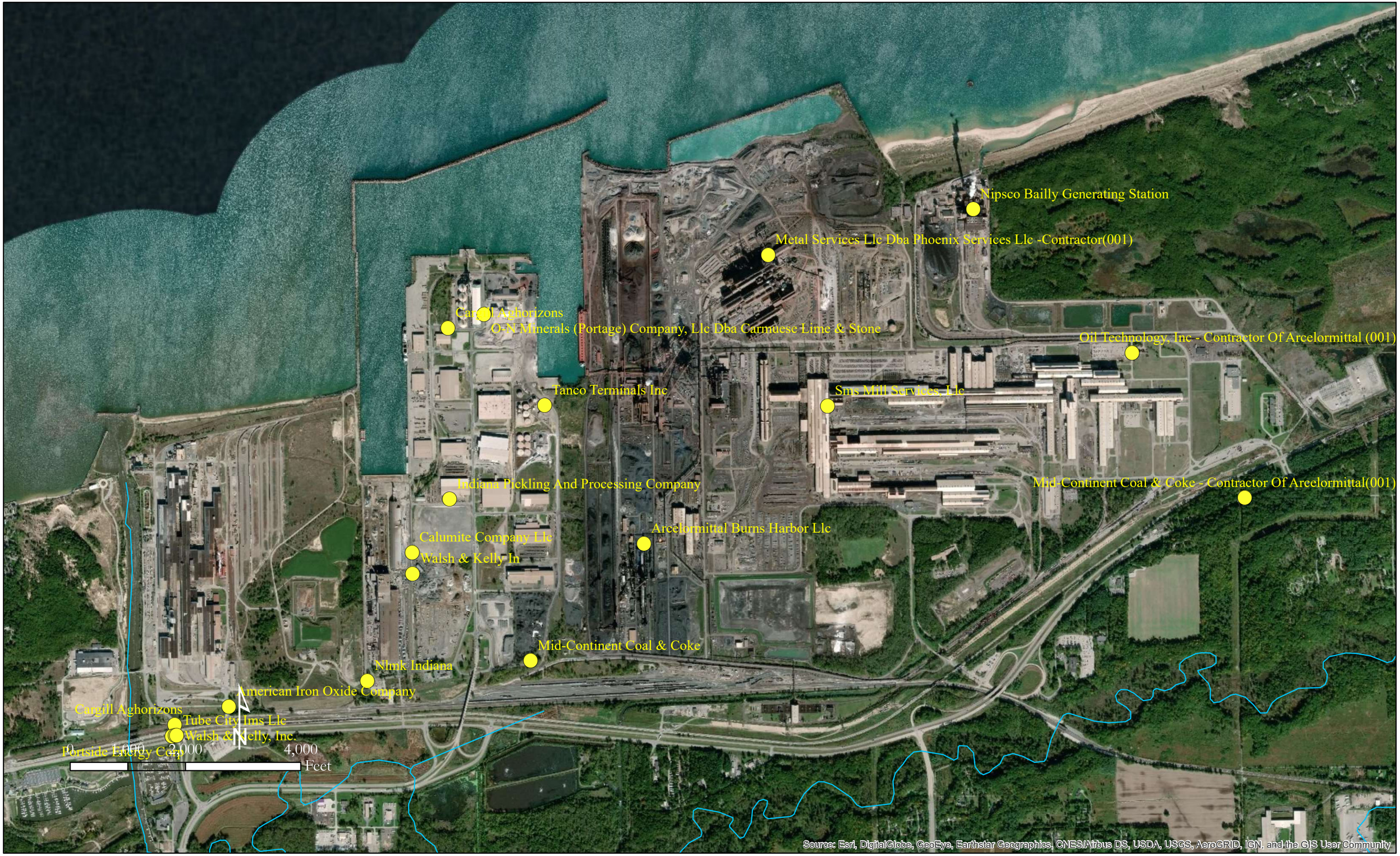
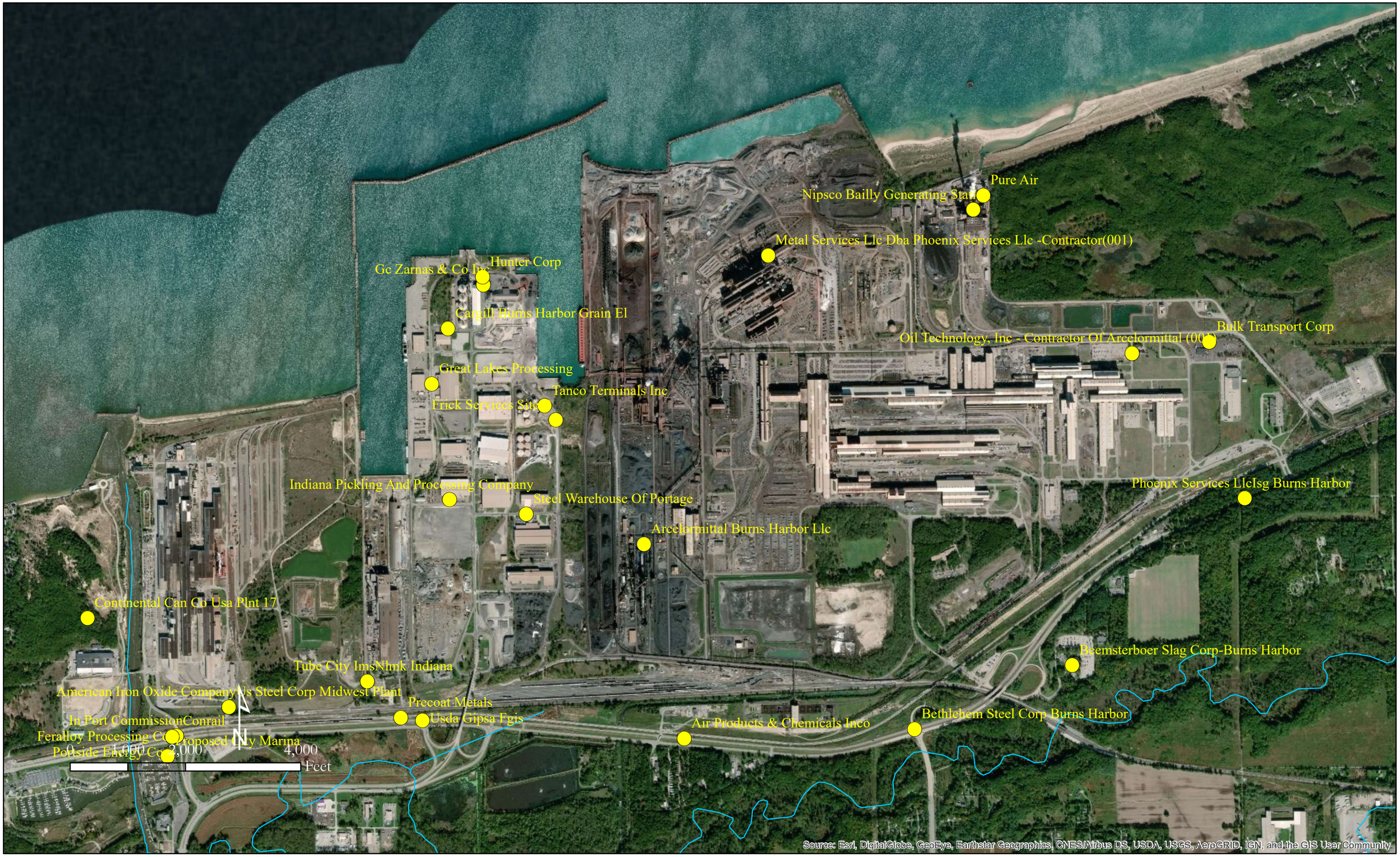


Figure 7 - Adjacent Waste and Chemical Management Sites

U.S. Army Corps of Engineers
Chicago District



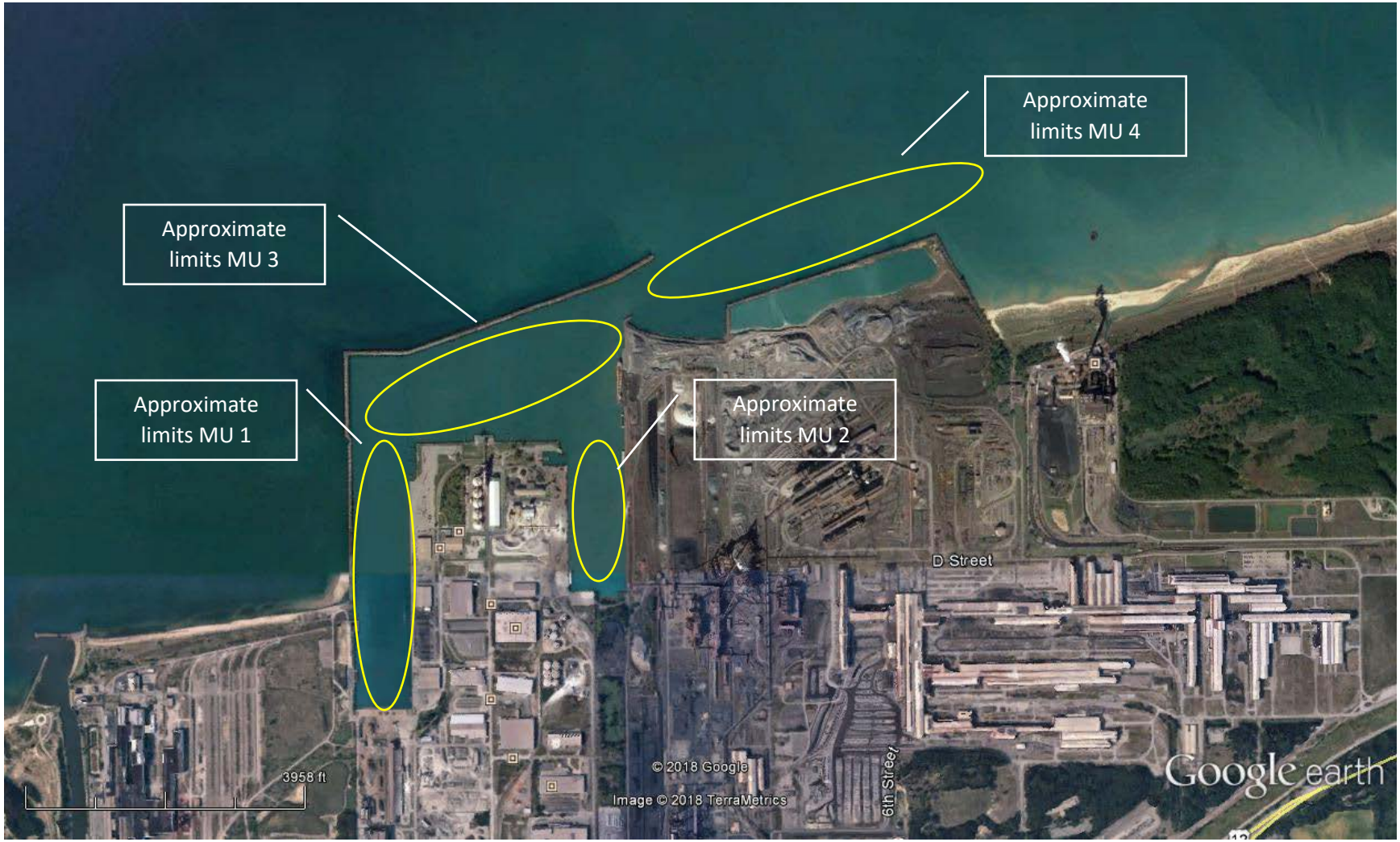


Figure 8 – 2019 Sampling Dredged Material Management Units

Figure 9 – 2019 Sampling Reference Site Locations

● Sample Location

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Figure **10**

Dredged Material Management Unit Sample Locations

Burns Waterway Harbor, Indiana

Prepared By: DJ	Checked By: CK

PARS ENVIRONMENTAL
a Montrose Environmental Group company

Contract:W912QR-14-D-0006 Delivery Order: W912P619FCX10	Date: 9/25/2019

Document Path: G:\USArmyCorp\a_MXD_PDFs\Burns Waterway Harbor\Work Plan\PARSLOGO\ManagementUnitSampleLocations.mxd

● Sample Location

Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community
Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Figure 11

Reference Site Sample Locations

Burns Waterway Harbor, Indiana

Prepared By: DJ	Checked By: CK
PARS ENVIRONMENTAL INC.	
Contract:W912QR-14-D-0006 Delivery Order: W912P619FCX10	Date: 9/26/2019

Document Path: G:\USArmyCorp\a_MXD_PDFs\Burns Waterway Harbor\Work Plan\PARSLOGO\ReferenceSiteSampleLocations.mxd

Attachment 1

USEPA ArcelorMittal Management Map

Attachment 2

2019 Sampling Work Plan

Attachment 3
2019 Sampling Final Report