US Army Corps of Engineers
Buffalo District

CLEAN WATER ACT SECTION 404(b)(1) EVALUATION

OPERATIONS AND MAINTENANCE
CLEVELAND HARBOR, CUYAHOGA COUNTY, OHIO
DISCHARGE OF SEDIMENTS DREDGED FROM UPPER CUYAHOGA RIVER CHANNEL

April 2016

SUMMARY

This evaluation was prepared pursuant to Section 404(b)(1) of the Clean Water Act (CWA) (33 USC 1344) and 40 CFR 230, "Guidelines for the Specification of Disposal Sites for Dredged and Fill Material" (Guidelines). It addresses the proposed U.S. Army Corps of Engineers (USACE) discharge of sediments dredged from Cleveland Harbor's federal navigation channel in the upper Cuyahoga River (Upper Cuyahoga River Channel) at a designated deep-water lake area in Lake Erie referred to as CLA-1. This proposal was described in a November 20, 2015 Section 404(a) Public Notice at which time USACE requested CWA Section 401 water quality certification from Ohio Environmental Protection Agency (Ohio EPA) for the discharge of these dredged sediments at CLA-1 in 2016.

Ohio EPA, Ohio Department of Natural Resources (ODNR) and Ohio Attorney General, as well as various other interests, have cited various concerns with the proposed discharge of this dredged sediment. Per request by the State of Ohio, a Section 404 Public Hearing was held on March 1, 2016 where USACE received testimony. The majority of concerns raised during this comment period relate to Section 2.4 of this evaluation. Generally, these concerns related to the potential effects of open lake placement on the bioaccumulation of polychlorinated biphenyls (PCBs) including in fish such as walleye, toxic effects of polycyclic aromatic hydrocarbons (PAHs), Lake Erie harmful algal blooms (HABs) and public drinking water supplies. All data generated by USACE and Ohio EPA on Upper Cuyahoga River Channel and Lake Erie sediments, as well as all supporting information and public comments, were considered in this evaluation.

Fundamentally, the discharge of dredged sediment at a designed open water site will comply with the Guidelines if it would not result in unacceptable adverse effects to the affected aquatic ecosystem. Demonstrating compliance with the "Contaminant Determination" Guidelines requires the application of a suite of various state-of-the-science tests and an evaluation of data generated from those tests according to formal U.S. Environmental Protection Agency/USACE guidance. The standard of comparison for most of these tests is existing sediment at the disposal site environment referred to as "reference sediment." Since all environmental media (air, water, soil, sediment, biota) in the 21st Century environment, including these channel and Lake Erie sediments, is contaminated with ambient levels of metals, PCBs, PAHs and phosphorus, it is important to evaluate the *effects* of dredged sediments that are discharged back into the aquatic ecosystem relative to reference conditions at the placement area. In this case, reference sediment at CLA-1 was used because bulk sediment contaminant levels were consistent with those that occur regionally across lake sediments offshore of Cleveland. Such reference sediments are not "toxic" and they bioaccumulate PCBs within regional background levels. Although portions of CLA-1 were formerly used for dredged sediment placement several decades ago, most current surface sediments are not unique in comparison to regional lake sediments offshore of Cleveland. Testing and evaluation of Upper Cuyahoga River Channel sediments showed that placement of the dredged sediments at CLA-1: (1) would not meaningfully increase PCB bioaccumulation from lake sediments, because concentrations and bioaccumulation from the channel and CLA-1 reference sediments are comparable; and (2)

would not result in any sediment toxicity to lake sediments because the bioavailability of PAHs (and other constituents such as metals) in the channel and CLA-1 reference sediments is sufficiently low to impede toxic effects. Additionally, testing and modeling showed that placement of the dredged sediments at CLA-1: (1) would not play any role in the development of HABs because phosphorus released from the sediment would result in only minor increases in water column concentrations within the immediate vicinity which would rapidly decline back to ambient conditions; and (2) would not influence the quality of drinking water supplies because suspended sediment plumes would be within the immediate vicinity and rapidly decline to ambient conditions, and dredged sediments would behave similarly to existing bottom sediments at CLA-1 and exhibit no net migration from the placement site. Finally, testing and evaluation according to formal USEPA/USACE guidance indicated that placement of the dredged sediment at CLA-1 would comply with applicable Ohio water quality standards.

This Section 404(b)(1) Evaluation shows that the discharge of sediment dredged from the Upper Cuyahoga River Channel at CLA-1 would not result in unacceptable adverse effects to the affected aquatic ecosystem in Lake Erie. Placement of this dredged sediment over impaired sediments identified within the southeast quadrant of CLA-1 is proposed, and would initiate an isolation of localized high PAH-related sediment toxicity, as well as a reduction in the benthic bioaccumulation of PCBs. This would constitute beneficial use of the dredged sediment because it would improve conditions in the aquatic environment by directly benefiting benthically-coupled aquatic organisms that reside and feed on the deep-water lake bottom.

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Section 404(b)(1) of the Clean Water Act (CWA) (33 USC 1344) requires that disposal sites for discharges of dredged or fill material into waters of the United States be specified through the application of guidelines developed by the Administrator of the U.S. Environmental Protection Agency (USEPA) in conjunction with the Secretary of the Army. This evaluation addresses the open lake placement of dredged sediment from Cleveland Harbor's federal navigation channels in the upper Cuyahoga River (Upper Cuyahoga River Channel) and is based on the regulations found at 40 CFR 230, "Guidelines for the Specification of Disposal Sites for Dredged and Fill Material."

Public and agency comments were considered in this evaluation. A Section 404(a) Public Notice for open lake placement was released by the U.S. Army Corps of Engineers (USACE) on November 20, 2015, and a Public Hearing was hosted by USACE on March 1, 2016. A summary of all comments received on the notice, and during and after the hearing, and responses to those comments, are provided in Attachment 1. Attachment 2 provides correspondence from USACE in response to Ohio Environmental Protection Agency (Ohio EPA) concerns presented between November 20, 2015 and March 11, 2016, and Attachment 3 provides all correspondence received in response to the notice and hearing along with a transcript of oral comments received during the hearing. Attachment 4 provides the Evaluation of Cleveland Harbor Federal Navigation Channel (Upper Cuyahoga River) Dredged Material with Respect to Suitability for Open-Lake Placement (USACE 2016), which is an evaluation of sediment quality in the Upper Cuyahoga River Channel and Lake Erie that addresses the potential for contaminant-related impacts associated with the proposed open lake placement of dredged sediment.

The environmental impacts of the open lake placement of dredged sediment have been assessed in accordance with the National Environmental Policy Act (NEPA), and a Finding of No Significant Impact (FONSI) was determined. This analysis is provided in the Environmental Assessment (EA)/FONSI, Operations and Maintenance, Open-lake Placement of Material Dredged from Cleveland Harbor Federal Navigation Channels in the Upper Cuyahoga River (USACE 2014a).

1. PROJECT DESCRIPTION

1.1 Location.

Cleveland Harbor is located in Cuyahoga County, Ohio and is situated on the south shore of Lake Erie at the mouth of the Cuyahoga River, approximately 190 miles southwest of Buffalo, New York and 110 miles east of Toledo, Ohio.

1.2 General Description.

1.2.1 *Cleveland Harbor Federal Navigation Project*. The federal navigation project at Cleveland Harbor is designed to accommodate commercial navigation and is maintained by USACE. The harbor consists of a breakwater protected lakefront harbor on Lake Erie and improved navigation channels in the Cuyahoga and Old Rivers. A series of authorized federal navigation channels are designed and maintained so that deep-draft commercial vessels can safely navigate the harbor. The harbor includes an Outer Harbor section and Cuyahoga River section, consisting of a River Channel, Turning Basin, Old River Channel and Outer Harbor channels. Project maps of the Outer Harbor and Cuyahoga River sections of Cleveland Harbor are provided as Figures 1 and 2, respectively.

Cleveland Harbor requires maintenance dredging on an annual basis to facilitate commercial, deep-draft navigation. About 80 percent of the harbor's annual dredging needs are typically in the upper reach of the Cuyahoga River Channel between the upstream limit (Station 799+00) and downstream upper Turning Basin (Station 736+00). This reach is referred to as the Upper Cuyahoga River Channel. The quantity of sediment annually dredged from this reach is on the order of 200,000 cubic yards, the vast majority of which has been placed in federal and non-federal confined disposal facilities (CDFs) since about 1968.

1.2.2 *Maintenance Dredging of Upper Cuyahoga River Channel with Open Lake Placement of Dredged Sediments.* Sediments within the Upper Cuyahoga River Channel were evaluated using sampling and test data collected between 2012 and 2015 to determine whether the sediments would comply with the "contaminant determination" (40 CFR 230.11 [d]) of the Section 404(b)(1) Guidelines for open water placement. This determination is based on joint formal USEPA/USACE guidance for the testing and evaluation of dredged sediment as prescribed in the Great Lakes Dredged Material Testing and Evaluation Manual (Great Lakes Testing Manual) (GLTM) (USEPA/USACE 1998a) and Evaluation of Dredged Material Proposed For Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual) (ITM) (USEPA/USACE 1998b). The proposed operation and maintenance plan for this area of the harbor is annual or biannual dredging, with placement of up to 200,000 cubic yards of dredged sediment at an open lake placement area in Lake Erie. This area, referred to as CLA-1, is shown in Figure 3. This maintenance dredging would be performed by a private firm contracted by the federal government. The dredging would be completed by mechanical means using a clamshell bucket, with placement of the dredged sediment material in a scow. The scow of dredged sediment would be transported to the designated open lake placement area and discharged.

1.3 Authority and Purpose.

The federal navigation project at Cleveland Harbor, including its operation and maintenance was authorized by the River and Harbor Acts of 1875, 1886, 1888, 1896, 1899, 1902, 1907, 1910, 1916, 1917, 1935, 1937, 1945, 1946, 1958, 1960, 1962, the Water Resources Development Acts of 1976 and 1986, the Supplemental Appropriations Act of 1987 and the Energy & Water Appropriations Act of 1988.

The purpose of this project is to maintain authorized dimensions (i.e., depths and widths) of the Upper Cuyahoga River Channel in Cleveland Harbor. Shoaling of the channel causes a reduction in navigable depths for deep-draft commercial navigation. Dredging restores channels to authorized project dimensions (both width and depth), which facilitates safe commercial navigation and its associated benefits.

1.4 General Description of Dredged or Fill Material.

1.4.1 *General Characteristics of the Material*. Physical analyses of Upper Cuyahoga River Channel sediments are described in USACE (2013a and 2016). The dredged sediment is composed of fine sands, silts, clays and water with residual bulk concentrations of contaminants and organic matter. Residual concentrations of contaminants are similar to those in the open lake environs and not of toxicological significance. Sediments within the Upper Cuyahoga River Channel generally consist of organic rich brown clayey silt, with localized areas of sand, gravel and leaf debris mixed in the sediments located immediately downstream of the upstream limit of the federal navigation project.

1.4.2 *Quantity of Material*. An estimated 200,000 cubic yards of dredged sediment would be dredged annually or biannually from the Upper Cuyahoga River Channel, and discharged at a designated area in the open lake.

1.4.3 *Source of Material*. The source of the dredged sediment will be the Upper Cuyahoga River Channel. Sediments enter Cleveland Harbor's Cuyahoga River Channel mainly from the upstream river reach. These sediments are deposited in the channel where widening and deepening have created low current velocities.

The Cuyahoga River naturally transports a large sediment supply, which is suspended in the water column under certain water velocities and carried downstream. A primary source of sediment loading is natural erosion within the Middle Valley of the Cuyahoga River watershed, including Cuyahoga Valley National Park (USACE 2011). Erosive riverbank soils are subject to increased runoff volumes caused by urbanization of surrounding areas, resulting in streams carrying a heavy sediment load. As water enters the enlarged Upper Cuyahoga River Channel at the upstream end of Cleveland Harbor, velocities decrease significantly, resulting in the rapid deposition of the previously suspended sediment.

1.5 General Description of the Proposed Discharge Sites.

1.5.1 *Location*. The proposed open lake placement area, CLA-1, is located in the Central Basin of Lake Erie approximately 9.43 miles north of the West Breakwater Light (Main Entrance Light) at a bearing of N3.1635°W (azimuth 357°). CLA-1 is located in a larger offshore, regional Lake Erie environment running west-to-east between Rocky River, Ohio and Cleveland, in depths ranging from 0 (the general lake shoreline) to 62 feet below LWD. This regional lake area is largely influenced by urban activities as well as urban point and non-point source discharges.

CLA-1 represents the historic open lake placement area for Cleveland Harbor (per 1941 USACE drawing). This area has not been used for dredged sediment placement for over 45 years.

1.5.2 *Size*. CLA-1 is two square miles in area (two miles in length and one mile in width) and has is at an approximate depth of 62 feet LWD[1].

1.5.3 *Type of Site*. CLA-1 is an unconfined deep water lake area. Physical analysis of the sediments is described in USACE (2013a) and USACE (2016); bottom substrate consists predominantly of silts and clays. CLA-1 was previously used for the placement of material dredged from Cleveland Harbor over 45 years ago. Currents and velocities in the vicinity of CLA-1 are principally wind-driven and unstratified, and are predominantly in an easterly or east-northeasterly direction, running parallel to the shoreline.

Lake sediments offshore of Cleveland range widely in composition, and can consist of coarse sand and gravel, shell fragments, hardpan clay, shale and clayey silt. Lake sediments at CLA-1, as well as other deep open lake areas offshore of the harbor, are more similar to the shoaled sediments in the navigation channel, generally consisting of brown clayey silt.

1.5.4 *Type of Habitat*. CLA-1 is essentially comprised of warm-water, mud-bottom (mainly silt/clay) benthic substrate with overlying water column. Bottom sediment at this area is colonized by a community of benthic invertebrates that are relatively low in species diversity and dominated by oligochaetes and chironomids. The water column at this area is used by most fish, nekton and plankton on a transient basis as required for foraging and migration. Aquatic birds use the water surface and water column on a transient basis for resting and foraging.

A detailed description and assessment of the benthic macroinvertebrate communities at CLA-1 is contained in Kennedy *et al.* (2014). Four sediment grab samples were collected from CLA-1 to characterize the associated benthic communities. The most abundant phylum identified was the segmented annelid worms, which consisted of three genera from the oligochaete family Tubificidae and one specimen from the leech family Glossiphoniidae. The second most abundant phylum was Arthropoda (e.g., insects, crustaceans), which was represented only by the insect family Chironomidae (midges). Mollusks were the third most abundant phylum, consisting of sphaeriid clams and dreissenid (zebra/quagga) mussels. Finally, the phylum Nematoda (segment-less worms) was represented by only four individual specimens (<2% of the total). The benthic communities in CLA-1 had a relatively low density and low taxonomic richness, and the majority of the organisms were pollution tolerant.

1.5.5 *Timing and Duration of Discharge*. Open lake placement of dredged sediment would occur during the harbor's dredging operations which generally occur between May 1 and

1 Low Water Datum (LWD) for Lake Erie is defined as 569.2 feet above mean sea level at Rimouski, Quebec, Canada (IGLD 1985).

December 30. Dredged sediment discharges from a scow would consist of a series of episodic, discrete, short-term discharges throughout the dredging operation.

1.6 Description of Discharge Method.

Sediment from the Upper Cuyahoga River Channel would be mechanically dredged using a clamshell bucket, then placed in a scow for transport to the discharge site. The scow of dredged sediment would be discharge at the designated open lake placement area. During discharge, dredged sediment descends through the water column until it hits the lake bottom substrate, then collapses and spreads out before coming to rest on the lake bottom.

2. FACTUAL DETERMINATIONS

2.1 Physical Substrate Determinations.

2.1.1 *Substrate Elevation and Slope*. The discharge of dredged sediment at CLA-1 would serve to slightly increase the elevation of the existing lake bottom. This increase in bottom relief would have a slight slope. Over time, this increase in surface relief would flatten out.

2.1.2 *Sediment Type*. Sediment at CLA-1 is primarily comprised of silts and clays. The dredged sediment primarily consists of silts and clays, with some fine sands. Both sediments are appropriately described as brown clayey silt.

2.1.3 *Dredged Material Movement*. Dredged sediment placed at CLA-1 would be subject to any lake-bottom currents. The placed sediment would behave in a manner similar to the adjacent and surrounding lake bottom sediments; deeper depths of the open lake placement areas would serve to allay the potential for sediment erosion, resuspension and movement. Dredged sediment movement following active open lake placement would not occur because the bottom shear stress at CLA-1 are too small to erode and resuspend the bedded sediment, even under severe storm conditions. The potential for erosion/resuspension of placed sediment during typical hydrodynamic conditions, as well as severe storm events, was evaluated through a Long-Term Fate (LTFATE) modeling study (Schroeder and Hayter 2014a,b). Based on the modeling study, no significant resuspension/erosion of placed sediment was predicted to occur, even during severe storms. During strong storm events, bed shear stresses would only be predicted to approach the critical shear stress for the thin veneer of fine clay and silt particles which would constitute the sediment surface. This sediment layer would only be a few millimeters (up to a centimeter) thick and consist of fine sediment which was re-suspended in the water column during placement activities and subsequently settled out. These sediments would be characteristic of the “fluff” material common to the sediment surface in deeper areas of Lake Erie, which is similarly subject to potential resuspension. Resuspension of these sediments would represent about 1% of the dredged sediment placed, with the bulk of the placed sediment predicted to remain stable at the placement site. Bed shear stresses produced during storms do not exceed critical shear stresses for significant erosion of placed sediments.

Ohio EPA submitted an alternative analysis (Hawley 2015) which challenged the conclusions of Schroeder and Hayter (2014a,b). Review of this analysis by the U.S. Army Engineer Research and Development Center (USAERDC) indicated substantial flaws and confirmed the previous modeling results (Schroeder and Hayter 2016). Hawley (2015) did not evaluate net erosion of placed sediments, did not consider sedimentation at the placement site and did not consider the physical characteristics of dredged sediments with regard to resuspension potential. Because Hawley (2015) did not consider these factors, the results of his analysis do not change the conclusion that dredged sediment placed at CLA-1 would exhibit no net migration on the lake bottom.

2.1.4 *Physical Effects on Benthos*. The particle size distribution of the dredged sediment is similar to that of the substrate at CLA-1. Since the dredged sediment particle size is similar to bottom sediments at the open lake placement area, significant alterations in physical sediment characteristics at CLA-1 would not occur. Consequently, placement of the dredged sediments at CLA-1 would not result in any significant changes to benthic community composition.

2.1.5 *Other Effects*. Some compaction of the existing substrate at the open lake area may occur as a result of dredged sediment placement.

2.1.6 *Actions Taken to Minimize Impacts*:

- Dredged sediment placement at CLA-1 would result in no significant change in physical substrate.
- Dredged sediment placed at the deep water area of CLA-1 would not be subject to any meaningful resuspension and migration.

2.2 Water Circulation, Fluctuation and Salinity Determinations.

2.2.1 *Water*:

a. Salinity—Not applicable.

b. Water Chemistry—Reference Section 2.3.2.

c. Clarity—Reference Section 2.3.1.

d. Color—Reference Section 2.3.1.

e. Odor—The atmospheric exposure of organic matter which may be contained in the dredged sediment would result in a short term, localized malodor.

f. Taste—No significant effects.

g. Dissolved Gas Levels—Reference Section 2.3.2.

h. Nutrients—Reference Section 2.3.3.

i. Eutrophication—Reference Section 2.3.3.

2.2.2 *Current Patterns and Circulation*:

a. Current Pattern and Flow—No significant effects.

b. Velocity—No significant effects.

c. Stratification—No significant effects.

d. Hydrologic Regime—No significant effects.

2.2.3 *Normal Water Level Fluctuations*. No significant effects.

2.2.4 *Salinity Gradients*. Not applicable.

2.2.5 *Actions Taken to Minimize Impacts.* No further actions are deemed appropriate.

2.3 Suspended Particulate/Turbidity Determinations.

2.3.1 *Expected Changes in Suspended Particulates and Turbidity in the Vicinity of the Placement Site*. The open lake placement of dredged sediment would result in episodic, short-term, localized increases in turbidity. The dredged sediment is typically released from a scow into the water column and therefore settles very rapidly as a mass that is similar to flocculent settling. Because it settles as a mass, very little turbidity is generated via a plume before the sediment reaches the lake bottom. Turbidity plumes from the discharge are typically small in spatial extent and magnitude, and decay to background within a matter of hours.

Short-term fate (STFATE) modeling predicted that suspended solid plumes from open lake placement of sediments dredged from the Upper Cuyahoga River Channel would rapidly decrease from about 2 g/L to 10 mg/L (about water column total suspended solids [TSS] background) within 30 minutes. Recent water quality monitoring of open lake placement activities for Toledo Harbor dredged sediment indicated that suspended solids concentrations in the water column underwent exponential decline, indicating rapid deposition to the lake bottom. Within an hour, plumes diminished to near background conditions (Ecology and Environment/LimnoTech 2014). Only approximately 1 to 5% of the dredged sediment remained as a suspended solid plume in the water column immediately after placement. Sediment plumes were small and short-lived, remaining well within the boundaries of the placement area. These results are consistent with findings of other such studies showing open lake placement plumes to be temporally and spatially limited.

2.3.2 *Effects on Chemical and Physical Properties of the Water Column*:

a. Light Penetration—The open lake placement of dredged sediment would result in negligible reductions in light penetration into the water column resulting from episodic, minor, short term increases in turbidity.

b. Dissolved Oxygen—Dredged sediments are typically anoxic; the open lake placement of dredged sediment would result in episodic, short-term, minor reductions in dissolved oxygen in the water column.

c. Toxic Metals and Organics—Metals and organics would be introduced to the water column from the open lake placement of dredged sediment and would primarily be associated with suspended solids. These releases would be intermittent, unsteady and short-term as upon discharge, contaminant concentrations would immediately begin to decrease to ambient conditions from dilution and dispersion in the water column. Standard elutriate testing was conducted to predict the release of contaminants to the water column from the dredged sediment discharge (USACE 2013a, USACE 2016, USAERDC 2016a). Pesticides and polychlorinated biphenyls (PCBs) were not detected in the elutriate samples. Low dissolved releases of polycyclic aromatic hydrocarbons (PAHs), toluene, metals and inorganics (cyanide, ammonia, nitrate, phosphorus) were detected. The low releases comply with applicable state water quality standards (WQSs) for the protection of aquatic life (see Section 2.6.2).

d. Pathogens—The open lake placement of dredged sediment would not significantly influence pathogens.

e. Aesthetics—The short-term increases in turbidity resulting from the open lake placement of dredged sediment would be temporarily aesthetically displeasing. The turbidity plume would be localized and dissipate before affecting widespread areas.

2.3.3 *Effects on Biota*:

a. Primary Production and Photosynthesis—The open lake placement of dredged sediment would result in negligible changes in primarily production and photosynthesis at CLA-1. Relatively small amounts of nitrogen and phosphorus would be expected to be released during dredged sediment placement. Most of the released phosphorus will be particulate phosphorus, a form which is not readily available for algal growth and will quickly settle to the lake bed along with the sediments to which it is attached. Small releases of dissolved phosphorus, which is more bioavailable to algae, would rapidly dissipate in the water column to ambient conditions from dilution and dispersion, along with re-adsorption to the settling sediment particles. Dredged sediment-associated nutrients will rarely have an adverse effect on eutrophication-related water quality at placement areas mainly because the events are short-lived, there is typically fairly rapid dilution of the disposed of sediment, and relative to dilution, nutrient release is small (Jones and Lee 1981).

The potential of open lake placement of sediments dredged from the Upper Cuyahoga River Channel to influence Lake Erie Harmful Algal Blooms (HABs) was specifically investigated (Borrowman *et al.* 2013). Since algal production is initiated through dissolved phosphorus concentrations in the water column, this investigation utilized sediment standard elutriate test data and STFATE modeling to evaluate total phosphorus releases to the water column during barge discharges of dredged sediment. Elutriate data show that initial dissolved concentrations of phosphorus releases from the dredged sediment would generally range from 65 to 124 µg/L. However, rapid mixing and dilution of these concentrations in the water column would occur upon discharge. Two low water column phosphorus criteria were used to evaluate the potential for HAB development associated with the discharge of dredged sediment: (1) 7 µg/L dissolved phosphorus, which is considered a conservative value below which little chance for cyanobacteria dominance in algal biomass; and (2) 10 µg/L dissolved phosphorus, which is considered a more realistic value above which the frequency of cyanobacteria dominance over algal biomass increases (Great Lakes Water Quality Agreement mean annual total phosphorus concentration goal for surface waters in the Central Basin of Lake Erie). Using a background lake water concentration of 5 µg/L (approximately the 50^{th} percentile for dissolved phosphorus concentrations near Cleveland [Great Lakes Environmental Database]) and maximum elutriate concentration of 124 µg/L, STFATE modeling showed that a dissolved phosphorus water column concentration of less than 7 µg/L would be achieved within five minutes of the discharge with continuing decline to ambient conditions over time. The area briefly exceeding the 7 µg/L criteria would be within 400 feet of the discharge point. Using a background lake water concentration of 5 µg/L and maximum elutriate concentration of 320 µg/L (using 2015 data [USACE 2016]), STFATE modeling showed that a dissolved phosphorus water column concentration of less than 7 µg/L would be achieved within 30 minutes of the discharge with continuing decline to ambient conditions over time. The area briefly exceeding the 7 µg/L criteria would be no longer than 2,400 feet of the discharge point for a maximum velocity of 1.6 feet per second (fps) or as little as 750 feet for a minimum velocity of 0.3 fps. Typically, the plume would be about 1,500 feet in length with a width of 300 feet and thickness of 30 feet, and centered at a depth of 30 feet. The plume would be well within placement area boundaries for all velocities. These model predictions showed that the extent and duration of dissolved phosphorus plumes within the open lake placement area would be small and short-lived. When considering size, duration, depth and turbidity, these plumes would be insufficient to trigger or pose an effect on the occurrence of HABs, or to significantly impact water quality in the Central Basin of Lake Erie. Therefore, open lake placement of this dredged sediment would not play any role in the development of HABs.

A recent investigation was performed to evaluate the potential for placement of Toledo Harbor dredged sediment in the Lake Erie Western Basin to influence HABs (Ecology and Environment/LimnoTech 2014). This study included water quality monitoring during dredged sediment placement events, including immediately after barge discharges. Similar to the model predictions relative to the discharge of Upper Cuyahoga River Channel dredged sediment, water quality monitoring indicated very little desorption of dissolved total phosphorus, including soluble reactive phosphorus (SRP) during dredged sediment discharges, with particulate phosphorus quickly depositing along with the suspended solids to which it is adsorbed to the lake sediment bed. SRP is considered to be 100% bioavailable to support algal growth and therefore is the most important form of phosphorus to influence HABs. There was very little release of SRP during dredged sediment discharges, with concentrations quickly decreasing to background levels as the released phosphorus dispersed and re-adsorbed to the settling sediments. Monitoring during barge discharges indicated that SRP released from dredged sediment discharges would represent only 0.02% of the total annual SRP load to western Lake Erie and would be less than 1% of the annual internal and external loads from the Maumee and Detroit Rivers. Similar to the predictions for the Upper Cuyahoga River Channel sediments that are open lake placed, dissolved phosphorus concentrations in the water column returned to ambient conditions within an hour of discharge. The investigation concluded that sediment resuspension from Toledo Harbor dredged sediment placement activities in the Western Basin was not a source of bioavailable phosphorus contributing to HABs.

Jones and Lee (1978) note that the removal of released dissolved phosphorus within suspended sediment plumes from dredged sediment discharges is rapid due to its association with freshly formed ferric hydroxide floc, dilution, and sorption onto finely-divided particulate matter. Dissolved phosphorus is released under anoxic conditions, which is typical of dredged sediments, resulting in the potential for elevated concentrations in the water column immediately upon discharge. However, upon discharge, considerable mixing of oxic waters with the suspended sediments promotes oxygenation of ferrous iron associated with the dredged sediment and results in removal from solution of phosphate and other contaminants released during dredging and transport. Concentrations of dissolved phosphorus in suspended sediment plumes rapidly decrease from the discharge point, as oxidation of iron, precipitation and sorption reactions occur, in addition to dilution. Removal of the dissolved fraction occurs onto fine materials within the suspended sediment plume, thus dissolved phosphorus is converted to particulate phosphorus, which is not readily available for algal growth and settles to the sediment bed. Additional dissolved phosphorus release could occur in the suspended sediment plume, however release under oxic conditions in the presence of iron is slow and would not likely occur before complete dissipation of the suspended sediment plume.

While bulk concentrations of total phosphorus themselves are not a determinant for the potential of sediments to be associated with algal production or HABs, total concentrations in the dredged sediment range from 50 to 1,350 mg/kg, and are comparable to that of the open lake placement area (420 to 1,280 mg/kg) and regional lake sediments offshore of Cleveland (44 to 1,130 mg/kg) (USACE 2013a; USACE 2016). Once dredged sediment and associated particulate phosphorus are deposited to the sediment bed, they would be expected to behave similarly to existing lake sediments.

b. Suspension/Filter Feeders—Suspension and filter feeder populations in the vicinity of CLA-1 may be temporarily adversely affected by increases in suspended solids and turbidity during open lake placement of dredged sediment. Such effects would be minor and localized.

c. Sight Feeders—During dredged sediment placement operations, the modes of impact indicate that adverse impacts to fish are minor and short-term. The increase in suspended sediments and turbidity resulting from the open lake placement of dredged sediment would be spatially and temporally small, and therefore unlikely to trigger any significant adverse effects to fish. Impacts on fish over the full range of possible effects include either avoidance or no noticeable effect. Many fishes have a wide tolerance for turbidity, and fish behavior in response to a dredged sediment placement event depends on the species. The placement of dredged sediment at the open lake area may result in some mortality to demersal fish eggs (e.g., from broadcast spawning species) existing on the lake bottom in very close proximity to the actual placement of dredged sediment due to suffocation from burial or siltation, and/or oxygen deficiency at the sediment-water interface.

2.3.4 *Actions Taken to Minimize Impacts*.

- Accidental spills of petroleum, oil or lubricants would be minimized. The contractor would be required to prepare and implement an Environmental Protection Plan and Oil Spill Contingency Plan.
- No placement activities would occur during Lake Erie storm events. This ensures accurate placement and minimal turbidity plume migration.

2.4 Contaminant Determinations.

This evaluation pertains to the "contaminant determination" at 40 CFR 230.11(d), and its purpose is to determine the degree to which the dredged sediment proposed for discharge would introduce, relocate or increase contaminants. A comprehensive evaluation of the sediments dredged from the Upper Cuyahoga River Channel, in accordance with formal guidance prescribed in USEPA/USACE (1998a,b), is presented in "Evaluation of Cleveland Harbor (Upper Cuyahoga River Channel) Dredged Sediments with Respect to Suitability for Open-Lake Placement " (USACE 2016). This contaminant determination summarizes the evaluation presented in USACE (2016). Previous supporting documentation includes "Evaluation of Cleveland Harbor Federal Navigation Channel (Upper Cuyahoga River) Dredged Material with Respect to Suitability for Open-Lake Placement" (USACE 2013a) and associated response to Ohio EPA comments on the evaluation (USACE 2013b).

2.4.1 *Potential Sources of Sediment Contamination*. Cleveland Harbor is located within the Cuyahoga River Area of Concern (AOC), which includes the lower 45 miles of the river between the Ohio Edison Dam and mouth, and approximately 19 miles of Lake Erie shoreline between Edgewater Park eastward to Wildwood Park (USEPA 2014). There are a number of potential sources of sediment contamination, both anthropogenic and natural. These sources include: municipal and industrial discharges, urban and agricultural runoff, sewer overflows/bypassing, atmospheric deposition, biological production (detritus) and mineral deposits.

2.4.2 *Dredged Material Evaluation*. Comprehensive testing and evaluation of channel and Lake Erie sediments occurred over several events in 2012, 2014 and 2015. Additionally, several channel and Lake Erie sediment sampling and testing activities accomplished by the Ohio EPA between 2013 and 2015 were considered in this evaluation.

a. Sediment Sampling and Testing

●<u>USACE</u>—A more detailed description of these sampling/testing events (including information on sample type and compositing, dredged material management units [DMMUs], etc.) is provided in Section 2.0 of USACE (2013a) and USACE (2016) (Attachment 4).

►*2012*—This event involved comprehensive sampling and testing of channel and lake sediments to determine whether sediment dredged from the Upper Cuyahoga River Channel met CWA "contaminant determination" Section 404(b)(1) Guidelines (40 CFR 230.11[d]). Sediment sampling locations within the Upper Cuyahoga River Channel are presented in Figure 4.

Bulk sediment samples were tested for grain size (sieve and hydrometer) and analyzed for the following chemical parameters: metals, total cyanide, ammonia-nitrogen, total phosphorus, total kjedlahl nitrogen, total organic carbon (TOC), PCBs, pesticides, PAHs (16 USEPA priority pollutants and methylnaphthalenes), percent organic matter, benzene-toluene-ethylbenzene-xylenes (BTEX), and total extractable hydrocarbons.

Additional sediment testing was conducted to evaluate contaminant bioavailability and toxicity. These tests included simultaneously extracted cationic metals/acid volatile sulfide (SEM/AVS) analysis, PAH pore water analysis (solid phase microextraction methods (SPME); American Society of Testing and Materials (ASTM) method D7363) and biological testing.

Biological testing included benthic and water column bioassays (standard 10-day *Hyalella azteca* and *Chironomus dilutus* whole sediment toxicity tests, and standard 48-hour *Ceriodaphnia dubia* and 96-hour *Pimephales promelas* water column toxicity tests). In addition, benthic bioaccumulation tests for PCBs, and dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE) (∑DDT), including measurements of lipid content (standard 28-day *Lumbriculus variegatus* bioaccumulation tests), were conducted.

Standard elutriate testing was conducted to determine the potential release of contaminants to the water column during open lake placement activities. These date were also generated to evaluate whether the open lake discharge of dredged sediment would comply with applicable state WQSs.

►*2014*—This event was conducted to address concerns identified by Ohio EPA in reviewing the 2013 water quality certification application for open lake placement of Upper Cuyahoga River Channel sediments. As such, the 2014 sampling focused on the analyses of

PAHs and PCBs in channel and lake sediments. Another objective of the 2014 investigation was to evaluate the variability of PAHs and PCBs in regional lake sediments offshore of Cleveland, as well as in and around the open lake placement area. Sediment sampling locations within the channel and lake are provided in Figures 5 and 6, respectively. Additionally, 25 lake sediment samples were collected from locations spaced at two-mile increments across a triangular grid to characterize regional lake sediments extending from just outside Cleveland Harbor breakwaters to CLA-1, an approximately 64 square mile area (Figure 7).

Sediment samples were analyzed for bulk grain size (sieve and hydrometer) and percent moisture, TOC, PCBs and PAHs (16 USEPA priority pollutants and methylnaphthalenes). The additional lake samples (Figure 3) were also analyzed for total phosphorus. Additionally, sediment and pore water were analyzed for 34 PAHs (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) which have been identified as being generally most abundant in the environment and commonly measured (USEPA 2003).

►*2015*—Like that accomplished in 2012, this event involved comprehensive sampling and testing to determine whether sediment dredged from the Upper Cuyahoga River Channel met CWA “contaminant determination” Section 404(b)(1) Guidelines (40 CFR 230.11[d]). Channel and lake sediment sampling locations are presented in Figures 8 and 9, respectively. Unique to 2015, a subset of channel samples from certain locations were collected through core sampling from the sediment surface to project depth (CH-3, 5, 7, 9, 12 and 15). This was done to address concerns raised by the Ohio EPA regarding the use of surface grab samples to characterize channel sediments, despite surface grab sampling being a standard method for characterization of rapidly deposited sediment shoals as occurs in the Upper Cuyahoga River Channel. Sediment testing generally included bulk sediment physical (sieve and hydrometer) and chemical analyses (metals, total cyanide, ammonia-nitrogen, total phosphorus, total kjedlahl nitrogen, TOC, PCBs, pesticides, PAHs [16 USEPA priority pollutants and methylnaphthalenes], and SEM/AVS analysis), PAH pore water analysis, elutriate testing, standard whole sediment and elutriate bioassays, and sediment bioaccumulation testing for PCBs, DDT, DDD and DDE. Standard elutriate testing was also conducted.

●Ohio EPA. Individual descriptions of these sampling/testing events are provided in Section 3.5 of USACE (2016) (Attachment 4). Ohio EPA conducted several sampling and testing events on Upper Cuyahoga River and Cleveland offshore Lake Erie sediments across nine events in 2013, 2014 and 2015 (Figures 10 – 17). Chemical analyses of sediment samples collected through Ohio EPA efforts included the nutrients nitrogen-ammonia and total phosphorus, TOC, metals, PCBs, pesticides, PAHs, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs). Numerous sample results had to be removed from the Ohio EPA dataset as sample locations were located in areas that were outside of the Upper Cuyahoga River Channel dredging prism and consequently would not be representative of the dredged sediment. Additionally, bioaccumulation and toxicity testing conducted on channel and lake sediments could not be used primarily because the testing did not follow standard laboratory methodologies for testing and evaluation of dredged sediment.

b. Sediment Evaluation—Bulk sediment contaminant concentration ranges were determined across the sampling events for channel and lake sediments. Table 1 summarizes both USACE and Ohio EPA datasets for channel sediments. Table 2 summarizes both USACE and Ohio EPA datasets for CLA-1 reference and regional sediments offshore of Cleveland. CLA-1 reference sediment is used as an indicator of sediment conditions at the open lake placement area and serves as the point of comparison for potential contaminant effects of dredged sediment. CLA-1 reference sediments are appropriate as a reference sediments because bulk sediment contaminant concentrations are consistent with those across the larger regional area offshore of Cleveland (Table 2). Reference sediments at CLA-1 contain background levels of contaminants that are characteristic of the region. Discrete areas with higher bulk PAH and PCB concentrations (impaired sediments) identified within CLA-1 were removed from consideration as reference sediment (USACE 2016). Similarly, discrete areas with higher bulk PAH and PCB concentrations identified in regional sediment offshore of Cleveland were not considered reference sediment (USACE 2016).

In a letter dated March 1, 2016, Ohio EPA presented comments to USACE regarding its Section 401 water quality certification application which were summarized as "PCBs and Bioaccumulation" and "PAH Contamination, the Lake Erie 'Hot Spot' and Proposed Beneficial Use of Dredged Material" (Attachment 3). USACE initially responded to this letter in a letter dated March 10, 2016 (Attachment 2), noting that Ohio EPA's comments pertained to compliance of the proposed dredged sediment discharge with CWA Section 404(b)(1) Guidelines, which fall under the regulatory authority of USACE. USACE further noted that the concerns presented by Ohio EPA were outside the regulatory purview of CWA Section 401 water quality certification. A more detailed response to the Ohio EPA March 1, 2016 letter is included in Attachment 2. In a letter dated March 12, 2016, Ohio EPA presented additional comments to USACE as part of the formal record (Attachment 3), which was also in follow-up to their March 1, 2016 letter. The USACE response to those comments are contained in letter dated March 21, 2016, as well as in the earlier referenced more detailed response in Attachment 2.

●Bulk Sediment Chemistry.

►*Metals*—The range in channel sediment metal concentrations across all sampling events (Table 1) is comparable to that of CLA-1 reference sediments and regional lake sediments offshore of Cleveland (Table 2).

In most cases across the 2012 and 2015 USACE sampling events, the bulk concentration of metals in channel sediment samples are comparable or lower than those in CLA-1 reference sediments. Further evaluation of sediment cationic metal partitioning has been accomplished through SEM/AVS analysis. AVS is regarded as a key sediment partitioning phase that binds cationic metals (cadmium, copper, lead, nickel, silver and zinc) to form insoluble sulfide complexes, thereby reducing their presence and bioavailability in sediment interstitial (pore) water (Di Toro *et al.* 1992). Methodology from USEPA (2005) was applied to determine whether an excess of SEM relative to AVS (on a molar basis) existed in channel sediments. The analyzed AVS/SEM levels indicate that metals associated with channel sediments are not bioavailable and are protective of benthic organisms. Additional information evidencing the low bioavailability of sediment-associated metals is provided by the sediment toxicity test results summarized in the Biological Testing section.

A more detailed discussion of these results is provided in Sections 3.4.1 and 3.5 of USACE (2016) (Attachment 4).

►*PCBs*—Across all sampling events, the total PCB concentration range from 12 to 343 µg/kg in channel sediments (Table 1) is comparable to both the range of 58.1 to 236 µg/kg in CLA-1 reference sediments and range of 9.36 to 400 µg/kg across regional lake sediments offshore of Cleveland (Table 2). Across all sampling events, TOC-normalized total PCB concentrations in channel sediments range from 571 to 26,385 µg/kg-TOC (Table 1). This is higher than the range of 2,003 to 8,138 µg/kg-TOC in CLA-1 reference sediments but comparable to the range of 248 to 25,000 µg/kg-TOC across regional lake sediments offshore of Cleveland (Table 2). The similarity in TOC-normalized total PCB concentrations between the channel sediments, CLA-1 reference sediments and regional lake background sediments offshore of Cleveland using 2012 and 2014 data is illustrated in Figure 3 of USACE (20160 (Attachment 4).

Using Ohio EPA channel sediment data only, the ranges in channel sediment total PCB concentration (37 to 294 µg/kg) and TOC-normalized total PCB concentration (1,484 to 12,258 µg/kg-TOC) are consistent with the ranges in total PCB concentration (9.36 to 400) and TOC-normalized total PCB concentration (248 to 25,000 µg/kg-TOC) in regional lake sediments offshore of Cleveland.

For both the 2012 and 2015 USACE sampling events, PCB concentrations on a TOC-normalized basis across channel sediments were greater than those relative to lake reference sediments. Based on this information, the potential for PCB bioaccumulation was further evaluated through laboratory benthic bioaccumulation testing. For the 2014 sampling event, total PCB concentrations and TOC-normalized PCB concentrations were consistent with that of CLA-1 reference sediments; however bioaccumulation testing was completed nonetheless. The results of these tests are summarized in the Biological Testing section.

With respect to CLA-1, a localized area of significant sediment-associated PCB contamination (1,450 µg/kg) was observed within the southeast quadrant (14-CLA1-5 [Figure 6]). This site was excluded from consideration as reference sediment.

A more detailed discussion of these results is provided in Sections 3.3.1, 3.4.1 and 3.5 of USACE (2016) (Attachment 4).

►*Pesticides*—Across all sampling events, most pesticides in the channel sediment samples were not detectable. Across all sampling events, the ∑DDT concentration range of 3.4 to 54.2 µg/kg in channel sediments (Table 1) is higher than the range of 7.55 to 17.6 µg/kg in CLA-1 reference sediments, but comparable to the range of 7.11 to 49 µg/kg across regional lake sediments offshore of Cleveland (Table 2). Across all sampling events, TOC-normalized ∑DDT concentrations in channel sediments range from 292 to 3,007 µg/kg-TOC (Table 1). This is higher than the range of 259 to 704 µg/kg-TOC in CLA-1 reference sediments and the range of 284 to 1,750 µg/kg-TOC across regional lake sediments offshore of Cleveland (Table 2).

For the 2012 USACE sampling event, ∑DDT concentrations exceeded lake reference sediment concentrations. Based on this information, sediment associated ∑DDT was further evaluated through laboratory benthic bioaccumulation testing. For the 2015 USACE sampling event, no pesticide concentrations were elevated compared to CLA-1 reference sediments; however, laboratory benthic bioaccumulation testing for pesticides was nevertheless performed. The results of these tests are presented in the Biological Testing section.

In some cases, ∑DDT concentrations measured by Ohio EPA in channel sediments were elevated relative to CLA-1 reference sediments. However, application of the theoretical bioaccumulation potential (TBP) model (McFarland 1984) using empirical biota-sediment accumulation factors (BSAFs) predicted similar benthic bioaccumulation potential between the channel sediments (up to 9 µg/kg tissue) and CLA-1 reference sediments (up to 17 µg/kg tissue).

A more detailed discussion of these results is provided in Sections 3.4.1 and 3.5 of USACE (2016) (Attachment 4).

►*PAHs*—Across all sampling events, the total PAH concentration range of 570 to 24,230 µg/kg in channel sediments (Table 1) is comparable to both the range of 1,003 to 27,230 µg/kg in CLA-1 reference sediments and range of 193 to 33,399 µg/kg range across regional lake sediments offshore of Cleveland (Table 2). The same is true for TOC-normalized total PAH concentrations in the sediments.

Using Ohio EPA channel sediment data only, the ranges in channel sediment total PAH concentration (570 to 24,230 µg/kg) and TOC-normalized total PAH concentration (44 to 1,425 mg/kg-TOC) are consistent with the ranges in total PAH concentration (193 to 33,399) and TOC-normalized total PAH concentration (7 to 1,336 mg/kg-TOC) in regional lake sediments offshore of Cleveland.

For the 2012 USACE sampling event, total PAH concentrations across channel samples were sometimes greater than those relative to lake reference sediments. However, it is imperative to note that total PAH concentrations in sediments are not necessarily an accurate measurement of PAH-related toxicity. The potential risk of PAH mixtures in these sediment samples to the freshwater amphipod *H. azteca* were estimated using hydrocarbon narcosis and equilibrium partitioning (EqP) models (USEPA 2003). USEPA guidelines for protecting benthic organisms in PAH contaminated sediments are based on the concentrations of "freely dissolved" PAH concentrations in sediment interstitial water or pore water. The USEPA narcosis risk model converts the concentration of each PAH to a calculated total toxic unit (TU) on the basis of its partitioning behavior from water to an organism, and the risk to aquatic organisms is based on the sum of the individual PAH toxic units. Calculated TUs did not predict unacceptable PAH-associated toxicity resulting from total PAH concentrations in harbor sediments. Additionally, sediment pore water concentrations of 34 PAH structures (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) were measured in the composite samples using solid phase microextraction methods (SPME; ASTM method D7363). TUs were determined based on comparison to PAH specific Final Chronic Values from USEPA 2003. The total TUs did not predict PAH-related toxicity, indicating that channel sediment PAHs are protective of benthic organisms.

Similarly, in the 2014 and 2015 USACE sampling events, total PAH concentrations and TOC-normalized concentrations across channel sediments at times appeared somewhat elevated compared to CLA-1 reference sediment concentrations. Again, pore water analysis of PAH concentrations indicated that PAHs associated with channel sediments are protective of benthic organisms. Additional information evidencing the low bioavailability of sediment-associated PAHs is provided by the sediment toxicity test results summarized in the Biological Testing section.

Paired core and surface grab collected from the channel in 2015 showed no significant differences in total PAH concentrations, re-confirming that surface grab sediment samples provide an adequate representation of sediments that are maintenance-dredged.

With respect to CLA-1, localized areas of significant PAH contamination (up to 93,210 µg/kg) were observed in sediments within the southeast quadrant (14-CLA1-5 [Figure 6] and 15-CLA1-1 [Figure 9]). These discrete sites were excluded from consideration as reference sediment. These sediments were predicted to be toxic to benthic organisms based on calculated PAH TUs from pore water analyses.

A more detailed discussion of these results is provided in Sections 3.3.1, 3.4.1 and 3.5 of USACE (2016) (Attachment 4).

► *VOCs*—VOCs have generally been non-detectable in channel and lake sediments. In 2012, toluene was the only VOC detected in the channel sediments. Toluene is not bioaccumulative and tends to not be environmentally persistent. Equilibrium partitioning sediment benchmarks (ESB), protective of benthic organisms, were compared to the bulk sediment concentrations. With the exception of two discrete samples, none of the bulk sediment concentrations exceeded the ESB. The two exceptions were minor in extent (10% to 21% greater) and within the range of generally accepted analytical variability. VOC concentrations measured by Ohio EPA across several sampling events were mainly non-detectable, with the exception of toluene, which was occasionally measured at levels similar to those measured by USACE in 2012. Further information regarding the bioavailability of sediment-associated toluene is provided by the sediment toxicity test results summarized in the Biological Testing section.

►*SVOCs*—SVOC concentrations in the channel sediments, as analyzed by Ohio EPA across several sampling events, were mainly non-detectable.

●Biological Testing.

►*Standard 10-day H. azteca and C. dilutus Whole Sediment Bioassays*—These toxicity tests measure the response of sensitive benthic organisms to a mixture of sediment contaminants, through survival and growth (measured as dry weight) endpoints. This toxicity testing employed *H. azteca and C. dilutus* as test species. *H. azteca* is an amphipod, which is a small freshwater crustacean that inhabits the water column and sediment surface, feeding on detritus. This species is an important food item for bottom feeding and water column fish in the Great Lakes. *C. dilutus* is the insect known as the midge fly. Midge fly larvae burrow into sediments of eutrophic ponds and lakes, and are an important food item in the diets of various species of fish and waterfowl. The two species vary in sensitivity to different contaminants, e.g. *H. azteca* is quite sensitive to metals, while *C. dilutus* tends to be more sensitive to pesticides (USEPA/USACE 1998a). The primary purpose of these bioassays is to assess the potential toxicity of the dredged material to benthic organisms relative to lake bottom sediments. These test results are summarized in Table 3.

To minimize the confounding effects of ammonia in the channel sediments in the laboratory (typical for Great Lakes watershed sediments) and ensure a true test for persistent contaminant-related effects, sediment was initially purged of ammonia according to USEPA/USACE (1998b). Ammonia is a naturally occurring chemical common to sediment pore water and can cause toxicity at relatively low concentrations to fish and other aquatic organisms. Ammonia is typically not a concern as it undergoes rapid oxidation and dilution during the dredging and placement of sediments. In two cases in 2015, bioassays were re-run because a very high density of indigenous oligochaetes, likely tubificids, were suspected of playing a role in reducing test organism survival. Prior to re-running the *H. azteca* bioassay, channel sediments were sieved to reduce the density of native oligochaetes according to USEPA (2001) guidance. Reynoldson *et al.* (1994) also recommends sieving sediments prior to testing when large populations of indigenous invertebrates are present, particularly oligochaetes. The number of native oligochaetes was reduced in channel sediments by sieving through a 1 mm sieve, a recommended method to remove indigenous organisms when suspected of negatively impacting test organisms (USEPA 2000; USEPA 2001; ASTM 2005).

Across the 2012 and 2015 events, the mean survivals of *H. azteca* exposed to the channel sediments were high, ranging from 82 to 94% and were not more than 10% less than that of CLA-1 reference sediments or CLA-4 sediments (range 84 to 94%). The mean survival of *C. dilutus* exposed to the channel sediment were also high, ranging from 80 to 92% and were not more than 20% less than that of CLA-1 reference sediments and CLA-4 sediments (range 88 to 96%). With respect to *C. dilutus* growth, mean biomass expressed as mean dry weight (MDW) exposed to the channel sediments ranged from 0.80 to 3.5 mg and exceeded the minimum MDW of 0.6 mg (USEPA/USACE 1998a). Using the 2012 and 2015 USACE bioassay survival data, the lack of benthic toxicity associated with the channel sediments, CLA-1 reference sediments and CLA-4 sediments is illustrated in Figures 8 and 9 of USACE (2016) (Attachment 4).

In summary, the bioassay data did not show any significant, persistent contaminant-related acute or sublethal toxicity associated with channel sediments. These results are consistent with the bulk sediment chemistry data and bioavailability analysis, which did not indicate the potential for toxicity.

Ohio EPA provided *H. azteca* 10-day toxicity testing on Upper Cuyahoga River sediments that were in contrast to these results (mean survival range of 16 to 40%). However, there were several substantive methodological issues with the conduct of these tests. The primary issues identified were that ammonia pore water monitoring/reduction was not conducted and sediments were not sieved to remove indigenous organisms. Another issue was that various discrete sediment samples collected from outside the channel dredging prism were included in some of the composite samples used for the bioassay. Based on previous experience, ammonia pore water levels in these channel sediments are typically at levels that require purging (e.g., USACE 2013a) in accordance with standard guidance for conducting dredged material bioassays (USEPA/USACE 1998b). Additionally, as discussed above, substantial numbers of indigenous organisms were likely present in channel sediments used by Ohio EPA. If not addressed, indigenous organisms can confound bioassay results. It is likely that the failure to monitor pore water ammonia concentrations and purge sediment as necessary, and failure to reduce the influence caused by indigenous organisms by sieving, yielded erroneous bioassay data. As such, these tests are not believed to be representative of channel sediments and are unusable for the determination of the potential biological effects of sediment contaminants. Ohio EPA *H. azteca* 10-day toxicity tests for regional lake sediments, where ammonia and oligochaete density have not typically been identified as factors influencing test results, showed consistent 100% mean survivals.

These bioassay data show that discharge of the channel sediments at CLA-1 would not result in any contaminant-related unacceptable, adverse effects to the aquatic ecosystem. A more detailed discussion of these results is provided in Sections 3.4.2 and 3.5 of USACE (2016) (Attachment 4).

►*Standard 28-day L. variegatus PCB and ∑DDT Bioaccumulation Testing*—*L. variegatus* is a freshwater oligochaete worm (aquatic earthworm) that burrows in sediments and can be a food item for some bottom feeding fish. Test results for PCB and DDT/DDD/DDE bioaccumulation in this test species are summarized in Tables 4 and 5, respectively.

Across all sampling events, mean total PCB residues in *L. variegatus* tissues exposed to channel sediments range from 53 to 181 µg/kg, which are comparable to those of CLA-1 reference sediments (51 to 195 µg/kg). Across the larger, regional lake area offshore of Cleveland, oligochaete worm PCB bioaccumulation potential from sediments similarly ranges from 13.7 to 180 µg/kg. A comparison among benthic bioaccumulation of total PCBs from the channel sediments, CLA-1 reference sediments, CLA-1 sediments and regional lake background sediments offshore of Cleveland using 2012 and 2014 USACE data is illustrated in Figure 5 of USACE (2016) (Attachment 4).

Evaluated as individual events, measured PCB bioaccumulation from channel sediments were not statistically different from CLA-1 reference sediments in 2012 (with the exception of one DMMU [DMMU-1]) and 2014. However, they were statistically higher in 2015. In instances where tissue concentrations for channel sediments were higher than CLA-1 reference sediments, the magnitude of difference (MOD) ranged from 1.6 to 1.9. These differences are less than the two-fold difference recommended by ASTM guidance (ASTM E1688 – 10; ASTM [2010]) as a minimum detectable difference between test and reference sediments for determining the potential for ecological and human health concerns. Additionally, the differences are within the variation observed between paired laboratory and field bioaccumulation tests (in situ and ex situ tests), which compare within a factor of two (Beckingham and Ghosh 2010). Similarly, Burkhard *et al.* (2012) provides that laboratory bioaccumulation tests with *L. variegatus* are reliable indicators of oligochaete bioaccumulation in the field because BSAFs between paired field-collected oligochaetes and test organisms typically fall within a factor of two. This suggests that the small differences, when detected, between bioaccumulation from the channel and CLA-1 reference sediments in the lab, are not ecologically meaningful and fall within the range of uncertainty for predicting effects in the field. This concept using bioaccumulation data across the 2012, 2014 and 2015 USACE sampling events is illustrated in Figure 10 of USACE (2016) (Attachment 4). Because PCB bioaccumulation from channel sediments is within the range of bioaccumulation that occurs from CLA-1 reference sediments, as well as that which occurs from lake sediments across the regional lake area offshore of Cleveland, discharge of the channel sediments at CLA-1 is not expected to result in unacceptable, adverse PCB bioaccumulation-related effects to the aquatic ecosystem.

Ohio EPA provided additional 28-day *L. variegatus* bioaccumulation test data in which total PCB concentrations in tissue ranged from 225 to 362 µg/kg for Upper Cuyahoga River sediments and from 34.9 to 108 µg/kg for lake sediments. As with the toxicity testing, several substantive methodological issues were identified with the conduct of these bioaccumulation tests, and the results were determined to be unrepresentative of channel and lake sediments. The tests were not conducted in accordance with formal dredged material testing and evaluation guidance pursuant to CWA Section 404(b)(1) Guidelines (USEPA/USACE 1998a,b), including the failure to analyze the tissue of *L. variegatus* sampled from individual replicates, the use of substandard gut purging procedures and failure to conduct PCB congener analysis for sediment samples. The test results suggested that PCB residues in *L. variegatus* tissues were not representative of bulk sediment PCB concentrations in the sediment samples. Total PCB BSAFs derived from the data for both channel and lake sediments were as high as 8.0 (with a mean of 5.0) further suggesting that the bioaccumulation data were not within the range of what would normally be expected. Such mean BSAFs are improbable as they are almost an order of magnitude larger than previous estimates of bioavailability for the channel and lake sediments (mean of 0.73), and fall outside of the 95th percentile for BSAFs determined by other researchers as contained in the BSAF database (mean of 1.30; USAERDC 2016) (see Figures 11 and 12 of USACE [2016] [Attachment 4]). Another issue with these data are that various discrete sediment samples collected from outside the channel dredging prism were included in some of the composite samples used for the bioaccumulation test. Because these test results are not representative of channel or lake sediments, the data could not be used for the contaminant determination.

As previously stated in the Bulk Sediment Chemistry section, a localized area of significant PCB contamination was observed within the southeast quadrant of CLA-1 (14-CLA1-5 [Figure 6]) and was excluded from consideration as reference sediment. The PCB bioaccumulation potential for this localized site would be 550 µg/kg-tissue.

With respect to ∑DDT bioaccumulation testing across all sampling events, mean concentrations in tissue exposed to channel sediments range from 3.4 to 8.4 µg/kg, compared to 5.4 to 6.4 µg/kg for CLA-1 reference sediments. For the 2012 event, test results for channel sediments were not statistically different from CLA-1 reference sediments. In 2015, test results for channel sediments were statistically greater than CLA-1 reference sediments. However, MODs ranged from 1.1 to 1.3 indicating that the differences were not ecologically meaningful. Based on this information, discharge of the channel sediments at CLA-1 is not expected to result in unacceptable, adverse ∑DDT bioaccumulation-related effects to the aquatic ecosystem.

A more detailed discussion of these results is provided in Sections 3.3.2, 3.4.3, 3.4.4 and 3.5 of USACE (2016) (Attachment 4).

►*Standard 48-hour C. dubia and 96-hour P. promelas Water Column Bioassays*—Water column toxicity tests assess the potential toxicity of sediment-associated contaminants to sensitive organisms that live in the water column. These bioassays provide information on the toxicity of contaminants not included in WQSs and indicate possible interactive effects (additive, synergistic or antagonistic) of multiple contaminants. Water column toxicity tests use elutriate preparations prepared by mixing sediment and water (on a 1:4 ratio) into a slurry. The slurry is allowed to settle and the supernatant is decanted. The supernatant is then centrifuged to remove suspended particles. The supernatant is the elutriate which is used as the test solution for water column toxicity tests. This toxicity testing employed the test species *C. dubia* and *P. promelas*. *C. dubia* is a species of water flea that is common in the Great Lakes and represents an important food item for small and young fish. The fathead minnow *P. Promelas* is a small fish that is ubiquitous throughout the Great Lakes and its tributaries, and is forage food for larger fish. These test results are summarized in Table 6.

Significantly reduced survival in the 100% elutriates occurred for *P. promelas* in the 2012 and 2015 tests, and *C. dubia* in the 2015 tests. In each case, ammonia was suspected as the cause of toxicity. Unionized ammonia levels in the impacted bioassays approached or exceeded thresholds of toxicity (LC_{50} values) for *C. dubia* and *P. promelas*, and test species survival strongly correlated with unionized ammonia concentrations in the elutriate.

In each case of significant toxicity, a toxicity identification evaluation/toxicity reduction evaluation (TIE/TRE) was conducted to determine whether contaminants other than ammonia may have been a contributing factor. TIE/TRE treatments on the undiluted elutriates included new bioassays using freshly prepared unpurged sediment, and bioassays employing zeolite column manipulation using unpurged sediment elutriate, two pH (6.5 and 7.2) manipulations for unpurged sediment elutriate, ethylenediaminetetraacetic acid (EDTA) metal chelation manipulation using purged sediment elutriate and C18 column treatment using purged sediment elutriate. Similar to the data collected from the initial bioassays and consistent with elutriate chemical analysis, these treatments provided strong lines of evidence that ammonia is the cause of toxicity.

Since ammonia was identified as the cause of the sediment elutriate toxicity, an application factor of 0.1 was applied to the LC_{50} data to compute limited permissible concentrations (LPCs). An application factor of 0.1 is appropriate for protection of *P. promelas* (Kennedy *et al.* 2015). The most conservative LPC would be 6.7%, which based on STFATE modeling would be expected to be achieved during the first five minutes of discharge and within 140 feet of the discharge point. Collectively, the mixing model and water column bioassay data show that the release of contaminants during open water placement of the channel sediments would not result in any contaminant-related unacceptable, adverse impacts to the aquatic ecosystem.

A more detailed discussion of these results is provided in Section 3.4.5(b) and 3.5 of USACE (2016) (Attachment 4).

●<u>Elutriate Testing</u>. The result of this testing, and evaluation of the data with respect to compliance with applicable WQSs, are addressed in Section 2.6.2.

2.4.3 *Determination*. Comprehensive evaluation of bulk sediment contaminant concentrations, toxicity and bioaccumulation modeling, and bioassays have not indicated unacceptable adverse benthic and water column impacts associated with open lake placement of dredged Upper Cuyahoga River Channel sediments at CLA-1. Therefore, it is determined that the discharge of these dredged sediments at CLA-1 meet CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d).

2.5 Aquatic Ecosystem and Organism Determinations.

2.5.1 *Effects on Plankton*. Only minor short-term adverse impacts would be expected on plankton populations due to limited, temporary increases in suspended solid and turbidity levels during the open lake placement of dredged sediment. Localized plankton at CLA-1 would be temporarily displaced during open lake placement.

2.5.2 *Effects on Benthos.* The impacts to benthos resulting from the open lake placement of dredged sediment at CLA-1 would be primarily minor, adverse and short-term. The open lake placement of dredged sediment would impact the resident macroinvertebrate community through smothering and short-term suspended sediments, which would result in a temporary localized loss of benthic organisms. However, the new bottom substrate at the areas would be similar to pre-placement conditions and be recolonized by benthic organisms residing in the dredged sediment and surrounding lake bottom. Due to the similarity in the sediment grain size and toxicity between the dredged sediment and lake bottom sediments, significant long-term changes in the benthic community resulting from the placement of this new sediment would be unlikely. The physical change in bottom elevation and contours at the open lake area may diversify the benthic community to some degree from the surrounding lake bottom. A 2003 study conducted on the macroinvertebrate community in the vicinity of the Toledo Harbor open lake placement area in the Western Basin of Lake Erie (Heidelberg College 2003) concluded that the taxonomic richness and abundance of invertebrates at the placement area were similar to other areas in the Western Basin. Further, a cluster analysis showed that there was no association among sampling areas in relation to their proximity to the open lake placement area. These results indicate that the open lake placement of dredged sediment would have no significant effect on the quality of the benthic macroinvertebrate community either within or outside the open lake placement areas.

Placement of the dredged sediment within the southeast quadrant of CLA-1 would initiate an isolation of localized high PAH-related sediment toxicity (USACE November 20, 2015 letter to Ohio EPA; Attachment 2). This reduction in sediment toxicity would directly benefit benthically-coupled species that reside and feed on the deep-water lake bottom. Initially, benthic species unable to survive and reside in this locally impaired area would recolonize the area and reproduce.

2.5.3 *Effects on Nekton*. Placement of dredged sediment at CLA-1 would result in localized minor, adverse, short-term impacts to some fish. There are no notable fish spawning grounds within the open lake placement area or in areas potentially impacted by turbidity plumes. Fish behavior relative to the open lake placement of dredged sediment depends on the species being affected. They may avoid the area or swim through the turbidity plume. Intermittent, short-term increased turbidity generated by dredged sediment placement at the open lake area would not have a significant adverse effect on fish. An historic study examining 16 species of warmwater fish in laboratory aquaria did not show evidence of any observable behavioral reactions to turbidity until TSS concentrations approached 20,000 mg/L (Wallen 1951). Regarding sublethal responses in adult warmwater fish sensitive to suspended sediments, the minimum dose of TSS that elicited a sublethal effect in white perch was 650 mg/L after 5 days (Sherk *et al.* 1974). Given these studies and the short-term duration of turbidity plumes from dredged sediment placement, there appears to be a very low likelihood of turbidity-related adverse effects to fish.

2.5.4 *Effects on Aquatic Food Web*. Only minor, temporary adverse effects on the aquatic food web are expected to occur as a result of the open lake placement of dredged sediment, due primarily to the smothering of some benthic organisms. Rapid re-colonization of the impacted area by benthos is anticipated and no significant long-term degradation of the benthic community would be expected to occur. Disruption and disturbance by equipment during the dredged sediment placement operation would result in a short-term avoidance by local wildlife species, primarily fish and aquatic birds.

In letter dated February 10, 2015, Ohio EPA expressed concerns that the bioaccumulation of PCBs in walleye resulting from the open lake placement of Upper Cuyahoga River Channel dredged sediments could potentially result in a change of the existing Lake Erie walleye PCB fish consumption advisory (FCA) from one meal per month to one meal per week. This concern is addressed in Section 2.6.3(b).

Placement of the dredged sediment within the southeast quadrant of CLA-1 would decrease localized elevated surface lake sediment PCB concentrations, and initiate a reduction in the localized benthic bioaccumulation of PCBs (USACE November 20, 2015 letter to Ohio EPA; Attachment 2). This reduction in PCB bioaccumulation would directly benefit benthically-coupled species that reside and feed on the deep-water lake bottom.

2.5.5 *Effects on Special Aquatic Sites*:

a. Sanctuaries and Refuges—Not applicable.

b. Wetlands—No significant effects are expected.

c. Mud Flats—No significant effects are expected.

d. Vegetated Shallows—No significant effects are expected.

e. Coral Reefs—Not applicable.

f. Riffle and Pool Complexes—Not applicable.

2.5.6 *Threatened and Endangered Species*. Correspondence with the US Fish and Wildlife Service (letter dated September 12, 2013) and Ohio Department of Natural Resources (letter dated January 17, 2014) noted the potential for a variety of threatened and endangered species in the project vicinity; however, due to the project type and location, no impact to threatened or endangered species was expected.

2.5.7 *Other Wildlife*. Disruption and disturbance by equipment during the dredged sediment placement operation would result in a short-term avoidance of CLA-1 by local wildlife species, primarily aquatic birds. However, some bird species, such as gulls, may be attracted to dredged sediment placement activities while foraging. Wildlife impacts in this regard would be minor, adverse and short-term.

2.5.8 *Actions Taken to Minimize Impacts*.

- Utilization of CLA-1, an open lake area that has previously used for dredged sediment discharge.
- Use of mechanical equipment to dredge and discharge the dredged sediment.
- Spatially limiting the placement of dredged sediment to a one-half square mile area within the southeast quadrant of CLA-1.

2.6 Proposed Discharge Site Determinations.

2.6.1 *Mixing Zone Determination*. The mixing zone has been designated as the one-mile by two-mile zone of CLA-1.

2.6.2 *Determination of Compliance with Applicable Water Quality Standards*. Compliance with WQSs is demonstrated in USACE (2013a) and USACE (2016) based on testing and evaluation of sediment samples in 2012 and 2015. Formal CWA guidance (USEPA/USACE 1998a,b) present testing and evaluation procedures that are intended to address all aspects of water quality impacts from dredged sediment discharges and are directed at being sufficient for a Section 401 water quality certification decision that the discharge complies with applicable state WQSs. In accordance with this guidance, standard elutriate testing was conducted on Upper Cuyahoga River Channel sediments and the results were compared to applicable state WQSs. The elutriate test is a laboratory preparation used to predict the release of contaminants to the water column resulting from the discharge of dredged sediment. Sediment and water from the dredging site are mixed into a slurry with a sediment to water ratio of 1:4, and subsequently allowed to settle for one hour. The resultant supernatant is sampled, centrifuged to remove particulates and then analyzed as the elutriate. Dredged sediment discharges would occur on a discrete, intermittent basis, resulting in unsteady, short-term exposures to the water column. As such, the elutriate results are compared to WQSs protective of acute exposures to aquatic life.

Elutriates on channel and lake (CLA-1) composite sediment samples in 2012 were analyzed for metals, total cyanide, ammonia, total phosphorus, total kjedlahl nitrogen, TOC, water hardness, TSS, turbidity, PCBs (as Aroclors), pesticides and PAHs (16 USEPA priority pollutants and methylnaphthalenes). With the exception of ammonia, the elutriate test data indicate that the proposed dredged sediment discharge would comply with applicable state WQSs for the protection of aquatic life (Tables 7-10). Ammonia concentrations were further evaluated after considering mixing in the water column. STFATE modeling, based on site-specific chemistry, sediment, site and operations data, determined that the ammonia WQS would be met within a minute of the discharge upon mixing in the water column (Borrowman and Schroeder 2013). This limited exposure would not represent an unacceptable impact to the water column at the open lake placement area.

Elutriates on channel and lake (CLA-1 and CLA-4) composite sediment samples in 2015 were analyzed for metals, total cyanide, ammonia, total phosphorus, total kjedlahl nitrogen, PCBs (as Aroclors), pesticides and PAHs (16 USEPA priority pollutants and methylnaphthalenes). Similar to the testing in 2012, ammonia was the only contaminant analyzed in the elutriate that exceeded applicable state WQSs for the protection of aquatic life (Tables 11-15). Ammonia concentrations were further evaluated after considering mixing in the water column. STFATE modeling, based on site-specific chemistry, sediment, site and operations data, determined that the ammonia WQS would be met within a minute of the discharge upon mixing in the water column (USAERDC 2015).

Pursuant to Section 401 of the CWA, USACE-Buffalo District has provided the above information and data to the Ohio EPA, and requested water quality certification that the proposed discharge complies with applicable state WQSs.

2.6.3 *Potential Effects on Human Use Characteristics*:

a. Municipal and Private Water Supply—No impacts to local potable water intakes (PWIs) (Crown, Morgan, Baldwin and Nottingham) are expected from dredged sediment placement at CLA-1. Bailey *et al.* (2013) details project-specific modeling parameters used to predict the fate and transport of dredged sediment in Lake Erie during placement operations, including operations data (proposed method, volume, location, and rate of discharge), placement site conditions, hydrodynamic considerations (current patterns, water circulation and fluctuations, wind and wave action, and other physical factors on the movement of suspended particulates), and suspended sediment source data (classification and concentrations of suspended particulate/turbidity in the vicinity of the disposal site, the shape, size and duration of the plume of suspended particulates). Suspension of sediment during placement activities results in minor, short lived turbidity plumes which rapidly dissipates to background conditions. The Particle Tracking Model (PTM) study (Bailey *et al.* 2013) concluded that suspended solids resulting from the placement of Upper Cuyahoga River Channel sediment at CLA-1 would be predicted to have no measurable impact on water column TSS concentrations at the Crown, Morgan, Baldwin and Nottingham PWI structures, the nearest of which would be about five miles southeast of CLA-1. This is because currents are predominantly in an easterly or east northeasterly direction during the time of placement operations, tracking well north and away from all of the PWI structures. Furthermore, velocities are generally too low to generate a sufficient bottom shear stress to keep discharge plumes in suspension, or to suspend deposited sediments.

b. Recreational and Commercial Fisheries—The placement of dredged sediment at CLA-1 may result in minor, short-term disturbances to recreational and commercial fisheries in the vicinity.

In letter dated February 10, 2015, Ohio EPA expressed concerns that the bioaccumulation of PCBs in walleye resulting from the open lake placement of Upper Cuyahoga River Channel dredged sediments could potentially result in a change of the existing Lake Erie walleye PCB fish consumption advisory (FCA) from one meal per month to one meal per week. This supposition is based on an assumed increase in Lake Erie tissue walleye PCB residues in 2011, 2012 and 2013 relative to 2005 through 2010. USACE initially responded to Ohio EPA's concerns in letter dated February 17, 2015, strongly disagreeing that open lake placement of these channel sediments could have any measureable effect on the FCA. There are several lines of evidence that explain why open lake placement of these channel sediments would not result in any increase in PCB residues in Lake Erie walleye:

●<u>Total PCB Concentrations in Sediment</u>. Total PCB concentrations in the dredged sediments are similar to CLA-1 reference sediments as well as regional lake background sediments offshore of Cleveland (Section 2.4.2[b]). Therefore, open lake placement would not represent an increase in current Lake Erie sediment PCB concentrations.

●<u>Benthic Bioaccumulation of Total PCBs from Sediment</u>. Evaluation of laboratory tests shows that there is no ecologically meaningful difference between bioaccumulation of total PCBs from dredged sediments and CLA-1 reference sediments (Section 2.4.2[b]). Such bioaccumulation is within the range of bioaccumulation potential which occurs across regional lake background sediments offshore of Cleveland (Section 2.4.2[b]). Therefore, open lake placement would not meaningfully increase the benthic bioaccumulation of PCBs from Lake Erie sediments.

●Independent of the result that neither sediment PCB concentrations or benthic PCB bioaccumulation would meaningfully increase as a result of open lake placement of the dredged sediments, the following provide other reasons as to why open lake placement would not result in an increase in bioaccumulation of PCBs by walleye:

►*There is a weak trophic connection between walleye and benthos*—The food web connection between walleye and benthic organisms is weak, and largely absent in deep-water lake areas in the Central Basin. Adult walleye are piscivorous and their diet is comprised largely of pelagic, planktivorous fish (e.g., soft-rayed fishes such as emerald and spottail shiners, clupeids such as gizzard shad and alewife; lesser so spiny-rayed fishes such as white and yellow perch, and white bass) (Knight *et al.* 1984; Hartman and Margraf 1992; Knight *et al.* 1993; Morrison *et al.* 1997). Of the pelagic fish species that walleye consume, only spottail shiner and yellow perch have a smaller benthic dietary component predominantly via the consumption of chironomid larvae (Griswold and Tubb 1977; Knight *et al.* 1984; Hartman *et al.* 1992). Juvenile (yearling) walleye largely forage on pelagic species (e.g., juvenile shiners, gizzard shad and alewife) but will also prey on benthic invertebrates, mostly chironomid larvae (Knight *et al.* 1984). While chironomids comprise a small portion of the benthic community at CLA-1

(Kennedy *et al.* 2013), juvenile walleye are not expected to feed on benthic species in deep-water lake areas in the Central Basin.

►*The Western Basin-region aquatic ecosystem provides the greatest ambient source of PCBs to walleye in Ohio's Lake Erie*—It is well recognized that the PCB contamination gradient in Lake Erie background sediments progressively decreases eastward from Detroit, Michigan and Toledo, Ohio toward Buffalo, New York. Total PCB concentrations are highest in Western Basin sediments approaching an average of 0.2 mg/kg, declining to an average of about 0.1 mg/kg in the Central Basin (Marvin *et al.* 2002; Marvin *et al.* 2004; USACE 2016). The major source of PCBs to the Western Basin is the Detroit River (e.g., Stevens and Neilson 1989) and PCBs in this shallower basin and river are also comparably more bioavailable due to storm-induced resuspension of sediments resulting in releases of the freely dissolved form into the water column (Whittle *et al.* 2003). Furthermore, existing evidence suggests that most Lake Erie walleye in the Western and Central Basins are spawned in the Western Basin and exhibit natal site fidelity, indicating that they spend a significant portion of their lifetime in the more heavily contaminated Western Basin region (e.g., Regier *et al.* 1969; Wang *et al.* 2007). Collectively, this indicates that the majority of the exposure of Ohio's Lake Erie walleye to PCBs occurs in the aquatic ecosystem of the Western Basin-region where PCB contamination is the highest and most bioavailable within the Lake Erie Basin.

►*Open lake placement would result in a net reduction of the benthic bioaccumulation of PCBs*—Placement of the channel sediments within the southeast quadrant of CLA-1 would decrease localized lake surface sediment PCB concentrations, as well as start a reduction in the benthic bioaccumulation of PCBs, in that area (USACE November 20, 2015 letter to Ohio EPA; Attachment 2). However, given the diminutive food web connection between deep-water lake sediments and walleye, this reduction in bioaccumulation would not affect walleye. This reduction in PCB bioaccumulation would directly benefit benthic species that reside and feed on the deep-water lake bottom.

c. Water-Related Recreation—The placement of dredged sediment at CLA-1 may result in minor, short-term disturbances to recreational boating activities in the vicinity.

d. Aesthetics—The placement of dredged sediment at CLA-1 may temporarily detract from aesthetics in the vicinity.

e. Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves—Not applicable.

2.7 Determination of Cumulative Effects on the Aquatic Ecosystem.

Placement of dredged sediment at CLA-1 would create a slight mound, which would result in some local bottom surface relief. This mound would be subject to consolidation and tend to flatten over time, following the cessation of dredged sediment placement. Available relevant evidence indicate that the aquatic ecosystem at open lake placement areas are resilient, and that the periodic disturbance created by open lake placement of dredged sediment is absorbed or accommodated by the ecosystem because its structure and function would not fundamentally change over the long-term to a different state. Ecosystem resilience signifies ecosystem health (gauged by species diversity) and stability (the probability that all species persist) (e.g., Scrimgeour and Wicklum 1996).

2.8 Determination of Secondary Effects on the Aquatic Ecosystem.

No significant, adverse secondary effects on the aquatic ecosystem would be expected to occur as a result of the discharge of dredged sediment.

2.9 Public and Agency Comments (2015-2016)

2.9.1 *Section 404(a) Public Notice*

A CWA Section 404(a) Public Notice for open lake placement of sediment dredged from the Upper Cuyahoga River channel was released by USACE for 30-day public review and comment on November 20, 2015. Written comments received from the Ohio Attorney General and Port of Cleveland are included in Attachment 3 and the USACE responses to these comments are included in Attachments 1 and 2. Highlights from the two public notice comments are provided below (see Attachment 1 for USACE response):

Ohio Attorney General letter dated December 18, 2015: Requested a public hearing. Disposal of contaminated sediments into Lake Erie is likely to be inconsistent with or violate Ohio's WQSs, and jeopardize the health of Ohio's citizens. National policy has been to end open-water disposal. Ohio recently enacted a law to prohibit all open lake placement by 2020 (Ohio Rev. Code 6111.32). The USACE has issued an ultimatum: either Ohio or another non-federal entity pay for the USACE' environmental compliance or the USACE will not dredge. Contrary to federal and state law, the USACE claims that it, rather than Ohio EPA, determines whether USACE projects comply with Ohio's WQSs. Ohio's Coastal Management Program states that "polluted [dredged material] must be disposed...in confined disposal facilities" and requires compliance with Ohio water quality certifications. The USACE' own test results show that CLA-1 is five times more polluted than other areas surrounding Cleveland Harbor. Ohio EPA's latest test results show the sediment is 4-8 times more polluted than Lake Erie background conditions. USACE' claim that sediment will remain in place in the lake is flawed and ignores decades of research. Ohio EPA believes open lake placement elevates human health risks of fish consumption in the impacted region of the lake.

Port of Cleveland letter dated December 18, 2015: Requested a public hearing. Disputes USACE plan for open lake placement because it is in contravention of state and federal law and it imperils commercial navigation. Sediment quality has not improved, yet USACE again improperly is attempting open lake placement for sediments that have not met Ohio's standards for water quality. Disagrees with the USACE claim in the public notice that sediment sampling in 2014 and 2015 demonstrates sediments are not toxic and that open lake disposal would not lead to any unacceptable adverse effects to the aquatic system. The Port supports Ohio's analysis of the 2014 and 2015 data. Open lake placement is invalid because of arbitrary and capricious NEPA analysis, invalid Federal Standard determination, and faulty analysis (exhibits 1 & 2). USACE dismissed a viable local alternative agreed upon by the Port and USACE expand CDF capacity and upland beneficial use. USACE imposing open lake placement and threaten the viability of Cleveland Harbor. Contradicting its mission and Congressional intent to maintain navigation.

2.9.2 *Section 404 Public Hearing*

A Section 404 Public Hearing was hosted by USACE on March 1, 2016 at the Breen Center, 2008 West 30th Street, Cleveland, Ohio. Approximately 43 written and oral comments were received by USACE during this hearing and associated written comment period. Participants at the hearing included the general public, non-governmental organizations, Congressional representatives, local municipalities, representatives from industry, and state resource agencies. A transcript of all oral comments made during the hearing along with the written comments received is included in Attachment 3. All comments have been summarized and responded to in Attachment 1.

At the outset to the Public Hearing, the USACE explained the Federal Standard, which is the environmentally acceptable and least cost alternative that is consistent with sound engineering practices. Furthermore, the Federal Standard sets the maximum investment that the federal government can make for maintenance dredging of a harbor, and it is the basis against which all other dredged sediment management alternatives must be compared. However, if a state requires or desires an alternative that costs more, the USACE can implement that alternative but the state or another non-USACE partner must pay the difference. It was also explained during the outset of the public hearing that USACE uses guidelines and guidance for the evaluation of sediment that has been developed between the USEPA and USACE.

The USACE also made it clear at the hearing that the Upper Cuyahoga River channel sediment proposed for open lake placement has been sampled, tested, and evaluated with more rigor and scrutiny than sediment from any other Great Lakes harbor. Additionally, the USACE evaluated and fully considered data that Ohio EPA provided in October 2015 from their recent sampling events and responded to Ohio EPA directly concerning these data on February 24, 2016 (Attachment 2).

The USACE process for evaluating the channel sediment for toxicity and PCB bioaccumulation was briefly explained. This evaluation revealed that there is no sound science indicating that placement of this channel sediment at the open lake placement area would lead to an increase of PCBs in walleye, and therefore any change to the state’s fish consumption advisory because of open lake placement would be unwarranted. The USACE open lake placement proposal remains protective of human health and the environment, and is in full compliance with CWA Section 404(b)(1) Guidelines.

The main themes of the comments received, in no particular order, included an emphasis on the overall importance of Cleveland Harbor navigation to the local/regional economy and therefore urged the USACE and Ohio EPA to continue dialogue to prevent any delay in dredging. Many expressed that open lake placement was incompatible with the long-term health of Lake Erie, including perceptions that there would be unacceptable adverse impacts to public drinking water, that the practice would increase PCB bioaccumulation in fish and exacerbate HABs, that the sediment is toxic, and that USACE was misapplying federal guidance so as to obtain a desired outcome. Additional comments included encouraging USACE to pursue beneficial use of the sediment instead of open lake placement.

2.9.3 *Conclusions from Section 404 Public Review Process*

Although public and agency comments were provided on a range of topics, no relevant new data or information were provided to USACE during the Section 404 public review process that would alter its previous FONSI (USACE 2014a), 2016 dredged sediment evaluation (USACE 2016; Attachment 4), Federal Standard determination (USACE 2014b), or the finding of compliance with CWA Section 404(b)(1) Guidelines (i.e., this Section 404[b][1] Evaluation). The USACE stated during its public hearing that it would not place dredged sediment at CLA-1 in 2016 without a state water quality certification, and expressed continued hope that cost-neutral and locally acceptable alternatives to open lake placement can be identified if this continues to be the State of Ohio's preference.

FINDING OF COMPLIANCE

1. No Significant adaptations of the Section 404(b)(1)Guidelines were made relative to this evaluation.

2. The proposed plan was selected based on its ability to best address the identified community needs and to sufficiently satisfy national goals and planning objectives. It reasonably maximizes National Economic Development (NED) benefits consistent with protecting the Nation's Environmental Quality.

3. The discharge of dredged sediment would not violate applicable state WQSs, nor will it violate the Toxic Effluent Standards of Section 307 of the CWA.

4. The discharge of dredged sediment would not jeopardize the continued existence of any Federal-listed threatened or endangered species, or their designated critical habitat.

5. The discharge of dredged sediment would not contribute to significant degradation of waters of the United States, nor would it result in significant adverse effects on human health and welfare; municipal and private water supplies; recreation and commercial fishing; plankton, fish, shellfish, wildlife, or special aquatic sites; life stages of organisms dependent on the aquatic ecosystem; ecosystem diversity, productivity and stability; or recreational, aesthetic, and economic values.

6. Appropriate and practicable steps would be taken to minimize potential adverse impacts of the discharges associated with this dredging operation on the aquatic ecosystem.

7. Consideration has been given to public and agency comments received from the Section 404(a) public notice as well as from public hearing held on March 1, 2016.

8. On the basis of the guidelines, the discharge of dredged sediment is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution and adverse effects on the aquatic ecosystem.

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Figures

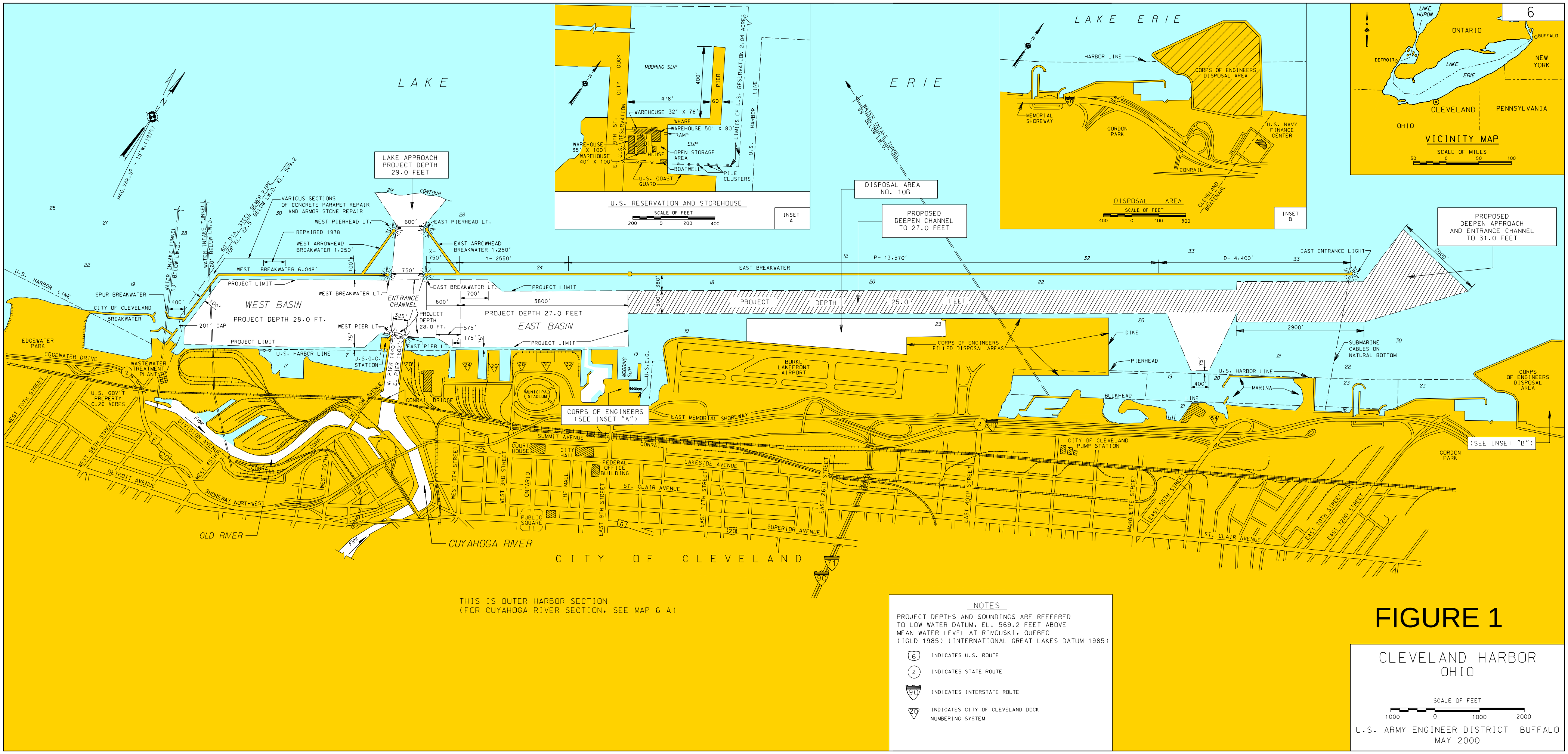
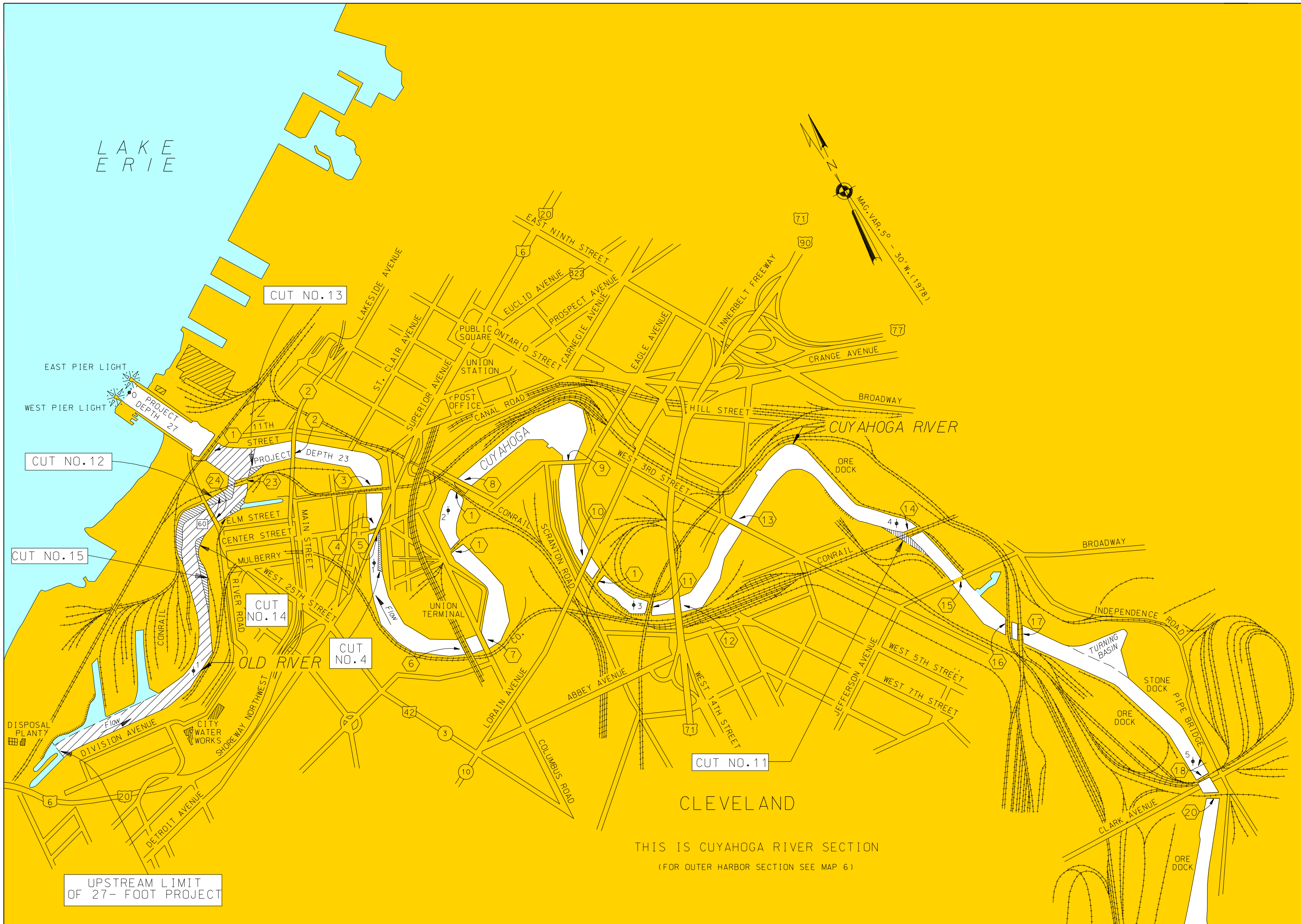

6
LAKE
ERIE
MAG. VAR. 5° - 15' W. (1975)
LAKE APPROACH PROJECT DEPTH 29.0 FEET
VARIOUS SECTIONS OF CONCRETE PARAPET REPAIR AND ARMOR STONE REPAIR
REPAIRED 1978
WEST PIERHEAD LT.
EAST PIERHEAD LT.
WEST ARROWHEAD BREAKWATER 1,250'
EAST ARROWHEAD BREAKWATER 1,250'
WEST BREAKWATER 6,048'
EAST BREAKWATER
EAST BREAKWATER LT.
WEST BREAKWATER LT.
EAST ENTRANCE LIGHT
PROJECT LIMIT
WEST BASIN
PROJECT DEPTH 28.0 FT.
EAST BASIN
PROJECT DEPTH 27.0 FEET
ENTRANCE CHANNEL
PROJECT DEPTH 28.0 FT.
PROJECT DEPTH 25.0 FEET
WEST PIER LT.
EAST PIER LT.
SPUR BREAKWATER
CITY OF CLEVELAND BREAKWATER
201' GAP
U.S. HARBOR LINE
U.S.C.G. STATION
EDGEWATER PARK
EDGEWATER DRIVE
WASTEWATER TREATMENT PLANT
U.S. GOV'T PROPERTY 0.26 ACRES
DISPOSAL AREA NO. 10B
PROPOSED DEEPEN CHANNEL TO 27.0 FEET
PROPOSED DEEPEN APPROACH AND ENTRANCE CHANNEL TO 31.0 FEET
P- 13,570'
Q- 4,400'
X- 750'
Y- 2550'
CORPS OF ENGINEERS FILLED DISPOSAL AREAS
BURKE LAKEFRONT AIRPORT
DIKE
PIERHEAD
BULKHEAD
MARINA
SUBMARINE CABLES ON NATURAL BOTTOM
CORPS OF ENGINEERS DISPOSAL AREA
(SEE INSET "B")
GORDON PARK
CORPS OF ENGINEERS (SEE INSET "A")
MUNICIPAL STADIUM
MOORING SLIP
EAST MEMORIAL SHOREWAY
CONRAIL
CONRAIL BRIDGE
SUMMIT AVENUE
COURT HOUSE
CITY HALL
FEDERAL OFFICE BUILDING
LAKESIDE AVENUE
ST. CLAIR AVENUE
SUPERIOR AVENUE
PUBLIC SQUARE
CITY OF CLEVELAND PUMP STATION
OLD RIVER
CUYAHOGA RIVER
CITY OF CLEVELAND
WEST 9TH STREET
WEST 3RD STREET
ONTARIO
THE MALL
EAST 9TH STREET
EAST 17TH STREET
EAST 26TH STREET
EAST 40TH STREET
MARQUETTE STREET
EAST 55TH STREET
EAST 70TH STREET
EAST 72ND STREET
WEST 25TH
WEST 45TH
WEST 58TH STREET
WEST 70TH STREET
DIVISION AVENUE
DETROIT AVENUE
SHOREWAY NORTHWEST
WILLOW AVENUE
THIS IS OUTER HARBOR SECTION
(FOR CUYAHOGA RIVER SECTION, SEE MAP 6 A)
U.S. RESERVATION AND STOREHOUSE
SCALE OF FEET
INSET A
MOORING SLIP
WAREHOUSE 32' X 76'
WHARF
WAREHOUSE 50' X 80'
RAMP
WAREHOUSE 35' X 100'
WAREHOUSE 40' X 100'
OPEN STORAGE AREA
BOATWELL
PILE CLUSTERS
U.S. COAST GUARD
LIMITS OF U.S. RESERVATION 2.04 ACRES
U.S. HARBOR LINE
E. 9TH ST.
CITY DOCK
PIER
LAKE ERIE
HARBOR LINE
CORPS OF ENGINEERS DISPOSAL AREA
MEMORIAL SHOREWAY
GORDON PARK
U.S. NAVY FINANCE CENTER
CONRAIL
CLEVELAND BRATENAHL
DISPOSAL AREA
INSET B
LAKE HURON
ONTARIO
DETROIT
LAKE ERIE
BUFFALO
NEW YORK
CLEVELAND
PENNSYLVANIA
OHIO
VICINITY MAP
SCALE OF MILES
NOTES
PROJECT DEPTHS AND SOUNDINGS ARE REFFERED TO LOW WATER DATUM, EL. 569.2 FEET ABOVE MEAN WATER LEVEL AT RIMOUSKI, QUEBEC (IGLD 1985) (INTERNATIONAL GREAT LAKES DATUM 1985)
INDICATES U.S. ROUTE
INDICATES STATE ROUTE
INDICATES INTERSTATE ROUTE
INDICATES CITY OF CLEVELAND DOCK NUMBERING SYSTEM
CLEVELAND HARBOR OHIO
SCALE OF FEET
U.S. ARMY ENGINEER DISTRICT BUFFALO
MAY 2000

FIGURE 1



6A

VICINITY MAP

SCALE OF MILES

50 0 50 100

INDEX TO BRIDGES

SHOWN THUS ⟨1⟩

* 1	CONRAIL
2	MAIN AVE. HIGH LEVEL BRIDGE
* 3	FLATS DEVELOPMENT INC.
4	CENTER STREET BRIDGE
5	DETROIT SUPERIOR HIGH LEVEL BRIDGE
6	UNION TERMINAL (RAILWAY) HIGH LEVEL BRIDGE
7	COLUMBUS RD. BRIDGE
8	CARTER RD. BRIDGE
9	EAGLE AVE. BRIDGE
10	LORAIN CARNEGIE HIGH LEVEL BRIDGE
*11	NORFOLK AND WESTERN RAILWAY
12	INNER BELT FREEWAY HIGH LEVEL BRIDGE
13	3RD. ST. BRIDGE
**14	CONRAIL
15	JEFFERSON AVE. BRIDGE SUPERSTRUCTURE REMOVED
16	NEWBURG AND SOUTH SHORE RAILWAY BRIDGE
17	BALTIMORE AND OHIO RAILWAY BRIDGE
18	RIVER TERMINAL RAILWAY BRIDGE
*19	NORFOLK AND WESTERN RAILWAY, BRIDGE NO. 2 (L) WESTERN AND LAKE ERIE RAILROAD (O)
20	NORFOLK AND WESTERN RAILWAY, BRIDGE NO. 3 (L) WESTERN AND LAKE ERIE RAILROAD (O)
21	NEWBURG AND SOUTH SHORE RAILWAY BRIDGE
**22	FLATS DEVELOPMENT INC. } OLD RIVER
*23	WILLOW AVE. BRIDGE } OLD RIVER

NOTE: FEDERAL PARTICIPATION IN REPLACEMENT
* COMPLETED
** AUTHORIZED

NOTES

PROJECT DEPTHS
27.0 FEET IN LOWER CUYAHOGA RIVER TO JUNCTION WITH OLD RIVER AND
23.0 FEET IN REMAINDER OF CUYAHOGA RIVER.
18.0 FEET IN TURNING BASIN AT MILE 4.8 ON CUYAHOGA RIVER.
27.0 FEET IN OLD RIVER.

PROJECT DEPTHS AND SOUNDINGS ARE REFFERED TO LOW WATER DATUM ELEVATION 569.2 FEET ABOVE MEAN WATER LEVEL AT RIMOUSKI, QUEBEC (IGLD 1985) (INTERNATIONAL GREAT LAKES DATUM 1985)

MILES ABOVE WEST PIER LIGHT AT OUTER END OF WEST PIER SHOWN THUS 2♦

(42) INDICATES U.S. ROUTES

(10) INDICATES STATE ROUTES

(71) INDICATES INTERSTATE ROUTE

AREAS PARTIALLY DREDGED

CUYAHOGA RIVER PARTIALLY DREDGED TO 23.0 FEET UPSTREAM OF BRIDGE NO. 1 TO JUNCTION WITH OLD RIVER.

OLD RIVER PARTIALLY DREDGED TO 23.0 FEET FROM JUNCTION WITH CUYAHOGA RIVER TO OPPOSITE SAND PRODUCTS CORP. DOCK, REMAINDER DREDGED TO 21.0 FEET

FIGURE 2

CLEVELAND HARBOR
OHIO

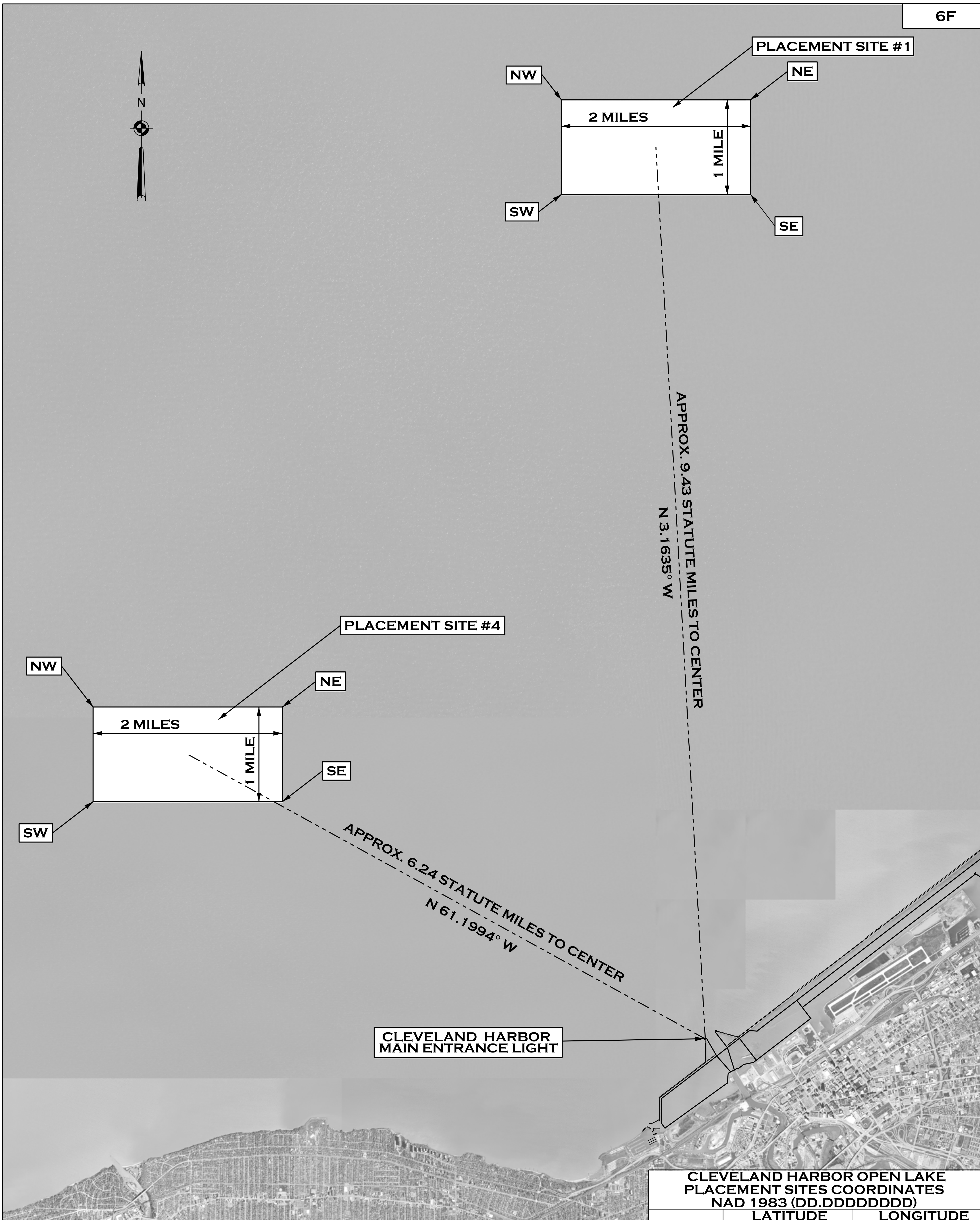
SCALE OF FEET

1000 0 1000 2000

U.S. ARMY ENGINEER DISTRICT BUFFALO
MAY 2000

CORPS OF ENGINEERS U.S. ARMY

6F



CLEVELAND HARBOR OPEN LAKE PLACEMENT SITES COORDINATES NAD 1983 (DD.DDDDDDDD)

	LATITUDE	LONGITUDE
SITE 1		
CENTER	41.645504988	81.726066535
NE	41.652619543	81.706661473
SE	41.638130041	81.706837175
SW	41.638387177	81.745467376
NW	41.652876734	81.745300230
SITE 4		
CENTER	41.553171131	81.822554593
NE	41.560302010	81.803187373
SE	41.545811921	81.803341480
SW	41.546037006	81.841917596
NW	41.560527144	81.841772022

LOCATION OF PLACEMENT AREAS WERE CALCULATED AS FOLLOWS:

1. THE LAT/LON COORDINATES WERE PROVDIED TO TD-DS IN A EMAIL FROM PM-EA ON 17 OCT. 2013.
2. THE COORDINATES WERE CONVERTED TO STATE PLANE COORDINATES USING CORPSCON AND PLOTTED IN A CADD FILE.
3. THE SOUTHWEST CORNER WAS HELD AS THE STARTING POINT WITH LINES DRAWN DUE EAST AT 2 MILES AND DUE NORTH AT 1 MILE, THEN COPIED PARALLEL TO FORM THE 2 MILE X I MILE SITE.
4. THE XY STATE PLANE COORDINATES OF THE CORNERS FROM THE DRAWN PLACEMENT SITE WERE THEN CONVERTED TO LAT/LON FOR INCLUSION ON THIS MAP.
5. THE BEARING AND DISTANCE TO THE CENTERS WAS CALCULATED BY DRAWING A LINE FROM THE CENTER OF THE PLACEMENT SITE TO THE LIGHTHOUSE SHOWN ON A GEOREFERENCED SID FILE OBTAINED FROM THE OHIO GRAPHICALLY REFERENCED INFORMATION PROGRAM.

CLEVELAND HARBOR
OHIO
OPEN LAKE PLACEMENT SITE LOCATION
SCALE OF MILES
1 ½ 0 1
U.S. ARMY ENGINEER DISTRICT BUFFALO
NOVEMBER 2013

FIGURE 3

FIGURE 4: 2012 Cleveland Harbor Upper River Reach Discrete Sample Locations and DMMU Boundaries

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Legend

- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit

0 250 500 1,000
Feet

US Army Corps of Engineers® Buffalo District
U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR 2014 ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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Date Saved: 06 Nov 2015
Time Saved: 7:42:11 AM

CLEVELAND, OHIO

FIGURE 5

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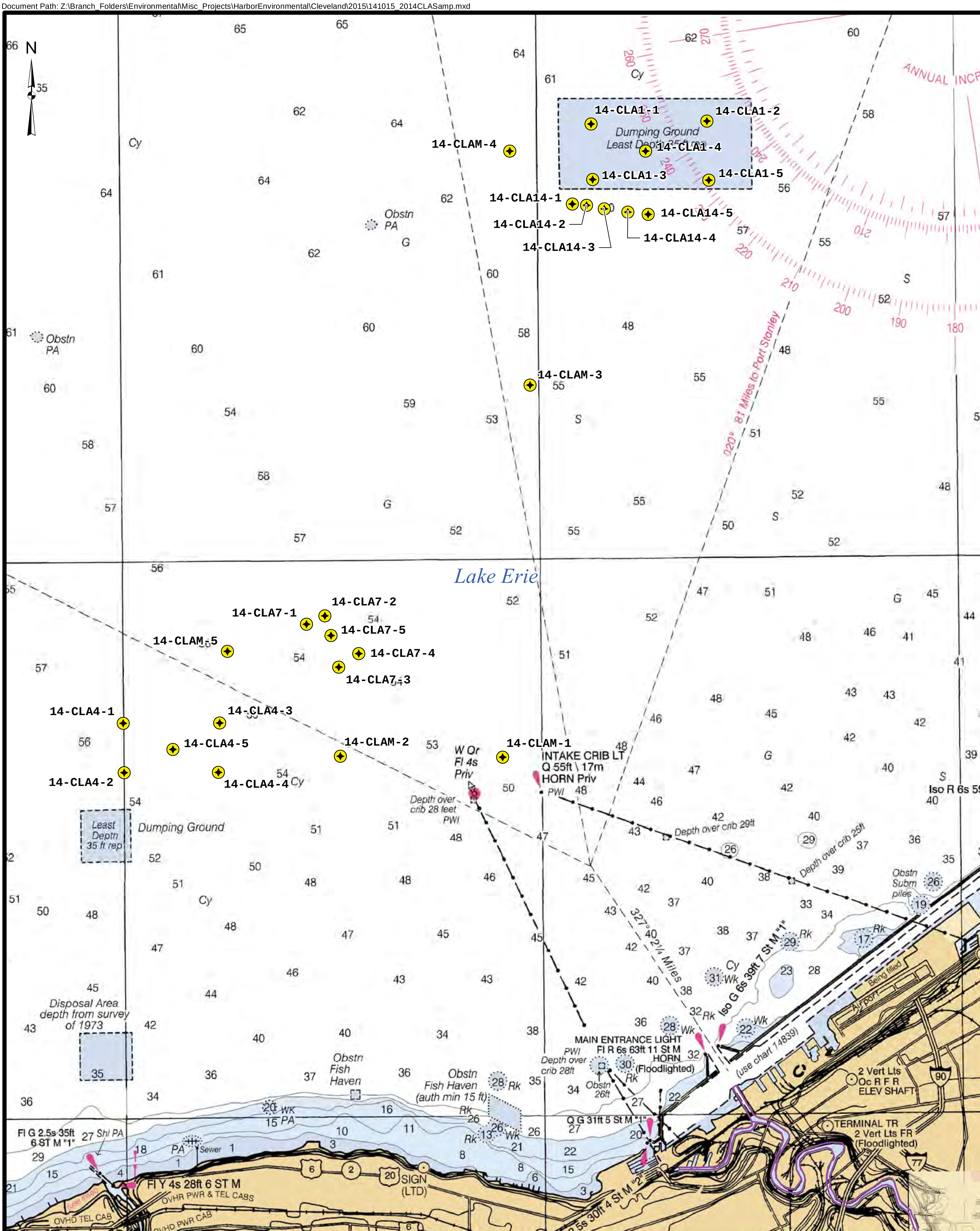

Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

US Army Corps of Engineers® Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

SAMPLING SITES FOR 2014 ANALYSES OF SEDIMENTS AT
PROPOSED-OPEN LAKE PLACEMENT AREA CLA-1, AND OTHER
LAKE AREAS AND SITES OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE 6

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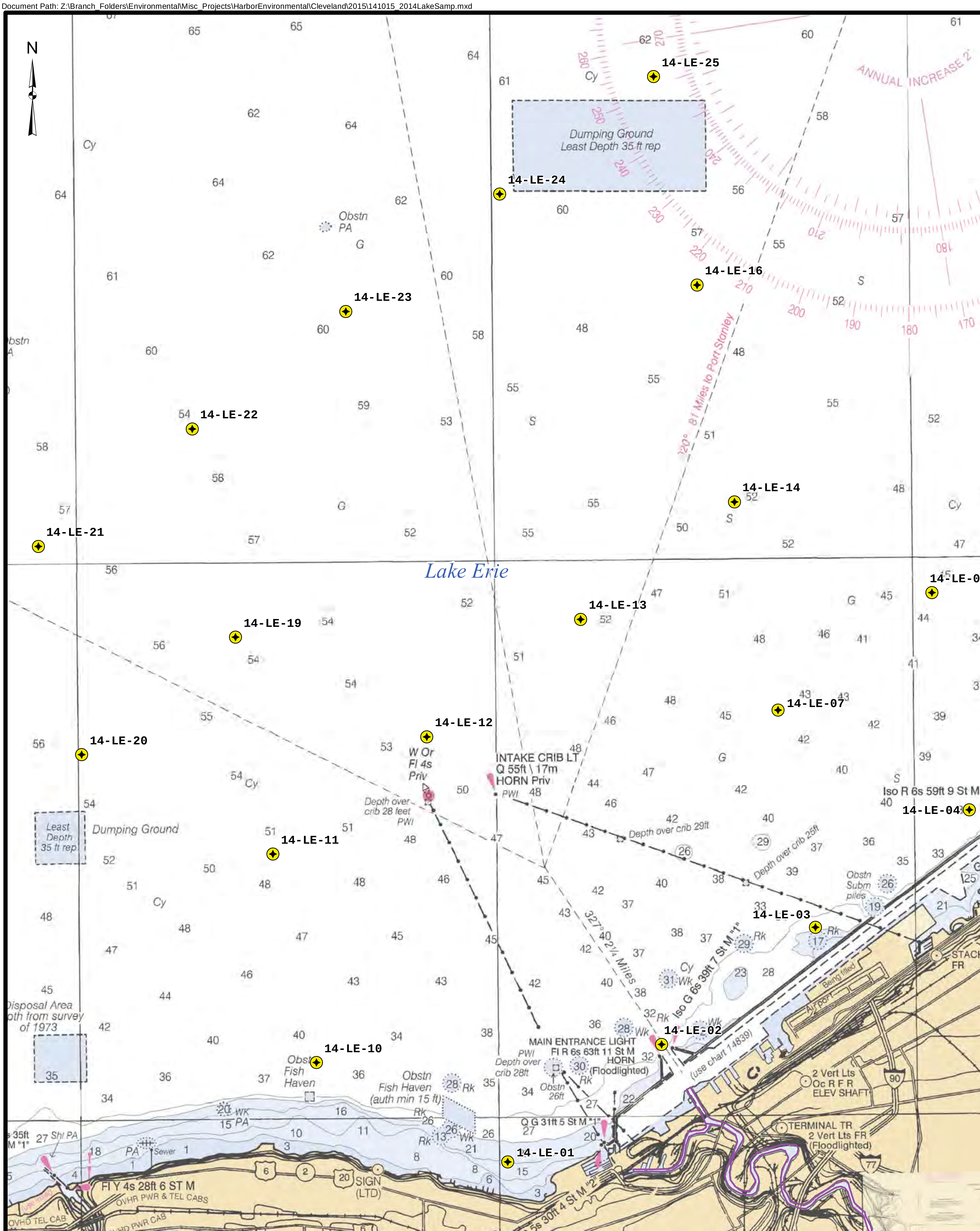

Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

US Army Corps of Engineers Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

SAMPLING SITES FOR 2014 ANALYSES OF REGIONAL LAKE ERIE SEDIMENTS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE 7

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit

0 250 500 1,000 Feet

US Army Corps of Engineers® Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR 2015 ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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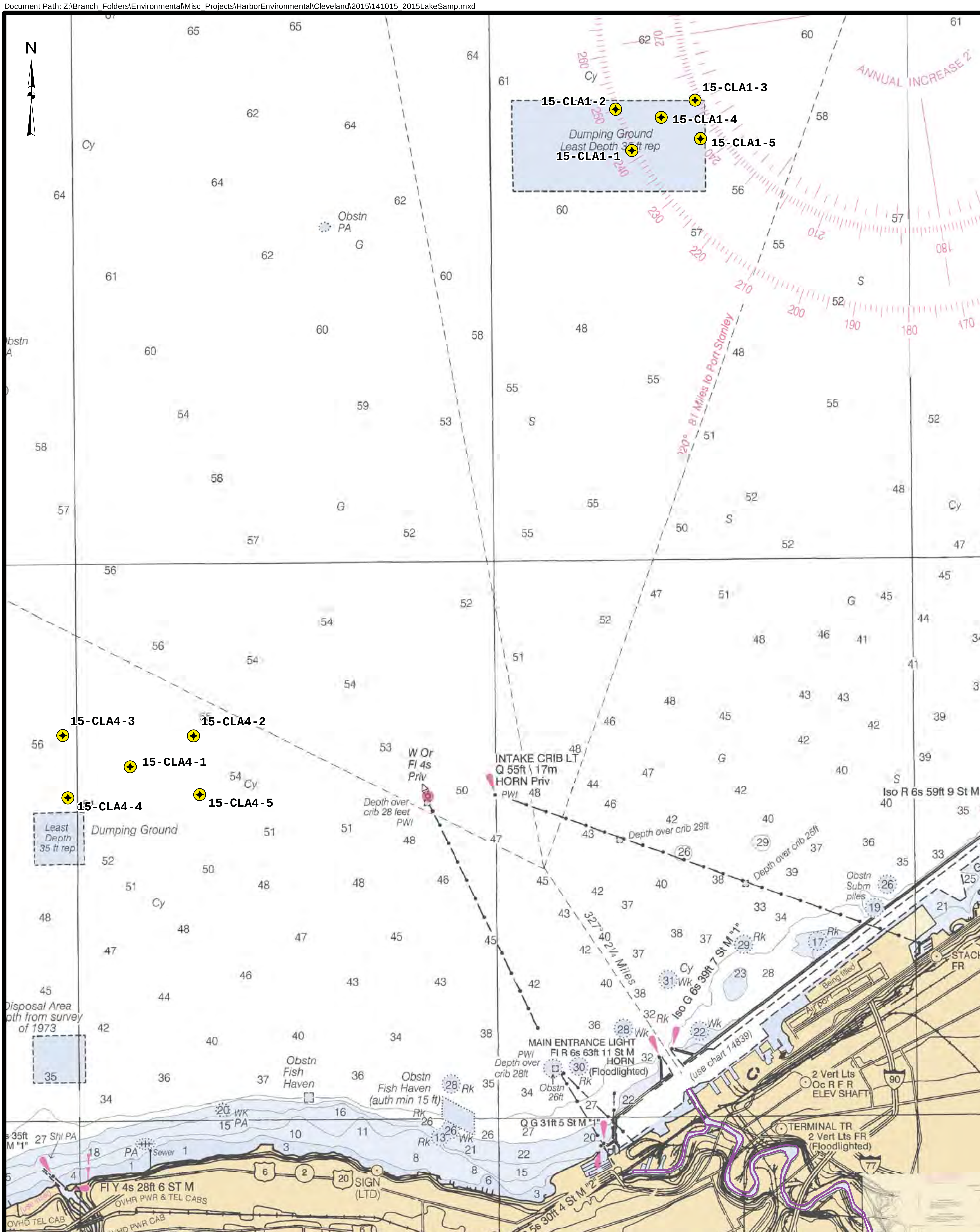
CLEVELAND, OHIO

FIGURE 8



Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

US Army Corps of Engineers
Buffalo District

SAMPLING SITES FOR 2015 ANALYSES OF SEDIMENTS AT PROPOSED OPEN LAKE PLACEMENT AREA CLA-1 AND OTHER LAKE AREAS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE 9

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers®
Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2013 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 10

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers® Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR APRIL 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 11

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR MAY 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 12

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers
Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR AUGUST 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 13

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers Buffalo District — U.S. ARMY ENGINEER DISTRICT CORPS OF ENGINEERS BUFFALO, NY	DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS
Document Name: 250116_OEPA1014.mxd Drawn By: H5TDESPM Date Saved: 17 Feb 2016 Time Saved: 11:12:14 AM	CLEVELAND, OHIO — FIGURE 14

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR APRIL 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 15

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Legend

- Sediment Core/Grab Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

US Army Corps of Engineers Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE 16

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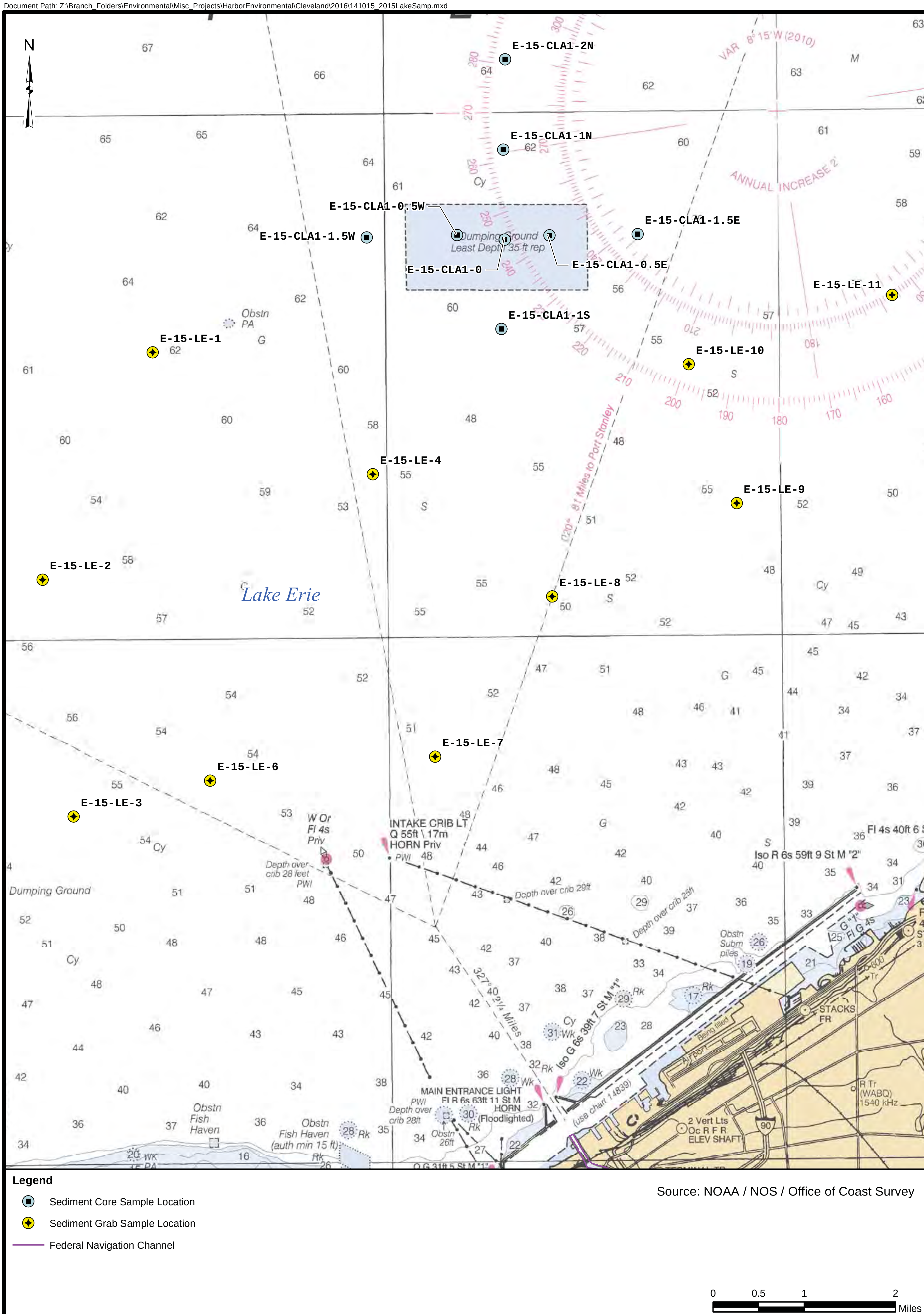

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

US Army Corps of Engineers Buffalo District

SAMPLING SITES FOR 2015 OEPA ANALYSES OF REGIONAL LAKE ERIE SEDIMENTS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE 17

Tables

TABLE 1. Summary of Cleveland Harbor Upper Cuyahoga River Channel bulk sediment contaminant concentration data.

CONTAMINANT	UNITS	UPPER CUYAHOGA RIVER CHANNEL SEDIMENT			
		OEPA		USACE	
		MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
ALUMINUM	mg/kg	2,800	14,400	3,400	16,000
ANTIMONY	mg/kg	NA	NA	0.96	2.2
ARSENIC	mg/kg	6.8	19	6.1	21
BARIUM	mg/kg	30	95	18	94
BERYLLIUM	mg/kg	0.23	0.69	0.34	0.57
CADMIUM	mg/kg	0.387	3.5	0.078	0.90
CALCIUM	mg/kg	4,600	18,800	4,200	20,000
CHROMIUM, TOTAL	mg/kg	7.8	85	6.3	26
COBALT	mg/kg	4.2	13	4.1	12
COPPER	mg/kg	13	83	13	77
IRON	mg/kg	11,900	33,500	17,200	42,000
LEAD	mg/kg	17	55	12	44
MAGNESIUM	mg/kg	2,030	7,180	1,800	8,700
MANGANESE	mg/kg	222	947	210	1,000
MERCURY	mg/kg	0.036	0.93	0.007	0.12
MOLYBDENUM	mg/kg	NA	NA	2.02	4.18
NICKEL	mg/kg	13	36	16	138
POTASSIUM	mg/kg	1,270	2,780	520	2,900
SELENIUM	mg/kg	NA	NA	0.44	0.89
SILVER	mg/kg	0.137	0.289	0.26	0.44
SODIUM	mg/kg	NA	NA	88	317
THALLIUM	mg/kg	NA	NA	0.29	0.34
VANADIUM	mg/kg	NA	NA	8.7	33
ZINC	mg/kg	79	395	82	209
CYANIDE	mg/kg	NA	NA	0.35	1.8
NITROGEN, AMMONIA	mg/kg	43	1,100	10	380
NITROGEN, TOTAL KJELDAHL (TKN)	mg/kg	NA	NA	260	2,300
PHOSPHORUS, TOTAL (AS P)	mg/kg	50	1,350	50	824
TOTAL ORGANIC CARBON	%	1.2	3.8	0.19	2.9
TOLUENE	µg/kg	56	11,900	7.7	14,500
TOTAL PAH	µg/kg	570	24,230	909	16,192
TOC-NORMALIZED TOTAL PAH	mg/kg-OC	44	1,425	115	1,749
TOTAL PCB	µg/kg	37	294	12	343
TOC-NORMALIZED TOTAL PCB	µg/kg-OC	1,484	12,258	571	26,385
TOTAL DDT	µg/kg	5.8	54.2	3.4	26.3
TOC-NORMALIZED TOTAL DDT	µg/kg-OC	292	3,007	542	2,424

TABLE 2. Summary of bulk sediment contaminant concentration data at open-lake reference areas offshore of Cleveland, Ohio.

CONTAMINANT	UNITS	LAKE ERIE REFERENCE SEDIMENT[1]			
		CLA-1 REFERENCE		CLEVELAND OFFSHORE REGIONAL AREA	
		MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
ALUMINUM	mg/kg	14,400	34,000	5,720	34,000
ANTIMONY	mg/kg	1.6	3.8	1.5	2.7
ARSENIC	mg/kg	7.5	15.7	4.77	76.9
BARIUM	mg/kg	105	150	47.7	188
BERYLLIUM	mg/kg	0.077	0.96	0.321	1.07
CADMIUM	mg/kg	1.5	4.66	0.728	2.88
CALCIUM	mg/kg	1,100	14,100	4,340	16,000
CHROMIUM, TOTAL	mg/kg	43.8	60.6	12.6	61
COBALT	mg/kg	11.9	18	6.08	17
COPPER	mg/kg	50	69.1	12.2	55
IRON	mg/kg	33,900	49,000	18,300	70,900
LEAD	mg/kg	53	108	15.7	73.5
MAGNESIUM	mg/kg	1,300	15,000	3,710	17,000
MANGANESE	mg/kg	528	981	401	1540
MERCURY	mg/kg	0.07	0.4	0.04	0.75
MOLYBDENUM	mg/kg	1.07	1.69	1.1	1.3
NICKEL	mg/kg	44.6	71	16.7	67
POTASSIUM	mg/kg	2,610	7,100	2,900	7,300
SELENIUM	mg/kg	1.36	1.76	1.51	1.57
SILVER	mg/kg	0.5	0.79	0.47	5.38
SODIUM	mg/kg	172	250	161	280
THALLIUM	mg/kg	0.46	0.53	0.45	0.48
TITANIUM	mg/kg	73	73	37	93
VANADIUM	mg/kg	30.6	79	32.9	78
ZINC	mg/kg	220	466	72.9	261
CYANIDE	mg/kg	0.8	1	0.89	0.91
NITROGEN, AMMONIA	mg/kg	104	420	60.4	3200
NITROGEN, TOTAL KJELDAHL (TKN)	mg/kg	1,850	5,400	840	52,000
PHOSPHORUS, TOTAL (AS P)	mg/kg	420	1280	44	1130
TOTAL OIL & GREASE	mg/kg	450	450	460	460
TOTAL ORGANIC CARBON (TOC)	%	2.4	3.2	0.19	4.4
ENDOSULFAN SULFATE	µg/kg	1.8	2.5		
ENDRIN	µg/kg	2.2	2.2		
ENDRIN ALDEHYDE	µg/kg	1.8	1.8	20	20
GAMMA BHC (LINDANE)	µg/kg	1.7	1.7		
HEPTACHLOR EPOXIDE	µg/kg	1.5	1.5		
TOTAL PAHs	µg/kg	1,003	27,230	193	33,399
TOC-NORMALIZED TOTAL PAHs	mg/kg-OC	31	939	7	1,336
TOTAL PCBs	µg/kg	58.1	236	9.36	400
TOC-NORMALIZED TOTAL PCBs	µg/kg-OC	2,003	8,138	248	25,000
TOTAL DDT	µg/kg	7.55	17.6	7.11	49
TOC-NORMALIZED TOTAL DDT	µg/kg-OC	259	704	284	1,750

[1] Excludes all bottom core samples and samples that are likely toxic to benthic organisms.

TABLE 3. Results of standard 10-day *Hyalella azteca* and *Chironomus dilutus* solid phase bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments.

Test Species	Measurement Endpoint	Bioassay	Upper River Channel						Lake Area				Control	
			DMMU-1		DMMU-2a		DMMU-2b		CLA-1		CLA-4			
			2012	2015	2012	2015	2012	2015	2012	2015	2012	2015	2012	2015
H. azteca	Mean Survival (%)	Initial	94±6	92±8	94±6	**50±26**[1]	82±25	**58±13**[1]	84±15	98±5	92±11	94±13	90±7	98±5
		Follow-up[2]	NA	NA	NA	**92±8**	NA	**86±11**	NA	94±6	NA	92±8	NA	90±10
C. dilutus	Mean Survival (%)	Initial	80±7	92±5	86±13	88±13	90±10	88±13	90±10	92±11	88±5	96±9	94±6	100
	Mean Growth (mass, mg DW)	Initial	3.5±0.1	2.6±0.6	2.3±0.3	1.4±0.3	2.2±0.3	0.8±0.04	1.7±0.1	1.9±0.2	1.7±0.2	1.8±0.4	1.7±0.2	2.1±0.2

[1] Lower survival was statistically significant.
[2] Bioassay re-run following standard removal of indigenous organisms from sediment samples.

TABLE 4. Results of standard 28-day *Lumbriculus variegatus* PCB bioaccumulation tests on Cleveland Harbor Upper Cuyahoga River Channel and open-lake reference sediments.

AREA	MANAGEMENT UNIT/LAKE AREA	MEAN TOTAL PCB CONCENTRATION (µg/kg-TISSUE)		
		2012	2014	2015
UPPER CUYAHOGA RIVER CHANNEL	DMMU-1	86	156	153
	DMMU-2a	53	105	164
	DMMU-2b	58	103	181
LAKE	CLA-1	51	195	97

TABLE 5. Results of standard 28-day *Lumbriculus variegatus* DDT bioaccumulation tests on Cleveland Harbor Upper Cuyahoga River Channel and open-lake reference sediments.

AREA	MANAGEMENT UNIT/LAKE AREA	MEAN ∑DDT CONCENTRATION (µg/kg-TISSUE)	
		2012	2015
UPPER CUYAHOGA RIVER CHANNEL	DMMU-1	5.3	8.4
	DMMU-2a	3.4	6.7
	DMMU-2b	5.6	7.3
LAKE	CLA-1	5.4	6.4

TABLE 6. Results of 48-hour *Ceriodaphnia dubia* and 96-hour *Pimephales promelas* elutriate bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel sediments and lake water .

Sample	Elutriate Concentration (%)	Test Species							
		C. dubia				*P. promelas*			
		2012		2015		2012		2015	
		Survival (%)	Survival (%) TRE[1]	Survival (%)	Survival (%) TRE[1]	Survival (%)	Survival (%) TRE[1]	Survival (%)	Survival (%) TRE[1]
DMMU-1	13	96±9	NA	NA	NA	98±4	NA	98±4	NA
	25	92±18	NA	NA	NA	100	NA	88±4	NA
	50	100	NA	92±11	NA	96±9	NA	92±8	NA
	100	100	NA	96±9	NA	98±4	NA	80±23	NA
DMMU-2a	13	96±9	NA	N/A	NA	96±5	NA	98±4	NA
	25	92±18	NA	84±9	NA	100	NA	100	NA
	50	84±17	NA	84±22	NA	96±5	NA	90±7	NA
	100	84±17	NA	**64±33[2]**	**100**	**0**	**100**	**22±44[2]**	**93±6**
DMMU-2b	13	100	NA	N/A	NA	100	NA	96±9	NA
	25	100	NA	92±18	NA	96±5	NA	98±4	NA
	50	92±11	NA	100	NA	96±5	NA	88±13	NA
	100	76±17	NA	100	100	**0**	**100**	**22±26[2]**	**97±6**
Control	N/A	92±18	NA	100	93±12	100	52±19	98±4	100
Lake Site Water	N/A	80±28	NA	96±9	100	100	100	100	100

[1]Survival following toxicity reduction evaluation (TRE) bioassay using zeolite-treated 100% elutriates to reduce ammonia concentrations; zeolite removed all acute toxicity observed in initial bioassay. Sediment elutriate data re-confirm no other contaminant cause of acute toxicity.

[2]Mean survival is ≥10% less and statistically different from that of lake water.

TABLE 7. Maximum metal and inorganic standard elutriate test (SET) results on Cleveland Harbor Upper Cuyahoga River Channel Sediment (2012).

METALS	MAXIMUM SET CONCENTRATION (µg/L)	OMZM WATER QUALITY STANDARD (µg/L)
ALUMINUM	20	
ANTIMONY	1.8	900
ARSENIC	12.4	340
BARIUM	71.2	2,000
BERYLLIUM	0.5U[1]	
CADMIUM	0.5U	4.3
CALCIUM	70,400	
CHROMIUM, TOTAL	1.3	570
COBALT	0.7J[2]	220
COPPER	4.9	13
IRON	71.4	
LEAD	0.5	97
MAGNESIUM	15.4	
MANGANESE	1,210	
MERCURY	0.075	1.4
NICKEL	6.9	470
POTASSIUM	8,730	
SELENIUM	2.3	
SILVER	0.5	
SODIUM	32,800	
THALLIUM	0.5	79
VANADIUM	0.9J	150
ZINC	7.6	120

MISCELLANEOUS	MAXIMUM SET CONCENTRATION (mg/L)	OMZM WATER QUALITY STANDARD (mg/L)
AMMONIA, N	**16.8**	4.5*
CYANIDE	0.01	0.022
PHOSPHORUS	0.124	

[1]Non-detectable at the specified detection limit.
[2]Estimated value between the minimum detection limit and reporting limit.
[*]water temperature of 25°C and pH of 8.1.

TABLE 8. Maximum pesticide SET results on Cleveland Harbor Upper Cuyahoga River Channel sediments (2012).

PESTICIDE	MAXIMUM SET CONCENTRATION (µg/L)	FEDERAL FRESHWATER CMC (µg/L) (ACUTE)
ALDRIN	0.001U[1]	
ALPHA BHC	0.001U	
BETA BHC	0.001U	
DELTA BHC	0.001R[2]	
GAMMA BHC (LINDANE)	0.001U	
ALPHA CHLORDANE	0.001U	
GAMMA CHLORDANE	0.001U	
DDD, 4,4'-	0.001U	
DDE, 4,4'-	0.001U	1.1
DDT, 4,4'-	0.001U	
DIELDRIN	0.001U	
ENDOSULFAN-I	0.001U	
ENDOSULFAN-II	0.001U	
ENDOSULFAN-SULFATE	0.001U	
ENDRIN	0.001U	
ENDRIN ALDEHYDE	0.001U	
ENDRIN KETONE	0.001R	
HEPTACHLOR	0.001U	
HEPTACHLOR EPOXIDE	0.001U	
METHOXYCHLOR	0.001U	
TOXAPHENE	0.001U	

[1]Non-detectable at the specified detection limit.

[2]Rejected.

TABLE 9. Maximum PCB SET results on Cleveland Harbor Upper Cuyahoga River Channel sediments (2012).

PCB	MAXIMUM SET CONCENTRATION (µg/L)	FEDERAL FRESHWATER CCC (µg/L) (CHRONIC)
AROCLOR 1016	0.03U[1]	0.014
AROCLOR 1221	0.03U	0.014
AROCLOR 1232	0.03U	0.014
AROCLOR 1242	0.03U	0.014
AROCLOR 1248	0.03U	0.014
AROCLOR 1254	0.03U	0.014
AROCLOR 1260	0.03U	0.014

[1]Non-detectable at the specified detection limit.

TABLE 10. Maximum PAH compound SET results on Cleveland Harbor Upper Cuyahoga River Channel sediments (2012).

PAH COMPOUND	MAXIMUM SET CONCENTRATION (µg/L)	OMZM WATER QUALITY STANDARD (µg/L)
1-METHYLNAPHTHALENE	1.6U[1]	
2-METHYLNAPHTHALENE	1.6U	
ACENAPHTHENE	0.04U	19
ACENAPHTHYLENE	0.04U	120
ANTHRACENE	0.04U	0.18
BENZO(A)ANTHRACENE	0.04J[2]	42
BENZO(A)PYRENE	0.08J	0.54
BENZO(B)FLUORANTHENE	0.12J	23
BENZO(G,H,I)PERYLENE	0.08J	
BENZO(K)FLUORANTHENE	0.08J	
CHRYSENE	0.08J	42
DIBENZ(A,H)ANTHRACENE	0.04U	
FLUORANTHENE	0.16J	3.7
FLUORENE	0.04U	110
INDENO(1,2,3-C,D)PYRENE	0.08J	
NAPHTHALENE	0.04U	170
PHENANTHRENE	0.04J	31
PYRENE	0.12J	42

[1]Non-detectable at the specified detection limit.

[2]Estimated value between the method detection limit and reporting limit.

TABLE 11. Metal SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (2015)

METAL (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY STANDARD (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALUMINUM	0.018	0.043	0.3	0.12	0.44	
ANTIMONY	0.001 U[1]	0.001 U	0.001 U	0.001 U	0.001 U	0.9
ARSENIC	0.001	0.001	0.018	0.035	0.047	0.34
BARIUM	0.021	0.017	0.25	0.25	0.28	2
BERYLLIUM	R[2]	0.001 U	0.001 U	0.001 U	0.001 U	
CADMIUM	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.0043
CALCIUM	37	32	52	74	80	
CHROMIUM, TOTAL	0.001	0.001	0.001	0.001	0.003	0.57
COBALT	0.001 U	0.001 U	0.001	0.001	0.002	0.22
COPPER	0.002	0.001	R	R	R	0.013
IRON	0.12 U	0.092	3.1	5.3	9.9	
LEAD	0.001 U	0.001 U	0.003	0.002	0.004	0.097
MAGNESIUM	9	8.7	11	15	16	
MANGANESE	0.002	0.001	1.9	2.8	2.5	
MERCURY	0	0	0	0 U	0 U	0.0014
NICKEL	0.002	0.002	0.006	0.006	0.006	0.47
POTASSIUM	1.4	1.3	4.9	6.1	7.5	
SELENIUM	0.003 U	0.003 U	0.003 U	0.002	0.003 U	
SILVER	R	0.001 U	0.001 U	0.001 U	0.001 U	
SODIUM	9.4	9.2	25	32	35	
THALLIUM	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.079
VANADIUM	0.001 U	0.001 U	0.001	0.001	0.002	0.15
ZINC	0.003	0.003	0.021	0.021	0.023	0.12

[1] Not detected at the specified detection limit.

[2] Strong method blank bias.

TABLE 12. Nutrient and cyanide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (2015)

PARAMETER (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY STANDARD (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
CYANIDE	0.014	0.009	0.016	0.015	0.014	0.022
NITROGEN, AMMONIA	0.1	0.1	**5.7**	**8.7**	**19**	4.5*
NITROGEN, TOTAL KJELDAHL (TKN)	6.9	0.95	5	8	14	
PHOSPHORUS, TOTAL (AS P)	0.011	0.008	0.19	0.28	0.32	1

*Temp 25°C, pH 8.1

TABLE 13. PCB SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (2015)

PCB (µg/L)	LAKE WATER		UPPER RIVER CHANNEL			FEDERAL FRESHWATER CCC (µg/L) (CHRONIC)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
AROCLOR 1016	0.041 U[1]	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1221	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1232	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1242	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1248	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1254	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1260	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U	0.014
AROCLOR 1262	0.051 U	0.053 U	0.053 U	0.054 U	0.054 U	0.014
AROCLOR 1268	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	0.014
TOTAL PCBs (SUM OF AROCLORS)	0 U	0 U	0 U	0 U	0 U	

[1] Not detected at the specified detection limit.

TABLE 14. Pesticide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (2015)

PESTICIDE (µg/L)	LAKE WATER		UPPER RIVER CHANNEL			FEDERAL FRESHWATER CMC (µg/L) (ACUTE)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALDRIN	0.004 U[1]	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	**0.009**	
ALPHA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
CHLORDANE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	
DDD (DICHLORODIPHENYLDICHLORETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	0.004 U	0.004 U	0.004 U	0.004 U	**0.024**	1.1
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DIELDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDOSULFAN SULFATE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN ALDEHYDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN KETONE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA BHC (LINDANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR EPOXIDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
METHOXYCHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
TOXAPHENE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	

[1] Not detected at the specified detection limit.

TABLE 15. PAH SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (2015)

PAH COMPOUND (μg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY STANDARD (μg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
2-METHYLNAPHTHALENE	0.15 U[1]	**0.08**	0.16 U	0.16 U	0.16 U	
ACENAPHTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	19
ACENAPHTHYLENE	0.15 U	**0.04**	0.16 U	0.16 U	0.16 U	120
ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	0.18
BENZO(A)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	42
BENZO(A)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	0.54
BENZO(B)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	23
BENZO(G,H,I)PERYLENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(K)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
CHRYSENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	42
DIBENZ(A,H)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
FLUORANTHENE	0.15 U	0.15 U	**0.19**	**0.19**	**0.19**	3.7
FLUORENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	110
INDENO(1,2,3-C,D)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
NAPHTHALENE	0.15 U	**0.21**	0.16 U	0.16 U	0.16 U	170
PHENANTHRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	31
PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	42

[1] Not detected at the specified detection limit.

Attachment 1

Responses to Public & Agency Comments

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Cong. Kaptur (Nick Turner)	404 Hearing (oral statement)	As a Great Lakes lawmaker, I would like the Corps to address concerns about Great Lakes dredging needs, which will grow and become more complex. More attention must also be paid to Corps policies, which in some cases have not changed in decades (e.g., lack of innovative financing of dredging projects and dredge sediment disposal). There needs to be innovative cross-agency collaboration and ports must be kept open for business, but not at expense of water security, safety, and drinking water quality. I believe that open lake placement raises PCB levels and that a failure to dredge has large economic impacts. The Corps is ignoring Congressional efforts to ban open lake disposal. I urge the Corps to join in local innovation and finding alternatives to open lake placement. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/2016	Our nation is facing a growing crisis related to the condition of our infrastructure. Maintenance requirements across the U.S. far exceed the investments our country is making, and that means there isn't enough money to go around to address all needs. With this context, the Corps understands that the Cuyahoga River federal navigation channel is the lifeline for local and regional economies. It is the Federal Standard which ensures protection of the aquatic ecosystem while safeguarding such economic lifelines across the Great Lakes and the nation. It is the result of a fair, consistent, and thorough scientific process to identify the maximum investment the Corps can make to maintain the nation's federal navigation channels. This Federal Standard is the basis for comparing dredged material management alternatives so the maximum number of harbors can be dredged without compromising our responsibility to protect the environmental health of the Great Lakes. The Federal Standard ensures that limited funds are used fairly to maintain infrastructure projects nationwide. This Section 404(b)(1) Evaluation describes how open lake placement would comply with Clean Water Act Section 404(b)(1) Guidelines and not present any risk to water security or quality. Open lake placement would not increase PCB levels in Lake Erie sediments as discussed in Section 2.4.2(b) of this evaluation.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Cong. Fudge	404 Written Statement	The Corps continues to pursue a practice which flies in the face of responsible environmental stewardship. Lake Erie is important for drinking water for more than 11 million people and 3 million Ohioans. Increasing PCB levels in Lake Erie would halt the wheels of progress and undermine decades of achievement in water quality improvement. I hope that the Corps will pursue alternatives to open lake placement. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/2016	This 2016 Section 404(b)(1) Evaluation, the 2016 dredged sediment evaluation, and the 2014 Environmental Assessment all utilize and document state-of-the-science methods to demonstrate that the open lake placement of dredged sediment would not contribute to the degradation of Lake Erie. Open lake placement of this dredged sediment would not present any risk to the quality of drinking water supplies, as discussed in Section 2.6.3(a) of this evaluation. Open lake placement would not increase PCB levels in Lake Erie sediments (Section 2.4.2(b) of this evaluation) or impact progress toward water quality improvement (e.g., Sections 2.3.2[c] and 2.6.2 of this evaluation). In 2016, placement of the dredged sediments in the southeast quadrant of CLA-1 would initiate a reduction of benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation). The fact that this dredged sediment has been determined to meet Clean Water Act Section 404(b)(1) Guidelines for open lake placement is testimony to the successful administration of the Clean Water Act. The Corps supports alternatives to open lake placement to the extent within its authority. In search of mutually agreeable outcomes, the Corps has consistently coordinated this dredged sediment management issue with state and local stakeholders since 2010.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Port of Cleveland (Will Friedman)	404(a) PN Written Comment	The Corps' plan for open lake placement is in contravention of state and federal law, and it imperils commercial navigation. Sediment quality has not improved, yet the Corps again is improperly attempting open lake placement for sediments that have not met Ohio's standards for water quality. I disagree with the Corps' claim in the public notice that sediment sampling in 2014 and 2015 demonstrates that the sediments are not toxic and that open lake disposal would not lead to any unacceptable adverse effects to the aquatic system. Rather, the Port supports Ohio's analysis of the 2014 and 2015 data. Open lake placement is invalid because of the Corps' arbitrary and capricious NEPA analysis, invalid Federal Standard determination, and its faulty analysis (earlier comments as exhibits 1 & 2). The Port requests a public hearing. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	12/18/2015	The requested public hearing was held on March 1, 2016 in Cleveland. The Federal Standard ensures protection of the aquatic ecosystem while safeguarding economic lifelines across the Great Lakes and the nation. It is the result of a fair, consistent, and thorough scientific process to identify the maximum investment the Corps can make to maintain the nation's federal navigation channels. This Federal Standard is the basis for comparing dredged sediment management alternatives so the maximum number of harbors can be dredged while protecting the environmental health of the Great Lakes. The sediment in the Cleveland Harbor Upper Navigation Channel has been sampled, analyzed, and evaluated with greater rigor and frequency than sediment from any harbor on Lake Erie. The Corps' senior research scientists and engineers have reviewed these sediment evaluations and have agreed with the methods applied and conclusions reached. Section 2.4.2(b) of this evaluation discusses why the dredged sediments are not toxic. The dredging plan outlined by the Corps to the State of Ohio in a Water Quality Certification application meets applicable State water quality standards, is protective of human health and the environment, and is in the best interest of American taxpayers.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Port of Cleveland (Will Friedman)	404 Hearing (oral statement)	The Corps' push for open lake placement threatens jobs, the health of Lake Erie, and the people who eat lake fish and drink tap water. The Corps' application of its Federal Standard is an overreach and the agency does not get to decide themselves if dredge material can be placed in Lake Erie. The state has said “no” repeatedly. The Corps' baseline can't be a yearly theocratical alternative. Open lake placement cannot be the least-cost alternative because it is not a real alternative at all. Corps' proposal jeopardizes thousands of jobs and harms a multi-billion dollar fishery and exposes people to more carcinogens. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Please see response above to your December 18, 2015 public notice comment. The Corps has communicated for a number of years that implementation of dredged sediment management options which are more costly than the Federal Standard would require a non-Corps partner to contribute the additional costs. Options that are less costly or cost neutral, as compared to the Federal Standard, could be accomplished at federal expense. Under Section 404 of the Clean Water Act, the Corps has the authority to authorize or not authorize dredged and fill material discharges at specified sites into navigable waters. State 401 programs certify whether or not such discharges meet their federally approved applicable water quality standards. Open lake placement is the result of a fair and consistent process for determining the Federal Standard nationally. Open lake placement would not result in any meaningful increases in carcinogens to Lake Erie (Section 2.4.2[b] of this evaluation), or to fish or people (Sections 2.5.4 and 2.6.3 of this evaluation).
Port of Cleveland (Christopher S. Ronayne)	404 Written Testimony	The Port has developed an alternative to open lake placement using a clean and innovative dredge management practice (sustainable sediment management system). I request the Corps' partnership in supporting this practice and if not the Corps threatens business vitality and human health. We have opportunity to promote regional sustainable practices.	3/1/16	Although the majority of this comment is unrelated to this Section 404(b)(1) Evaluation, the following response is offered: Within the limits of its authorities, the Corps fully supports implementation of regional sustainable practices related to dredged sediment management. The Corps has communicated what the limits of its authorities are and encouraged stakeholders to collaborate within them to take advantage of federal dredging operations. However, costs that exceed the Federal Standard (i.e., open lake placement) cannot be imposed on the federal government to support such alternatives. Open lake placement would not pose a risk to human health (Section 2.6.3 of this evaluation).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Port of Cleveland (Christopher S. Ronayne)	404 Hearing (oral statement)	We invite Corps to talk with us (Board of Directors of Cleveland Port Authority) so that we can show you the things we're doing on the river and the CDF, and our practices toward marketing this sediment. We should be a partnership. The Port has developed alternative to open lake placement and we ask for your support of our sustainable practices. Otherwise, your actions threaten the businesses and economy and health.	3/1/16	Please refer to response above.
Ohio Attorney General (David Emerman)	404(a) PN Written Comment	I request a public hearing. The disposal of contaminated sediments into Lake Erie is likely to be inconsistent with or violate Ohio's water quality standards, and jeopardize the health of Ohio's citizens. National policy has been to end open-water disposal. Ohio recently enacted a law to prohibit all open lake placement by 2020 (Ohio Rev. Code 6111.32). Contrary to federal and state law, the Corps claims that it, rather than Ohio EPA, determines whether Corps projects comply with Ohio's water quality standards. Ohio's Coastal Management Program states that "polluted [dredged material] must be disposed...in confined disposal facilities" and requires compliance with Ohio water quality certifications. The Corps' own test results show that CLA-1 is five times more polluted than other areas surrounding Cleveland Harbor. Ohio EPA's latest test results show that the sediment is 4-8 times more polluted than Lake Erie background conditions. The Corps' claim that sediment will remain in place in the lake is flawed and ignores decades of research. Ohio EPA believes that open lake placement elevates human health risks of fish consumption in the impacted region of the lake. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	12/18/2015	A public hearing was conducted on March 1, 2016. Placement of this dredged sediment at CLA-1 meets applicable Ohio water quality standards based on formal U.S. Environmental Protection Agency (USEPA)/Corps Clean Water Act guidance for open water placement of dredged sediment. The Corps is unaware of any national policy that ends open water placement when it is proposed in compliance with Clean Water Act Section 404(b)(1) Guidelines. Open lake placement is not an ultimatum but the result of a fair and consistent process for determining the Federal Standard, which is required by federal code. The Corps is not looking for others to pay for its compliance with applicable environmental laws. Rather, the Corps has complied with all such laws. Any funds received from a non-Corps party would pay for additional costs incurred to perform work in a manner that is preferred by the state but is not required to meet the applicable laws and regulations. Under Section 404 of the Clean Water Act, the Corps has the authority to authorize or not authorize dredged and fill material discharges at specified sites into navigable waters. State 401 programs certify whether or not such discharges meet their federally approved, applicable water quality standards. [Continued below...]

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Attorney General (David Emerman) [Continued]	404(a) PN Written Comment	See above.	12/18/2015	…Continued from above: All data on CLA-1 reference sediments show that they are consistent with reference sediments at the proposed placement area and regional lake background sediments offshore of Cleveland (Section 2.4.2[b] of this evaluation). With respect to recent Ohio EPA sampling results, please see the Corps' letter dated February 24, 2016 (Attachment 2). With respect to concerns over sediment at CLA-1 remaining in-place, please see the Corps' letter dated March 21, 2016 (Attachment 2). Open-lake placement would not pose a risk to human health with respect to fish consumption (Sections 2.5.4 and 2.6.3[b] of this evaluation).
Ohio Attorney General (David Emerman))	404 Hearing (oral statement)	The Corps threatens to place toxic and carcinogenic material into Lake Erie rather than into existing CDFs. Dredging is necessary, but not at expense of Lake Erie or Ohio's economy. The Corps must dredge, but the State gets to determine the appropriate standard for disposal. The Corps is using financial coercion to pressure Ohio to lower its standards for health and the environment. The Corps' proposal is a violation of federal law which requires them to maintain channels at 100% federal cost. Open lake placement would increase toxins in the lake and in the fish we eat. The Corps also used an inappropriate open lake reference area. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Please refer to responses immediately above and below. Section 2.4.2(b) of this evaluation explains why the dredged sediments are not toxic. In addition, sediments at the proposed placement area are appropriate as reference sediments because bulk sediment contaminant concentrations are consistent with those in lake background sediments across the regional area offshore of Cleveland.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Attorney General (Mike DeWine)	404 Written Testimony	Cleveland Harbor sediment contains persistent toxic carcinogens (i.e., PCBs). Open lake placement of this sediment would increase amount of these carcinogens in Lake Erie and the organisms that reside there. This would increase Ohioan's exposure to these toxins. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/11/16	Dredged sediment from the Upper Cuyahoga River Channel has been characterized by Ohio EPA as toxic and by others as sludge; however, sound scientific analysis has confirmed that these characterizations are inaccurate. It is important to evaluate this sediment using rational scientific methodologies. Classifying this dredged sediment as toxic sludge is not only incorrect, but is a divisive term that raises unnecessary barriers to attaining the common goal of beneficially using the sediment as a natural resource. All sediments (as well as air, water and biota) in the Lake Erie and other Great Lakes Basins contain persistent carcinogens such as PCBs. The PCB “background” levels in most of Lake Erie (e.g., western basin) are consistent with or even higher than those found in the Upper Cuyahoga River Channel sediments. This dredged sediment is no more toxic than common lake bottom sediments found throughout the Lake Erie and other Great Lakes Basins. Section 2.4.2(b) of this evaluation discusses PCB bioaccumulation, and Section 2.6.3(b) of this evaluation discusses effects on recreational and commercial fisheries.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio EPA (Kurt Princic)	404 Written Testimony	Cleveland Harbor sediments have higher PCB bioaccumulation potential than CLA-1 and Lake Erie background sediments. Tier 2 data should not have been included in the Tier 3 data set. The Corps proposal also identified a contaminated hot spot in the vicinity of CLA-1 which it has proposed to cap with the dredged sediment. The Corps used inappropriate reference sites and CLA-4 represents true background for Cleveland Harbor. Remedial activities that may be needed have not been adequately evaluated within CLA-1 or elsewhere and further evaluation of this needed. The current technical review by the Corps is inadequate. It is also evident that sediment is clearly moving to areas outside of CLA-1 (map of two sq. mile lake area provide). These concerns will impact Ohio's ability to issue 401 certification. The Corps' proposal involves an attempt to cap or remediate existing contamination in Lake Erie. This contamination is partially within CLA-1 and extends outside CLA-1. Capping may cause contamination to move to other areas. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Please refer to the Corps' response letters to Ohio EPA dated February 24, March 10, March 17, and March 21, 2016 (Attachment 2).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio EPA (Kurt Princic)	404 Hearing (oral statement)	The Corps proposes to place contaminated sediment into Lake Erie. OEPA has raised concerns about this since 2012. But the Corps has made a unilateral decision that its proposal meets Ohio's water quality standards and that it is the least cost alternative. CLA-1 does not represent Lake Erie sediment background. Recent sampling shows there to be a highly contaminated area in and around CLA-1 and it now appears to the Corps that CLA-1 is not a suitable background site. Instead of proposing CDF placement, the Corps proposes to cap this hot spot and cover it over with additional polluted material. We agree this area needs to be cleaned up, but we are not able to agree with the Corps' proposal to cover it over with dredged sediment. Additional investigation is needed. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Please see response to Ohio EPA above. Attachment 2 contains a detailed response to these oral comments. Also, please refer to the Corps' response letters to Ohio EPA dated February 24, March 10, March 17, and March 21, 2016 (Attachment 2).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio DNR (Scudder Mackey)	404 Written Testimony	The State continues its proactive approach to this issue, including committing $10M to help find solutions to reduce and safely manage dredged sediment from Cleveland and Toledo Harbors. Open lake placement has the potential to increase bioaccumulative PCB levels in fish tissue. The Ohio EPA data indicates that sediment contaminant levels exceed Ohio EPA standards. The Corps' modeling erroneously minimizes resuspension of potential sediment on the lakebed and increased PCB levels may change fish consumption advisories from once a week to once a month and impact sport fishery and associated economy. Ohio DNR is concerned about the impact of open lake placement on fish spawning and survival. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/16/16	The Corps understands that Ohio prefers alternatives to open-lake placement, including beneficial use. Within the limits of its authorities, the Corps supports implementation of such dredged sediment management alternatives. Open-lake placement would not increase PCB levels in fish tissue and does not have the potential to change the walleye fish consumption advisory (Sections 2.5.4 and 2.6.3[b] of this evaluation). In 2016, placement of the dredged sediments within the southeast quadrant of CLA-1 would initiate a reduction in the benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of this evaluation). The Corps standards for open lake placement are the Clean Water Act Section 404(b)(1) Guidelines, and the dredged sediments meet these guidelines for placement at CLA-1. With respect to assessing compliance with Ohio water quality standards, the Corps followed formal USEPA/Corps guidance to demonstrate that the placement of the dredged sediments in the lake would not violate any applicable numeric or narrative water quality standards (Section 2.6.2 of this evaluation). The Corps is unaware of any Ohio EPA standards relating to sediment contaminant levels. Regarding concerns over sediment movement from CLA-1, based on the detailed analysis and modeling by U.S. Army Engineer Research and Development Center, sediment placed in CLA-1 has little potential... [Continued below]

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio DNR (Scudder Mackey) [Continued]	404 Written Testimony	See above.	3/16/16	[Continued from above] ...and migration (Section 2.1.3 of this evaluation, and Corps letter dated March 21, 2016 [Attachment 2]). Through collaboration with the state and other interests, CLA-1 was specifically selected to minimize potential impacts to fisheries (Section 4.2.6 of 2014 Environmental Assessment).
City of Cleveland (Dept. of Public Utilities)	404 Written Testimony	We oppose the plan of open lake placement and are concerned it would impact Lake Erie water quality. The effectiveness of our treatment process and plants depends on our strategically placed intakes. The water intakes have been located where they are to improve water quality and the Corps' proposal now puts these at risk and increases treatment costs. Claims that the sediment will remain in place are not supported by recent sampling by the U.S. and Ohio EPA. We also question accuracy of any modeling work that shows material does not move.	3/10/16	Potential impacts of open lake placement to public drinking water supplies are addressed in Section 2.6.3(a) of this evaluation and 2014 Environmental Assessment. Appropriate and thorough analysis indicates that placement of the dredged sediment at CLA-1 would not result in any significant contribution of suspended solids, contaminants, total organic carbon, dissolved organic carbon, or ammonia to the water column at any municipal potable water intake, and have no potential to violate water quality standards for the protection of human health. With respect to concerns over dredged sediment at CLA-1 not remaining in-place following placement, based on the detailed analysis and modeling by U.S. Army Engineer Research and Development Center, sediment placed in CLA-1 has little potential for meaningful suspension and migration (Section 2.1.3 of this evaluation, and Corps letter dated March 21, 2016 [Attachment 2]).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
City of Lakewood (Mayor Michael Summers)	404 Written Testimony	Since the exactness of silt removal cannot be established by the Corps, open lake placement is a significant human health and environmental threat (i.e., protection of drinking water, fish species, beaches & lake front/public health, and prevention of future algae blooms). Alternatives are available. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Extensive and thorough scientific analysis has shown that the dredged sediment is not a threat to human health and is protective of the aquatic ecosystem (refer to this evaluation and 2014 Environmental Assessment). Placement of the dredged sediment at CLA-1 would be protective of public drinking water supplies (Section 2.6.3[a] of this evaluation) and fish (Sections 2.5.4 and 2.6.3[b] of this evaluation), and it would not migrate (Section 2.1.3 of this evaluation). With respect to the potential of open lake placement to influence harmful algal blooms, modeling demonstrates that it would not trigger or effect the occurrence of blooms in the Central Basin of Lake Erie (Section 2.3.3[a] of this evaluation). Regarding alternatives to open lake placement, the Corps supports implementation of other sustainable practices, including beneficial use, related to dredged sediment management within the limits of its authorities. However, dredged sediment management costs that exceed open lake placement as the Federal Standard cannot be imposed upon the Corps. The Corps has communicated these limits, including potential requirements for non-Corps partners, to its regional stakeholders for several years.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
NEORSD (Julias Ciaccia)	404 Written Testimony	We are under a $3 billion federal court order to reduce pollutants to the Cuyahoga River and Lake Erie by reducing combined sewer overflows. We are therefore concerned with the introduction of any potential source of pollutants to area waterways. We support beneficial use of sediment, but this does not include open lake placement which could increase lake wide PCB levels and contribute nutrients that exacerbate algal blooms.	3/11/16	Open lake placement would not introduce pollutants to area waterways or the Lake Erie Basin. The dredged sediment originates within the Lake Erie Basin and remains within the Lake Erie Basin upon placement. Placement activities would not increase lake sediment PCB levels (Section 2.4.2[b] of this evaluation). Nutrient releases from open lake placement would not trigger or exacerbate harmful algal blooms (Section 2.3.3[a] of this evaluation). Open lake placement in 2016 could provide a beneficial use because placement within the southeast quadrant of CLA-1 would initiate a reduction of benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation). The Corps is proposing open lake placement because all appropriate and valid analyses indicate that it is protective of the aquatic ecosystem and human health.
ArcelorMittal (Michael LaWell)	404 Hearing (oral statement)	The source of the sediment is the Cuyahoga Valley National Park, urban runoff, CSO, and other non-point sources. ArcelorMittal respects the work of the Corps and Ohio EPA. Encouraged by work toward alternatives to open lake placement.	3/1/16	Although a majority of these comments are unrelated to this Section 404(b)(1) Evaluation, the following response is offered: The Corps is committed to dredging the full federal navigation channel and has worked diligently with state agencies and stakeholders to resolve sediment management issues. The Corps recognizes the importance of maintaining Cleveland Harbor federal navigation channels, in tandem with protecting Lake Erie as an invaluable regional, national, and international resource (refer to this evaluation and 2014 Environmental Assessment).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Cleveland Water Alliance (Bryan Stubbs)	404 Hearing (oral testimony)	Dredging the Cuyahoga River is essential to the economy of NE Ohio, as are decade long efforts to improve water quality and restore ecosystems in Lake Erie. By discounting Ohio EPA's concerns about PCBs, however, the Corps is using its own findings to justify what it views as the least toxic option. PCB levels in sediment remain too high and will further damage diversity in Lake Erie. Open lake placement is not the least costly method and will harm economy and ecology of Lake Erie. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	All appropriate analyses, including this Section 404(b)(1) Evaluation, indicates that open lake placement is protective of the aquatic ecosystem and human health. The Corps has not discounted, but does not agree with, Ohio EPA's concerns with respect to PCBs. The Corps has objectively reviewed all data and considered all concerns of Ohio EPA, and has provided scientifically credible feedback to them on all issues (e.g., Attachment 2 contains the most recent written communications with Ohio EPA on this matter). PCB concentrations in the dredged sediments are consistent with reference sediments at the proposed placement area and regional lake background sediments offshore of Cleveland. Consequently, open lake placement would not increase Lake Erie sediment PCB concentrations (Section 2.4.2[b] of evaluation). In 2016, placement of the dredged sediments within the southeast quadrant of CLA-1 would reduce PCB concentrations in that area, as well as initiate a reduction in the benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of evaluation). Dredged sediment has been clearly demonstrated to not be toxic (Section 2.4.2[b] of this evaluation). Within the limits of its authority, the Corps will continue to coordinate with state and local stakeholders to pursue agreeable alternatives for dredged sediment management.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Western Reserve Land Conservancy (Joy Mulinex)	404 Written Statement	Placing contaminated sediments into Lake Erie could enter the food chain and ultimately the human food chain. Encourage agencies to continue negotiations to find a solution.	Not Dated (Rec'd 3/8/2016)	The Corps shares your interest in protecting the invaluable ecosystems of Lake Erie and all Great Lakes, and all who depend on them. To this end, a comprehensive evaluation of the sediment proposed to be open lake placed and its associated potential effects on the Lake Erie ecosystem has been completed (e.g., this evaluation and 2014 Environmental Assessment). Open lake placement is protective of the aquatic ecosystem and human health. The potential for contaminants in the dredged sediments to enter the food chain has been thoroughly examined by the Corps (e.g., Sections 2.4.2[b], 2.5.4 and 2.6.3[b] of the evaluation), and national experts agree that bioaccumulation of sediment contaminants from the dredged sediments would not be ecologically meaningful. Section 2.4.2(b) of this evaluation addresses bioaccumulation of PCBs and DDTs from the dredged sediments and lake sediments. Sections 2.5.4 and 2.6.3(b) of this evaluation address PCB bioaccumulation in fish. Open-lake placement of the dredged sediments in 2016 would initiate a reduction in the benthic bioaccumulation of PCBs within the southeast quadrant of CLA-1 (Sections 2.5.4 and 2.6.3[b] of this evaluation). Open-lake placement in 2016 would also initiate a reduction of benthic bioaccumulation of PCBs within the southeast quadrant of CLA-1, thereby reducing PCB residues in the food web (Sections 2.5.4 and 2.6.3[b] of evaluation).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Greater Cleveland Partnership (Joe Roman)	404 Written Statement	Scientific research is mixed on whether the sediment would negatively impact the water quality of Lake Erie. Open lake placement has potential to impact the fragile balance of our lakes and economy. Recent tactics by the Corps have intensified the local community questioning the integrity of agency's work. Sediment should be placed into CDFs. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Open lake placement is protective of Lake Erie and human health, and is the least cost, engineeringly sound alternative for the management of dredged sediment. In 2016, placement of the dredged sediments in the southeast quadrant of CLA-1 would actually initiate a reduction of benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation). Additionally, the limited remaining space within the federal CDF must be conserved for Cleveland Harbor sediment that has not yet been determined to meet Clean Water Act Section 404(b)(1) Guidelines for open lake placement. Use of CDFs throughout the Great Lakes has allowed for the management of sediments not suitable for open lake placement while watersheds have improved under enforcement of various environmental laws since the latter half of the 20th century. While open lake placement of this dredged sediment may appear to be a cost saving measure by the federal government conveniently proposed at a time when its CDFs are reaching capacity, it is in reality an objective marker of federal, state and local progress that has been made toward restoring the ecology of the Great Lakes. With respect to Cleveland Harbor, the Corps seeks only to continue to facilitate this restoration while maintaining a viable navigation system in the most effective and efficient manner possible.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Cuyahoga County (Michael Foley)	404 Hearing (oral statement)	Sensitivity to issues of water quality is at an all-time high, with the exception of the Corps. Ohio EPA has found key pollutants in their testing of the sediment, but the Corps downplays Ohio EPA's findings and vice versa. It defies logic that the Corps is proceeding with this plan given the amount of uncertainty. The Corps is playing games and taking unnecessary risks with Lake Erie and water quality and we oppose plan to open lake place sediment. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps shares your focus on protecting the invaluable ecosystems of Lake Erie and all the Great Lakes, as well as all who are depend on them. To this end, a comprehensive evaluation of the sediment proposed to be open lake placed and its associated potential effects on the lake aquatic ecosystem has been completed (e.g., this evaluation and 2014 Environmental Assessment). Open lake placement is proposed because all appropriate and valid analyses indicate that it is protective of the aquatic ecosystem and human health. Open lake placement of this dredged sediment would not present any risk to the quality of drinking water supplies as discussed in Section 2.6.3(a) of this evaluation. Sections 2.3.2 and 2.6.2 of this evaluation address the water quality-related effects of open lake placement. Open lake placement in 2016 would initiate a reduction of benthic bioaccumulation of PCBs (Sections 2.5.4 and 2.6.3[b] of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1. The Corps has cited serious concerns with much of the data generated by Ohio EPA on Upper Cuyahoga River and Lake Erie sediments (refer to letter dated February 24, 2016 [Attachment 2]).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Sierra Club (Jessica Ferrato)	404 Hearing (oral statement)	A Corps' 2009 study found that channel sediment was too polluted for open lake placement, but the Corps' stance is now that additional PCBs will not harm the lake. The Corps argues that CLA-1 is already valueless [sic] because of legacy contamination and placing new sediment over it is easy. I make reference to a document entitled "Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps..." This 1997 document sets the tone for the values which the Army should follow in reaching its cost determinations, and underscores the importance of building in experts from state and federal stakeholders in formulating this analysis. I assert that the Corps' cost analysis has been incomplete on the basis of its failure to invite collaboration of other stakeholders. They do not consider hidden costs, such as increased water treatment, loss of habitat and fishing.	3/1/16	Although many of these comments are unrelated to this Section 404(b)(1) Evaluation, the following response is offered: The 2009 study cited was the draft Dredged Material Management Plan (DMMP) which preceded the change in the Federal Standard for the management of Upper Cuyahoga River Channel sediment from CDF to open lake placement. As early as 2010, improvement in the quality of these dredged sediments was communicated to partners and stakeholders as it was evident that they may begin to meet Clean Water Act Section 404(b)(1) Guidelines for open lake placement. The referenced 1997 document (actual date is 1994) by Kenneth D. Orth (IWR Report 94-PS-2) is guidance from the Corps' Institute for Water Resources (IWR). Its intent is to ensure that the requirements of Engineering Regulation 1105-2-100-2000, which discusses performance of an incremental cost analysis to discover and describe variation in costs and describe the best cost plan. The report explains that the Corps completes this analysis using a team approach to disciplines within the Corps. Other agencies and interested parties are to be engaged to identify management measures to be analyzed, and the Corps would take this information and incorporate it into its evaluation. [Continued below...]

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Sierra Club (Jessica Ferrato) [Continued]	405 Hearing (oral statement)	See above.	3/1/16	[Continued from above] ...In response to comments specific to this Section 404(b)(1) Evaluation, PCB-related effects to the lake are discussed throughout this evaluation (e.g., Sections 2.4.2[b], 2.5.4, 2.6.3[b]). Open-lake placement would not increase PCB levels in fish tissue and does not have the potential to change the walleye fish consumption advisory (Sections 2.5.4 and 2.6.3[b] of this evaluation). Impaired sediments at CLA-1 were not used to evaluate the dredged sediment (Section 2.4.2[b] of this evaluation). Increased water treatment costs would not result from placement at CLA-1 because studies indicate the dredged sediment would not migrate from the placement area (Section 2.1.3 of this evaluation). Loss of fish and wildlife habitat is also not expected since CLA-1 is located in deep water where lake-bottom habitat is of lower quality and open-lake placement would not significantly change that habitat (this evaluation and 2014 Environmental Assessment). Open lake placement in 2016 would initiate a reduction of benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1. Open lake placement of dredged sediment has occurred historically across Ohio's harbors and is currently utilized at each of the other seven commercial harbors.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Environmental Counsel (Peter Griesinger)	404 Hearing (oral statement)	Regarding the 9.4 miles between CLA-1 and the shoreline and the position of the water intakes, the map used in presentation misleading on proximity. Ohio EPA's recent data confirms high levels of PCBs in dredging areas 1, 2A, and 2B are far higher than background. From the Corps' 2013 sediment analysis, sediments from dredge site 1 had led to 70% more PCB bioaccumulation in insects than at the proposed disposal site. It is unclear how the Corps can determine that the sediment are safe. Encourage Buffalo District to approach disposal more like other districts (e.g., Chicago). Open lake placement does not comply with Ohio CZM Program or Great Lakes Water Quality Agreement. Corps should use existing CDFs.	3/1/16	The CLA-1 location was selected after collaboration and recommendations from state and federal stakeholders, including Ohio EPA. While the Corps originally considered two open lake placement areas (CLA-1 and CLA-4), CLA-4 was eliminated in response to public concerns and concerns from other agencies over perceived potential impacts to the various municipal potable water intakes in Lake Erie along the Cleveland shoreline area, even though all modeling showed that there would be no impacts to drinking water. Ohio EPA's PCB concentration data on the dredged sediments within the channel are consistent with the Corps', and show that PCB levels are consistent with CLA-1 reference sediments as well as regional lake background sediments offshore of Cleveland (Section 2.4.2[b] of this evaluation). The Corps objectively reviewed Ohio EPA's data, and provided our comments and concerns to them in a letter dated February 24, 2016 (Attachment 2). To review how the Corps has determined that the dredged sediments are safe for open lake placement, refer to this evaluation and the 2014 Environmental Assessment. Section 2.4.2[b] evaluates the benthic bioaccumulation of PCBs from dredged sediment, CLA-1 reference sediment and regional lake background sediments offshore of Cleveland across 2012, 2014 and 2015. [Continued below...]

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Ohio Environmental Counsel (Peter Griesinger) [Continued]	405 Hearing (oral statement)	See above.	3/1/16	[Continued from above] ...Bioaccumulation from dredged sediment is within the range of reference sediments at the proposed placement area and that of regional background sediments offshore of Cleveland. State Coastal Management consistency concurrence has already been granted by Ohio DNR (January 25, 2016), but on the condition that a Section 401 water quality certification is received from Ohio EPA. Open lake placement is currently utilized in each of the Ohio commercial harbors except Cleveland. Approximately 70% of Great Lakes harbors manage dredged sediment through in-water placement; of those that do not, many are never or rarely dredged.
Ohio Environmental Counsel (Peter Griesinger)	404 Written Statement	Same as oral statement above.	3/1/16	See above.
Friends of Crooked River (Elaine Marsh)	404 Hearing (oral statement)	The parties need to work in partnership. Lake Erie is a distressed ecosystem. A week ago parties signed a binational agreement (U.S. & Canada) to reduce phosphorus in Lake Erie by 40%. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps agrees with the need for partnership at all levels and has worked proactively to seek alternatives, within the limits of its authorities. The Corps has been coordinating the potential for open lake placement with state and local stakeholders since 2010; however, less cost or cost-neutral alternatives to open lake placement have not been identified. There are legal limits to the Corps' ability to fund more expensive alternatives. With respect to the release of phosphorus from dredged sediment during open lake placement, elutriate data show that it would be very low. Modeling demonstrates that such low phosphorus releases would decline rapidly to ambient conditions within the immediate vicinity of the placement area, and would be insufficient to trigger or effect the occurrence of HABs in the Central Basin of Lake Erie (Section 2.3.3[a] of this evaluation).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Friends of Crooked River (Jacki Zevenbergen)	404 Hearing (oral statement)	River mouths have historically contained a lot of nutrients, so we don't need tests to know this. It’s ridiculous that the government spends money on cleaning up nutrient runoff only to then put dredge sediment in the lake. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps agrees with the need for partnership at all levels and has worked proactively to seek alternatives, within the limits of its authorities. The Corps has been coordinating the potential for open lake placement with state and local stakeholders since 2010; however, less cost or cost-neutral alternatives to open lake placement have not been identified. There are legal limits to the Corps’ ability to fund more expensive alternatives. Sampling and testing of the sediment is required to determine whether it is suitable for placement in the aquatic ecosystem. Sediment analysis indicates similar concentrations of phosphorus in the dredged sediment and reference sediments at the proposed placement area and regional background sediments offshore of Cleveland. However, sediments are typically not a large contributor to the bioavailable phosphorus that influences algal growth and sediment elutriate data on the dredged sediments demonstrate this. Elutriate data show that low releases of bioavailable phosphorus to the water column would occur during dredged sediment placement. Modeling demonstrates that such low phosphorus releases would decline rapidly to ambient conditions within the immediate vicinity of the placement area, and would be insufficient to trigger or effect the occurrence of HABs in the Central Basin of Lake Erie (Section 2.3.3[a] of this evaluation and Environmental Assessment).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Daryl Davis	404 Hearing (oral statement)	This whole issue is confusing. The Corps' description of alternatives does not match EPA's description. We have been asked to compromise our water quality. If this were safe then we wouldn't be here tonight. Cuyahoga AOC has several beneficial use impairments (e.g., habitat degradation) and we can't now compromise our water quality by placing AOC sediment into the open lake. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	No compromise of water quality is being requested or is expected. All relevant and reliable scientific evidence shows that all water quality-related impacts from open lake placement would be insignificant and short-term, limited to the immediate vicinity of the placement area, as documented in this evaluation and the 2014 Environmental Assessment. The Section 404 Public Hearing on March 1, 2016 was conducted at the request of the state of Ohio, and it was not conducted because the proposed open lake placement of dredged sediment is believed to be unsafe by the Corps. The objective of the hearing was to ensure that all relevant information has been made available to the Corps and considered for its decision-making.
Joe Belsito	404 Written Statement	The Corps knows there are contaminants in the sludge, but because of the almighty dollar it prefers to continue to poison the water that people drink. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	This Clean Water Act Section 404(b)(1) Evaluation (and 2014 Environmental Assessment) provides an in-depth discussion of the evaluation of the Upper Cuyahoga River Channel dredged sediment proposed for open lake placement. Open lake placement of this dredged sediment would not present any risk to the quality of drinking water supplies, as discussed in Section 2.6.3(a) of this evaluation.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
GCC (Melane Biche)	404 Written Statement	What are other lakes in the Great Lakes doing with dredged material?	3/1/16	Open lake placement is currently utilized in each of Ohio's seven other Lake Erie commercial harbors; Cleveland is the only exception. In part, this is because confined disposal facilities, which were intended as temporary measures starting in the 1970s, functioned as intended by permanently removing polluted sediment from the ecosystem and allowing time for sediment quality within watersheds to recover. Approximately 70 percent of Great Lakes harbors now utilize open lake (i.e., in-water) placement to manage dredged sediment. Of those that do not, many are never or rarely dredged.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Jeanette Girosky	404 Written Statemet	There is too much disagreement between agencies on this issue to convince me that this is a good idea. I also disagree with ammonia-N being eliminated as a PCOC. The argument that it's ambient and ephemeral is weak. The same argument could be made for phosphorus and look at the havoc that caused. Information provided about Microcystis, including that macronutrient nitrogen can influence growth and toxin production in Microcystis spp. (Vézie et al. 2002; Hark and Gobler 2013). Microcystins are 14% nitrogen and studies have indicated increased nitrogen loading increases cellular microcystin content (Wang et al. 2009). I do not feel that the issue of ammonia-N as a nutrient dump, let alone its removal as a pollutant, has been sufficiently addressed.	3/1/16	The Corps performed a detailed evaluation of the potential for phosphorus (a nutrient linked to harmful algal bloom [HAB] development) releases during open lake placement of the dredged sediment to influence HABs (Section 2.3.3[a] of this evaluation and 2014 Environmental Assessment). Although algae need other nutrients for growth, such as nitrogen and other trace nutrients, phosphorus is generally regarded as the limiting nutrient in the Great Lakes. Bulk concentrations of phosphorus in the dredged sediment are consistent with levels that already exist at the open lake placement area and the regional area offshore of Cleveland. Model predictions show that the extent and duration of a predicted phosphorus plume within the open lake placement area would be very small and short-lived, limited to the immediate vicinity of the placement area. The low levels of released phosphorus and short duration of plumes above ambient conditions indicate that dredged sediment placement activities would not influence the occurrence of HABs, or significantly impact water quality in the Central Basin of Lake Erie. The Corps is unaware of any professional peer-reviewed documentation or scientific consensus that open-lake placement of dredged material has the potential to significantly influence HABs or Lake Erie anoxia, and indirectly, the fish community. [Continued below...]

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Jeanette Girosky [Continued]	405 Written Statemet	See above.	3/1/16	[Continued from above] ...Similarly, the release of ammonia to the water column during dredged sediment placement activities, as evaluated through elutriate testing and water quality modeling, would also result in only minor increases in water column concentrations at the point of discharge that would immediately begin to rapidly decrease to ambient conditions. Ammonia concentrations in the water column would meet the state's water quality standard for the protection of aquatic life within a minute of discharge (Section 2.6.2 of this evaluation).
Drink Local Drink Tap (Erin Huber)	404 Written Statement	The Corps contradicts itself by saying open lake placement is safe and then telling us that they will put it 9.4 miles out because we're not sure about human and environmental health. I will not stand for petty fighting back and forth when my drinking water and lake are at risk. Why did you decide to test/compare the old 1970's hazardous dredge sediment in the lake and compare it to the new dredge material? [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The proposed placement area (CLA-1) was not selected because it was far enough offshore so as to not impact public drinking water supplies. Thorough evaluation has demonstrated that use of an open lake placement area located closer to the potable water intakes (i.e., CLA-4) relative to CLA-1 would also be protective of the environment and public water supplies. CLA-1 was ultimately selected in consideration of public and agency concern over perceived potential impacts to the various municipal potable water intakes in Lake Erie along the Cleveland shoreline. The use of both sites was originally proposed in 2013. The dredged sediment was not compared to formerly placed dredged sediment. Reference sediments at CLA-1 are consistent with those over the regional lake background area offshore of Cleveland. Section 2.4.2(b) of this evaluation addresses these aspects of the dredged sediment evaluation.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Big Creek Connects (Roger Kalbrunner)	404 Written Statement	Are there any scientific studies that indicate the affect that a PCB 0.1 ppm has on plant life, fish, and potable water? What are the affects to the lake bottom when dredged material is deposited? How long before lake bottom returns to its prior condition?	3/1/16	Reference sediments at the proposed placement area are the point of comparison for contaminant-related impacts of dredged sediment. A mean total PCB concentration of 0.1 ppm in sediments is consistent with that of dredged sediments, sediments at the proposed placement area and regional lake background sediments offshore of Cleveland (Section 2.4.2[b] of this evaluation). Open lake placement of dredged sediment would not represent an increase to current sediment PCB concentrations in the lake. Such concentrations of PCBs in sediment are not associated with direct toxicity to aquatic life and are reflective of ambient conditions within the Central Basin of Lake Erie. As discussed in Section 2.5.4 of this evaluation, placement of the dredged sediments within the southeast quadrant of CLA-1 in 2016 would initiate a localized reduction of PCB concentrations in surface lake sediments. Placement of the dredged sediment at CLA-1 would be protective of drinking water supplies (Section 2.6.3[a] of this evaluation) and fish (Sections 2.5.4 and 2.6.3[b] of this evaluation). For a discussion on effects of dredged material placement on the lake bottom, refer to Section 2.5.2 of this evaluation. Because dredged sediments and sediments at the placement area are of similar grain size (brown clayey silt), no long-term effects to the physical substrate or benthic community at CLA-1 are expected.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Peter Kerling	404 Written Statement	Who benefits from the dumping of dredged sediment into Lake Erie? If there is even a 0.1% chance of harming the water supply and aquaculture, then open lake placement should not be considered. If it comes down to John Q tax payer, then I'm more than confident that the people of Cuyahoga County would prefer to pay a little more and not gamble with their drinking water. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps is legally mandated to be a good steward of both the environment and taxpayers' money. The Corps has objectively demonstrated that open lake placement of Upper Cuyahoga River Channel sediment complies with applicable federal and state law. Open lake placement of these sediments has been determined as the Federal Standard, which is the result of a fair, consistent, and thorough scientific process to identify the maximum investment the Corps can make to maintain the nation's federal navigation channels. It is the most viable, long-term and environmentally acceptable plan to ensure timely maintenance dredging in accordance with Congressional intent and at 100% federal cost. Open lake placement in 2016 would initiate a reduction of benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1. Open lake placement of this dredged sediment would not present any risk to the quality of drinking water supplies (Section 2.6.3[a] of this evaluation).
Scott Hurley	404 Hearing (oral statement)	Everyone should read the letter from the Corps' dated February 24, 2016 to Ohio EPA. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	Comment Noted

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Susan Miller, et al.	404 Hearing (oral statement)	I am resubmitting comments that I provided last year and urge the Corps to withdraw its application for open lake placement. The Great Lakes are under assault in many ways. Why do we clean up areas on one hand and propose dumping toxic sludge into it on the other hand? Open lake placement for the first time in 40 years would set a precedent for future use. The Corps seeks to contravene the Clean Water Act. Beneficial use is possible just like what was done with Dike 14. If this can't be done, then other confined disposal areas should be sought. Signed by 39 northeast Ohioans. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps did not withdraw its application for Section 401 water quality certification with Ohio EPA because no relevant or reliable information was provided which showed that the selection of open lake placement as the Federal Standard was inappropriate. Although many have referred to this sediment as "toxic sludge," sound scientific analysis has confirmed that these characterizations are inaccurate (Section 2.4.2[b] of this evaluation). Upper Cuyahoga River Channel sediments predominantly originate from bank erosion within the Cuyahoga Valley National Park and are widely viewed as suitable for beneficially uses, such as aquatic ecosystem restoration and upland applications. Open lake placement of this dredged sediment is in conformance with Section 404 of the Clean Water Act as documented in this Section 404(b)(1) Evaluation. Note that open lake placement in 2016 would initiate a reduction of benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1. Open lake placement would not set any precedent since additional sediment sampling is completed on a routine basis to determine whether it remains suitable for open water placement. Open lake placement is applied at each of Ohio's seven other commercial harbors. [Continued below...]
Susan Miller, et al. [Continued]	404 Hearing (oral statement)	See above.	3/1/16	[Continued from above] ...The Corps has coordinated this issue with state and local stakeholders since 2010; however, a cost-neutral alternative to open lake placement has not been identified. There are also legal limits to the Corps' ability to fund such alternatives when they exceed the cost of the Federal Standard.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Susan Miller, et al.	404 Written Statement	Last year only a lawsuit filed by Ohio and subsequent court order brought about the proper disposal of toxic material. Criticism of the Corps' budget process. On behalf of 37 co-signers, we resubmit our comments from last year.	3/1/16	Please see above (i.e., Susan Miller, et al).
Carla Rautenberg	404 Hearing (oral statement)	Last year I submitted a comment signed by 37 other people and we are resubmitting it today (same comment referenced by Ms. Miller above). Your proposal was bad last year and its bad now. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	See response above (i.e., Susan Miller et al.). Note that this Section 404(b)(1) evaluation, and our 2016 proposal to open lake place sediment dredged from the Upper Cuyahoga River Channel, is based on additional data since last year from several other sediment sampling/analysis events, including some conducted by Ohio EPA. Therefore, in comparison to the 2015 open lake placement proposal, the current water quality certification application is based on new information.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Joel Lieske	404 Written Statement	Section 230.10(a) of the Clean Water Act states that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem." The most severe potential impact of open lake placement is to drinking water. This is what happened to drinking water in Duluth, MN when Reserve Mining was allowed to dump taconite tailings into Lake Superior. PCB's would also impact food chain. The practicable alternative to open lake placement is disposing in a landfill. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/4/16	This section of the Clean Water Act is the Section 404(b)(1) "Guidelines for Specification of Disposal Sites for Dredged or Fill Material" (40 CFR Part 230.10). Please note that Part 230.10(a)(1) of these Guidelines include open water placement within its definition of "practicable alternative." It furthers states that "an alternative is practicable if it is...capable of being done after taking into consideration cost...and logistics in light of overall project purposes." The 2016 Section 404(b)(1) Evaluation and the 2014 Environmental Assessment demonstrate that the proposed discharge is protective of the aquatic ecosystem. While the Corps supports alternatives to open lake placement, no cost neutral or less costly options have yet been identified, tipping fees for use of the Port's CDF have not been waived, and no non-Corps partner has been identified to fund dredged sediment management costs that exceed the Federal Standard. For evaluation of drinking water, please refer to Section 2.3.6(a) of this evaluation and the 2014 Environmental Assessment. Sections 2.4.2(b), 2.5.4 and 2.6.3(b) of this evaluation address PCB bioaccumulation and food web effects. Open lake placement would reduce benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
William Maki	404 Written Statement	Is it correct that in the past, sediment discharged from the Cuyahoga River was swept east by prevailing lake currents? Did this provide protection for the cliffs by making beaches? If so, then the dredging has interfered with this. I do not agree with open lake placement. I would agree with placing the sediment along a shallow area of the lake so it can re-establish the natural replenishment of beaches. I do not think the sediment is toxic. This would solve two issues: protect shorelines from erosion and provide a disposal location. If there is a problem with the sediment, perhaps put it into caissons and then sink them off shore of eroding shoreline areas and eventually make beaches?	3/2/16	Based on the detailed analysis and modeling by U.S. Army Engineer Research and Development Center, sediment placed at the deep-water CLA-1 located 9.4 miles north of Cleveland Harbor has little potential for meaningful migration and suspension after placement. Sediments in CLA-1 have also not significantly moved with prevailing lake currents. Placement of dredged sediment that is suitable for open lake placement within the near shore area of Lake Erie has been considered in the past (e.g., beneficial use), but would also require that a water quality certification be issued by Ohio EPA for this discharge. Unconfined near shore placement would also require that the sediment consist primarily of coarse grain material, such as sand and gravel, which typically represents a minor component of this dredged sediment. Based on past coordination with the state and other agencies, CLA-4 was removed from consideration for open lake placement because of perceived water quality concerns regarding the proximity of placement activities to local public water intakes even though all applicable analysis indicated otherwise. Dredged sediment management alternatives that are more costly than open lake placement require a non-Corps sponsor.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
GC of Cleveland (Martha Thompson)	404 Written Statement	The Corps undertook a study that took 4 years and $4M and they came up with no recommendations. By mandate they must dredge the river. It won't be safe to place sediment into the shallowest Great Lake. We need to save the Great Lakes and safeguard our drinking water, protect our fishing, and provide safe beaches and bluffs. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	A comprehensive evaluation of the sediment proposed to be open lake placed and its potential effects on the aquatic ecosystem has been completed (e.g., 2014 Environmental Assessment and this Section 404(b)(1) Evaluation). Open lake placement is protective of the aquatic ecosystem and human health. Placement of the dredged sediment at CLA-1 would be protective of drinking water supplies (Section 2.6.3[a] of this evaluation) and fish (Sections 2.5.4 and 2.6.3[b] of this evaluation). Open lake placement would also initiate a reduction of benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation) and PAH-related sediment toxicity (Section 2.5.2 of this evaluation) within the southeast quadrant of CLA-1. With respect to the referenced 4 year study, it is assumed that this is the draft Dredged Material Management Plan released for public review in 2009. For sediment not suitable for open lake placement, this Plan tentatively selected the locally preferred plan which was construction of a new CDF near East 55th Street. A subsequent Short-term DMMP was then drafted (2011-2014), which recommended placement within the Port's CDF 12 and for which the Corps received approval to pursue by the Assistant Secretary of the Army for Civil Works. The Port did not follow through with its original interest in pursuing either recommended plan, which would have been necessary for either to be implemented.

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Debbie Wright	404 Written Statement	Lake Erie is the drinking water source for 11 million people and home to 50% of the fish found in Great Lakes. Putting additional PCBs into the lake would undermine decades of water quality achievements. Maintaining the navigation channels is important, but it must be done in way that sees the health of the lake as a primary concern. Alternatives to open lake placement should be pursued.	[Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	Open lake placement is proposed because all appropriate and valid analyses show it to be protective of the aquatic ecosystem and human health. Placement of the dredged sediment at CLA-1 would be protective of drinking water supplies (Section 2.6.3[a] of this evaluation) and would not increase PCB levels in Lake Erie sediments (Section 2.4.2[b] of this evaluation). It would not meaningfully increase PCB bioaccumulation (Section 2.4.2[b] of this evaluation) or pose a risk to human health with respect to fish consumption (Sections 2.5.4 and 2.6.3[b] of this evaluation). The Corps coordinated this issue with state and local stakeholders since 2010, however, a cost-neutral alternative to open lake placement has not been identified. Costs in excess of open lake placement require a non-Corps sponsor. Open lake placement would not undermine past water quality achievements, and it is actually a testimony to those achievements.
Unsigned	404 Written Statement	I support the Corps.	3/1/16	Comment noted.
Howard Simon	404 Hearing (oral statement)	Exposing animals to carcinogens (i.e., PCBs) on short-term basis does not prove anything. I am not convinced that even a small amount of PCBs is safe. There are fish in our lake that pregnant women are advised not to eat and others people shouldn't eat more than every two months. I am no authority, but I understand that PCBs last forever. [Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	3/1/16	The Corps agrees that acute exposures of aquatic organisms to PCBs at the sediment concentrations in this case are not toxic. Therefore, PCBs in the Upper Cuyahoga River Channel sediments were evaluated through laboratory PCB bioaccumulation testing (Section 2.4.2[b] of this evaluation). Open lake placement would not increase PCB levels in Lake Erie sediments (Section 2.5.4 of this evaluation). Open-lake placement would not meaningfully increase PCB bioaccumulation (Section 2.4.2[b]) or pose a risk to human health with respect to fish consumption (Sections 2.5.4 and 2.6.3[b] of this evaluation). Open lake placement in 2016 would actually initiate a reduction of benthic bioaccumulation of PCBs (Section 2.5.4 of this evaluation).

Commentor(s)	Comment Type	Comment Highlights (See Attachment 3 for original comments)	Date	USACE Response
Anthony Szpak	404 Hearing (oral statement)	Proposing to place this sediment into the open lake is like filling the Akron Rubber Bowl up and dumping it in our water by the water intakes every year. I think federal standards are wonderful, but why don't you go and develop standards for about 300 dangerous chemicals that are in those sediments and come back in 20 years. In the meantime, dredge it and put it into the CDF.	[Remaining comments did not pertain to this Section 404(b)(1) Evaluation]	Please refer to Section 2.4 of this Section 404(b)(1) Evaluation for a description of the sediment in the Upper Cuyahoga River Channel and reference area in Lake Erie. One of the reasons to employ biological testing, as addressed in Section 2.4.2(b) of this evaluation, is to address and evaluate the effects of the various contaminants present in sediments. Such testing showed that the various contaminants in the dredged sediments (and lake sediments) were not toxic. The dredged sediments are not appropriate for CDF placement because they meet Clean Water Act Section 404(b)(1) Guidelines for open lake placement, as detailed in this evaluation. Placement of the dredged sediment at CLA-1 would not impact the quality of water at any municipal water intake (Section 2.6.3[a] of this evaluation and Section 4.2.2.3 of the 2014 Environmental Assessment).

Attachment 2

USACE Letters & Responses to Ohio EPA

(November 20, 2015 – March 21, 2016)

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

November 20, 2015

REPLY TO
ATTENTION OF

Environmental Analysis Team

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Request for Section 401 Water Quality Certification for Discharges of Dredged Sediments Associated with the Scheduled 2016 Maintenance Dredging Project

Mr. Craig W. Butler
Director
ATTN: Mr. Ric Queen
Ohio Environmental Protection Agency
Division of Surface Water
P.O. Box 1049
Columbus, Ohio 43216-1049

Dear Mr. Butler:

The U.S. Army Corps of Engineers (USACE), Buffalo District is requesting Clean Water Act (CWA) Section 401 water quality certification (WQC) from the Ohio Environmental Protection Agency (OEPA) for the discharge of sediments dredged from the Cleveland Harbor Upper Cuyahoga River Channel (between Station 799+00 [upstream federal navigation channel limit] and Station 736+00 [Upper Turning Basin]) at the designated open-lake placement area CLA-1, and for the discharge of effluent from confined disposal facility (CDF) 10B. Sediment dredged from the remainder of the channel will be placed in CDF 10B. The USACE is requesting WQC for the discharge of sediments removed from individual dredged material management units (DMMUs) 1, 2a and 2b at CLA-1. The discharge of channel sediments from each of these DMMUs at CLA-1 meets CWA Section 404(b)(1) Guidelines and applicable state water quality standards (WQSs) as demonstrated in the enclosed WQC application materials (Enclosures 1 and 2). Please note that National Environmental Policy Act (NEPA) documents (Environmental Impact Statements [EISs] and Environmental Assessments [EAs]) for dredging and management of Cleveland Harbor dredged sediments have been previously furnished to your office, including the 2014 EA for selection of the open-lake placement location.

The 2015 dredged sediment evaluation (Enclosure 2) is based on data generated from three sampling events in 2014 and 2015, and with reference to the 2013 dredged sediment evaluation. The 2015 evaluation supports reaffirmation that Upper Cuyahoga River channel sediments meet CWA Section 404(b)(1) Guidelines for placement in the open-lake at CLA-1 and complies with applicable state WQSs. Please note that the laboratory bioaccumulation results from 2015 have not been included in this evaluation since verification/validation of the analytical data is not yet complete. Additionally, the USACE will review the supplemental information provided by OEPA via letter dated September 30, 2015 and integrate relevant data into a revision to the 2015 dredged sediment evaluation. The USACE will provide that revision to OEPA as a supplement, if applicable, to our WQC application in early 2016.

This WQC application is being submitted at this stage to allow OEPA sufficient time to review it and render a decision in advance of the scheduled 2016 dredging season. The USACE requires WQC in order to accept contract bids on this project. The bid opening date has been scheduled for March 24, 2016. Receiving WQC by this date will avoid delays in maintaining the Cleveland Harbor federal navigation channels.

The USACE continues to use the scientific standard "weight-of-the-evidence" approach to determine whether the Upper Cuyahoga River Channel sediments meet CWA Section 404(b)(1) Guidelines for open-lake placement. This means USACE considers multiple lines of evidence in its evaluation and draws conclusions based on all relevant information. The USACE continues to welcome any additional relevant and defensible lines of scientific evidence which indicate that these channel sediments do not meet CWA Section 404(b)(1) Guidelines for open-lake placement. In order to document weight-of-the-evidence in a mutually agreeable way, we recommend that our agencies cooperate to identify the uncertainties and relevant lines of evidence pertaining to open-lake placement of dredged sediments from the Upper Cuyahoga River Channel. This would lend additional transparency to this issue.

A number of concerns have been expressed to the USACE over the past two years regarding its determination that sediments in the Upper Cuyahoga River Channel meet Section 404(b)(1) Guidelines for open-lake placement. Many of these concerns focus on whether the determination was conducted in accordance with formal federal guidance on testing and evaluation, and if all testing and evaluation has been conducted in accordance with both the Evaluation of Dredged Material Proposed for Discharge in Waters of the U. S.–Testing Manual (Inland Testing Manual [ITM]) (U. S. Environmental Protection Agency [USEPA]/USACE, 1998) and the Great Lakes Dredged Material Testing and Evaluation Manual (Great Lakes Testing Manual [GLTM]) (USEPA/USACE, 1998). Enclosure 3 discusses these items further, and also addresses several other concerns raised by OEPA in letters dated December 20, 2014, January 10, 2015, February 20, 2015 and July 22, 2015, and the Ohio Attorney General letter dated December 17, 2014. The following elements are addressed in this enclosure: (1) determination that these channel sediments meet CWA Section 404(b)(1) Guidelines for open-lake placement with respect to bioaccumulation of PCBs, (2) application of GLTM and ITM, (3) use of CLA-1 sediments to make a dredged sediment open-lake placement determination, (4) OEPA's assessment of PCB bioaccumulation from these channel sediments in Lake Erie fish, (5) potential effect of open-lake placement of these channel sediments on the existing fish consumption advisory (FCA) to consume no more than one meal/month of Lake Erie walleye, (6) vertical homogeneity of these channel sediments, and (7) recent results of standard 10-day *Hyalella azteca* solid phase bioassays applied to these channel sediments in 2015.

In 2014, USACE encountered some significant sediment contamination in existing lake sediments within and outside of CLA-1 (e.g., CLA-14). A summary assessment of this contamination is presented in Enclosure 4. In 2016 therefore, USACE proposes to beneficially use Upper Cuyahoga River Channel sediments by placing them over these existing contaminated sediments within the southeast quadrant of CLA-1 to improve lake bottom (benthic) habitat at impacted locations. Consideration should also be given to future beneficial use of Cleveland Harbor dredged sediments to cap contaminated sites identified outside of CLA-1. As discussed in Enclosure 4, placement of the Upper Cuyahoga River Channel sediments over impacted sites would improve the existing aquatic ecosystem by restoring lake bottom habitat to a condition that is more suitable for the reestablishment of a viable benthic community at those sites.

This transmittal letter also includes the Section 404(a) Public Notice for the proposed discharges of dredged sediment (Enclosure 1, Item 4b). The Public Notice has been prepared in conformance with USACE regulation, "Practice and Procedure: Final Rule for Operation and Maintenance of Army Corps of Engineers Civil Works Projects Involving the Discharge of Dredged Materials into Waters of the United States or Ocean Waters," 33 CFR 337.1. A copy of the Public Notice has been sent to U.S. Fish and Wildlife Service (Ecological Services, Columbus, Ohio) and ODNR (Division of Wildlife, Ohio Biodiversity Database, Columbus, Ohio) to coordinate comments with respect to Threatened and Endangered species, including the presence or absence of Critical Habitat. In addition, an e-mail has been sent to these two entities to request their comments with copy furnished to OEPA (Enclosure 1, Item 4c and 4d).

Finally, please be aware that a denial of the WQC or the inclusion of conditions prohibiting open-lake placement would put USACE in the position of having to consider the deferral of dredging of the Upper Cuyahoga River Channel in 2016. In this event, non-USACE entities may be able to dredge this reach of federal navigation channel and manage the sediments in a manner of the State's (or other's) preference, pending their receipt of applicable federal and state approvals. Additionally, the USACE re-emphasizes its willingness to work with the State and other stakeholders, should they identify and propose a dredge material placement option other than the federal standard. Implementation of such an option would require a non-USACE entity to contribute the additional costs above the federal standard, and would need to be coordinated as soon as possible in advance of the anticipated 2016 dredging contract award to avoid possible delays in dredging.

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Request for Section 401 Water Quality Certification for Discharges of Dredged Sediments Associated with the Scheduled 2016 Maintenance Dredging Project

If you have any questions pertaining to this matter or you would like to discuss any of it in greater detail, please feel free to contact Mr. Scott W. Pickard (716-879-4404; scott.w.pickard@usace.army.mil), or by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

Sincerely,

Martin P. Wargo, PWS
Supervisory Biologist
Environmental Analysis Section

Enclosures

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

February 24, 2016

Environmental Analysis Team

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Revised Dredged Sediment Evaluation for Upper Cuyahoga River Channel Sediments

Mr. Richard D. Blasick, P.E.
Environmental Manager
Division of Surface Water
Ohio Environmental Protection Agency
P.O. Box 1049
Columbus, Ohio 43216-1049

Dear Mr. Blasick:

The U.S. Army Corps of Engineers (USACE), Buffalo District has completed a comprehensive review of analytical and biological test data generated by the Ohio Environmental Protection Agency (Ohio EPA) on Cleveland Harbor's Upper Cuyahoga River sediments across several sampling and analysis (SSA) efforts performed in 2013, 2014 and 2015. The majority of these data were provided to USACE between September 30, 2015 and January 15, 2016.

USACE review of these data revealed considerable substantive quality control and technical issues. A detailed discussion of these issues, as well as all additional appropriate Ohio EPA data, have been integrated into the revised 2016 dredged sediment evaluation (Enclosure 1), the original of which was provided in our November 20, 2015 application for Clean Water Act (CWA) Section 401 water quality certification (WQC). The revised evaluation also includes USACE 2015 data on the bioaccumulation of polychlorinated biphenyls (PCBs). USACE consideration of the additional Ohio EPA data did not change the determination that sediments dredged from the Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines (40 CFR 230.11[d]) for placement at CLA-1 in Lake Erie.

USACE identified two overarching issues with the data generated by Ohio EPA: (1) many of the sediment samples across the sampling events were collected from outside the Federal navigation channel dredging prism; and (2) the solid phase bioassays (acute toxicity and PCB bioaccumulation tests) did not follow appropriate laboratory methodologies and failed to yield useable data. In addition, Ohio EPA did not perform any testing relative to Section 5.1 of the U.S. Environmental Protection Agency (USEPA)/USACE Evaluation of Dredged Material for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual) (ITM). This section of formal CWA guidance is specifically directed at evaluating compliance of any discharge of dredged sediment at a specified open-water site with respect to applicable state water quality standards (WQSs).

The following provides a summary of USACE concerns with the additional data generated by Ohio EPA:

a. Sediment sample locations. As initially noted in our March 2, 2015 letter, many of the core sediment samples obtained from the river by Ohio EPA in April 2014 were collected from outside the Federal navigation channel dredging prism (this is illustrated in the 2016 dredged sediment evaluation). Review of the other sampling events (2013, May 2014, August 2014, October 2014, June 2015 and October 2015) also showed that many sediment samples were collected from outside the dredging prism. In general, these samples were either collected from outside channel boundaries, in areas of the authorized channel officially "not maintained" (i.e., in dredged material management unit [DMMU]-1), below dredging elevation or on channel side slopes. Data on these samples could not be included in the 2016 dredged sediment evaluation as they are not representative of the dredged sediments. USACE further notes that most of the sampling conducted by Ohio EPA across these events was biased in that it targeted sites along the boundaries of the channel (such as outfalls) rather than the shoals that are actually dredged within the Federal navigation channel. Regardless, sediment contaminant concentration data on all sites located within the dredging prism were integrated into the evaluation.

b. Sediment sampling methodologies. Sediment sampling did not follow the appropriate protocols prescribed in formal guidance (USEPA/USACE 1998a and 1998b). For example, DMMUs were not utilized (the data generated by OEPA were placed into the three USACE designated DMMUs to better enable interpretation) and DMMU composite samples were not created from discrete samples collected from each individual DMMUs. Also, open-lake reference area sediments were not collected during each individual sampling event.

c. Sediment testing methodologies. Ohio EPA did not follow the appropriate protocols for the sampling and testing of dredged sediments as prescribed in formal CWA guidance contained in the ITM and Great Lakes Dredged Material Testing and Evaluation Manual (GLTM). In many cases, this resulted in the generation of data that were unusable or of poor quality, and therefore could not be used for any dredged material management decision-making. Also note that many of the discrete samples contributing to the composite samples employed for the bioassays were collected from outside the dredging prism. The rationale as to why the bioassay data are unusable is presented below:

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Revised Dredged Sediment Evaluation for Upper Cuyahoga River Channel Sediments

1. Hyalella azteca *bioassay for survival*—This bioassay did not follow appropriate testing protocols prescribed in the ITM and GLTM. Sediment pore water data was not measured or monitored, and the bioassay water was not purged to preclude effects from ammonia in the bioassay. Ammonia is a naturally occurring constituent of pore water that can confound bioassays performed in the laboratory because it can be toxic. Pre-existing information on ammonia toxicity in these sediments available to Ohio EPA (i.e., previous USACE dredged sediment evaluations relating to Cleveland Harbor) reinforces the need to include sediment pore water ammonia monitoring in the bioassay procedures. It is also important to evaluate sediment pore water ammonia toxicity as it can confound the potential toxicity of persistent contaminants. In addition, the presence of a high density of native oligochaete worms in various sediment samples (see 2016 dredged sediment evaluation) may have been a factor in the observed reduced survival of *H. azteca*. Given this information, it is evident that sediment pore water ammonia and/or native oligochaetes were factors contributing to, or in fact driving, the reduced survival (and growth) observed, thus yielding false-positive toxicity data.

2. Lumbriculus variegatus *PCB bioaccumulation experiments*—This test did not follow appropriate testing protocols prescribed in the ITM and GLTM, and the data generated are not representative of the dredged sediments. Because of this it could not be used for any dredged sediment management decision-making.. This is detailed as follows:

(a) Following test exposures, a fundamental requirement is to allow a standard 24-hour period for *L. variegatus* gut clearance; Ohio EPA's test provided for a gut clearance of 6 hours which is 18 hours less than the standard. A 24-hour gut clearance is also recommended by the most recent American Society of Testing and Materials (ASTM) Standard Guide for Determination of the Bioaccumulation of Sediment-Associated Contaminants by Benthic Invertebrates (ASTM E1688-10). Under an assumption that the channel samples contained a significant number of native oligochaete (tubificid) worms in the sediments (as has been USACE observation since at least 2010), it is also possible that the inclusion of tubificidae genera in the tissue samples absent a minimum 24 hour gut clearance biased test PCB concentrations high due to material remaining in the gut. Furthermore, regarding replication, formal USEPA/USACE guidance requires the standard bioaccumulation experiments to be accomplished with five replicates, including quantification of PCB residues in each individual replicate. The five replicates run by Ohio EPA were composited into a single tissue sample, which resulted in no replication of the measured PCB tissue data. These two deviations from formal guidance render these data to be unusable in this case.

(b) In comparison to USACE data and theoretical values, the Ohio EPA data yielded much higher PCB tissue residues relative to PCB concentrations in both channel and lake sediments. This is uncharacteristic for these sediments and unusual for any sediments with such low residual PCB concentrations. Total organic carbon (TOC)-normalized total PCB concentrations measured in both the channel and lake sediment samples infer that total PCB bioaccumulation in *L. variegatus* should be on order of 0.1 mg/kg. However, reported Ohio EPA *L. variegatus* total PCB tissue residues were on average 470 to 760% higher than would be theoretically expected based on PCB and TOC sediment concentrations alone. Such results are improbable because they are inconsistent with recent site-specific bioaccumulation data following appropriate methodologies, and greatly exceed theoretical values.

To examine this sediment-to-tissue concentration aberration further, biota-sediment accumulation factors (BSAFs) were calculated using the reported Ohio EPA *L. variegatus* total PCB bioaccumulation data. This yielded mean BSAFs of 5.0 for both the channel and lake sediment samples, which is over six times the mean BSAF of 0.73 generated from site-specific USACE data using appropriate test methodologies. It is also approximately four times a mean BSAF of 1.30 derived across other researchers using a standard 28-day laboratory exposure period for *L. variegatus*. The disparity among a BSAF of 5, and those based on site-specific data and data from other researchers, is illustrated in Enclosure 2. Even individual Ohio EPA BSAF values do not appear to reflect any apparent adsorptive influence from hard carbon (which reduces PCB bioavailability), which is to be expected in these sediments.

Enclosure 3 is a histogram (frequency distribution) of mean total PCB BSAFs from various researchers using a standard 28-day laboratory exposure period for *L. variegatus*. The data are heavily skewed right. Mean BSAFs of 5 based on the reported Ohio EPA data lie on the extreme right tail of the distribution, beyond the 95th percentile. In other words, 96% of the BSAFs generated by other researchers are less than or equal to 5. The harbor and lake sediment USACE BSAFs of 0.78 and 0.57 fall at the highest point of the distribution (the mode) and occur within the range of values generated by most of the researchers. Furthermore, the combined harbor/lake sediment USACE BSAF mean of 0.73 is comparable to the median of 0.88 across the BSAF distribution.

Collectively, and regardless as to whether the sediment samples were collected from within or outside the channel dredging prism, this information suggests that the Ohio EPA data are not representative of PCB bioaccumulation from channel shoals or sediments at the placement area.

d. <u>Polycyclic aromatic hydrocarbon (PAH) sediment contamination</u>. With respect to the evaluation of sediment-associated PAH contamination, Ohio EPA analyzed the sediments samples across the SSA efforts for bulk concentration. USACE reiterates that the state-of-the-science approach to evaluating accurate PAH-specific toxicity in sediments is through sediment pore water measurements. USACE has now accomplished this type of testing three times on the Upper Cuyahoga River Channel sediments. Since PAHs in these channel sediments are of predominantly pyrogenic origin, PAH compounds tightly adsorb to sediment hard carbon making them less bioavailable to cause any significant toxicity. We are concerned that Ohio EPA continues to disregard this information and revert to bulk sediment concentration data. Such an

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Revised Dredged Sediment Evaluation for Upper Cuyahoga River Channel Sediments

approach has a high potential to inaccurately portray PAH toxicity.

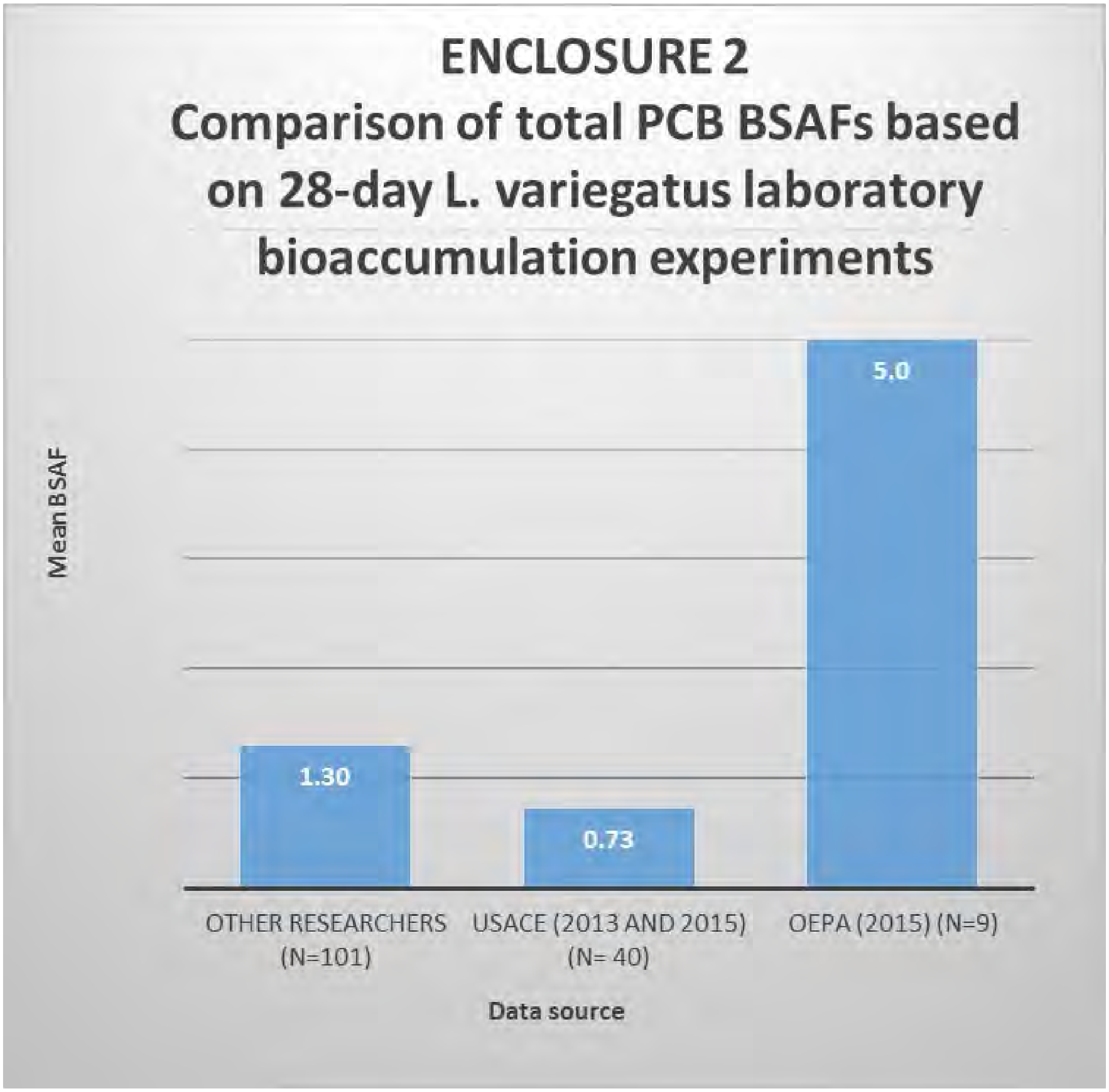
We appreciate the provision of this additional information and are hopeful that our review will serve to alleviate some of Ohio EPA's concerns. In the interest of carrying forth a weight-of-the-evidence approach toward the characterization of Upper Cuyahoga River Channel sediments as recommended in our November 20, 2015 letter, we request that Ohio EPA provide a direct technical response to this letter.

Questions pertaining to this matter should be directed to Mr. Scott W. Pickard (716-879-4404; scott.w.pickard@usace.army.mil) by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

Sincerely,

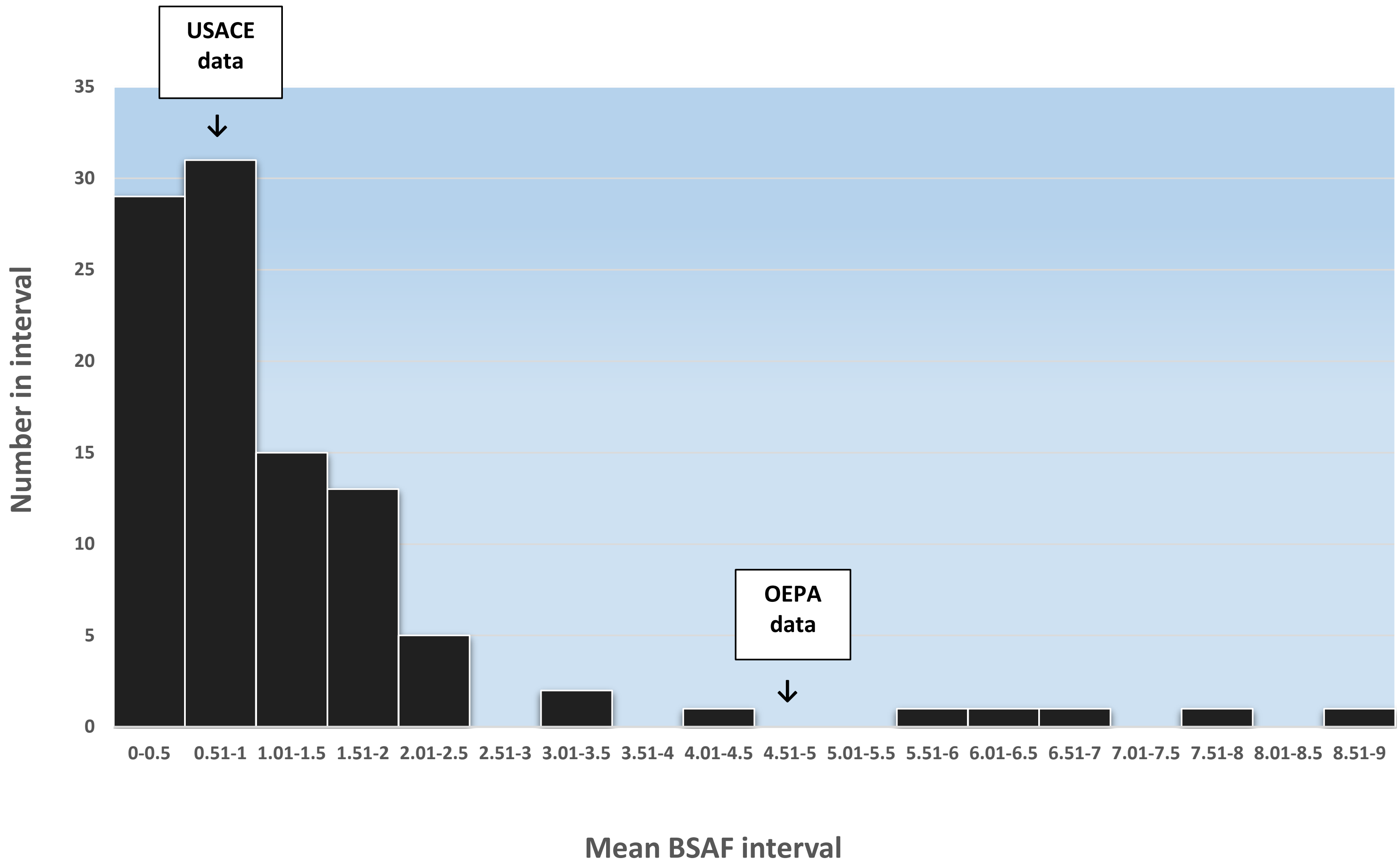
Martin P. Wargo, PWS
Supervisory Biologist
Environmental Analysis Team

Enclosures


ENCLOSURE 2
Comparison of total PCB BSAFs based on 28-day L. variegatus laboratory bioaccumulation experiments
Mean BSAF
1.30
0.73
5.0
OTHER RESEARCHERS (N=101)
USACE (2013 AND 2015) (N= 40)
OEPA (2015) (N=9)
Data source

ENCLOSURE 3

Mean total PCB BSAF histogram, *L. variegatus* 28-day laboratory bioaccumulation data from various researchers



DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

March 10, 2016

Programs and Project Management Branch

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

Mr. Kurt M. Princic
District Chief
Northeast District Office
Ohio Environmental Protection Agency
2110 East Aurora Road
Twinsburg, Ohio 44087-1924

Dear Mr. Princic:

This is in response to your March 1, 2016 letter presenting comments on the U.S. Army Corps of Engineers (USACE) application of Section 401 water quality certification (WQC) for the discharge of dredged sediment associated with the 2016 maintenance dredging of Cleveland Harbor Federal navigation channels.

Many of the comments presented by Ohio Environmental Protection Agency (Ohio EPA) address the quality of sediments dredged from the Upper Cuyahoga River Channel and in Lake Erie rather than water quality. Therefore, these comments pertain to Clean Water Act (CWA) Section 404(b)(1) Guidelines and the applicable formal guidance prescribed in the 1998 Evaluation of Dredged Material for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual) (ITM) and Great Lakes Dredged Material Testing and Evaluation Manual (GLTM). Compliance with CWA Section 404(b)(1) Guidelines is administered by USACE. The concerns presented by Ohio EPA are outside the regulatory purview of CWA Section 401 WQC, which is focused on compliance with Federally approved numeric and narrative water quality standards (WQSs) as they apply to the water column. USACE has provided sufficient information toward compliance with applicable Ohio WQSs in our November 20, 2015 application for WQC. Concerns expressed by Ohio EPA about PCB concentration in sediments, bioaccumulation, and polycyclic aromatic hydrocarbon (PAH) toxicity relate to demonstration of compliance with CWA 404(b)(1) Guidelines, which fall under the regulatory authority of USACE.

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

As part of our exhaustive sediment analyses found in the November 20, 2015 WQC application and the February 24, 2016 revised dredged sediment evaluation, we clearly demonstrate that PCB concentrations and bioaccumulation associated with sediments from the Cleveland Harbor Upper Cuyahoga River Federal Navigation Channel are not only consistent with reference sediments at CLA-1, but are also within the range of regional background reference sediments offshore of Cleveland. In addition, solid phase bioassay data from USACE analyses show that the PAH concentrations in channel sediments are not toxic to benthic organisms.

USACE agrees that if covering of toxic sediments outside of CLA-1 with Cleveland Harbor dredged sediments were pursued, additional characterization regarding the extent of contamination would be appropriate. USACE is not proposing a remediation of lake-bottom sediments in this area. We are merely illuminating an opportunity to utilize maintenance dredging to promote the isolation of existing contaminated sediments from the aquatic environment in one area of CLA-1.

Your comments will be incorporated into and responded to in our CWA Section 404(b)(1) Evaluation as appropriate. This evaluation will be available on our website at http://www.lrb.usace.army.mil/Missions/CivilWorks/DistrictProjects/ClevelandHarbor.aspx later this month.

If concerns remain after reviewing the analyses already submitted to Ohio EPA as cited above, we request that Ohio EPA specify the Federally approved water quality standard(s) that open-lake placement of the channel sediment would violate, along with the accompanying criteria for compliance.

Questions pertaining to this matter should be directed to Mr. Scott W. Pickard (716)-879-4404; scott.w.pickard@usace.army.mil) by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

Sincerely,

//SIGNED//

Ronald J. Kozlowski, PMP, CGFM
Chief, Programs and Project Management Branch

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

REPLY TO
ATTENTION OF

March 17, 2016

Programs and Project Management Branch

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

Mr. Kurt M. Princic
District Chief
Northeast District Office
Ohio Environmental Protection Agency
2110 East Aurora Road
Twinsburg, Ohio 44087-1924

Dear Mr. Princic:

Thank you for the opportunity to provide formal written comment on the Section 401 water quality certification (WQC) public hearing for our proposed discharge of dredged sediment into the designated open lake placement area in Lake Erie. This work is associated with our upcoming 2016 maintenance dredging of Cleveland Harbor federal navigation channels.

The United States Army Corps of Engineers (USACE) would like to thank the Ohio Environmental Protection Agency (Ohio EPA) for its consideration of our Clean Water Act (CWA) Section 401 WQC application dated November 20, 2015 and supplemented on February 24, 2016. During its review of our application, Ohio EPA has expressed concerns about PCB concentration in sediments, bioaccumulation, and PAH toxicity related to the proposed open lake placement of sediments dredged from the Upper Cuyahoga River Channel. These concerns pertain to CWA Section 404(b)(1) Guidelines and the applicable formal guidance. Compliance with CWA Section 404(b)(1) Guidelines is administered by USACE. The concerns presented by Ohio EPA are outside the regulatory purview of Section 401 of the CWA, which is focused on compliance with applicable federally approved numeric and narrative water quality standards (WQSs) as they apply to the water column.

The USACE is requesting that Ohio EPA please specify the applicable federally approved water quality standard that open lake placement of the channel sediment could violate, along with the accompanying criteria for compliance.

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

Thank you for your time and continued attention to this matter. If you have any questions, please contact Mr. Scott W. Pickard (716-879-4404; scott.w.pickard@usace.army.mil) by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

Sincerely,

Ronald J. Kozlowski, PMP, CGFM
Chief, Programs and Project Management Branch

DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

March 21, 2016

REPLY TO
ATTENTION OF

Programs and Project Management Branch

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

Mr. Kurt M. Princic
District Chief
Northeast District Office
Ohio Environmental Protection Agency
2110 East Aurora Road
Twinsburg, Ohio 44087-1924

Dear Mr. Princic:

The purpose of this letter is to provide Ohio Environmental Protection Agency (Ohio EPA) the following: The U.S. Army Corps of Engineers (USACE) response to your March 12, 2016 letter to Mr. Eric Hannes which offered a formal comment for the record as a follow-up to your March 1, 2016 letter; USACE analysis of the "Report of Dr. Nathan Hawley on Sediment Migration at CLA-1" transmitted to us on November 20, 2015; and USACE comments on the draft 2016 water quality certification (WQC) provided to us on March 17, 2016.

The USACE will address all formal comments that were received from our Clean Water Act Section 404 public hearing within our 2016 Section 404(b)(1) Evaluation pertaining to our proposal for open lake placement of dredged sediment from the Upper Cuyahoga River Federal navigation channel.

Please note that your March 12, 2016 letter mischaracterizes what USACE proposed in our WQC application regarding placement of sediment over sites of highly bioavailable polycyclic aromatic hydrocarbons (PAHs) within CLA-1. We were merely illuminating an opportunity to utilize this year's maintenance dredged sediment to promote the isolation of these existing sediments from the aquatic environment in one area of CLA-1. The proposed beneficial use of dredged sediment to cover over these sediments in the southeast quadrant of CLA-1 is not part of any larger project or proposal by the federal government to remediate or cover over contamination in Lake Erie bottom sediments outside of CLA-1. Therefore, there is no federal action proposed by the USACE at this time for which additional National Environmental Policy Act compliance is warranted.

The USACE still believes, however, that beneficial use of dredged sediment within the southeast quadrant of CLA-1, while not necessary, would provide an ancillary benefit to the

SUBJECT: Cleveland Harbor, Cuyahoga County, Ohio—Discharge of Dredged Material Associated with 2016 Maintenance Dredging Project (DSW401144574)

affected aquatic ecosystem. Such an action could easily be taken by USACE at 100 percent federal cost and should objectively be viewed as an improvement to the existing condition to this portion of CLA-1. Sufficient sampling/analyses has already been completed within CLA-1 to accurately delineate the locations and extent of this area, as was illustrated on Attachment 2 of Enclosure 4 of our November 20, 2015 WQC application. The figure attached to your March 1, 2016 letter shows what appears to be a hand drawn line presumably indicating the extent of PAH-contaminated sediments in Lake Erie and includes the entirety of CLA-1. Ohio EPA's 2015 bioassay data indicate no toxicity associated with sediments in this area. This line is inaccurate with respect to CLA-1 and should at most only incorporate its southeast quadrant.

To support your expressed concern about sediment within CLA-1 migrating to other portions of Lake Erie, you previously provided the "Report of Dr. Nathan Hawley on Sediment Migration at CLA-1," which challenges the analysis and modeling conclusions documented by the U.S. Army Engineer Research and Development Center (USAERDC). We have reviewed Dr. Hawley's report and have several substantive concerns with his analysis and conclusions. These concerns are detailed in the enclosed technical review (Enclosure 1). Based on the detailed analysis and modeling by USAERDC, sediment placed in CLA-1 has little potential for meaningful resuspension and migration, and therefore would not increase the cost or complexity of possible future efforts to further investigate the nature and extent of contamination outside CLA-1.

Finally, comments specific to the draft WQC are presented in Enclosure 2. USACE is again requesting that Ohio EPA specify the applicable federally approved water quality standard that open lake placement of the channel sediment could violate, along with the accompanying criteria for compliance.

Thank you for your continued engagement on this project and comments provided as part of our Clean Water Act Section 404 public hearing. If you have any questions pertaining to this matter, please feel free to contact Mr. Scott W. Pickard (716-879-4404; scott.w.pickard@usace.army.mil) by writing to the following address: U.S. Army Corps of Engineers, 1776 Niagara Street, Buffalo, New York 14207-3199.

Sincerely,

Ronald J. Kozlowski, PMP, CGFM
Chief, Programs and Project Management Branch

Enclosures

DEPARTMENT OF THE ARMY
ENGINEER RESEARCH AND DEVELOPMENT CENTER, CORPS OF ENGINEERS
ENVIRONMENTAL LABORATORY
WATERWAYS EXPERIMENT STATION, 3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

MEMORANDUM

To: Scott Pickard, CELRB-TD-EH
Michael Asquith, CELRB-PM-PM

From: Paul R. Schroeder, Ph.D., PE
Earl Hayter, Ph.D.

Date: 14 March 2016

We have reviewed Dr. Nathan Hawley's report on sediment migration at the open-lake placement area CLA-1 (Enclosure 1) which challenges the analysis and conclusions of modeling documented by U.S. Army Engineer Research and Development Center (USAERDC) (2014a, 2014b). We have several substantive concerns with his analysis and conclusion. Our comments are as follows:

1. Dr. Hawley states that "If sediment from the Cleveland Harbor is placed at CLA -1, it will be resuspended and migrate multiple times per year under typical weather conditions. Generally, the sediment will likely migrate miles per year in a largely unpredictable pattern, but eventually will end up in the eastern basin of Lake Erie."

Dr. Hawley does not cite any papers or reports that would support this statement. He only provides a bibliography of studies on the Great Lakes, and he did not provide information specific to CLA-1 and mechanically placed dredged material. If Dr. Hawley could reference such studies, then we will review those to determine whether we should change the conclusions of our focused modeling study on erosion potential under typical annual conditions at the proposed placement sites.

2. Dr. Hawley states that "There is ample evidence that sediment resuspension occurs throughout the central basin of the lake multiple times per year, and that this material may travel considerable distances, and may remain unburied for years to decades before it is finally buried and removed from the ecosystem."

a. As before, Dr. Hawley needs to cite specific published literature that supports his contention.

b. Raw water turbidity data for the Cleveland area potable water intakes show that resuspension does indeed occur about a dozen times per year, almost exclusively in November through April; the larger events occur in November through February. Eighty percent of the dredging occurs in May and June, which allows four months for the dredged material to consolidate and become incorporated within the sediment bed before significant storms occur. During these storms/resuspension events, total suspended solids (TSS) increase in the water column at the deep water intakes (greater than 45 ft) by 25 to 50 mg/L, while the TSS at the water intake in shallower water increases by 50 to 100 mg/L. The data suggests that resuspension is much greater in water depths less than 40 feet where waves contribute significantly to the bottom shear stress. Resuspension events are both greater and more frequent in shallow water. To increase the TSS in the water column by 50 mg/L, only 1 mm of consolidated sediment or 3 mm of unconsolidated sediment would need to be resuspended. After a resuspension event, the TSS will settle out in deeper areas where the sediments tend to be fine-grained such as at CLA-1, and then reestablish the surface with new deposition. This new deposition is resuspended in subsequent resuspension events and the underlying sediment remains in place. Therefore, locations such as CLA-1 in 60 ft of water tend to be slightly net depositional (a few millimeters per year) because sediment will generally be transported from shallow to deeper water. The raw water turbidity data for the Cleveland area water intakes show that the TSS settle in one to two days after the resuspension event ends, suggesting a settling velocity of 0.1 to 0.2 mm/sec, representative of small (10 to 20 microns in diameter) aggregates of fine-grained material rather than discrete clay and fine silt particles. Dr. Hawley's analysis ignores sedimentation occurring at CLA-1. His report does not address whether the site is erosional, but merely states that resuspension will occur multiple times per year. Resuspension occurring at a location is not equivalent to a location being net erosional. Our modeling addresses whether the site is likely to be net erosional and dispersive, as opposed to whether surficial resuspension occurs, which was the focus of Dr. Hawley's report. Neglecting sedimentation is a critical flaw in Dr. Hawley's report and leads to the false conclusion that the dredged material will be transported out of CLA-1 by resuspension.

3. Dr. Hawley states that "The Corps used models similar to those described above, the results of which contain serious flaws because the Corps used unreasonably high critical stresses and unreasonably low bottom stresses in its models. In doing so, the Corps ignored 20 years of Great Lakes research performed by NOAA and others and instead relied on outdated research and data from studies of river and ocean sediments."

No research was ignored during this modeling. It is not true that we "relied on outdated research and data from studies of river and ocean sediments." Since Dr. Hawley does not specify which outdated research and data from other studies he is referring to, we cannot give a specific reply to this comment.

4. Dr. Hawley states that "The Corps reports that it first ran its model to simulate a thirty-day period between 31 May and 30 June of 2002. The Corps asserts that no resuspension was predicted even though the bottom current velocities were as large as 40 cm/s, which are considerably higher than the ambient monthly average velocities (4-9 cm/s) observed by NOAA. However, the Corps presented no information about what, if any, waves were included in its simulation. Furthermore, no values of bottom stresses are given, yet the Corps reports that no resuspension of material was predicted to occur. Without considering information on wave energy during this time period, this model is of little value in predicting future annual sediment resuspension and migration."

Long-term (LT) FATE was used to perform the three-dimensional hydrodynamic and sediment transport modeling for both periods that were modeled. The bottom shear stresses used in performing the sediment transport modeling account for both current and wave generated shear stresses calculated by the SEDZLJ sediment bed model. We did use the wave record from a nearby NOAA buoy to calculate the wave-induced stresses because wave modeling could not be performed under this focused modeling study. The simulated 40 cm/s current velocities during an event that occurred in June 2002 were not bottom currents as stated by Dr. Hawley, but were surface currents. Dr. Hawley further states that "Apparently, the Corps calculated simulated waves and currents using a different model for the first time period, but that model was not provided." The hydrodynamic model and results were documented in a Technical Memorandum entitled "Lake Erie Circulation Modeling Conducted Using the ADCIRC Long-wave Hydrodynamic Model to Evaluate Flow Conditions during Representative Time Periods for Open-Water Dredged Material Placement Operations" prepared for the USACE Buffalo District by the Coastal and Hydraulics Laboratory of the U.S. Army Engineer Research and Development Center and dated 30 July 2013 (USAERDC 2013).

5. Dr. Hawley states: "This first report also briefly describes results for the period during Hurricane Sandy, when, according to the Corps, the calculated bottom stresses approached 0.2 Pa. However, the Corps provided no information regarding what inputs it used to represent waves and currents."

The report did describe the forcings (including the use of wave data at the nearby NOAA buoy) used as boundary conditions for LTFATE.

6. Dr. Hawley offered several other comments. Our responses to those comments are given below.

a. "The Corps has underestimated the potential for sediment resuspension at disposal site CLA-1 for several reasons. First, the Corps significantly underestimated the value of the bottom stress exerted on the sediments by the waves and currents. The Corps' bottom stresses are significantly lower (by up to 10 times) than those measured and/or calculated by other studies in the Great Lakes. In Saginaw Bay, for instance, Hawley et al. (2014) calculated bottom stresses of over 1 Pa when the waves were much smaller than those observed during Hurricane Sandy."

A comparison with bottom shear stresses in Saginaw Bay is inappropriate because nearly all of Saginaw Bay is less than 30 ft deep and most of it is less than 20 ft deep. Additionally, Saginaw Bay is not an open lake environ; rather, it is an embayment subject to additional forcing functions such as the river flow. The water depths at the CLA-1 site, which vary between 60 and 65 ft (18.3 and 19.8 m), are the main reason for the bed shear stresses calculated by SEDZLJ being lower than what Dr. Hawley expected.

b. "My calculations show that using the maximum wave height would produce values of τ_w and τ_{cw} approximately 30% greater than those reported by the Corps, or 0.16-0.21 Pa for τ_w and 0.21-0.26 Pa for τ_{cw} over fine-grained material. These values of τ_{cw} exceed even the unreasonably high values that the Corps used as the critical stress for resuspension for silt (0.2

Pa). Therefore, resuspension of most of the material in composites 2 and 3 would be predicted to occur." Additionally, "However, the most important reason the Corps results are flawed is because the Corps has significantly overestimated the value of the critical stress for the silt-sized material. Apparently the Corps determined this value based on the work of Jepsen et al. (1997) who took bottom samples from the Fox River, the Detroit River, and off of Santa Barbara (Pacific Ocean) and experimentally eroded them. The Corps determined that the critical stress of the silt-sized material was 0.2 Pa. However there are a large number of published studies from the Great Lakes that show that the critical stress value for silt sized material is actually between 0.05 and 0.15 Pa and that resuspension not only occurs frequently in the lakes, but that it also occurs during storms when the conditions were much less severe than during hurricane Sandy."

We strongly disagree that 0.2 Pa is an unreasonably high value of the critical shear stress for resuspension. We did not use this value based on the work of Jepsen *et al*. (1997). The range of critical shear stresses found in numerous SEDFLUME studies performed in lakes, rivers, harbors, and estuaries typically vary between 0.05 to more than 1.0 Pa. A value of 0.2 Pa is a common value measured for sediments in the top 5 cm of the tested sediment cores. The value depends on the degree of cohesiveness of the sediment, which depends on, among other factors, the fraction of clays to larger sediment size classes, the mineralogy of the clay size fraction, and the degree of consolidation of the sediment (Mehta *et al*. 1989). The reported critical shear stress were measured on sediment cores, and not mechanically dredged and placed dredged material that may be denser than surficial sediments formed by sedimentation and disturbed by bioturbation. The Upper Cuyahoga River Channel sediment has a wet bulk density of 1.57 kg/L, liquidity index of 1.85 and toughness index of 1.70, indicating that the sediment is highly resistant to water entrainment and shear. Recent open-lake area sample collection offshore of Ashtabula Harbor for similar dredged material and dredging operations confirms that virtually no entrainment of water or bulking in the surface samples should be expected; three weeks after placement, the dredged material wet bulk density was the same as it was in the barge prior to placement. Most surficial fine-grained sediments would have a wet bulk density of 1.15 to 1.3 kg/L and a liquidity index of 6 to 12, which would yield a critical shear stress approximately an order of magnitude smaller than would exist for the Upper Cuyahoga River Channel sediment. Critical shear stresses of the Upper Cuyahoga River Channel sediment below the top 5 cm are likely to be greater than 1 Pa. Therefore, the critical shear stress of 0.2 Pa used in our modeling study would likely represent a realistic worst-case value. Consequently, our modeling of erosion potential is likely to over predict the erosion potential rather than under predict as Dr. Hawley's report states.

c. "As a final piece of anecdotal evidence to refute the Corps' conclusion that sediment resuspension did not occur during Hurricane Sandy, I have attached a satellite image (Fig. 2) of Lake Erie taken seven days after the storm (the first day that the cloud cover allowed observations to be made). This figure shows a wide band of suspended sediment along the southern shore, even though the waves and currents had decreased considerably after the storm. This demonstrates that the waves and currents produced in Lake Erie during Hurricane Sandy were sufficiently strong to resuspend bottom sediments on the Lake bed near Cleveland."

We agree that the waves and currents during Hurricane Sandy were most likely strong enough to resuspended bottom sediments near Cleveland where the water depths are shallower than they are at the CLA-1 site. USAERDC (2014b) indicates that the Composite #1 fluff layer could be resuspended during Super Storm Sandy, but that its mass and PCB contribution would not be significant compared to resuspension occurring in the shallow water environs.

d. "Additional, anecdotal evidence that bottom sediments and the pollutants adsorbed onto them have been transported from site CLA-1 is presented in a summary of results of a survey conducted by the Ohio EPA (Ohio EPA 2015). Contaminated sediments were deposited at CLA-1 prior to about 1960, and the concentrations of both PCBs and PAHs remain high at the site. However, the data also clearly show that both PAH and PCB concentrations are markedly higher to the south of CLA-1 than to the north, where the concentrations approach the background concentrations. The obvious explanation for this pattern is that contaminated sediments have been transported from the disposal site southward during the period since the sediment was deposited at CLA-1."

The report entitled "Cleveland Harbor (Upper Cuyahoga River Channel) Dredged Sediments with Respect to Suitability for Open-Lake Placement" performed by the USACE Buffalo District (USACE 2016) found that dredged material that had been placed at CLA-1 was still present, but contaminant concentrations on the surface at many locations were comparable or only slightly greater than the surrounding concentrations. The contaminant concentrations at a few locations were significantly higher, particularly to the south as noted by Dr. Hawley. The fact that contamination is still present after more than 45 years and perhaps 500 resuspension events clearly suggests that significant net erosion is not occurring at the site. The lower contaminant concentrations in deeper water within the site and north of the site suggest a net deposition of at least 2 to 3 mm per year occurs at the site as concluded above, while the location south of the site is shallower and therefore less depositional. If sediment were transported to the south by resuspension events, there should be a contaminant concentration gradient with the highest concentration in CLA-1 and decreasing concentrations proceeding south. Existing data fail to suggest any such trend.

7. We will not comment on the Section "Transport and fate of resuspended material" in Dr. Hawley's report since the scope of our modeling study was limited to determining if the sediment resuspended or not during the two simulated time periods.

8. In conclusion, Dr. Hawley's analysis and conclusions are substantively flawed because:

a. His analysis focused only on sediment resuspension and not net sediment erosion.

b. He did not consider the effects of sedimentation in the lake, which replenishes the sediment surface following each resuspension event and limits the exposure and resuspension of the placed dredged material below the deposition.

c. He did not consider the density of mechanically dredged and placed dredged material in estimating critical shear stress. Instead, he relied on natural lake sediment cores formed by sedimentation, which are significantly less dense, more liquid and, therefore, more erodible than mechanically dredged and placed dredged material. Therefore, he overestimates the potential for erosion and resuspension.

d. He has not generated estimates of the bottom shear stress for representative storm events and wave conditions at CLA-1 or provided estimates for comparison with bottom shear stresses used for previous modeling.

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Enclosure

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USAERDC. 2014a. Long-Term Fate (LTFATE) Modeling Approach and Results for Cleveland Harbor Open Lake Placement Assessment. Technical memorandum dated 20 February 2014.

USAERDC. 2014b. Evaluation of NOAA Cleveland-area buoy data for potential resuspension and erosion of open-lake placed dredged material by severe sustained storms. Technical memorandum dated 22 April 2014.

Enclosure 2

USACE Comments on Draft 2016 Cleveland Harbor WQC

1. Part I – The minimal degradation alternative was of the discharge of approximately 180,000 cubic yards of sediment at CLA-1, not for the actual dredging of the federal navigation channel. Please note that no authority is provided to states under Section 401 of the Clean Water Act (CWA) to regulate the act of dredging itself since it does not involve a discharge of dredged material.

2. Part I – Figure 1 with the draft WQC does not depict the proposed discharge of dredged material at CLA-1 for which USACE has requested WQC. Rather, it only illustrates the areas to be dredged within Cleveland Harbor.

3. Part II (B) – Please note that a WQC is not an "authorization." It is a certification as to whether a proposed discharge of dredged or fill material complies with applicable state water quality standards. Section 404 of the CWA provides USACE the authority to authorize or not authorize dredged and fill material discharges into navigable waters.

4. Part II (C) – A WQC application was not submitted pertaining to any placement of dredged material into a confined disposal facility (CDF). Ohio EPA does not have the authority to direct that USACE place material at any specific location pursuant to a WQC. Its authority is only to certify whether or not a discharge into navigable waters complies with applicable state water quality standards.

5. Part II (C, D) – Please specify the applicable federally approved water quality standard that open lake placement of the channel sediment could violate, along with the accompanying criteria for compliance.

6. Part II (E, F, H) – As we have commented on in past draft WQCs, please note that these conditions are not linked to the proposed discharge of dredged material and/or applicable Ohio water quality standards. These conditions do not pertain to any impact that the certified discharge may have on water quality. Therefore, they are inappropriate and unenforceable as part of a WQC granted under Section 401 of the CWA.

More Detailed Response to Ohio EPA Oral Testimony

&

Ohio EPA Letter Dated March 1, 2016

OHIO EPA MARCH 1, 2016 SECTION 404 PUBLIC HEARING TESTIMONY:

MR. PRINCIC: Good evening. I'm Kurt Princic, Chief of Ohio EPA Northeast District Office. I'm here today to express Ohio EPA's concern with the Army Corps proposed plan to place contaminated dredge material from Cleveland Harbor into the open waters of Lake Erie.

The director of Ohio EPA, Craig Butler, is unavailable this evening, and I am speaking on his behalf. Ohio has been very clear in expressing our concerns to the Corps regarding their proposal to dispose of contaminated sediments from the Cuyahoga River into Lake Erie.

Since 2012, Ohio raised concerns about the material and suggested at a minimum the Corps should plan for the possibility that Ohio EPA would not approve open lake disposal. The Corps has not planned for this even after the State of Ohio challenged the same decision last year by filing a lawsuit.

We have conducted a review of the Corps' application for the 2016 dredging in Cleveland Harbor. The Corps has once again proposed a disposal of 180,000 cubic yards of Cleveland harbor sediments into the open waters of Lake Erie based on their unilateral finding that such a proposal meets Ohio's water quality standards and is the least costly environmentally acceptable alternative, or as Colonel Jansen called it, the federal standard.

It has been the Corps' position that the area in Lake Erie where they want to dispose of the material which is called CLA-1, represents lake background conditions. This position is fundamental to their argument that the sediments are safe for open lake disposal.

Ohio has repeatedly stated that CLA-1 does not represent background because through the mid-1970s, this is where all the contaminated dredge material from the Cuyahoga River was dumped, and we were concerned that the area was impacted by those historic dumping practices.

As it turns out, both Ohio EPA's and the Corps' most recent sampling data from 2015 show there's a highly contaminated area of sediment, a hot spot of contamination in and around this historic dump disposal site CLA-1. And it now appears to the Corps that CLA-1 is not a suitable background site. But instead of placing the sediments in the confined disposal facilities as they have for the past 40 years plus, they now propose to use the sediment to cap this hot spot area of contamination.

Essentially, the Corps want to cover up the dirty and toxic material with additional polluted material. Ohio EPA agrees this hot spot and the area around it does need to be cleaned up; however, we are not able to choose a remedy for this work on this basis the Corps has submitted.

Before any clean-up occurs, it is critical to adequately investigate this area and implement a remedy that is sure to be successful. Currently, the technical review provided by the Corps is approximately one page, and is a completely inadequate analysis by which to proceed with this clean-up project.

You heard from Colonel Jansen that they only have the budget this year to manage the material in accordance with their unilateral view of the federal standard in Ohio's water quality standards, which is to place 180,000 yards of contaminated material in Lake Erie.

It is important to know the Corps did have sufficient budget to properly manage the material; however, the Corps, unbeknownst virtually to everyone purposely reduced their budget for Cleveland Harbor so it appears they only have enough money to place the material in Lake Erie even though they knew there was ongoing litigation, and all available data failed to support their position.

This is just another example of their poor planning and lack of transparency when it comes to Cleveland Harbor and the protection of Lake Erie.

Further, as most are aware, the Corps provided a letter to Lake Erie stakeholders just last week criticizing Ohio EPA's data gathering techniques and analysis of harbor sediments claiming that our data was invalid and scientifically unreliable.

Let me say now that this criticism is absolutely false and misplaced. Ohio EPA carefully relies upon approved EPA methods. Our PCB data is scientifically valid and reliable.

It's critical to point out that while the Corps was quick to attempt to discredit our data, it once again missed the most important point, which is regardless of whose data you choose, Ohio EPA's or the Corps, the answer is still the same: The sediment from Cleveland Harbor is too contaminated to dispose of in Lake Erie.

In conclusion, I'm here to ask the Corps to rethink this flawed strategy based only on economics, not environmental and public health protection, and partner with Ohio in protecting Lake Erie, a state and national treasure.

Further, it is Ohio's position that all sediment should be disposed of in the Cleveland confined disposal at full federal expense. Thank you for your time and attention on this important matter.

USACE RESPONSE:

Within the Clean Water Act (CWA) regulatory framework pertaining to the discharge of dredged material, Ohio EPA’s role under Section 401 is to issue or deny (rather than approve) water quality certification (WQC) for the proposed discharge of dredged sediments in Lake Erie. This WQC requires compliance with applicable Ohio water quality standards (WQSs). USACE provided sufficient information to Ohio EPA toward compliance with applicable Ohio WQSs in the November 20, 2015 application for WQC and in the February 24, 2016 revised dredged sediment evaluation (Attachment 4). The USACE role in the CWA regulatory framework is to administer and determine whether open-lake placement of the channel sediments complies with Section 404(b)(1) Guidelines. All of Ohio EPA’s testimony above pertains to compliance with CWA Section 404(b)(1) Guidelines.

All sediments within the Lake Erie Basin as well as the rest of the Great Lakes Basin are “contaminated” to some degree by a variety of natural and anthropogenic pollutants including carcinogenic contaminants. The fundamental question is whether such contamination is the cause of toxicity or bioaccumulate in organisms to levels that result in unacceptable adverse effects. On a bulk concentration basis, contamination in Upper Cuyahoga River Channel sediments is consistent with that in CLA-1 reference sediments as well as regional lake reference sediments offshore of Cleveland (see Section 2.4.2[b]). Neither the channel or CLA-1 reference sediments are toxic based on appropriate solid phase bioassays (Section 2.4.2[b]), and bioaccumulate similar levels of PCBs within the range of reference sediments offshore of Cleveland (Section 2.4.2[b]).

Ohio EPA insisted that sediments within the confines of the CLA-4 "box," an area previously considered for open lake placement, are exclusively representative of background levels of contaminants within the regional area offshore of Cleveland. CLA-4 is two square miles compared to the 64 square mile nearshore to deep water area offshore of Cleveland which includes CLA-4 and CLA-1. Reference sediment is used as an indicator of localized sediment conditions at the placement area and serves as the point of comparison for potential contaminant-related effects of dredged sediments. CLA-1 sediments are appropriate as a reference sediments because, with few exceptions, bulk sediment contaminant concentrations are consistent with that across the larger regional area and similarly, the sediment bioaccumulation potential of PCBs is within the range observed across the larger regional area. Reference sediments at CLA-1 contain only background levels of contaminants that are characteristic of the region. Discrete areas of higher contamination within CLA-1 are readily apparent and were explicitly removed from consideration as reference sediment. Appropriate standard solid phase bioassays and sediment PAH pore water analysis have consistently demonstrated that CLA-1 reference sediments are not toxic (Section 2.4.2[b]). Ohio EPA's concern that CLA-1 reference sediments are not suitable as a basis of comparison because they are "dirty and toxic" discounts this fundamental information.

Existing scientific data show that most surface sediments within the CLA-1 box are not impaired. Accordingly, most of the impaired sediments in this vicinity of the lake appear to be south of CLA-1. In 2016, USACE proposed to cover the impaired sediments within the southeast quadrant of CLA-1 in order to initiate a reduction of significant benthic toxicity and reduce PCB bioaccumulation in that portion of CLA-1. This proposal was based on a comprehensive review of several USACE and Ohio EPA data sets and concisely summarized for Ohio EPA in a letter dated November 20, 2015. As indicated in USACE letter dated November 20, 2015 (Attachment 2), 40 CFR 230.70(c) emphasizes the selection of former disposal sites for dredged sediment placement, which in this case would represent a betterment of an impaired portion of CLA-1. Furthermore, and as clarified by our letter to Ohio EPA dated March 21, 2016 (in response to your March 12, 2016 letter to USACE) (Attachment 2), this betterment would not be part of any larger project or proposal by the federal government to remediate or cover over contamination in Lake Erie bottom sediments outside of CLA-1, nor would it interfere with any possible future efforts to further delineate contamination in such areas.

With respect to the data generated by Ohio EPA, USACE disagrees that they were all scientifically reliable. As detailed in our February 24, 2016 letter, many of the sediment samples (including some of those used for the bioassays, including PCB bioaccumulation) were collected from outside the channel dredging prism. While the bioassay methods used were USEPA methods, they were not the appropriate USEPA/USACE methods provided under formal guidance pursuant to CWA Section 404(b)(1) Guidelines. There are a variety of reasons why the methodologies employed by Ohio EPA in this case would yield unreliable data leading to erroneous conclusions. Ohio EPA data that were scientifically reliable were duly integrated into the 2016 dredged sediment evaluation. USACE strongly disagrees that relevant data indicate that “the sediment from Cleveland Harbor is too contaminated to dispose of in Lake Erie.” Such a conclusion disregards the data contained and evaluated in the 2016 dredged sediment evaluation.

In summary, open-lake placement of the channel sediments at CLA-1 in 2016 would not result in any increase in lake sediment toxicity or bioaccumulation of PCBs. In addition, placement within the southeast quadrant would initiate a restoration of impaired lake conditions in that area of CLA-1.

USACE RESPONSE TO OHIO EPA LETTER DATED MARCH 1, 2016:

This serves to provide detailed information in addition to that provided in the initial USACE response in letter dated March 10, 2016 (Attachment 2).

All of the comments presented by Ohio EPA in a letter dated March 1, 2016 address the proposed open-lake placement of sediments dredged from the Upper Cuyahoga River Channel at CLA-1 in Lake Erie, and pertain to CWA Section 404(b)(1) Guidelines and the applicable formal guidance prescribed in the 1998 Evaluation of Dredged Material for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual) (ITM) and Great Lakes Dredged Material Testing and Evaluation Manual (GLTM). Compliance with CWA Section 404(b)(1) Guidelines is administered by USACE. As explained in our letter to Ohio EPA dated March 17, 2016, the concerns presented by Ohio EPA are outside the regulatory purview of CWA Section 401 WQC, and that sufficient information toward compliance with applicable Ohio WQSs was included in the USACE November 20, 2015 application for WQC and 2016 dredged sediment evaluation (Attachment 4) (USACE 2016).

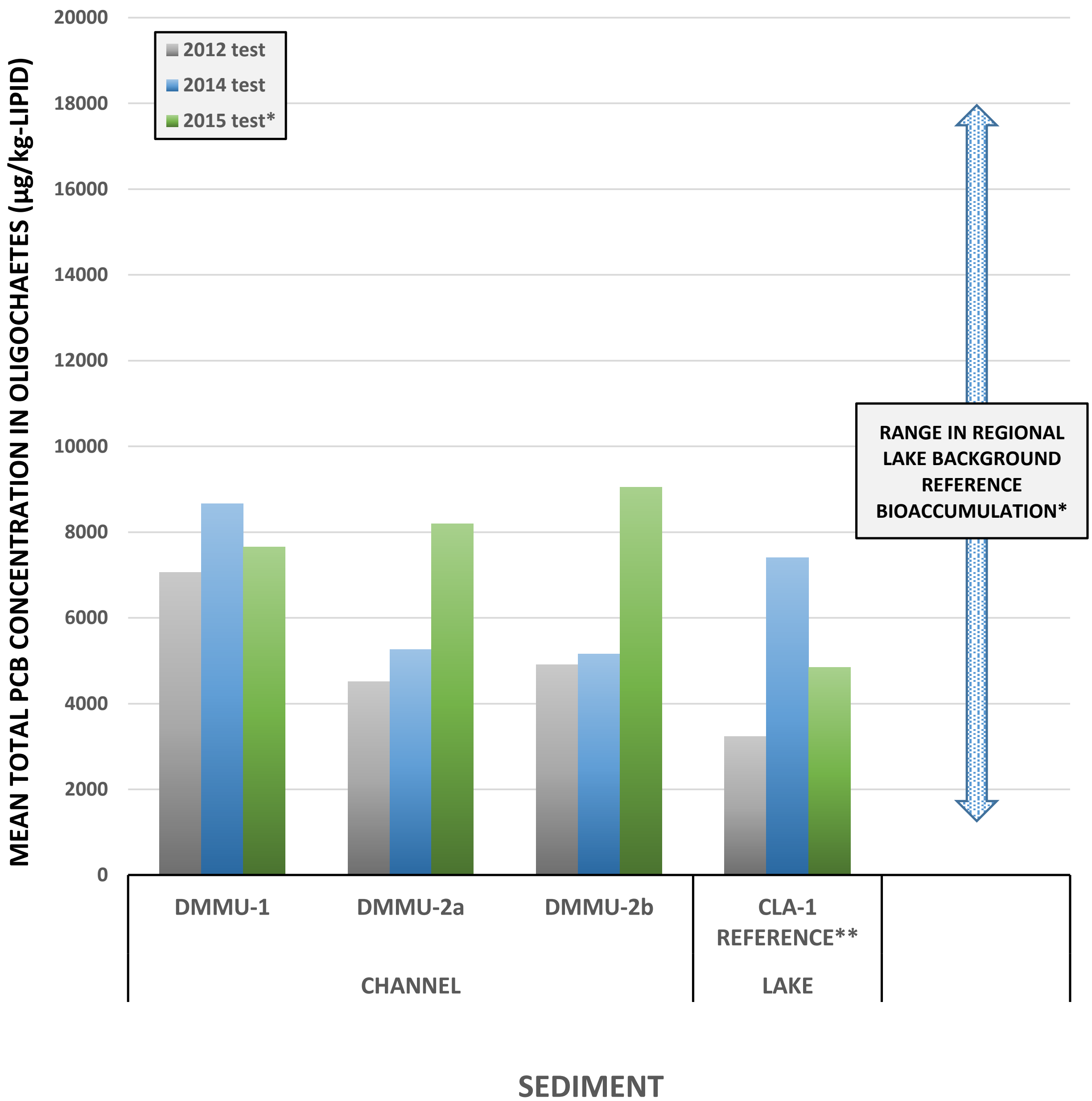
Furthermore, these comments are not based on a standard scientific weight-of-the-evidence (WOE) approach. They often fail to consider relevant lines of evidence (LOE) and improperly mesh various technical elements. The following provides a detailed response:

1. PCBs and bioaccumulation.

a. *Use of CLA-1 and CLA-4 sediments as reference sediments for comparison to the channel sediments*—Neither the Upper Cuyahoga River Channel or CLA-1 reference sediments have a higher PCB bioaccumulation potential than that found across regional Lake Erie background sediments. Ohio EPA's position is based on a preference to solely use sediments within the two square mile CLA-4 "box" to represent regional "background" conditions which Ohio EPA has also incorrectly assumed to be the same as "reference" sediments. For assessing dredged sediments, reference sediments are used as an indicator of sediment conditions, exclusive to the specific contaminant studied, at the proposed open-water placement area. USACE evaluated benthic bioaccumulation of PCBs from channel sediments against CLA-1 as the proposed placement area, as well as lake sediments across the larger regional area offshore of Cleveland. CLA-4 was previously considered as a potential placement area but is no longer being considered at this time. Accordingly, localized sediment conditions at CLA-4 are not appropriate as reference sediments for evaluating management of the channel sediments.

Ohio EPA's ongoing position that CLA-1 sediments are inappropriate as reference sediments is inconsistent with formal federal guidance pursuant to CWA Section 404(b)(1) Guidelines. This position also fails to acknowledge the difference between "reference sediments" and one discrete sediment sample representing an elevated PCB concentration within the southeast quadrant of CLA-1. Figure 5 of the 2016 dredged sediment evaluation (Attachment 4) shows that oligochaete bioaccumulation of PCBs from the channel sediments is within the range of CLA-1 reference sediments, which are themselves within the range of bioaccumulation from regional lake sediments. Across the 2012, 2014, and 2015 USACE sampling events, bioaccumulation of PCBs from the channel sediments is similar to that from CLA-1 reference sediments, mathematically showing that open-lake placement would not increase PCB bioaccumulation in any ecologically meaningful way. This concept is illustrated in Figure 1. As detailed in USACE February 24, 2016 letter to Ohio EPA (Attachment 2) and the 2016 dredged sediment

FIGURE 1.
TOTAL PCB BIOACCUMULATION DATA ON UPPER CUYAHOGA RIVER CHANNEL, CLA-1 REFERENCE AND REGIONAL LAKE SEDIMENTS



*Due to absence of lipid content data on test samples, mean lipid content assumed to be 2% based on mean control sample value of 2.8%.

**Excludes sites suspected of being impacted by past discharges.

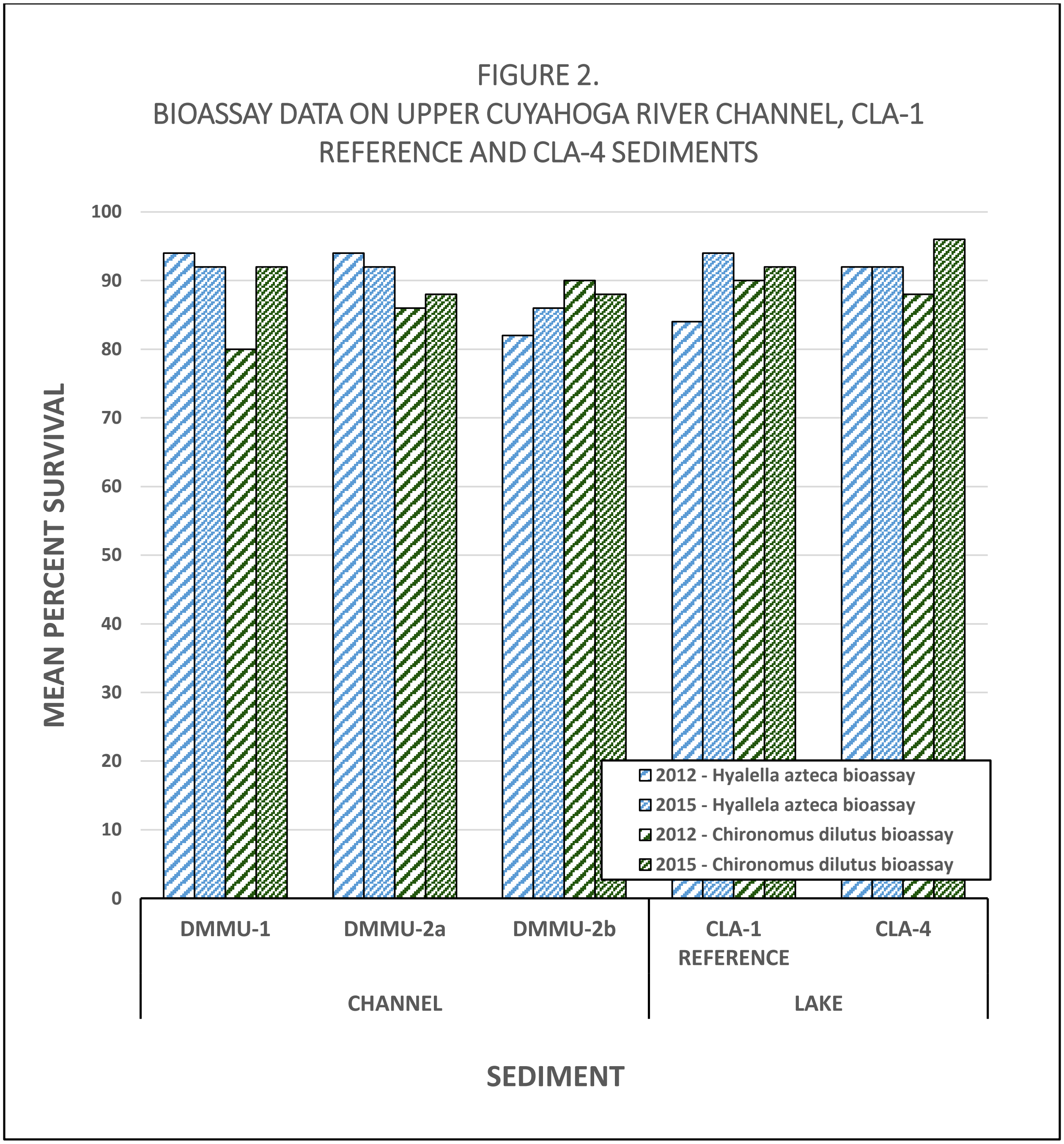
evaluation (Attachment 4) (USACE 2016), Ohio EPA's 2015 PCB bioaccumulation test failed to follow appropriate methodologies, and yielded data that are scientifically unreliable for both channel and lake sediments.

WOE indicates that open-lake placement of the channel sediments within the southeast quadrant of CLA-1 would serve to begin reducing the bioaccumulation of PCBs toward reference levels. It would not result in any increase in PCB bioaccumulation from CLA-1 reference sediments.

b. *Regional background PCB bioaccumulation from lake sediments*—Ohio EPA's contention that theoretical bioaccumulation potential (TBP) modeling in not appropriate for the evaluation of PCB bioaccumulation from sediment has no basis. The TBP model is applied internationally across all levels of government, private sector and academia, and it is widely accepted that the use of valid empirical, site-specific biota-sediment accumulation factors (BSAFs), which were employed in this case, enhance its predictive capabilities. Furthermore, Ohio EPA's use of "Tier 2 vs. 3" terminology is not relevant in this context and confuses the technical point made.

2. <u>PAH contamination, the Lake Erie "hot spot" and proposed beneficial use of dredged material</u>. Ohio EPA's apparent conclusion that PAHs in the channel sediments are toxic and therefore not suitable for placement at CLA-1 is principally flawed. This is because solid phase bioassay data, as well as sediment PAH pore water analysis, show that the channel sediments are not toxic to benthic organisms, akin to what has been demonstrated for both CLA-1 reference and CLA-4 sediments. The fact that CLA-1 reference and CLA-4 sediments are similarly non-toxic makes Ohio EPA's distinction between the two lake sediments unjustified. This concept is illustrated in Figure 2.

As presented in USACE February 24, 2016 letter and 2016 dredged sediment evaluation, Ohio EPA's 2015 bioassay data on the channel sediments likely stemmed from ammonia effects or other non-persistent contaminant-related factors(s) because various procedures were omitted from the test. Independent of the absence of toxicity in any of the properly tested sediments, USACE reiterates that Ohio EPA's approach to characterizing PAH-related toxicity is technically unreliable because it uses bulk sediment concentration to inaccurately portray toxicity while excluding other superseding lines of evidence specific to bioavailability, such as sediment bioassay and PAH pore water data. This issue was most recently raised in USACE February 24, 2016 letter to Ohio EPA. WOE shows that placement of the channel sediments at CLA-1 would not increase Lake Erie sediment toxicity, and would also serve to initiate an elimination of high PAH-related sediment toxicity at two discrete sites within the southeast quadrant of CLA-1.



a. *Use of CLA-1 and CLA-4 sediments as reference sediments for comparison to the channel sediments*—Ohio EPA's concern regarding PAH contamination at CLA-1 with regard to the assessment of PAH toxicity in the channel sediments is perplexing for several reasons. Solid phase bioassays and pore water analysis have consistently indicated that the channel sediments are protective of benthic organisms even as compared to lake sediments outside of CLA-1. Ohio EPA's position on CLA-1 sediments also fails to acknowledge the difference between reference sediments and the discrete elevated PCB and PAH concentrations in the southeast quadrant of CLA-1. Note that USACE did not recommend that "CLA-1 be capped" as described by Ohio

EPA. Rather, the dredged sediment evaluation and WQC application are explicit that placement is proposed to target the southeast quadrant to improve impaired sediment conditions at discrete sites within CLA-1. Ohio EPA's conclusion "when river sediments are compared to the CLA-4 reference site they fail for open-lake disposal" is patently incorrect because the bioassay data on the channel sediments are not statistically different from those on the CLA-4 sediments that Ohio EPA prefers (see Figure 2). Aside from this, USACE further notes that since it has been Ohio EPA's preference that "CLA-4 represents the true background for Cleveland Harbor," the delineation of highly PAH-contaminated lake sediments by OEPA as provided in the letter is inconsistent with OEPA's own set of criteria. This is because the apparent bulk sediment concentration "threshold" used for the delineation is much less than the maximum reference concentration of 33.3 mg/kg measured in CLA-4 sediments. Finally, Ohio EPA's own 2015 solid phase bioassay data showed no toxicity associated with lake sediments collected from different sites in and around CLA-1, which, in principal, fundamentally contradicts the intended point of the delineated "highly contaminated region" based on bulk sediment concentration.

b. *Capping of toxic lake sediments*—USACE agrees that if capping of toxic sediments outside of CLA-1 with Cleveland Harbor dredged sediments were pursued, additional characterization regarding the extent of contamination outside of CLA-1 would be appropriate. It should be made clear that the CWA Section 404(b)(1) Guideline contaminant determination to place sediments at CLA-1 is based on the dredged sediment evaluation received by Ohio EPA as part of the WQC application, rather than by a single page "technical review" as has been portrayed. That enclosure to the application was included to succinctly highlight the potential to place channel sediments within a specific area of CLA-1 to promote the isolation of toxic sediments from the aquatic environment. USACE does not agree that insufficient analysis has been provided to support placement of these sediments at CLA-1 per CWA Section 404(b)(1) Guidelines. USACE also does not agree that "sediment is clearly migrating from CLA-1" because state-of-the-science modeling shows that the area is not net erosional (Section 2.1.3). Supporting evidence includes that there is no high to low gradient in sediment PAH concentrations away from CLA-1, and that highly contaminated sediments remain in-place within CLA-1 and CLA-14 despite more than 45 years of resuspension events.

Attachment 3

Public & Agency Comments Received

(December 2015 – March 2016)

Section 404(a) Public Notice Comments

December 2015

PORT
CLEVELAND

Via Electronic and U.S. Mail

December 18, 2015

Lt. Col. Karl D. Jansen
U.S. Army Corps of Engineers—Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
Attn: Environmental Analysis—Cleveland Harbor Dredging
clevelanddredging@usace.army.mil

Re: Comments on USACE November 20, 2015 Public Notice and Request for Public Hearing
Cleveland Harbor Dredging
USACE Public Notice No. Cleveland-16

Dear Lt. Col. Jansen and the Environmental Analysis Team,

The Cleveland-Cuyahoga County Port Authority ("Port") received notification from the U.S. Army Corps of Engineers ("USACE") regarding its Operation and Maintenance Dredging and Dredged Sediment Placement Plan for the Cleveland Harbor in 2016 and its related "Open letter to Lake Erie Stakeholders." The Port agrees with USACE that it is critical to our region's economy that USACE continue its duty to maintain proper depths in the Cleveland Harbor navigation channel, as maritime commerce is an essential interest of the Port. The Port disputes, however, USACE's plan, including the proposal for open lake disposal of the dredged sediments, because it is in contravention of state and federal law and it unnecessarily imperils the maintenance of commercial navigation. This letter provides the Port's comments on the Public Notice and constitutes the Port's request for a public hearing.

As USACE acknowledges in the Public Notice, in 2015 Ohio EPA refused to grant Section 401 water quality certification for open-lake placement of dredged sediments. Further, the United States District Court for the Northern District of Ohio (Case No. 1:15-CV-679) granted Ohio EPA's motion for an injunction preventing open lake disposal, and ordered USACE to place the dredged sediments in confined disposal facilities (CDFs) in 2015. Although the sediment quality has not improved, USACE again improperly attempts to proceed with open lake disposal for sediments that have not met Ohio's standards for water quality. The Port strongly disagrees with USACE's claim in the Public Notice that sediment sampling in 2014 and 2015 demonstrate that the sediments are not toxic and that open lake disposal would not lead to any unacceptable adverse effects to the aquatic system. The Port supports the State of Ohio's analysis of the 2014 and 2015 data, and recognizes that the State and USACE must work in partnership and agreement to provide protection of human health and the environment.

USACE's selection of open lake disposal for the Cleveland Harbor sediments is invalid for several reasons, including: (1) the NEPA analysis upon which it is based is arbitrary and capricious; (2) USACE's selection of open lake disposal is based on an invalid Federal Standard determination and (3) the decision to proceed with open lake disposal is based on a faulty analysis of data. The Port refers USACE to the Port's April 8, 2014 comments regarding USACE's Finding of No Significant Impact for the proposed open lake disposal (see Exhibit 1 setting forth the Port's support as to why the NEPA analysis was unlawful), and Ohio EPA's December 17, 2014 comments regarding the improper Federal Standard and faulty data analyses. (See Exhibit 2).

Significantly, USACE's proposed open lake disposal plan improperly dismisses a viable local alternative agreed upon by the Port and USACE that includes expanding CDF capacity and upland beneficial use of dredged materials. Since 2013, the Port and USACE have been negotiating an agreement pursuant to Section 217 of the Water Resources Development Act (WRDA) for the proper disposal of the dredged sediments. Pursuant to the Section 217 negotiations, the Port provided a short-term and long-term plan for CDF disposal of the dredged material. The Port demonstrated long-term future capacity in the CDFs, beneficial uses of the dredged material, and methods for dewatering to reduce the volume of materials stored in the CDFs.

The Port has a viable solution for the disposal of contaminated sediments that is in compliance with state and federal laws, and the Port has capacity to manage the sediments in the CDFs in 2016 and beyond.[1] USACE's Lt. Col. Jansen acknowledged that the Section 217 Plan was consistent with the Federal Standard. (See Exhibit 3). Further, Assistant Secretary of the Army Civil Works Jo-Ellen Darcy approved of the Section 217 Plan on October 1, 2014, (see Exhibit 4), and General Peabody published an Implementation Guidance for the 217 Plan on February 4, 2015. (See Exhibit 5). Despite the Port's significant investment in the Section 217 Plan (approximately $5 million since 2010), USACE again in 2016 chooses to ignore the Port's viable alternative.

Instead, USACE has chosen to impose open lake disposal, or, in the alternative, to demand non-federal payments as a condition of maintaining commercial navigation. USACE has repeatedly stated formally that not dredging the Cuyahoga River navigational channel is not an option because it would cause devastating economic impacts.[2] With this attempt to impose open lake disposal again, USACE is persisting in needlessly threatening the viability of the Cleveland Harbor, and continues to contradict USACE's mission and Congressional intent to maintain navigation within Ohio's water quality standards.

The Port is ready to meet with USACE to discuss the proper disposal of the Cleveland Harbor dredged material. The Port remains prepared to partner with USACE and can provide CDF capacity for the

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[1] On November 25, 2015, the United States District Court for the Northern District of Ohio ordered USACE to complete the Administrative Record with all documents that were "available to the agency" at the time of the decisions regarding 2015 dredging were made, including documents regarding the WRDA Section 217 plans and negotiations with the Port . The Port thus expects that USACE will fully consider all of these documents in connection with the 2016 plan and especially regarding any possible deferral of necessary dredging.

[2] *See* USACE 2014 EA/FONSI, at p. 2 of FONSI and p. 8 of EA (ruling out not dredging as a nonviable alternative); *see also*, USACE March 9, 2015 Draft Cleveland Harbor EA/FONSI, at 13 ("Without dredging, the navigation channel would progressively shoal in and eventually impede commercial navigation. Deep-draft commercial navigation would become economically nonviable and gradually cease.") and at 30 ("This could result in less cargo per shipment since commercial vessels would not be able to navigate the shallower channels with full loads. This would have a direct adverse impact to the roughly 15,000 jobs related to commercial shipping in the Cleveland area and ultimately to the cost of goods.").

disposal of Cleveland Harbor dredged sediments. The Port's proposal dating back to 2013 is still a viable solution for the dredged sediment disposal with benefits and low cost to taxpayers.

The Port requests a public hearing on this matter and expects to submit additional documentation in connection with the public hearing.

Please do not hesitate to contact me to discuss any matters in this letter or the attachments.

Sincerely,

William Friedman
President & CEO
Cleveland-Cuyahoga County Port Authority

CC: Honorable Sherrod Brown
Honorable Rob Portman
Representative Marcia Fudge
Representative Bob Gibbs
Representative Marcy Kaptur
Representative Jim Renacci
Representative David Joyce
Representative Tim Ryan
Honorable John Kasich, Governor of Ohio
Craig W. Butler, Director, Ohio EPA

Exhibit 1

PORT CLEVELAND

April 8, 2014

By Electronic and U.S. Mail

U.S. Army Corps of Engineers- Buffalo District
Attn: Environmental Analysis Team
1776 Niagara Street
Buffalo, New York 14207

Re: Draft Environmental Assessment: Cleveland Harbor – Upper Cuyahoga River Federal Navigation Channel dredging and open lake dredged material placement; Cuyahoga County, Ohio

Dear Environmental Analysis Team:

The Cleveland-Cuyahoga County Port Authority (Port) has received notification from the U.S. Army Corps of Engineers (USACE) regarding the release of its Draft Environmental Assessment (Draft EA) and a Finding of No Significant Impact (FONSI) for the proposed placement of dredged material from the Cleveland Harbor – Upper Cuyahoga River Federal Navigation Channel (River) at two open-lake placement areas in Lake Erie. The USACE Draft EA has generated considerable regulatory and local opposition around numerous scientific and policy criticisms. This letter provides the comments of the Port on the Draft EA and FONSI.

Most significantly, the FONSI is invalid under NEPA for failure to consider viable alternatives. The best route forward is for USACE to dredge immediately and place material into existing CDFs in 2014 and expeditiously to complete the agreements under discussion with the Port consistent with the Port's proposal that implements its Strategic Sediment Management Plan.

I. The USACE in its Draft EA failed to consider the highly viable alternative local proposal.

The USACE considered only two alternatives in its draft EA: (1) inaction (i.e. no dredging); and (2) open lake disposal for the dredged material. The draft EA states, "Several beneficial use studies are currently being evaluated- however none had progressed to the point that they are ready for implementation." **This statement in the draft EA is factually inaccurate.** USACE's EA is deficient because it fails to evaluate the Port's viable proposal including the Port's SSMP. [1]

[1] The NEPA deficiencies noted herein also apply to USACE's failure to consider the commonsense proposal to continue disposal in the existing CDFs where sufficient capacity and budget appropriations already exist. This deficiency is greatly underscored by the remaining scientific uncertainty over sampling of material and impacts to the environment in the record.

Cleveland-Cuyahoga County Port Authority
1100 West 9th Street, Suite 300
Cleveland, Ohio 44113
216.241.8004
www.portofcleveland.com

PORT CLEVELAND

On December 3, 2012 the Port sent Buffalo District a proposed dredged material management plan that involved disposing of dredged material in existing CDFs that would be improved by the Port and the implementation of the Port's Sustainable Sediment Management Plan (SSMP). The plan provided for payment of a user fee by the Corps of Engineers under the authority of Section 217 of the Water Resources Development Act of 1996. On July 17, 2013 the Port met with the Vertical Team of the Corps of Engineers (Headquarters, Great Lakes and Ohio River Division and Buffalo District) to discuss the Port proposal and agree on a path-forward for review and approval of the Port plan. The proposal, still under discussion between USACE and the Port, provides a near term and long term plan for accommodating dredge materials for more that 35 years. In addition to utilizing existing CDFs, the SSMP embraces techniques to harvest and repurpose sediment as a commodity thereby further extending the life of the CDFs.

It is difficult to understand how the Port's proposal was not considered in the Draft EA. The SSMP presented by the Port has been a viable alternative under discussion with USACE since before USACE announced it would begin considering open lake placement. The Port has budgeted over $2million through FY 2014 to prepare CDF 12 for receiving dredge material in 2015. An alternative that remains under discussion and is funded cannot be summarily ignored as a matter of law or reasonable public policy. The Port proposal stands as a reasonable alternative that must be considered by USACE in detail under NEPA.

II. The decision of the USACE to ignore the Port's reasonable alternative in its draft EA is arbitrary and capricious and invalidates the draft EA and FONSI.

USACE's draft EA is unlawful in that it evaluates only two alternatives for its annual maintenance dredging of the Cuyahoga River. Under the National Environmental Policy Act (NEPA), USACE is required to "identify and assess the reasonable alternatives" to any proposed actions that could have adverse effects on the environment. 42 U.S.C. 4332(2)(E). The draft EA, however, merely looks at: (1) no action; and (2) open lake disposal for the dredged material.

NEPA has two goals: (1) to force agencies to consider the environmental impacts of their actions and (2) to ensure the public is informed about these impacts. *Vt. Yankee Nuclear Power Corp. v. Natural Res. Def. Council*, 435 U.S. 519, 553 (1978).

To achieve the first goal, "agencies are required to... give full and meaningful consideration to all reasonable alternatives." *Western Watersheds Project v. Rosenkrance*, 2011 WL 39651, *8 (D. Idaho Jan. 5, 2011) (quoting *Te-Moak Tribe of Western Shoshone of Nevada v. U.S. Dep't of the Interior*, 608 F.3d 592, 602 (9th Cir. 2010)). A perfunctory consideration of alternatives will not suffice; NEPA requires that an agency take a "hard look" at all reasonable alternatives. *Flaherty v. Bryson*, 850 F.Supp.2d 38 (D.C.Cir. 2012).

An agency "cannot make informed decisions if it does not consider all relevant information at its disposal. Nor can the public evaluate [an agency's] decisionmaking without being fully informed." *Western Watershed* at *8. This speaks to the purpose of NEPA's second goal; the agency must ensure that the public is fully informed. Therefore, an agency's EA is not complete even if the agency has considered all reasonable alternatives unless the agency includes a meaningful discussion of those alternatives in its EA. "A properly drafted EA must include a discussion of appropriate alternatives to the proposed project." *Davis v. Mineta*, 302 F.3d 1104, 1120 (10th Cir. 2002).

PORT CLEVELAND

As such, the USACE was required under NEPA to include a meaningful analysis of this option in the EA. *Flaherty* at *10 (finding the Bureau of Land Management's EA arbitrary and capricious for failure to consider all reasonable alternatives).

In addition, the Port is in the process of negotiating a Section 217 Agreement with USACE, yet, USACE's EA does not evaluate the disposal management considerations set forth in the proposed Agreement.

USACE does not explore any of these alternatives in myopically focusing on open lake disposal for the Cleveland Harbor sediments, and as such, the EA is unlawful, arbitrary and capricious.

The USACE was in no way obligated to pursue the open lake placement option in 2014 and has, consequently, encountered extensive state and local opposition to its open water disposal plan. It is very difficult to understand why an agency whose mission is to maintain navigation would risk delaying dredging of the Cuyahoga River when viable alternatives to open lake disposal exist.

The Port remains ready and able to meet with USACE at all levels to discuss these matters further. If the USACE merely completes the agreements regarding the viable Port proposal made in January, 2013, Cuyahoga River dredge disposal will be addressed for up to 35 years with benefits and low cost to the community. The Port is ready to partner with the USACE to make this a reality.

Sincerely,

William Friedman
Cleveland-Cuyahoga County Port Authority

cc: Marty Wargo, USACE-Buffalo District
Scott Pickard, USACE-Buffalo District
Tinka Hyde, USEPA-Director, Region 5 Water Division
Christopher Korleski, USEPA-Director, Great Lakes National Program Office
Kenneth Westlake, USEPA-Chief, NEPA Implementation Section
Megan Seymour, USFWS
Kurt Princic, OEPA-NEDO
Joe Loucek, OEPA-NEDO
Ric Queen, OEPA-CDE
Steve Holland, ODNR-Office of Coastal Mgmt.
John Kessler, ODNR-Office of Real Estate

Exhibit 2

Ohio EPA

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

December 17, 2014

RE: Cleveland Harbor Dredging
2015
Permit - Short Term
Correspondence
401 Wetlands
Cuyahoga
DSW401144574

U.S. Army Corps of Engineers - Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
ATTN: Environmental Analysis - Cuyahoga River Dredging
Mr. Eric Hannes

Subject: Comments on Corps Public Notice and Request for Public Hearing
Cleveland Harbor Dredge 2015
Corps Public Notice No. CLEVELAND-15
Ohio EPA ID No. 144574

Mr. Hannes:

Ohio EPA is respectfully submitting the following comments in response to the U.S. Army Corps of Engineers (USACE) Public Notice for "Operation and Maintenance Dredging and Dredged Material Placement Cleveland Harbor Cuyahoga County, Ohio (Cleveland-15)." Attached to these comments are supplemental documents and additional comments.

Over the past year, our respective technical teams have met numerous times and have resolved a number of issues. However, Ohio EPA's analysis of the sediment in the Cuyahoga River indicates that the disposal of that material in Lake Erie would pose an unacceptable risk. Ohio EPA's concerns are summarized below and discussed in further detail in the attached public comments and documents.

Ohio EPA's primary concern is the potential environmental impact to Lake Erie that would occur if the contaminated sediments are disposed of in the lake. Based on the data provided by USACE, the sediments do not meet the technical criteria of the USACE/USEPA co-authored Great Lakes Testing Manual (GLTM) and considering Ohio's Antidegradation Rule, Ohio EPA continues to have strong objections regarding the disposal of sediments from the Cuyahoga River in Lake Erie. This position is supported by the following:

1. Relative to PCBs, USACE's data demonstrates that the sediment from the Cuyahoga River will have an unacceptable impact on the aquatic food web relative to the background sediments in the lake. According to the GLTM, *"Dredged material is considered* ***not*** *to meet the Guidelines when the mean concentration of bioaccumulative contaminant(s) in test organisms exposed to the dredged material is statistically greater than the concentration of these contaminant(s) in test organisms exposed to the disposal site sediments (emphasis in the original)."* It is our understanding that USACE acknowledges this fact, but disagrees that these concerns are relevant or necessarily important in determining if the sediment can be disposed in Lake Erie. We continue to disagree on this point as outlined in the attached.

2. It was expressed by USACE at our meeting in Cleveland November 7, 2014 that virtually all other Ohio harbor dredged material is disposed in Lake Erie. Ohio EPA agrees and has approved of this practice under our authority per the Clean Water Act to provide a water quality certification. For those other harbors, the sediment has been consistently evaluated utilizing the GLTM tiered criteria and found to be suitable to both USACE and Ohio EPA. Unfortunately, consistent sampling has shown that the Cleveland Harbor dredge material still does not meet the standards in accordance with the tiered approach of the GLTM for disposal in Lake Erie.

   Inexplicably to Ohio EPA, USACE deviated from using the GLTM and unilaterally decided to utilize other methods, including the application of the Inland Testing Manual (ITM) and internal draft USACE guidance to approve the material for open lake disposal.

   Ohio EPA has consistently expressed concerns with this approach and believes that USACE's application of the ITM and the internal draft guidance was inappropriate when the GLTM showed the sediment did not meet the established formal federal guidelines for open lake disposal. Further, the GLTM clearly indicates that any testing and evaluations beyond Tier 3 should be coordinated up-front with other partner agencies like Ohio EPA. This coordination is extremely important so that evaluative procedures to be utilized can be consistently developed and agreed to. This did not occur and has contributed to the fundamental disagreement our Agencies have regarding the suitability of Cleveland Harbor dredged sediments. Finally, Ohio EPA believes that critical lines of evidence were not included in USACE's ITM evaluation (as described in the attached technical memo), further calling into question USACE's conclusions supporting open lake disposal.
3. Ohio EPA has consistently expressed our concern that the selected open lake placement area designated CLA-1 (used as a reference site for assessing contamination in the harbor sediments) does not represent background conditions in the lake. The GLTM process for evaluating sediment is to ensure the dredged material is of the same or better quality than the placement area,

which must be representative of the regional background conditions. The area chosen by USACE is a former (pre-CWA) disposal area for dredged material when the Cleveland Harbor sediments were likely much more heavily contaminated. It is important to note that preliminary reports from USACE's recent sampling conducted in 2014 (as described in the attached technical memo) support Ohio EPA's concern that this reference site is contaminated above background. This makes this site inappropriate to use as a reference location.

4. Lake Erie currently has an ongoing impairment of the human health beneficial use due to PCB contamination in fish, as demonstrated by exceedances of Ohio's human health impairment threshold and the existence of fish consumption advisories due to PCBs. Ohio EPA has provided data indicating that fish caught in the vicinity of Cleveland Harbor exceed Ohio's human-health impairment threshold by 10 times the acceptable risk level. Through the USACE sampling and review of the analytical data, USACE has acknowledged that fish exposed to these sediments will have an increase in PCBs in their tissue, further raising the risk level for consumers of these fish. Ohio's Antidegradation Rule states that any new impact from a Bioaccumulative Chemical of Concern (BCC), like PCBs, in the Lake Erie basin constitutes a significant lowering of water quality. As such, an evaluation of any cost effective alternatives that would eliminate the impact must be further evaluated should discharge to the environment be considered. USACE did not provide this alternative analysis in the 2014 WQC. Please see the attached Graph (Figure 1).

5. USACE did not consider anti-degradation rule compliance assistance components Ohio EPA detailed in our October 10, 2014 letter to USACE. Specifically, we indicated that an anti-degradation review pursuant to Ohio EPA's Antidegradation Rule (Ohio Administrative Code 3745-1-05) subsection (F) related to Bioaccumulative Chemicals of Concern (BCC) would have to be included in the 2015 WQC application. Based on USACE Public Notice, this BCC review was not conducted.

6. There have been ongoing discussions between Ohio EPA, USACE, the Port of Cleveland and others through a Dredge Management Task Force regarding management of the dredged material. Over the past year, a number of proposals were developed as alternatives to open-lake placement. Most notably is the "five by 45" plan, which would have greatly reduced potential open lake placement. Based on this Public Notice, this proposal does not look to have been considered as part of the anti-degradation process.

Further, it is our strong opinion that due to the PCB bioaccumulation potential of these sediments and failure to meet the formal federal guidelines for open lake disposal, it is not appropriate for USACE to consider open lake disposal the least cost, environmentally acceptable method as the Federal Standard. As a result, USACE should alternatively place the contaminated sediments in existing Confined Disposal Facilities at USACE's expense. USACE remains adamant that there is no flexibility in the federal standard. USACE has indicated that unless there is a local cost share sponsor who will pay the cost difference between open lake and CDF disposal, USACE is required by law to follow the federal standard which you again believe to be open lake disposal. However, USACE document EEDP-04-8 dated August 1988, titled Environmental Effects of Dredging Technical Notes – Corps of Engineers' Procedures and Policies on Dredging and Dredged Material Disposal (The Federal Standard), which is still an applicable Guidance Document, states the following: *"The Corps' District Engineer has the necessary discretionary authority to develop additional evaluative information requested by the State, which in the District Engineer's opinion, is technically justified and reasonably related to enforcement of the State's water-quality standards. The legislative record for the CWA provides congressional recognition that Federal project costs may be increased in some instances to address reasonable and technically appropriate State water-quality concerns."*

The above information, attached public comments and documents form the basis for Ohio EPA's concerns and objections to USACE's request to dispose of contaminated Cleveland Harbor sediment in Lake Erie. Please be advised that Ohio EPA requests a public hearing on this matter. The Ohio Attorney General will be representing Ohio EPA and will file a formal request for a public hearing.

If you have any immediate questions regarding this letter or the attachment, please do not hesitate to contact me at (330) 963-1258.

Sincerely,

Joe Loucek
Environmental Specialist
401/Wetlands Section

JL/cs

Attachments

cc: Karl Gebhardt, Deputy Director, Water Programs, Ohio EPA
Dale Vitale, Section Chief, Environmental Enforcement Section, Ohio Attorney General's Office
William D. Friedman, President & CEO, Port of Cleveland

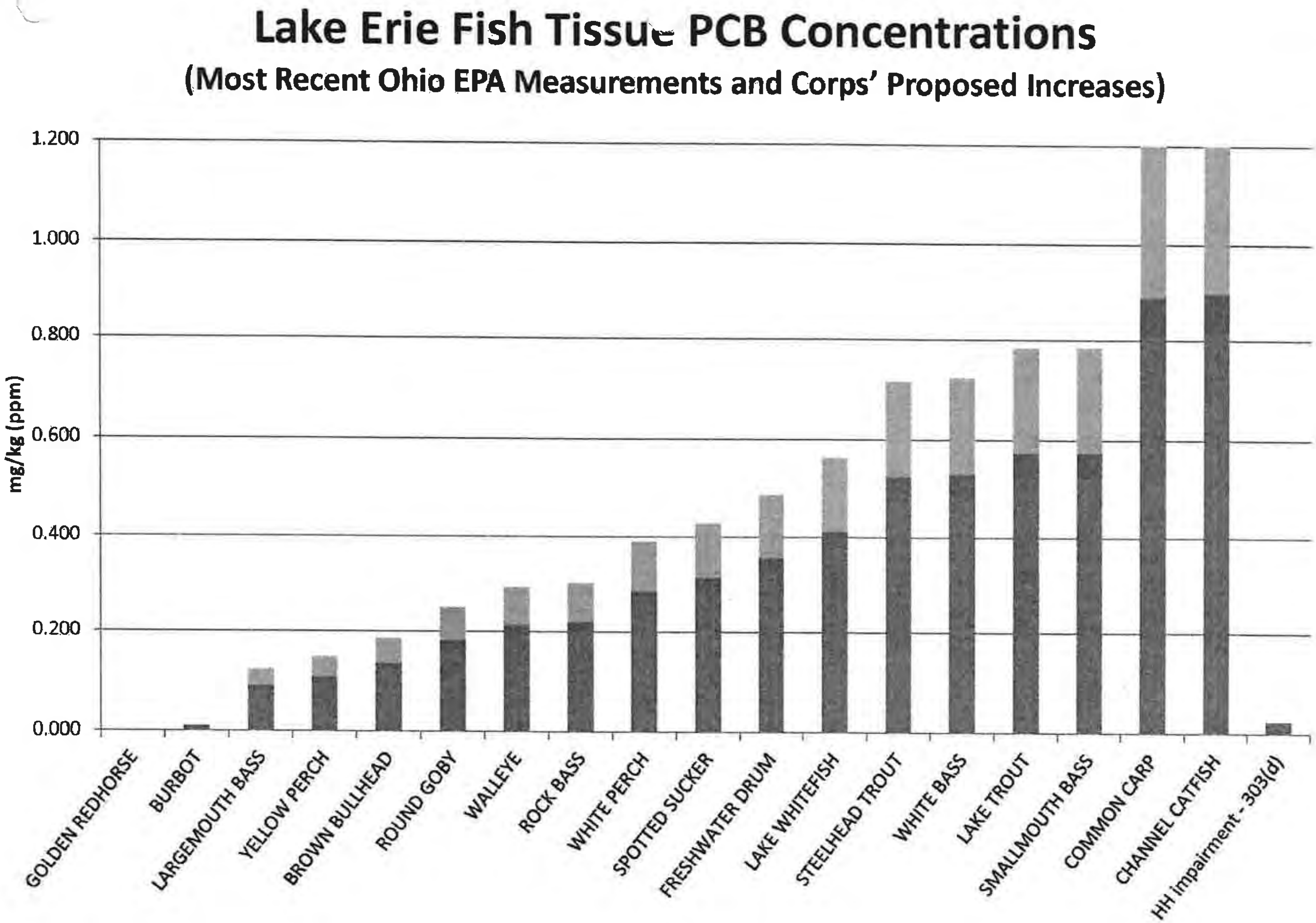

Figure 1: The current PCB levels in Lake Erie fish tissue (based on Ohio EPA's data, 2002-2011) (blue). USACE has proposed (based on USACE's 2013 Cleveland Harbor evaluation) PCB fish tissue increases of roughly 10% above current PCB levels (red). USACE determined that anything less than roughly 50% increase above current PCB levels resulting from open lake placement of dredge material is acceptable (red +green). Ohio EPA does not consider the proposed increase in PCB fish tissue concentrations to be acceptable. The bar on the far right represents Ohio's human health impairment threshold for PCBs in fish tissue for the Lake Erie basin. This represents the PCB fish tissue concentration which, under Federal law, Ohio considers to be protective of human health.

Lake Erie

Friday, November 14, 2014

Fish tissue summary for: Cleveland Harbor discussion

Data filters: Lake Er* 2002 to 2011

Species	Sample Size	As	Cd	Pb	Hg	Se	PCBs
RAINBOW TROUT	9	0.040	0.001	0.009	0.120	0.262	0.477
BURBOT	15	0.000	0.000	0.000	0.124	0.000	0.008
CHANNEL CATFISH	47	0.069	0.002	0.027	0.081	0.217	0.816
COMMON CARP	40	0.074	0.011	0.009	0.165	0.186	0.809
FRESHWATER DRUM	57	0.125	0.005	0.010	0.174	0.302	0.325
GOLDEN REDHORSE	1	0.000	0.000	0.000	0.276	0.000	0.000
LAKE TROUT	19	0.000	0.000	0.000	0.079	0.000	0.522
BROWN BULLHEAD	4	0.000	0.000	0.000	0.270	0.000	0.124
LARGEMOUTH BASS	16	0.000	0.000	0.000	0.174	0.000	0.082
YELLOW PERCH	73	0.020	0.003	0.031	0.077	0.294	0.099
ROCK BASS	18	0.000	0.000	0.000	0.186	0.000	0.201
ROUND GOBY	18	0.000	0.000	0.000	0.040	0.000	0.166
SMALLMOUTH BASS	76	0.184	0.001	0.019	0.219	0.469	0.522
SPOTTED SUCKER	2	0.000	0.000	0.000	0.034	0.000	0.285
WALLEYE	72	0.046	0.002	0.018	0.177	0.265	0.195
WHITE BASS	45	0.085	0.002	0.028	0.205	0.501	0.482
WHITE PERCH	36	0.089	0.003	0.028	0.085	0.762	0.259
LAKE WHITEFISH	31	0.127	0.001	0.010	0.029	0.371	0.375

Total samples 579

Non-detect handling:
Metals assigned 1/2 reporting limit.
PCBs assigned 1/2 reporting limit for any Aroclors detected in any samples of a given species. Assigned zero if Aroclor not detected in any samples of that species.
PCBs reported as the sum of 7 Aroclors (1016, 1221, 1232, 1242, 1248, 1254, 1260)

Lake Erie

Friday, November 14, 2014

Fish Tissue data for **Cleveland Harbor discussion**

Data filters: Lake Er* 2002 to 2011

Year	Sampl	Site	Species	As	Cd	Pb	Hg	Se	PCBs
2008	465	Lake Erie, Off Wildwood Park	BROWN BULLHEAD	0.000	0.000	0.000	0.079	0.00(	0.093
2008	464	Lake Erie, Off Wildwood Park	BROWN BULLHEAD	0.000	0.000	0.000	0.064	0.00(	0.239
2005	257	Lake Erie West Harbor	BROWN BULLHEAD	0.000	0.000	0.000	0.825	0.00(	0.093
2005	267	Lake Erie off Wildwood	BROWN BULLHEAD	0.000	0.000	0.000	0.110	0.00(	0.071
2004	687	rpt_FCA_MetalsPCBs_SiteList: Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.159	0.00(	0.010
2004	693	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.092	0.00(	0.014
2004	692	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.187	0.00(	0.005
2004	691	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.149	0.00(	0.010
2004	690	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.136	0.00(	0.005
2004	689	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.093	0.00(	0.005
2004	688	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.082	0.00(	0.005
2004	686	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.100	0.00(	0.005
2004	685	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.140	0.00(	0.005
2004	684	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.097	0.00(	0.024
2004	683	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.128	0.00(	0.005
2004	682	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.110	0.00(	0.005
2004	681	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.167	0.00(	0.005
2004	680	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.110	0.00(	0.005
2004	679	Lake Erie - Town of Ripley	BURBOT	0.000	0.000	0.000	0.106	0.00(	0.005
2006	340	Lake Erie - Perry Grid 1310 CRN 583	CHANNEL CATFISH	0.019	0.005	0.019	0.045	0.18(	0.362
2005	176	Lake Erie - Grid 896	CHANNEL CATFISH	0.020	0.005	0.070	0.045	0.23:	1.124
2005	168	Lake Erie - Grid 898	CHANNEL CATFISH	0.018	0.005	0.018	0.049	0.20!	0.861
2005	172	Lake Erie - Grid 970	CHANNEL CATFISH	0.019	0.004	0.046	0.065	0.16(	1.436
2005	171	Lake Erie - Grid 985	CHANNEL CATFISH	0.020	0.004	0.020	0.049	0.20(	0.790
2005	179	Lake Erie - Grid 1035	CHANNEL CATFISH	0.019	0.002	0.053	0.066	0.21:	0.542
2005	175	Lake Erie - Grid 911	CHANNEL CATFISH	0.019	0.002	0.182	0.049	0.21:	0.622
2005	167	Lake Erie - Grid 953	CHANNEL CATFISH	0.020	0.008	0.020	0.077	0.20	1.314
2005	180	Lake Erie - Grid 1017	CHANNEL CATFISH	0.020	0.002	0.020	0.044	0.17!	0.410
2006	339	Lake Erie - Perry Grid 1310 CRN 583	CHANNEL CATFISH	0.019	0.004	0.019	0.130	0.21!	1.133
2010	388	Lake Erie Grid 1097	CHANNEL CATFISH	0.246	0.002	0.020	0.063	0.39:	0.757
2010	389	Lake Erie Grid 1103	CHANNEL CATFISH	0.116	0.002	0.020	0.048	0.33!	0.580
2010	398	Lake Erie Grid 1328	CHANNEL CATFISH	0.246	0.004	0.020	0.051	0.36:	0.730
2010	400	Lake Erie Grid 1217	CHANNEL CATFISH	0.151	0.002	0.085	0.042	0.33!	1.117
2006	338	Lake Erie - Perry Grid 1310 CRN 583	CHANNEL CATFISH	0.019	0.002	0.019	0.115	0.23!	0.822
2009	414	Lake Erie - Grid 890	CHANNEL CATFISH	0.161	0.002	0.020	0.045	0.26(	0.205
2009	393	Lake Erie - Grid 980	CHANNEL CATFISH	0.150	0.002	0.020	0.071	0.26!	0.991

2009	389	Lake Erie - Grid 994	CHANNEL CATFISH	0.159	0.002	0.020	0.090	0.26	1.063
2006	297	Lake Erie - Grid 905	CHANNEL CATFISH	0.051	0.002	0.020	0.106	0.21	1.195
2009	404	Lake Erie - Grid 981	CHANNEL CATFISH	0.148	0.002	0.020	0.087	0.34	1.086
2006	286	Lake Erie - Grid 1005	CHANNEL CATFISH	0.038	0.004	0.019	0.159	0.16	2.108
2006	285	Lake Erie - Grid 905	CHANNEL CATFISH	0.020	0.002	0.020	0.147	0.17	1.276
2009	432	Lake Erie - Nearshore off Lorain Harbor - Grid 1073	CHANNEL CATFISH	0.265	0.002	0.020	0.141	0.27	0.791
2009	412	Lake Erie - Grid 970	CHANNEL CATFISH	0.050	0.002	0.053	0.031	0.40	0.620
2005	187	Lake Erie - Grid 1005	CHANNEL CATFISH	0.020	0.002	0.020	0.036	0.13	0.273
2006	341	Lake Erie - Perry Grid 1310 CRN 583	CHANNEL CATFISH	0.020	0.002	0.020	0.022	0.18	0.334
2006	276	Lake Erie - Grid 905	CHANNEL CATFISH	0.019	0.004	0.019	0.061	0.17	1.167
2010	401	Lake Erie Grid 1280	CHANNEL CATFISH	0.257	0.002	0.155	0.077	0.37	1.092
2009	433	Lake Erie - Nearshore off Lorain Harbor - Grid 1058	CHANNEL CATFISH	0.129	0.002	0.020	0.104	0.34	0.402
2009	434	Lake Erie - NW Ashtabula 1394, nearshore NW Conneaut 1439	CHANNEL CATFISH	0.171	0.002	0.041	0.045	0.59	0.229
2009	435	Lake Erie - Nearshore, NW Ashtabula Harbor - Grid 1395	CHANNEL CATFISH	0.157	0.002	0.020	0.062	0.52	0.439
2005	189	Lake Erie - Grid 1031	CHANNEL CATFISH	0.020	0.002	0.020	0.028	0.30	0.510
2009	410	Lake Erie - Grid 952	CHANNEL CATFISH	0.050	0.002	0.020	0.034	0.32	0.269
2011	336	Lake Erie Grid 918	CHANNEL CATFISH	0.130	0.002	0.020	0.181	0.31	1.460
2011	327	Lake Erie Grid 970	CHANNEL CATFISH	0.091	0.002	0.020	0.043	0.29	0.648
2011	335	Lake Erie Grid 981	CHANNEL CATFISH	0.101	0.002	0.020	0.053	0.29	0.608
2011	340	Lake Erie Grid 890	CHANNEL CATFISH	0.086	0.002	0.020	0.079	0.31	0.838
2005	270	Lake Erie off Lakewood	COMMON CARP	0.000	0.000	0.000	0.121	0.00	0.856
2006	277	Lake Erie - Grid 801	COMMON CARP	0.019	0.076	0.041	0.193	0.38	0.975
2008	469	Lake Erie, Off Lakewood	COMMON CARP	0.000	0.000	0.000	0.055	0.00	0.075
2009	416	Lake Erie - Grid 890	COMMON CARP	0.191	0.004	0.020	0.055	0.65	0.130
2006	278	Lake Erie - Grid 904	COMMON CARP	0.046	0.053	0.020	0.087	0.35	1.477
2008	456	Lake Erie, Cleveland Harbor East	COMMON CARP	0.000	0.000	0.000	0.158	0.00	0.655
2011	322	Lake Erie Grid 953	COMMON CARP	0.265	0.035	0.020	0.179	0.70	0.682
2009	392	Lake Erie - Grid 989	COMMON CARP	0.396	0.048	0.020	0.117	0.67	0.847
2005	266	Lake Erie off Wildwood	COMMON CARP	0.000	0.000	0.000	0.169	0.00	0.090
2008	452	Lake Erie, Cleveland Harbor West	COMMON CARP	0.000	0.000	0.000	0.111	0.00	1.380
2005	263	Lake Erie Eastlake	COMMON CARP	0.000	0.000	0.000	0.290	0.00	0.050
2006	299	Lake Erie - Grid 905	COMMON CARP	0.041	0.030	0.019	0.106	0.33	0.795
2005	256	Lake Erie West Harbor	COMMON CARP	0.000	0.000	0.000	0.258	0.00	0.112
2011	326	Lake Erie Grid 970	COMMON CARP	0.407	0.064	0.020	0.087	0.96	1.380
2009	397	Lake Erie - Grid 981	COMMON CARP	0.665	0.008	0.020	0.111	0.59	0.432
2011	337	Lake Erie Grid 890	COMMON CARP	0.264	0.006	0.067	0.152	0.79	0.259
2009	398	Lake Erie - Grid 980	COMMON CARP	0.228	0.010	0.020	0.134	0.70	0.559

2008	460	Lake Erie, Off Eastlake	COMMON CARP	0.000	0.000	0.000	0.193	0.00	0.186
2011	343	Lake Erie Grid 918	COMMON CARP	0.427	0.112	0.069	0.223	0.92	2.406
2005	260	Lake Erie East Harbor	COMMON CARP	0.000	0.000	0.000	0.294	0.00	2.960
2006	289	Lake Erie - Grid 1005	COMMON CARP	0.020	0.009	0.020	0.120	0.35	0.674
2005	258	Lake Erie West Harbor	FRESHWATER DRUM	0.000	0.000	0.000	0.818	0.00	0.626
2005	261	Lake Erie East Harbor	FRESHWATER DRUM	0.000	0.000	0.000	0.353	0.00	0.243
2005	265	Lake Erie Eastlake	FRESHWATER DRUM	0.000	0.000	0.000	0.169	0.00	0.143
2009	436	Lake Erie - Nearshore off Lorain Harbor - Grid 1073	FRESHWATER DRUM	0.244	0.010	0.020	0.216	0.70	0.187
2009	437	Lake Erie - Nearshore off Lorain Harbor - Grid 1073	FRESHWATER DRUM	0.312	0.004	0.020	0.155	0.85	0.199
2005	269	Lake Erie off Wildwood	FRESHWATER DRUM	0.000	0.000	0.000	0.385	0.00	0.920
2006	287	Lake Erie - Grid 1005	FRESHWATER DRUM	0.019	0.010	0.019	0.184	0.28	0.231
2011	347	Lake Erie Grid 890	FRESHWATER DRUM	0.424	0.011	0.020	0.084	0.65	0.534
2006	326	Lake Erie - Cleveland Grid 1229 CRN 18a	FRESHWATER DRUM	0.018	0.010	0.018	0.124	0.39	0.622
2009	390	Lake Erie - Grid 989	FRESHWATER DRUM	0.542	0.010	0.020	0.072	0.56	0.503
2011	346	Lake Erie Grid 918	FRESHWATER DRUM	0.411	0.006	0.020	0.053	0.63	0.513
2006	298	Lake Erie - Grid 905	FRESHWATER DRUM	0.097	0.005	0.020	0.086	0.26	0.444
2011	330	Lake Erie Grid 980	FRESHWATER DRUM	0.253	0.007	0.020	0.081	1.07	0.316
2009	403	Lake Erie - Grid 981	FRESHWATER DRUM	0.158	0.008	0.020	0.227	0.61	0.295
2005	272	Lake Erie off Lakewood	FRESHWATER DRUM	0.000	0.000	0.000	0.118	0.00	0.084
2009	409	Lake Erie - Grid 952	FRESHWATER DRUM	0.595	0.006	0.020	0.102	0.50	0.510
2006	282	Lake Erie - Grid 804	FRESHWATER DRUM	0.019	0.016	0.019	0.088	0.36	0.498
2011	331	Lake Erie Grid 981	FRESHWATER DRUM	0.246	0.008	0.020	0.087	1.02	0.326
2006	279	Lake Erie - Grid 906	FRESHWATER DRUM	0.020	0.009	0.020	0.061	0.45	0.198
2009	417	Lake Erie - Grid 890	FRESHWATER DRUM	0.260	0.033	0.020	0.098	0.78	0.609
2009	420	Lake Erie - Grid 918	FRESHWATER DRUM	0.195	0.022	0.061	0.120	0.75	0.193
2009	402	Lake Erie - Grid 980	FRESHWATER DRUM	0.511	0.006	0.020	0.058	0.77	0.372
2004	779	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.090	0.00	0.171
2009	438	Lake Erie - Nearshore, W of Cleveland Harbor - Grid 1158	FRESHWATER DRUM	0.116	0.007	0.020	0.049	0.92	0.231
2004	783	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.102	0.00	0.233
2009	439	Lake Erie - Nearshore, W of Cleveland Harbor - Grid 1158	FRESHWATER DRUM	0.670	0.005	0.020	0.041	0.75	0.439
2006	329	Lake Erie - Cleveland Grid 1229 CRN 32b	FRESHWATER DRUM	0.079	0.019	0.020	0.159	0.30	0.478
2004	782	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.176	0.00	0.187
2004	781	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.278	0.00	0.179
2004	780	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.181	0.00	0.113
2006	328	Lake Erie - Cleveland Grid 1229 CRN 17b	FRESHWATER DRUM	0.043	0.009	0.019	0.067	0.43	0.275
2006	327	Lake Erie - Cleveland Grid 1229 CRN 18a, 36a	FRESHWATER DRUM	0.084	0.018	0.020	0.079	0.35	0.398
2008	468	Lake Erie, Off Lakewood	FRESHWATER DRUM	0.000	0.000	0.000	0.059	0.00	0.465

2004	784	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.110	0.00(	0.351
2004	729	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.086	0.00(	0.222
2010	391	Lake Erie Grid 1346	FRESHWATER DRUM	0.166	0.006	0.044	0.051	1.34(	0.252
2010	392	Lake Erie Grid 1346	FRESHWATER DRUM	0.819	0.010	0.020	0.059	0.74:	0.509
2004	778	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.108	0.00(	0.249
2004	777	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.114	0.00(	0.345
2004	741	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.210	0.00(	0.170
2010	396	Lake Erie Grid 1346	FRESHWATER DRUM	0.588	0.018	0.020	0.068	0.80:	0.279
2010	397	Lake Erie Grid 1346	FRESHWATER DRUM	0.239	0.013	0.020	0.071	0.85(	0.129
2004	730	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.175	0.00(	0.140
2004	740	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.059	0.00(	0.362
2004	738	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.244	0.00(	0.182
2004	739	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.118	0.00(	0.171
2004	728	Lake Erie	FRESHWATER DRUM	0.000	0.000	0.000	0.182	0.00(	0.161
2008	461	Lake Erie, Off Eastlake	GOLDEN REDHORSE	0.000	0.000	0.000	0.276	0.00(	0.000
2004	719	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.040	0.00(	0.302
2004	713	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.044	0.00(	0.276
2004	712	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.086	0.00(	0.563
2004	711	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.106	0.00(	0.778
2004	710	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.061	0.00(	0.507
2004	714	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.132	0.00(	1.007
2004	715	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.095	0.00(	0.554
2004	716	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.062	0.00(	0.349
2004	726	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.118	0.00(	0.627
2004	718	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.090	0.00(	0.592
2004	720	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.042	0.00(	0.194
2004	721	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.085	0.00(	0.440
2004	722	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.102	0.00(	0.659
2004	709	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.033	0.00(	0.303
2004	723	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.083	0.00(	0.796
2004	724	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.094	0.00(	0.494
2004	725	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.079	0.00(	0.702
2004	727	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.078	0.00(	0.354
2004	717	Lake Erie - Dunkirk	LAKE TROUT	0.000	0.000	0.000	0.064	0.00(	0.415
2004	817	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.052	0.00(	0.531
2004	816	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.050	0.00(	0.414
2004	808	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.006	0.00(	0.098
2004	809	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.025	0.00(	0.141
2004	810	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.045	0.00(	0.684
2004	811	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.051	0.00(	1.106

2004	812	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.037	0.00(	0.484
2004	813	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.073	0.00(	0.618
2004	819	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.053	0.00(	0.148
2004	815	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.003	0.00(	0.692
2006	313	Lake Erie - Ashtabula Grid 1327 CRN 1021 , Grid 1337 , CRN 1022	LAKE WHITEFISH	0.089	0.005	0.019	0.043	0.31	0.444
2006	311	Lake Erie - Chagrin Grid 1268 CRN 14b	LAKE WHITEFISH	0.019	0.002	0.019	0.012	0.43	0.074
2004	818	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.047	0.00(	0.758
2004	820	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.038	0.00(	0.634
2004	821	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.003	0.00(	0.469
2004	822	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.040	0.00(	0.376
2006	310	Lake Erie - Chagrin Grid 1268 CRN 14a	LAKE WHITEFISH	0.019	0.002	0.019	0.009	0.42	0.105
2006	312	Lake Erie - Chagrin Grid 1268 CRN 14b	LAKE WHITEFISH	0.019	0.002	0.019	0.009	0.43	0.181
2004	814	Lake Erie - Brocton Shoal	LAKE WHITEFISH	0.000	0.000	0.000	0.051	0.00(	0.945
2010	411	Lake Erie Grid 1155, 1215	LAKE WHITEFISH	0.537	0.002	0.020	0.009	0.62	0.205
2009	468	Lake Erie - Nearshore Fairport Harbor	LAKE WHITEFISH	0.198	0.002	0.020	0.023	1.03(	0.149
2009	467	Lake Erie - Nearshore Perry - Grid 1329	LAKE WHITEFISH	0.732	0.002	0.020	0.025	0.49	0.363
2010	421	Lake Erie Grid 1158	LAKE WHITEFISH	0.245	0.002	0.020	0.037	0.77	0.225
2010	416	Lake Erie Grid 1063	LAKE WHITEFISH	0.366	0.002	0.020	0.035	0.71	0.144
2010	410	Lake Erie Grid 1216	LAKE WHITEFISH	0.384	0.002	0.020	0.009	0.59	0.145
2009	466	Lake Erie - Nearshore Perry - Grid 1329	LAKE WHITEFISH	0.140	0.002	0.020	0.010	1.20(	0.193
2009	465	Lake Erie - Nearshore Conneaut - Grid 1439	LAKE WHITEFISH	0.171	0.002	0.020	0.029	1.04(	0.208
2009	464	Lake Erie - Offshore Avon - Grid 1107	LAKE WHITEFISH	0.243	0.002	0.020	0.025	1.28(	0.376
2009	461	Lake Erie - Nearshore NNW of Cleveland Harbor - Grid 1157	LAKE WHITEFISH	0.425	0.002	0.020	0.030	0.62	0.304
2009	463	Lake Erie - NNW of Cleveland Harbor - Grid 1155	LAKE WHITEFISH	0.175	0.002	0.020	0.012	0.79(	0.213
2009	462	Lake Erie - Nearshore Avon - Grid 1097	LAKE WHITEFISH	0.161	0.002	0.020	0.029	0.71	0.207
2008	467	Lake Erie, Off Lakewood	LARGEMOUTH BASS	0.000	0.000	0.000	0.138	0.00(	0.050
2008	455	Lake Erie, Cleveland Harbor East	LARGEMOUTH BASS	0.000	0.000	0.000	0.060	0.00(	0.111
2005	259	Lake Erie West Harbor	LARGEMOUTH BASS	0.000	0.000	0.000	0.784	0.00(	0.058
2005	264	Lake Erie Eastlake	LARGEMOUTH BASS	0.000	0.000	0.000	0.553	0.00(	0.033
2008	450	Lake Erie, Cleveland Harbor West	LARGEMOUTH BASS	0.000	0.000	0.000	0.157	0.00(	0.189
2008	458	Lake Erie, Off Eastlake	LARGEMOUTH BASS	0.000	0.000	0.000	0.181	0.00(	0.050
2010	407	Lake Erie Grid 1216	RAINBOW TROUT	0.066	0.002	0.020	0.045	0.61	0.236
2008	462	Lake Erie, Off Wildwood Park	RAINBOW TROUT	0.000	0.000	0.000	0.150	0.00(	0.395
2008	454	Lake Erie, Cleveland Harbor East	RAINBOW TROUT	0.000	0.000	0.000	0.115	0.00(	0.510
2010	408	Lake Erie Grid 1216	RAINBOW TROUT	0.087	0.002	0.020	0.085	0.62(	0.344
2010	412	Lake Erie Grid 1216	RAINBOW TROUT	0.076	0.002	0.020	0.109	0.55	0.346
2010	406	Lake Erie Grid 1216	RAINBOW TROUT	0.128	0.002	0.020	0.067	0.57	0.298
2004	823	Lake Erie at Canadaway Creek	RAINBOW TROUT	0.000	0.000	0.000	0.218	0.00(	0.659

2004	824	Lake Erie at Canadaway Creek	RAINBOW TROUT	0.000	0.000	0.000	0.184	0.00(	1.074
2004	825	Lake Erie at Canadaway Creek	RAINBOW TROUT	0.000	0.000	0.000	0.110	0.00(	0.431
2004	762	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.123	0.00(	0.137
2005	262	Lake Erie East Harbor	ROCK BASS	0.000	0.000	0.000	0.285	0.00(	1.260
2004	769	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.165	0.00(	0.132
2004	764	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.149	0.00(	0.108
2004	765	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.133	0.00(	0.111
2004	766	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.200	0.00(	0.117
2004	767	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.139	0.00(	0.148
2004	768	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.205	0.00(	0.154
2004	763	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.430	0.00(	0.233
2004	776	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.207	0.00(	0.176
2004	771	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.162	0.00(	0.070
2004	772	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.110	0.00(	0.103
2004	773	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.106	0.00(	0.130
2004	774	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.192	0.00(	0.041
2004	775	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.221	0.00(	0.186
2008	451	Lake Erie, Cleveland Harbor West	ROCK BASS	0.000	0.000	0.000	0.148	0.00(	0.319
2004	770	Lake Erie	ROCK BASS	0.000	0.000	0.000	0.142	0.00(	0.121
2008	459	Lake Erie, Off Eastlake	ROCK BASS	0.000	0.000	0.000	0.229	0.00(	0.075
2004	756	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.012	0.00(	0.177
2004	792	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.055	0.00(	0.170
2004	748	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.028	0.00(	0.217
2004	790	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.037	0.00(	0.161
2004	794	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.047	0.00(	0.191
2004	759	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.032	0.00(	0.154
2004	795	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.084	0.00(	0.159
2004	749	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.026	0.00(	0.151
2004	793	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.032	0.00(	0.145
2004	788	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.069	0.00(	0.107
2004	758	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.022	0.00(	0.236
2004	791	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.034	0.00(	0.152
2004	789	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.035	0.00(	0.149
2004	760	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.046	0.00(	0.131
2004	785	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.071	0.00(	0.114
2004	786	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.057	0.00(	0.133
2004	757	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.017	0.00(	0.190
2004	787	Lake Erie	ROUND GOBY	0.000	0.000	0.000	0.021	0.00(	0.252
2004	744	Lake Erie	SMALLMOUTH BASS	0.000	0.000	0.000	0.161	0.00(	0.281
2006	288	Lake Erie - Grid 1005	SMALLMOUTH BASS	0.047	0.002	0.019	0.152	0.33(	0.306

Exhibit 3

From: Jansen, Karl D LTC LRB [redacted]
Sent: Wednesday, July 23, 2014 1:03 PM
To: william.friedman@[redacted] Craig.Butle[redacted]
Subject: Upcoming Cleveland Task Force Meeting (UNCLASSIFIED)
Attachments: CLEVELAND TF AGENDA.docx

Classification: UNCLASSIFIED
Caveats: NONE

Gentlemen,

Looking forward to meeting with all of you again next week in Cleveland!

I've taken a look at the draft agenda items, and I'm offering a slightly different framing of the discussion that best represents, in my perspective, the direction we should be steering the narrative and planning efforts.

In short, we'll be prepared to address all items currently in circulation, but I propose in a manner that leads to productive outputs rather than exacerbating some legacy sticking points.

I'm reaching out to you in hopes of having our organizations meet and discuss these productive outputs on Monday, a day prior to the task force meeting.

I would like to convey, in clear terms, that USACE is fully supportive of beneficial uses of dredged material; further, that the Buffalo District aims to demonstrate meaningful leadership in this field when it comes to supporting pioneering efforts to implement long-term sustainable and predictable dredged material management plans underpinned by beneficial re-use.

To me, the 2016 and beyond vision is to achieve 100% beneficial re-use of Cleveland's dredged material, with 2015 serving as a bridge to that goal. The execution of the 217 agreement is decisive to this vision, while remaining consistent with the Federal Standard.

We all understand that each of our organizations operate within constraints- I think we will be best served in the end if we can transcend from some of our differences, respect the constraints / jurisdictions we have, and move forward with some creative problem solving that results in a Win - Win - Win. I've invested considerable time with my organization to embrace this vision and the opportunity that comes with it.

Please let me know if you're willing to team with us in this regard. The proposed agenda is attached and included below.

Sincerely,
Karl Jansen

****

THEME: Unified path to predictable and sustainable management of Cleveland's dredged material
I. 2016 and Beyond Vision: Pioneers for Maximizing Beneficial Re-Use of Dredged Materials
a. Where we'd like to be in 2016
b. Case studies: Erie Pier and Green Bay projects
c. Cleveland Opportunities: 2011 ERDC Report Re-Cap

II. 2015 Bridging Strategy: What we need to do and how we can do it

PLAINTIFFS' JOINT
Exhibit F-3

a. Dredging requirements
b. CDF storage assessments
c. Array of simultaneous placement alternatives

III. 2015 Planning Factors: Key actions, limitations, and constraints
a. 217 Agreement - Status and future coordination
b. Consistency with the Federal Standard - 07JUL legal meeting re-cap
c. 2015 Water Quality Certification approach - 11JUL technical meeting re-cap
d. Funding - State capitol $, In-kind credit opportunities, UEPA

IV. Contingency Planning
a. CDF Space for contaminated sediment
b. Long-term viability of 217 agreement

****

LTC Karl Jansen, P.E., PMP
Commander & District Engineer
Buffalo District
U.S. Army Corps of Engineers
Office: [redacted]
Mobile: [redacted]

Classification: UNCLASSIFIED
Caveats: NONE

THEME: Unified path to predictable and sustainable management of Cleveland's dredged material

I. 2016 and Beyond Vision: Pioneers for Maximizing Beneficial Re-Use of Dredged Materials
   a. Where we'd like to be in 2016
   b. Case studies: Erie Pier and Green Bay projects
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   d. Funding – State capitol $, In-kind credit opportunities, UEPA

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   a. CDF Space for contaminated sediment
   b. Long-term viability of 217 agreement

Exhibit 4

DEPARTMENT OF THE ARMY
OFFICE OF THE ASSISTANT SECRETARY
CIVIL WORKS
108 ARMY PENTAGON
WASHINGTON DC 20310-0108

OCT - 1 2014

MEMORANDUM FOR DEPUTY COMMANDING GENERAL FOR CIVIL AND EMERGENCY OPERATIONS

SUBJECT: Cleveland Harbor, Ohio, Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014)

This responds to the July 11, 2014 memorandum from the Director of Civil Works, requesting my review and approval of the Decision Document and Environmental Assessment for short-term dredged material management at Cleveland Harbor, Ohio. These documents serve as the basis for developing an agreement with non-Federal interests pursuant to section 217(d) of the Water Resources Development Act (WRDA) of 1996, as amended by section 2005 of WRDA 2007, to secure 1,000,000 cubic yards of new confined disposal capacity to cover an immediate need at Cleveland Harbor. This is an exception to Army policy that any approved dredged material management plan (DMMP) have a duration of at least 20 years. This exception is intended to have a narrow and short-term focus, which is to provide an emergency interim plan for a period of 4 years, while a longer term DMMP that meets Army policy is pursued with the state of Ohio.

The Decision Document recommends a least cost plan advanced by the Cleveland-Cuyahoga County Port Authority (Port) where the Port would fully fund design and construction of an expansion to confined disposal facility (CDF) number 12 to an elevation of up to +35 feet low water datum (LWD) and operate and maintain the site at a total present worth cost of $31,350,000 (as compared to a Federal Base Plan present worth cost of $39,890,000). The Port, as facility owner-operator, would recover its capital investment, plus a fixed reasonable rate-of-return on that capital investment, by charging the U.S. Army Corps of Engineers (Corps), and any other CDF users, a tipping fee for disposal of dredged material. The Port proposes further, that the tipping fee for the Corps only, be fixed for a period of two years at a rate currently estimated to be about $11.50 per cubic yard (cy), 19-percent less than the unit cost associated with the Corps Federal Base Plan of $14.16 cy for expansion of three CDF sites (9, 10B and 12) to an elevation of +20 feet LWD. Thereafter, the tipping fee would be determined based on the Government's audit of the Port's actual cost to construct the expanded CDF 12.

The Decision Document notes that the Port will initially accept significant risks by charging a fixed tipping fee, as opposed to audited actual costs, but in return, the Port expects to benefit from any differences if actual costs are lower than the fixed tipping fee charge. If after two years, the audited actual costs incurred are lower than predicted, a renegotiated tipping fee charge to the Corps would be reduced. Conversely, if the audited actual costs incurred are higher than predicted, a renegotiated tipping fee would be increased. However, in no case will the tipping fee exceed the estimated unit cost associated with the Corps Base Plan of $14.16 cy as described in the Decision Document. It is important to note that while section 217 allows for credit to the non-federal entity for construction, in this case the Port and the State of Ohio are in agreement with the Corps that any such credit eligibility will be waived in perpetuity in light of the Port's recovery of tipping fees as the credit for the Port's and the State's investment. Finally, the report notes that this proposal provides incentives for the CDF owner-operator (Port) to pursue efficiencies and cost controls during project implementation that could result in a greater rate-of-return on their investment and savings to the Federal government. This would be accomplished through additional evaluations of dewatering activities, geotechnical explorations and sediment characterization by the Port to reach the most economical approach to the final design.

My office has reviewed the Cleveland Harbor Decision Document and the supporting documentation submitted by the Corps and has determined that this information is sufficient to allow an exception to the Army's standard DMMP policy and to recommend the Port's interim short term DMMP, subject to several conditions. The first is that the memorandum of agreement (MOA) include wording that explicitly reflects the agreement between the parties that the tipping fees charged by the Port will serve as the sole credit for construction by the Port under section 217. Second, the MOA must address the fact that open lake disposal is currently unlikely to be accepted as a method to dispose of 80 percent of the dredged material in any new proposed 20-year DMMP. Third, the Corps and the Port must agree quickly upon a path forward to formulate a new 20-year DMMP that can realistically be implemented within the four years that this temporary interim DMMP is in place. Subject to these conditions, I approve the subject Decision Document as the basis for securing the additional short-term confined dredged material disposal capacity that is needed as an emergency measure to maintain the viability of commercial navigation at Cleveland Harbor and as a requirement for executing an agreement between the Port and the Corps. The Corps should proceed with the development and negotiation of an agreement with non-Federal interests that stipulates the above conditions, pursuant to section 217(d) of the WRDA of 1996, as amended by section 2005 of WRDA 2007, at the earliest opportunity. The Corps will then submit the negotiated agreement to my office for review and approval.

Jo-Ellen Darcy
Assistant Secretary of the Army
(Civil Works)

Exhibit 5

DEPARTMENT OF THE ARMY
U.S. ARMY CORPS OF ENGINEERS
441 G STREET, NW
WASHINGTON, DC 20314-1000

REPLY TO
ATTENTION OF

CECW-ZA

4 February, 2015

MEMORANDUM THRU Commander, Great Lakes and Ohio River Division

FOR Commander, Buffalo District

SUBJECT: Implementation Guidance for the Cleveland Harbor, Ohio, Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014)

1. References:

a. Memorandum, Department of the Army, ASA(CW), 1 Oct 14, subject: Cleveland Harbor, Ohio, Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014) (Encl 1).

b. Memorandum, HQ, USACE, DCW, 3 Oct 14, subject: Cleveland Harbor Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014) (Encl 2).

2. By Reference 1.a, the Assistant Secretary of the Army (Civil Works) (ASA(CW)) approved the Cleveland Harbor, Ohio, Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014). The ASA(CW) memorandum also directed the U.S. Army Corps of Engineers (Corps) to proceed with the development and negotiation of an agreement with the Cleveland-Cuyahoga County Port Authority (Port) to carry out the interim dredged material management plan recommended in the decision document, pursuant to Section 217(d) of the Water Resources Development Act (WRDA) of 1996, as amended by Section 2005 of WRDA 2007. The purpose of the interim dredged material management plan (DMMP) and the agreement is to secure additional short-term confined dredged material placement capacity in order to maintain the viability of commercial navigation at Cleveland Harbor.

3. The ASA(CW) approved the interim DMMP and directed negotiation of the 217 agreement subject to certain conditions, including that:

a. The agreement must explicitly reflect that tipping fees paid to the Port will serve as the sole credit for construction by the Port under Section 217;

b. The agreement must address the potential that open lake placement of the dredged material may not be accepted as part of a 20-year dredged material management plan; and;

c. The Corps and the Port must agree quickly on a path forward to formulate a 20-year plan that can be realistically implemented within the four years that the interim DMMP is in place.

4. To address the near term need for confined placement capacity for material that is unsuitable for open water placement, the Buffalo District shall expeditiously engage the Port in negotiations for a Section 217(d) agreement for those materials. The agreement must specifically address all three conditions required by Reference 1.a.

a. The agreement shall acknowledge that tipping fees charged by the Port shall serve as the sole credit for construction by the Port under Section 217. In other words, the Port's upfront investment cost in expansion of the placement site will be paid back solely through tipping fees paid under the agreement pursuant to Section 217(d), and not otherwise reimbursed or credited.

b. The agreement shall address the potential that open lake placement of dredged material may not be acceptable to the state of Ohio or other parties as part of a 20 year dredged material management plan developed and approved by the Corps, even if that alternative meets the federal standard, and the agreement shall address the impacts of that non-acceptance. Specifically, the agreement shall clearly state that in order for dredged material to be placed in the Port's facility, where the district engineer has determined under the federal standard that dredged material is suitable for placement in the open lake or at some other alternative location for a lesser cost, non-federal interests shall pay any portion of the negotiated tipping fee for placement in the Port's facility that exceeds the lesser cost of open lake or other placement.

c. As indicated by the third condition of ASA(CW) approval, the approval of the Short Term Decision Document and negotiation of a Section 217(d) agreement is intended to be an interim measure to address the more immediate need for confined placement capacity for material that may not be placed in the open water. That interim measure may also become an integral part of the long term plan to manage material that must be confined. In order to address the long term management needs of the Cleveland Harbor, Ohio federal navigation project, and as required by the third condition in the ASA(CW) memorandum, the Buffalo District must immediately take steps to comply with Appendix E, paragraph E-15, of ER 1105-2-100 (22 April 2000), which requires a preliminary assessment to document the continued viability of the Cleveland

CECW-ZA
SUBJECT: Implementation Guidance for the Cleveland Harbor, Ohio, Decision Document and Environmental Assessment for Short-Term Dredged Material Management (June 2014)

Harbor project and the availability of dredged material placement capacity sufficient to accommodate 20 years of maintenance dredging. If the preliminary assessment determines that there is not sufficient capacity to accommodate maintenance dredging for the next 20 years, then a dredged material management study shall be performed as soon as possible. If a study is necessary, the Port must actively engage in building local consensus for a management plan that can be implemented before capacity for material unsuitable for open lake placement is exhausted. Placement of dredged material into the confined site under the Section 217 agreement shall not commence until the preliminary assessment is complete and the district has developed a scope of work, cost estimate, and schedule for completing a dredged material management plan that provides at least 20 years of additional capacity if one is necessary.

5. Finally, it warrants noting that the ASA(CW) approval of the interim DMMP and of the Corps proceeding with negotiation of the Section 217(d) Agreement will only address the dredged material management needs of the Cleveland Harbor project starting in 2016. As the Buffalo District proceeds to negotiate the Section 217(d) Agreement and completes the Preliminary Assessment, the district also shall work cooperatively with the Port and other interested parties to develop a plan for the placement of dredged material at the Cleveland Harbor project in 2015. That plan also must be consistent with the above guidance, including that any material determined to be suitable by the district for open lake placement may be placed in an alternate site only if the difference in cost of that alternate site above open lake placement is paid by non-federal interests. Note that a separate memorandum of agreement will be necessary to accept non-federal funds to accomplish the 2015 placement plan. In all cases, any site proposed for confined placement in 2015 shall comply with all relevant Corps engineering and other standards necessary to ensure the safe and reliable placement of material.

6. The authority to approve the Section 217(d) Agreement is with the ASA(CW). After review and concurrence by HQUSACE, the agreement will be submitted to her office for review and approval.

Building Strong!

2 Encls
1. ASA(CW) Memo, 1 Oct 14
2. DCW Memo, 3 Oct 14

JOHN W. PEABODY
Major General, USA
Deputy Commanding General
for Civil and Emergency Operations

MIKE DEWINE
★ OHIO ATTORNEY GENERAL ★

Environmental Enforcement
Office (614) 466-2766
Fax (614) 644-1926

30 E. Broad Street, 25th Floor
Columbus, OH 43215
www.OhioAttorneyGeneral.gov

December 18, 2015

U.S. Army Corps of Engineers - Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
ATTN: Environmental Analysis – Cuyahoga River Dredging

RE: **Request for Public Hearing pursuant to 33 U.S.C. § 1344 and 33 C.F.R. § 327**
Cleveland Harbor Dredging, 2016; Public Notice No. CLEVELAND-16

To LTC Karl Jansen:

On behalf of the Ohio Environmental Protection Agency ("Ohio EPA"), the Ohio Department of Natural Resources ("ODNR"), and the State of Ohio, the Ohio Attorney General hereby requests a public hearing regarding Public Notice No. CLEVELAND-16. The Ohio Environmental Protection Agency, the Ohio Department of Natural Resources, and the State of Ohio have multiple interests that are adversely affected by the proposed disposal of dredged material and the disposal location selected by the United States Army Corps of Engineers ("the Corps") in Cleveland Harbor.

Ohio EPA is committed to protecting Ohio's environment and the health and safety of the citizens of Ohio. Ohio EPA also recognizes that there is an important need to dredge the Cleveland Harbor and the Cuyahoga River but wants that dredging to be accomplished in a way that is consistent with its mission. The disposal of contaminated sediment from the Cleveland Harbor into Lake Erie would harm Ohio's environment, is likely to be inconsistent with or violate Ohio's water quality standards,[1] and would jeopardize the health of Ohio's citizens. Likewise, a failure or refusal to dredge would harm Ohio's economy and the livelihood of many Ohio residents. Therefore, Ohio's economic and environmental interests are in ensuring that the Cleveland Harbor is dredged and that contaminated dredged material is not placed in Lake Erie.

The Corps stands alone in its position that disposing of contaminated sediment in Lake Erie is environmentally acceptable. For decades, the overwhelming national policy has been to end the practice of open-water disposal of dredged material. In amending the Clean Water Act in 1977, the Senate Committee on Environment and Public Works stated that "Congress intended that [the Clean Water Act] would in its initial implementation end the open water disposal of dredge spoil …." Sen. Rep. No. 95-370. United States Environmental Protection Agency ("U.S. EPA") regulations state that "no discharge of dredged or fill material shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse [environmental] impact." 40 C.F.R. § 230.10. In a September 12, 2013 letter to the Corps, U.S. Fish and Wildlife Service commented that starting an open-Lake disposal regime in Cleveland would rebuff "the regulatory trend … to try and reduce open-lake disposal." Consistent with national policy, the State of Ohio recently enacted a law to prohibit all open-Lake placement of dredged material into Lake Erie by 2020.[2] Ohio Rev. Code § 6111.32.

Despite strong national policy, and Federal and State environmental laws to the contrary, the Corps intends to place contaminated sediment from the Cleveland Harbor in Lake Erie. In

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[1] Ohio EPA is currently reviewing the Corps' application for an Ohio Water Quality Certification. In previously years, however, Ohio EPA determined that open-Lake disposal of sediments from the Cleveland Harbor would violate Ohio's water quality standards.

[2] This prohibition is subject to a few exceptions, such as beneficial use and habitat restoration projects for clean material.

December 2014, the Corps determined that dumping the contaminated sediment from the Cleveland Harbor into Lake Erie was its preferred disposal method (what the Corps claims to be "the Federal Standard"). The Corps believes that its December 2014 determination required it to use open-Lake disposal in 2015 and still requires it to use open-Lake disposal in 2016. However, under Federal law the Corps is prohibited from dumping dredged material into Lake Erie without approval from Ohio EPA in a State Water Quality Certification.

For the 2015 dredging, the Ohio EPA could not issue the desired Water Quality Certification because placing the dredged material from Cleveland Harbor in Lake Erie would violate Ohio water quality standards. As a result, the Corps issued Ohio an ultimatum: either Ohio or another non-Federal entity paid for the Corps' environmental compliance or the Corps refused to dredge. However, because the Water Resources Development Act of 1986 reaffirmed that maintenance dredging of Federal channels shall be at 100% Federal expense, the State of Ohio challenged the Corps' ultimatum in Federal Court as unlawful. 33 U.S.C. § 2211. As phrased best by the District Court in granting the State a preliminary injunction, "[t]he State cannot be blackmailed into contributing to these costs under threat of shutting down what is potentially the most commercially important section of [the harbor]." *Ohio v. U.S. Army Corps of Engineers*, No. 1:15-CV-679, 2015 WL 2341114, at *7 (N.D. Ohio May 12, 2015). Hopefully, the Corps will not give Ohio the same ultimatum this year if Ohio EPA again determines that dumping contaminated sediment in Lake Erie would violate state water quality standards.

The Corps has acknowledged that U.S. EPA regulations require the Corps' preferred disposal method (the Federal Standard) to comply with water quality standards that Ohio sets.[3] Ohio's water quality standards provide that adding persistent carcinogenic toxins into Lake Erie constitutes a "significant lowering of water quality." Ohio Adm.Code 3745-1-05(F). Additionally, Ohio EPA cannot issue a water quality certification if the discharge of dredged material into Lake Erie would cause a predicable increase of persistent toxins in the aquatic food chain. Ohio Adm.Code 3745-32-05. Contrary to Federal and State law, the Corps claims that it, rather than Ohio EPA, determines whether Corps projects comply with Ohio's water quality standards as applied to U.S. EPA's prohibition under 40 C.F.R. § 230.10(b) ("No discharge of dredged…material shall be permitted if it: Causes or contributes … to violations of applicable State water quality standards"). The Corps also claims that adding contaminated sediment—that is documented to contain persistent carcinogenic toxins—to Lake Erie would not violate Ohio's water quality standards, despite the clear prohibition cited above. Additionally, for all other Federal agency projects other than the Corps' projects, the Corps' regulations provide that State Water Quality Certifications "will be considered conclusive with respect to water quality considerations … ." 33 C.F.R. § 320.4. Nevertheless, the Corps asserts that as it relates to its projects, Ohio is not the judge of Ohio water quality standards.

Lake Erie is Ohio's greatest natural resource and its protection has been entrusted to the State of Ohio. The Corps contradicts national policy in its attempt to usurp Ohio's authority regarding water quality standards. The Clean Water Act specifically states that "it is the policy

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[3] Current proposed legislation (Section 106 of House Amendment #1 to H.R. 2029), if enacted, would specifically prohibit the Corps from using Federal funds for open-Lake disposal of dredged material into Ohio's portion of Lake Erie without approval from Ohio EPA. If this legislation is enacted, the public hearing would be an opportunity for testimony regarding its impact on the Corps' proposed project.

of the Congress to recognize, preserve, and protect the primary responsibilities and rights of States to prevent, reduce, and eliminate pollution." 33 U.S.C. § 1251(b).

ODNR shares responsibility with Ohio EPA for protection of our treasured resource, Lake Erie. The Submerged Lands Act states, "ownership of the lands beneath navigable waters within the boundaries of the respective States … and the right and power to manage …said lands …in accordance with applicable State Law …[is] vested in and assigned to the respective States…." 43 U.S.C. §1311. Responsibility for the protection and management of this resource has been given to ODNR. Ohio Rev. Code §§ 1506.02(A), 1506.10. The Coastal Zone Management Act ("CZMA") states, "[t]he Congress finds and declares that it is the national policy … to encourage and assist states to exercise effectively their responsibilities in the coastal zone … ." 33 U.S.C. § 1452. The CZMA requires all Federal agencies, when undertaking a project in a state's coastal zone, to comply to the maximum extent practicable with State Coastal Management Programs. 16 U.S.C. §1456. Ohio's Coastal Management Program states that "Polluted [dredged material] must be disposed … in confined disposal facilities" and requires the disposal of dredged material to comply with Ohio water quality standards in accordance with Ohio Water Quality Certifications. Therefore, both the CZMA and CWA give Ohio the authority to determine what is environmentally safe to put in Ohio's waters, yet the Corps attempts to usurp that power.

The Corps uses past pollution and flawed conclusions to support its claim that putting carcinogenic toxins in Lake Erie is environmentally safe and consistent with Ohio water quality standards. First, the Corps states that the Cleveland Harbor sediment is no more polluted than the proposed Lake Erie disposal location (labeled "CLA-1"). However, the Corps' own test results show that CLA-1 is five times more polluted than other areas surrounding the Cleveland

Harbor.[4] Furthermore, the very reason CLA-1 is polluted in the first place is because the Corps dumped contaminated sediment there 40 years ago. Additionally, Ohio EPA's latest test results demonstrate that the Cleveland Harbor sediment is four to eight times more polluted than Lake Erie background conditions. Therefore, the Corps is attempting to use past pollution that it caused to justify the placement of new pollution.

Second, the Corps has maintained that Cleveland Harbor sediment once placed at CLA-1 will stay at that precise location in Lake Erie. This claim is made in an attempt to substantiate the Corps' proposal to bury its old pollution with new pollution. However, multiple scientific studies and an expert analysis provided to the Corps demonstrate that the Corps' claim that the sediment will stay in place is seriously flawed and ignores decades of research on this very topic.

Based on these concerns, Ohio EPA believes that placing contaminated sediment from Cleveland Harbor into Lake Erie is environmentally unacceptable and would likely violate Ohio's water quality standards. Furthermore, Ohio EPA believes that the Corps' own data suggests that open-Lake disposal may substantially elevate the human health risks of fish consumption in the impacted region of Lake Erie. The resulting negative impacts on Ohio's most valuable resource and the fish and wildlife indigenous to it are in derogation to the responsibility of ODNR to protect those resources for the benefit of the citizens of Ohio. As a result, the State of Ohio's interests are clearly affected by the Corps' proposed action.

Therefore, on behalf of Ohio EPA, ODNR, and the people of the State of Ohio, the Ohio Attorney General requests a public hearing so that it and all interested parties are able to present additional evidence for the Corps' consideration with regard to the dredging of the Cleveland

[4] "Polluted," as used here, refers to a relative contribution of persistent carcinogenic toxins to the aquatic food chain.

Harbor and the disposition of the dredged material in 2016. The State of Ohio thanks the Corps for the opportunity to request this hearing and will continue to work together with the Corps to protect Lake Erie.

Respectfully submitted,

MICHAEL DEWINE
OHIO ATTORNEY GENERAL

David Emerman
DAVID E. EMERMAN (0089348)
Assistant Attorney General

DALE T. VITALE (0021754)
Section Chief,
Environmental Enforcement Section

cc: Craig Butler, Director, Ohio Environmental Protection Agency
James Zehringer, Director, Ohio Department of Natural Resources
Karl Gebhardt, Deputy Director, Water Programs, Ohio EPA
Scudder Mackey, Ph.D., Chief, Office of Coastal Management, ODNR

Section 404 Public Hearing Comments

March 2016

Hannes, Eric LRB

From: Joe Belsito [redacted]
Sent: Tuesday, March 01, 2016 1:54 PM
To: DLL-CELRB-ClevelandDredging
Subject: [EXTERNAL] Dredging Of Lake Erie

Importance: High

I just read the article about dumping the dredged sludge and depositing it in the Lake. I am totally against this. What the heck is wrong with the Corp Of Engineers. You KNOW there are contaminants in the sludge but because of the almighty dollar you prefer to continue to poison the water that people drink. You have the court order and as a citizen I expect that you will honor that order. If you do not than I certainly would be interested in joining any class action suits that will undoubtedly come about. I had cancer twice in my life and do not plan on having it again.

Joe

US Army Corps of Engineers®
Buffalo District
BUILDING STRONG®

U. S. Army Corps of Engineers
Cleveland Harbor Dredged Sediment Public Hearing

March 1, 2016

Would you like to submit a written comment? If so, complete the information below and place this form in the comment box.

Name: Melanie Bidé

Group Affiliation *(if applicable)*: GCC

Comments: What are other lakes – in the Great ~~l~~ Lakes doing with dredging material

City of Cleveland
Frank G. Jackson, Mayor

Department of Public Utilities
1201 Lakeside Avenue
Cleveland, Ohio 44114-1175
216/664-2444 • Fax: 216/664-3454
www.clevelandwater.com

March 10, 2016

LTC Karl Jansen
Buffalo District Commander
U.S., Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207-3199

Dear LTC Jansen:

Consistent with previous communications to both the United States Army Corps of Engineers (USACE) and the Ohio Environmental Protection Agency (Ohio EPA), dated February 17, 2015 and March 11, 2014 respectively, Cleveland Water continues to oppose the USACE plan to dispose dredged material from the Cuyahoga River into the open waters of Lake Erie.

As the drinking water supplier to more than 1.4 million people in Cleveland and 79 surrounding suburbs, Cleveland Water produces high quality water from our four, interconnected treatment plants. The strength and reliability of our system starts with Lake Erie, which provides an excellent, stable source of raw water for our treatment process. As such, we are concerned about any effort that would adversely impact water quality in Lake Erie.

In addition, the effectiveness of our treatment process and plants depends on our strategically placed intakes. Each of the intakes for our four water treatment plants is located three to four miles from the shore to minimize the potential negative effects of pollution. More than 100 years ago, Cleveland Water's intakes were much closer to shore and suffered when the polluted water of the rapidly industrializing Cuyahoga River made its way into the water supply. Rising numbers of cholera and typhoid cases - especially among the young - were only some of the resulting negative impacts. In response, Cleveland Water made the strategic decision to move its intakes farther from shore and the negative effects of this industrial activity. The more pristine and stable water quality conditions closer to the center of the lake has proved to be a vital component in our ability to deliver a reliable supply of safe drinking water. At a cost of tens of millions of dollars (adjusted to 2016 dollars), we moved our intakes away from the river. Now, the USACE wants to bring the river back to our intakes.

As proposed, the USACE plan risks increased treatment costs for Cleveland Water should any of the dredged contaminants reach the intakes. Any degradation in Lake Erie's quality and consistency results in higher treatment chemical dosages which in turn results in higher costs to dispose of the material removed from the water. Depending upon the nature of the contamination, capital costs for new treatment facilities could also prove necessary to maintain the high quality of finished water that Cleveland Water takes pride in delivering to our customers. These costs would ultimately be passed onto Cleveland Water customers.

The USACE's repeated claims that the deposited material will simply sink to the bottom of Lake Erie and stay in place are not supported by existing sampling. The U.S. EPA and Ohio EPA sampling data from the fall of 2015 has shown that deposited material from the CLA-1 deposit site has, in fact, migrated. Additionally, during our periodic maintenance activities, Cleveland Water finds debris has migrated to our intake structures, supporting the idea that material does move along the Lake floor. We question the accuracy of any modeling work that states deposited material does not move.

The safety of water systems across the country is being publicly debated, in no small measure due to harmful algal blooms and lead. Even the remotest possibility that these, or any other, contaminants could enter the water supply creates unnecessary anxiety for our customers and could shake their confidence in the safety of Cleveland Water.

We as a region should be proud of the significant environmental improvements made over the past forty years, including advances in the health of Lake Erie. Open lake disposal of contaminated soils runs counter to that progress, and is an irresponsible policy when other disposal options are available. In light of the above, Cleveland Water continues to object to the USACE policy of open lake disposal, and urges the USACE to work with Ohio EPA to find an alternative solution for disposal of dredged material that does not potentially compromise Cleveland Water's existing treatment process, introduce unnecessary risk to the health of Lake Erie, and allows vital business activity to make continuous use of the navigation channel.

Sincerely,

Robert L. Davis, Director
Department of Public Utilities
City of Cleveland

12650 DETROIT AVENUE • 44107 • 216/521-7580• fax 216/521-1379
Website: www.onelakewood.com

MICHAEL SUMMERS
MAYOR

March 1, 2016

BY EMAIL

Mr. Andrew Kornacki
U.S. Army Corps of Engineers – Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
Andrew.a.kornacki@usace.army.mil

Re: Cleveland Harbor, Cuyahoga County, Ohio – U.S. Army Corps of Engineers Dredge Disposal

Dear Mr. Kornacki,

The City of Lakewood sits immediately upland from the locations in Lake Erie in which the U.S. Army Corps of Engineers (USACE) intends to dispose of dredge material from the Cleveland Harbor and Cuyahoga River. On behalf of the citizens of the City of Lakewood, I am shocked that the USACE has come back to this region again with the same plan for open water disposal in Lake Erie of environmentally concerning sediment from the Cuyahoga River.

Since the exactness in execution of the silt removal cannot be established by the USACE, the proposed dumping of dredged material into Lake Erie is a significant human health and environmental threat to the citizens of the City of Lakewood and the region. The following human health and environmental issues far outweigh the USACE's option to use your proposed easiest method of disposal:

- Protection of drinking water
- Protection of fish species for a healthy lake ecosystem
- Protection of our beaches and lake front for the adults & children who use the lake for enjoyment and a food source
- Prevention of future algae blooms

There are many other options for disposal of the potentially contaminated dredged Cleveland Harbor and Cuyahoga River material so we are greatly saddened and disappointed that the USACE again threatens the economic and healthy viability of this region by suggesting this dredge disposal plan.

The City of Lakewood and its 52,000 citizens depend upon the U.S. Army Corps of Engineers not to take any arbitrary or capricious actions that might create risks of harm to them or any users of Lake Erie.

Respectfully,

Michael P. Summers, Mayor
mike.summers@lakewoodoh.net

cc: Ohio Environmental Protection Agency (by email)
ODNR Coastal Management Office (by email)

Statement from Christopher S. Ronayne, Chairman of the Board of Directors
Cleveland Cuyahoga County Port Authority
U.S. Army Corps of Engineers March 1, 2016 Public Hearing Regarding Cleveland Harbor Dredge Disposal

As public officials, our foremost responsibility at any level of government is the health, safety, and welfare of the citizens we serve. As a division of the United States Army, the Army Corps of Engineers should know and respect that duty to protect more than anybody. As Chairman of the Cleveland Cuyahoga County Port Authority, I and my colleagues on the Board take the health and welfare of citizens and their environment seriously. Given the known presence of PCBs in the Cuyahoga riverbed, the Port of Cleveland has intentionally developed an alternative to the open lake placement of dredged material - a practice that redirects toxins from the aquatic food chain that would otherwise pose a threat to human health.

As the City of Cleveland approaches the 50th anniversary of the Cuyahoga River fire that literally sparked the Clean Water Act, the Port of Cleveland partners in the challenge to keep our river and great lake clean using innovative dredge management practice. Through a combination of interception, removal, de-watering, and re-use of materials where appropriate, The Port of Cleveland has developed a sustainable sediment management system that offers to be a model to other great lakes ports.

We ask for your partnership in supporting this practice as an alternative to what appears to be obstinate behavior and budgetary gamesmanship. By rejecting the full funding proposed in the President's approved budget, challenging local tipping fees, and by threatening not to dredge the upper mile nearest a productive Cleveland mill, you threaten business vitality and moreover human health.

We simply ask for your partnership in promoting a healthy alternative to open lake placement. The technology and markets exist to truly create a 21st century viable and sustainable practice of dredge management on the Great Lakes. The Army Corps should be leading the way on cleaner practices using the Great Lakes Restoration Act as a framework. At the least, we ask for your partnership in promoting a local best practice emerging at The Port of Cleveland with widespread Great Lakes application. The United States Army Corps of Engineers should be a leader in developing strategies to sustain clean water on the Great Lakes and throughout the U.S.

The Corps and the Great Lakes Ports, working together with the US and state EPAs, have the opportunity to promote sustainable practices that may ultimately have global educative and environmental application. Debating levels of PCB in the midst of current water quality challenges throughout Great Lakes states and cities fly in the face of policy reforms taking shape as we speak. Philosophically digging in, dumping, and turning away from new technology in sediment management only endangers the health of citizens we have a foremost duty to partner to protect. And to battle this in court only costs taxpayers a bill they would not have to pay were it not for the lack of partnership. The Cleveland Cuyahoga County Port Authority asks for your partnership in delivering a healthy alternative to open lake placement. At the Port of Cleveland, that practice is now in place. In furtherance of the physical and financial health of Clevelanders and the sustainability of our Great Lakes region we seek your partnership.

STATEMENT FOR THE HEARING RECORD OF CONGRESSWOMAN MARCIA L. FUDGE (OH) FOR THE U.S. ARMY CORPS OF ENGINEERS PUBLIC HEARING ON OPEN-LAKE DUMPING IN LAKE ERIE

Tuesday, March 1, 2016

Good evening, Lieutenant Colonel Jansen, and thank you for allowing me to submit this statement for the hearing record. My name is Congresswoman Marcia L. Fudge, and I again come before you as both the U.S. Representative for the 11th Congressional District of Ohio, and a citizen concerned with the future of our Great Lakes.

It was little more than a year ago that many of us, including citizens from around the region, elected officials and environmental groups, came before the U.S. Army Corps of Engineers (USACE) urging the use of environmentally-friendly alternatives to open-lake dumping of dredged sediment. Yet, neither public outcry nor a U.S. District Court injunction has halted the Corps' plans to continue with open-lake dumping. Since 2014 Ohio EPA has disqualified sediment from the upper river channel for open-lake dumping due to persistent levels of toxins, yet the USACE continues to pursue a practice which flies in the face of responsible environmental stewardship.

Moreover, the USACE recently advised Congressional Appropriations Committees to cut funding for the Cleveland Harbor project from President Obama's request of $9.54 million to $5.94 million, producing a significant shortfall in funding for the 2016 dredging season. After advocating for a $3.6 million decrease to its own budget, the USACE now insists that a non-federal partner provide the extra funding for the alternative disposal of dredged sediment. That view found no support in District Court when an injunction was issued directing the USACE to fulfill its responsibility under the law and place dredged sediment into a confined disposal facility at full federal cost. Given the ongoing legal dispute between the State of Ohio and the Corps, it is irresponsible for the USACE to reduce the budget allocation for the Cleveland Harbor project and threaten to delay the dredging process.

Lake Erie is the primary source of drinking water for more than 11 million people, including nearly 3 million Ohioans. Its waters have long been the lifeblood of the Northeast Ohio region, supporting jobs and recreation. Nearly 18,000 jobs and $1.8 billion in annual economic activity are tied to the approximately 15 million tons of cargo moving through the Port of Cleveland and the Cuyahoga River channel each year. Permitting the disposal of additional PCBs into the Lake would halt the wheels of progress and undermine decades of achievement in water quality improvement.

While I fully support USACE in its mission to maintain navigation channels, there must be conscious, coordinated efforts to minimize the risk that open-lake dumping poses to the millions of people who depend on a healthy lake. It is my hope that the USACE will pursue safe alternatives to open-lake dumping at full federal cost, rather than jeopardize the health, safety, and economic vitality of our region.

Hannes, Eric LRB

From: Jeanette Girosky [redacted]
Sent: Tuesday, March 01, 2016 3:29 PM
To: DLL-CELRB-ClevelandDredging
Subject: [EXTERNAL] Dredging-against

To whom this may concern,

I am against the dumping of the dredged materials into the open lake. At this point, there is still too much disagreement of protocol between the USACE and Ohio EPA to convince me this is a good idea.

I also disagree STRONGLY about ammonia-N being eliminated as a PCOC. The argument that it is ambient and ephemeral is weak. The same argument could be made for phosphorus and look at the havoc that has caused, recently requiring a 40% load reduction across the board.

Microcystis aeruginosa is a species of non-nitrogen fixing cyanobacteria that are common in freshwater systems. Microcystins (MCs) are monocyclic heptapeptides, a group of hepatotoxins, produced by M. aeruginosa. The macronutrient nitrogen (N) can influence growth and toxin production in Microcystis spp. (Vẻzie et. al, 2002) (Gobler and Hawke, 2013). MCs are 14% nitrogen and studies have indicated increased N loading increases cellular microcystin content (Wang et. al, 2009).

I do not feel that the issue of ammonia-N as a nutrient dump, let alone its removal as a pollutant, has been sufficiently addressed.

Sincerely,
Jeanette Girosky
[redacted]

Vézie,C.,Rapala,J., Vaitomaa,J., Seitsonen, J., Sivonen,K. 2002. Effect of Nitrogen and Phosphorus on Growth of Toxic and Nontoxic Microcystis Strains and on Intracellular Microcystin Concentrations.

Harke MJ, Gobler CJ (2013) Global Transcriptional Responses of the Toxic Cyanobacterium,
Microcystis aeruginosa, to Nitrogen Stress, Phosphorus Stress,and Growth on Organic Matter. PLoS ONE 8(7): e69834.
doi:10.1371/journal.pone.006983
Microbial Ecology.Volume 43, Issue 4, pp 443-454

Wang H, Gruden CL, Bridgeman TB, Chaffin JD. Detection and quantification of microcystis spp. and microcystin-LR in western Lake Erie during the summer of 2007. Water science and technology : a journal of the International Association on Water Pollution Research. 2009;60(7):1837.

Joe Roman
President and CEO
Greater Cleveland Partnership

U.S. Army Corps of Engineers
Public Hearing on Cuyahoga River Dredging
March 1, 2016

Good evening Lieutenant Colonel Jansen, U.S. Army Corps of Engineers staff, and public stakeholders. My name is Joe Roman and I am President and CEO of the Greater Cleveland Partnership (GCP). The GCP is the metropolitan chamber of commerce for our region and is the largest business organization in the state. Our mission is to mobilize private-sector leadership, expertise and resources to create jobs and leverage investment to improve the economic vitality of the region. It is through this lens that we view the most recent effort of the Corps to move forward with open-lake disposal of Cuyahoga River sediment.

The greater Cleveland business community recognizes the importance of a healthy Lake Erie. Much of our agenda revolves around what we can do to improve the lake and to encourage greater private waterfront investment by businesses and individuals. To that end, we have engaged federal and state policy-makers to ensure the lake is protected and that there are sufficient resources to restore and preserve this precious asset.

The scientific research is mixed on whether the make-up of the riverbed sediment would negatively impact the water quality of the lake. Open-lake dumping of sediment has the potential to have a devastating impact to the delicate balance in our lake, which is the most fragile of the Great Lakes. Beyond the obvious and important health related concerns, any threat to water quality represents a substantial problem to our economy. It has taken us decades to overcome the stigma of our earlier challenges on related issues. The risks associated with foreseeable dredge-related drinking water problems could be catastrophic for our region.

The long-running disagreement between the Corps and the local community is a threat to commerce along the river. The last segment of the Cuyahoga River is a vital and dynamic part of our local economy. Thousands of jobs depend on it. No place is this more apparent than ArcelorMittal, one of the most productive steel producing facilities in the world. The Corps' choke hold on ArcelorMittal has the potential to impact their 1,900 employees and countless other suppliers and related businesses in our region. The direct and indirect jobs generated from ArcelorMittal are estimated at over 14,000 with an annual payroll of $820 million.

The recent tactics used by the Corps, including the language inserted in the federal omnibus bill, has intensified questioning by the local community regarding the integrity of the agency's work on this extremely important project. Those tactics have specifically heightened local concerns about your claims that dredge material will not negatively impact the quality of the lake.

We call upon Corps leaders to do what is best for our region: Adhere to past practices, dredge the entire river channel and dispose of the material in confined disposal facilities. Thank you.

US Army Corps of Engineers
Buffalo District
BUILDING STRONG®

U. S. Army Corps of Engineers
Cleveland Harbor Dredged Sediment
Public Hearing

March 1, 2016

Would you like to submit a written comment? If so, complete the information below and place this form in the comment box.

Name: ERIN HUBER

Group Affiliation *(if applicable)*: DRINK LOCAL DRINK TAP

Comments: THE ARMY CORPS SPEAKER SAID "WE ARE NOT WORRIED ABOUT THE DREDGE - ITS SAFE" IN ONE SENTENCE. IN THE NEXT SENTENCE HE SAID "WE WILL PLACE THE SEDIMENT 9.4 MILES OUT "BECAUSE" WE CARE ABOUT HUMAN + ENV. HEALTH.

WHICH IS IT - IS THE DREDGE SAFE (NO, WE KNOW THAT) OR IS MONEY THE REAL PUSHING FORCE HERE? I WILL NOT STAND FOR THIS PETTY FIGHTING BACK AND FORTH WHEN MY DRINKING WATER + LAKE ARE AT RISK AGAIN.

PLEASE RESPOND IF POSSIBLE AND TELL ME WHY YOU DECIDED TO TEST/COMPARE THE OLD 1970s HAZARDOUS DREDGE IN THE LAKE AND COMPARE IT TO THE NEW DREDGE.

[redacted]

US Army Corps of Engineers
Buffalo District
BUILDING STRONG®

U. S. Army Corps of Engineers
Cleveland Harbor Dredged Sediment
Public Hearing

March 1, 2016

Would you like to submit a written comment? If so, complete the information below and place this form in the comment box.

Name: ROGER KALBRUNNER

Group Affiliation *(if applicable)*: BIG CREEK CONNECTS

Comments: (1) ARE THERE ANY SCIENTIFIC STUDIES THAT INDICATE THE AFFECT THAT A PCB 0.1 PPM HAS ON PLANT LIFE, FISH AND POTABLE WATER?

(2) WHEN DREDGED MATERIAL IS DEPOSITED IN AN OPEN LAKE THERE MUST BE A DISRUPTION TO THE LAKE AND LAKE BOTTOM WHAT ARE THE AFFECTS TO THIS DISRUPTION? HOW LONG BEFORE THE LAKE BOTTOMS RETURNS TO IT'S CONDITION PRIOR TO THE DREDGED MATERIAL BEING DUMPED?

Hannes, Eric LRB

From: Petermkerlimg [redacted]
Sent: Tuesday, March 01, 2016 2:07 PM
To: DLL-CELRB-ClevelandDredging
Subject: [EXTERNAL] Dredging Cleveland harbor

Dear usace,
Who benefits from dumping the Cleveland harbor dredged material out in Lake Erie? I'm aware of the shortage of federal funds to pay to remove the material from the water. I'm all so aware that this shortage of funds is do to the uacse asking for less than what was originally allocated to remove the material from the water system. If there is even a .1% chance of harming the water supply and aquaculture dumping the dredged materials out in Lake Erie should not even be considered. Especially because the money to remove it from the system was already allocated. So I ask again, who benefits from dumping the material out in the lake? If it only comes down to John Q tax payer, I'm more than confident that the people of cuyahoga county would prefer to pay alittle more and not gamble with their drinking water.

Concerned Clevelander,

Pete Kerling

Hannes, Eric LRB

From: Kornacki, Andrew LRB on behalf of Affairs, Public LRB
Sent: Monday, March 14, 2016 12:48 PM
To: Hannes, Eric LRB
Subject: FW: Cleveland Public Hearing 3-1-16

This is from the PA mailbox for Cleveland.

Thank you,

Andrew A. Kornacki,
Public Affairs, Chief

-----Original Message-----
From: Joel A Lieske [mailto[redacted]
Sent: Friday, March 04, 2016 3:21 PM
To: Affairs, Public LRB <LRB.Public.Affairs@usace.army.mil>; DredgingCleveland@usacoe.com
Subject: [EXTERNAL] Cleveland Public Hearing 3-1-16

I tried repeatedly to send my comments to the second email address. But my emails kept getting rejected. Please forward this to the responsible party. Thanks.

Save Lake Erie or Police the World?

Re: Formal written comments to the U. S. Army Corps of Engineers.

There may indeed may be no limit to the depths that the U.S. Army Corps of Engineers will sink in order to dump polluted and toxic Cuyahoga River dredge into Lake Erie (Cleveland PD Editorial, Jan. 24).

But neither is there any justification or reason to do so under the provisions of the Clean Water Act. Sec. 230.10(a) is very explicit: "no discharge of dredged or fill material

shall be permitted if there is a practicable alternative to the proposed discharge which

would have less adverse impact on the aquatic ecosystem."

The most severe impact is the possible pollution of Cleveland's drinking water from the city's water intake valve, which is located just offshore. This is what happened to the drinking water of Duluth, Minnesota, when Reserve Mining was allowed to dump taconite tailings into Lake Superior.

Another impact is the PCB's that will be injected into the food chain of what is arguably the greatest natural fishery in the world. This is what my son discovered when he caught a ten-pound walleye near the mouth of the Rocky River last fall on Veteran's day.

The practicable alternative is disposing of the dredge in a land fill. But this apparently was no longer possible "after Army brass obtained a $3 million cut in funds budgeted for dredging the Cuyahoga River shipping channel."

Apparently the U. S. Army has enough money to station 340,000 troops around the world at an average cost of $1 million per soldier. But it does not have enough money to ensure the purity of our drinking water and the fish we eat from Lake Erie.

So our elected representatives and administrators in Washington need to do two things. First, they need to restore the cuts in funding made by the Army Corps of Engineers. Second, they need to create an independent agency that will do the work that is needed to clean up the nation's polluted rivers, harbors, and lakes once and for all.

Joel Lieske

Republican Candidate for the 9th Congressional District

[redacted]

Hannes, Eric LRB

From: William Maki [redacted]
Sent: Wednesday, March 02, 2016 11:01 PM
To: DLL-CELRB-ClevelandDredging
Subject: [EXTERNAL] Fw: Cuyahoga River/Cleveland Harbor Dredging

On Wednesday, March 2, 2016 10:45 PM, William Maki <william[redacted]wrote:

Hi I have been following this issue in the Akron Beacon Journal. Sorry I missed the meeting.

Based on studies by the University of Akron there will be more sediment washed downriver in the future. Much more. So that leaves us with the issue of keeping the river/harbor open.
I also note that there is cliff erosion east of Cleveland. A religious camp is having a fundraiser to stabilize the cliffs at their property

Is it correct to assume that in the past sediment discharged from the Cuyahoga was swept east by the prevailing lake currents? And this provided protection for the cliffs by making beaches?
If so, then the dredging has interfered with this natural course of events.
I do not agree, at this time, with dumping dredged material in the lake.
I would agree with dumping the material along a shallow area of the lake so the material re-establishes the natural replenishment of beaches, stopping cliff erosion.
I do not think the material is toxic, and this would solve two issues - protect the cliffs to the east and provide a method to dispose of the material.
For years to come.

thanks
If there is a problem with the sediment, then perhaps the sediment could be pumped into caissons like the Mulberry harbors built/used at the D-Day landing in Normandy.
Once filled, these caissons could be towed east and sunk off the area of the eroding cliffs. Would this make artificial beaches eventually?

Public Comment to the U.S. Army Corps of Engineers

March 1, 2016

Re: Disposal of Cuyahoga River shipping channel sediment

My name is Carla Rautenberg. Almost two years ago, Susan Miller and I composed a public comment to the USACE, imploring the agency not to dump toxic sediment from the Cuyahoga shipping channel in our beloved and endangered Lake Erie. By the time we submitted it, thirty-seven of our friends and neighbors had signed it. The Ohio EPA did not grant the USACE permission to dump the sediment in the open lake in 2014, and it was properly deposited in a confined disposal facility.

Despite the positive outcome at the time, since then it's been Groundhog Day here on the shores of Lake Erie. The same nightmare is inflicted on us each year.

Last year, in 2015, the Army Corps defied the Ohio EPA, Governor Kasich, our two U.S. Senators, and Congressional Representatives Kaptur and Fudge, and again insisted that it would dump the PCB-laced sediment in the open lake. Only a lawsuit filed by Ohio Attorney General Mike DeWine and a subsequent court order brought about the proper disposal of the toxic material then.

After Congress specifically appropriated sufficient funds to cover dredging and safe disposal of the toxic Cuyahoga sediment in confined disposal facilities, the USACE has upped its game. According to a Plain Dealer editorial published on Jan. 24, 2016, the rogue agency quietly went to the appropriations committee and asked that their budget for this task be slashed by several million dollars, a request which was granted. Then the USACE again announced to the Ohio EPA that the industrial sediment is "safe" and they want a permit to dump it in the lake, right next to the drinking water intake for the City of Cleveland.

We understand, Buffalo District Commander Lieutenant Colonel Karl Jansen, that we the taxpayers pay your salaries, and all of the salaries in your huge federal agency. But what we really want to know is, *who are you working for*?

Because our 2014 public comment is unfortunately just as timely today as it was then, on behalf of our 37 co-signers we will resubmit that comment today. To preface it, Susan Miller and I offer just four more words that have not been approved by our co-signers. These are strictly from the two of us:

Toledo.
Flint.
Prison time.

Carla Rautenberg, [redacted]

Susan Miller, [redacted]

Public Comment to the U.S. Army Corps of Engineers

First submitted March 26, 2014; Still relevant and so re-submitted March 1, 2016

Re: U.S. Army Corps of Engineers Permit Application for Cleveland Harbor Dredging

We, the undersigned, urge the USACE to withdraw the permit application that would allow dumping of toxic sediment dredged from the Cuyahoga River shipping channel and the Cleveland Harbor into the open waters of Lake Erie near the intakes that supply drinking water to millions of NE Ohioans.

We are aware that Lake Erie is already greatly threatened by the agency's ineffectual and inadequate response to invasive Asian carp. As the shallowest and most fragile of the Great Lakes, Lake Erie is constantly challenged with biological and chemical pollutants.

Our Great Lake is also under assault by combined sewer overflows. In NE Ohio, we are being forced to finance $3 billion worth of infrastructure to keep this foul mixture out of our precious Lake Erie, the source of our drinking water and the most significant natural asset of the entire region.

NE Ohio Regional Sewer District rates have tripled for the average household over the last 23 years. Furthermore, these sky-high rates are forecast to double again over the next 8 years. http://www.cleveland.com/datacentral/index.ssf/2014/02/find_out_how_much_the_northeas.html

As rate-payers, are we supposed to pay these incredibly increased rates to clean up our lake on the one hand, while agreeing to let the U.S. Army Corps of Engineers dump toxic sludge in it on the other?

We think not. Of all of the comments made at the Ohio EPA public hearing which the first two undersigned attended on March 6, Paul Sherlock of Cleveland was perhaps the most direct when he said:

"I simply cannot understand the logic that is behind this decision. If this was a terrorist organization putting poison into our lake, what would the public reaction to that be?"

When the USACE, a federal agency, seeks to contravene the Clean Water Act and asks OEPA for permission to dump toxic sludge from maintenance dredging in our lake, what are we to think? We understand that the dredging is a necessary annual event to keep the shipping channel navigable. If the USACE is permitted to dump dredged materials in the open lake for the first time in 40 years in 2014, it will surely set a precedent for future years. This is insane!

Beneficial reuse of contaminated sediment is possible as described here: http://water.epa.gov/type/oceb/oceandumping/dredgedmaterial/beneficial_use.cfm. We have a wonderful fresh water example right here on Lake Erie with the recent creation of the Cleveland Lakefront Nature Preserve at Dike 14.

If beneficial reuse of the toxic sludge cannot be immediately implemented, the material should be removed to other confined disposal facilities (CDFs) as has been done successfully done for the last 40 years in accordance with the Clean Water Act.

Although the USACE cites one study claiming that the toxicity of the Cuyahoga sediment lessened from 2007 to 2012, the dumping request seems more likely to be money-driven than science-based. The silt alone would be an immediate threat to the aquatic environment and would be detrimental to the fishing and recreational activity on our lake. In the coming weeks, the Healthy Lake Erie allocation for $10 million over the next 2 years will most likely be passed in our statehouse, allowing ODNR to find beneficial reuse options for the dredged material.

We cannot imagine that the good people of any other region of the country would allow this to be done to their sole source of drinking water and most important natural resource. As concerned citizens, greater Clevelanders, parents, grandparents, taxpayers and just regular, reasonable people, all of whom need clean water, we ask the USACE to WITHDRAW the application for this permit.

Signed,

Susan Miller, [redacted]

Carla Rautenberg, [redacted]

Alan Crossman, [redacted]

Phil Mohorich, [redacted]

Bess Matuszewski, [redacted]

Dennis Dobbs, [redacted]

Rachel Hsu, [redacted]

Karen Katzman, [redacted]

David Clingingsmith, [redacted]

John Hubbard, [redacted]

Kim Thomas, [redacted]

Susan L. Eagan, [redacted]

Linda Freeman, [redacted]

Don Ramos [redacted]

Joyce Rajki [redacted]

Kathleen T. Rosen, [redacted]

Ann Marie Knotek, [redacted]

Bob Parker [redacted]

Sonja Rice, [redacted]

Mary Kelsey [redacted]

Pamela Bertaud, [redacted]

Kathleen Fant [redacted]

Pamela Kelly, [redacted]

John Rautenberg, [redacted]

Harriet Slive, [redacted]

Anita S. McNeal [redacted]

Martina Hainke [redacted]

Laurie Garrett [redacted]

Shannon O'Connor [redacted]

Louisa Oliver [redacted]

Hans Pitsch [redacted]

Rosalie Wieder [redacted]

John L. Clark, [redacted]

Naomi Klarreich [redacted]

Carol Nunez, [redacted]

Joan Spoerl, [redacted]

Roslyn S. Collins, [redacted]

Marty Lesher, [redacted]

Linda Margolin, [redacted]

Cc: Ohio EPA, Ohio Environmental Council, Governor John R. Kasich, Senator Sherrod Brown, Senator Rob Portman, Representative Marcia Fudge, Representative Marcy Kaptur

MIKE DEWINE
★ OHIO ATTORNEY GENERAL ★

Environmental Enforcement
Office (614) 466-2766
Fax (614) 644-1926

30 E. Broad Street, 25th Floor
Columbus, OH 43215
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March 11, 2016

U.S. Army Corps of Engineers - Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
ATTN: Environmental Analysis – Cleveland Harbor Dredging

RE: **Written comments of Ohio Attorney General Mike DeWine**
Cleveland Harbor Dredge 2016, Public Notice No. CLEVELAND-16

On March 1, 2016, at the United States Army Corps of Engineers' ("the Corps") public hearing regarding Public Notice No. CLEVELAND-16, I submitted a statement that a member of my staff delivered orally. That statement expressed my dismay at the Corps' decision to, yet again, put forth open-Lake disposal as the viable, preferred, and only fully-funded method for dealing with contaminated dredged sediment from Cleveland Harbor[1] in 2016. My statement stressed the importance of preserving and improving Lake Erie's water quality and Ohio's economic viability.

At that same hearing, many concerned citizens testified that merely maintaining Lake Erie's water quality is not enough and that water quality must be improved. They also expressed support for the State of Ohio and Cleveland-Cuyahoga County Port Authority's ongoing litigation against the Corps to preserve and improve Lake Erie's water while continuing to protect Ohio's economy. Consistent with the views of these citizens, I highlighted the fact that alternatives to open-Lake disposal do exist: confined disposal facilities ("CDFs"), built for this particular purpose, which have

[1] As used in these comments, "Cleveland Harbor" or "the Harbor" consists of 5.5 miles along the Cleveland shoreline that is enclosed by breakwater structures, 5.8 miles of the lower Cuyahoga River, and 1 mile of the Old River, unless otherwise specified.

been successfully utilized for the past 40 or more years. The existence and value of these CDFs are important because the Corps has erroneously claimed that the Harbor sediment is no more polluted than the Lake sediment. It is only possible to reach this fallacious conclusion by comparing the Harbor sediment to a spot already polluted by the Corps through its previous dumping activities during the 1970s—activities that have not been authorized since that time. The Corps' flawed premise is further complicated by their unsubstantiated and incorrect conclusion that the Harbor sediment, once placed in the Lake, would remain at the open-Lake disposal site indefinitely and would not migrate to other (cleaner) portions of the Lake. The data simply do not support the Corps' analyses and conclusions.

At the public hearing, the Corps again stated that, notwithstanding the fact that it believes that their self-determined Federal Standard allows open-Lake disposal, it will place all dredged material in one of the available confined disposal facilities ("CDF") this year, with the qualification that an entity other than the Corps must pay for any additional cost of this disposal in a CDF.

Throughout this ongoing process I have believed that CDF disposal is required under both State and Federal law, and therefore, disposal within a CDF (1) should be the disposal method utilized here, and (2) should be performed at full Federal expense. My belief is consistent with that of the Ohio EPA and the Ohio Department of Natural Resources. The following written comments further express the position of the Ohio Attorney General's Office and supplement my March 1, 2016 oral statement.

I. For the "Federal Standard" to be legally valid, it must comply with certain Ohio environmental requirements and the Corps has no basis for requiring Ohio to pay for that compliance.

The Corps defines the "Federal Standard" as "the alternative that meets required environmental laws and regulations in the least costly manner consistent with sound engineering practices." 53 FR 14902. The Corps' regulations define the Federal Standard as "… the dredged material disposal alternative or alternatives identified by the Corps which represent the least costly alternatives consistent with sound engineering practices and meeting the environmental standards established by the 404(b)(1) evaluation process or ocean dumping criteria." 33 C.F.R. § 335.7. It is from this regulation that the Corps apparently only considers three factors when determining the Federal Standard: 1) engineering concerns, 2) cost, and 3) Federal environmental compliance. The Corps believes that after it has determined the Federal Standard alternative, it should not be required to pay for any other alternative that causes an increase in cost. However, other considerations must apply. Specifically, in addition to Federal environmental compliance, the Corps must also comply with Ohio's federally-approved Water Quality Standards.

In 1977, Congress amended the Clean Water Act to require Federal agencies to comply with state water quality standards. *Natl. Wildlife Fed'n v. U.S. Army Corps of Engineers*, 384 F.3d 1163, 1167 (9th Cir. 2004), citing 33 U.S.C. § 1323. Open-Lake disposal of Cleveland Harbor sediment does not properly address the Corps' obligations to comply with Ohio Water Quality Standards. Specifically, any increase in PCB bioaccumulation would be a significant degradation in water quality, in violation of Ohio Adm.Code 3745-33-05, and consequently the Clean Water Act.

The Corps' position in the past, and seemingly again this year, has been that it will comply with those State rules, but only by either deferring dredging or by requiring a non-Federal entity to pay for consistency with those rules. However, the Corps has no legal basis for either requiring Ohio to pay for the Corps to comply with Ohio's Water Quality Standards or for failing to comply with its own mandate to maintain navigation.

Congress, when it amended Section 404 of the Clean Water Act in 1977, intended for the Corps to pay and comply with State pollution abatement laws. Specifically, in 1977 the Senate Committee on Environment and Public Works reported the following:

> Section 404 [of the Clean Water Act] . . . mandates that all dredging activities of the U.S. Army Corps of Engineers be conducted in compliance with applicable state water quality standards, and all other State substantive and procedural requirements.
> …
> By this amendment [to Section 404 of the Clean Water Act], the committee clarifies that [C]orps' dredging activities are not exempt from State pollution abatement requirements . . . Several [C]orps district offices to date have requested and received funds to provide on land or confined disposal of dredge spoil. Pursuant to this amendment, **the [C]orps may be required by the States in some instances to expend additional funds to protect water quality**.

S.Rep. 95-370 (emphasis added).

This Senate Report indicates that when Congress amended Section 404 of the Clean Water Act in 1977, Congress contemplated situations where states may require the Corps to spend additional money to comply with State environmental laws should those laws be more protective than the baseline requirements of the Clean Water Act. Therefore, the Corps' hard-line insistence that because of the Federal Standard it is unable to expend Federal funds to comply with state water quality requirements is not only contrary to their own Federal Standard, but it is also contrary to the expressed purpose of Congress' amendment to the Clean Water Act in 1977, which is still applicable today.

Last year, consistent with past years of analyses, Ohio EPA determined that placing Harbor sediment in Lake Erie was unsafe and accordingly would not grant the Corps' application for open-Lake disposal. The justification was simple and clear: The Cleveland Harbor sediment contains persistent toxic carcinogens, namely PCBs. Open-Lake dumping of that sediment would increase the amount of these carcinogens in Lake Erie and, as a result, in the organisms that reside there. Ohio EPA found that open-Lake disposal would increase Ohioans' exposure to these toxins.

Though the Ohio EPA has not yet completed the 2016 Water Quality Certification process, it is reasonable to assume that the data, which establish the same or more PCB contamination as identified in the 2015 Water Quality Certification application, will lead to the same conclusion. On the basis of last year's process, the Federal District Court for the Northern District of Ohio characterized the Corps' action as "blackmail" and deemed it an "ultimatum: Either find a way to pay for the CDF disposal for the Channel sediment with non-[F]ederal money, or the Corps will not dredge that section of the Cleveland Harbor." *Memorandum Opinion and Order on Motion for Temporary Restraining Order and Preliminary Injunction*, Case No. 1:15-cv-00679, Doc. 33 at PageID 2450 (Nugent, J.).

Through last year's Motion for Temporary Restraining Order and Preliminary Injunction, the Corps was ultimately ordered to dredge the Harbor and place the dredged material in a CDF at full Federal expense. Moreover, the Court found that "[t]he pollution of a Great Lake affects not only the State of Ohio and the Cleveland Harbor area, but has an effect on the many other areas of the country that rely on the resources of the Great Lakes," and "[f]orcing the State to permit the introduction of pollutants into Lake Erie in order to guarantee the continued navigability of [the Harbor was] deleterious not only to Ohio but would clearly negatively affect the general public interest." *Id.* at PageID 2549. As Attorney General, I caution the Corps against entering into such an ultimatum again this year, should the 2016 Water Quality Certification not be issued to the Corps' preference. The public at large and the Court have both spoken on the Corps' responsibilities to the environmental quality of Lake Erie. As I admonished at the public hearing and as the legislative history related to this matter demonstrates, the Corps is prohibited from dumping sediment in Lake Erie without Ohio's approval but must maintain the navigability of Cleveland Harbor.

II. The "Federal Standard" must be consistent with Ohio's Coastal Management Program because compliance with state Coastal Management Programs is required under the Coastal Zone Management Act.

The Corps acknowledges whatever alternative it determines to be the Federal Standard for an action must be consistent with Federal environmental laws. 53 FR 14902; 33 C.F.R. § 335.4. Therefore, the Federal Standard must be an alternative that is also consistent with the Coastal Zone Management Act ("CZMA"). The Corps, however, has declared that open-Lake disposal of the dredged material from the Cleveland Harbor is the Federal Standard again in 2016, despite the fact that open-Lake disposal will violate the Federal consistency requirements of the CZMA. In doing so, the Corps is again attempting to force Ohio to pay for the Corps' compliance with the CZMA.

Under the CZMA, states may develop Coastal Management Programs ("CMP") which, after approval from the National Oceanic and Atmospheric Administration ("NOAA"), become requirements that Federal agencies must comply with to the maximum extent practicable. 16 U.S.C. § 1456(c)(1) ("Each Federal agency activity within … the coastal zone … shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs."). The CZMA's legislative history stresses the importance of Federal agency compliance with state CMPs approved under the CZMA. Specifically, the Senate Commerce Committee reported that "the intent of this legislation is to enhance state authority by encouraging and assisting the states to assume planning and regulatory powers over their coastal zones." *See*, *California Coastal Comm'n v. Granite Rock Co.*, 480 U.S. 572, 1987, citing S.Rep. No. 92–753. The report further stated that "it is essential that Federal agencies administer their programs, including development projects, consistent with the states' coastal zone management program." S.Rep. 92-753.

The legislative history of the 1990 amendments to the CZMA clearly indicates that it was Congress' intent to subject Federal dredging activities to the CZMA. Specifically, the House Conference Committee reported that Federal dredging activities under the Ocean Dumping Act must comply with the requirements of the CZMA:

> [It is unnecessary to include a] specific clarification that Federal agency activities and Federal permits under the Ocean Dumping Act, including ocean dumping site designations, and operation and maintenance dredging, are subject to the requirements of section 307… because the amendments to section 307(c)(1) leave no doubt that **all Federal agency activities and all Federal permits are subject to the CZMA's consistency requirements**…. a statutory "listing" of activities should be avoided to prevent any implication that unlisted activities are not covered.
>
> Finally, the conferees are aware of the argument that the application of Federal consistency to activities under the Ocean Dumping Act amounts to state regulations of ocean dumping for purposes of section 106(d) of that Act. The conferees reject this argument.

H.Rep. 101–964 (emphasis added). This report demonstrates how emphatically Congress intended that the Corps' dredging projects be consistent with state CMPs. This report also demonstrates that the requirement to comply with state CMPs is a Federal requirement rather than a state rule. Therefore, since the Federal Standard is, by its own definition, an alternative that complies with Federal environmental laws (here, the CZMA), that alternative can only be one that is consistent with Ohio's CMP to the maximum extent practicable.

NOAA's regulations define "maximum extent practicable" as fully consistent with the enforceable policies of management programs unless full consistency is prohibited by existing law applicable to the Federal agency. 15 C.F.R. § 930.32. NOAA's regulations also prohibit a Federal agency from using funding restraints to demonstrate compliance to the maximum extent practicable. "Federal agencies should include the cost of being fully consistent with [state CMPs] … in their budget … **to the same extent** that a Federal agency would plan for the cost **of complying with other Federal requirements**." 15 C.F.R. § 930.32 (emphasis added).

Therefore, the Corps is required to budget its dredging projects for compliance with state CMPs unless appropriation "laws contain *specific* legal prohibitions . . . Absent such specific prohibitions, the Presidential exemption is the only provision which may be used by a Federal agency to make a finding that a lack of funds prohibits full consistency." 65 FR 77134 (emphasis added). For the 2016 Project, as they did in 2015, the Corps appears to be glossing over this requirement and simply concluding that their determination of the Federal Standard is automatically consistent with state CMPs to the maximum extent practicable. 53 FR 14906. The Corps bases its opinion on a 1986 letter from Douglas A. Riggs, General Counsel, Department of Commerce, to the Corps. *See* 53 FR 14906. However, NOAA has a different interpretation of that letter. When NOAA promulgated its 2000 regulations, NOAA's position was that "[t]he reference to 'appropriations' in the Riggs letter is ambiguous at best, but, if interpreted with the statute and NOAA's regulations at the time, merely means that if something in appropriations law prohibits full consistency, then the Corps is consistent to the maximum extent practicable. Any ambiguities in the Riggs letter were replaced by the clear language of the CZMA as amended in 1990." 65 FR 77134.

In the Corps' Environmental Assessment for the 2015 Cleveland Harbor Dredging, on page 2, the Corps cited to Section 148 of Public Law 94-587, the Corps' appropriation for 2015 projects, to justify its refusal to evaluate CDF disposal as an alternative for the dredged material from the Cleveland Harbor and Cuyahoga River. Public Law 94-587, however, contains no such *specific prohibition* on the use of CDFs. Instead, the law identifies management practices that the Corps should adopt to improve efficient *use* of CDFs.

> SEC. 148. The Secretary of the Army, acting through the Chief of Engineers, shall utilize and encourage the utilization of such management practices as he determines appropriate to extend the capacity and useful life of dredged material disposal areas such that the need for new dredged material disposal areas is kept to a minimum. Management practices authorized by this section shall include, but not be limited to,

> the construction of dikes, consolidation and dewatering of dredged material, and construction of drainage and outflow facilities.

Nothing in this law specifically requires the Corps to use open lake disposal or specifically prohibits the use of a CDF. More importantly, nothing in this law *specifically prohibits* the Corps from fully complying with Ohio's CMP. In fact, this law supports Ohio EPA's and the Port Authority's assertion that, not only should the Corps use the available CDFs, the Corps should implement "dry loading" practices that would increase CDF capacity.

NOAA's policy documents define "practicable" as "capable of being done." The Corps cannot argue that CDF disposal is incapable of being done because CDF's are available, there is capacity within them, and they were used for disposal in 2014 and 2015. The Corps' implementation of its regulations seeks to limit a state's authority under the CZMA by holding dredging projects ransom. The Corps does not have the statutory authority to promulgate regulations that allow it to violate the requirements of the CZMA. In fact, the opposite is true: Federal law—here the CZMA—controls regulations, including the Federal Standard. By taking the approach that it will defer dredging unless a state's CMP is lenient enough, the Corps subverts Congressional intent, which seeks to give the States greater control over their coastal zones and that those protections should be binding upon the Corps whenever practicable. Furthermore, the Corps is usurping States' federally granted authority to protect their own coastal zones by exerting economic pressure on States to conform their CMPs to the Corps' desires.

Under the Corps' ultimatum, if Ohio insists on compliance with its CMP, Ohio or another non-Federal sponsor must pay for the extra cost of complying with the CMP compliant alternative. However, because compliance with Ohio's CMP is mandated under Federal law, compliance with Ohio's CMP is a Federal—not State—requirement. Therefore, the Federal Standard must be an alternative that complies with the CZMA and consequently, complies with Ohio's CMP.

The Ohio Department of Natural Resources has determined that open-Lake disposal is not consistent with Ohio's CMP again in 2016 because the project "must be carried out in a manner consistent with all conditions contained in [the Corps' Section 401 water quality certification]." LETTER FROM SCUDDER MACKEY, CHIEF OF THE OFFICE OF COASTAL MANAGEMENT, OHIO DEPARTMENT OF NATURAL RESOURCES TO MARTIN WARGO, ARMY CORPS OF ENGINEERS, BUFFALO DISTRICT, JANUARY 25, 2016. If the Corps does not obtain a Section 401 certification from Ohio EPA allowing open-Lake disposal of dredged material from the Harbor, open-Lake disposal of that material would not be consistent with Ohio's CMP, and ODNR's conditional concurrence would become an objection to the Corps' consistency determination. 15 C.F.R. § 930.4(b). Unless and until this issue is resolved, open-Lake disposal would not be consistent with the CZMA. Therefore, open-Lake disposal cannot be the legal Federal Standard alternative, and as a result, the Corps will be required to use CDF disposal at its own expense.

III. The Corps' Self-Imposed Budgetary Shortcomings in 2016

By its own choice, the Corps has underfunded the 2016 Cleveland Harbor Project. The Corps' original 2016 budget request, approved by the President of the United States, sought over $9.54 million for Cleveland Harbor operation and maintenance, which included approximately $6.7 million for the Harbor dredging project, plus additional amounts for the west breakwater rehabilitation and other operations. This sum would have been more than sufficient for the Corps to dredge the Harbor at full Federal expense, while employing the CDFs consistent with Federal law and what was ordered by the Court in 2015. The House adopted this budget amount in May 2015, as did the Senate later that same month. Sometime later, the Corps intentionally requested that the budget for Cleveland Harbor be cut by approximately $3.8 million, essentially giving back, or at best diverting, funds that had already been identified and approved for the 2016 Cleveland Harbor

Project. This unnecessary change decreased the amount of funding available for the Cleveland Project when the final Energy and Water Bill was approved as a part of the omnibus Budget. The Corps' allocation for 2016 dredging operation and maintenance now rests at approximately $2.88 million.

Though it is not yet entirely certain what the shortfall will be, it is clear that this amount will not cover the proper use of CDFs for management of dredged material. By early estimations, comparing last year's budget and bidding, the Corps has most likely created a deficit of over $1 million for the 2016 Harbor Project. Cleveland Harbor was one of only four project sites nationwide to receive this type of decrease in budget, out of the hundreds of dredging operations the Corps is charged with maintaining. By unilaterally reducing its funding, the Corps has failed to fully budget for the 2016 Cleveland Harbor Project, which not only ignores its requirements under Federal law, but also flouts the clear direction from the Court's Order in 2015.

The Corps' transparent gamesmanship is evident by both the nature and the timing of its actions. In his Decision on the State's and Port Authority's Motion for a Temporary Restraining Order and Preliminary Injunction in 2015, Judge Nugent held that, "the federal government has already allocated these funds and made them available through their funding of the federal government's Great Lakes maintenance and operational duties. This means that in all likelihood, the government will be spending this money on similar or related projects whether or not the Corps is forced to pay for CDF disposal." *Memorandum Opinion and Order on Motion for Temporary Restraining Order and Preliminary Injunction*, Case No. 1:15-cv-00679, Doc. 33 at PageID 2457. Judge Nugent issued this Decision on May 12, 2015, exactly the time that Congress had fully funded the 2016 Cleveland Harbor Project. Then, immediately after the Court's holding, the Corps sought the $3.8 million dollar reduction in the Project, leaving 2016 unnecessarily underfunded.

In addition, during an administrative process in February of 2016, the Buffalo District of the Corps sought and was awarded additional funding for its work plans. The Buffalo District was awarded an additional $3.45 million for dredging activities at Fairport Harbor and Toledo Harbor and engineering and dike repair at Sandusky Harbor and Toledo Harbor, but did not seek or obtain additional funds so that the Cleveland Harbor Project could be accomplished legally at Federal expense. Such an action demonstrates the Corps' lack of transparency and single-minded unwillingness, yet again, to do its job and comply with law and Ohio's Water Quality Standards and Coastal Zone Program. Such maneuvering is disappointing to the State, disingenuous to the public which the Corps is charged with serving, and threatening to the health of Lake Erie.

IV. Conclusion

The Corps is again attempting to strong-arm Ohio into paying for its compliance with Ohio's federally-approved Water Quality Standards and Ohio's federally-approved Coastal Management Program. The Corps, however, has no legal authority that allows it to require non-Federal sponsors to support its dredging program. Instead, the Corps has created a scheme that punishes states for exercising their federally-delegated authorities—and thereby the Corps will fail to fulfill its mandate to maintain navigation—if the State cannot or will not cover any additional costs of compliance. The legislative history of both the Clean Water Act and Coastal Zone Management Act demonstrate clear Congressional intent for the Corps to comply with state environmental requirements at the Corps' expense in these very circumstances. Moreover, the Court (thus far), local and national public opinion, and the multitude of interested parties in this matter—including the Port Authority, Arcelor-Mittal Steel, the Ohio Environmental Council, the Cuyahoga County Commissioners, United States Senators Brown and Portman, Congresswoman Kaptur, ODNR, and Ohio EPA—have spoken out over and over again, urging the Corps to re-think its troubling position as it relates to Ohio's most important natural resource. As Ohio Attorney General, I demand that the Corps dredge the Cleveland Harbor at full Federal expense in compliance with Ohio's Water Quality Standards, Ohio's Coastal Management Program, and the Federal Standard as it was intended to be carried out.

Respectfully Submitted,

MIKE DEWINE
OHIO ATTORNEY GENERAL

Ohio Department of Natural Resources
JOHN R. KASICH, GOVERNOR
JAMES ZEHRINGER, DIRECTOR

April 22, 2016

U.S. Army Corps of Engineers - Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199
ATTN: Environmental Analysis- Cleveland Harbor Dredging

Re: Proposed FY 16 Cleveland Harbor Notice - comments

Project: The proposed project involves maintenance dredging of federal navigation channels in order to maintain sufficient depth for deep-draft commercial vessels.

Location: The proposed project is located in the Cleveland Harbor, Cuyahoga County, Ohio.

The State of Ohio recognizes the economic importance of maintaining navigable waterways for the ports of our Lake Erie cities. Nowhere is that access more important to our economy than in Cleveland.

In recognition of this fact, the State of Ohio continues to take an aggressive, proactive approach to dealing with this important issue. In just the past year, the State has committed $10 million of Ohio funds to find solutions to reduce and safely manage materials dredged from the Cleveland and Toledo Harbor ship channels in ways that protect and do not negatively impact Lake Erie water quality.

New information received by the Department indicates that open-lake placement of material dredged from Cleveland Harbor has the potential to increase bio-accumulative PCB levels in fish tissue. Recent sediment data from Ohio EPA continues to indicate that contaminant levels exceed Ohio EPA standards; and a review of the Corps' modeling work reveals that that the parameters used by the Corps erroneously minimizes the resuspension potential of sediments on the lakebed. In other words, contaminated materials placed on the lakebed are not stable – they <u>can</u> be resuspended and they <u>can</u> be transported by bottom currents.

Long-term exposure to PCBs may result in an increase of bio-accumulative PCB levels in fish tissue. If PCB levels in fish tissue were to increase from their current levels, fish consumption advisories for Lake Erie may change from once a week to once a month. This could have a devastating impact on an $800 million sport fishery that supports 7,000 jobs and contributes more than $208 million in wages and salaries to Ohio's economy.

Moreover, the Department is concerned about the impact that open-lake disposal and subsequent resuspension of contaminated materials may have on fish spawning and survival of larval-and-juvenile fish. Bio-accumulative and other chemical effects on larval-and-juvenile fish can be significantly different than for adult fish due to differences in developmental stages.

As stewards of Ohio's natural resources, the Ohio Department of Natural Resources cannot afford to gamble with the health of our Lake Erie fishery.

Thus this last year ODNR joined with Ohio EPA in a federal action filed by the Ohio Attorney General against the Corps to stop the proposed open lake disposal of this contaminated material. The federal judge agreed and required the Corps to dispose of the material in a confined disposal facility. That action was filed due to the Corps' determination -- first made in the fall of 2013 -- that open-lake disposal of materials dredged from the Cleveland Harbor navigation channel now meets the "Federal Standard." A decision that the Corps made despite the State's continuing clear and emphatic objections.

This year, the Corps appears to have intentionally under-funded its' own budget for the 2016 Cleveland Harbor maintenance dredging project. The Corps, without consulting with the Port of Cleveland, the State of Ohio, or Ohio's Congressional delegation, requested a reduction in the amount allocated to dredge Cleveland Harbor – leaving an amount that would only cover the cost for open lake disposal -- despite an injunction issued by the Federal District court last year that forced the Corps to dispose of the dredge material from the entire Cleveland Harbor navigation channel in a CDF at full federal expense.

Of note, only four harbors in the nation had their dredging appropriations reduced, and Cleveland Harbor was the only harbor in the Great Lakes – and in fact, the only harbor in the lower 48 states where this occurred.

In summary, we believe that material dredged from the Cleveland Harbor navigation channel is unsuitable for open-lake disposal and that the current US Army Corps of Engineers "Federal Standard" is environmentally unacceptable.

The Corps' recent proposal to dredge only 45,000 cubic yards from the lower five miles of the navigation channel, and to defer dredging of the rest of the navigation channel if a non-Federal sponsor is not found, would result in severe economic harm to industries that depend on direct water access to Lake Erie.

The Ohio Department of Natural Resources urges the Corps to reconsider their current position and dredge the entire six-mile length of the Cleveland Harbor navigation channel and place all dredged material into Confined Disposal Facilities at full federal expense.

Finally, the State of Ohio is committed to work with the Corps and the Port of Cleveland to find a solution that will protect Lake Erie and maintain the economic vitality of the region.

ODNR appreciates the opportunity to provide these comments. Please contact Scudder Mackey at 419-626-7980 if you have any questions about these comments or need additional information.

Scudder Mackey
Office of Coastal management
105 W. Shoreline Drive
Sandusky, Ohio 44870

Ohio Environmental Council

[UNLEASHING THE POWER OF GREEN]

March 1, 2016

U.S. Army Corps of Engineers - Buffalo District
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ATTN: Environmental Analysis – Cleveland Harbor Dredging
ClevelandDredging@usace.army.mil

Testimony of the Ohio Environmental Council

Good evening. Thank you for the opportunity to testify tonight. My name is Peter Griesinger and I am a board member of the Ohio Environmental Council (OEC). Tonight, I am speaking on behalf of the Ohio Environmental Council. The OEC is a statewide not-for-profit public interest organization representing more than 100 member environmental and conservation organizations, as well as thousands of individual members throughout the state of Ohio. Our mission is to secure healthy air, land, and water for all who call Ohio home.

The OEC opposes the Corps' plan for open-lake disposal of dredged material from the Cuyahoga River and Cleveland harbor into the waters of Lake Erie. We are disappointed that the Buffalo District of the Corps' plan offers a false economy: open-lake disposal may seem like it is the cheapest form of waste disposal; but in actuality, it is waste disposal at all costs. The Ohio EPA's recent data confirms the Corps' own sampling data of high levels of PCBs in Dredging Areas 1, 2a, and 2b, far higher levels of PCBs than from the background and disposal site. In fact, per the Corps' 2013 sediment analysis, sediments from dredge site 1 led to 70% more PCB bioaccumulation in benthic organisms at the 2016 proposed disposal site.

PCBs rise up the food chain to accumulate in sport fish and ultimately to birds and humans who may consume contaminated fish. Exposure to PCBs can have devastating neurological effects on babies developing in the womb, resulting in lowered IQ, hyperactivity, delayed development and other serious problems. PCBs also concentrate in the breast milk of nursing mothers. Knowing this, it is unclear to the OEC how the Corps can determine the dredged sediments from the Cuyahoga River and Cleveland navigational channel are safe to dispose of in the open-waters of Lake Erie.

To add insult to injury, the Corps' recently had their own dredge management budget slashed by $3.6 million, leaving the Corps just enough money to dispose of the sediments into the open-waters of Lake Erie. The Buffalo district appears to have its heels dug into the sand and is unwilling to come to the negotiating table to negotiate a viable solution.

In addition, frustrated by a lack of progress toward any viable solutions, the Cleveland-Cuyahoga County Port Authority (Port) retained its own consultants in 2015. As a result, the Port has moved forward with some very innovative projects to reduce sediment flowing down the Cuyahoga River, as well as to make room for additional sediments within the existing confined disposal facilities. Now the Port Authority is asking for up to a $9.50 per ton tipping fee to offset some of the costs it will incur from maintaining and operating the confined disposal facility, but the Corps claims the Port Authority is price gouging the Corps.

The Corps continues to seem to hide behind language within the Water Resources Development Act (WRDA), claiming the agency must choose the cheapest option while at the same time appearing to skew analyses of its own data to fit its clear preference to open-lake dispose of dredged sediments from the Cuyahoga River. We urge the Buffalo District to approach the disposal of dredged sediments more like the Detroit and Chicago districts. They are under the same mandate but interpret the WRDA language differently. These districts appear to interpret the WRDA language resulting in a goal of ease of shipping **and** ecosystem health, at the cheapest cost.

Lastly, placement of the contaminated sediments into the open-waters of Lake Erie does not comply with Ohio Department of Natural Resource's federally-approved Coastal Zone Management Program, nor with the International Great Lakes Water Quality Agreement.

The OEC, therefore, respectfully requests the Corps dispose of 2016 Cleveland navigational channel dredged sediments into the existing confined disposal facilities. We also respectfully request the Corps approach resolving this problem with an open mind towards innovation and a goal of overall ecosystem health.

Thank you again for the opportunity to provide this public comment.

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

March 1, 2016

RE: CLEVELAND HARBOR DREDGING 2016
PERMIT - INTERMEDIATE
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CERTIFIED MAIL

Mr. Ronald Kozlowski, PMP, CGFM
Chief, Programs and Project Management
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, New York 14207-3199

Subject: Cuyahoga County / City of Cleveland
401 Certification Application Cleveland Harbor Dredging 2016
Ohio EPA ID No.154844

Dear Mr. Kozlowski:

We have conducted an initial review of the United States Army Corps of Engineers' (USACE) application for water quality certification (WQC) for the 2016 dredging of Cleveland Harbor. USACE has once again proposed disposal of the dredged material at open-water site CLA-1, approximately nine miles offshore of Cleveland. USACE's proposal also identified a contaminated hot spot in the vicinity of site CLA-1, a portion of which USACE has proposed to cap with the dredged material from Cleveland Harbor in order to bury toxic sediments and hopefully improve the benthic habitat in that area.

As with the two previous 401 water quality certifications submitted by USACE for maintenance dredging of Cleveland Harbor, USACE is proposing to open lake dispose 180,000 cubic yards of contaminated Harbor sediments into the open waters of Lake Erie based on its unilateral finding that such a proposal is the least costly, environmentally acceptable alternative, i.e. the federal standard.

On the basis of the available data and the applicable laws and regulations, Ohio EPA continues to have serious concerns and reservations about the water quality impacts of the USACE's proposal. These are the same concerns that led to past certifications by Ohio EPA requiring the USACE to place dredged material into confined disposal facilities and has also led to ongoing litigation between our respective organizations.

A summary of the main technical points of concern are listed below.

PCBs and Bioaccumulation

- All of the PCB data sets (including USACE 2012 and 2014, and Ohio EPA 2015) show that the Cleveland Harbor sediments have a higher PCB bioaccumulation potential than the Lake Erie background sediments. In general, the harbor sediments show up to 5 times as much PCB bioaccumulation potential as the background sediments.

- Two of the three data sets (USACE 2012 and Ohio EPA 2015) show that the Harbor sediments have a higher bioaccumulation potential than sediments at disposal site CLA-1. However, CLA-1 and CLA-14, the historic disposal sites, exceed Lake Erie background for PCB bioaccumulation.

- USACE has provided evaluations concluding that Harbor sediments do not exceed CLA-1 or background for PCB bioaccumulation. However, this was accomplished by including Tier 2 values, i.e. modelled estimates, into the Tier 3 data set. We do not agree that this approach is appropriate and do not believe it yields valid conclusions.

PAH Contamination, the Lake Erie "Hot Spot," and Proposed Beneficial Use of Dredged Material

- Both Ohio EPA and USACE have observed that there is a highly contaminated region of sediments in the vicinity of the historic disposal site CLA-1. Please see attachment. Ohio EPA has observed sediment PAH concentrations as high as 400 parts per million in this area. USACE concludes that at least some areas are highly toxic to benthic organisms, with predicted mortality as high as 100% for organisms exposed to some Lake sediments. USACE proposes to use the dredged harbor sediments to cap a portion of the contaminated zone; however, USACE can only cap the zone that lies within site CLA-1 at this time due to lack of NEPA and 404(b)(1) approval for sites outside of CLA-1. The most heavily impacted zone lies outside of CLA-1 and could not be capped at this time.

- These new data also help validate concerns that we have raised in the past. Ohio EPA has previously raised concerns to USACE regarding their inappropriate use of contaminated reference sites multiple times over the past 2 ½ years. The new USACE and Ohio EPA data confirm the significant PAH sediment contamination within the former disposal areas.

- Previously, USACE dismissed Ohio EPA's concerns on CLA-1 being a contaminated reference site. USACE has repeatedly stated, including in their February 5, 2014 letter to Chris Korleski, U.S. EPA Great Lakes National Program Office, that USACE's "assessment is that the open-lake reference areas selected for the Upper Cuyahoga River Channel dredged material evaluation are representative of Lake Erie background sediment contaminant levels present offshore of other harbors, and that the toxicity of sediments at these areas is insignificant." In contrast, this same letter from USACE also stated that CLA-1 was a "dredged material open-lake placement area which is estimated to be covered with at least one foot of sediment since it was last used over 45 years ago." A man-made disposal site is not and cannot be appropriate "background" reference by which to base the comparative analysis with harbor\river sediments. As stated previously CLA-4 represents the true background for Cleveland Harbor. When river sediments are compared to the CLA-4 reference site they fail for open lake disposal.

- Both USACE's and Ohio EPA's 2014 and 2015 sediment data have documented highly contaminated sediment in and beyond historic disposal site CLA-1. USACE has changed their position from stating that "there is no reason to believe that the bottom sediment at either open-lake area are unacceptably toxic in terms of their use as open-lake reference areas," to now, in the 2015 Sediment Evaluation, recommending CLA-1 be capped due to its sediment toxicity.

- Although Ohio EPA concurs that there is significant contamination within CLA-1, as well as further contamination beyond CLA-1 to the south and east, the remedial activities that may be needed have not been adequately evaluated. At a minimum, the nature and extent of sediment contamination in both areas first needs to be more accurately defined. Once the nature and extent of contamination has been determined, a thorough study should be completed to properly evaluate remedial alternatives in accordance with U.S. EPA guidance. Currently, the technical review provided by USACE is approximately one page, which is an insufficient analysis to support this remediation project.

- Further sampling is necessary to get a better handle on the true nature and extent of the contamination, since the sediment is clearly migrating from CLA-1. Based on the available data, we estimate that there are about two square miles of sediments with PAH levels in excess of 100 ppm, and a larger area with lower (but still elevated) PAH levels. Due to the elevated PAH levels recently documented, further sampling, including total petroleum hydrocarbons (TPH) analyses, should be conducted to more fully evaluate the contamination. Cleanup goals will also need to be developed specific to this project.

These concerns will clearly impact Ohio's ability to issue a 401 water quality certification application for the activity you have requested. We will, however, continue to review the application and consider public comments as part of our review.

If you have any immediate questions regarding this letter, please do not hesitate to contact me at (330) 963-1204.

Sincerely,

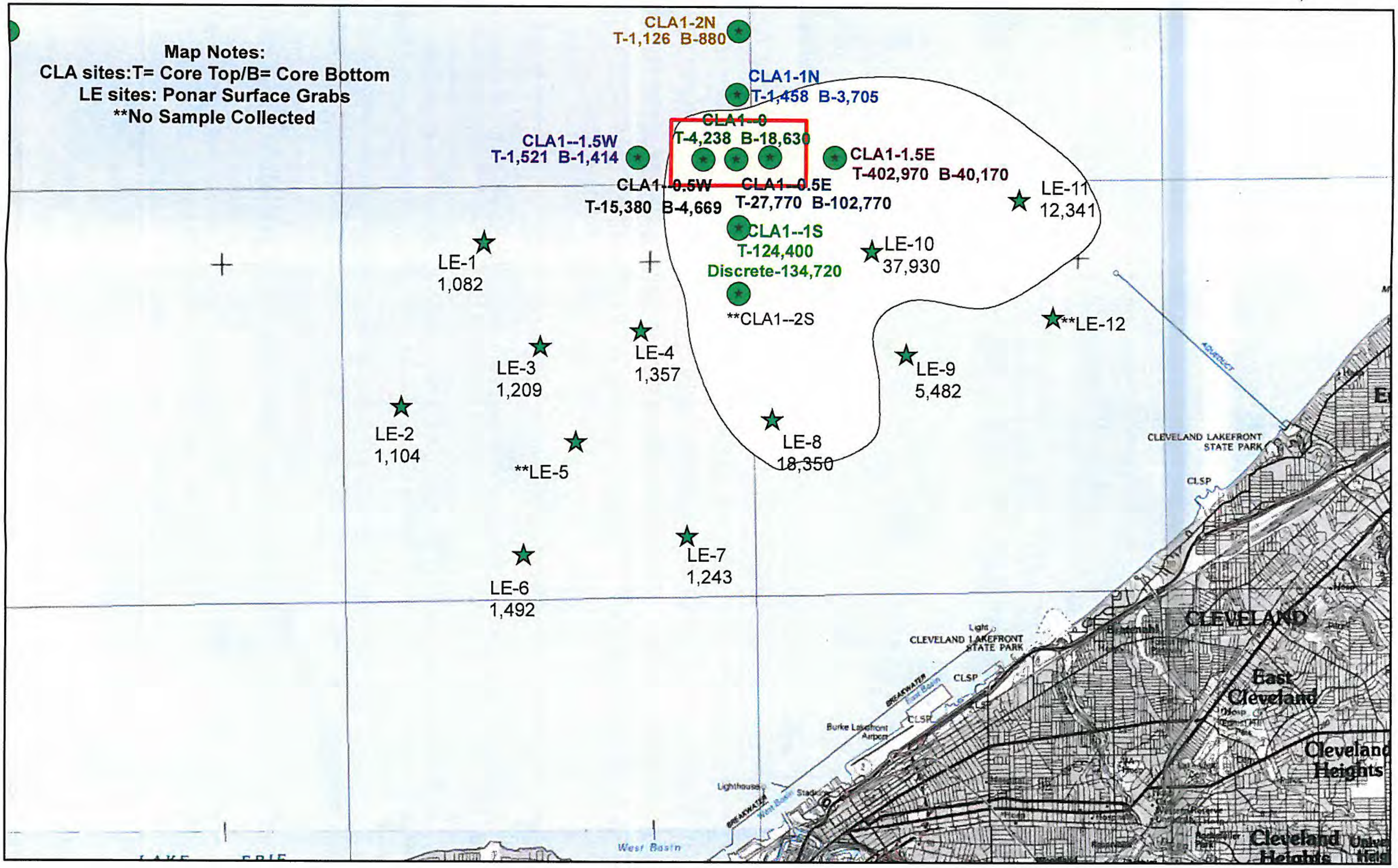
Kurt M. Princic
District Chief
Northeast District Office

KMP/ams

Attachments

ec: Rich Blasick, Environmental Manager, Ohio EPA, NEDO, DSW
Bill Fischbein, Attorney, Ohio EPA, Central Office, Legal
Joe Loucek, Environmental Specialist, Ohio EPA, NEDO, DSW
Tiffani Kavalec, Division Chief, Ohio EPA, NEDO, DSW

2015 Lake Erie Total PAH Concentrations ug/kg



Total PAHs represent the sum of the 16 priority pollutant PAHs.
All non-detects were assigned a value one-half RL.

Legend

- Ponar Grab Samples
- Multicore Samples
- CLA-1
- PAH AOC

0 1.5 3 6 Miles

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

March 12, 2016

RE: Written comments of Ohio EPA
Cleveland Harbor Dredge 2016, Public
Notice No. CLEVELAND – 16

U.S. Army Corps of Engineers – Buffalo District
1776 Niagra Street
Buffalo, NY 14207-3199
Attn: Mr. Eric Hanes

Dear Mr. Hannes,

Attached you will find the document dated March 1, 2016 from Kurt Princic, Ohio EPA to Ron Kozlowski, USACE – Buffalo District. Please accept this letter as part of the formal record for comments.

In addition to the March 1, 2016 letter Ohio EPA offers the following comment:

The proposed project involves an attempt to cap or remediate existing contamination in Lake Erie ("a contamination hot spot") by covering a portion of the hot spot with 180,000 cubic yards of material from the Cleveland Harbor. Recent data from both the Corps and Ohio EPA collected in 2014 and 2015 demonstrate that this hot spot is partially within CLA-1, but also extends beyond the parameters of CLA-1. Neither the original EIS from the Cleveland Dredging project (circa 1978) nor the EA/FONSI for open lake disposal of the Cleveland harbor sediment (December 2014) contemplated using the harbor sediment for capping contamination or for remediating contamination. As such, neither of these NEPA documents evaluated the environmental impact or effectiveness of using the Cleveland Harbor sediment in this way. In particular, because the project does not propose to remediate the entire hot spot, using the Cleveland Harbor sediment to cap only a portion of the hotspot has the potential of making future remediation efforts less effective or more costly. Additionally, because the effectiveness of the proposed remediation project has not been fully evaluated, the project has the potential of masking contamination without actually reducing exposure thereby hiding the harm from future generations. Furthermore, if the harbor sediment is allowed to commingle with the contaminated hotspot and then migrated to other portions of the lake, it could transport new contamination to otherwise clean portions of Lake Erie. Lastly, the proposed project has the potential of disturbing the contaminated hotspot during placement and thereby has the potential of causing greater resuspension and migration of the existing contamination. All of these potential environmental impacts and all other potential environmental impacts from this new project should be evaluated under the NEPA process before this project could commence. Specifically, a Supplemental Environmental Impact Statement—or an EA and FONSI—should be completed before this project could commence.

Additionally, this project is presumably part of a larger project to remediate the entire contamination hotspot, which itself would be a major federal action. The proposed project is an improper segmentation of complete remediation. The complete remediation project would be a separate project from the dredging project or proposed open lake disposal project as the contamination extends beyond the CLA1 and capping the hot spot would require more than 180,000 cubic yards of material. Therefore, an Environmental Impact Statement should be completed that evaluates the environmental impacts of the entire remediation of the contamination hotspot.

Please feel free to contact me 330-963-1204 if you have any questions.

Sincerely,

Kurt M. Princic
District Chief
Ohio EPA Northeast District Office

KP/peb

Attachments

Ec: Rich Blasick, Environmental Manager, Ohio EPA, NEDO, DSW
Bill Fischbein, Attorney, Ohio EPA, Central Office, Legal
Joe Loucek, Environmental Specialist, Ohio EPA, NEDO, DSW
Tiffani Kavalec, Division Chief, Ohio EPA, Central Office, Legal

Ohio Environmental Protection Agency

John R. Kasich, Governor
Mary Taylor, Lt. Governor
Craig W. Butler, Director

March 1, 2016

RE: CLEVELAND HARBOR DREDGING 2016
PERMIT - INTERMEDIATE
CORRESPONDENCE
401 WETLANDS
CUYAHOGA
DSW401144574

Mr. Ronald Kozlowski, PMP, CGFM
Chief, Programs and Project Management
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, New York 14207-3199

CERTIFIED MAIL

Subject: Cuyahoga County / City of Cleveland
401 Certification Application Cleveland Harbor Dredging 2016
Ohio EPA ID No.154844

Dear Mr. Kozlowski:

We have conducted an initial review of the United States Army Corps of Engineers' (USACE) application for water quality certification (WQC) for the 2016 dredging of Cleveland Harbor. USACE has once again proposed disposal of the dredged material at open-water site CLA-1, approximately nine miles offshore of Cleveland. USACE's proposal also identified a contaminated hot spot in the vicinity of site CLA-1, a portion of which USACE has proposed to cap with the dredged material from Cleveland Harbor in order to bury toxic sediments and hopefully improve the benthic habitat in that area.

As with the two previous 401 water quality certifications submitted by USACE for maintenance dredging of Cleveland Harbor, USACE is proposing to open lake dispose 180,000 cubic yards of contaminated Harbor sediments into the open waters of Lake Erie based on its unilateral finding that such a proposal is the least costly, environmentally acceptable alternative, i.e. the federal standard.

On the basis of the available data and the applicable laws and regulations, Ohio EPA continues to have serious concerns and reservations about the water quality impacts of the USACE's proposal. These are the same concerns that led to past certifications by Ohio EPA requiring the USACE to place dredged material into confined disposal facilities and has also led to ongoing litigation between our respective organizations.

A summary of the main technical points of concern are listed below.

PCBs and Bioaccumulation

- All of the PCB data sets (including USACE 2012 and 2014, and Ohio EPA 2015) show that the Cleveland Harbor sediments have a higher PCB bioaccumulation potential than the Lake Erie background sediments. In general, the harbor sediments show up to 5 times as much PCB bioaccumulation potential as the background sediments.

- Two of the three data sets (USACE 2012 and Ohio EPA 2015) show that the Harbor sediments have a higher bioaccumulation potential than sediments at disposal site CLA-1. However, CLA-1 and CLA-14, the historic disposal sites, exceed Lake Erie background for PCB bioaccumulation.

- USACE has provided evaluations concluding that Harbor sediments do not exceed CLA-1 or background for PCB bioaccumulation. However, this was accomplished by including Tier 2 values, i.e. modelled estimates, into the Tier 3 data set. We do not agree that this approach is appropriate and do not believe it yields valid conclusions.

PAH Contamination, the Lake Erie "Hot Spot," and Proposed Beneficial Use of Dredged Material

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If you have any immediate questions regarding this letter, please do not hesitate to contact me at (330) 963-1204.

Sincerely,

Kurt M. Princic
District Chief
Northeast District Office

KMP/ams

Attachments

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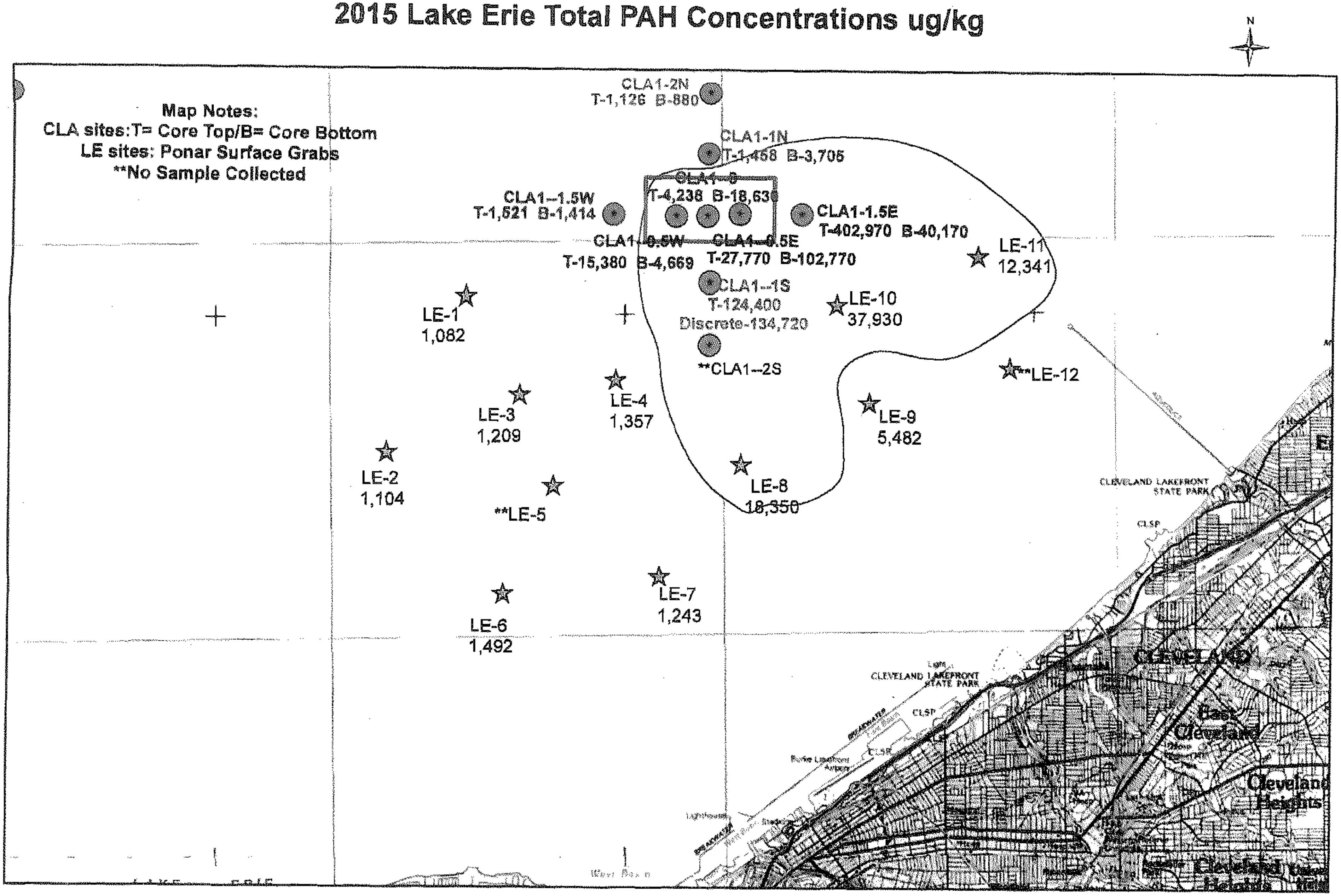

Legend

- Ponar Grab Samples
- Multicore Samples
- CLA-1
- PAH AOC

Total PAHs represent the sum of the 16 priority pollutant PAHs.
All non-detects were assigned a value one-half RL.

U. S. Army Corps of Engineers
Cleveland Harbor Dredged Sediment
Public Hearing

US Army Corps of Engineers®
Buffalo District
BUILDING STRONG®

March 1, 2016

Would you like to submit a written comment? If so, complete the information below and place this form in the comment box.

Name: Martha P. Thompson [redacted]

Group Affiliation *(if applicable)*: mbr. CC of Cleveland

Comments: The US Corps of Engineers undertook a study - it took 4 years + cost 4 million dollars - results - they came up with ZERO recommendations! What a waste of time, money + where were their brains? They, by mandate, must dredge the Cuyahoga River (they've ever waffled here) + now think that it would be safe to discharge all the silt + dregs, contaminents into the shallowest Great Lake! Boggles your mind. We already are threatened by the carp's invasion because of failed gates in the Chicago-Gary area. (Another horror) Now add the toxins that bloom in ever widening swaths fouling fresh + clean + pure water. Look at the boondoggle in Flint where government failed to monitor water quality. The Great Lakes are a world treasure + we need to save them. You'd better reverse your dreadful plans

(over)

We need to safeguard our drinking water, protect our fishing + boating industries, provide clean, safe beaches + bluffs.

US Army Corps of Engineers®
Buffalo District
BUILDING STRONG®

U. S. Army Corps of Engineers
Cleveland Harbor Dredged Sediment Public Hearing

March 1, 2016

Would you like to submit a written comment? If so, complete the information below and place this form in the comment box.

Name: ____________________

Group Affiliation *(if applicable)*: ____________________

Comments:

I support the CORP!

Cleveland Harbor Hearing
U.S. Army Corps of Engineers, Buffalo District
Burke Lakefront Airport (West Concourse), 1501 North Marginal Road, Cleveland

Thank you for the opportunity to provide comments on disposing dredge sediment in the open waters of Lake Erie. Western Reserve Land Conservancy is a non-profit organization that works to protect our enduring natural resources—the prime soils, freshwater and wildlife—of northeastern Ohio. These resources provide enduring prosperity for our region, yet unfortunately, they are all threatened by multiple stressors.

To date, we have protected almost 44,000 acres throughout 21 counties in northeastern Ohio, including six counties bordering the Lake Erie shoreline. Not only are these projects an investment in our cities, farms, parks, and people, but they are an investment in Ohio's rivers, streams and lakes. Every acre of land that is protected, left undeveloped, has a positive effect on water quality.

A naturally vegetated landscape provides the greatest benefits for water quality. Undeveloped lands, especially forests, filter both surface water and groundwater. Developed lands are predominantly impervious surfaces that do not allow water to filter directly into the ground. Water that isn't absorbed into the ground will flow over the land, collecting sediment and contaminants along the way, until it eventually enters a waterway. Impervious surfaces also affect the amount of runoff entering streams. Not only does impervious surface accelerate stream erosion and degrade water quality of surface waters or streams, it blocks or diverts water from infiltrating the soil to recharge ground water.

Water is a critical natural resource, and is necessary for life. It covers over 70% of the earth's surface, though only 3% is fresh water. Unfortunately, access to clean freshwater is not always possible. Ohio is a water rich state blessed with Lake Erie, the Ohio River, and a network of tributaries covering the state.

Because Western Reserve Land Conservancy works earnestly to protect Ohio's valuable natural resources, including water, we are concerned that dredging the Cleveland Harbor and disposing of the material in the open waters of Lake Erie will re-suspend PCBs and other contaminants. Once suspended, these contaminated sediments could then enter into the food chain of Lake Erie's fish and wildlife, and ultimately into the human food chain. Jeopardizing the health of Lake Erie and its fish and wildlife, as well as Northeastern Ohioans, undermines the Land Conservancy's mission to provide healthy communities.

I encourage the Corps of Engineers and the state of Ohio to continue to negotiate to find a solution that allows the contaminated dredge spoils to be dumped into a combined disposal facility (CDF). The Port of Cleveland is an economic driver for the region so the Cuyahoga River must be maintained for commercial navigation. Yet while hundreds of millions of federal dollars are being spent on Great Lakes restoration, contaminated dredge spoils should not be dumped back into Lake Erie.

In addition to addressing the immediate need of determining where to deposit the dredge spoils, the Land Conservancy supports additional preventative efforts to minimize the amount of material that must be removed from the Cuyahoga River each year. The Land Conservancy will continue to conserve land to minimize the amount of sediment and contamination entering into the Cuyahoga, and additional resources will help accelerate prevention efforts.

Thank you.

Joy Mulinex
Director of Government Relations
Western Reserve Land Conservancy

Hannes, Eric LRB

From: Debbie Wright [redacted]
Sent: Thursday, March 03, 2016 3:46 PM
To: DLL-CELRB-ClevelandDredging
Subject: [EXTERNAL] please stop open lake disposal of dredged sediment

To The Army Corp 0f Engineering and to whom it may concern,

Please do not approve open lake placement of dredged sediment from Cleveland Harbor.

Lake Erie is the primary source of drinking water for more than 11 million people, including 3 million people in Ohio. The water of Lake Erie is home to 50% of the fish found in the Great Lakes. These waters have long been the lifeblood of the Northeast Ohio region, supporting jobs and recreation. Also, Nearly 18,000 jobs and $1.8 billion in annual economic activity are tired to the approximately 15 million tons of cargo moving through the Port or Cleveland and the Cuyahoga River Chanel each year, according to Government statistics. Permitting the disposal of sediment and additional PCBs into the Lake would undermine decades of achievement in Water Quality.

It is important for USACE to maintain navigation Channels, but it should be done in such a way that the health of the Lake is still a primary concern., I would expect that USACE would want to pursue safe alternatives to open lake dumping to ensure the health, safety and economic vitality of our entire region.

Thank You,

Deborah Wright
[redacted]

Debbie Wright

U.S. Army Corps of Engineers - Buffalo District

Cleveland Harbor Dredging

Clean Water Act

Section 404 Public Hearing

Thursday, March 1st, 2016

6:00 p.m.

Held at:

St. Ignatious High School Breen Building

2008 West 30th Street

Cleveland, Ohio 44113

Melissa E. Case, RPR, Notary Public

LTC JANSEN: Well, good evening, everyone. Thank you very much for visiting with us tonight. My name is Karl Jansen. I'm the commander of the Buffalo District U.S. Army Corps of Engineers. I proudly represent the 300 dedicated Department of Army Civilians that make up the Buffalo District. Our headquarters is in Buffalo, but we have offices here in Cleveland, Toledo, Oak Harbor, Stow, and Orwell as well.

Before we get started, would you mind standing up, if you can, and joining me with the Pledge of Allegiance?

I pledge allegiance to the flag of the United States of America. And to the republic for which it stands, one nation, under God, indivisible, with liberty and justice for all.

All right. Thank you very much. We've got Super Tuesday. We've got an engaging public hearing. It's raining outside. It's a good day to be an American. Thank you.

Since 1857, Buffalo District has served the people in the watersheds of Lake Erie, Lake Ontario, and the St. Lawrence Seaway. Today, we deliver vital engineering solutions in collaboration with our partners to secure our nation, energize our economy, and reduce risk from disaster.

Tonight I'll provide you about a 20-minute presentation on our 2016 proposal to dredge Cleveland Harbor. And then we'll transition to hear and record the public comments. We'll develop and publish responses to your comments within the next couple of weeks.

As all of you probably well know, over time the issue of what to do with Cleveland Harbor sediment has developed into a heated dispute. It's a very complicated issue. The federal guidelines we follow can be confusing to those not involved with them on a daily basis. And the scientific processes we rely on are very technical.

It's my hope that no matter what your stance is on this issue, you'll be able to leave here tonight having learned something new and that you may be better postured to shape the future of Cleveland Harbor dredging for years to come.

Despite what you may sometimes read, I want you to know that in no way do we intend to cause harm to you, to the environment, or to the economy. Even though this dispute has played out in a very public way, I know we can work through it in a civil manner.

It will take time to settle our differences. But once we do, all parties will be able to reconcile

and continue to serve the public as a partnership. Our motives are very simple. We remain protective of human health and the environment, and strictly comply with federal guidelines.

As contentious as this issue has been, there's really nothing in it for us as an agency other than to stay true to our science and our policy-based decision-making. Other harbors across the State, the Great Lakes, and the Nation depend on us to operate in this objective way.

In fact, it's our duty to operate in a way that complies with federal guidelines. They have the effect of law, and it's not optional for us to follow them. The State of Ohio, the Port of Cleveland, and many other stakeholders prefer and even demand that we operate in a certain way here in Cleveland at full federal cost, but it's important to understand that our current federal guidelines do not allow for that.

Sometimes I think there's a false dichotomy in the conversations surrounding this issue that we insist on dredging in the manner we propose or Cleveland Harbor won't be dredged at all and the regional economy would suffer irreparable harm. But that's not true.

With shared responsibility and without overstating the chemical and biological characteristics

of the sediment. There are many ways that Cleveland Harbor can be dredged in a way that's economical and in ways that derive environmental benefits.

I'm confident that we can work through the complicated process to dredge all of Cleveland Harbor this year. We know and appreciate how important dredging is to support the local and regional economy. We also know that the Great Lakes navigation system, the interconnected system of 140 harbors, is the backbone of our nation's industrial economy and ultimately helps assure our national security.

We currently utilize open lake placement in each of the 13 Lake Erie commercial harbors expect for Buffalo, Monroe, and here in Cleveland. This is because confined disposal facilities, or CDFs, which came about in the 1970s, which were intended as temporary measures, did their job by permanently removing polluted sediment from the ecological system while strict environmental laws could take effect.

There is limited space remaining in these CDFs, and the space was created at a very high cost. So it's imperative that we utilize them only for sediment that doesn't qualify for lake placement or readily available beneficial uses.

Cleveland's federal navigation channel includes

the first six upstream miles from the mouth of the Cuyahoga River. We currently manage it in two main sections. The local river channel starts at the mouth and extends five miles upstream. And the upper river channel extends one more additional mile upstream to what's known as the head of navigation adjacent to ArcelorMittal Steel.

On average, we dredge about 225,000 cubic yards of sediment each year to keep the channel open for business. The sediment we dredge largely originates in Cuyahoga Valley National Park where stream banks erode during storm events. The sediment travels through the watershed during high-flow events and then settles out in the deeper, wider navigation channel near the head of navigation.

We dredge the upper channel portion twice per year, in the summer and again in the fall. So the sediment that we'll dredge this summer will have been deposited since November of 2015.

Federal regulations mandate that the Corps operates in a manner consistent with what's called the federal standard, which is the least-cost alternative consistent with sound engineering practices and selected through Clean Water Act guidelines.

The federal standard sets the maximum investment that the federal government can make to maintain a harbor, and is the basis against which all other alternatives must be compared. Application of the federal standard is important because it's the way we ensure all harbors across the nation are evaluated consistently so limited funds can be distributed fairly.

The federal standard in Cleveland is open lake placement for sediment dredged in the upper channel, and CDF placement for sediment dredged in the lower channel.

This method requires an estimated $2.8 million in federal appropriations based on bid data that we received last year. And this is the amount we have available to dredge in 2016.

If a state requires a different method that costs more, the Corps can implement that method, but the state or another non-Corps partner must pay the difference.

In the course of our normal annual budgeting process, the Corps reduced Cleveland Harbor's budget in 2016 by $3.6 million because the budgeted funds exceeded what was needed to dredge in a way that is consistent with the federal standard. The reduction allowed the government to fund other critical infrastructure needs.

It's important to know that the Corps' annual operation and maintenance program is never fully funded.

In fact, Buffalo District has a nearly $30 million shortfall in our program this year alone.

Although harbors nearby in Lorain and Fairport also require dredging to stay open, they were not funded in the 2016 President's budget. Applying our budget adjustment process across the nation resulted in these harbors receiving funding this year. So every tax dollar counts. And applying the federal standard fairly and consistently assures that we are good stewards of these resources.

The most important aspect of applying the federal standard is completing a proper sediment evaluation to determine if it's chemically and biologically suitable for open lake placement. The Corps does this using Clean Water Act Section 404(b)(1) Guidelines based on protocols described the "Inland Testing Manual" and the "Great Lakes Dredged Material Testing and Evaluation Manual." These manuals provide formal regional and national guidance developed and adopted in concert with the USEPA.

The upper channel sediment had been sampled, tested, and evaluated with more rigor and more scrutiny than in any other Great Lakes harbor.

Last year's water quality certification application was based primarily on sampling from 2012;

however, this year's application, which we submitted to the Ohio EPA in November, is based on three more sampling events that we have conducted in 2014 and 2015.

We also factored in data that Ohio EPA provided us late last year from their sampling events. These data were gathered during nine sampling events over the last few years. We have determined that upper river channel sediments meet Clean Water Act guidelines and applicable state water quality standards for open lake placement.

When we test sediment for toxicity, we expose benthic invertebrates -- these are bugs that live on the lake bottom -- to dredge sediment, to sediment found in the background reference location, and also to a certified clean sediment that serves as the experiment's control.

We also exposed minnows to dredged sediment and to that control. The survival rates of the bugs and the minnows are the same when exposed to the dredge sediment, the background sediment, and the clean control. So we determined that upper-channel sediment is non-toxic. Upper river channel sediment is also safe for the water we drink and the fish we eat.

Open lake placement does not involve dumping sediment in random areas. Instead, discreet sites are

studied and selected to maximize protection of human health and the environment.

The area we studied is known as CLA-1, which stands for Cleveland Lake Area Number One. This is a rectangular area, two-square miles in size. It's located just over nine miles from the shoreline and in about 60 feet of water.

People are always concerned about the safety of their drinking water, and rightly so. Especially considering the crisis of lead contamination in Flint, Michigan and even in areas here in Northeastern Ohio.

We've conducted state of the art modeling and analysis. And placing sediment at this location would pose no risk to Cleveland area water intakes.

Upper river channel sediment is also safe for the fish we eat because the concentration of the PCBs in the sediment are consistent with the background concentrations found offshore in Cleveland. We fully recognize that our proposal for open lake placement of that last mile, that upper river channel, is unpopular.

The Ohio EPA has even warned that issuing an Open Lake Placement 401 Water Quality Certification may prompt them to change their Walleye consumption advisory from one meal per week to one meal per month. There's absolutely no sound science that indicates depositing upper-channel sediment at the placement site would lead to an increase of PCB in Walleye and would warrant such a drastic measure.

While we feel that we meet all applicable state water quality standards, the Director of the Ohio EPA has already signaled that it's unlikely that he would issue a 401 Water Quality Certification for this activity.

But I'd like to reassure everyone here tonight that the U.S. Army Corps of Engineers has not and will not move ahead and place Cleveland Harbor sediment in the open lake without a state issued 401 Water Quality certification.

If the State were to deny water quality certification, there are still several scenarios that lead to dredging all of Cleveland Harbor in 2016.

It's encouraging that the quality of Cleveland sediment has increased greatly over the years. This improvement is the result of decades of dredging and confinement of the most contaminated of these sediments and enforcement of the Clean Water Act.

The good news is that we can now begin to open the door to beneficial use of this sediment. Beneficial use is managing dredge sediment in a way that derives an environmental benefit.

As many of you know, the State of Ohio is seeking to transition from open lake placement to beneficially using sediment by July 1st, 2020.

We do share common goals with the State, especially when it comes to beneficial use of dredge sediment. It's important to point out the State of Ohio does not view open lake placement and near shore, in-water beneficial use as the same thing.

While they object to open lake placement, they are open to exploring near-shore placement if and where it makes sense. And most cost effective alternatives to open lake placement involve beneficial uses that are within the body of water; like covering other areas with elevated levels of PCB or other pollution, habitat creation, and beach nourishment.

So it's important that we don't overstate sediment characteristics, which could unnecessarily rule these opportunities out. An example is using terms like muck, sludge, and toxic waste. Those terms can be both inaccurate and misleading.

I'd like to spend a few moments discussing the various ways the Corps can dredge this year. We typically aim to begin dredging in mid-May to support the navigation interest. And in order to do so, we must advertise contracts in mid-February, and then award a

contract in early April.

Last week, on the 24th of February, we advertised a contract that included three different ways of dredging, two of which do not involve open lake placement. The first is our proposal that is consistent with the federal standard. Sediment from the lower five miles of the channel would be placed into the Federal CDF, and sediment from the upper-most mile of the channel would be placed at the open lake placement area. The estimated contractor cost for this proposal is $2.8 million based on last year's bids.

The second alternative also calls for placing sediment from the lower five miles into the Federal CDF, but then relies on our contractor to identify an alternative location other than the open lake placement site to transfer the sediment from the upper river.

You'll probably hear about one such site from the Port of Cleveland tonight. This way is likely more expensive than our federal standard proposal, and, in fact, it could cost two or three times as much. So for the Corps to award this type of contract, a non-Corps partner would have to agree to pay the cost difference.

The third alternative calls for placing all of the sediment from both the upper and the lower river channel into the federally-operated CDF. Because of the

limited space remaining in the CDF, an alternative method of transferring the sediment would have to be used, and this is very costly. Again, for the Corps to award this type of contract, a non-Corps partner would have to agree to pay the cost difference.

We'll know more about the actual cost difference between these three alternatives when we open the bids later this month.

Again, in applying the federal standard, we do not dictate the way sediment is managed in a particular harbor. Applying the federal standard simply sets the maximum investment of federal taxpayer dollars that the government can make.

As I wrap up, I'd like to share that idea of developing cost-neurtral alternatives to open lake placement. Some Great Lake states share the position of Ohio; that regardless of the scientific analysis we offer, they just want to avoid open lake placement.

Local leadership in states like Minnesota and Wisconsin have worked with the Corps to develop alternatives that are locally acceptable, but cost the same or less as open lake or placement. And that's what I mean by cost neutral.

Ohio EPA has provided several million dollars in grant money to the Port of Cleveland so they can rework their CDF in a way that may lead to increased storage capacity and sales of sediment for beneficial uses.

The Port will probably tell you more about the plan later tonight. But their operation is far from cost neutral because they add fees and require placement methods that drive the cost up to two or three times more than that of the federal standard. Not only are we unauthorized to pay these higher costs, if we did, we would have fewer resources to dredge other harbors and this could create serious problems for other commercial harbor communities.

But I'm confident that with your help, the more we discuss cost-neutral alternatives and places where they've been successful across the Great Lakes, we can apply the same mindset right here in Cleveland, and we can identify true win-win solutions.

Thank you very much for your attention during my presentation. We look forward to hearing and recording all of your comments this evening. As I told you at the beginning, we'll respond to all of these comments in writing over the next few weeks.

The responses will be posted on our website along with the complete body of our scientific analysis and our water quality certification application. And the access information for our website is included on

the handout you picked up on your way in. So with that, I'll hand it over to our public hearing facilitator Mr. Andy Kornacki. Thank you very much.

MR. KORNACKI: Thank you, Colonel Jansen. At this time, we will begin the public hearing portion. To make verbal comments, please make sure you have signed up at the sign-up table at the entrance at the auditorium.

If you do not wish to make verbal comments tonight, you can also provide written comments until March 12th. Those comments can be submitted through various methods included on the handout that you picked up at the entrance tonight.

I would ask before we get started and before you make your statements, please provide your full name for the record, your affiliation, if any, and try and keep your comments to around three minutes. I will provide you with a signal when you have about 20 seconds left of that three minutes.

To begin the comment period, I would ask federal, state, and local governmental officials to provide their comments. We'll go in order as they were received.

First up tonight is going to be Kurt Princic followed by Dave Emerman, then Mike Foley, Will

Friedman, and Chris Ronayne. I hope I got those right. So at this time, I'd ask that Kurt Princic step up to the microphone.

MR. PRINCIC: Up here or where?

MR. KORNACKI: Right back there. The microphones are stationed one over there and one over on my left, maybe your right.

MR. PRINCIC: Good evening. I'm Kurt Princic, Chief of Ohio EPA Northeast District Office. I'm here today to express Ohio EPA's concern with the Army Corps proposed plan to place contaminated dredge material from Cleveland Harbor into the open waters of Lake Erie.

The director of Ohio EPA, Craig Butler, is unavailable this evening, and I am speaking on his behalf. Ohio has been very clear in expressing our concerns to the Corps regarding their proposal to dispose of contaminated sediments from the Cuyahoga River into Lake Erie.

Since 2012, Ohio raised concerns about the material and suggested at a minimum the Corps should plan for the possibility that Ohio EPA would not approve open lake disposal. The Corps has not planned for this even after the State of Ohio challenged the same decision last year by filing a lawsuit.

We have conducted a review of the Corps'

application for the 2016 dredging in Cleveland Harbor. The Corps has once again proposed a disposal of 180,000 cubic yards of Cleveland harbor sediments into the open waters of Lake Erie based on their unilateral finding that such a proposal meets Ohio's water quality standards and is the least costly environmentally acceptable alternative, or as Colonel Jansen called it, the federal standard.

It has been the Corps' position that the area in Lake Erie where they want to dispose of the material which is called CLA-1, represents lake background conditions. This position is fundamental to their argument that the sediments are safe for open lake disposal.

Ohio has repeatedly stated that CLA-1 does not represent background because through the mid 1970s, this is where all the contaminated dredge material from the Cuyahoga River was dumped, and we were concerned that the area was impacted by those historic dumping practices.

As it turns out, both Ohio EPA's and the Corps' most recent sampling data from 2015 show there's a highly contaminated area of sediment, a hot spot of contamination in and around this historic dump disposal site CLA-1. And it now appears to the Corps that CLA-1

Page 19

is not a suitable background site. But instead of placing the sediments in the confined disposal facilities as they have for the past 40 years plus, they now propose to use the sediment to cap this hot spot area of contamination.

Essentially, the Corps wants to cover up the dirty and toxic material with additional polluted material. Ohio EPA agrees this hot spot and the area around it does need to be cleaned up; however, we are not able to choose a remedy for this work on this basis the Corps has submitted.

Before any clean-up occurs, it is critical to adequately investigate this area and implement a remedy that is sure to be successful. Currently, the technical review provided by the Corps is approximately one page, and is a completely inadequate analysis by which to proceed with this clean-up project.

You heard from Colonel Jansen that they only have the budget this year to manage the material in accordance with their unilateral view of the federal standard in Ohio's water quality standards, which is to place 180,000 yards of contaminated material in Lake Erie.

It is important to know the Corps did have sufficient budget to properly manage the material;

Page 20

however, the Corps, unbeknownst virtually to everyone purposely reduced their budget for Cleveland Harbor so it appears they only have enough money to place the material in Lake Erie even though they knew there was ongoing litigation, and all available data failed to support their position.

This is just another example of their poor planning and lack of transparency when it comes to Cleveland Harbor and the protection of Lake Erie.

Further, as most are aware, the Corps provided a letter to Lake Erie stakeholders just last week criticizing Ohio EPA's data gathering techniques and analysis of harbor sediments claiming that our data was invalid and scientifically unreliable.

Let me say now that this criticism is absolutely false and misplaced. Ohio EPA carefully relies upon approved EPA methods. Our PCB data is scientifically valid and reliable.

It's critical to point out that while the Corps was quick to attempt to discredit our data, it once again missed the most important point, which is regardless of whose data you choose, Ohio EPA's or the Corps, the answer is still the same: The sediment from Cleveland Harbor is too contaminated to dispose of in Lake Erie.

Page 21

In conclusion, I'm here to ask the Corps to rethink this flawed strategy based only on economics, not environmental and public health protection, and partner with Ohio in protecting Lake Erie, a state and national treasure.

Further, it is Ohio's position that all sediment should be disposed of in the Cleveland confined disposal at full federal expense. Thank you for your time and attention on this important manner.

MR. EMERMAN: Good evening. My name is Dave Emerman. I'm the Assistant Attorney General from the Ohio Attorney General's Office and Mike DeWine's office, the Environmental Enforcement section.

First off, I want to thank the Corps for the opportunity to provide these comments. The Attorney General is traveling and sent his regrets that he cannot provide these comments in person.

The Corps is once again threatening to dump toxic and carcinogenic material into Lake Erie rather than using the fine disposal facilities that were built for the very purpose of containing those toxins. Cleveland Harbor is essential to Ohio's economy, and that dredging absolutely needs to be done. But it needs not be done at the expense of our health and our lake. And I can assure you that the Ohio Attorney General

Page 22

supported by the Ohio EPA and the Department of Natural Resources will never allow the Corps to jeopardize or compromise the health of our families and our children.

And I can further assure you that we will never allow the Corps to jeopardize Ohio's economy or the jobs of thousands of Ohioans if the Corps attempts to defer its obligation to maintain the Cleveland Harbor.

The law that is there is straightforward. The Corps funded by Congress is required to maintain the Harbor, but the State of Ohio gets to determine the standard for safe disposal.

Specifically, the Clean Water Act requires the Corps to comply with all state and water quality standards while doing dredging and is further clarified by the 2016 Budget Bill. The Corps is prohibited from spending funds on open lake disposal without approval from the State of Ohio.

Now, the Corps claims that it will comply with state water quality standards, but only on the condition that Ohio pays for that compliance. If we won't pay, they just won't dredge. In doing this, the Corps is using financial coercion to pressure Ohio into lowering its standard and compromising the health and environment of its most precious natural resource, Lake Erie.

This practice is also in violation of federal law, which requires the Corps to maintain federal navigational channels at 100 percent federal expense and directs the Corps to maintain Great Lake harbors with its available funds.

Now, last year, Ohio EPA determined that placing the harbor sediment in Lake Erie was environmentally unacceptable and would not grant approval for open lake disposal. Ohio's justification was simple. The harbor sediment contains persistent toxic carcinogens called PCBs.

Placing harbor sediment in Lake Erie would increase the amount of these toxins in the lake, and as a result in the fish that we eat. Simply, open lake disposal would increase Ohioans' exposure to these toxins. You might guess the Corps disagrees. The Corps erroneously claims that the harbor sediment is no more polluted than the lake sediment. But this mistaken conclusion is only reached by comparing the polluted sediment to a spot in Lake Erie already polluted by the Corps previous dumping.

The Corps is actually using its previous pollution, which has caused the spot on Lake Erie that's six times more contaminated than background conditions to justify even more pollution. And furthermore, the Corps' entire analysis is based on the absurd claim that

if they dumped material in Lake Erie, it would just stay in the same spot that they dumped it.

Alternatives to open lake disposal exists. Specifically, the Corps should use the confined disposal facilities that were built for the very purpose of containing Cleveland Harbor sediment and which the Corps has used during their previous dredging projects for the past four years. And this was all ultimately required by a federal judge and litigation being filed last year where the Corps tried to do this exact same thing.

Even more infuriating this year, the Corps has played games with its budget to underfund the 2016 Cleveland dredging product. The Corps' original budget request, which is approved by the President that we saw earlier, saw over $6 million for the Cleveland Harbor project.

Then the Corps without consulting the State of Ohio or a house congressional delegation intentionally requested that that amount be decreased to an amount that will only allow for the lake disposal. But despite the Corps' budget games and whether or not the Corps agrees with Ohio's attempts to protect Lake Erie, the Corps is prohibited from using open lake disposal without approval from the State of Ohio.

Last year, the Corps gave Ohio an ultimatum,

that Ohio pays for the disposal or the Corps won't dredge. But as the Federal District Court stated last year, the State cannot be blackmailed into contributing to these causes under threat of shutting down the harbor.

Hopefully the Corps will reconsider issuing Ohio the same ultimatum again this year. Ohio, again, determines that placing toxic carcinogens in Lake Erie is environmentally unacceptable. The Ohio Attorney General demands full compliance with Ohio water quality standards and demands that the Cleveland Harbor be dredged at full federal expense. Thank you for your time, and thank you for your attention to this important matter.

MR. KORNACKI: Mike Foley.

MR. FOLEY: Hi. My name is Mike Foley. I'm the Director of Sustainability for Cuyahoga County. As Lieutenant Colonel Jansen mentioned in his opening remarks, there is a great sensitivity to clean water in the United States today. From lead in the water in Flint to algae in the western basin of Lake Erie to beach closings, to combined closings in Cuyahoga County, the whole regions of the country out west who are practically out of water, sensitivity to having access to clean, fresh, drinkable water is at an all time high

virtually among everyone with the notable exceptions to the U.S. Army Corps of Engineers. The US EPA contracts with the Ohio EPA to make a determination about the quality of water and the impacts different events will have on water quality in Lake Erie.

The Ohio EPA has done study samples and found key pollutants such as PCBs, heavy metals, and other toxins in their testing from the soil bed of the Cuyahoga River.

Lake Erie is our county's primary source of water. The findings from Ohio EPA conflict the findings from the Army Corps. The Army Corps downplays the Ohio EPA's findings. Ohio EPA contests the Army Corps' findings.

Given the history of pollution in the Cuyahoga River and given the severe sensitivity to both be able to seek needs and having access to clean, fresh water in Lake Erie, it defies logic that the Army Corps is proceeding with a plan to dump dredge materials into the lake bed when there is at best much uncertainty in the agreement over the amount of toxins they contain.

We shouldn't be playing games or taking unnecessary risks with Lake Erie and its water quality. If the Army Corps is doing just that, they're not working in good faith with the Ohio EPA and the Port of

Cleveland.

On behalf of the Cuyahoga Department of Sustainability as well as county executive Armond Budish we strongly and urgently oppose the Army Corps plan to dispose of dredge material in Lake Erie.

MR. KORNACKI: Thank you. Mr. Friedman.

MR. FRIEDMAN: Good evening. I'm Will Friedman. I'm President and CEO of the Port of Cleveland, officially known as the Cleveland and Cuyahoga County Port Authority. I want to thank all of you who have come out on your own time tonight to participate. We really appreciate your doing so.

It looks like we have a new right of spring in Cleveland unfortunately, which is coming out to public things like this to fight the Army Corps to protect our shipping and our jobs and our greatest natural asset.

The Corps' push for open lake dumping was wrong three years ago when they first tried it, and it's wrong today. Its irresponsibly threatens jobs, the health of Lake Erie, and people who eat lake fish and drink tap water. The Corps application of its federal standard rule is an egregious overreach. The law is clear. The Corps does not get to decide by themselves if dredge material can be placed in Lake Erie. Congress established a system intended to build public trust by

having multiple authorities decide.

Like it or not, the State has a say and it has said no repeatedly. The Corps' baseline standard can't be a yearly theocratical alternative that cannot be implemented due to the legitimate exercise of authority by other public agencies carrying out their mandates in the public interest.

Let me repeat. Open lake cannot be the least-cost alternative because it is not a real alternative at all. The Corps can't maintain the public trust by using the state's legitimate and approved action as an excuse to turn the federal government statutory responsibility into a financial obligation for Ohio.

The federal court called this maneuver blackmail in last year's order forcing the Corps to dredge the shipping channel.

How the Corps reaches its conclusion and more importantly why they reach it is baffling and extremely troubling. In the end, this isn't only about the law or administrative rules or even money, it's about right and wrong and acting in the public interest. Twisting the rules to achieve a preferred outcome, whatever the motivation, it is not right and not in the public interest.

The Corps says, as you heard tonight, it is merely looking out for the American taxpayer. What they failed to mention is that congress mandates them to keep commercial harbors open and that dredge dollars come from fees paid by harbor shippers, not American taxpayers. Nor can you explain how jeopardizing thousands of jobs or harming the EPA's multi-billion dollar fishery or exposing people to more carcinogens is looking out for the tax payer.

The course the mission is to keep harbors open for commercial navigation. Congress has seen fit for decades to appropriate funds to keep Cleveland Harbor open without open lake dreading. Ohio's policy and law, which the Corps must abide, doesn't allow open lake dumping. Yet the Corps persists in proposing open lake dumping.

I take no pleasure in saying this, but this is institutional failure in the highest order. The Corps has utterly failed to produce a viable plan to keep this harbor open this year and in the future. Instead, it threatens us each year to not dredge unless someone else pays to handle the material in the only manner allowed by the State and as directed by congress.

Despite what you hear about the environmental suitability of the federal standard, as you heard it

tonight, this is a gotcha scheme entirely of the Corps' own making. They have chosen this past. And in so doing, rejected the only alternative actually available to them. The approach we are successfully implementing now with the State of Ohio as a full partner despite the Corps' opposition.

I'm going to close now by quoting Colonel Jansen's own words in a memo he wrote entitled the Commander Position Paper Cleveland, Ohio Dredging the Right Thing to Do, dated August 4th of 2014.

The right thing to do. In our situation, the right thing is to demonstrate some humility and cooperation: Respect the concerns of the Ohio EPA, back off our determination of the federal standards for 2015 and deliberately move forward to incorporate each of Ohio EPA sample testing recommendations in the future water quality certification application.

We should not view Ohio EPA's additional sampling and testing requests as outrageous or unreasonable. Instead, we should view them as a rational means of guaranteeing the health of Lake Erie.

We should only apply for water quality certification to accomplish the clean water demonstration project for 2015. We should formally agree to set forth a unified sampling and testing methodology and application process for 2016. Taking the aforementioned actions, doing the right thing in quote marks is not admitting failure, scientific error, or impropriety. Rather we are investing to earn the public's trust. We serve serve faithfully, and with genuine concern for Lake Erie.

This path builds good wealth and reinforces our core values. Failing to do so would perpetuate conflict and places an implementation of a long-term sustainability strategy at risk.

Again, I was quoting from the memo written by Colonel Jansen dated August 4th of 2014. Obviously the Corps is not choosing to earn the public's trust. I urge decision makers of the Corps, stop selectively hiding behind your rules and start doing the right thing. Put aside these futile gains and get to work safeguarding commercial navigation for Cleveland Harbor as congress has directed you. Thank you.

MR. KORNACKI: The next four people will be Carla Rantenberg, Susan Miller, Nick Turner, and Brian Stubbs.

MR. ROMAYNE: Good evening. My name is Chris Romayne. I'm the chairman of the board of directors of the Cleveland Cuyahoga County Port Authority. First thing I want to do is actually go off my own notes and

invite you and your colleagues, Lieutenant Colonel Jansen, to Cleveland to a board meeting of the Cleveland Cuyahoga County Port Authority.

I think you'd find it less of a monologue and more of a dialogue. We need dialogue. And that's why our board, my colleague Jan Roller's also here tonight. We invite you to come talk with us. We'll show you some of the things we're doing on the river. We'll show you some of the things we're getting out of the CDF and we'll talk with you about some of our practices that we have as we go forward in the marketplace.

We should be a partnership, and so we invite you back to Cleveland on another day -- we meet monthly as a board -- to just sit down and dialog so this isn't a monologue back and forth.

But here it goes. I'll give you mine. I think you hear the passion for our Great Lake tonight. And I'm going to say this from the perspective of a public official as you are too. As public officials, our foremost responsibility of any level of government is the health, safety, and welfare of the citizens we serve. As a division of the United States Army, the Army Corps of Engineers should know and respect that duty to protect more than anybody.

As chairman of the Cleveland Cuyahoga County

Port Authority, I and my colleagues of the board take the health and welfare of our citizens and their environment seriously. Given the known presence of PCBs in the Cuyahoga River bed, the Port of Cleveland has intentionally developed an alternative to the open lake placement of dredge material, an alternative that redirects toxins from the aquatic food chain that would otherwise pose a threat to human health.

As the City of Cleveland approaches the 50th anniversary of the Cuyahoga River fire that literally sparked the Clean Water Act, the Port of Cleveland partners in the challenge to keep our water and Great Lake clean using innovative dredge management practice. We're proud of that.

Through a combination of interception, removal, de-watering, and reuse of material where appropriate, the Port of Cleveland has developed a sustainable sediment management system that offers to be a model to other Great Lakes ports. We ask you for your partnership in supporting this practice as an alternative to what appears to be otherwise an obstinate behavior and a budgetary appeasementship. By rejecting the full funding proposal in the President's approved budget, challenging local tipping fees, and by threatening not to dredge the upper mile of the federal

navigation channel, you threaten business and the economy, and moreover, Cleveland health. We simply ask for your partnership in providing a healthy alternative to open lake placement.

The technology and markets exist to truly create a 21st century viable and sustainable practice of dredging management in the Great Lakes. The Army Corps should be leading the way on fair practices using the Great Lakes Restoration Act as the framework. At the least, we ask for your partnership in promoting the local best practice and merging the Port of Cleveland with widespread Great Lakes application.

The United States Army Corps of Engineers should be a leader in developing strategies to sustain clean water on the Great Lakes and throughout the U.S. The Corps and the Great Lakes ports working together with the U.S. and State EPAs and the opportunity to promote sustainable practices that may ultimately have been global educative environmental application.

Debating levels of PCB in the midst of current water quality channels throughout the Great Lake, state, and cities finally facing policy reforms taking shape as we speak. Philosophically digging in, dumping, and turning away from new technology and sediment management only endangers the health of citizens that we have the foremost duty to partner to protect.

And to battle this in Court only costs tax payers what they would not otherwise have to pay if it were not for the lack of partnership. The Cleveland Cuyahoga County Port Authority asks for your partnership in delivering a healthy alternative to open lake placement. At the Port of Cleveland, that practice is now in place.

In the furtherance of the physical and financial health of Clevelanders and the sustainability of our Great Lakes region, we seek your partnership. Thank you.

MS. RAUTENBERG: Good evening. My name is Carla Rautenberg. I live in Cleveland Heights, and I am a stakeholder in what goes on with Lake Erie. Almost two years ago, my friend Susan Miller and I proposed a public comment for the uses imploring the agency not to dump toxic sediment from the Cuyahoga shipping channel in our beloved and endangered Lake Erie.

By the time we submitted it, 37 of our friends and neighborhoods had signed it. The Ohio EPA did not grant the USACE's permission to dump the sediment into the open lake in 2014, and it was properly deposited in a confined disposal facility. Despite the cost and time, since then it's been Groundhog Day here on the

shores of Lake Erie. The same nightmare is inflicted on us each year.

I'm not going to repeat what others have already said about what has happened at the last few years and how the Army Corps has defied the Ohio EPA, Governor Kasich, our two U.S. senators, Congressional representative Marcia Fudge, the Port Authority, for two years in a row. And really it's behaved like a rogue agency.

I just need to say we understand, Buffalo District Commander Jansen, that we the taxpayers pay your salaries and all of the salaries in your huge federal agency, but what we really want to know is: Who are you working for? Because our 2014 public comment is unfortunately, just as timely today as it was then.

On behalf our 37 cosigners, we will resubmit that comment today. To preface it, Susan Miller and I offer just four more words that have not been approved by our cosigners. These are strictly from the two of us: Toledo, Flint, prison time.

MS. MILLER: My name is Susan Miller, and I'm going to resubmit our comments from 2014 somehow we've missed. We the undersigned urge the U.S. Army Corps of Engineers to withdraw the permit application that would allow you dumping a toxic sediment dredged from the

Cuyahoga River shipping channel in Cleveland Harbor into the open waters of Lake Erie's intake that supply drinking water to millions of Northeast Ohioans.

We are aware that Lake Erie is already greatly threatened with the agencies ineffectual and inadequate response to Asian Carp. As the shallowest and most fragile of the Great Lakes, Lake Erie is constantly challenged with biological and chemical pollutions.

Our Great Lake is also under assault by combining sewer overflows. In Northeast Ohio, we are being forced to finance $3 billion worth of infrastructure to keep this foul mixture out of our precious Lake Erie, the source of our drinking water and the most significant natural asset of the entire region.

Northeast Ohio Regional Sewer District rates have tripled for the average household over the last 23 years. Furthermore, these sky-high rates are forecast to double again in the next eight years. As rate payers, we are supposed to pay these incredibly increased rates to clean up our lake on the one hand, while agreeing to let U.S. Army Corps of Engineers dump toxic sludge in it on the other. We think not.

Of all the comments made at the Ohio EPA public hearing, which the first two undersigned, that's Carla and myself, attended on March 6th, Paul Sherlock of

Cleveland was perhaps the most direct when he said, and I quote, "I simply cannot understand the logic that is behind this decision. If this was a terrorist organization putting poison into our lake, what would the public reaction be?" End quote.

When the U.S. Army Corps of Engineers, a federal agency, seeks to contravene the Clean Water Act and asks Ohio EPA for permission to dump toxic sludge from maintenance dredging in our lake, what are we to think?

We understand that the dredging is a necessary annual event to keep the shipping navigable. If U.S. Army Corps of Engineers is permitted to dump dredged materials into the open lake for the first time in 40 years in 2014, it will surely set a precedent for future use. And here we are in 2016. This is insane.

Beneficial reuse of contaminated sediment is possible. We have a wonderful fresh water example right here on Lake Erie with the recent creation of the Cleveland Lakefront major preserve at Dike 14. If the beneficial reduce of the toxic sludge cannot be immediately implemented, the material should be removed to other confined disposal facilities as has been done successfully for over the past 40 years in accordance with the Clean Water Act. Although the Army Corps cites one study claiming that the toxicity of Cuyahoga sediment lessened from 2007 to 2012, the dumping request seems more likely to be money driven than science based.

And here we are in 2016 talking about it again. The soot alone would be an immediate threat to the aquatic environment and would be detrimental to the fishing and recreational activity on our lake.

In the coming weeks, the healthy Lake Erie allocation of $10 million over the next two years will most likely be passed in our state house allowing the ODNR to find beneficial use options for the dredge material. We cannot imagine that the good people of any other region of our country would allow this to be done to their sole source of drinking water and most important natural resource.

As concerned citizens, greater Clevelanders, parents, grandparents, taxpayers, and just regular reasonable people, all of whom need clean water, we ask the Army Corps to withdraw the application for this permit. This comment was signed by 39 Northeast Ohioans and submitted on March 26th, 2014, and it is resubmitted today.

MR. TURNER: Good evening. My name is Nick Turner. I'm here on behalf of Congresswoman Marcy Kaptur. The congresswoman couldn't be here, but she did ask me to read a statement on her behalf, so bear with

me. As a member of Congress who has worked on issues of beneficial reuse for more than two decades, it is disappointing that we find ourselves back here in Cleveland talking about the same issue and facing this stalemate.

We welcome Lieutenant Colonel Jansen and his team from the U.S. Army Corps of Engineers back to Cleveland, and remain hopeful a solution-oriented dialogue will commence.

As a Great Lakes law maker, I would like you to address serious and widely-held concerns about Great Lakes dredging needs. The need will continue to grow and solutions will become more complex as we face the changing nature of our climate and seek visionary solutions that demonstrate our commitment to environmentally friendly and sustainable solutions.

While the Army Corps of Engineers does life-saving work, I very much appreciate and value your efforts. I believe more attention must be paid to the policies of the Corps, which in some instances have not changed in decades. Two areas come to mind immediately, the lack of innovative financing in how we as a nation finance major projects such as maintaining shipping channels in high runoff areas, and how we address the problem with dredging disposal.

There remains a need for innovative, cross-agency collaboration and implementation especially in the light of toxic algae bloom crisis that plagues Americans's North Coast and the unfolding tragedies that have stricken our communities from Flint, Michigan, to Sebring, Ohio.

There is a need for innovate cross-agency thinking and honest and respectful communication. I stand alongside the millions of people who rely on Lake Erie as their source of clean and safe drinking water, and the tens of thousands of hard-working Ohioans whose jobs are directly supported by the Port of Cleveland, the Cleveland Harbor, and Lake Erie's fishing. Great Lake's ports are critical to our regional and national economy supporting our critical manufacturing base, and we must keep these ports open for business; however, this need not come at the expense of water security, safety, and quality of drinking water, or environmental integrity of this precious and unparalleled fresh water ecosystem.

There are two glaring problems with the Army Corps failing to dredge the Cuyahoga River and the Cleveland Harbor. First, the Great Lakes holds 80 percent of our nation's freshwater assets. Lake Erie alone provides drinking water to more than 11 million

people. And open lake dumping of dredged materials raises PCB levels that make the water less safe to drink and increase the toxic contamination of our Walleye, Perch, Northern Pike, and so on. Lake Erie is the Walleye capital of the world, but Ohio EPA has already recommended that people not eat more than one or two of these fish each week.

Second, the failure to dredge comes with big economic consequences. The Port of Cleveland, which requires annual dredging, directly supports an estimated 18,000 jobs and has an economic impact around $1.8 billion annually. The Lake Erie fishery supports another 10,000 jobs and adds around $1 billion to the region each year.

However, the Corps has decided to dig its heels, yet again. This time the casting aside nearly $4 million Congress had earmarked for dredge and placement of that dredge in a confined disposal facility, and our efforts in Congress to include a ban on open lake disposal in the last year's Omnibus Appropriations Act appears to be headed for the refrain. The Army Corps of Engineers will stop dredging the Port of Cleveland.

It seems every day is Groundhog Day around here. Routinely and repeatedly, the Port of Cleveland has put forth innovative and viable capacity management plans

Page 43

from intercepting commercially valued, bed-loaded material before it enters the federal channel to harvesting the dredged material for reuse in community improvement and road construction projects.

I urge the Corps of Engineers to join in the innovation, give us the power of fresh ideas from an agency that has a rich legacy of innovation and know-how. Let us forge a partnership based in creative solutions and forward thinking problem solving.

MR. KORNACKI: Bryan, just before --

MR. STUBBS: Bryan Stubbs with the Cleveland Water Alliance. The Cleveland Water Alliance is a consortium of industry, many of which clone or use the Cuyahoga River infrastructure partners, research institutions, both academic as well as the -- such as including national dilemma. Dredging the Cuyahoga River is essential to the economy of Northeast Ohio. Just as important are decade long efforts to improve water quality and restore ecosystems into Lake Erie. We believe by discounting the concerns raised by the Ohio EPA related to the level of PCPs that remain in the sediment, the U.S. Army Corps of Engineers is using its own finding to justify what it views as the least toxic option as established in the Clean Water Act. PCB levels in the dredge sediment remain too high does

Page 44

further damage to the diversity of Lake Erie and at a time where we need to be willing to acces nutrients from entering the lake. In addition, Northeast Ohio is experiencing a robust economic vibrancy for the first time in four decades, something that our group calls the blue economy. The blue economy is a $6 billion and direct economic impact to this economy and another 22 when you include, induce, and derive at the costs or benefits.

We support the dredging of Cleveland Harbor. It supports our local economy and industrial staple; however, open lake placement of dredge sediment is not the least costly method and stands to harm the economic and ecological health of Lake Erie.

We encourage the U.S. Army Corps of Engineers to work with the State of Ohio and the Port of Cleveland to find a solution that does not involve open lake placement of the dredge sediment at full federal cost. Thank you.

MR. KORNACKI: The next five people that we have up are Scott Rodger Hurley, Peter R. Griesinger, Elaine Marsh, Darrell Davis, and Jackie -- I'm just going to say Z.

MR. HURLEY: Thank you. Hi. My name is Scott Hurley, and I'm an attorney here in Cleveland, but I

Page 45

generally represent the poor, so I never really get myself over to federal court to get too involved in those matters there. But I will tell you that every single person in this room should read two documents.

The first is, of course, Judge Nugent's opinion from May 12th of last year. It is quite insightful when it comes to all of the issues that we're talking about here today.

The other document that I would suggest every single person read is the letter from the Army Corps of Engineers dated February 24th last week to the EPA. And it really describes all the faults that it sees with the testing mechanisms.

You've got to read these two documents if you really want to be a part of this conversation. I would submit to you that if I'm in a criminal case or any kind of case or to go on a PR tour to try to explain how the other side was wrong and my side was right while there was a pending injunctive declaratory judgment against me, that I would probably be found in contempt.

I would submit to you the decision first and foremost to increase its own budget is contentious of Judge Nugent's opinion. I would also submit to you that this PR campaign that is engaged right now, right here is Exhibit A in that continuing contempt. And I guess

Page 46

I'd just like to say good luck on that front because I think you guys have barked up the wrong tree. Peace.

MR. KORNACKI: Peter.

MR. GRIESINGER: Hi. I'm Peter Griesinger. I'm representing -- I'm a board member of -- on the board of directors for the Ohio Environmental Counsel. I'd like to read a statement from our water resources manager Kristy Meyer. But I do have to comment outside of that on my own personal statements that to the Corps.

Cleveland and Cuyahoga County and the State of Ohio have clearly come into the 21st century. And being an old activist with certain matters here in Cleveland in the past, I'm really truly touched and moved by the kind of things I'm hearing from our own Port Authority, from our own Cuyahoga County, from our own State of Ohio, and from our Attorney General.

All of these people who have spoken tonight are speaking with such clarity and such a sense of justice for our environment that I'm really truly appalled at the behavior of the Army Corps. And one of the things that I noted in your presentation, your slide on what you describe as CLA-1 -- and I wasn't aware of what really consists in the lake there.

That you have a slide that demonstrates a 9.4-mile extent to the shoreline to this plot and then you demonstrate the number of water treatment plants. But really, the concern and the disguise that that kind of PR puts out is that five miles out, I think, is where the water tank is, and who cares where the water treatments are, but that's what you put on your map -- on your slide, not where the water tank is.

And it's just appalling that a federal agency like this is trying to pull off this kind of deception. And it seems like something that you might see in the 50s about atomic energy and how it's safe to meter. This is how you're coming across.

All right. So this is my testimony from the Ohio Environmental Counsel. Good evening. Thank you for the opportunity to testify tonight. My name is Peter Griesinger. I'm a board member of the Ohio Environmental Counsel. Tonight I am speaking on behalf of the Ohio Environmental Counsel. We are a statewide public interest organization representing more than 100 members of environmental conservation organizations as well as thousands of individual members throughout the State of Ohio.

Our mission is to secure healthy air and drinking water for all Ohio homes. The OEC opposes the Corps' plan for open lake disposal of dredge material from the Cuyahoga River and the Cleveland Harbor into

the waters of Lake Erie.

We are disappointed that the Corps' plan offers a false economy. Open lake disposal may seem like it's the cheapest form of waste disposal, but in all actuality it's wasting disposal at all costs.

The Ohio EPA's recent data confirms the Corps' own samples of data of high levels of PCBs in dredging areas 1, 2A, and 2B far higher than PCBs from the background and disposal site, incredibly not what we've heard today.

In fact, the Army Corps' 2013 sediment analysis, sediments from dredge site 1 had led to seven percent more PCB accumulation in insects and organisms at the 2016 proposal site. PCBs rise up the food chain to accumulate in the fish, ultimately to the birds, then humans who may eat contaminated fish. Exposure to PCBs can have devastating neurological effects on babies developing in the whom resulting in lower IQ, hyper activity, delay in development, and other serious problems.

PCBs are also concentrated in the breast milk of nursing mothers. Knowing this, it is unclear to the OEC how the Corps can determine the dredge sediments from the Cuyahoga River and Cleveland Navigational Channel are safe to dispose of in the open waters of Lake Erie.

To add insult to injury, as you all have already heard, the Corps recently had their own dredge management budget slashed from 3.6 million leaving the Corps just enough to money to dispose of the sediments into the open waters of Lake Erie.

The Buffalo District appears to have its heals dug into the sand and is unwilling to come to the negotiation table to negotiate a viable solution.

In addition, frustrated by a lack of progress for any viable solutions, the Cleveland Cuyahoga County Port Authority obtained its own consultants in 2013. As a result, the Port has moved forward with some very good projects to reduce sediment flowing in the Cuyahoga River as well as to make any additional sediments within compliance.

Now, the Port Authority is asking for up to 150 per ton tipping fee to offset some of the costs that it will incur from maintaining operating and confined disposal facilities, but the Port Authorities does not agree with the Corps. The Corps continues to seem to hide behind the language that fits the Water Resources Developing Act claiming that the agency must choose the cheapest option while at the same time appearing to steal the analysis of its own data to fit its clear preference to open lake disposal of dredge sediments in

the Cuyahoga River. We urge the Buffalo District to approach the disposal of the dredge sediments more like Detroit and Chicago districts. These districts appear to interpret the WRDA language resulting in a goal of ease of shipping and ecosystem health at the cheapest price.

Lastly, placement of the contaminated sediments into the open waters of Lake Erie does not comply with the Ohio Department of National Resources federally approved costal zone management program nor with the international Great Lakes water quality agreement.

The OEC, therefore, respectfully requests the Corps dispose of the 2016 Cleveland Navigational Channel dredge sediments into the existing compliance disposal facilities. We also request that the Corps approach this problem with an open mind towards the goal of overall ecosystem health. Thank you again for the opportunity to provide this comment. Thank you.

MR. KORNACKI: Elaine.

MS. MARSH: Hello. I'm Elaine Marsh with Friends of the Crooked River, and I will have written comments to send in. I just learned about this meeting on Wednesday. I've known about the Ohio EPA meeting next Thursday for a long time. And so one of the first things I did, what I always try to do is to get people

Page 51

out. And I got two comments from people who were not able to be here tonight. One was, why should we go? We said all of this time and time again. Our public officials have testified. Environmental groups have testified. Private citizens have testified. And what good did it do?

I believe this proposal is exactly why people are losing faith in government and why we are seeing this sad response to our political system. If government cannot respond to the public need and the public voice, it is hurting us. I believe this is a perfect example of why people are so discouraged about government.

So that was one reply I got. And the other reply I got was, you know, I can't go to that meeting. It is the annual AOC hearing out of town. I mean, why would you schedule a Lake Erie hearing when half of the people who are interested in Lake Erie are at an AOC meeting?

So anyway, that's what I wanted to say about this hearing itself and what I have heard people say who we're not going to be here tonight.

But what my overarching comments are as a person who has followed these issues for a really long time is that this proposal is entirely wrong-headed and

Page 52

incredibly ill-timed. Lake Erie is a distressed ecosystem, and the world is beginning to wake up to that.

As a matter of fact, just February 22nd, a week ago, the parties signed a binational agreement -- that is the parties of the United States of America and Canada -- have signed an agreement to come up with strategies to reduce phosphorous in Lake Erie by 40 percent. That was February 22nd.

This is a distressed ecosystem. And you can argue about the U.S. EPA standards that you use and have to follow. Well, U.S. EPA is the negotiator for the Great Lakes Water Quality Agreement. We have got to stop segmenting this whole system and finding ways to point, oh, its the Corp's. No, it's the city. No, it's the Army Corp. No, it's the farmers.

It's all of us. And we have got to work in partnership if Lake Erie is this priority. And people are going to pay. The Army Corp is going to pay. The rest of us are going to pay. You can't have a priority without spending money.

So I think Chris Romayne's statements and the other people who talk about partnership is the key thing here. We aren't good guys or bad guys. We're Lake Erie guys, and we all need to work together. We need to do

Page 53

our part, whatever our part is. So come on. Do the right thing. That's all we want. Do the right thing.

MS. DAVIS: My name is Daryl Davis. I live in the City of Cleveland in the Big Creek Water Channel. I am a recent past board member of the Ohio Wetlands Association. I am on the Cuyahoga County Green Card Central Committee. I'm a member of the OEC. I'm a member of the Sierra Club. And I am from the muddy boots contingent of the environmental committee. And I think that I have tried to read everything that was around about this, and I find it all very confusing, probably politically so because I usually know what I'm reading. According to the EPA memo notice dated January 22nd, discharges from the preferred alternative activity would result in degradation of the water quality of the Cuyahoga River and Lake Erie. This description of the preferred alternative calls for placement of 180,000 cubic yards of dredged material and a new -- and I guess it isn't new, open lake area in Lake Erie.

The proposed minimal degradation alternative still calls for 180,000 cubic yards of dredge material at the same new open lake area. I don't think that this qualifies as a new degradation alternative.

Now, I think this request seeks to be known in reality of the coming water crisis. The Army Corps'

Page 54

description of alternatives does not match the EPA's description. It's not just apples to oranges. It's more like tractors to mules. I am disappointed that the entire analysis that we saw up here tonight is not available to us as a printout. I think that's a really cheap cop-out. There's not that many of us here.

The problem here is that the situation with our water is getting worse, and people are getting desperate all over the country. And the Army Corps is involved all over the country. Um-hmm. Let's look at this a little closer.

I think subjecting our water to a cost-benefit analysis is critical. We have been asked to compromise water quality. And at this point, we must bluff all further degradation of our water. If this was safe, if any of this was safe, we would not be here tonight. If it would not add to the degradation of the water of Lake Erie, we wouldn't be here either.

Lake Erie, of course, has a number of sites that are officially designated areas of concern, which remains just as you mentioned, the AOC. Here's a description of the Cuyahoga River from which we will have dredged material placed near the city water in-take bin. It travels. It's water.

Environmental problems on the Cuyahoga River AOC in there causes water quality due to replication, toxic substances, bacterial contamination, loss of biodiversity due to water contamination, habitat degradation, sedimentation. Lands have changed that have altered the river in our shipping turfs. And it goes on and on.

Now, the AOC can be officially determined if any one or more of these issues exists; restrictions on fish consumption, degradation of fish population; fish tumors or other deformities. I fish. I know.

Degradation of benefits. Restrictions on navigational dredging. Interpretation or undesirable algae. Beach closings. Public access and recreational parties. Degradation of centers. Loss of fish habitats. Every single one of these exists in Lake Erie. Every single one.

Now, we have been asked to compromise and compromise and compromise. The time to compromise is over. Not one more degradation should be permitted. Thank you.

MR. KORNACKI: Jacki. After Jacki, Jessica Ferrato, Howard Simm, Martha H. and Edward Zelaski.

MS. ZEVELBERGER: My name is Jacki Zevenbergen, and I'm with the Friends of the Crooked River. I agree with a lot of what's been said tonight, but mostly I

would just like to sort of reemphasize that we are spending as the public a lot of money, and rightfully so, to clean out the Great Lakes with the Great Lakes Restoration Initiative. And I think the taxpayers deserve to make -- for public agencies to make sure that they are working in concert and not against one another.

And we all know that the mouths of rivers are the areas where sediments contain great amounts of nutrients. That's why historically throughout the history of mankind, this need has been placed for people have settled and farmed, so it doesn't take a lot of tests to know that that's going to be a nutrient-rich area and those dredge materials are going to be full of nutrients.

And I know that's not what they've been measuring for, but it seems absolutely ridiculous that as the federal government spends, rightfully so, great deals of money to clean up Lake Erie and try and resolve some of the problems that we're having with nutrients running off, that we would take dredge material and dump them openly into the lake makes no sense whatsoever. Thank you.

MS. FERRATO: My name is Jessica Ferrato. I'm here on behalf of the Ohio Sierra Club and tonight I want to talk about -- we've heard about the Army Corps'

responsibility to stay true to our science, about the Corps' duty to comply with federal guidelines, by employing the least-cost alternative in keeping with Clean Water Act guidelines.

Well, first of all, staying true to our science, the Army Corps' own 2009 study -- I brought this up last year as well -- found that Lake Erie channels sediment was too polluted for open lake dumping, and that analysis remains for the lower channel.

The upper channel has been found to also contain bio-accumulative contaminants, the risk of which is at dispute. The ACOE's stance is that additional PCBs will not harm the lake, thereby making open lake dumping the least-cost alternative unless the tax payers of Cuyahoga County agree to foot the bill for a universally acknowledged less damaging alternative.

But more importantly what is in dispute here is the value of our resource. Army Corps argues that CLA-1, the proposed lake dumping ground, is already valueless because of legacy contamination, and so the alternative of placing more contamination on top of it is an easy bill.

But Northeast Ohioans and Clevelanders have been rooting for that particular piece of ground along with our other legacy contaminated resources. And to watch

these lands be further contaminated and treated as they were mistakenly treated 70 years ago before we knew better, represents a value that is not being recognized by the Army Corps' current cost analysis.

I bring your attention to a document entitled Cost Effectiveness Analysis for Environmental Planning: Nine Easy Steps. U.S. Army Institute for Water Resources, Policy & Special Studies Programs.

This 1997 document sets the tone for the values which U.S. Army should follow in reaching its cost determinations and underscores the importance to the U.S. Army specifically of incorporating the professional analyses of experts from state and federal agency stakeholders in formulating their cost analysis of alternatives, of incorporating not just immediate short-term financial cost of an alternative, but also cost to the tax payer of various alternatives, environmental value as determined by experts in the collaborative field, incremental rather than average costs of long-term solutions, et cetera.

I assert here that the Army Corps of Engineers' cost analysis has been incomplete on the basis of its failure to invite the collaboration of stakeholders such as water treatment plant operators, public health officials, and many of the other stakeholders present here tonight including the Ohio EPA, Port Authority, City of Cleveland and Cuyahoga County officials, and the Ohio Attorney General's Office among others.

In particular, the Army Corps has failed to demonstrate that the cost of its lowest-cost alternative, which it puts forth not as the alternative going forward but as the budget for what the Corps is willing to pay reflects such hidden costs that should be included according to the U.S. Army protocols hidden costs which include increased water treatment costs to Cuyahoga County citizens, increased costs related to public health, the loss of habitat and recreational fishing, and other societal or environmental costs.

And particularly, the Corps has failed to demonstrate that the tipping fees which the Army Corps wishes to have waived for them, fees which would otherwise fall to the taxpayers of Cuyahoga County, exceed these unaccounted costs, and to which degree.

It is without challenge that the Army Corps of Engineers must be responsible to pay the differences. In short, Army Corps needs to sit down with its stakeholders and re-evaluate its cost assessment in arriving at its lowest cost alternative in order to find a true and honest cost of protecting our precious resources while maintaining our navigable channels and

ports.

Thank you for the opportunity to testify.

MR. KORNACKI: Do we have a representative from Arcelor here?

MR. LAWELL: Thank you. My name is Michael LaWell. I represent ArcelorMittal, and I have a statement to read here. It's a little bit lengthy. I'll try to abbreviate by eliminating a paragraph here and there that may result in a transition that's a little bit awkward, but much of this is historical perspective.

Obviously, the solution is still not completely at hand, so we don't have that to offer by any means. Some of this is historical, some of it you're familiar with it, but I think a lot of it needs to be restated because we do need to understand what is at play here, both environmentally and in terms of the economy and obviously our perspective addressing both to some degree.

ArcelorMittal is the world's leading steel and mining company and the largest manufacturer of steel in Ohio with seven locations in the State of Ohio. These include production facilities not only here in Cleveland, but in Columbus and Marion and Shelby, a coke production facility in Warren, a tailored mine

production facility in Pioneer, and the regional office in Richfield.

The company's Ohio facilities employ approximately 3,100 people with annual payroll and payroll-related taxes of $300 million and annual purchases in the State of Ohio of $1.5 billion including 6.8 million in non-payroll tax payments.

Our largest Ohio steel facility is located on 950 acres on both sides of the Cuyahoga River near downtown Cleveland. Steel has been produced at this location for more than 100 years, and steel production is one of the foundations of Cleveland's economy.

The ArcelorMittal Cleveland Steel Mill, which employs approximately 1,900 people, is one of the largest in the U.S. and is recognized as one of the most productive integrated steel facilities in the world, producing one ton of steel for slightly more than one worker hour, compared to an industry average of one ton of steel per nearly two worker hours.

This is an outstanding facility. Our Cleveland facility has an annual raw steel production capacity of 3.8 million tons serving the automotive, appliance, service center, and construction, and converter markets. 60 percent of our annual production goes to Ohio manufacturers where thousands more Ohioans are employed

to use this steel in the manufacture of automobiles, appliances, pipe, fasteners, and many more products essential to our way of life and our modern economy.

Our Cleveland steel mill is completely reliant on maritime for the delivery of iron ore and limestone, both of which are essential raw materials for steel production.

In fact, the ArcelorMittal plant cannot receive adequate raw material supplies through any other means. Annually, the mill receives maritime deliveries of approximately 4 million tons.

In short, the Port of Cleveland, the Cuyahoga River Federal Navigation Channel are the lifelines for one of the most productive steel mills in the world and a major engine of the Cleveland and Ohio economies.

Dredging of the harbor and channel are critically important to Great Lakes freighter traffic, which in Cleveland serves the asphalt, gravel, petroleum, salt, cement, and steel industries.

The Cuyahoga River is naturally shallow, typically ranging three to six feet. Without regular twice per year dredging the navigation channel, commercial navigation quickly become restricted and then impossible.

From Akron north, the river flows towards Lake

Page 63

Erie. During this journey north, it collects solid materials from Cuyahoga Valley National Park, urban runoff, combined sewer overflows, and other non-point sources, all of which result in heavy siltation in the navigation channel every year.

The suspended sediment flowing in the shallow river quickly settles when it enters the much deeper Federal Navigation Channel. Spring snow melt and the rainstorms that suspend large volumes of sediment in the river can deposit as much as eight to ten feet of sediment into the 23- to 27-foot deep channel near the head of navigation. The U.S. Army Corps of Engineers annually removes approximately 250,000 cubic yards of sediment from the narrow and circuitous navigation channel.

Additionally, private dock owners are responsible for dredge sediments that fall between their private docks and the boundary of the navigation channel in the center of the river.

In addition to federal dredging, ArcelorMittal annually pays for private dredging. During the past two years, the company has paid approximately $1.5 million for private dredging and CDF placement of dredged sediments. Additionally, ArcelorMittal pays a substantial harbor maintenance tax annually and other

Page 64

taxes to ensure the channel is navigable.

The CDFs have for decades received and safely stored all dredged sediment from the Cleveland Harbor and Cuyahoga River Federal Navigation Channel. In 2009 to 2010 based on the assumption that sediment disposal and management would remain unchanged, it was estimated that CDF capacity would be reached in a few years, approximately 2014-2015. Without dredged material storage capacity, dredging would have to be discontinued.

The economic dislocation that would result from a failure to dredge would be severe. Dredging of the navigation channel from the harbor are integral to the well-being to the Cleveland and Ohio economies. This alarming determination caused the creation of the Cleveland Dredge Material Task Force to identify alternatives and develop a plan for continued sediment management. Two strategies took shape by late 2013.

The issue under consideration at this public hearing is the appropriateness of one of those strategies. The Corps' open lake dredged material disposal plan. The U.S. Army Corps of Engineers recommended the open lake disposal strategy, and in its regulatory capacity conducted scientific analysis of this dredged sediment and applied regulatory rules with

Page 65

which they must comply.

They determined that 80 percent of dredged sediment is suitable for open lake disposal. However, the primary regulatory agency charged with protecting the waters of Lake Erie, the Ohio Environmental Protection Agency has indicated they do not concur with the Corps' findings.

Governor Kasich's February 11th, 2015 emergency executive order further emphasizes the State of Ohio's view of open lake dredge sediment disposal. Another legislation calls it persistent as well.

ArcelorMittal respects the work of both agencies in the 401/404 for process, and supports responsible environmental stewardship. In the absence of agreement between the agencies, we are very encouraged that an alternative strategy was also developed through the collaborative efforts of the Cleveland - Cuyahoga County Port Authority, the OEPA, the Corps, and the other members of the Cleveland Dredge Material Task Force.

This strategy is expected to extend life of the existing lakefront CDFs by 35 years or more. The strategy includes an OEPA-approved beneficial use recycling program for much of the sediment placed in the CDFs and an in-river harvesting of bed-load sediments before they reach the navigation channel.

Page 66

These harvested sediments would also be sold for OEPA-approved beneficial uses and would not be placed to the CDFs. This strategy does not include any open lake sediment disposal.

Historically, all costs for dredging the federal channel and harbor and disposal dredge sediment were paid by the federal sources through the Corps of Engineers. In 2015, funding responsibility for the cost between implementation of the Corps open lake disposal plan and the alternative plan became the critical issue with the Corps indicating it could not under its own regulations pay the higher cost of the alternative plan.

That position was reaffirmed by the Corps in a written communication dated February 24th, 2016. Last year this cost issue was temporarily resolved by order of federal court with all sediments being placed in CDFs and the Corps paying all sediment disposal costs. That order applied to dredge management costs for 2015 only with the ultimate financial responsibility for those 2015 costs and future years' cost sill in consideration by the court.

In conclusion, we reemphasize that uninterrupted twice annual dredging is essential to continued commercial navigation on the Cuyahoga River Federal Navigation Channel. Thousands of jobs in Cleveland and throughout the State of Ohio depend on it. ArcelorMittal remains committed to working with the Corps of Engineers, Ohio EPA, and the Port of Cleveland to establish a safe and reliable plan for dredging in 2016 and for the long term. Thank you.

MR. KORNACKI: Before you get going, Ron, is there anybody else that has signed up?

Howard, please.

MR. SIMION: My name is Howard Simon. I am a retired primary care physician. I work part time at Metro Health. I was elected a public member of the Cuyahoga River Concern Advisory Committee, and I will be going there at 6:00 in the morning so I can get there in by 9.

I came to this meeting after reading a judgment piece -- court opinion this morning hoping that I would get to make a statement, hoping that the Army Corps of Engineers would convince me that dumping sediment into the open lake would be safe. And I have to tell you that after your presentation, I am not convinced that that is the case.

You cited two things you have done. One is that you have exposed minnows and other animals to the dredge material and found that they were able to survive. My understanding of PCBs is that they are carcinogens, and

exposing the animals to carcinogens on a short-term basis would not prove anything to me.

The other thing is that you say that there aren't a lot of PCBs in the dredge material. I would have to be convinced that a small amount of PCB is safe. And I can't imagine that you have an experiment with that to show that the amount of PCBs that are being dredged and deposited in the lake are safe.

You said that there have been people who said that we wouldn't be able to eat Walleye except for once a week -- I'm sorry. Once a month. It's not once a week. And you say that's not true, but I feel that we shouldn't be swayed by that. But the fact is that there are fish in our lake that pregnant women are advised not to eat at all. That there are now fish in the lake that we are advised not to eat more than every two months. And there are many fish in the lake that we are already advised not to eat more than once a month.

It's impossible for me to understand how even a small amount of PCBs, which are said -- that you are going to do or this is what you want to do. We have a small amount of PCBs, how that's going to improve things?

PCBs, I'm not an authority with PCBs, but my experience is they last almost forever and whatever PCBs

we put in the lake, no matter how small the amount is, will be there for our lifetimes, our children's lifetimes, and our grandchildren's lifetimes. It's -- I'm saddened.

I didn't know anything about this topic until I read last year about the lawsuit. And the Army Corps mentioned its plan not to dredge at all until the State came up with the money. And I'm saddened that what you have done now it seems has just decreased the amount that you've asked for from the government to clean up Lake Erie and said that you now can't do anything more because of that decreased amount of money when it's clear that that's the amount of money that you asked for.

So I don't see this as a member of the Erie Concerned Advisory Committee because I can't speak for them. I've not contacted them in any way. I'm speaking for myself as a physician and as a citizen of Cuyahoga County, and to tell you that I am unhappy with The Corps of Engineers and their presentation tonight.

MR. KORNACKI: I believed the next name is Martha P. looks like H. Last name starts with H. Edward Zelaski? All right. So last name we have then is Antony Spock.

MR. SZPAK: Szpak.

LTC JANSEN: Szpak. I'm sorry.

MR. SZPAK: My name is Anthony Szpak, and I'm a resident of the City of Parma. I'm also a registered professional engineer, but not regarding the environment, although I've spent a lot of money.

I don't want to get into lots of details, but let's try to grab a hold of this thing. You take the Akron Rubberbowl, okay, fill it to the top and dump it in our water intake zone every year. That's the amount of whatever you're picking up and dumping that gets dispersed by minerals, solvents, everything. Not just PCBs. Or another way to look at it, how about 3,400 radio cars in our water supply intake zone every year.

This one gentleman said earlier that the lake feeds water to 7 million people. And my research shows the Cleveland area -- we are 1,300,000 people. Not Flint, Michigan. 1,300,000. You're talking $3,000,000 that you could have probably gotten from my understanding, and I don't know what the politics is, gentlemen. We're getting tired of a lot of this confrontational politics is what we're talking about.

Listen, we're all the same. I'm like you. You're like the EPA. We're all people. Who would -- oh, one other thing. Lake Erie is a pond. You know where you're dumping it is less than two-thirds the length of the ceiling. That's how deep the water is over there. That's all. Okay. That's all.

And dump 3,000 radio cars in there and two miles away from it we've got water feeds sucked in to feed 1,300,000 people. And I agree so much with so many people that said, why are we here? Why are you here? Why is anybody here?

I've done analysis all of my life of all kinds, and no one would even come up and ask us to do something as ludicrous as that especially when they're spending $3,000,000,000 conveniently and you haven't got the foggiest guess of how much instrumentation it would take to analyze the 2,000,000 chemicals that they're going there.

And yet pin on one thing or one federal standard. I appreciate federal standards. It's wonderful. It's saved a lot of my legal problems as an engineer because I can use them to tell companies that they're crazy.

And I'm going to use practical sense here. Why don't you go and develop standards for about 300 dangerous chemicals that are in those sediments and develop a standard for each of them and come back in 20 years. But in the meantime, dredge it and put it in the disposable facility until you know. Because if CO2

is in the entrance, gentlemen, we can't go back and take it back out. Thank you very much.

MR. KORNACKI: Did anybody else sign up to speak tonight I that missed? Okay. On the behalf of the Corp of Engineers, I'd like to thank you all for coming out tonight. Again, public comments will be accepted until March 12th. These are the methods that you can use to submit those comments. With that, the public hearing is over. And again, I'd like to thank you all for coming out tonight and please drive safely.

(Hearing concluded at 7:48 p.m.)

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C E R T I F I C A T E

I, Melissa E. Case, a stenographic reporter, do hereby certify that I attended the foregoing proceedings in their entirety; that I wrote the same in Stenotype, which was subsequently transcribed into typewriting by means of computer-aided transcription under my direction; and that the foregoing Transcript of Proceedings is a true and correct transcript of my Stenotype notes.

Signed this 8th day of March, 2016.

Melissa E. Case, RPR, Notary Public.
within and for the State of Ohio.
My commission expires July 21, 2018.

WORD INDEX

Attachment 4

2016 Sediment Evaluation

US Army Corps of Engineers
Buffalo District

Cleveland Harbor (Upper Cuyahoga River Channel) Dredged Sediment Evaluation—2016

EVALUATION OF CLEVELAND HARBOR (UPPER CUYAHOGA RIVER CHANNEL) DREDGED SEDIMENTS WITH RESPECT TO SUITABILITY FOR OPEN-LAKE PLACEMENT

EXECUTIVE SUMMARY

Cleveland Harbor, Ohio sediments within the reach of the Cuyahoga River Channel near the upstream Federal navigation project limit (Upper Cuyahoga River Channel) are typically dredged twice a year to maintain adequate depths for deep-draft commercial navigation. The predominant source of these sediments is erosion within the upstream portions of the Cuyahoga River watershed, including Cuyahoga Valley National Park. Like other sediments or soils within an urbanized and developed watershed or water body influenced by anthropogenic activities, these channel sediments are impacted by low concentrations of metals, nutrients, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides and many other constituents reflective of ambient conditions in the 21st Century environment. These channel sediments were evaluated to determine their suitability for placement at a designated site in Lake Erie. During three sampling events conducted in 2014 and 2015, sediments from this reach of the harbor were sampled as dredged material management units (DMMUs) designated DMMU-1, DMMU-2a and DMMU-2b, and subjected to a suite of physical, chemical and biological tests. In addition, bottom sediments were sampled from a two-square mile deep-water area in Lake Erie proposed for the placement of these dredged sediments (open-lake placement area CLA-1). Other lake locations offshore of Cleveland were also sampled and subjected to similar testing. Depending on the sampling event and sediments sampled, testing included bulk sediment physical and chemical analyses, simultaneously extracted metals/acid volatile sulfide (SEM/AVS) analysis, PAH sediment pore water testing, standard elutriate testing, standard sediment (benthic) and elutriate (water column) bioassays, and sediment benthic bioaccumulation testing for PCBs and pesticides. Data generated from this effort were used to evaluate whether these dredged sediments meet Clean Water Act (CWA) Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for placement in the open-water, including compliance with applicable state water quality standards (WQSs).

To evaluate whether sediments dredged from the Upper Cuyahoga River Channel meet these Guidelines for open-lake placement with respect to contaminant-related impacts, relevant contaminant pathways were examined to evaluate fate, exposure and risks. Primary contaminant exposure pathways in the water column include the uptake of contaminants by plankton and fish as they are released from the dredged sediments during discharge. Water column toxicity tests (bioassays) using a water flea (48-hour survival of *Ceriodaphnia dubia*) and minnow (96-hour survival of *Pimephales promelas*) were used as measurement endpoints to assess these risks. Contaminant exposure pathways from the dredged sediments on the lake bottom include direct toxicity, and net uptake (bioaccumulation) and/or trophic transfer through bioaccumulation. Standard sediment benthic bioassays using an amphipod (10-day survival of *Hyalella azteca*) and midge (10-day survival and growth of *Chironomus dilutus*), and standard benthic bioaccumulation experiments using an oligochaete worm (28-day *Lumbriculus variegatus* bioaccumulation), were used to assess toxicity and bioaccumulation endpoints, respectively.

With respect to benthic contaminant-related impacts after the dredged sediments are placed on the lake bottom, results of the benthic bioassays demonstrated that the channel sediments did not exhibit any toxicity when compared to reference sediments or standard criteria (*H. azteca* mean survival range 86 to 92%; *C. dilutus* mean survival range 88 to 92%; *C. dilutus* mean growth range 0.80 to 2.65 mg dry weight). Total PAHs were initially identified as a preliminary contaminant of concern (PCOC) because bulk concentrations in the channel sediments were at times higher than those in CLA-1 reference sediments. However, the laboratory benthic bioassays and PAH sediment pore water testing indicated that the channel sediments were protective of benthic organisms. PCBs were identified as a PCOC in the channel sediments because bulk concentrations were occasionally measured at higher concentrations than those in CLA-1 and other reference sediments. Laboratory experiments showed that the benthic bioaccumulation of total PCBs from the channel sediments (mean range 5,259 µg/kg-lipid to 8,666 µg/kg-lipid) was not significantly higher than that from CLA-1 reference sediments (mean 7403 µg/kg-lipid [excluding any suspected PCB impacted sediments]), and/or associated magnitudes of difference (MODs) (measured laboratory bioaccumulation from dredged sediments/measured laboratory bioaccumulation from reference area sediments) relative to CLA-1 reference sediments were less than a factor of 2, suggesting that such a difference is not likely to warrant ecological and human health concerns. In addition, benthic bioaccumulation of total PCBs from the channel sediments was comparable to bioaccumulation measured using regional lake background sediments collected offshore of Cleveland (surface area-weighted mean 5,188 µg/kg-lipid). Laboratory experiments showed that the benthic bioaccumulation of dichlorodiphenyldichloroethylene (DDE) from DMMU-1 (8.4 µg/kg) and DMMU-2b sediments (7.3 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (6.4 µg/kg). However, MODs relative to CLA-1 reference sediments were less than a factor of 2, suggesting that such a difference is not likely to warrant ecological and human health concerns. Laboratory experiments showed that the benthic bioaccumulation of DDE from DMMU-2b sediments (6.7 µg/kg) was not statistically different than those associated with the CLA-1 reference sediments. This information shows that open-lake placement of the channel sediments at CLA-1 would not result in any significant or ecologically meaningful increase in PCBs or DDE bioaccumulation in aquatic life, including in fish, and meets CWA Section 404(b)(1) Guidelines. An important consideration is the benefit resulting from strategic placement of dredged sediments within the southeast quadrant of CLA-1. Placement of this dredged sediment at this location would serve to cap and abate significant PAH-related benthic toxicity associated with existing CLA-1 sediments in that area, and result in a several-fold reduction in potential PCB bioaccumulation from sediments within a portion of that area.

With respect to impacts when contaminants in the dredged sediments are released to the water column during open-lake placement, elutriate testing and water column bioassays identified ammonia-N (maximum measured elutriate concentration 19 mg/L) as a water column PCOC. It was identified as a PCOC because sediment elutriate concentrations were greater than levels protective of water column organisms, prior to consideration of dilution and dispersion during dredged sediment placement. Ammonia is a naturally occurring constituent of sediment pore water and, due to its labile and ephemeral nature, is generally not considered a contaminant of concern in the management of dredged sediments. Water quality modeling indicated that ammonia released during dredged sediment placement would rapidly dilute in the water column to levels protective of aquatic life. Therefore, ammonia-N was eliminated as a PCOC. Elutriate data and modeling indicated that the discharge of the dredged sediments at CLA-1 would be protective of aquatic life and human health, and comply with applicable State WQSs after consideration of dilution and dispersion.

Across several events between 2013 and 2015, the Ohio Environmental Protection Agency (OEPA) generated data on Upper Cuyahoga River and Lake Erie sediments offshore of Cleveland. Data generated from these efforts were reviewed and considered, and some were not integrated into the evaluation due to quality control and technical issues. OEPA data integrated into this evaluation were similar to the data generated by USACE between 2012 and 2015.

This evaluation indicates that the discharge of sediments dredged from DMMU-1, DMMU-2a and DMMU-2b at CLA-1 would not result in contaminant-related, unacceptable adverse effects to the aquatic ecosystem. This conclusion is analogous with the previous 2013 dredged sediment evaluation. Based on this information, it has been concluded that these dredged sediments meet CWA Section 404(b)(1) Guidelines for open-lake placement at CLA-1 as presented in 40 CFR 230.11(d).

1.0 INTRODUCTION AND BACKGROUND

Cleveland Harbor, Ohio is located on south shore of Lake Erie at the mouth and lower reach of the Cuyahoga River at Cleveland, Ohio. Federal navigation channels in the harbor are deep-draft and designed to accommodate commercial navigation, and include a River Channel, Turning Basin, Old River Channel and Outer Harbor channels. These channels have authorized depths ranging from -23 to -29 feet low water datum (LWD)[1]. Cleveland Harbor is situated within the designated Cuyahoga River Great Lakes Area of Concern (AOC) (U.S. Environmental Protection Agency [USEPA] 2015a). The AOC includes the lower 45 miles of the river from the Ohio Edison Dam to the mouth, and approximately 10 miles of Lake Erie shoreline from Edgewater Park to Wildwood Park on the west and east sides of Cleveland, respectively. Maintenance dredging of harbor channels requires the need to manage the resulting dredged sediments. In 2013, sediments dredged from the Upper Cuyahoga River Channel between the upstream limit (Station 799+00) and downstream upper Turning Basin (Station 736+00), which is represented by three dredged material management units (DMMUs) designated DMMU-1, DMMU-2a and DMMU-2b (Figure 1), were found to meet Clean Water Act (CWA) Section 404(b)(1) Guidelines ("contaminant determination" at 40 CFR 230.11[d]) for open-lake placement at the deep-water Lake Erie area referred to as CLA-1 (Figure 2) (USACE 2013a).

In the Cuyahoga River portion of Cleveland Harbor, human alterations to the channel have enlarged channel dimensions compared to the more natural upstream sections of the river. The Cuyahoga River naturally transports a large sediment supply, which is suspended in the water column under certain water velocities and carried downstream. A primary source of sediment loading is natural erosion within the Middle Valley of the Cuyahoga River watershed, including Cuyahoga Valley National Park (USACE 2011). Erosive riverbank soils are subject to increased runoff volumes caused by urbanization of surrounding areas, resulting in streams carrying a heavy sediment load. As water enters the enlarged Upper Cuyahoga River Channel at the upstream end of Cleveland Harbor, velocities decrease significantly, resulting in the rapid deposition of the previously suspended sediment. Consequently, the Upper Cuyahoga River Channel acts as a trap for sediments that would otherwise be discharged and deposited to downstream areas, including Lake Erie. As sediments deposit through sedimentation and accumulate as shoals, they tend to obstruct deep-draft commercial navigation in the channel, thus requiring regular maintenance dredging.

[1] Low Water Datum for Lake Erie is elevation 569.2 feet above mean water level at Rimouski, Quebec, Canada (International Great Lakes Datum [IGLD] 1985).

FIGURE 1
UPPER CUYAHOGA RIVER CHANNEL
CLEVELAND, OHIO

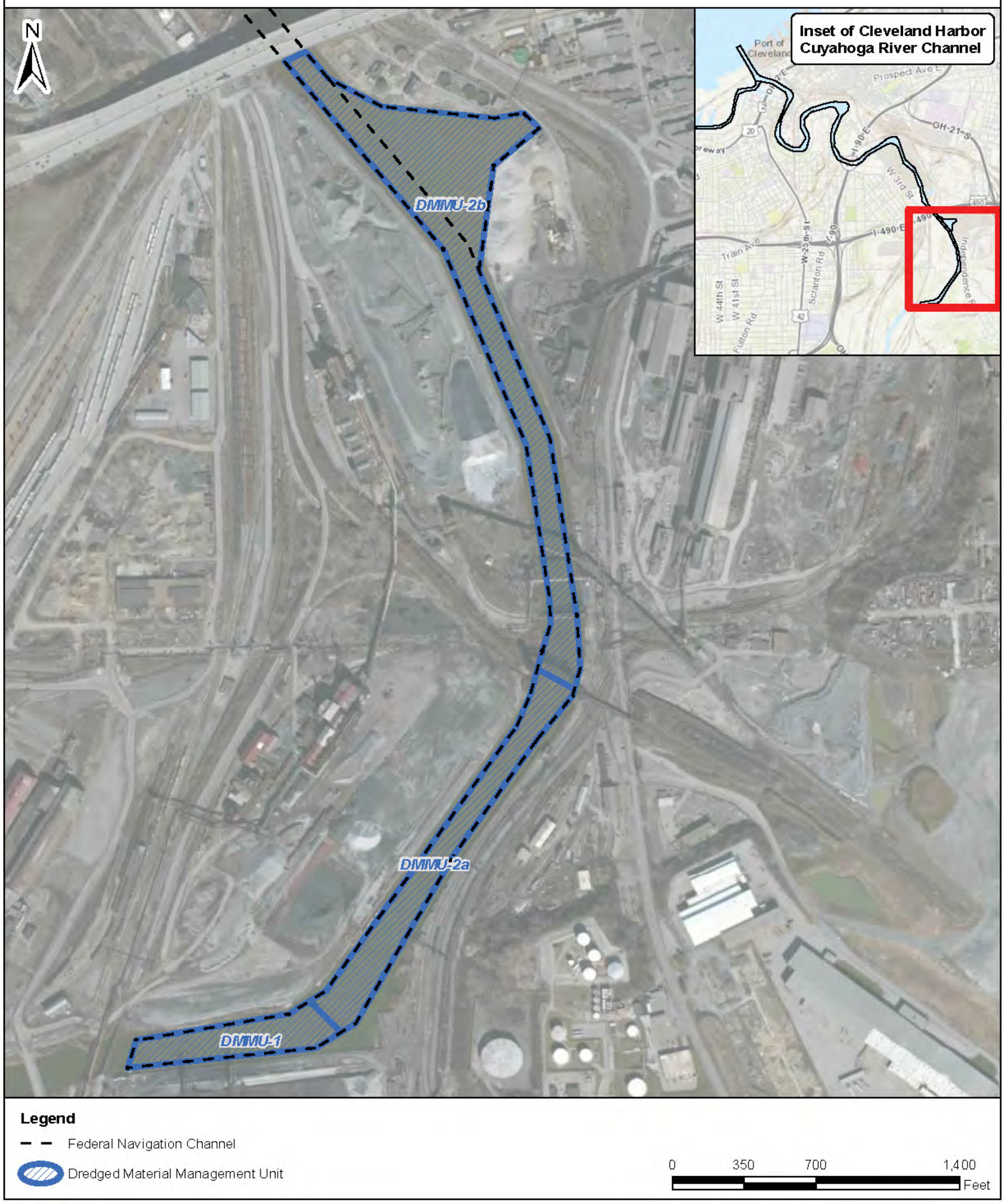
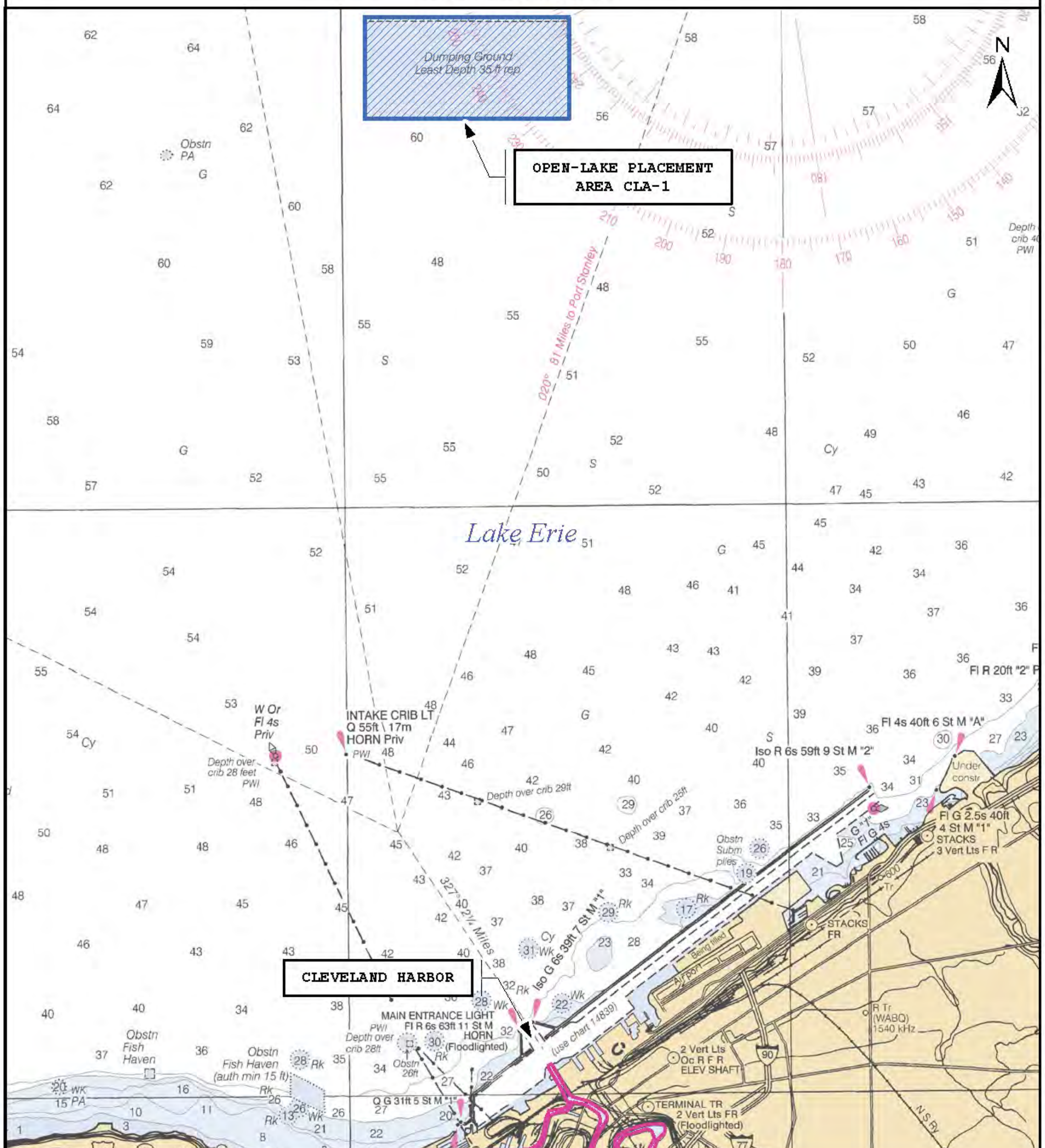


FIGURE 2
PROPOSED OPEN-LAKE PLACEMENT AREA CLA-1
CLEVELAND, OHIO



Legend

Federal Navigation Channel

Open-Lake Placement Area

0 0.625 1.25 2.5 Miles

Sediments within the Upper Cuyahoga River Channel generally consist of organic rich brown clayey silt, with localized areas of sand, gravel and leaf debris mixed in the sediments located immediately downstream of the upstream limit of the Federal navigation project. Lake sediments offshore of Cleveland range widely in composition, and can consist of coarse sand and gravel, shell fragments, hardpan clay, shale and clayey silt. Lake sediments at CLA-1, as well as other deep open-lake areas offshore of the harbor, are more similar to the shoaled sediments in the channel, generally consisting of brown clayey silt.

Because the transition from upstream streambed to the maintained channel functions as a sediment trap, the Upper Cuyahoga River Channel experiences significantly higher shoaling rates than the rest of the harbor, estimated at more than eight feet per year in certain areas. About 200,000 cubic yards of sediment are dredged annually from this portion of the Cuyahoga River Channel, often over multiple dredging events per year, to maintain depths adequate for deep-draft commercial navigation. Cleveland Harbor is typically dredged in two phases; in the spring between May and June, and fall between October and November. The vast majority of sediments are dredged during the spring phase. About 80 percent of the harbor's annual dredging needs are typically in the Upper Cuyahoga River Channel. There are a number of potential sources of sediment contamination within the watershed, both anthropogenic and natural. These sources include: municipal and industrial discharges, urban and agricultural runoff, combined sewer overflows, atmospheric deposition, biological production (detritus) and mineral deposits. Due to the potential for contaminant-related impacts, the vast majority of sediments dredged from harbor have been placed in Federal and non-Federal confined disposal facilities (CDFs) since about 1968. However, evaluations conducted on sediment samples obtained in 2010 to determine suitability of sediment for beneficial use concluded that sediments from the Upper River Channel would be suitable for aquatic placement scenarios (Kreitinger *et al.* 2011). In 2013, sediments dredged from the Upper Cuyahoga River Channel were concluded to meet contaminant-related CWA Section 404(b)(1) Guidelines for open-lake placement at CLA-1 (USACE 2013a).

The objective of this report is to evaluate whether sediments dredged from Cleveland Harbor's Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d) for open-lake placement at CLA-1 based on new data. USACE (2013a) concluded that these dredged sediments met these Guidelines. This evaluation is in accordance with the protocols and guidelines prescribed in the Great Lakes Dredged Material Testing and Evaluation Manual (Great Lakes Testing Manual [GLTM]) (USEPA/U.S. Army Corps of Engineers [USACE] 1998a) and Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.—Testing Manual (Inland Testing Manual [ITM]) (USEPA/USACE 1998b), and is specific to 40 CFR 230.11(d) ("contaminant determination") (USEPA 2015b). Further, it is consistent with 33 CFR 336 toward establishment of the Federal standard relating to the least costly dredged material management alternative, consistent with sound engineering practices and selected through CWA Water Act Section 404(b)(1) Guidelines (USACE 1988).

2.0 SEDIMENT SAMPLING AND TESTING

This evaluation emphasizes 2014 and 2015 analyses performed on sediment samples collected from the Upper Cuyahoga River Channel, and open-lake nearshore and deep water areas in Lake Erie. It addresses the discharge of sediments dredged from the Upper Cuyahoga River Channel at CLA-1. This evaluation also considers relevant sediment data and information from 2012 as contained in USACE (2013a), as well as relevant data and information generated by the Ohio Environmental Protection Agency (OEPA) across several sediment sampling and analysis events performed between 2013 and 2015 (see Section 3.5).

2.1 2014 and 2015 investigations

2.1.1 Objective

The overall objective of the 2014 and 2015 sediment sampling and analyses efforts was to evaluate whether sediments dredged for maintenance of the Upper Cuyahoga River Channel meet CWA Section 404(b)(1) Guidelines at 40 CFR 230.11(d), which includes compliance with applicable state water quality standards (WQSs), for open-lake placement.

The 2014 investigation was implemented to address the most pressing concerns identified by OEPA in reviewing the 2013 water quality certification application for open-lake placement. As such, the 2014 sampling focused on the analyses of polycyclic aromatic hydrocarbons (PAHs) and polychlorinated biphenyls (PCBs) in Cleveland Harbor and lake sediments. Another objective of the 2014 investigation was to evaluate the variability of PAHs and PCBs in regional lake sediments offshore of Cleveland, as well as in and around the previously identified open-lake placement/reference areas. The 2015 investigation was a more standard sampling/testing effort to support dredged sediment management decisions. The details of these investigations are provided below.

2.1.2 2014 investigation

a. **Sampling**

Sediment sampling in 2014 was conducted across two events, June 9-11, 2014 and September 23 and 24, 2014. Harbor and lake sediments were sampled in June, and additional lake sampling was conducted in September.

To characterize sediment shoals within the Upper Cuyahoga River Channel, 15 bulk surface sediment grab samples (sites CH-1 through CH-15) were collected from locations staged throughout channel boundaries (Figure A1).

To characterize lake bottom sediments in Lake Erie, sediment grab samples were collected from several deep-water areas adjacent to Cleveland Harbor: CLA-1 (discrete sites CLA1-1 through CLA1-5), and additional reference areas/sites CLA-4 (discrete sites CLA4-1 through CLA4-5), CLA-7 (discrete sites CLA7-1 through CLA7-5), CLA14 (discrete sites CLA14-1 through CLA14-5) and CLAM-1 through CLAM-5 (Figure A2). Discrete sediment samples were also composited as follows (see Figures 1 and 2): DMMUs—composite DMMU-1 (discrete sites CH-1 through CH-5), composite DMMU-2a (discrete sites CH-6 through CH-10), composite DMMU-2b (discrete sites CH-11 through CH-15); proposed open-water placement area—composite CLA-1 (discrete sites CLA1-1 through CLA1-5) and reference composite CLA-4 (discrete sites CLA4-1 through CLA4-5), CLA-7 (discrete sites CLA7-1 through CLA7-5), and CLA-14 (discrete sites CLA14-1 through CLA14-5).

In September, 25 additional lake sediment samples were collected from locations spaced at two-mile increments across a triangular grid extending from just outside Cleveland Harbor breakwaters to CLA-1 (LE-1 through LE-25) (Figure A3). Sediment samples were not collected from six of the proposed sampling locations (LE-5, 8, 9, 15, 17 and 18) due to poor sample recovery.

b. **Analyses**

The sediment samples were analyzed by RTI (2014a) and RTI (2014b) as follows:

(1) **Bulk sediment analyses**

(a) *Discrete samples*—Discrete sediment samples from the harbor and lake were analyzed for bulk grain size (sieve and hydrometer) and percent moisture, total organic carbon (TOC), PCBs (209 congeners) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). The lake samples collected in September were also analyzed for total phosphorus (TP).

(b) *Composite samples*—Composite sediment samples from the harbor (DMMU-1, DMMU-2a and DMMU-2b) and lake (CLA-1, CLA-4, CLA-7 and CLA-14) were also analyzed for bulk grain size (sieve and hydrometer) and percent moisture, TOC, PCBs (209 congeners) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). In addition, sediment and pore water was analyzed for 34 PAHs (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) which have been identified as being generally most abundant in the environment and commonly measured (USEPA 2003).

(2) **Biological testing**

(a) ***28-day Lumbriculus variegatus bioaccumulation (from sediment)***—28-day *L. variegatus* bioaccumulation tests for PCBs (209 congeners) were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1, CLA-4, CLA-7 and CLA-14. Additionally, bioaccumulation testing was applied to each discrete lake sample collected in June. A subset of samples from September were subject to bioaccumulation testing (LE-1, 3, 11, 12, 13, 19, 21, 23, 24). Lipid content in *L. variegatus* tissue was determined for each sample.

2.1.3 2015 investigation

a. **Sampling**

Sediment sampling in 2015 was conducted during the week of April 27, 2015.

To characterize sediment shoals within the Upper Cuyahoga River Channel, 15 bulk surface sediment grab samples (sites CH-1 through CH-15) were collected from locations staged throughout the area, within the navigation channel boundaries (Figure A4). In addition, a subset samples from certain locations collected through core sampling from the sediment surface to project depth or dredging prism (CH-3, 5, 7, 9, 12 and 15).

To characterize sediments in the open-waters of Lake Erie, sediment grab samples were collected from CLA-1 (discrete sites CLA1-1 through CLA1-5), and an additional reference area, CLA-4 (discrete sites CLA4-1 through CLA4-5) (Figure A5).

b. **Analyses**

The sediment samples were analyzed by RTI (2015) and USAERDC (2015a) as follows:

(1) **Bulk sediment analyses**

(a) ***Discrete samples***—Discrete sediment samples from the harbor and lake were analyzed for metals (23 target analytes list (TAL, including mercury), total cyanide, total Kjeldahl nitrogen (TKN), ammonia nitrogen (NH_3), TP, pesticides, bulk grain size (sieve and hydrometer) and percent moisture, TOC, PCBs (Aroclors) and PAHs (16 USEPA priority pollutants and methylnaphthalenes). The lake samples were also analyzed for total oil and grease.

(b) ***Composite samples***—Composite sediment samples from the harbor (DMMU-1, DMMU-2a and DMMU-2b) and lake (CLA-1 and CLA-4) were subjected to the same physical and chemical analyses as the discrete samples with the addition of the analysis of acid volatile sulfides/simultaneously extracted metals (AVS/SEM), PCBs (209 congeners) and analysis of pore water for 34 PAHs.

(2) **<u>Biological testing</u>**

(a) ***28-day*** **Lumbriculus variegatus** ***bioaccumulation (from sediment)***—Standard 28-day *L. variegatus* bioaccumulation tests for PCBs (209 congeners) were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1 and CLA-4. Lipid content was determined for each sample.

(b) ***10-day*** **Hyalella azteca** ***and*** **Chironomus dilutus** ***whole sediment toxicity tests***—Standard 10-day *H. azteca* and *C. dilutus* whole sediment (solid phase) toxicity tests were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b and lake composite samples CLA-1 and CLA-4.

(b) ***48-hour*** **Ceriodaphnia dubia** ***and 96-hour*** **Pimephales promelas** ***water column toxicity tests***—Standard 48-hour *C. dubia* and four-day *P. promelas* water column toxicity tests were applied to harbor composite samples DMMU-1, DMMU-2a and DMMU-2b. Based on the results of these bioassays, toxicity identification/reduction evaluation (TIE/TRE) was performed on the sediment elutriates.

(3) **<u>Elutriate testing</u>**

The standard elutriate test (SET) was performed on harbor composite sediment samples DMMU-1, DMMU-2a and DMMU-2b. The SET is a laboratory simulation to predict the potential release of contaminants from dredged sediments to the water column during open-water placement of dredged sediments. Elutriate preparations and lake water were analyzed for the same chemical parameters as the discrete sediment samples.

3.0 DREDGED SEDIMENT EVALUATION

3.1 General description

This evaluation focuses on sediments dredged from the upper Cuyahoga River Channel as represented by DMMU-1, DMMU-2a and DMMU-2b (Figure 1), and its placement at open-lake area CLA-1 (Figure 2). It references or integrates information from the previous 2013 dredged sediment evaluation (USACE 2013) as appropriate.

The initial step toward evaluating the toxicological effects of placing any dredged sediments in the open-lake is to compare bulk contaminant concentrations in the DMMU samples to those from open-lake placement area(s). If any DMMU contaminant concentration significantly exceeds open-lake placement area sediment concentrations such that they would present a potential toxicological risk, it was identified as a preliminary contaminant of concern (PCOC) or COC, and then subjected to further testing and/or evaluation. Further testing/evaluation typically includes modeling or biological testing (bioassays). With respect to applicable state WQSs, sediment elutriate data are used to assess compliance after consideration of dilution and dispersion. Water column bioassay data are also utilized to evaluate water quality-related effects and compliance.

3.2 Site conceptual model

The site conceptual model for this activity focuses on potential contaminant-related adverse impacts to the aquatic ecosystem that would occur as a result of the discharge of the dredged sediment at the deep-water open-lake area designated CLA-1. This area is two square miles and in water depths of between 50 and 60 feet. Aquatic habitat at CLA-1 consists primarily of warm water, mud-bottom (mainly silt/clay), benthic substrate with overlying water column. Some of CLA-1 has been impacted by dredged sediment as it was previously used for the placement of sediments dredged from Cleveland Harbor over 40 years ago. Bottom sediments at this area are colonized by a community of benthic invertebrates that are relatively low in species diversity and dominated by oligochaetes and chironomids. The water column at this area is used by most fish, nekton and plankton on a transient basis as required for foraging and migration. Aquatic birds use the water surface and water column on a transient basis for resting and foraging.

Under this dredged sediment management alternative, sediments from Cleveland Harbor would typically be mechanically dredged from the channel using a clamshell bucket, then placed in a scow for transport and discharged at CLA-1. The dredged sediment is composed mainly of silts, clays, sands and water with residual bulk concentrations of contaminants and organic matter. During discharge, dredged sediment is released from the scow and descends through the water column until it hits the bottom substrate, then collapses and spreads out before coming to rest on the lake bottom. Contaminant-related impacts can occur in both the water column and benthic environs, and are assessed mainly through toxicity and bioaccumulation endpoints relative to biological receptors. Typical exposure pathways between the dredged sediment and receptors would include uptake through absorption (bioconcentration) and absorption/ingestion (bioaccumulation), and trophic transfer through bioaccumulation. With respect to contaminant-related impacts in the water column, effects require exposure to biota and include the release of dissolved contaminants from the dredged sediments and turbidity, both of which are short-term events. These effects are evaluated via comparison of elutriate contaminant concentrations, after considering the effects of dilution and dispersion in the water column by modeling of sediment elutriate data, with WQSs and toxicity criteria developed by elutriate bioassays using a minnow and water flea as representative test species. With respect to contaminant-related benthic impacts associated with the placed dredged sediments, effects require exposure to biota and include toxicity and bioaccumulation. These effects are evaluated through bulk sediment chemistry, solid phase bioassays using an amphipod and midge as representative test species, bioaccumulation experiments using an aquatic worm, and modeling. Regarding dredged sediment movement on the lake bottom, the placed sediment would behave in a manner similar to the adjacent and surrounding lake bottom sediments, whereby a thin layer of the actively bioturbated zone could resuspend and migrate from the area under severe storm conditions. Resuspended dredged sediments under these conditions would constitute a very small fraction of the regional suspended sediment load during the storm event. Any resuspended dredged sediments would mix thoroughly with the load and be indistinguishable from the regional load. Deeper depths of the open-lake placement area would serve to allay the potential for sediment erosion, resuspension and movement.

3.3 2014 investigation

3.3.1 Bulk sediment analyses

a. **<u>Physical testing</u>**

Tables B1and B2 present the results of these analyses. The particle size data across the DMMU-1, DMMU-2a and DMMU-2b discrete samples show that the sediments are comprised of between 4.2% (CH-2) and 98.4% (CH-14) clays and silts, with the remainder sands and gravels (on a composite sample basis, 80.8% sands/gravels in DMMU-1 to 84.8% silts and clays in DMMU-2b). Sediments within DMMU-1 and the immediately downstream Site CH-6 were more coarse-grain in nature, ranging from

55.8% (CH-3) to 95.9% (CH-2) sands and gravels. Bottom sediments in discrete samples from CLA-1 were predominantly fine-grain in nature and composed of 87.1% (CLA1-5) to 99% (CLA1-2 and CLA1-4) clays and silts, with the remainder sands and gravels. Bottom sediments in discrete samples from open-lake area CLA-14 were more of a mixture of fine- and coarse-grain sediments, and composed of 44.6% (CLA14-5) to 68.7% (CLA14-4) clays and silts, with the remainder sands and gravels. Bottom sediments at the remaining open-lake areas and sites varied, ranging from 1.8% (LE-6) to 99.6% (CLA7-2) clays and silts, with the remainder sands and gravels. Note that fine sand content in each of the samples is classified with a sieve size of 0.075-0.425 mm as compared to a silt sieve size of 0.005-0.075 mm. It can be very difficult to visually or texturally discern a difference between silt and fine sand under this classification. Consequently, dredged sediments that are predominantly fine sand under this classification are oftentimes not well suited for littoral or beach nourishment.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Tables B3 and B4 present the results of these analyses

●*TOC*—Table B3 presents the results of these analyses. TOC content in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.72% (CH-2) to 2.8% (CH-6). On a composite sample basis, TOC content in the channel sediments ranged from 1.2% (DMMU-1) to 2.0% (DMMU-2a). The DMMU composite sample mean of 1.6% was higher than the mean of 1.2% in 2012 (USACE 2013). TOC content in discrete samples of bottom sediments at CLA-1 was consistent and ranged from 2.6% (CLA1-4) to 3.6% (CLA-1 composite). TOC content in discrete samples of bottom sediments at open-lake area CLA-14 varied somewhat, ranging from 2.4% (CLA14-1 and CLA14-2) to 6.7% (CLA14-4). TOC content in discrete samples of bottom sediments at the remaining open-lake areas and sites also varied, ranging from 0.19% (LE-11) to 4.4% (CLAM-3).

●*TP*—Table B4 presents the results of these analyses. TP concentrations in discrete samples of bottom sediments at the open-lake sites varied, ranging from 44 (LE-6) to 730 (LE-3) mg/kg.

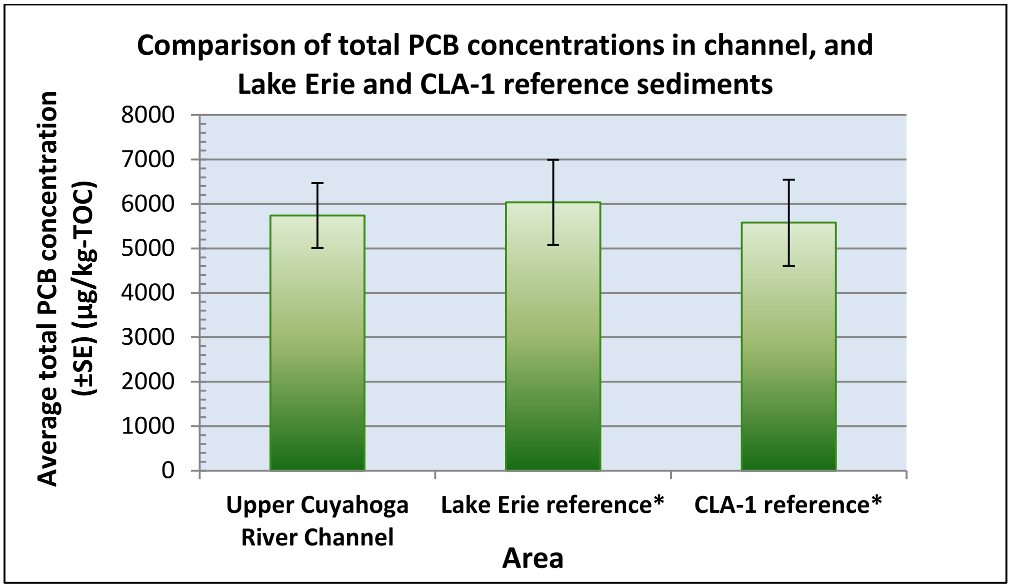
(2) ***Organic analyses***

(a) **PCBs**—Tables B5 and B6 summarize the results of these analyses (congener data are in RTI 2014a and RTI 2014b, respectively). Total PCB concentrations in the sediment samples were determined by summing all congeners, with non-detectable concentrations valued at zero.

●*PCB concentrations in lake bottom sediments*—For the purposes of this evaluation, bulk sediment total PCB concentrations of up to 400 µg/kg were determined to be within the range of ambient lake bottom sediments (not influenced by past dredged sediment discharges) based on the range in measured PCB concentration between sediment samples from LE-11 and LE-10 (Table B6). This also served as the basis for assessing whether total PCB concentrations in sediment samples at assumed former dredged sediment discharge sites were significantly influenced by dredged sediments. These sites were determined to include CLA1-5 (1,450 µg/kg) within the proposed open-lake placement area, LE-3 (5,880 µg/kg) outside and adjacent to Cleveland Outer Harbor and LE-16 (968 µg/kg) just outside of CLA-14. Excluding these three sites, the average and range in total PCB concentrations across all discrete samples in Lake Erie offshore of Cleveland was 112 µg/kg (5,778 µg/kg-TOC) and 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC, respectively. Excluding sites from CLA-1 and CLA-14 made little difference in these values, resulting in an average and range of 102 µg/kg (6,038 µg/kg-TOC) and 9.36 to 400 µg/kg (248 to 25,000 µg/kg-TOC,) respectively. Using this approach, CLA-1 reference sediments were determined based on PCB data from CLA1-1, CLA1-2, CLA1-3 and CLA1-4, yielding a total PCB concentration mean of 156 µg/kg (5,579 µg/kg-TOC).

●*Comparison of PCB concentrations in channel and lake sediments*—The average total PCB concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 95 µg/kg (5,737 µg/kg-TOC) (range 32 to 300 µg/kg or 2854 to 15000 µg/kg-TOC) and comparable to the average of 102 µg/kg (6,038 µg/kg-TOC) (range 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC) across all discrete Lake Erie sediment samples not influenced by past dredged sediment placement. It is also comparable to the average of 112 µg/kg (5,778 µg/kg-TOC) (range 9.36 to 400 µg/kg or 248 to 25,000 µg/kg-TOC) across all discrete Lake Erie sediment samples when including samples from CLA-1 and CLA-14, and excluding samples where PCB contamination is assumed to be associated with formerly placed dredged sediments. This shows that PCB contamination in the channel sediments is consistent with (or less than) that which exists in surface Lake Erie sediments offshore of Cleveland. Total PCB concentrations in the vast majority of surface sediments sampled at CLA-1 were consistent with ambient levels (CLA1-1 through CLA1-4 average 156 µg/kg [5579 µg/kg-TOC]), indicating limited impact in these samples from former sediment placement activities. The average total PCB concentration across all discrete DMMU-1, DMMU-2a and DMMU-2b samples was lower or comparable to this average (range 104 to 236 µg/kg or 4,000 to 8,138 µg/kg-TOC). Figure 3 compares total PCB concentrations in the channel, Lake Erie and CLA-1

FIGURE 3



*Excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

reference sediments.

Table 1 summarizes the total PCB data across all of the channel and lake sediment samples:

TABLE 1

PCB MEASUREMENT	LOCATION/AREA			
	HARBOR	LAKE		
	UPPER RIVER CHANNEL	CLA-1 REFERENCE*	CLA-14*	OTHER AREAS/SITES*
DISCRETE SAMPLES				
Total PCBs (µg/kg)	**32 to 300**	**104 to 236**	**82 to 291**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**2,854 to 15,000**	**4,000 to 8,138**	**2,158 to 9,700**	**248 to 25,000**
COMPOSITE SAMPLES				
Total PCBs (µg/kg)	**67.9 to 144**	**156****	**179**	**110 to 155**
TOC-normalized PCBs (µg/kg-TOC)	**5,100 to 8,471**	**5,579****	**5,967**	**3,929 to 5,536**

*Excludes areas/sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.
**Due to higher PCB contamination encountered at CLA1-5 (1,450 µg/kg) (which biased the composite sample concentration high [1,250 µg/kg]), the average value across CLA1-1 through CLA1-4 was used in lieu of the composite sample concentration.

With respect to comparisons among the channel and lake sediments, there are two main points that can be concluded from the data in this table:

- *PCB contamination in the channel sediments is within the range of PCB contamination in Lake Erie bottom sediments not impacted by past dredged sediment placement activities.*
- *Except for one site within CLA-1 and one site just outside of CLA-14, PCB contamination in reference sediments at open-lake areas CLA-1 and CLA-14 is within the range of PCB contamination in Lake Erie bottom sediments not impacted by past dredged sediment discharge activities.*

The PCB data on the channel sediments are consistent with those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 33.3 to 333 µg/kg (composite sample range 81.4 to 95.6 µg/kg), and from 2,932 to 26,385 µg/kg-TOC (composite sample range 6,373 to 9,146 µg/kg-TOC) on a TOC-normalized basis. The PCB data on bottom sediments at open-lake areas CLA-1 (except for CLA1-5) and CLA-4 are also consistent with those presented in USACE (2013a).

Based on this information, total PCBs were not identified as a PCOC in the channel sediments. However, benthic bioaccumulation testing for PCBs was nevertheless performed (see paragraph 3.3.2).

(b) **PAHs**

●*PAH concentrations in sediments*—Table 2 summarizes total PAH data across all of the channel and lake sediment samples:

TABLE 2

PAH MEASUREMENT	LOCATION/AREA			
	HARBOR	LAKE		
	UPPER RIVER CHANNEL	CLA-1	CLA-14	OTHER AREAS/SITES
DISCRETE SAMPLES				
Total PAHs (16 USEPA priority pollutants) (µg/kg)	**1,059 to 12,619**	**3,350 to 10,780**	**9,700 to 14,540**	**177 to 13,070**
TOC-normalized PAHs (16 USEPA priority pollutants) (mg/kg-TOC)	**113 to 1,753**	**137 to 385**	**441 to 539**	**7 to 816**
COMPOSITE SAMPLES				
Total PAHs (16 USEPA priority pollutants) (µg/kg)	**3,180 to 6,360**	**6,792***	**12,120***	**2,470 to 2,690***
TOC-normalized PAHs (16 USEPA priority pollutants) (mg/kg-TOC)	**311 to 376**	**243***	**490***	**91 to 96***
Total PAHs (34 PAH structures) (µg/kg)	**8,680 to 14,110**	**529,750****	**587,970****	**9,820 to 10,320**
TOC-normalized PAHs (34 PAH structures) (mg/kg-TOC)	**706 to 801**	**14,715****	**19,599****	**364 to 369**

*Excludes areas/sites where PAH contamination was suspected to be influenced from past dredged sediment discharges.
**Sample likely impacted by past dredged sediment discharges.

- **USEPA 16 priority pollutants**—Tables B7 and B8 summarize the results of these analyses (see Table B9 for total PAH data on the composite sediment samples). Total PAH concentrations in the sediment samples were determined by summing the USEPA 16 priority pollutants. The average total PAH concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 5,764 µg/kg (401 mg/kg-TOC) (range 1,059 to 12,619 µg/kg or 113 to 1753 mg/kg-TOC) and higher than the average of 2,562 µg/kg (193 mg/kg-TOC) (range 177 to 13,070 µg/kg or 7 to 816 mg/kg-TOC) across all discrete Lake Erie sediment samples not impacted by past dredged sediment placement. It was also somewhat higher than the average of 4,467 µg/kg (249 mg/kg-TOC) (range 177 to 13,070 µg/kg or 7 to 816 mg/kg-TOC) across all discrete Lake Erie sediment samples (excluding samples assumed to be impacted by formerly placed dredged sediments). This shows that PAH contamination in the channel sediments is somewhat higher than that which exists in surface Lake Erie sediments offshore of Cleveland. Depending on whether the data are TOC-normalized, the average total PAH concentration across all discrete DMMU-1, DMMU-2a and DMMU-2b samples was lower or higher than the average of 6,792 µg/kg (243 mg/kg-TOC) (range 3,350 to 10,780 µg/kg or 137 to 385 mg/kg-TOC) across all discrete non-impacted sediment samples at CLA-1. Regardless of whether the bulk PAH concentrations in the channel sediments are higher or lower than those in these open-lake sediments, gauges of potential PAH toxicity in sediments were evaluated in the form of solid phase bioassays and analysis of sediment pore water concentrations.

The PAH data on the channel sediments are overall consistent with those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 842 to 16,336 µg/kg (composite sample range 6,250 to 14,972 µg/kg), and from 183 to 778 mg/kg-TOC (composite sample range 417 to 1,682 mg/kg-TOC) on a TOC-normalized basis. The PAH data on bottom sediments at CLA-1 (except for CLA1-3 and CLA1-5) are consistent with or somewhat higher than those presented in USACE (2013a). The PAH data on bottom sediments at CLA-4 are consistent with or somewhat lower than those presented in USACE (2013a).

- **34 PAH structures (18 non-alkylated parent compounds and 16 groups of generic alkylated forms)**—Table B9 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 34 PAH structures (this table also includes total PAH concentrations based on the 16 USEPA priority pollutants). Total PAH concentrations in the DMMU-1, DMMU-2a and DMMU-2b composite samples ranged from 8,680 to 13,610 µg/kg (706 to 801 mg/kg-TOC). These concentrations are comparable to or somewhat higher than those measured in the CLA-4 and CLA-7 sediments. Note that the very high total PAH concentration in the CLA-1 composite sediment sample appeared to reflect the high concentrations measured in discrete sediment samples CLA1-3 and CLA1-5.

●*PAH concentrations in sediment pore water*—The hydrocarbon narcosis and equilibrium partitioning (EqP) models (USEPA 2003) assume that the risk of PAH mixtures to benthic organisms is attributable to the freely dissolved PAH compound concentrations in sediment pore (interstitial) water. PAHs in the dissolved phase are those which are bioavailable and have potential to cause toxicity. The predicted measure of toxicity is an EqP sediment benchmark toxic unit final chronic value ($\sum ESBTU_{FCV}$). Sediments determined to have $\sum ESBTU_{FCV} < 1.0$ for a mixture of PAH compounds are predicted to be acceptable for the protection of benthic organisms. In this case, dissolved water concentrations in sediment pore water were directly measured using ASTM method D7363. Using direct sediment pore water concentration data, sediment interstitial water toxic unit final chronic values ($\sum IWTU_{FCV}$) are calculated as:

$$\sum IWTU_{FCV} = \sum \frac{C_{IW\ PAHi}}{FCV_i} \tag{1}$$

Where:
$C_{IW\ PAHi}$ = Dissolved concentration of PAH compound in sediment interstitial water (µg/L)
FCV_i = PAH compound-specific FCV concentration in sediment pore water (µg/L)

Table B10 summarizes sediment pore water concentrations of the 34 PAH structures and associated calculated $\sum IWTU_{FCV}$. Channel sediment $\sum IWTU_{FCV}$ were all <0.1, indicating that PAH bioavailability is low and the measured concentrations in bulk sediment are protective of benthic organisms. Lake area $\sum IWTU_{FCV}$ were <0.1 (CLA-4 and CLA-7), 208 (CLA-1) and 403 (CLA-14), indicating that while PAH contamination in the CLA-4 and CLA-7 sediments was protective of benthic organisms, PAH contamination in certain sediments at CLA-1 and CLA-14 are expected to be chronically toxic to benthic organisms.

The $\sum IWTU_{FCV}$ data on channel sediments are consistent with those sampled in 2012 USACE (2013a). Although the $\sum IWTU_{FCV}$ for CLA-1 sediment samples in 2012 was 2.8, no acutely toxicity to *H. azteca* was observed in the solid phase bioassay (USACE 2013a). This result can be explained by reviewing literature on the critical body burden expected to result in toxicity to *H. azteca*. Sediment pore water concentrations predicted to result in a body burden of less than 13.9 µmol/g-lipid are not expected to be toxic (USEPA 2003). These CLA-1 sediments were predicted to result in a critical body burden of 6.1 µmol/g-lipid which is lower than the 13.9 µmol/g-lipid whole body concentration at which chronic effects would be expected (USACE 2013b). Therefore, the potential risk of toxicity associated with sediments sampled from CLA-1 in 2012 is insignificant, while those collected in the composite sample in 2014 are likely to be toxic with respect to PAHs. It is evident that very high $\sum IWTU_{FCV}$ for CLA-1 sediments sampled in 2014 was influenced by discrete sediment samples CLA1-3 and CLA1-5. For CLA-4, the $\sum IWTU_{FCV}$ were consistent in 2012 and 2014. Figure 7 (Paragraph 3.4.1[b][2][b]) presents a graph of the 2012, 2014 and 2015 $\sum IWTU_{FCV}$ data across the channel, lake reference and toxic lake sediments. These data also indicate that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an abatement of acute and chronic toxicity to benthic invertebrates.

Based on this information, PAHs were not identified as a PCOC in the channel sediments.

3.3.2 PCB bioaccumulation testing

a. **Results**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Results of the standard 28-day *L. variegatus* bioaccumulation testing for PCBs on channel and lake area sediment samples are provided in Tables B11 and B12 (congener data are in RTI 2014a and RTI 2014b, respectively). Table B11 includes bioaccumulation test data on the channel, and CLA-1 and CLA-14 sediment samples, while Table B12 includes bioaccumulation test data on sediments from CLA-1, CLA-4 and other various lake areas/sites. Table 3 summarizes the benthic bioaccumulation PCB data and corresponding bulk composite sediment sample total PCB data:

TABLE 3

PCB MEASUREMENT	LOCATION/AREA						
	UPPER RIVER CHANNEL			LAKE			
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE*	CLA-4	CLA-7	OTHER DISCRETE SITES**
TISSUE							
Total PCBs (µg/kg)	**156**	**105**	**103**	**195**	**34.8**	**35**	**13.7 to 92.7**
Lipid-normalized PCBs (µg/kg-lipid)	**8,666**	**5,259**	**5,261**	**7,403**	**1,558**	**1,648**	**1,211 to 4,414**
SEDIMENT							
Total PCBs (µg/kg)	**67.9**	**102**	**144**	**156**	**117**	**110**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**5,658**	**5,100**	**8,471**	**5,579**	**4,333**	**3,929**	**248 to 25,000**

*The average value across CLA1-1 through CLA1-4 was used in lieu of the composite sample concentration. CLA1-5 (1,450 µg/kg) was determined to be an outlier that is not representative of reference sediments.
**Excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

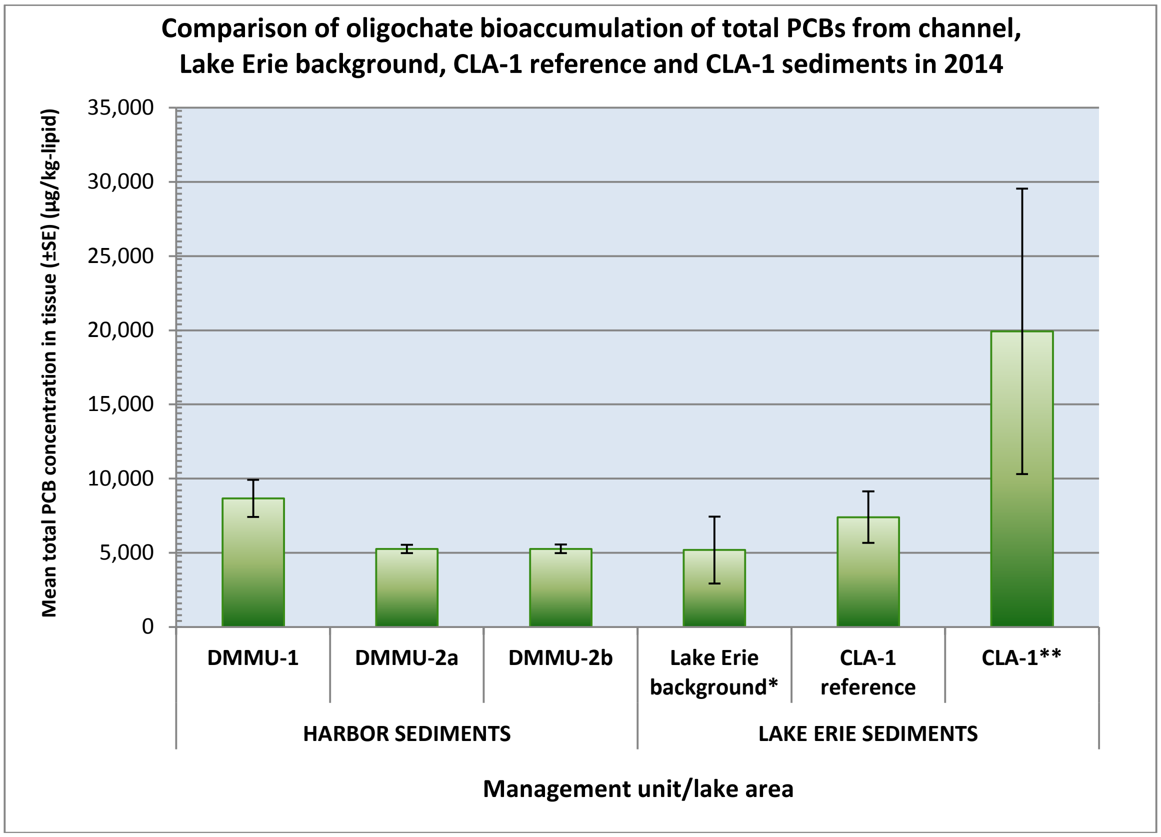
For the purposes of statistical comparisons among the channel and lake area bioaccumulation data and comparison of the 2012 (USACE 2013a) and 2014 bioaccumulation data sets, the 2014 PCB *L. variegatus* tissue data were lipid-normalized. This was because a significant positive linear relationship was established between tissue PCB concentrations and lipid content (Pearson correlation, r=0.748), as well as the fact that the mean lipid content for the 2014 data (1.93±0.05%) was statistically greater than that of the 2012 bioaccumulation data set (1.21±0.02%) (two-sample t-test; P<0.01). The average lipid content of 1.93% for the 2014 bioaccumulation data was almost double the overall lipid content of 1% that is characteristic field-collected oligochaetes (Oliver 1984 and 1987; Ankley *et al*. 1992). Similar bulk sediment PCB concentrations and higher TOC content relative to the 2012 dataset indicate that it is likely that the higher lipid content increased PCB bioaccumulation by *L. variegatus* in the laboratory in 2014.

b. **Comparisons to Lake Erie sediments at open-lake placement area and other areas/sites in Lake Erie**

(1) ***CLA-1 and regional background sediments***

(a) **Channel sediments vs. CLA-1 and regional background sediments, 2014 data**—In comparison to CLA-1 reference sediments (7,403 µg/kg-lipid), mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the DMMU-2a (5,259 µg/kg-lipid) and DMMU-2b (5,261 µg/kg-lipid) sediments were lower, while those exposed to the DMMU-1 sediments (8,666 µg/kg-lipid) were higher. On a sole total PCB concentration basis, residues in *L. variegatus* tissues exposed to all of the channel sediments (range 67.9 to 144 µg/kg) were lower than those associated with the CLA-1 reference sediments (195 µg/kg). None of the mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to channel sediments were significantly different in comparison to those exposed to CLA-1 reference sediments (one-tailed Wilcoxon rank sum test; P≤0.05). Therefore, placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of PCBs at the placement area. The data also indicate that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an estimated reduction in the benthic bioaccumulation of PCBs from 55,015 to 6,395 µg/kg-lipid. Figure 4 compares mean oligochaete bioaccumulation of total PCBs from the channel sediments to regional Lake Erie sediments offshore of Cleveland (surface area-weighted), and CLA-1 reference and CLA-1 areas, respectively. It illustrates how the placement of channel sediments at CLA-1 would not result in any significant increase in benthic bioaccumulation of PCBs.

FIGURE 4



*Surface area-weighted mean including some modeled values.
**Includes one modeled value.

(b) **Channel sediments vs. CLA-1 reference sediments**

●*2012 and 2014 data, grouped*—Total PCB benthic bioaccumulation data on the channel and CLA-1 reference sediments from 2012 (USACE 2013) were grouped with those from 2014. In comparison to the grouped CLA-1 reference sediments (5,122 µg/kg-lipid), mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the grouped DMMU-2a (4,888 µg/kg-lipid) and DMMU-2b (5,086 µg/kg-lipid) sediments were lower, while those exposed to the grouped DMMU-1 sediments (7,867 µg/kg-lipid) were higher. On a total PCB concentration basis, residues in *L. variegatus* tissues exposed to all (range 78.9 to 121 µg/kg) but the grouped DMMU-1 sediments were lower than those associated with the grouped CLA-1 reference sediments (115 µg/kg). None of the mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to grouped channel sediments were significantly different in comparison to those exposed to the grouped CLA-1 reference sediments (one-tailed Wilcoxon rank sum test; P≤0.05).

●*2012 vs. 2014 data*—To facilitate comparison of total PCB tissue concentrations between 2012 and 2014, a linear relationship (square of Pearson's, r >0.99) was established between the congener subset analyzed and summed in 2012, and complete list of 209 congeners summed in 2014:

$$\text{Total PCBs} = 3.2 + 1.5(\sum \text{PCB}) \qquad (2)$$

When the mean lipid-normalized total PCB concentrations in *L. variegatus* tissues across individual DMMUs in 2012 and 2014 were compared, no statistically significant differences were observed (one-tailed homoscedastic t-Test; P≤0.05). In addition, between 2012 and 2014, there were no statistically significant differences in lipid-normalized total PCB concentrations in *L. variegatus* tissues associated with CLA-1 reference sediments (one-tailed homoscedastic t-Test; P≤0.05).

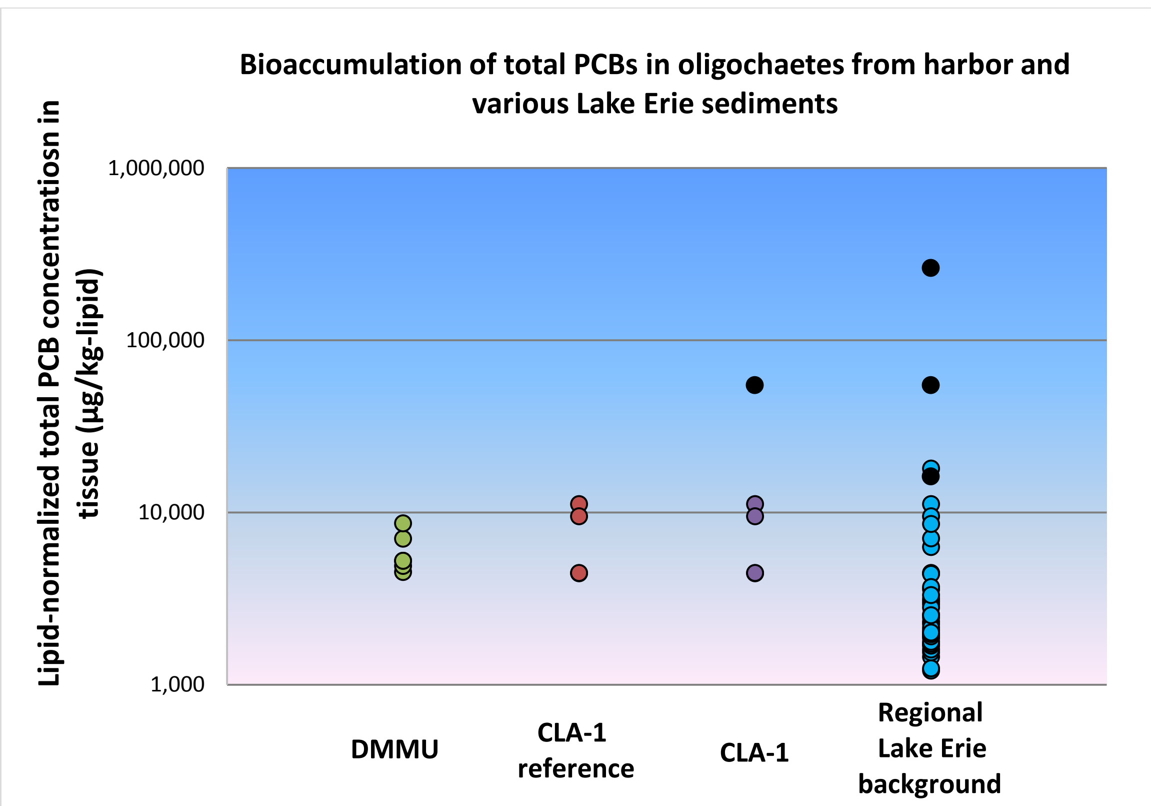
(2) ***Sediments at other lake areas/sites not formally used for dredged sediment discharges***—This includes all 2014 areas/sites excluding those assumed to be formally used for dredged sediment discharges over four decades ago (CLA1-1, CLA1-2, CLA1-3, CLA1-4, CLA1-5, CLA14-1, CLA-14-2, CLA14-3, CLA14-4, CLA14-5, LE-3 and LE-16). Across all discrete lake sediment samples, total PCB residues in *L. variegatus* tissues ranged from 13.7 µg/kg (1,245 µg/kg-lipid) to 92.7 µg/kg (4,414 µg/kg-lipid).

However, this range does not include a value from LE-10 sediments which possessed a higher total PCB concentration of 400 µg/kg for which bioaccumulation was not specifically measured. The theoretical bioaccumulation potential (TBP) model projection (McFarland 1984) using an empirical biota-sediment accumulation factor (BSAF) of 0.72 for Lake Erie sediments offshore of Cleveland (and assuming a 1% lipid content in oligochaetes) estimates that PCBs from the LE-10 sediment sample would bioaccumulate to 180 µg/kg (or 18,000 µg/kg-lipid). This effectively increases the range of PCB bioaccumulation in oligochaetes from these lake sediments to 13.7 to 180 µg/kg (1245 to 18,000 µg/kg-lipid). Total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments were within the higher end of this range. Mean total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments was significantly greater relative to sediments at CLA-4 (1,558 µg/kg-lipid) (one-tailed least significant difference

[LSD] test; α=0.1). Collectively, this information shows that total PCB residues in *L. variegatus* tissues exposed to the channel and CLA-1 reference sediments is within the high end of the range of benthic bioaccumulation of PCBs from regional Lake Erie sediments offshore of Cleveland.

(3) ***Sediments at all lake areas/sites***—This includes all sites regardless of whether they may have been formerly used for dredged sediment discharges. These data represent existing regional background PCB bioaccumulation from Lake Erie sediments offshore of Cleveland. Figure 5 is a plot of combined 2012 and 2014 oligochaete PCB bioaccumulation values for channel sediments, and the 2014 values for CLA-1 reference, CLA-1 and regional lake sediments offshore of Cleveland. It illustrates how the benthic bioaccumulation of PCBs from the channel sediments is comparable to and well within the range of these designated small and large lake areas offshore of Cleveland.

FIGURE 5



NOTE: Black points designate background sites where lake surface sediments are assumed to be influenced from former dredged sediment placement.

Across all discrete lake sediment samples, total PCB residues in *L. variegatus* and oligochaete tissue ranged from 13.7 µg/kg (1245 µg/kg-lipid) to 5,880 µg/kg (262,583 µg/kg-lipid). This range includes several TBP model-predicted values using empirical BSAFs (and assuming a 1% lipid content in oligochaetes) for sites at which bioaccumulation was not specifically measured (CLA1-5, CLA14-4, LE-2, LE-10, LE-14, LE-16, LE-22, LE-23 and LE-25). Mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to DMMU-2a and DMMU-2b sediments (5,259 and 5,269 µg/kg-lipid, respectively) were comparable to the surface area-weighted background mean of 5,188 µg/kg-lipid across *L. variegatus* and oligochaetes (Figure 4). The mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to the DMMU-1 sediments (8,666 µg/kg-lipid) is somewhat higher, but within the range and still comparable to this surface area-weighted mean. The magnitude of difference (MOD) (measured laboratory bioaccumulation from dredged sediments/measured laboratory bioaccumulation from reference area sediments) for the benthic bioaccumulation of PCBs from DMMU-1 and regional lake background sediments is 1.67 and less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference, and the factor of 2 difference measured between PCB bioaccumulation by *L. variegatus* in paired laboratory and field-based experiments by Beckingham and Ghosh (2010). These data demonstrate that PCB bioaccumulation risk from the channel sediments is within the range and comparable to that which currently occurs from regional Lake Erie background sediments offshore of Cleveland. Figure 4 also illustrates how the benthic bioaccumulation of PCBs from channel sediments is not substantially different from that which currently occurs from regional Lake Erie sediments offshore of Cleveland.

3.3.3 COCs

No COCs were identified in the channel sediments based on data generated by USACE in 2014.

3.4 2015 investigation

3.4.1 Bulk sediment analyses

a. **<u>Physical characteristics</u>**

(1) ***Comparison of core and surface sediment grab samples***—Six core samples were co-located with six surface grab samples. The cores sampled intervals consistent with the dredged prism, which was about 2.5 to 3.5 feet at the time of sampling. Consistent with

the physical characteristics of the surface grab sediment samples, core samples consisted mainly of brown organic rich silt (generally 50 to 60%), with the remainder clays (generally 10 to 20%) and sands (generally 20 to 30%) (Table B13). This shoal material typically overlays light gray clay located below project depth. Within DMMU-1 at the upstream end of the channel, core samples consisted mainly of brown organic rich silt intermixed with comparably more fine sands.

(2) ***Testing***—Table B13 presents the results of these analyses. The particle size data across the DMMU-1, DMMU-2a and DMMU-2b discrete samples show that the sediments are comprised of between 64% (CH-3) and 80% (CH-14) clays and silts, with the remainder sands and gravels (on a composite sample basis, 72% to 80% silts and clays in DMMU-1 and DMMU-2b, respectively). Bottom sediments in discrete samples from CLA-1 were predominantly coarse-grain in nature and composed of 54% (CLA1-1) to 79% (CLA1-5) sands/gravels, with the remainder silts and clays (these differ from the 2014 results due to sampling sites differences). Bottom sediments in discrete samples from open-lake area CLA-4 were predominantly coarse-grain in nature and composed of 61% (CLA4-3) to 80% (CLA4-4) sands/gravels, with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B14 presents the results of these analyses.

●*TOC*—TOC content in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.19% (CH-2) to 2.9% (CH-5). On a composite sample basis, TOC content in the channel sediments ranged from 1.2% (DMMU-1) to 2.0% (DMMU-2a). The DMMU composite sample mean of 1.7% was similar to that in 2014 and higher than the composite sample mean of 1.2% in 2012 (USACE 2013). TOC content in discrete samples of bottom sediments at CLA-1 was generally consistent and ranged from 2.4% (CLA1-5) to 3.9% (CLA1-1). TOC content in discrete samples of bottom sediments at open-lake area CLA-4 was consistent and ranged from 2.8% (CLA4-1, CLA4-2 and CLA4-6) to 3.0% (CLA4-3 and CLA4-4).

●*Nitrogen/ammonia*—Nitrogen/ammonia concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 32 (CH-2) to 380 (CH-14) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 93 (DMMU-1) to 250 (DMMU-2b) mg/kg. Ammonia/nitrogen concentrations in discrete samples of bottom sediments at CLA-1 ranged from 210 (CLA1-3) to 420 (CLA1-2).

Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 180 (CLA4-2) to 3,200 (CLA4-1) mg/kg.

●*TKN*—TKN concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 260 (CH-2) to 2,300 (CH-9) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 410 (DMMU-1) to 1,800 (DMMU-2a) mg/kg. TKN concentrations in discrete samples of bottom sediments at CLA-1 ranged from 2,500 (CLA1-1) to 5,400 (CLA1-5). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 840 (CLA4-4) to 52,000 (CLA4-3) mg/kg.

●*TP*—TP concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 50 (CH-1) to 250 (CH-15) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 170 (DMMU-1) to 220 (DMMU-2a) mg/kg. TP concentrations in discrete samples of bottom sediments at CLA-1 ranged from 290 (CLA1-1) to 450 (CLA1 composite). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from 190 (CLA4-4) to 360 (CLA4 composite) mg/kg.

●*Cyanide*—Cyanide concentrations in discrete samples across DMMU-1, DMMU-2a and DMMU-2b ranged from 0.54 (CH-4) to 1.2 (CH-6) mg/kg. On a composite sample basis, concentrations in the channel sediments ranged from 0.54 (DMMU-2a) to 0.61 (DMMU-2b) mg/kg. Cyanide concentrations in discrete samples of bottom sediments at CLA-1 were all non-detectable (detection limit range 1.6 to 2 mg/kg). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 were all non-detectable (detection limit range 1.6 to 1.9 mg/kg).

●*Oil/grease*—Oil/grease concentrations in discrete samples of bottom sediments at CLA-1 ranged from non-detectable (detection limit range 370 to 410 mg/kg) to 1,800 mg/kg (CLA1-5). Concentrations in discrete samples of bottom sediments at open-lake area CLA-4 ranged from non-detectable (detection limit range 350 to 380 mg/kg) to 460 mg/kg (CLA4-4).

(b) **Metals**—Table B15 presents the results of these analyses. The bulk concentration of most metals in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b were comparable or lower than those at both CLA-1 and CLA-4. Arsenic was the only notable exception, which ranged in concentration from 6.1 (CH-2) to 21 (CH-9, CH-10 and DMMU-2b composite). Arsenic concentrations in discrete samples of bottom sediments at CLA-1 ranged from 7.5 (CLA1-2) to 13 (CLA1-1, CLA1-3 and CLA1 composite) mg/kg. The somewhat higher concentrations in channel sediments are reflective of background concentrations the Lake Erie/Ontario Lake Plain watersheds (sediment reference value [SRV] = 25 mg/kg) (OEPA 2008) and typically not of significant toxicological concern.

●*SEM/AVS*—Table B16 presents the result of these analyses. AVS is regarded as a key sediment partitioning phase that binds cationic metals (cadmium, copper, lead, nickel, silver and zinc) to form insoluble sulfide complexes, thereby reducing their presence in sediment interstitial water and bioavailability (Di Toro *et al.* 1992). Methodology from USEPA (2005) was applied to determine whether an excess of SEM relative to AVS (on a molar basis) existed in these samples. Based on that methodology, the ΣSEM/AVS model holds that when the molar concentrations of metals exceeds that of AVS (i.e., the ΣSEM-AVS difference is greater than 0.0 µmol), the solid phase concentrations of metals may not be sequestered by the presence of sulfides in the sediments, and therefore bioavailable with the subsequent potential to cause toxicity to benthic organisms.

AVS was not detected in each of the DMMU samples at a detection limit of 0.63 µmol/g. Conservatively assuming that AVS is zero in each of these samples, ΣSEM-AVS values ranged from 0.75 (DMMU-1) to 0.90 µmol/g (DMMU-2a). The composite sediment samples from CLA-1 and CLA-4 yielded ΣSEM-AVS of less than 0 (range CLA1 excess AVS 5.1 µmol/g to CLA4 excess AVS 3.8 µmol/g). For the channel sediments with an excess of SEM, zinc was the major contributor among the six metals. While the ΣSEM/AVS model predicts that no toxicity to benthic organisms in sediments will occur if ΣSEM/AVS ≤0.0, it is not intended to predict whether sediments are toxic if ΣSEM/AVS >0.0. The AVS/SEM ratios across the channel sediments (range 1.19 to 1.43) were all less than 2.0, suggesting that they would not be toxic to benthic organisms if zinc is the main contributor (Burton *et al.* 2005). Irrespective of this, toxicity is unlikely when ΣSEM-AVS <1.7 (USEPA 2005).

◊<u>ΣSEM-AVS model normalized to organic carbon (OC)</u>—Normalizing ΣSEM-AVS to OC content reduces variability associated with the prediction of sediment toxicity. The excess SEM through OC normalization yielded channel sediment ΣSEM-AVS/f_{oc} ranging from 44 to 63 µmol/g_{oc}. These values fall below the OC-normalized excess SEM range of 130 µmol/g_{oc} to 3,000 µmol/g_{oc} in which toxicity to benthic organisms is considered uncertain (toxicity associated with values below 130 µmol/g_{oc} is not likely) (USEPA 2005).

Given that the excess SEM is mostly attributable to zinc, the ΣSEM-AVS were <1.7 and ΣSEM-AVS/f_{oc} <130 µmol/g_{oc}, cationic metal contamination in the channel sediments was determined to be protective of benthic organisms. The results of solid phase bioassays on the channel sediments (Paragraph 3.4.2) reinforce this conclusion.

(2) ***Organic analyses***

(a) **PCBs**—Tables B17 and B18 summarize the results of these analyses. For the Aroclor analyses (Table B17) total PCB concentrations in the sediment samples were determined by summing detected Aroclor mixtures and valuing non-detectable concentrations at zero. For the congener analyses (Table B18), total PCB concentrations in the sediment samples were determined by summing all congeners, with non-detectable concentrations valued at zero.

●*Comparison of PCB concentrations in channel and lake sediments*—The average total PCB concentration (based on Aroclors) across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 37.6 µg/kg (3,459 µg/kg-TOC) (range 12 to 73 µg/kg or 571 to 12,105 µg/kg-TOC) and less than the average of 107 µg/kg (3,744 µg/kg-TOC) (range non-detectable [at 28 µg/kg] to 110 µg/kg or 875 to 4,583 µg/kg-TOC) across CLA-1 sediments, and comparable to the average of 47 µg/kg (1,634 µg/kg-TOC) (range 42 to 52 µg/kg or 1,400 to 1,857 µg/kg-TOC) across CLA-4 sediments. The average total PCB concentration (based on congeners) across all composite samples in DMMU-1, DMMU-2a and DMMU-2b was 137 µg/kg (7,978 µg/kg-TOC) (range 100 to 157 µg/kg or 7,750 to 8,333 µg/kg-TOC) and somewhat higher than the composite sediment concentration of 131 µg/kg (3,970 µg/kg-TOC) in CLA-1 sediments, and higher that the composite sediment concentration of 90.6 µg/kg (3,124 µg/kg-TOC) in CLA-4 sediments. Collectively, these data show that PCB contamination in the channel sediments is consistent with or higher than that which exists in sediment at CLA-1 and CLA-4. Based on this information, total PCBs were identified as a PCOC in the channel sediments. Nevertheless, PCB contamination in the channel sediments is also within the 220 to 25,000 µg/kg-TOC concentration range of those measured in regional Lake Erie sediments offshore of Cleveland not influenced by former dredged sediment discharges (see Table 3). Collectively, this information demonstrates that PCB contamination in the channel sediments is consistent with regional lake sediments offshore of Cleveland, even when excluding those which may have been influenced by former dredged sediment discharges.

Table 4 summarizes the total PCB data across all of the channel and lake area sediment samples:

TABLE 4

PCB MEASUREMENT	LOCATION/AREA		
	HARBOR	LAKE	
	UPPER RIVER CHANNEL	CLA-1 REFERENCE	CLA-4
DISCRETE SAMPLES (Aroclors)			
Total PCBs (µg/kg)	**12 to 73**	**28U* to 110**	**42 to 52**
TOC-normalized PCBs (µg/kg-TOC)	**571 to 12,105**	**875 to 4,583**	**1,400 to 1,857**
COMPOSITE SAMPLES (Aroclors)			
Total PCBs (µg/kg)	**36 to 73**	**150**	**41**
TOC-normalized PCBs (µg/kg-TOC)	**1,800 to 6,083**	**4,545**	**1,414**
COMPOSITE SAMPLES (congeners)			
Total PCBs (µg/kg)	**100 to 157**	**131**	**90.6**
TOC-normalized PCBs (µg/kg-TOC)	**7,750 to 8,333**	**3,970**	**3,124**

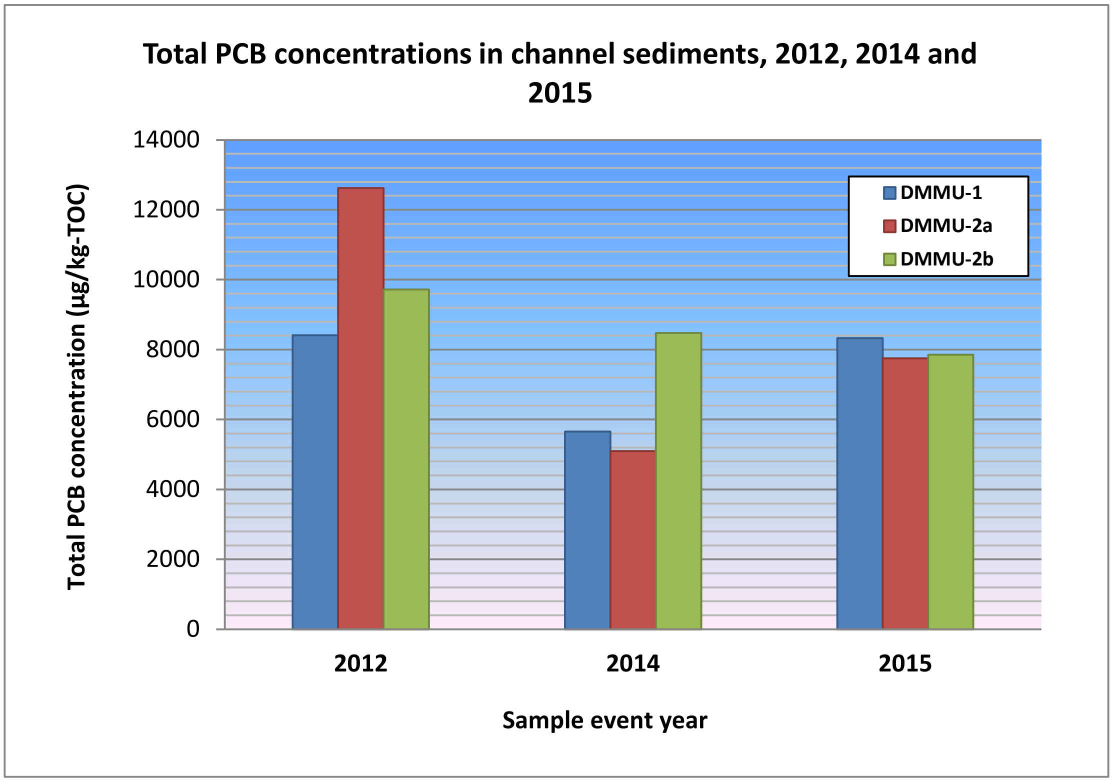
*Non-detectable at the specified detection limit.

●*Comparison of total PCB concentrations in channel sediments across 2015, 2014 and 2012*—Irrespective of the identification of total PCBs as a PCOC, note that the range in TOC-normalized concentrations across the DMMU-1, DMMU-2a and DMMU-2b sediments were within the range of those measured in 2014 (5,100 to 8,471 µg/kg-TOC) and lower than the range of those measured in 2012 (8,407 to 12,625 µg/kg-TOC [USACE 2013]) on a composite sample basis. These data are graphed in Figure 6.

The results of benthic bioaccumulation testing for PCBs on the channel and lake area sediments are discussed in Paragraph 3.4.3.

(b) **Pesticides**—Table B19 summarizes the results of these analyses. Expect for dichlorodiphenyltrichloroethane (DDT), dichlorodiphenyldichloroethane (DDD) and dichlorodiphenyldichloroethylene (DDE), all pesticides were non-detectable in the channel and lake area sediments at detection limits ranging from 2 to 250 µg/kg. In the channel sediments, ∑DDT was detected only in discrete DMMU-1 sediment samples ranging from 6.9 to 16 µg/kg. Such concentrations of ∑DDT are typically not of toxicological significance, and were lower or comparable to those measured in the open-lake area sediments where detectable ∑DDT concentrations ranged from 5.1 to 49 µg/kg. In all channel and open-lake area composite sediment samples, ∑DDT was non-detectable. On a TOC-normalized basis, ∑DDT concentrations in discrete DMMU-1 sediment samples ranged from 1,500 to 2,424 µg/kg-TOC. These were within the range or comparable to the ∑DDT concentration range of 131 to 1,750 µg/kg-TOC in the open-

FIGURE 6



lake area sediments. Even though no pesticides were identified as sediment PCOCs or COCs, benthic bioaccumulation testing for pesticides was nevertheless performed (see paragraph 3.4.4).

(c) **PAHs**—Tables B20 and B21 summarize the results of these analyses.

●*PAH concentrations in sediments*—Table 5 summarizes total PAH data across all of the channel and lake sediment samples:

TABLE 5

PAH MEASUREMENT	LOCATION/AREA		
	HARBOR	LAKE	
	UPPER RIVER CHANNEL	CLA-1 REFERENCE*	CLA-4
DISCRETE SAMPLES			
Total PAHs (µg/kg)	**1,008 to 10,007**	**1,001 to 9,650**	**796 to 1,045**
TOC-normalized PAHs (mg/kg-TOC)	**201 to 1,227**	**31.3 to 402**	**28.4 to 35.6**
COMPOSITE SAMPLES			
Total PAHs (µg/kg)	**4,133 to 5,649**	**6,935**	**1,029**
TOC-normalized PAHs (mg/kg-TOC)	**230 to 344**	**210**	**35.5**

*CLA-1 reference sediments (for PAHs) were determined based on lower bulk sediment concentration and no observation of oil in discrete sample (CLA1-1 was excluded as being suspected as influenced from former dredged sediment discharges).

- **USEPA 16 priority pollutants**—Table B20 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the USEPA 16 priority pollutants. The average total PAH concentration across all discrete samples in DMMU-1, DMMU-2a and DMMU-2b was 5,399 µg/kg (397mg/kg-TOC) to 10,007 µg/kg or 201 to 1,227 mg/kg-TOC), and comparable or higher than the averages of 5,409 µg/kg (201 mg/kg-TOC) (range 1,001 to 9,650 µg/kg or 31.3 to 402 mg/kg-TOC) and 945 µg/kg (33 mg/kg-TOC) (range 796 to 1,045 µg/kg or 1,400 to 1,857 mg/kg-TOC) for CLA-1 reference and CLA-4 sediments, respectively. However, the average total PAH concentration across DMMU composite samples of 4,793 µg/kg (285 mg/kg-TOC) was lower or comparable to the composite sample concentration for CLA-1 reference sediments (6,935 µg/kg or 210 mg/kg-TOC). This shows that PAH contamination in the channel sediments is similar or higher in comparison to the open-lake area sediments. PAH pore water analysis and solid phase bioassay data on the channel and lake area sediment samples are discussed below and in Paragraph 3.4.2, respectively.

  The PAH data on the channel sediments are consistent with those in 2014 in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 1,059 to 12,619 µg/kg (composite sample range 4,665 to 7,143 µg/kg), and from 113 to 1,753 mg/kg-TOC (composite sample range 311 to 376 mg/kg-TOC) on a TOC-normalized basis (Table 2). The PAH data on bottom sediments at CLA-1 (except for CLA1-5) are consistent with those presented in 2014. The PAH data on CLA-4 sediments are consistent with or somewhat lower than those presented in 2014.

The PAH data on the channel sediments are somewhat lower than those presented in USACE (2013a) in which concentrations in discrete sediment samples from DMMU-1, DMMU-2a and DMMU-2b ranged from 842 to 16,336 µg/kg (composite sample range 6,250 to 14,972 µg/kg), and from 183 to 778 mg/kg-TOC (composite sample range 417 to 1,682 mg/kg-TOC) on a TOC-normalized basis. The PAH data on bottom sediments at CLA-1 (except for CLA1-5) are consistent with or somewhat higher than those presented in USACE (2013a). The PAH data on bottom sediments at CLA-4 are consistent with or somewhat lower than those presented in USACE (2013a).

●*Concentrations of 34 PAH structures (18 non-alkylated parent compounds and 16 groups of generic alkylated forms) in sediment pore water*—Table B21 summarizes sediment pore water concentrations of the 34 PAH structures and associated calculated $\sum IWTU_{FCV}$ using Equation 1. Channel composite sample $\sum IWTU_{FCV}$ were all <0.1, indicating that PAH contamination in the sediments is protective of benthic organisms. Channel discrete sample $\sum IWTU_{FCV}$ ranged from <0.1 (CH-5, CH-7, CH-9 and CH-13) to 1.7 (CH-3).

Although an $\sum IWTU_{34}$ screening value of 1.0 is suggested by USEPA as a screening benchmark for evaluating potential toxicity of PAHs to aquatic organisms, an $\sum IWTU_{34}$ greater than 1.0 may not result in toxicity due to a number of site-specific factors. In this case, PAH-related toxicity to benthic invertebrates from sediments at CH-3 is not expected because the $\sum IWTU_{34}$ value of 1.7 is below the chronic toxicity critical body burden for *H. azteca* which is one of the most sensitive freshwater aquatic organisms to PAHs (USEPA 2003). The $\sum IWTU_{34}$ screening value of 1.0 is based on the sensitivity of both saltwater and freshwater aquatic species to PAHs. The FCV believed to be protective of both saltwater and freshwater aquatic organisms is 2.24 µmol/g-lipid, while *H. azteca* has been determined to have a critical body burden (mean acute value for genus) of 13.9 µmol/g-lipid. In addition, data provided in USEPA (2003) have demonstrated that the acute to chronic ratio for *H. azteca* is near 1. An $\sum IWTU_{34}$ value specific to *H. azteca* and protective of other freshwater invertebrates is estimated to be approximately 6. Hawthorne *et al.* (2007) provides additional empirical evidence that support these benchmark estimates for chronic toxicity to *H. azteca* (i.e., greater than 85% survival is predicted at body burdens <15 µmol/g-lipid).

CLA-1 discrete sample $\sum IWTU_{FCV}$ ranged from <0.1 (CLA1-3 and CLA1-5) to 22.2

(CLA1-1). This information showed that PAH contamination in sediments from CLA1-2 through CLA1-5, and in the composite sample ($\sum IWTU_{FCV} = 0.3$), were protective of benthic organisms. However, it indicated that PAH contamination in sediments from CLA1-5 are predicted to result in an internal benthic body burden of approximately 50 µgmol/g-lipid and therefore expected to result in chronic toxicity to *H. azteca* (Hawthorne *et al.* 2007).

The $\sum IWTU_{FCV}$ data on channel sediments were consistent with those sampled in 2014 and 2012 (USACE 2013a). The $\sum IWTU_{FCV}$ data on lake area/site sediments were consistent or different than those sampled in 2014 and 2012; differences among the sampling events were attributable to sediment sampling site and actual sediments sampled. For CLA-4 sediments, the $\sum IWTU_{FCV}$ were consistent in 2012, 2014 and 2015.

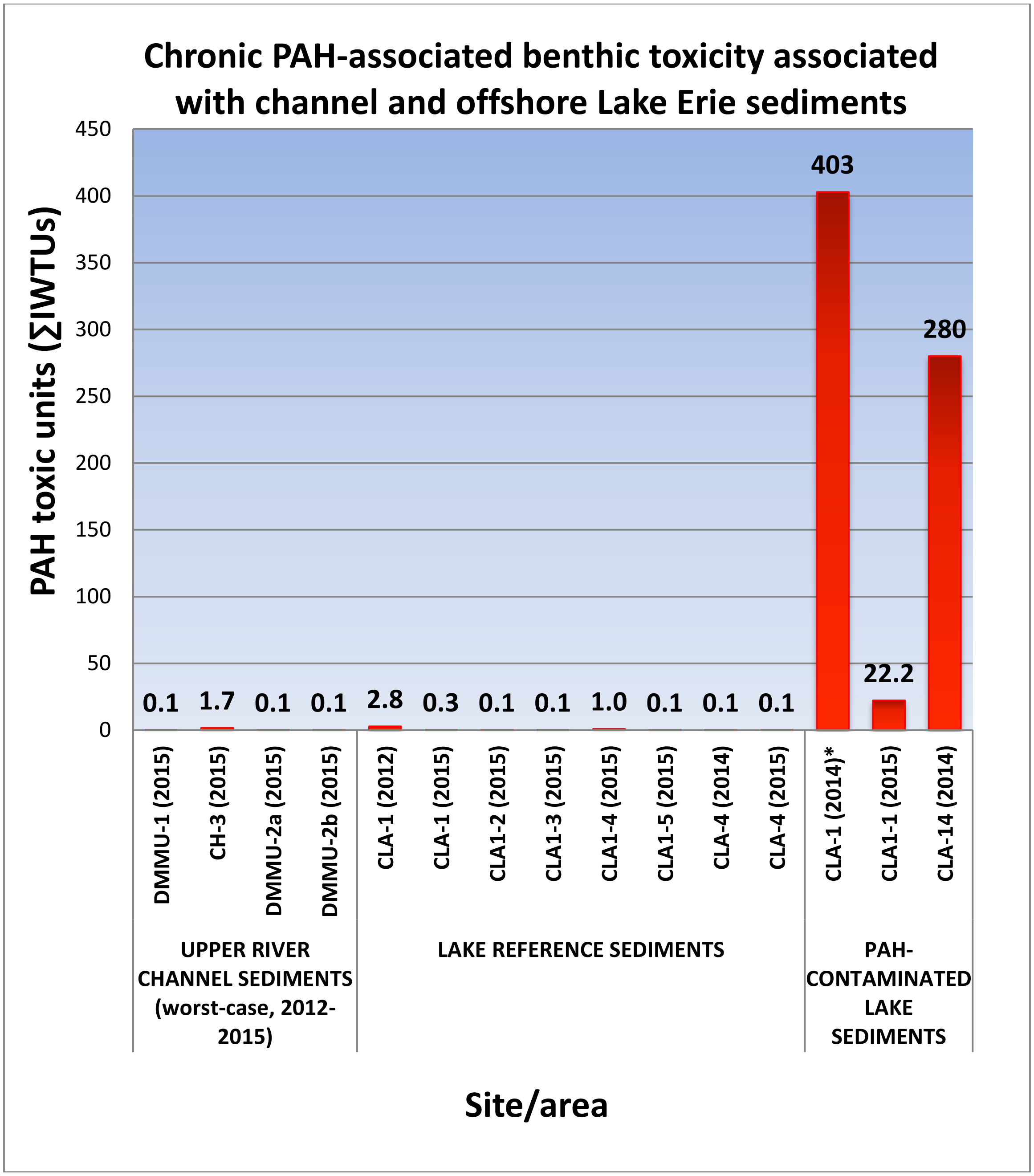
For the lake area sediments, the $\sum IWTU_{FCV}$ for CLA-1 sediment samples in 2012 was low at 2.8 and found to not be acutely or chronically toxic to *H. azteca* (USACE 2013a; USACE 2013b). Therefore, the toxicity of sediments sampled from CLA-1 in 2012 was insignificant, while those collected in the composite sample in 2014 were toxic with respect to PAHs. It is evident that very high $\sum IWTU_{FCV}$ for CLA-1 sediments sampled in 2014 is associated with the high values observed for discrete sediment samples CLA1-3 and CLA1-5. Figure 7 graphs the 2012, 2014 and 2015 $\sum IWTU_{FCV}$ data across the channel, lake reference and toxic lake sediments. Collectively, these data also indicate that placement of any of the channel sediments at CLA1-5 (2014 sample location) and CLA1-1 (2015 sample location) within the southeast quadrant of CLA-1 would result in an abatement of acute and chronic toxicity to benthic invertebrates.

Based on this information, PAHs were not identified as a PCOC in the channel sediments.

3.4.2 Solid phase bioassays

Solid phase bioassays measure the response of sensitive organisms to a mixture of sediment contaminants, through survival and growth endpoints. The amphipod *H. azteca* is a small freshwater crustacean that inhabits the water column and sediment surface, feeding on detritus. This species is an important food item for bottom feeding and water column fish in the Great Lakes. The midge fly *C. dilutus* burrows into sediments and are an important food item in the diets of various species of fish and waterfowl. The two species vary in sensitivity to different contaminants; *H. azteca* is quite sensitive to metals, while *C. dilutus* tends to be more sensitive to pesticides (USEPA and USACE 1998a).

FIGURE 7



*Composite sample assumed to be biased by discrete sample CLA1-5 (2014).

The results of the solid phase bioassays are summarized in Table B22. To minimize the confounding effects of ammonia in the channel sediments in the laboratory (typical for Great Lakes watershed sediments) and ensure a true test for persistent contaminant-related effects, sediment was initially purged of ammonia according to USEPA/USACE (1998b).

a. **H. azteca—**Two rounds of this bioassay were run as the initial bioassay yielded low survivals without any clear persistent contaminant-related cause.

(1) Initial bioassay—In the first bioassay, the mean survival of this test species exposed to the management unit samples ranged from 50±26% (DMMU-2a) to 92±8.4% (DMMU-1). The survival values for DMMU-2a and DMMU-2b (58±13%) sediment samples were statistically lower than that associated with the open-lake area sediments (CLA-1 mean survival 98±4.5% and CLA-4 mean survival 94±13% [Fisher least significant difference [LSD]; α=0.05]). The mean survivals for the DMMU-1 sample was less than 10% different from those for CLA-1 reference and CLA-4 sediments (CLA-1 mean survival 98±4.5% and CLA-4 mean survival 94±13%).

At test termination, a large number of indigenous oligochaetes, likely tubificids, were observed in the DMMU-2a and DMMU-2b sediment test replicates. The number of oligochaetes recovered from several replicates ranged from 104 to 128 worms per replicate. Indigenous organisms are considered a non-contaminant or non-treatment factor that, if present in high enough numbers, can adversely impact the results of a toxicity test (USEPA 2000; ASTM 2005; Reynoldson *et al.* 1994). This is likely due, at least in part, to competition for resources such as food and space. Reynoldson *et al.* (1994) demonstrated that tubificid densities of 75 worms per beaker resulted in mean *H. azteca* survival of 48% in a 28-day exposure, with survival in the absence of worms at 89%. This density is less than the densities of oligochaetes observed in the DMMU-2a and DMMU-2b sediment replicates which yielded a similar level of *H. azteca* survival. The sediment surface area per beaker in Reynoldson *et al.* (1994) was identical, and the sediment volume was similar, to those in the *H. azteca* bioassay.

Reynoldson *et al.* (1994) also showed that high levels of oligochaetes can produce significant reductions in growth for *H. azteca* and the midge *C. riparius*. A significant reduction in growth was similarly observed for *C. dilutus* in the presence of oligochaetes in the DMMU-2a and DMMU-2b sediments. This information, in tandem with the low bulk concentration of contaminants observed in the DMMU-2a and DMMU-2b sediments and supporting evidence that indigenous oligochaetes could be impacting the toxicity test results, incited a re-test.

(2) Follow-up bioassay—Prior to re-running the *H. azteca* bioassay including CLA-1 reference, CLA-4 and performance control sediments, DMMU-2a and DMMU-2b sediments were sieved to reduce the density of native oligochaetes according to USEPA (2001) guidance. Reynoldson *et al.* (1994) also recommended sieving sediments prior to testing when large populations of indigenous invertebrates are present, particularly oligochaetes. The number of native oligochaetes was reduced in the DMMU-2a and DMMU-2b sediments by sieving through a 1 mm sieve as one of the recommended methods for removing indigenous organisms prior to toxicity testing when the presence of indigenous organisms is suspected of negatively impacting test organisms (USEPA 2000; USEPA 2001; ASTM 2005). Note that sieving of sediments is generally believed to increase the likelihood that contaminant-related effects would be observed in a toxicity test since sieving can temporarily disrupt the equilibrium of the sediment resulting in increased bioavailability of organics and metals (USEPA 2000). In addition, contaminants are typically associated with the finer grain fraction of sediments (silts, clays, black carbon; Talley *et al.* 2002) due to the presence of greater surface area for contaminant adsorption; thus sieving and using the smaller fraction for testing increases the percentage of fine-grain sediment that likely contains a higher concentration of contaminants. Therefore, sieving sediments prior to bioassay testing is most likely to increase exposure to contaminants and therefore potentially result in enhanced toxicity. Consequently, the sieved sediment bioassay tests may be considered a more conservative assessment of the toxicological implications of the persistent sediment-associated contaminants.

The follow-up bioassay using the sieved DMMU-2a and DMMU-2b sediment samples yielded high *H. azteca* survivals. Mean survivals of *H. azteca* exposed to the DMMU sediment samples ranged from 86±11.4% (DMMU-2b) to 92±8.4% (DMMU-2a). These survivals were less than 10% different than those for the open-lake area sediments (CLA-1 mean survival 94±5.5% and CLA-4 mean survival 92±8.4%) (USEPA/USACE 1998a). This bioassay using sieved sediments, along with the observations by Reynoldson *et al.* (1994) and low levels of contaminants in the sediment samples, provide strong lines of evidence that a native oligochaete worm-related factor was the cause of the reduced *H. azteca* survival observed in the initial bioassay. It is hypothesized that the results of the initial bioassay reflected competition for resources between *H. azteca* and native oligochaete worms in the laboratory. Because no persistent contaminated-related cause could be identified for the evidenced toxicity in the DMMU-2 sediments in 2010 and associated abundance of native oligochaete worms in the sediments (Kreitinger *et al.* 2011), native oligochaete worms (and sediment pore water ammonia) may also have been a factor contributing to the low survival of *H. azteca* (58±8.4%).

b. <u>C. dilutus</u>—The mean survival of this test species exposed to the channel composite samples ranged from 88±13% (DMMU-2a and DMMU-2b) to 92±4.5% (DMMU-1), and was not reduced by more than 20% than that associated with the open-lake area sediments (CLA-1 mean survival 92±11% and CLA-4 mean survival 96±8.9%) (USEPA/USACE 1998a). With respect to *C. dilutus* growth, mean biomass expressed as mean dry weight (MDW) exposed to the channel composite samples ranged from 0.798±0.040 mg (DMMU-2b) to 2.638±0.580 mg (DMMU-1). All values exceeded a MDW of 0.6 mg (USEPA/USACE 1998a). The lower growth observed with the DMMU-2a and DMMU-2b sediments relative to all of the other channel and open-lake area composite samples was likely attributable to resource competition between *C. dilutus* and native oligochaetes, similar to that encountered in the initial standard 10-day solid phase *H. azteca* bioassay (USAERDC 2015a) (see Paragraph 3.4.2[a][2]).

These solid phase bioassay data did not show any significant, persistent contaminant-related acute or sublethal toxicity associated with the channel sediments, and are similar to those presented in USACE (2013a). Figures 8 and 9 are bar graphs showing the combined 2012 and 2015 results of the standard 10-day *H. azteca* and *C. dilutus* survival bioassays, respectively. These two graphs illustrate the consistently low channel sediment toxicity across the two sampling events, and the comparability of the channel sediment toxicity test data to those of the open-lake area sediments. These results indicate that placement of sediments dredged from DMMU-1, DMMU-2a and DMMU-2b at CLA-1 would not result in any persistent contaminant-related, unacceptable adverse impacts.

FIGURE 8

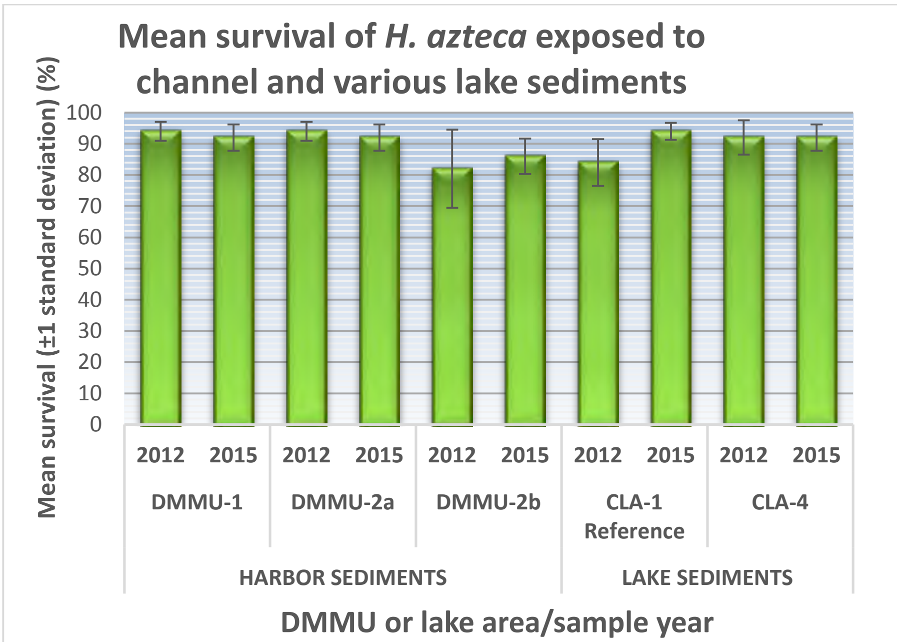
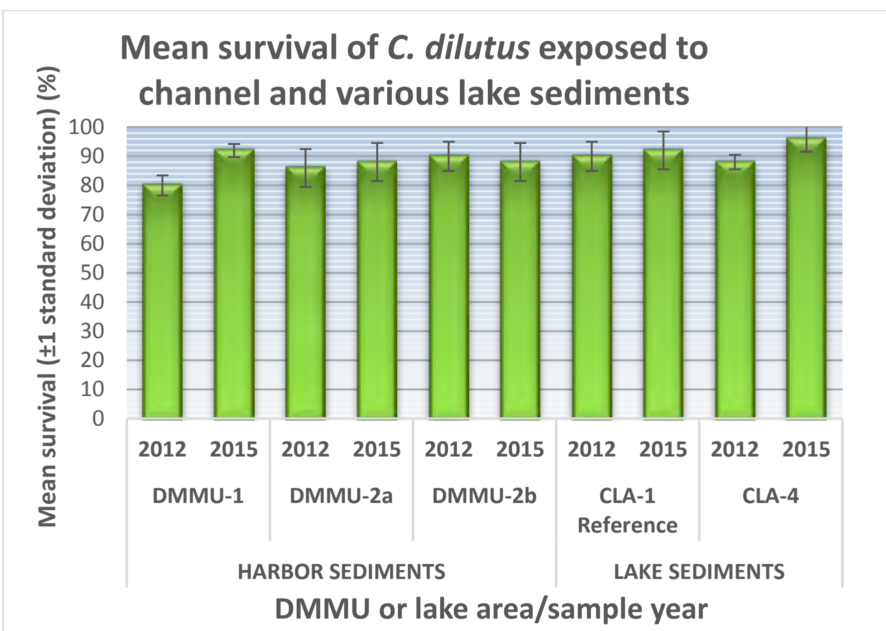


FIGURE 9



3.4.3 PCB bioaccumulation testing

a. **Results**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Results of the standard 28-day *L. variegatus* bioaccumulation testing for PCBs on channel and lake area sediment samples are provided in Table B23 (congener data are in RTI 2015). Table 6 summarizes the benthic bioaccumulation PCB data and corresponding bulk composite sediment sample total PCB data:

TABLE 6

PCB MEASUREMENT	LOCATION/AREA					
	UPPER RIVER CHANNEL			LAKE		
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE	CLA-4	OTHER DISCRETE SITES*
TISSUE						
Total PCBs (µg/kg)	**153**	**164**	**181**	**97**	**34**	**13.7 to 92.7**
SEDIMENT						
Total PCBs (µg/kg)	**100**	**155**	**157**	**131**	**90.6**	**9.36 to 400**
TOC-normalized PCBs (µg/kg-TOC)	**8,333**	**7,750**	**7,850**	**3,970**	**3,124**	**248 to 25,000**

*From Table 4; excludes sites where PCB contamination was suspected to be influenced from past dredged sediment discharges.

Due to data quality issues, lipid content data generated from the laboratory experiments could not be used for the purposes of quantifying bioaccumulation. However, lipid content data were generated on the test control sample were generated by USAERDC and are summarized in Table 7 (USAERDC 2016):

TABLE 7

CONTROL SAMPLE REPLICATE	SUBREPLICATE	PERCENT LIPID
A	A1	**3.1**
	A2	**1.8**
	A3	**2.6**
B	B1	**3.0**
	B2	**3.3**
	B3	**3.1**
MEAN		**2.8**

An average lipid content of 2.8% is a higher lipid content than what is typically observed for *L. variegatus* cultured in the laboratory setting. As with the 2014 data (see paragraph

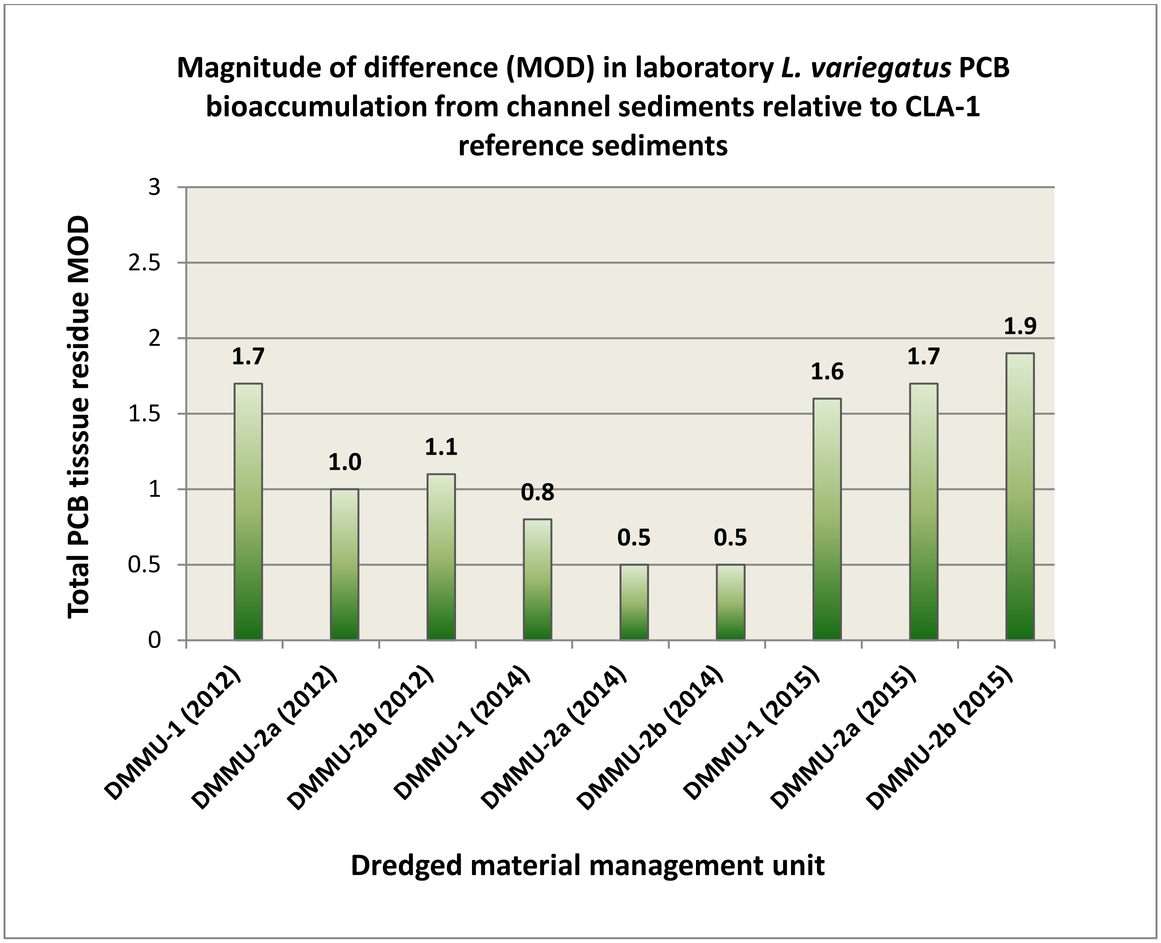
3.3.2[a]), a higher lipid content would explain the higher PCB residues measured in the 2015 *L. variegatus* bioaccumulation experiments. The observed higher PCB tissue residues in 2015 cannot be attributed to any increase in PCB contamination as TOC-normalized concentrations of total PCBs in the channel composite samples were similar to or lower than those measured in 2012 (mean 10,251 µg/kg-TOC; range 8,407 to 12,625 µg/kg-TOC [USACE 2013a]) and 2014 (mean 6,410 µg/kg-TOC; range 5,100 to 8,471 µg/kg-TOC [Table 3]).

b. **<u>Comparisons to Lake Erie sediments at open-lake placement area and other areas/sites in Lake Erie</u>**

(1) ***CLA-1 and regional background sediments***

(a) **Channel sediments vs. CLA-1 and regional background sediments, 2015 data**—On a sole concentration (i.e., not lipid-normalized) basis, total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments (range 153 to 181 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (97.0 µg/kg) (Fisher's least significant difference [LSD] method one-tailed test; α=0.05). Relative to USACE (2013a), note that the higher bioaccumulation of PCBs from the DMMU sediments was greater than that measured from CLA-1 sediments is a result of a less contaminated composite sample from CLA-1, and not from more contaminated DMMU sediments. Nevertheless, the respective MODs of 1.6, 1.7 and 1.9 for the DMMU-1, DMMU-2a and DMMU-2b sediments relative to CLA-1 reference sediments were all less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference, and the factor of 2 difference measured between PCB bioaccumulation by *L. variegatus* in paired laboratory and field-based experiments by Beckingham and Ghosh (2010). Therefore, placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of PCBs at the placement area. Figure 10 is a graph of the MODs for the bioaccumulation of PCBs from channel sediments relative to CLA-1 reference sediments based on the 2012, 2014 and 2015 data sets, illustrating that the MOD is consistently less than a factor of 2 (average MOD=1.2). This information shows that while the benthic laboratory bioaccumulation of PCBs across years may vary from both channel and lake sediments, placement of the channel sediments at CLA-1 would not result in any ecologically meaningful increase in PCB bioaccumulation (note that the 2015 MODs were higher than those from 2012 and 2014 due to less contaminated CLA-1 reference sediments and not more contaminated channel sediments; 2015 MODs relative

FIGURE 10



to grouped CLA-1 reference sediments from 2012, 2014 and 2015 [average total PCB tissue residue 115 µ/kg] ranged from 1.3 to 1.6).

While the lipid data on the bioaccumulation experiments were not used in this case, lipid-normalized PCB bioaccumulation appraisals can nevertheless be made using the 2.8% mean value generated on the laboratory test control sample (Table 7). This yields *estimated* lipid-normalized total PCBs concentrations for the DMMU-1, DMMU-2a, DMMU-2b and CLA-1 sediments on the order of 5,464, 5,843, 6,472 and 3,466 µg/kg-lipid, respectively. This enables a general comparison of the 2012, 2014 and 2015 laboratory PCB bioaccumulation data using lipid-normalized values. The average across the DMMU samples of 5,926 µg/kg-lipid based on estimated values is quite similar to the average of 5,623 µg/kg-lipid across laboratory PCB bioaccumulation measurements from 2012 (USACE 2013a) and 2014 (Table 3). This average is also comparable to mean oligochaete bioaccumulation of total PCBs from regional Lake Erie sediments offshore of Cleveland (surface area-weighted), as well as the 2014 laboratory PCB bioaccumulation from CLA-1 reference sediments (Figure 4). Similar to the conclusions in paragraph 3.3.2(b)(1)(a), this suggests that the placement of channel sediments at CLA-1 would not result in any significant increase in benthic bioaccumulation of PCBs. Further, this information also indicates that placement of any of the channel sediments at CLA1-5 within the southeast corner of CLA-1 would result in an estimated reduction in the benthic bioaccumulation of PCBs from 55,015 to about 6,000 µg/kg-lipid.

(b) **Channel sediments vs. CLA-1 reference sediments, grouped 2012, 2014 and 2015 data**—On a sole concentration basis, total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments were statistically higher than those associated with the grouped CLA-1 reference sediments (109 µg/kg) (Fisher's LSD method one-tailed test; $\alpha=0.05$). Nevertheless, the respective MODs of 1.4, 1.5 and 1.7 for the DMMU-1, DMMU-2a and DMMU-2b sediments relative to CLA-1 reference sediments were consistently all less than a factor of 2. The estimated lipid-normalized values indicate that differences between laboratory PCB bioaccumulation between the channel sediments relative to the grouped CLA-1 reference sediments (estimated 4,472 µg/kg-lipid) would be less than those portrayed through sole total PCB concentration. This information suggests that no ecologically meaningful increase in PCB bioaccumulation would occur from placement of the channel sediments over CLA-1 reference sediments.

(2) ***Sediments at other lake areas/sites not formally used for dredged sediment discharges***—This includes all 2014 areas/sites excluding those assumed to be formally used for dredged sediment discharges over four decades ago. Across all discrete lake sediment samples, total PCB residues in *L. variegatus* tissues ranged from 13.7 µg/kg to 180 µg/kg (or 18,000 µg/kg-lipid). On a sole total PCB concentration basis, residues in *L. variegatus* tissues exposed to all of the channel sediments were at the high end of this range. Mean total PCB residues in *L. variegatus* tissues exposed to all of the channel sediments was significantly greater relative to sediments at CLA-4 (34.0 µg/kg) (Fisher's LSD method one-tailed test; $\alpha=0.05$). Collectively, this information shows that total PCB residues in *L. variegatus* tissues exposed to the channel and CLA-1 reference sediments is within the high end of the range of benthic bioaccumulation of PCBs from regional Lake Erie sediments offshore of Cleveland. This comparison does not consider laboratory lipid content data which would serve to lower the actual range of PCB bioaccumulation from the channel sediments (e.g., to on the order of 6,000 µg/kg-lipid).

(3) ***Sediments at all lake areas/sites***—This includes all sites regardless of whether they may have been formerly used for dredged sediment discharges and therefore represent existing regional background PCB bioaccumulation from Lake Erie sediments offshore of Cleveland. It is evident that like the measured 2014 data, *estimated* laboratory bioaccumulation of PCBs from all of the channel sediments (range 5,464 to 6,472 µg/kg-lipid) is comparable to and well within the range of PCB residues *L. variegatus* and oligochaete tissues associated with the designated small and large lake areas offshore of Cleveland illustrated through Figure 5 (range 13.7 µg/kg [1245 µg/kg-lipid] to 5,880 µg/kg [262,583 µg/kg-lipid] (see paragraph 3.3.2[b][3]). This *estimated* mean lipid-normalized total PCB residues in *L. variegatus* tissues exposed to all three DMMU sediments were also comparable to the surface area-weighted background mean of 5,188 µg/kg-lipid across *L. variegatus* and oligochaetes (Figure 4). Like the 2014 data, this information indicates that PCB bioaccumulation risk from the channel sediments is within the range and comparable to that which currently occurs from regional Lake Erie background sediments offshore of Cleveland.

3.4.4 Pesticides bioaccumulation testing

a. **Results**. Results of the standard 28-day *L. variegatus* bioaccumulation testing for pesticides on channel and lake area sediment samples are provided in Table B24. DDE was detected in all the tissue samples associated all DMMU and CLA-1 sediments, but not CLA-4 sediments (at a higher detection limit).

The bioaccumulation data indicated a cluster of pesticide detections (alpha-chlordane, alpha-BHC, methoxylchlor and dieldrin) in the tissue samples associated with DMMU-2a and DMMU-2b sediments, all of which required analytical qualifications. There is a substantial amount of uncertainty associated with these tissue values. First, none of these pesticides were identified as sediment COCs because they were all non-detectable in corresponding sediment samples (paragraph 3.4.1[b][2][b]; USACE 2007; USACE 2013a), also suggesting that they should not appreciably be bioaccumulating in tissue. Second, none of these pesticides were detected in *L. variegatus* tissues generated from previous bioaccumulation testing efforts on these channel sediments (Kreitinger *et al.* 2011; USACE 2013a). Third, most of the values reported that were significantly above CLA-1 sediment detection limits were qualified as "P" indicating that the relative percent difference (RPD) in concentrations yielded between the primary and secondary gas chromatography (GC) column exceeded 40%. The values reported in Table B24 represent the maximum concentrations yielded from the primary column and do not consider the lower value generated from the secondary column (RTI 2014). Table 8 below summarizes this information to illustrate these differences:

TABLE 8

DMMU	PESTICIDE	REPLICATE	REPORTED VALUE (µg/kg)	SECONDARY GC COLUMN VALUE (µg/kg)	RPD (%)
DMMU-2a	Alpha-Chlordane	E	17	6.7	157
	Methoxylchlor	C	29	3.2	796
		D	7.5	3	150
		E	8.8	3.2	177
	Dieldrin	C	9.9	2.7	273
		D	6.9	4.4	55
		E	15	4.4	227
DMMU-2b	Methoxychlor	E	42	3.8	985
	Dieldrin	A	6.7	2.9	128
		B	8.3	3.9	111
		C	7.7	2.6	190
		D	9.4	3.3	185
		E	13	3.8	236

The data in Table 8 make it evident that use of the primary GC column data may have biased the actual tissue residues notably high. Consideration of the substantial RPDs and secondary column values in tandem with the remaining replicate values in this case suggests that actual tissue residues may approach levels of detection. This would be consistent with the corresponding sediment concentration data as well as historic data on these channel sediments. Given these data uncertainties with the fact that none of these pesticides detected in tissue were detected in the sediment samples or identified as sediment COCs, bioaccumulation was not evaluated (USEPA/USACE 1998b).

Table 9 summarizes the benthic bioaccumulation and corresponding bulk composite sediment sample data for DDE:

TABLE 9

DDE MEASUREMENT	LOCATION/AREA				
	UPPER RIVER CHANNEL			LAKE	
	DMMU-1	DMMU-2a	DMMU-2b	CLA-1 REFERENCE	CLA-4
TISSUE					
DDE (µg/kg)	8.4	6.7	7.3	6.4	3.8U*
SEDIMENT					
DDE (µg/kg)	4.8U	5.8U	6U	5.5	12U
TOC-normalized DDE (µg/kg-TOC)	-	-	-	167	-

*Not detectable at the detection limit.

b. **Comparisons to Lake Erie sediments at open-lake area CLA-1 and CLA-4**

On a sole concentration basis, DDE residues in *L. variegatus* tissues exposed to the DMMU-1 (8.4 µg/kg) and DMMU-2b sediments (7.3 µg/kg) were statistically higher than those associated with the CLA-1 reference sediments (6.4 µg/kg) (Fisher's LSD method one-tailed test; α=0.05). However, the respective MODs of 1.3 and 1.1 for the DMMU-1 and DMMU-2b sediments relative to CLA-1 reference sediments were all less than a factor of 2. This suggests that such a difference between test and reference sediments observed in the laboratory is not likely to warrant ecological and human health concerns based on the ASTM (2010) recommended minimum detectable difference. On a sole concentration basis, DDE residues in *L. variegatus* tissues exposed to the DMMU-2b sediments (6.7 µg/kg) were not statistically different than those associated with the CLA-1 reference sediments (Fisher's LSD method one-tailed test; α=0.05). Statistical comparisons to *L. variegatus* tissue residues associated with the CLA-4 sediments were not made because DDE concentrations were all less than a non-detectable concentration of 12 µg/kg. This information shows that placement of the channel sediments at CLA-1 meets the CWA Section 404(b)(1) Guideline and would not result in any ecologically meaningful increase in bioaccumulation of DDE at the placement area.

3.4.5 Elutriate testing

a. **SET**

(1) ***Metals and other inorganics***—Tables B25 and B26 summarize the results of this testing for metals and other inorganics, respectively. The elutriate data show low to moderate releases of metals and other inorganics from the channel sediments. Dissolved ammonia-N concentrations across the DMMU sediment elutriates ranged from 7.1 (DMMU-1) to 19 (DMMU-2b) mg/L and exceeded the acute water quality criterion of 4.5 mg/L. Therefore, ammonia was identified as a water column PCOC and would require dilution and dispersion in the water column during dredged sediment discharge operations. With respect to the copper "R" data qualifier for the channel composite sediment samples, separate SET data showed releases of copper (total basis) from the DMMU-2a and DMMU-2b sediments at 0.009 and 0.012 mg/L, respectively (USAERDC 2015a).

(a) Ammonia-N—The average dissolved ammonia level in sediment elutriate across DMMU sediments samples was 11.1 mg/L (each sample result was greater than the Ohio outside mixing zone maximum [OMZM] water quality criteria (WQC) for the protection of aquatic life of 4.5 µg/L at a pH of 8.1).

The Short-Term (ST) FATE simulation model was employed to predict and evaluate the release of ammonia to the water column during discharge of dredged sediment in the open-water (USAERDC 2015b). Modeling assumptions include (1) clamshell bucket (mechanical) dredging with discharge of the dredged sediment via scow; (2) dredged sediment with a solids content of 45% (about 10% less than *in-situ* material due to water entrained during dredging); (3) use of a 1500 cubic yard (CY) scow with a bin that is 120 x 30 x 12 feet; (4) dredged sediment placement is a single discharge from a slowly moving vessel over a 40-second period; (5) use of a single rectangular two-square mile open-lake placement area in a west-to-east direction with an average water depth of 60 feet; (6) a uniform water column density of 0.999; (7) five depth-averaged current velocities (0.33, 0.66, 0.98, 1.31 and 1.64 feet per second [fps]); (8) dredged sediment was free of clumps in DMMU-1, but was predicted to have 26% clumps by volume in DMMU-2a and 38% clumps by volume in DMMU-2b; and (9) volumetrically, dredged sediment in DMMU-1 was 61% water, 0% clumps, 31% sand, 5% silt and 3% clay, the dredged sediment in DMMU-2a was 55% water, 26% clumps, 4% sand, 10% silt and 5% clay, and the dredged sediment in DMMU-2b was 47% water, 38% clumps, 2% sand, 9% silt and 4% clay; and (10) all fractions except clumps are stripped in the water column with the silt/clay fractions being cohesive. The results of the STFATE model runs are presented by USAERDC (2015b).

Assuming a worst-case ammonia-N release of 19 mg/L and LC_{50} of 68% associated with the dredged sediment discharge and lake water background ammonia concentration of 0.1 mg/L, the STFATE model run indicated that the effluent would achieve the Ohio OMZM WQC of 4.5 µg/L within 100 feet of the point of discharge within one minute. Therefore, the WQS would be met well within the boundary of the open-lake placement area.

The released and rapidly diluted concentrations of ammonia would represent insignificant risk to fish. Fairchild *et al.* (2005) exposed several fish species to ammonia in the laboratory over a chronic 28-day duration. The most sensitive fish species was *P. promelas* exposed as 4-day olds. For this species, they reported a no observed effect concentration (NOEC), lowest observed effect concentration (LOEC) and chronic value (ChV; the geometric mean of the chronic NOEC and LOEC) of 0.31, 0.60 and 0.43 mg/L unionized ammonia (NH_3), respectively. At 25°C and the reported pH of 8.34, this ChV equates to a total ammonia concentration of approximately 6.3 mg/L. The ChV is considered a protective value (Adams and Rowland 2002) and is very conservative in terms of evaluating acute exposures associated with the discharge of dredged sediments from a scow. Fairchild *et al.* (2005) also reported no *P. promelas* mortality after a shorter seven day exposure period to 0.31 mg/L NH_3 which translates to 3.7 mg/L total ammonia at 25°C. Therefore, after immediate mixing in the water column (see next paragraph), ammonia released from these sediments would not be of any significant concern with respect to fish toxicity.

In summary, ample water column for ammonia dilution and dispersion is available at CLA-1. Based on this information, ammonia was eliminated as a water column PCOC.

(3) ***PCBs***—Table B27 summarizes the results of this testing. Dissolved Aroclors were not detected in any of the DMMU sediment elutriates at detection limits ranging from 0.04 to 0.11 µg/L. Such concentrations are well below those which would be expected to cause any acute toxicity.

(4) ***Pesticides***—Table B28 summarizes the results of this testing. With the exceptions of alpha endosulfan and DDE, dissolved pesticides were not detected in any of the DMMU sediment elutriates at detection limits ranging from 0.004 to 0.11 µg/L. Alpha endosulfan and DDE were measured at 0.009 and 0.024 µg/L in the DMMU-2b sediment elutriate. Such concentrations are well below those which would be expected to cause any acute toxicity.

(5) ***PAHs***—Table B29 summarizes the results of this testing. Except for fluoranthene, dissolved PAHs were not detected in any of the DMMU sediment elutriates at a detection limit of 0.16 µg/L. Fluoranthene was measured in all three sediment elutriates at 0.19 µg/L. Such concentration are well below those which would be expected to cause any acute toxicity.

b. **<u>Water column bioassays</u>**

Water column bioassays assess the potential toxicity of sediment associated contaminants to sensitive organisms in the water column. These tests provide information on the toxicity of contaminants not included in WQSs and indicate possible interactive effects (additive, synergistic or antagonistic) of multiple contaminants. Water column bioassays use elutriate preparations prepared by mixing sediment and water into a slurry. The slurry is allowed to settle and the supernatant decanted. The supernatant is then centrifuged to remove suspended particles. The supernatant is the elutriate, which is used as the test solution for the bioassays. The two organisms used, *C. dubia* and *P. promelas*, are common to the Great Lakes. The water flea *C. dubia* is an important food item for small and young fish and the minnow *P. Promelas* is a forage food item for larger fish.

The results of the water column bioassays are summarized in Table B30.

(1) ***C. dubia***—Mean survival associated with the lake site water (96±9%) was not

statistically different than the laboratory control (100%). The mean survival of this test species exposed to undiluted (100%) elutriate ranged from 64±33% (DMMU-2a) to 100% (DMMU-2b). Relative to the site water, the 100% DMMU-2a sediment elutriate showed a statistically lower mean survival. No other sediment elutriates showed statistically significant differences in mean survival relative to lake site water. The DMMU-2a bioassay data yielded a no observed effect concentration (NOEC) and LC_{50} of 50% and >100%, respectively. These bioassay data indicated acute toxicity associated with the undiluted DMMU-2a sediment elutriate. Bioassay data on the remaining sediment elutriates showed insignificant acute toxicity.

(2) ***P. promelas***—Mean survival associated with the lake site water (100%) was not statistically different than the laboratory control (98±4%). The mean survival of this test species exposed to undiluted elutriate ranged from 22±44% (DMMU-2a) and 22±26% (DMMU-2b), to 80±23% (DMMU-1). Relative to lake site water, the 100% DMMU-2a and DMMU-2b sediment elutriates showed a statistically lower mean survival. The DMMU-1 sediment elutriate did not show statistically significant differences in mean survival relative to lake site water. The DMMU-2a and DMMU-2b bioassay data yielded NOECs and LC_{50} values of 50% and 68%, and 50% and 75%, respectively. These bioassay data indicated acute toxicity associated with the undiluted DMMU-2a and DMMU-2b sediment elutriates. Bioassay data on the DMMU-1 sediment elutriate showed insignificant acute toxicity.

Data generated from the water column bioassays strongly suggest that the significant toxicity observed for the undiluted DMMU-1, DMMU-2a and DMMU-2b sediment elutriates was attributable to ammonia. First, unionized ammonia (usually the form most responsible for causing toxicity) concentrations in the DMMU-2a and DMMU-2b sediment elutriates were above specific toxicity reference values reported in the literature. Unionized ammonia concentrations were 0.89, 0.94 and 1.38 mg/L for the DMMU-1, DMMU-2a and DMMU-2b sediment elutriates, all of which approached or exceeded LC_{50} of 0.56 to 0.94 g/L for *P. promelas* (Nimmo *et al.* 1989). The unionized ammonia concentrations in the three elutriates also approached or exceeded an LC_{50} of 1.18 mg/L for *C. dubia* (Andersen and Buckley 1998). In addition, there were strong correlations between elutriate unionized ammonia concentrations and survivals for both test species (*P. promelas* $r=0.94$, $P<0.001$; *C. dubia* $r=0.92$, $P<0.001$). Finally, *P. promelas* typically exhibits a greater sensitivity to ammonia relative to *C. dubia* (relative to fish, *C. dubia* [and other invertebrates] is typically more sensitive to most contaminants, with ammonia as an exception).

A TIE/TRE was performed to determine whether contaminants other than ammonia may have contributed to the significant toxicity observed in the DMMU-2a and DMMU-2b sediment elutriates. TIE/TRE treatments on the undiluted elutriates included new bioassays using freshly prepared unpurged sediment, and bioassays employing zeolite column manipulation using unpurged sediment elutriate, two pH (6.5 and 7.2) manipulations for unpurged sediment elutriate, ethylenediaminetetraacetic acid (EDTA) metal chelation manipulation using purged sediment elutriate and C18 column treatment using purged sediment elutriate. As with the first round of tests, high *P. promelas* mortality (100%) was yielded from the undiluted DMMU-2a and DMMU-2b elutriates. In contrast to the first round of tests, *C. dubia* survival in the DMMU-2b elutriate was higher (88±18%) but lower for DMMU-2b sediment elutriate (20±14%) (likely due to a comparable increase in unionized ammonia concentration [2.10 mg/L]). For both elutriates, the zeolite stripping treatment removed toxicity (range of survival across both species 93±6 to 100%), suggesting that ammonia was the cause of the toxicity observed in the undiluted sediment elutriates (and that most metals and organic contaminants were not a contributor to the observed toxicity). Since zeolite can also bind some metals, the additional elutriate manipulations were designed to further evaluate potential metal-related toxicity. Those treatments were inconclusive due to either the confounding effects of high biological oxygen (BOD), low dissolved oxygen concentrations and unstable pH caused by the need to aerate elutriate waters due to biological oxygen demand (BOD) (pH treatments), or the ineffectiveness of purging to substantially lower ammonia sediment pore water concentrations, again due to BOD (EDTA and C18 column treatments). Nevertheless, SET data on the DMMU-2a and DMMU-2b sediments indicate that dissolved metal concentrations (Table 23) were protective of aquatic life. Collectively, the initial bioassay, TIE/TRE and SET chemistry data provide strong lines of evidence that ammonia was the cause of toxicity in the undiluted DMMU-2a and DMMU-2b sediment elutriates.

Since ammonia was identified as the cause of the sediment elutriate toxicity, an application factor of 0.1 was applied to the LC_{50} data to compute limited permissible concentrations (LPCs) (as opposed to using an application factor of 0.01 if the toxicity were a result of toxicants other than ammonia). An application factor of 0.1 is appropriate for protection of *P. promelas* (Kennedy *et al.* 2015). Assuming a LPCs of 10, 6.8 and 7.5% for the dredged sediments from DMMU-1, DMMU-2a and DMMU-2b, respectively, application of the STFATE model indicated that the effluent would achieve the LPCs during the first three minutes after discharge and within 300 feet of the discharge (USAERDC 2015b). Use of an application factor of 0.01 for the dredged sediments from DMMU-1, DMMU-2a and DMMU-2b would yield LPCs of 1, 0.68 and 0.75%, respectively. Application of the STFATE model to these reduced LPCs indicated that the effluent would achieve the LPCs during the first 25 minutes after discharge and within 2,500 feet of the discharge (well within the boundaries of the placement area) for the entire range of likely currents at the site (USAERDC 2015b).

This evaluation of channel sediment elutriate data is consistent with that presented in USACE (2013a). The SET and water column bioassay data, and modeling show that the release of contaminants from the dredged sediment to the water column during open-water placement would not result in any contaminant-related unacceptable, adverse impacts to the aquatic ecosystem. They also indicate compliance with applicable State WQSs after consideration of dilution and dispersion.

3.4.6 COCs

PCBs were identified as PCOCs in the channel sediments. Ammonia-N was identified as a water column PCOC. Further evaluation eliminated these PCOCs. No COCs were identified in the channel sediments based on data generated by data generated by USACE in 2015.

3.5 OEPA investigations

3.5.1 General

This section of the dredged sediment evaluation includes a review and evaluation of data generated by the OEPA on Upper Cuyahoga River and Cleveland offshore Lake Erie sediments across nine sampling/testing events accomplished in 2013, 2014 and 2015. All data generated by OEPA across these events have been considered, and appropriate data have been integrated into the evaluation and will be integrated into the CWA Section 404(b)(1) Evaluation. Most of the information on these events was provided to USACE in OEPA letter dated September 30, 2015 (OEPA 2015a). Additional information on these events was requested from OEPA in a USACE e-mail dated December 14, 2015 and provided in an e-mail dated January 4, 2016. Further information on these events was requested from OEPA in a USACE e-mail dated January 14, 2016 and provided in an e-mail dated January 15, 2016.

Review of this collective information provided by OEPA demonstrated considerable substantive data quality control and technical issues. The three overarching issues are summarized as follows:

a. Many of the sediment samples across the sampling events were collected from outside the Upper Cuyahoga River Channel dredging prism. In general, these samples were either collected from outside channel boundaries, in areas of the authorized channel officially "not maintained" (i.e., in DMMU-1), below dredging elevation or on channel side slopes. Data on these samples could not be included in the evaluation as they are not representative of the dredged sediments. It is further noted that the OEPA sites appeared to target the boundaries of the channel (such as near outfalls) rather than the shoals that are actually dredged within the Federal navigation channel. Regardless of sampling site, contaminant concentration data on all sites located within the dredging prism were integrated into the evaluation.

b. Sediment sampling did not follow the appropriate protocols prescribed in formal guidance (USEPA/USACE 1998a, 1998b). For example, DMMUs were not utilized (the data generated by OEPA were placed into the three USACE designated DMMUs to better enable interpretation) and DMMU composite samples were not created from discrete samples collected from each individual DMMU. Also, open-lake reference area sediments were not collected during each individual sampling event.

c. The solid phase bioassays (acute toxicity and PCB bioaccumulation tests) did not follow appropriate laboratory methodologies and failed to yield useable data.

It is also important to note that the sampling/testing efforts accomplished by OEPA did not involve the performance of a SET to the Upper Cuyahoga River sediment samples. As prescribed in Section 5.1 of the ITM (USEPA/USACE 1998b), this is the test directed at evaluating compliance of any discharge of dredged sediment at a specified site with respect to applicable state WQSs.

The remainder of this section addresses each individual OEPA sampling/testing event.

3.5.2 October 2013 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface grab sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Within the framework of the DMMUs, three discrete sediment samples were from DMMU-1, DMMU-2a and DMMU-2b. A total of nine discrete samples were subjected to testing. In addition, three discrete samples were composited to form three different composited samples. The sediment sampling sites are shown in Figure A6. No sediment samples were collected from any open-lake reference area for direct comparison purposes. Because of this, open-lake reference sediment contaminant concentration ranges were developed for comparison purposes and are summarized in Table B31. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, volatile organic compounds (VOCs) and semi-volatile organic compounds (SVOCs).

More than half of the discrete sediment samples were collected from outside the channel dredging prism, including 200013, F01A21, F01W50, F01S08 and 302580. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite samples) were not considered in the evaluation. Data on the remaining four discrete samples (200016, 302581, 302578 and F01A41) were included in the evaluation. Samples generally consisted of gray clays and silts. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B32 summarizes the results of the sediment grain size analyses. Each composite sediment sample subjected to grain size analysis was composed of discrete samples collected from outside the channel dredging prism.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B33 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. The upper range of TP concentrations was 1,350 mg/kg, which is comparable to open-lake reference concentrations.

(b) **Metals**—Table B34 summarizes the results of these analyses. Copper concentrations in samples 200016 and 302578 were both 83.3 mg/kg, which exceeded the maximum open-lake reference sediment concentration. Such levels of copper in sediment are not of significant toxicological concern. Similar concentrations measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca*. The associated composite sample concentrations (including various discrete samples outside the dredging prism) ranged from 46.9 to 66.4 mg/kg, and were below the maximum open-lake reference sediment concentration.

(2) ***Organic analyses***

(a) **PCBs**—Table B35 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 106 to 244 µg/kg (3,029 to 9,365 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation). Although most of the 302809 composite sample was collected from outside the dredging prism, the total PCB concentration of 2,419 µg/kg is suspect since the contributing discrete samples show total PCBs concentrations ranging from 120 to 215 µg/kg. In addition, most of the total PCB concentration is attributable to Aroclor 1254, a mixture that was not detected in any of the contributing discrete samples and has not been detected in Upper River Channel sediments.

(b) **Pesticides**—Table B36 summarizes the results of these analyses. All pesticide concentration were within the open-lake reference sediment concentration range.

(c) **PAHs**—Table B37 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B38 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples 302578 and F01A41 at 0.09 mg/kg (close to detection limits), and toluene was measured in all of the samples at concentrations ranging from 0.06 to 11.9 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(e) **SVOCs**—Table B39 summarizes the results of these analyses. Very few SVOCs were detected at low levels. Bis(2-ethylhexyl)phthalate is a common laboratory contaminant.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2013).

3.5.3 May 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface grab sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, two to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of nine samples were subjected to testing. The sediment sampling sites are shown in Figure A7. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

One sample, 302581, was collected from outside the channel dredging prism. Because this sample was not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining eight samples (200013, F01A21, F01A42, F01W50, F01S08, 302578, 302579 and 302580) were included in the evaluation. Sampled sediments were generally comprised of gray brown silty clays. Evaluation of these sediment data is summarized as follows:

a. **Inorganic analyses**

(1) ***Inorganics***—Table B40 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B41 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **Organic analyses**

(1) ***PCBs***—Table B42 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 46.8 to 158 µg/kg (2,753 to 12,177 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation).

(2) ***Pesticides***—Table B43 summarizes the results of these analyses. Except for DDD, DDE and DDT, all pesticide concentrations were non-detectable. DDE and DDT were measured in all of the samples with ∑DDT concentrations ranging from 26.9 to 53.6 µg/kg (1,029 to 3,007 µg/kg-TOC). The 53.6 µg/kg concentration in sample 301579 is comparable to the maximum open-lake reference sediment concentration. However, on a TOC-normalized concentration basis, most of the samples (range 1,829 to 3,007 µg/kg-TOC) exceeded the maximum open-lake reference sediment concentration. Projections based on the TPB model (McFarland 1984) using empirical ∑DDT BSAFs (and assuming a 1% lipid content in oligochaetes) indicate that bioaccumulation from the three DMMU sediments would consistently be on the order 9 µg/kg. This is within the range of ∑DDT bioaccumulation predicted for open-lake reference area sediments (1.3 to 17 µg/kg). ∑DDT bioaccumulation from the Upper Cuyahoga River Channel sediments based on 2015 bioaccumulation data is evaluated in Section 3.3.4.

(3) ***PAHs***—Table B44 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B45 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples F01W40 and F01S08 at 0.10 mg/kg (close to detection limits), and toluene was measured in samples 302578 and 302579 at concentrations ranging from 0.35 to 3.11 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(5) **SVOCs**—Table B46 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014a).

3.5.4 April 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete and vibro-core sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, six to eight discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of 21 samples were subjected to testing. The sediment sampling sites are shown in Figure A8. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

As noted in a March 2, 2015 USACE letter to OEPA (USACE 2015b), it is evident that portions of many of the core sediment samples obtained from the river in this event were collected from outside the Federal navigation channel's dredging prism. Figure A9 illustrates this. Also, the complete lack of elevation data for the sample's "50%/50% top and bottom of core split" and bottom of core made it impossible to accurately decipher what portion of the top and bottom samples were collected from within or outside the actual dredging prism. The lack of such fundamental information required making certain assumptions as to what core samples could reasonably be expected to be representative of sediments subject to maintenance dredging. Given this limited available information, it was determined that 14 of the 21 of the samples were collected from outside the dredging prism; these samples included 200013, F01A21, F01A42 (top and bottom), F01W50 (discrete and bottom), F01S08 (bottom), 302581 (bottom), 302578 (top and bottom), 302579 (bottom), 302580 (bottom) and F01A41 (top and bottom). Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining seven samples 200016, 302582 (top and bottom), F01S08 (top), 302579 (top) and 302580 (top) were included in the evaluation. Evaluation of these sediment data is summarized as follows:

a. **<u>Inorganic analyses</u>**

(1) ***Inorganics***—Table B47 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B48 summarizes the results of the sediment grain size analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **<u>Organic analyses</u>**

(1) ***PCBs***—Table B49 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 37.4 to 143 µg/kg (3,177 to 8,400 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) (as well as in this evaluation).

(2) ***Pesticides***—Table B50 summarizes the results of these analyses. Except for DDD, DDE and DDT, all pesticide concentrations were non-detectable. DDD, DDE and DDT were measured in most or all of the samples with ∑DDT concentrations ranging from 5.8 to 54.2 µg/kg (483 to 3,011 µg/kg-TOC). The 54.2 µg/kg concentration in sample F01508 (top) is comparable to the maximum open-lake reference sediment concentration. However, on a TOC-normalized concentration basis, samples 302582 (top), F01S08 (top) and 302580 (top) (range 1,913 to 3,007 µg/kg-TOC) exceeded the maximum open-lake reference sediment concentration. Projections based on the TPB model (McFarland 1984) using empirical ∑DDT BSAFs (and assuming a 1% lipid content in oligochaetes) indicate that bioaccumulation from the DMMU-2b sediments (where average TOC-normalized ∑DDT concentrations exceeded the maximum open-lake reference sediment

value) would be 7.25 μg/kg. This is within the range of ∑DDT bioaccumulation predicted for open-lake reference area sediments (1.3 to 17 μg/kg). ∑DDT bioaccumulation from the Upper Cuyahoga River Channel sediments based on 2015 bioaccumulation data is evaluated in Section 3.3.4.

(3) ***PAHs***—Table B51 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B52 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in sample 302580 (top) at 0.10 mg/kg (close to detection limits), and toluene was measured in samples 200016, 302582 (top and bottom), F01508 (top), 302581 (top), 302579 (top) and 302580 (top) at concentrations ranging from 0.08 to 7.69 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(5) **SVOCs**—Table B53 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014b).

3.5.5 August 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface sediment samples from the Upper Cuyahoga River, with subsequent bulk chemical analyses. Within the framework of the DMMUs, one to three discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of six to eight samples were subjected to testing. The sediment sampling sites are shown in Figure A10. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

Five of the eight samples (200013, F01A21, F01A42, F01W50 and 302579) were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga

River Channel, none of the associated data were considered in the evaluation. Data on the remaining three samples (F01S08, 302578 and 302580) were included in the evaluation. Sampled sediments generally consisted of brown gray silts with some sands. Evaluation of these sediment data is summarized as follows:

a. **Inorganic analyses**

(1) ***Inorganics***—Table B54 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(2) ***Metals***—Table B55 summarizes the results of the sediment grain size analyses. All metal concentrations were within the open-lake reference sediment concentration range.

b. **Organic analyses**

(1) ***PCBs***—Table B56 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 65.5 to 290 µg/kg (3,447 to 9,145 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(2) ***Pesticides***—Table B57 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(3) ***PAHs***—Table B58 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(4) **VOCs**—Table B59 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples F01S08, 302578 and 302580 at concentrations ranging from 0.07 to 0.09 mg/kg (close to detection limits).

(5) **SVOCs**—Table B60 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014c).

3.5.6 October 2014 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface sediment grab samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Within the framework of the DMMUs, three to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of three to 10 discrete samples were subjected to testing. The sediment sampling sites are shown in Figure A11. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs, VOCs and SVOCs.

One of the 10 samples (302579) was collected from outside the channel dredging prism. Because this samples was not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite sample) were not considered in the evaluation. Data on the remaining nine samples (200016, F01A21-east, F01A21-west, F01A42, F01W50, F01S08, 302581, 302578 and 302580) were included in the evaluation. Samples generally consisted of gray brown silts and clays, with some sands. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B61 summarizes the results of the sediment grain size analyses. Composite samples 302809 and 302808 were composed of silts and clays. Composite sample 302810 was composed of comparably more sands (42 to 72%), with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B62 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. The TP concentration in sample F01A21-west was 1,330 mg/kg but was very close to the maximum open-lake reference concentration.

(b) **Metals**—Table B63 summarizes the results of these analyses. The chromium concentration in sample 302578 was 84.5 mg/kg, which exceeded the maximum open-lake reference sediment concentration. Such levels of chromium in sediment are not of significant toxicological concern. The composite sample concentration (including discrete sample 302579 outside the dredging prism) was 44.8 mg/kg.

(2) ***Organic analyses***

(a) **PCBs**—Table B64 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 106 to 294 µg/kg (5,391 to 12,258 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B65 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(c) **PAHs**—Table B66 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B67 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in samples 302578 and 302580 at concentrations ranging from 0.12 to 0.18 mg/kg (close to detection limits). Toluene was measured in samples 200013, F01A21-west, F01A42, 302581 and F01508 at concentrations ranging from 0.07 to 1.0 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

(e) **SVOCs**—Table B68 summarizes the results of these analyses. Very few SVOCs were detected.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2014d).

3.5.7 April 2015 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface and gravity core sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. Discrete samples were composited into two composite samples from each DMMU. A total of six composite samples were subjected to testing. The sediment sampling sites are shown in Figure A12. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides, PAHs and VOCs.

Four of the six samples (F01A21, 200013, F01W50 and 302580) consisted of discrete samples that were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data were not considered in the evaluation. Data on the remaining two samples (302581 and 302578) were included in the evaluation. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B69 summarizes the results of the sediment grain size analyses. The samples were comprised of 99% silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B70 summarizes the results of the nitrogen-ammonia, TP and TOC analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(b) **Metals**—Table B71 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

(2) ***Organic analyses***

(a) **PCBs**—Table B72 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 116 to 139 µg/kg (5,043 to 8,176 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B73 summarizes the results of these analyses. Except for

DDD, DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were comparable to open-lake reference sediment concentration.

(c) **PAHs**—Table B74 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

(d) **VOCs**—Table B75 summarizes the results of these analyses. Very few VOCs were detected. Acetone, a common laboratory contaminant, was measured in sample 302581 at 0.12 mg/kg (close to detection limits). Toluene was measured in samples 302581 and 302578 at concentrations ranging from 2.6 to 3.8 mg/kg. Such concentrations are not of significant toxicological concern. Similar concentrations of toluene measured in USACE (2013a) did not result in any significant acute toxicity to *H. azteca.*

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2015b).

3.5.8 October 2015 event, Upper Cuyahoga River Channel—This effort involved the collection of discrete surface and core sediment samples from the Upper Cuyahoga River, with subsequent bulk physical and chemical analyses. The recovered length of core samples was about 10 to 15 inches. Two to four discrete sediment samples were collected from DMMU-1, DMMU-2a and DMMU-2b. A total of six to 12 samples were subjected to testing. The sediment sampling sites are shown in Figure A13. Since sediment samples were not collected from open-lake reference areas for direct comparison purposes, open-lake reference sediment contaminant concentration ranges from Table B31 were used. Chemical analyses included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs, pesticides and PAHs.

Eight of the 12 samples (F01A21 core, F01A21 grab, F01W50 core, F01W50 grab, 302581 core, 302581 grab, 302580 core and 302580 grab) were collected from outside the channel dredging prism. Because these samples were not representative of the sediments that are maintenance dredged from the Upper Cuyahoga River Channel, the associated data (and data on the related composite sample) were not considered in the evaluation. Data on the remaining four samples (200013 core, 200013 grab, 302578 core and 302578 grab) were included in the evaluation. Sampled sediments generally consisted of gray brown silts. Evaluation of these sediment data is summarized as follows:

a. **Physical characteristics.** Table B76 summarizes the results of the sediment grain size analyses. The samples were comprised of between 52.4 and 100% silts and clays, with the remainder sands.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Table B77 summarizes the results of these analyses. All concentrations of ammonia-nitrogen and TP were within the open-lake reference sediment concentration range.

(b) **Metals**—Table B78 summarizes the results of these analyses. All metal concentrations were within the open-lake reference sediment concentration range.

(2) ***Organic analyses***

(a) **PCBs**—Table B79 summarizes the results of these analyses. Total PCB concentrations in the sediment samples were determined by summing all detected Aroclor mixtures. The total PCB concentration range of 51 to 129 µg/kg (699 to 6,450 µg/kg-TOC) was within the open-lake reference sediment concentration range. These channel sediment PCB data are consistent with those presented in USACE (2013a) and USACE (2015a) as well as in this evaluation.

(b) **Pesticides**—Table B80 summarizes the results of these analyses. Except for DDE and DDT, all pesticide concentrations were non-detectable. ∑DDT concentrations were all below the maximum open-lake reference sediment concentration.

(c) **PAHs**—Table B81 summarizes the results of these analyses. Total PAH concentrations in the sediment samples were determined by summing the 16 USEPA priority pollutant compounds. All total PAH concentrations were within the open-lake reference sediment concentration range.

c. COCs

No COCs were identified in the channel sediments based on data generated by OEPA (2015c). No significant differences were noted in sediment contaminant concentrations among core and surface grab samples.

3.5.9 May and June 2015 events, Lake Erie and CLA-1 vicinity—In May 2015, surface grab sediment samples were collected for analysis across open-lake sites adjacent to Cleveland Harbor. Ten out of a possible 12 sediment samples were collected and analyzed (LE-1 through LE-11), along with two composite sediment samples (COMP-1 [LE-1 through LE-6] and COMP-2 [LE-7 through LE-11]. No sample was collected from LE-5 as planned (only mussel shells were recovered) and no sample was collected from LE-12 due to unsafe sampling conditions. The sediment sampling sites are shown in Figure A14. In June 2015, multicore sediment samples were collected for analysis within and adjacent to CLA-1. Multicore sediment samples were collected from eight of nine planned sample locations (CLA1-0, CLA1-0.5E, CLA1-1.5E, CLA1-1S, CLA0.5W, CLA1-1.5W, CLA1-1N and CLA1-2N). These sample locations were staged in north, south, east and west directions from the center of CLA-1, in half a mile and then mile increments. Core samples were subdivided into top and bottom samples for analysis, along with a composite of the top samples and bottom samples. Due to poor sediment recovery, the core from CLA1-1S was not split into top and bottom sections and no sample was collected from CLA1-2S, as planned. However, along with the composited core for location CLA1-1S, a discrete sample located at a depth of three inches was also analyzed for PAHs. Chemical analyses of samples included the nutrients nitrogen-ammonia and TP, TOC, metals, PCBs (as Aroclors), pesticides, PAHs and VOCs. Additionally, the composite samples were subjected to grain size analysis, 10-day *H. azteca* solid phase bioassays and 28-day *L. variegatus* bioaccumulation tests (tissue samples were analyzed for PCBs [as congeners] and lipid content) (Section 3.5.10 addresses this biological testing).

a. **Physical description and analysis. S**urface grab samples consist mainly of brown/gray silty sands. Multicore sample recovery generally ranged from 15 to 20 inches in depth, with the CLA1-1S sample being 10 inches. The core samples in and around CLA-1 generally consisted of gray silty clays with varying sand content. Samples CLA1-0.5W, CLA1-0, CLA1-1S and LE-10 were identified in the field logs as potentially evidencing petroleum contamination. These locations are in the vicinity of sites previously identified by USACE (2015c) as being impacted by petroleum within and to the south of CLA-1. Tables B82 and 83 summarize the results of the sediment grain size analyses. The composite of surface samples LE-7 through LE-11, and the composite of CLA-1 and vicinity core samples were primarily fine-grain, being composed of over 99% silts and clays. The LE-1 through LE-6 composite sample was more coarse-grain, being composed of 45% sands with the remainder silts and clays.

b. **Chemical testing**

(1) ***Inorganic analyses***

(a) **Inorganics**—Tables B84 and 85 summarize the results of these analyses. Nitrogen-ammonia, TOC and TP concentrations were similar among the two sampling events. However, TP concentrations (up to 1,370 mg/kg) were comparatively greater than the concentrations measured by USACE (2015a).

(b) **Metals**—Tables B86 and 87 summarize the results of these analyses. Metal concentrations across the two events were generally consistent with previous evaluations, with the exception of several of the CLA-1 cores which indicated elevated levels of cadmium, copper, lead and zinc. Higher metal concentrations were present in the core samples suspected of petroleum contamination as well as in sample CLA1-1.5E, both in the top and bottom sections of cores.

(2) ***Organic analyses***

(a) **PCBs**—Table B88 and 89 summarizes the results of these analyses. Total PCB concentrations across all samples ranged from non-detectable to 260 µg/kg (8,387 µg/kg-TOC), which is consistent with the data from USACE (2013a) and USACE (2015a) (as well as in this evaluation.

(b) **Pesticides**—Tables B90 and 91 summarize the results of these analyses. Pesticides were generally non-detectable, with the exception of two CLA-1 samples for DDE (18.3 and 32.9 µg/kg). USACE (2015a) (as well as in this evaluation) indicated similar ∑DDT concentrations when detected (ranging up to 49 µg/kg within CLA-4).

(c) **PAHs**—Tables B92 and 93 summarize the results of these analyses. Total PAH concentrations were comparatively elevated in samples LE-10 (37,930 µg/kg), the bottom of core samples CLA1-0.5E (102,770 µg/kg) and CLA1-1.5E (40,170 µg/kg), the top sections of core samples CLA1-1.5E (402,970 µg/kg), and the top and bottom section of CLA1-1S (124,400 µg/kg and 134,720 µg/kg). Of these samples, possible petroleum contamination was noted for samples LE-10 and CLA1-1S.

- <u>Total PAH concentrations consistent with background lake sediments</u>. Total PAH concentrations in the remaining samples, not suspected of being impacted by petroleum contamination, ranged from 780 to 27,680 µg/kg, which is consistent with previous evaluations of lake sediments (USACE 2013a; USACE 2015a [as well as in this evaluation). Total PAH concentrations in Samples LE-8 and LE-11 ranged up to 18,350 and 12,340 µg/kg, which were within the range of concentrations in open-lake reference sediments (Table B31). Similarly, the total

PAH concentration of 16,170 µg/kg in the composite sample of discrete samples LE-1 through LE-6 was well above the contributing discrete sample concentrations (range of 911 to 1,492 µg/kg), but within the range of lake reference sediment background concentrations not being impacted by petroleum contamination.

- Elevated lake sediment total PAH concentrations. The highest total PAH concentration was 402,970 µg/kg in sample CLA1-1.5E located half a mile east of CLA-1. However, unlike previous samples with elevated PAH concentrations in the vicinity of CLA-1, field observations did not indicate the presence of petroleum contamination. Similarly, sample CLA1-0.5E had a total PAH concentration of 102,770 µg/kg in the bottom section of the core with no field indication of petroleum contamination.
- Potential PAH-related sediment toxicity. Each of the lake composite samples submitted for 10-day solid phase toxicity testing yielded 100% survival for *H. azteca* (see Table B96). Total PAH concentrations of 30,130 µg/kg and 96,910 µg/kg were analyzed in the CLA-1 top of core and bottom of core composite samples, respectively and concentrations of 16,170 µg/kg and 1,214 µg/kg were analyzed in the two LE composite samples. The high rate of survival in each of the bioassays indicates low bioavailability of sediment-associated PAHs in the tested samples. The low bioavailability of PAHs, compared to the bulk concentrations in sediment, may be the result of a predominantly pyrogenic assemblage. Pyrogenic PAHs, those derived from combustion of organic matter, including coal tar and creosote, have a relatively low accessibility and bioavailability in sediments compared to petrogenic PAHs (Neff *et al.* 2005). Previous samples with elevated PAH concentrations were linked to suspected petroleum contamination, a petrogenic source, and were associated with higher PAH bioavailability, based on laboratory bioassays and pore water analysis. Based on the field observations and low PAH bioavailability, as evidenced by the solid phase bioassay results, it is suspected that samples CLA1-0.5E, CLA1-1.5E and the CLA-1 top and bottom core composite samples are representative of a pyrogenic source, a different source than the petroleum impacted samples previously identified. These pyrogenic based PAHs are oftentimes not toxic to benthic invertebrates, as contrasted to the petrogenic PAHs previously tested.

(d) **VOCs**—Tables B94 and B95 summarize the results of these analyses. VOCs were generally not detectable in the samples with the exception of acetone, a common laboratory contaminant. Low levels of methyl ethyl ketone, n-butylbenzene and sec-butylbenzene were detected in sample CLA1-1S and low levels of 4-chlorortoluene were detected in the CLA-1 composite samples.

3.5.10 Benthic bioassay 2015 (April, May and June) event, Upper River Channel, Lake Erie and CLA-1 vicinity—An *H. azteca* 10-day acute bioassay (using survival and growth as measurement endpoints) and *L. variegatus* 28-day PCB bioaccumulation test following the methodologies presented in USEPA (2000) were applied to channel and lake sediments offshore of Cleveland. The following composite sediment samples, composed of several discrete surface and/or core sediment samples, were used in this testing: F01A21, 200013, F01W50, 302581, 302580 and 302578 (channel sediments); LE 1 through LE-6 and LE 7 through LE-11 (Lake Erie sediments); and top and bottom of core samples (CLA-1 and vicinity sediments).

a. **H. azteca 10-day acute bioassay.** Table B96 summarizes the results of this bioassay. The mean survival of *H. azteca* ranged between 16 and 40% across all composite channel sediment samples, all of which were statistically lower than those associated with the reference sediments (all 100%). However, there were several major methodological issues with the conduct of this bioassay.

(1) ***Appropriate testing/evaluation guidance***—This bioassay did not follow appropriate formal USEPA/USACE testing and evaluation guidance prescribed in the GLTM and ITM (USEPA/USACE 1998a, 1998b). For example, sediment pore water data in the bioassay was not measured or monitored, and the bioassay water was not purged to preclude effects from ammonia in the bioassay (ammonia is a naturally occurring constituent of pore water that can quite readily confound bioassays performed in the laboratory). These procedures accomplish two main things: (1) most importantly, they ensure that the toxicity of any persistent sediment contaminant(s) is not confounded by toxicity caused by ammonia in the test; and (2) they provide evidence that ammonia may be a contributor to any observed toxicity. Pre-existing information on ammonia toxicity in these sediments available to OEPA (e.g., Kreitinger *et al.* 2011; USACE 2013a) underscores the need to include sediment pore water ammonia monitoring in the bioassay procedures.

(2) ***Effects of sediment pore water ammonia in laboratory testing***—No sediment pore water ammonia reduction procedures were performed. Therefore, it is highly likely that sediment pore water ammonia was a factor contributing to, or potentially driving, the reduced survival and growth observed. Note that while the growth of this *H. azteca* was measured, it is not an accepted measurement endpoint used for evaluating whether dredged sediment meets CWA Section 404(b)(1) Guidelines for open-lake placement due to the absence of interpretive guidance.

(3) ***Effects of native organisms in laboratory testing***—As documented in USACE (2015a) (as well as in this evaluation), it is likely that the presence of native oligochaetes

in many of the sediment samples within at least DMMU-2a and DMMU-2b played some role in the observed reduced survival of *H. azteca*.

(4) ***Consideration of other relevant lines of evidence***—Irrespective of the accuracy of the location of the collected sediment samples, a review of the bulk chemistry, in tandem with existing information, fails to suggest any clear sediment contaminants of concern (COCs). In addition, there were no evident trends among sediment contaminant concentrations and *H. azteca* survival. Regarding PAH contamination, the state-of-the-science approach to evaluating accurate PAH-specific toxicity is through sediment pore water measurements (USEPA 2003). This has been accomplished on the Upper Cuyahoga River Channel sediments three times by USACE (USACE 2013a; USACE 2015a [as well as in this evaluation]), which consistently indicated insignificant PAH-related toxicity. Weight-of-the-evidence (WOE) shows that PAHs in these channel sediments are of predominantly pyrogenic origin; because of this, the PAHs tightly adsorb to hard carbon and are therefore less bioavailable, which prevents them from causing any significant toxicity.

Based on the above information, it is concluded that the *H. azteca* bioassay failed to follow appropriate test procedures, and WOE indicates that the test yielded false-positive results on the Upper Cuyahoga River sediments.

b. **L. variegatus 28-day PCB bioaccumulation test**. Total PCB concentrations in tissue samples were determined by summing all congeners with non-detectable concentrations valued at zero. Table B97 summarizes the results of this test. Total PCB residues in *L. variegatus* tissues exposed to the channel composite sediment samples ranged from 225 to 362 µg/kg. These were statistically greater than those exposed to composited open-lake sediment samples (range 34.9 to 108 µg/kg), and much higher than those yielded from standard 28-day PCB *L. variegatus* bioaccumulation tests on channel sediments in USACE (2013) and USACE (2015) (as well as in this evaluation). However, there were several major methodological issues with the conduct of this bioaccumulation test.

This test did not follow appropriate formal USEPA/USACE testing and evaluation guidance (USEPA/USACE 1998a, 1998b), and the data generated do not appear to be representative of PCB bioaccumulation from the channel or lake sediments. This is detailed as follows:

(1) ***Appropriate testing/evaluation guidance***

(a) **Gut clearance**—Following test exposures, a fundamental requirement is to allow a standard 24-hour period for *L. variegatus* gut clearance; OEPA's test provided for a gut clearance of 6 hours which is 18 hours less than the standard required in formal guidance (USEPA/USACE 1998a, 1998b). A 24-hour gut clearance is also recommended by the most recent American Society of Testing and Materials (ASTM) (ASTM 2010). Under an assumption that the channel samples contained a significant number of native oligochaete (tubificid) (as has been USACE observation since at least 2010), it is also possible that the inclusion of tubificidae genera in the tissue samples absent a minimum 24-hour gut clearance biased test PCB concentrations high due to material remaining in the gut (e.g., Gillis *et al.* 2004).

(b) **Sample replication**—Five test bioaccumulation replicates were composited into a single sample for PCB analysis. USEPA/USACE (1998a, 1998b) requires the standard bioaccumulation experiments to be conducted with five replicates, including quantification of PCB residues in each individual replicate. The five replicates run by OEPA were composited into a single tissue sample, which resulted in no replication of the measured PCB tissue data. Due to lack of replication, no statistical comparisons to any open-lake reference area sediments could be conducted. This also effects lipid-normalization as there is unequal tissue and lipid mass in individual replicates. The average of lipid-normalized replicate tissue concentrations is not equal to the total PCB mass divided by the total lipid mass in the composite tissue sample. It will be biased by larger tissue masses of the individual replicates.

(2) ***PCB bioaccumulation data***

(a) ***L. variegatus* tissue residues relative to sediment**—In comparison to USACE (2013a and 2015a [as well as data in this evaluation]) data and theoretical values, OEPA's data yielded much higher PCB tissue residues relative to PCB concentrations in both channel and lake sediment samples. This is uncharacteristic for these sediments and sediments with such residual concentrations of PCBs.

- One initial issue with the PCB data generated is the use of less precise Aroclor mixtures (i.e., instead of congener data) to quantify total PCBs in the sediment samples. In addition, non-detectable data were yielded from the lake sediment samples due to high detection limits (i.e., 51 to 79.4 µg/kg). Performance of PCB congener analyses would have been a superior method to quantify sediment PCB concentration for the bioaccumulation test with improved precision, and would have added value to the test results.
- A more compelling anomaly is that TOC-normalized total PCB concentrations measured in the channel sediment samples infer that total PCB bioaccumulation from these channel sediments in *L. variegatus* should be on order of 0.1 mg/kg. This is based on application of the TBP model (McFarland 1984) employing the

use of a mean empirical, site-specific BSAF (USACE 2013a; USACE 2015a [as well as in this evaluation]). However, reported *L. variegatus* total PCB tissue residues were on average approximately five times higher than the TBP values. This indicates that the reported tissue values, on average, were 470 to 760% higher than would be theoretically expected based on PCB and TOC sediment concentrations alone. Such results are improbable because they are inconsistent with recent site-specific bioaccumulation data using appropriate methodologies (USACE 2013a; USACE 2015a [as well as in this evaluation]) and greatly exceed theoretical values.

(b) **Estimated bioavailability**—BSAFs for *L. variegatus* using these reported data were calculated to discern total PCB bioavailability and further examine the bioaccumulation data generated. This yielded mean BSAFs of 5.0 (range 2.14 to 8; N=9) for both the channel and lake sediment samples (the lake BSAFs in this case would likely be higher given that they were based on reported but high non-detectable levels of PCBs in sediment). A BSAF of 5 is over six times the mean BSAF of 0.73 (N=40) generated from site-specific data using appropriate test methodologies (USACE 2013a; USACE 2015a [as well as in this evaluation]). It is also approximately four times a mean BSAF of 1.30 (N=101) derived across other researchers using a standard 28-day laboratory exposure period for *L. variegatus* with mixed 24- and 6-hour gut clearance periods (i.e., Ankley *et al.* 1992; Call *et al.* 1993; Pickard *et al.* 2001; Burkhard *et al.* 2015) as contained in the BSAF database (USAERDC 2016). The disparity between such inordinately high mean BSAF values, and those from site-specific data and data from other researchers, is illustrated in Figure 11. In addition, the individual BSAFs alone do not reflect the diminution of PCB bioavailability attributable to the presence of hard carbon in these sediments.

FIGURE 11

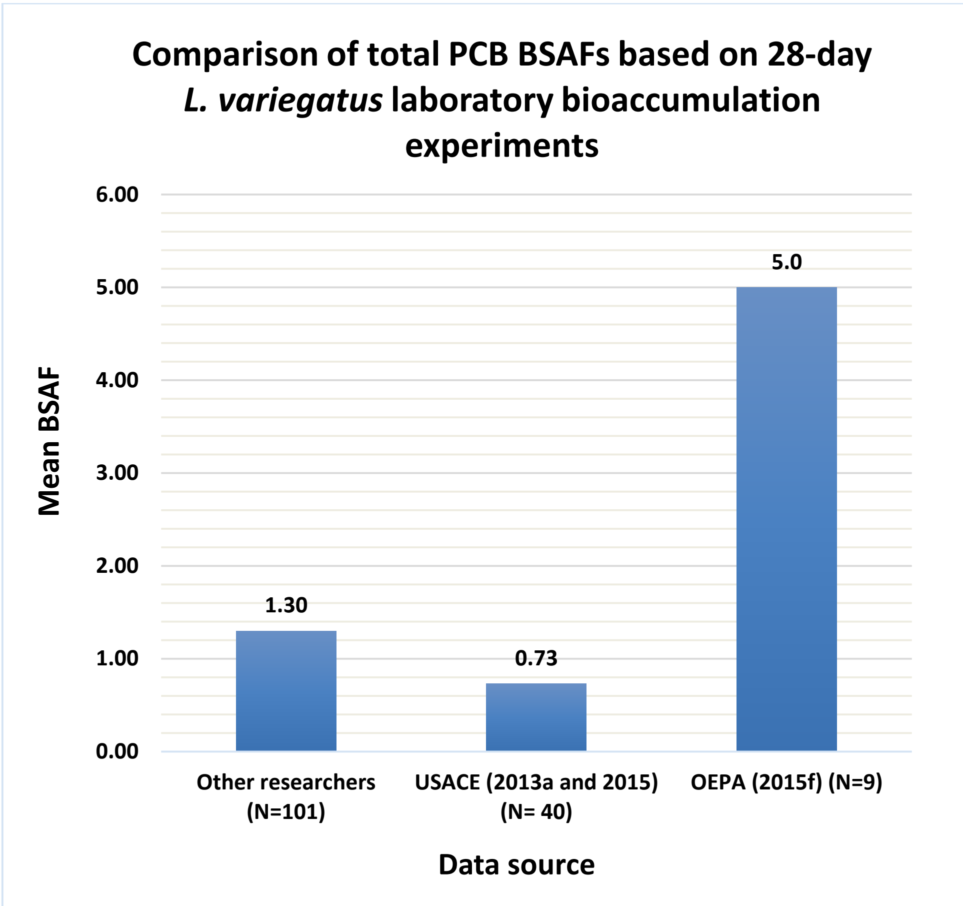
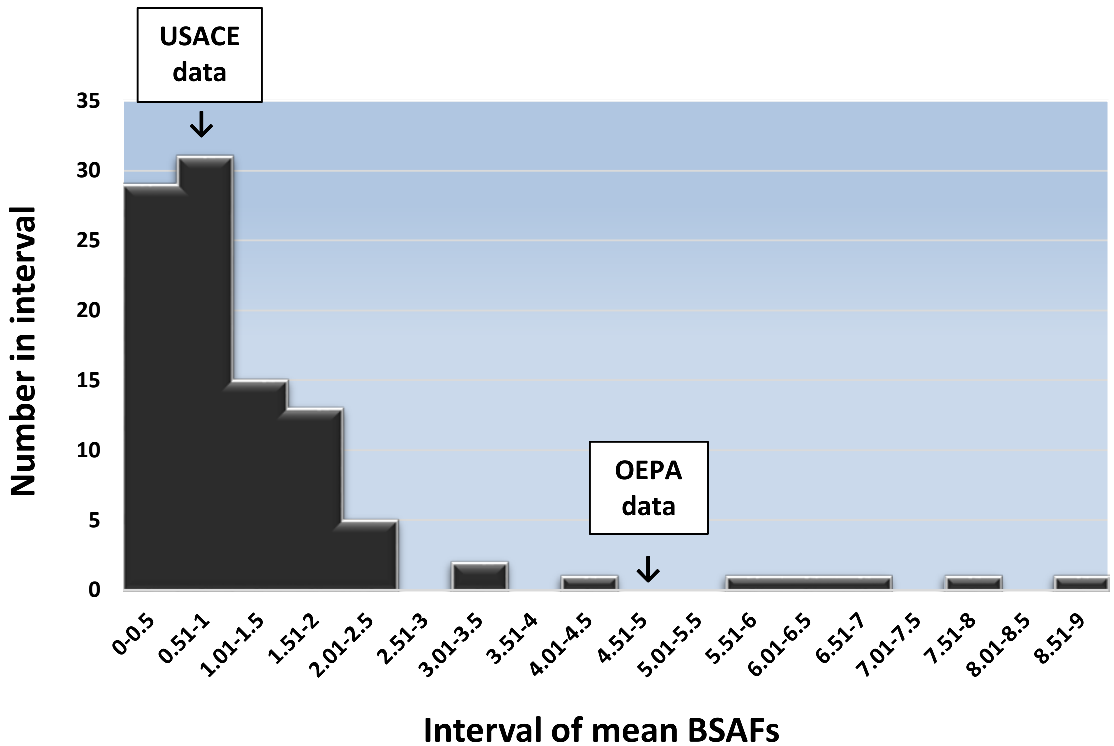


Figure 12 is a histogram (frequency distribution) of mean total PCB BSAFs from researchers using a standard 28-day laboratory exposure period for *L. variegatus* with mixed 24- and 6-hour gut clearance periods. The data are skewed right with about 90% of all mean BSAFs falling within the 0.1 to 2.0 range. The mean total PCB BSAFs for harbor and lake sediments of 0.78 and 0.57 based on data from USACE (2013a) and USACE (2015a) (as well as in this evaluation) are at the mode (high point of the distribution) and fall within the range of values generated by most of the researchers, with the combined harbor/lake sediment mean of 0.73 being comparable to the median of 0.88 across the BSAF distribution. In contrast, the mean total PCB BSAFs of 5 for harbor and lake sediments based on data reported from OEPA (2015f) fall on the right tail extreme of the distribution beyond the 95th percentile (96% of the BSAFs are less than or equal to 5), and are almost 6-fold greater than the distribution median value.

FIGURE 12

Mean total PCB BSAF histogram, *L. variegatus* 28-day laboratory bioaccumulation data from various researchers



Collectively, this data set suggests that the OEPA test results are not representative of PCB bioaccumulation from channel shoals or sediments in Lake Erie. Based on this information, it is concluded that the *L. variegatus* bioassay failed to follow appropriate test procedures, and WOE indicates that the test yielded improbable results on Upper Cuyahoga River and Lake Erie sediments.

4.0 CONCLUSION

Based on data from RTI (2014a, 2014b, 2015) and USAERDC (2015a) in tandem with USACE (2013a) and other relevant information such as from OEPA (2013, 2014a, 2014b, 2014c, 2014d, 2015b, 2015c, 2015d, 2015e and 2015f), contamination and toxicity associated with Cleveland Harbor Upper Cuyahoga River Channel sediments, as represented by DMMU-1, DMMU-2a and DMMU-2b, has been shown to be comparable relative to open-lake reference area sediments and/or would not represent any appreciable increased toxicological risk to the affected aquatic ecosystem when placed at CLA-1. Therefore, it is concluded that all sediments dredged from DMMU-1, DMMU-2a and DMMU-2b meet CWA Section 404(b)(1) guidelines at 40 CFR 230.11(d) for open-lake placement at CLA-1. In an effort to abate existing PAH-related toxicity and/or reduce bioaccumulation of PCBs from impacted lake sediments encountered at CLA1-5 (2014 sample location) and CLA1-1 (sample location), dredged sediment discharge should be conducted within the southeast quadrant of CLA-1 to create a thin layer cap over those sediments. Therefore, placement of Upper Cuyahoga River Channel dredged sediments in portions of CLA-1 would be a beneficial use of the material.

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OEPA (2014c) Analytical data on surface grab sediment samples collected from the Upper Cuyahoga River, Cleveland Harbor, Ohio. Data provided by OEPA to USACE.

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APPENDIX A

FIGURES

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Legend

- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit

0 250 500 1,000 Feet

US Army Corps of Engineers® Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR 2014 ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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Time Saved: 7:42:11 AM

CLEVELAND, OHIO

FIGURE A1

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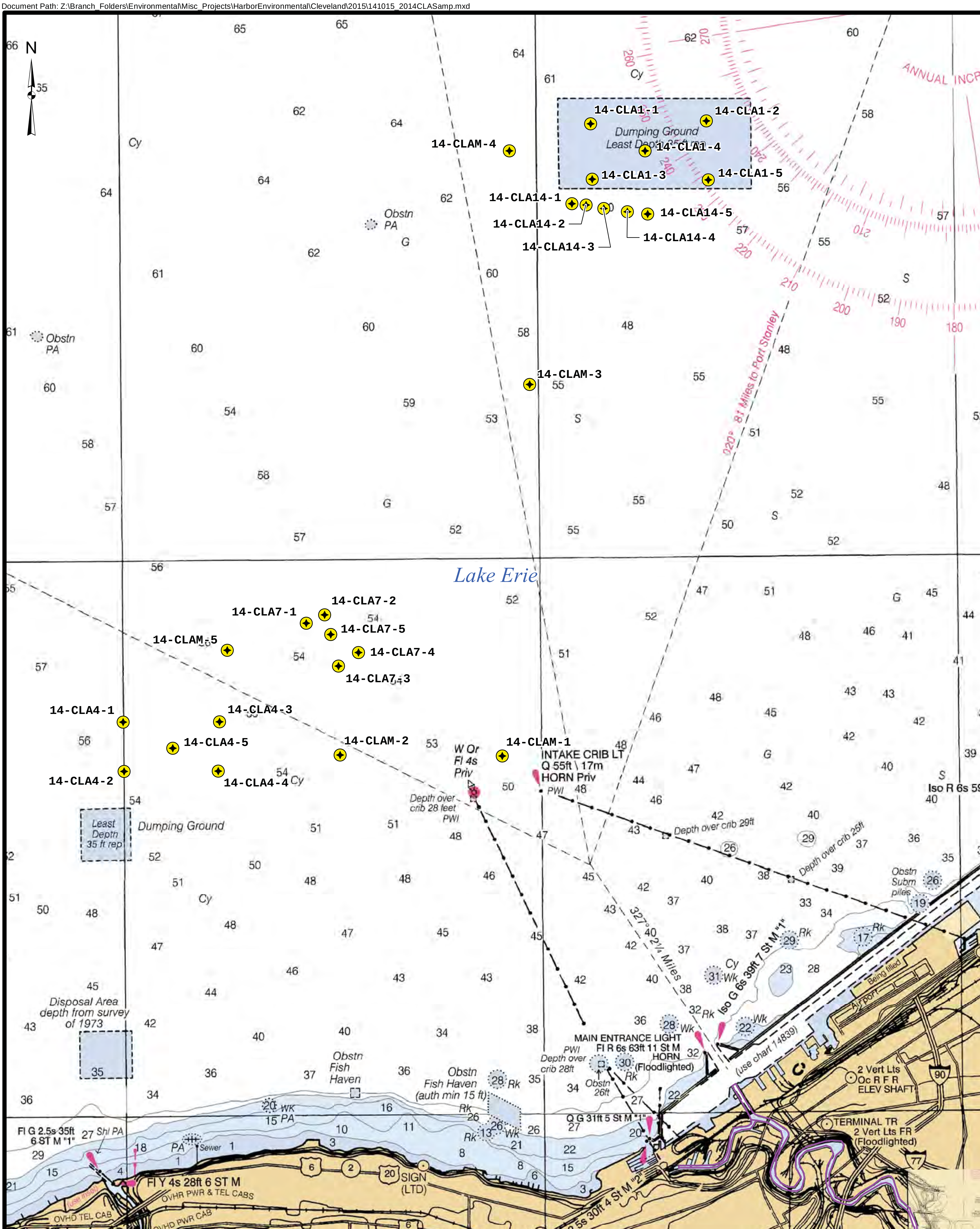

Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

US Army Corps of Engineers
Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

SAMPLING SITES FOR 2014 ANALYSES OF SEDIMENTS AT PROPOSED-OPEN LAKE PLACEMENT AREA CLA-1, AND OTHER LAKE AREAS AND SITES OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE A2

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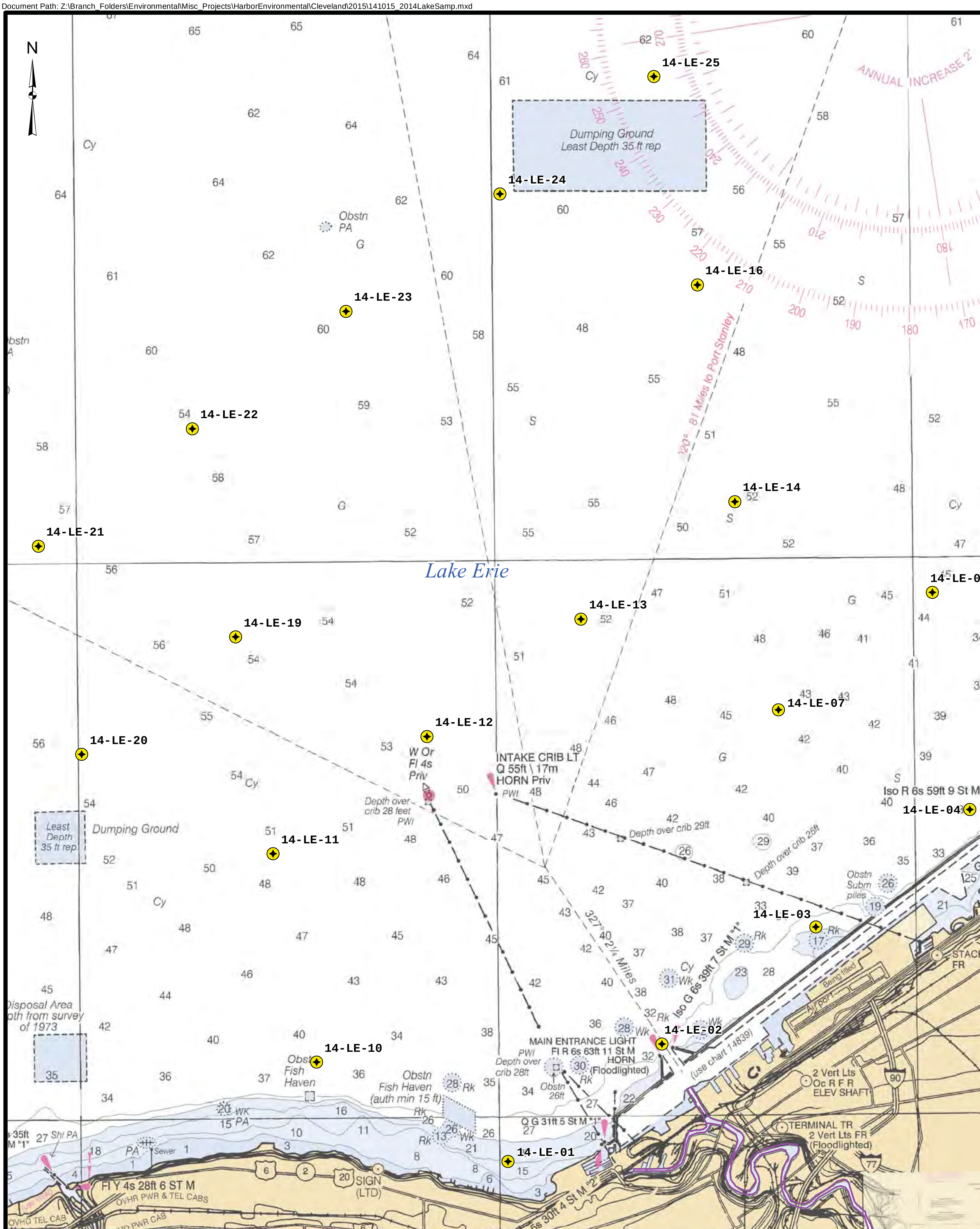

Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

US Army Corps of Engineers
Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

SAMPLING SITES FOR 2014 ANALYSES OF REGIONAL LAKE ERIE
SEDIMENTS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE A3

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit

0 250 500 1,000 Feet

US Army Corps of Engineers® Buffalo District

U.S. ARMY ENGINEER DISTRICT
CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR 2015 ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A4

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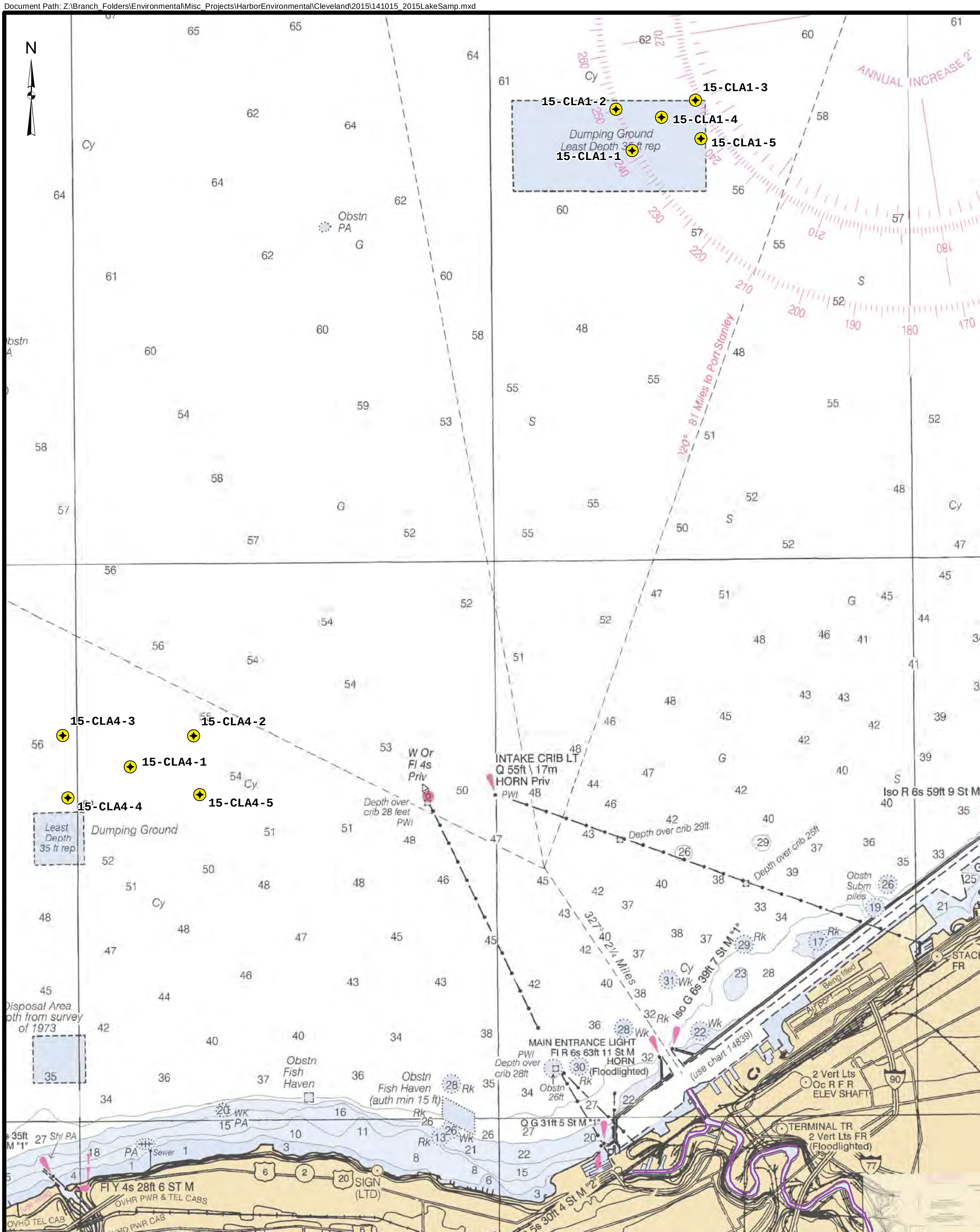

Legend

- Sediment Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

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BUFFALO, NY

SAMPLING SITES FOR 2015 ANALYSES OF SEDIMENTS AT PROPOSED OPEN LAKE PLACEMENT AREA CLA-1 AND OTHER LAKE AREAS OFFSHORE OF CLEVELAND

Document Name: 141015_2015LakeSamp.mxd
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CLEVELAND, OHIO

FIGURE A5

Document Path: Z:\Branch_Folders\Environmental\Misc_Projects\HarborEnvironmental\Cleveland\2016\250116_OEPA1013.mxd

Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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Buffalo District

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CORPS OF ENGINEERS
BUFFALO, NY

DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2013 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A6

Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR APRIL 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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Date Saved: 17 Feb 2016
Time Saved: 11:06:33 AM

CLEVELAND, OHIO

FIGURE A7

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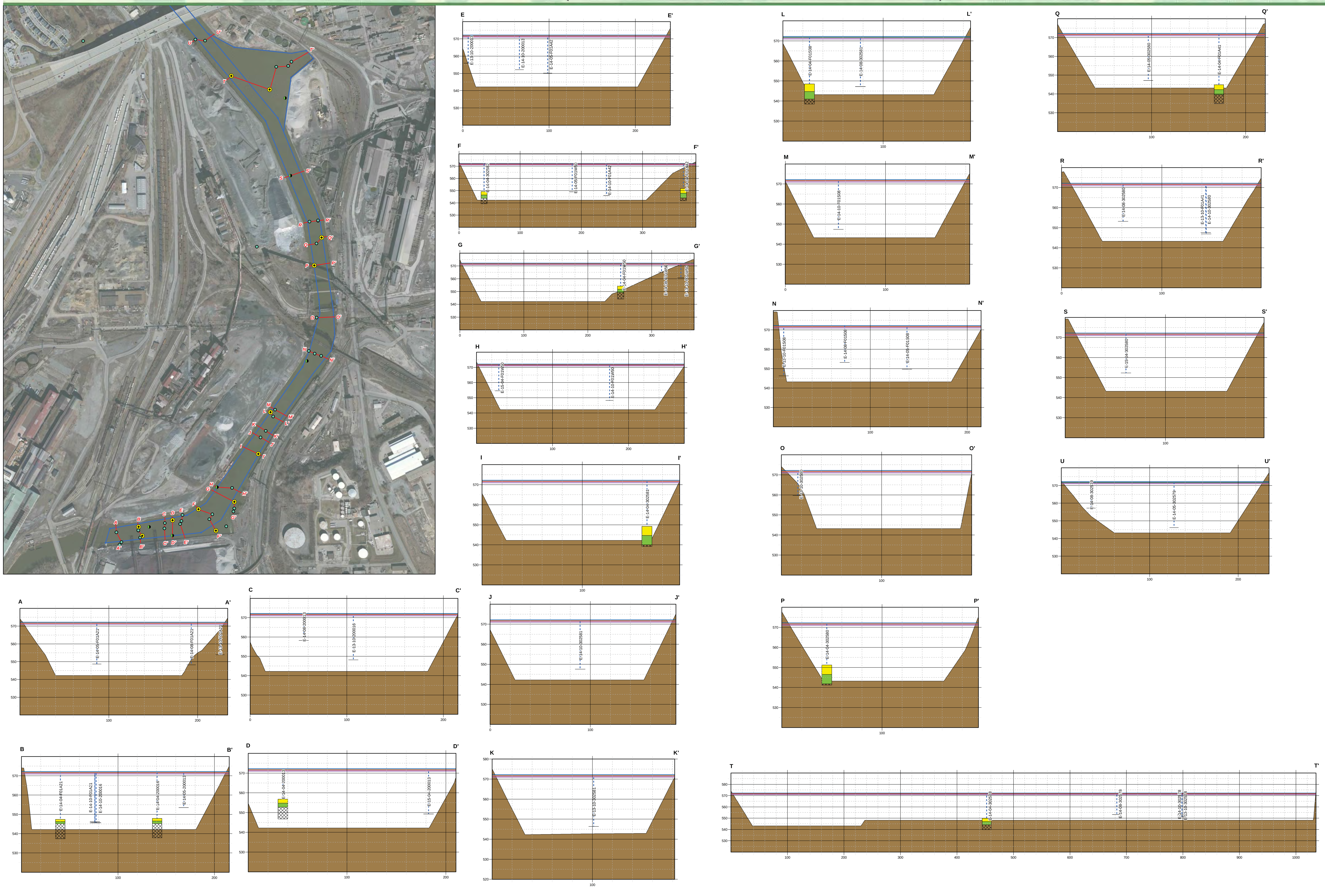
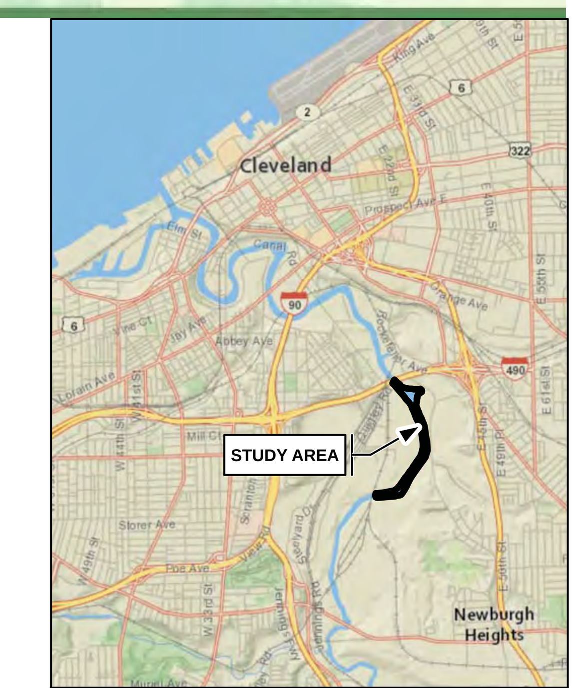
UPPER CUYAHOGA RIVER CHANNEL - CLEVELAND, OHIO
CROSS SECTIONS FOR OEPA SAMPLE LOCATIONS
(OCTOBER 2013 - MAY 2015)

BUILDING STRONG





Legend

- Ponar Grab Composite Sample
- Ponar Grab Discrete Sample
- Vibro-Core Sample Location
- Cross Section Location
- Navigation Channel

Cross Section Legend
(The cross sections were drawn at 2X vertical exaggeration.)

- Assumed Top of Core
- Assumed Bottom of Core
- 10' Core Length
- Water Depth at Time of Sample
- Channel Dredging Limits
- Mean Lake Elevation on 10/03/13
- Mean Lake Elevation on 04/24/14
- Mean Lake Elevation on 05/05/14
- Mean Lake Elevation on 08/14/14
- Mean Lake Elevation on 10/29/14
- Mean Lake Elevation on 04/30/15

NOTE: Dredge limit depths include advance maintenance and 1 foot of overdepth and 1 on 2 sideslopes.

FIGURE A8

N

0 400 800 Feet

Document Name: CrossSection_Layout.mxd
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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR MAY 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A9

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR AUGUST 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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Time Saved: 11:09:45 AM

CLEVELAND, OHIO

FIGURE A10

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2014 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A11

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Legend

- Sediment Core Sample Location
- Sediment Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR APRIL 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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CLEVELAND, OHIO

FIGURE A12

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Legend

- Sediment Core/Grab Sample Location
- Federal Navigation Channel
- Dredged Material Management Unit
- Area Not Maintained

0 250 500 1,000 Feet

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DREDGED MATERIAL MANAGEMENT UNITS AND SAMPLING SITES FOR OCTOBER 2015 OEPA ANALYSES OF UPPER CUYAHOGA RIVER CHANNEL SEDIMENTS

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Drawn By: H5TDESPM
Date Saved: 17 Feb 2016
Time Saved: 11:17:28 AM

CLEVELAND, OHIO

FIGURE A13

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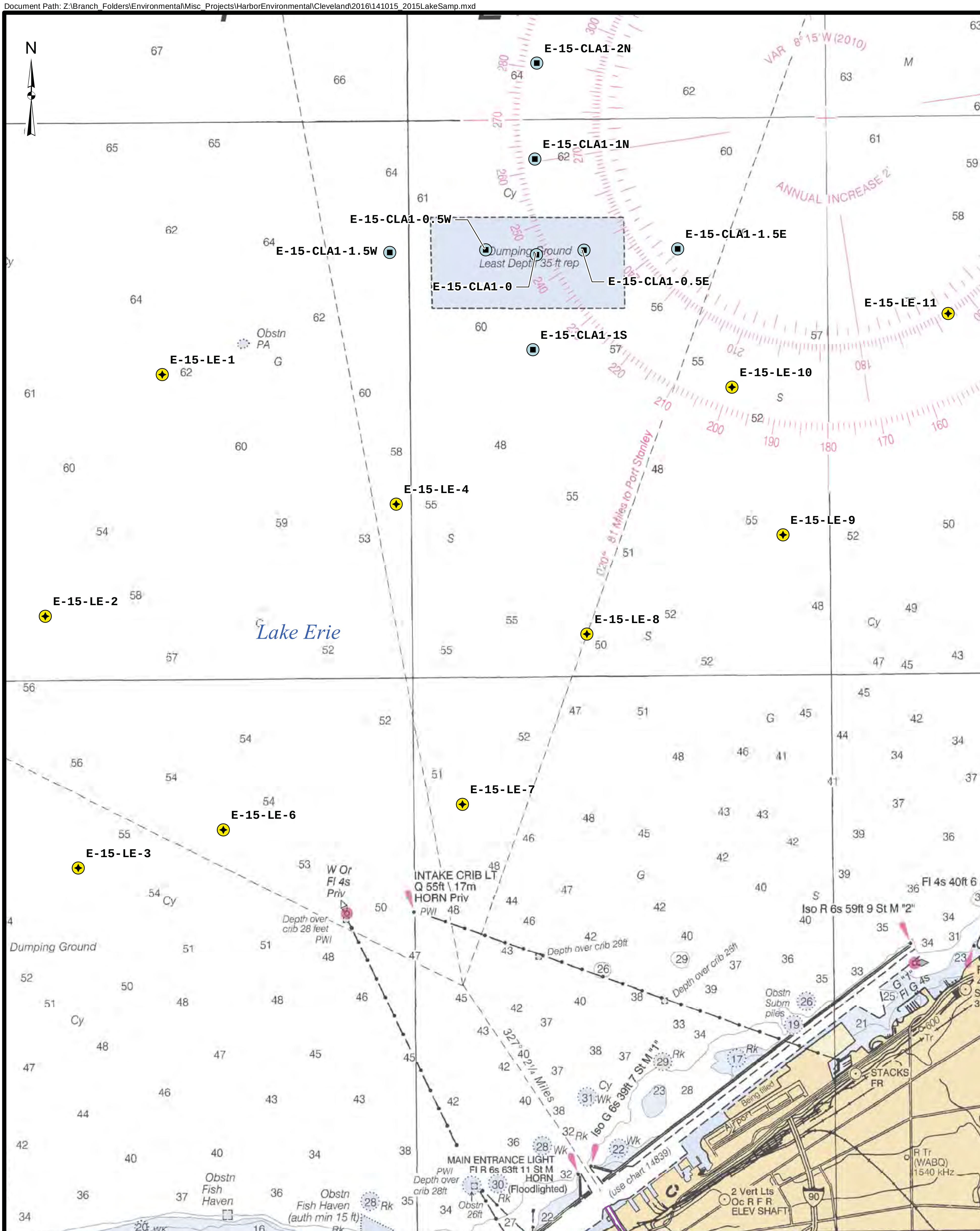

Legend

- Sediment Core Sample Location
- Sediment Grab Sample Location
- Federal Navigation Channel

Source: NOAA / NOS / Office of Coast Survey

0 0.5 1 2 Miles

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Buffalo District

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BUFFALO, NY

SAMPLING SITES FOR 2015 OEPA ANALYSES OF REGIONAL LAKE ERIE SEDIMENTS OFFSHORE OF CLEVELAND

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CLEVELAND, OHIO

FIGURE A14

APPENDIX B

TABLES

TABLE B1: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARTICLE SIZE (%)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
CLAY	2	1.2	16.3	12.6	12	7.3	3.4	22.4	27.3	27.3	24.8	25.3	17.8	26.4	27.8	40.2	28.6	24.3
SILT	5.5	3	27.9	24.2	15.7	11.9	42.1	44.4	59.5	60.9	60.2	52.2	35.3	68.1	66	58.2	68.5	60.5
FINE SAND	6	15.4	44	60.2	67.4	25.3	50.5	32	12.4	10.7	13.6	21	45	4.8	5.5	1.4	2.6	14.1
COARSE SAND	36.7	21.2	0.7	0.2	0.3	17.6	1	0.1	0	0.1	0.1	0.3	0.2	0.1	0	0	0	0
MEDIUM SAND	23.1	45.7	10.9	2.8	3.6	21.9	2.4	1.1	0.4	0.7	1	1.1	1.5	0.4	0.4	0.1	0.2	0.7
FINE GRAVEL	24.7	13.6	0.2	0	0	15.2	0	0	0	0	0	0	0	0	0	0	0	0
COARSE GRAVEL	2	0	0	0	0.9	0.8	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**7.5**	**4.2**	**44.2**	**36.8**	**27.7**	**19.2**	**45.5**	**66.8**	**86.8**	**88.2**	**85**	**77.5**	**53.1**	**94.5**	**93.8**	**98.4**	**97.1**	**84.8**
TOTAL SANDS/GRAVELS	**92.5**	**95.9**	**55.8**	**63.2**	**72.2**	**80.8**	**53.9**	**33.2**	**12.8**	**11.5**	**14.7**	**22.4**	**46.7**	**5.3**	**5.9**	**1.5**	**2.8**	**14.8**

PARTICLE SIZE (%)	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
CLAY	74.8	70.8	60.5	70.1	41.2	51.2	43.4	43.5	46.3	31.1	24	35.2	72.3	70.3	65	67.5	73.3	69.6
SILT	23.6	28.2	29.9	28.9	45.9	39.4	22.6	17.1	20.3	37.6	20.6	26.5	27.1	29.2	23.2	29.7	25.8	27.2
FINE SAND	1.2	0.8	8.1	0.6	9.2	5.9	26.9	26.3	24.1	15.1	40.6	27.9	0.4	0.3	6.3	1.4	0.5	1.6
COARSE SAND	0	0	0.1	0	0.5	0.3	0.3	0.7	0.9	2	1.7	1.5	0.1	0	0.3	0	0.1	0.3
MEDIUM SAND	0.2	0.1	1.5	0.4	1.8	3.1	6.5	11.9	7.6	7.2	12.4	8.4	0.2	0.1	5.1	1.4	0.3	1.4
FINE GRAVEL	0	0	0	0	1.4	0	0.2	0.5	0.7	4.6	0.7	0.6	0	0	0.1	0	0	0
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	2.4	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**98.4**	**99**	**90.4**	**99**	**87.1**	**90.6**	**66**	**60.6**	**66.6**	**68.7**	**44.6**	**61.7**	**99.4**	**99.5**	**88.2**	**97.2**	**99.1**	**96.8**
TOTAL SANDS/GRAVELS	**1.4**	**0.9**	**9.7**	**1**	**12.9**	**9.3**	**33.9**	**39.4**	**33.3**	**31.3**	**55.4**	**38.4**	**0.7**	**0.4**	**11.8**	**2.8**	**0.9**	**3.3**

PARTICLE SIZE (%)	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
CLAY	62.3	77.5	77.8	69.5	68.4	73.6	66.4	67.2	11.9	75.7	71.7
SILT	36.9	22.1	21.2	27.4	29.1	24.6	32.3	30.9	7.6	23	25.1
FINE SAND	0.3	0.3	0.8	2.5	1.7	1.2	0.9	1.5	56.3	0.5	2.5
COARSE SAND	0	0	0	0	0	0	0	0	9.9	0	0.1
MEDIUM SAND	0.2	0.1	0.1	0.6	0.8	0.5	0.3	0.4	10.7	0.7	0.7
FINE GRAVEL	0	0	0	0	0	0	0	0	3.6	0	0
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**99.2**	**99.6**	**99**	**96.9**	**97.5**	**98.2**	**98.7**	**98.1**	**19.5**	**98.7**	**96.8**
TOTAL SANDS/GRAVELS	**0.5**	**0.4**	**0.9**	**3.1**	**2.5**	**1.7**	**1.2**	**1.9**	**80.5**	**1.2**	**3.3**

TABLE B2: Bulk grain size distribution of lake sediment samples offshore of Cleveland (RTI 2014b)

PARTICLE SIZE (%)	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
CLAY	11.8	38.9	8.9	45.8	1.6	6.7	22.7	4.1	45.2	7.3	3.5	17.9	62.5	34.8	36	45.8	51.7	36.4	34.3
SILT	10.1	33.9	7.7	13.1	0.2	3.9	58.7	1.1	17.7	3.6	2.3	24.3	24.5	15.8	14.8	21	22.3	15.7	20.6
FINE SAND	77.2	7.9	39.9	30.3	12.4	16.3	12.3	10.1	11.5	41	15.1	39.9	3.4	13.2	14.7	7.3	6.2	16.1	13.9
MEDIUM SAND	0.7	12.3	20.2	7.2	65.6	57.9	5.7	69.6	24	33.9	40.4	14.9	9.3	33.5	32.2	24.6	18.9	30.1	29.5
COARSE SAND	0.1	1.6	7.7	0.8	13.1	10.1	0	8.6	1.5	9.3	19.1	1.4	0.3	2.6	2.3	1.3	0.9	1.6	1.6
FINE GRAVEL	0	5.3	14.6	2.9	7.2	5.1	0	1.8	0	3.3	15.4	1.6	0	0	0	0	0	0	0
COARSE GRAVEL	0	0	0.9	0	0	0	0	4.6	0	1.6	4.2	0	0	0	0	0	0	0	0
TOTAL CLAYS/SILTS	**21.9**	**72.8**	**16.6**	**58.9**	**1.8**	**10.6**	**81.4**	**5.2**	**62.9**	**10.9**	**5.8**	**42.2**	**87**	**50.6**	**50.8**	**66.8**	**74**	**52.1**	**54.9**
TOTAL SANDS/GRAVELS	**78**	**27.1**	**83.3**	**41.2**	**98.3**	**89.4**	**18**	**94.7**	**37**	**89.1**	**94.2**	**57.8**	**13**	**49.3**	**49.2**	**33.2**	**26**	**47.8**	**45**

TABLE B3: Bulk total organic carbon (TOC) and moisture data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARAMETER	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
TOC (%)	0.94	0.72	1.80	1.10	1.50	1.20	2.80	1.80	1.80	2.10	1.90	2.00	2.00	1.60	1.50	1.70	1.40	1.70
PERCENT MOISTURE	20	17	41	35	41	29	41	40	44	45	43	42	36	41	37	47	37	40

PARAMETER	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
TOC (%)	2.90	2.80	2.80	2.60	3.40	3.60	2.40	2.40	2.70	6.70	3.00	3.00	2.60	2.50	2.40	2.50	2.60	2.70
PERCENT MOISTURE	73	70	68	71	49	65	63	66	60	39	48	56	72	73	72	72	73	72

PARAMETER	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
TOC (%)	2.60	2.60	2.80	3.10	3.00	2.80	2.70	2.80	4.40	0.46	2.80
PERCENT MOISTURE	75	74	74	75	74	74	72	72	32	75	74

TABLE B4: Bulk total phosphorus, total organic carbon (TOC) and percent moisture data on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PARAMETER	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
TOC (%)	0.36	2.4	3.1	0.4	0.41	0.44	1.6	0.19	2.2	0.29	1.4	4.3	2.76	2.7	2.7	3	3.1	2.7	3.3
PHOSPHORUS, TOTAL (mg/kg)	120	230	730	98	44	110	280	59	370	100	180	500	400	380	450	460	430	480	550
PERCENT MOISTURE	77.2	31	52	19	26	20	36	44	28	74	43	46	75	72	76	76	76	76	78

TABLE B5: Bulk total PCB data (sum of congeners) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PARAMETER	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 Comp	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a Comp	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b Comp
TOTAL PCBs (µg/kg)	38	32	77	85	75	68	80	110	90	119	80	102	300	102	83	70	82	144
TOC (%)	0.94	0.72	1.80	1.10	1.50	1.20	2.80	1.80	1.80	2.10	1.90	2.00	2.00	1.60	1.50	1.70	1.40	1.70
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	3989	4375	4250	7736	4993	5658	2854	6111	5006	5667	4211	5100	15000	6375	5533	4094	5864	8471

PARAMETER	LAKE AREA																	
	CLA-1						CLA-14						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA-1 Comp	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA-14 Comp	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA-4 Comp
TOTAL PCBs (µg/kg)	236	116	169	104	1,450	1,240	52	100	82	156	291	179	109	75	102	77	89	117
TOC (%)	2.90	2.80	2.80	2.60	3.40	3.60	2.40	2.40	2.70	6.70	3.00	3.00	2.60	2.50	2.40	2.50	2.60	2.70
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	8138	4143	6036	4000	42647	34444	2158	4167	3030	2328	9700	5967	4192	2984	4250	3080	3431	4333

PARAMETER	LAKE AREA										
	CLA-7						CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLA-7 Comp	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
TOTAL PCBs (µg/kg)	103	123	109	131	121	110	136	262	10.9	109	155
TOC (%)	2.60	2.60	2.80	3.10	3.00	2.80	2.70	2.80	4.40	0.46	2.80
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	3962	4731	3893	4226	4033	3929	5037	9357	248	23696	5536

TABLE B6: Bulk total PCB data (sum of congeners) on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PARAMETER	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
TOTAL PCBs (µg/kg)	28.6	105	5,880	57.7	38.6	27.7	400	9.36	101	15.8	38.4	968	100	92	111	117	109	60.2	152
TOC (%)	0.36	2.4	3.1	0.4	0.41	0.44	1.6	0.19	2.2	0.29	1.4	4.3	2.76	2.7	2.7	3	3.1	2.7	3.3
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	7944	4375	189677	14425	9415	6295	25000	4926	4591	5448	2743	22512	3623	3407	4111	3900	3516	2230	4606

TABLE B7: Bulk PAH data (sum of 16 USEPA Priority Pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PAH COMPOUND (µg/kg)	UPPER RIVER CHANNEL														
	DMMU-1					DMMU-2a					DMMU-2b				
	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6	CH-7	CH-8	CH-9	CH-10	CH-11	CH-12	CH-13	CH-14	CH-15
2-METHYLNAPHTHALENE	20	17	16	13	17	17	23	21	30	66	28	25	18	19	26
ACENAPHTHENE	8.6	34	19	23	25	28	28	24	36	110	54	22	21	47 U[1]	21
ACENAPHTHYLENE	5.3	8.4	41 U	18	14	33	26	18	21	23	31	17	18	16	16
ANTHRACENE	20	250	49	76	72	140	110	71	110	120	220	62	73	43	60
BENZO(A)ANTHRACENE	72	1200	240	310	330	520	490	370	570	480	740	300	360	250	330
BENZO(A)PYRENE	82	1200	250	330	350	540	560	410	600	510	750	340	420	290	390
BENZO(B)FLUORANTHENE	170	1700	420	500	640	900	990	780	1300	970	1200	670	750	590	780
BENZO(G,H,I)PERYLENE	30	280	190	210	220	280	260	250	310	240	300	180	180	140	200
BENZO(K)FLUORANTHENE	54	640	170	210	220	290	400	240	330	300	440	220	290	170	260
CHRYSENE	91	960	310	360	420	580	600	470	730	570	780	380	480	310	450
DIBENZ(A,H)ANTHRACENE	6.1 U	41	82	89	94	110	80	100	120	110	120	81	86	65	81
FLUORANTHENE	200	2600	670	790	940	1300	1300	980	1500	1400	1900	820	960	630	960
FLUORENE	12	42	27	38	30	47	44	33	53	130	90	31	34	22	34
INDENO(1,2,3-C,D)PYRENE	35	330	220	250	260	310	270	280	370	280	350	200	240	180	220
NAPHTHALENE	15	14	41 U	38 U	41 U	17	24	21	24	130	28	25	18	19	26
PHENANTHRENE	94	820	290	370	380	600	510	400	590	790	950	330	390	240	370
PYRENE	170	2500	480	590	670	1100	1000	710	1100	980	1400	600	710	470	690
TOTAL PAHs	1,059	12,619	3,417	4,164	4,665	6,795	6,692	5,157	7,764	7,143	9,353	4,278	5,030	3,435	4,888
TOC CONTENT (%)	0.94	0.72	1.80	1.10	1.50	2.80	1.80	1.80	2.10	1.90	2.00	1.60	1.50	1.70	1.40
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	113	1,753	190	379	311	243	372	287	370	376	468	267	335	202	349

PAH COMPOUND (µg/kg)	LAKE AREA														
	CLA-1					CLA-14					CLA-4				
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA14-1	CLA14-2	CLA14-3	CLA14-4	CLA14-5	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5
2-METHYLNAPHTHALENE	76	76	160	24	640	140	56	83	6400	310	16	13	16	12	13
ACENAPHTHENE	120	210	370	64	4900	670	240	650	32000	6300	14	12	13	11	9.8
ACENAPHTHYLENE	66	130	240	47	610	290	140	230	400 U	960	14	13	15	9.5	11
ANTHRACENE	210	560	620	140	5000	1200	340	630	14000	6400	32	29	30	22	28
BENZO(A)ANTHRACENE	420	800	2300	250	5400	2000	870	1100	11000	8300	120	130	120	93	100
BENZO(A)PYRENE	440	810	1800	270	5300	1800	980	1200	9200	7200	140	140	130	100	120
BENZO(B)FLUORANTHENE	730	1300	2600	450	5900	2900	1400	1800	10000	11000	220	190	190	150	170
BENZO(G,H,I)PERYLENE	150	210	620	110	4000	460	260	310	6600	2100	130	110	110	83	87
BENZO(K)FLUORANTHENE	290	410	940	140	2000	760	590	610	4400	3100	83	89	73	54	59
CHRYSENE	520	830	2100	280	5800	1900	840	1100	9400	7500	150	130	130	110	100
DIBENZ(A,H)ANTHRACENE	61	100	270	51	1100	200	120	140	1500	850	30	31	31	17	22
FLUORANTHENE	1100	1800	5000	620	13000	4400	1400	2000	27000	15000	240	240	220	190	200
FLUORENE	120	340	190	100	6700	870	200	770	23000	6700	29	18	26	21	18
INDENO(1,2,3-C,D)PYRENE	170	260	690	120	3600	530	310	360	5500	2300	100	93	110	77	80
NAPHTHALENE	150	220	360	78	1900	440	240	240	3000	1100	28	22	31	20	21
PHENANTHRENE	520	1300	1000	370	17000	2900	670	1800	50000	15000	100	89	86	69	76
PYRENE	980	1500	3900	460	11000	3300	1100	1600	24000	15000	200	190	190	140	160
TOTAL PAHs	6,047	10,780	23,000	3,550	93,210	24,620	9,700	14,540	230,600	108,810	1,630	1,526	1,505	1,167	1,262
TOC CONTENT (%)	2.90	2.80	2.80	2.60	3.40	2.40	2.20	2.70	6.70	3.00	2.60	2.50	2.40	2.50	2.60
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	209	385	821	137	2,741	1,026	441	539	3,442	3,627	62.7	61.0	62.7	46.7	48.5

PAH COMPOUND (µg/kg)	LAKE AREA									
	CLA-7					CLAM				
	CLA7-1	CLA7-2	CLA7-3	CLA7-4	CLA7-5	CLAM-1	CLAM-2	CLAM-3	CLAM-4	CLAM-5
2-METHYLNAPHTHALENE	13	13	13	15	16	18	16	2	23	19 U
ACENAPHTHENE	9.2	19 U	13	11	13	13	14	4.9	42	19 U
ACENAPHTHYLENE	10	10	18	19	23	27	23	5.4	34	19 U
ANTHRACENE	28	29	28	29	29	43	33	8.8	94	12
BENZO(A)ANTHRACENE	96	97	100	110	120	170	130	29	170	45
BENZO(A)PYRENE	110	110	120	120	140	180	140	25	200	42
BENZO(B)FLUORANTHENE	160	150	220	230	280	320	260	38	350	64
BENZO(G,H,I)PERYLENE	80	78	78	81	83	89	68	11	97	36
BENZO(K)FLUORANTHENE	50	66	74	69	81	140	86	16	120	28
CHRYSENE	97	100	130	130	150	190	140	26	200	45
DIBENZ(A,H)ANTHRACENE	29	19	31	37	36	41	35	9.8	43	19 U
FLUORANTHENE	180	180	220	230	260	350	260	46	410	78
FLUORENE	20	18	23	24	28	36	29	6.4	52	7.7
INDENO(1,2,3-C,D)PYRENE	76	74	91	86	93	110	79	17	110	30
NAPHTHALENE	24	21	23	27	30	27	36	4.9	46	9
PHENANTHRENE	72	64	76	81	89	110	95	22	260	30
PYRENE	140	150	180	190	210	290	230	37	310	77
TOTAL PAHs	1,181	1,166	1,425	1,474	1,665	2,136	1,658	307	2,538	504
TOC CONTENT (%)	2.60	2.60	2.80	3.10	3.00	2.70	2.80	4.40	0.46	2.80
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	45.4	44.8	50.9	47.5	55.5	79.1	59.2	7.0	552	18.0

[1] Not detected at the specified detection limit.

TABLE B8: Bulk PAH data (16 USEPA Priority Pollutants) on Lake Erie sediments offshore of Cleveland (RTI 2014b)

PAH COMPOUND (µg/kg)	LAKE SITE																		
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-7	LE-10	LE-11	LE-12	LE-13	LE-14	LE-16	LE-19	LE-20	LE-21	LE-22	LE-23	LE-24	LE-25
2-METHYLNAPHTHALENE	12 U[1]	47	5,100	16	10 U	21	36	16	32 U	11 U	66	3,700	33 U	29 U	34 U	33 U	34 U	59	95
ACENAPHTHENE	11 U	25	1,800	35	9	27	26	10 U	29 U	10 U	170	11,000	30 U	27 U	30 U	30 U	31 U	660	92
ACENAPHTHYLENE	10 U	26	1,100	33	13	57	35	9.7 U	30	37	210	1,600	29 U	25 U	29 U	29 U	29 U	180	81
ANTHRACENE	22	72	1,900	100	34	100	90	11 U	45	31	470	12,000	34	32	33 U	37	43	430	200
BENZO(A)ANTHRACENE	53	310	1,900	260	77	250	280	15	170	150	1,100	13,000	140	130	110	130	160	920	440
BENZO(A)PYRENE	64	470	1,800	300	79	320	350	15	280	210	1,000	11,000	200	210	150	230	250	1,400	660
BENZO(B)FLUORANTHENE	130	800	2,200	410	140	460	570	39	510	340	1,300	15,000	440	470	350	480	500	2,000	1,200
BENZO(G,H,I)PERYLENE	56	290	710 U	120	26	120	140	16 U	140	71	360	4,500	97	87	67	94	110	510	230
BENZO(K)FLUORANTHENE	32	200	1000 U	130	37	100	160	24 U	150	76	350	4,500	110	92	79	140	140	520	290
CHRYSENE	76	400	2,000	240	93	240	290	20	190	150	810	12,000	140	150	110	170	170	830	430
DIBENZ(A,H)ANTHRACENE	38 U	100	1600 U	54	32 U	43	61	36 U	100 U	36 U	180	2400 U	110 U	95 U	110 U	110 U	110 U	110 U	120 U
FLUORANTHENE	190	800	5,200	530	180	510	670	32	360	190	2,100	37,000	270	280	210	300	310	1,900	870
FLUORENE	13 U	41	2,400	45	12	43	57	13 U	36 U	13 U	220	11,000	38 U	34 U	39 U	38 U	39 U	310	42 U
INDENO(1,2,3-C,D)PYRENE	42	290	520 U	130	26	120	160	12 U	150	88	400	4,300	110	100	78	110	130	580	250
NAPHTHALENE	9.3 U	51	29,000	34	22	36	45	12	39	11	250	11,000	46	26	29	48	44	230	230
PHENANTHRENE	81	300	6,800	180	69	190	240	15	110	47	1,000	42,000	90	86	74	100	110	1,300	500
PYRENE	140	580	4,700	450	180	390	530	29	300	160	1,500	33,000	220	220	170	260	260	1,300	740
TOTAL PAHs	**886**	**4,755**	**60,800**	**3,051**	**997**	**3,006**	**3,704**	**177**	**2,474**	**1,561**	**11,420**	**222,900**	**1,897**	**1,883**	**1,427**	**2,099**	**2,227**	**13,070**	**6,213**
TOC CONTENT (%)	**0.36**	**2.4**	**3.1**	**0.4**	**0.41**	**0.44**	**1.6**	**0.19**	**2.2**	**0.29**	**1.4**	**4.3**	**2.76**	**2.7**	**2.7**	**3**	**3.1**	**2.7**	**3.3**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**246**	**198**	**1961**	**763**	**243**	**683**	**232**	**93.2**	**112**	**538**	**816**	**5184**	**68.7**	**69.7**	**52.9**	**70.0**	**71.8**	**484**	**188**

[1] Not detected at the specified detection limit.

TABLE B9: Bulk PAH data (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms, and 16 priority pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2014a)

PAH compound (µg/kg)	UPPER RIVER CHANNEL			LAKE AREA			
	DMMU-1	DMMU-2a	DMMU-2b	CLA-14 Comp	CLA-1 Comp	CLA-4 Comp	CLA-7 Comp
1-METHYLNAPHTHALENE	60	40	50	1,870	220	20	20
2-METHYLNAPHTHALENE	130	110	110	1,900	790	60	70
ACENAPHTHENE	20 U	60	50	10,890	3,250	30	40
ACENAPHTHYLENE	40	60	50	1,330	1,100	50	60
ANTHRACENE	130	250	280	15,040	9,050	140	160
BENZO(A)ANTHRACENE	180	390	450	8,390	5,250	160	190
BENZO(A)PYRENE	210	440	480	7,530	4,350	180	230
BENZO(B,K)FLUORANTHENE	450	830	830	8,640	5,300	310	380
BENZO(G,H,I)PERYLENE	190	390	380	3,760	2,470	160	180
CHRYSENE	330	610	590	7,680	5,180	240	280
DIBENZ(A,H)ANTHRACENE	30	60	70	930	530	30	10 U[1]
FLUORANTHENE	480	910	980	16,190	10,690	290	310
FLUORENE	30	70	70	7,560	4,040	50	60
INDENO(1,2,3-C,D)PYRENE	210	460	470	5,920	3,390	190	200
NAPHTHALENE	140	160	120	2,890	2,520	130	40
PHENANTHRENE	310	550	650	21,950	13,000	210	230
PYRENE	450	840	890	15,080	10,040	300	330
PERYLENE	160	290	300	3,900	2,600	580	600
BENZO(E)PYRENE	240	410	390	3,720	2,390	160	220
C1 - CHRYSENE	370	640	640	13,140	9,450	370	390
C1 - FLUORANTHENE/PYRENE	260	490	470	15,730	10,510	270	290
C1 - FLUORENE	120	180	160	9,820	9,210	230	200
C1 - PHENANTHRENE/ANTHRACENE	270	390	380	20,450	17,730	310	360
C2 - CHRYSENE	340	610	490	17,860	15,930	100 U	100 U
C2 - FLUORENE	140	220	220	12,730	13,050	320	280
C2 - NAPHTHALENE	510	550	480	36,270	14,480	630	830
C2 - PHENANTHRENE/ANTHRACENE	1,130	1,740	1,520	102,830	118,410	1,860	1,990
C3 - CHRYSENE	200 U	200 U	200 U	10,320	11,020	200 U	200 U
C3 - FLUORENE	40 U	40 U	40 U	19,900	22,440	40 U	40 U
C3 - NAPHTHALENE	300	310	310	46,440	36,100	370	410
C3 - PHENANTHRENE/ANTHRACENE	680	1,030	840	59,430	74,800	950	940
C4 - CHRYSENE	200 U	200 U	200 U	200 U	200 U	200 U	200 U
C4 - NAPHTHALENE	490	610	540	46,520	46,030	750	810
C4 - PHENANTHRENE/ANTHRACENE	300	410	350	31,360	44,430	470	220
Total (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms)	**8,680**	**14,110**	**13,610**	**587,970**	**529,750**	**9,820**	**10,320**
TOC (%)	**1.20**	**2.00**	**1.70**	**3.00**	**3.60**	**2.70**	**2.80**
TOC-NORMALIZED CONCENTRATION (MG/KG-TOC)	**723**	**706**	**801**	**19,599**	**14,715**	**364**	**369**
Total (16 PRIORITY POLLUTANTS)	**3,310**	**6,190**	**6,470**	**135,680**	**80,950**	**2,530**	**2,760**

TABLE B10: PAH (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms) pore water concentrations in Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments with calculated USEPA Toxic Units (RTI 2014a)

PAH compound (ug/L)	UPPER RIVER CHANNEL						LAKE AREA								
	DMMU-1	TU	DMMU-2a	TU	DMMU-2b	TU	CLA-14 Comp	TU	CLA-1 Comp	TU	CLA-4 Comp	TU	CLA-7 Comp	TU	PAH FCV (ug/L)
1-METHYLNAPHTHALENE	**0.16**	0.0021	**0.1**	0.0013	**0.21**	0.0028	**24.74**	0.33	**1.53**	0.02	0.05 U[1]		0.05 U		75.37
2-METHYLNAPHTHALENE	**0.15**	0.0021	**0.13**	0.0018	**0.4**	0.0055	**6.64**	0.09	**0.85**	0.01	0.05 U		0.05 U		72.16
ACENAPHTHENE	0.1 U		0.1 U		0.1 U		**45.17**	0.81	**20.19**	0.36	0.1 U		0.1 U		55.85
ACENAPHTHYLENE	0.2 U		0.2 U		0.2 U		**1.92**	0.01	**1.13**	0.00	0.2 U		0.2 U		306.9
ANTHRACENE	0.05 U		0.05 U		0.05 U		**7.79**	0.38	**9.19**	0.44	0.05 U		0.05 U		20.73
BENZO(A)ANTHRACENE	0.001 U		0.001 U		0.001 U		**2.06**	0.93	**0.49**	0.22	0.001 U		0.001 U		2.227
BENZO(A)PYRENE	0.008 U		0.008 U		0.008 U		**0.95**	0.99	**0.25**	0.26	0.008 U		0.008 U		0.9573
BENZO(B,K)FLUORANTHENE	0.005 U		0.005 U		0.005 U		**1.46**	2.28	**0.39**	0.61	0.005 U		0.005 U		0.6415
BENZO(E)PYRENE	0.005 U		0.005 U		0.005 U		**0.45**	0.50	**0.12**	0.13	0.005 U		0.005 U		0.9008
BENZO(G,H,I)PERYLENE	0.001 U		0.001 U		0.001 U		**0.59**	1.34	**0.16**	0.36	0.001 U		0.001 U		0.4391
C1 - CHRYSENE	0.005 U		0.005 U		0.005 U		**1.48**	1.73	**0.36**	0.42	0.005 U		0.005 U		0.8557
C1 - FLUORANTHENE/PYRENE	0.01 U		0.01 U		0.01 U		**5.56**	1.14	**5.62**	1.15	0.01 U		0.01 U		4.887
C1 - FLUORENE	0.02 U		0.02 U		0.02 U		**16.86**	1.21	**21.3**	1.52	0.02 U		0.02 U		13.99
C1 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**33.9**	4.56	**46.16**	6.21	0.02 U		0.02 U		7.436
C2 - CHRYSENE	0.01 U		0.01 U		0.01 U		**2.58**	5.34	**0.88**	1.82	0.01 U		0.01 U		0.4827
C2 - FLUORENE	0.05 U		0.05 U		0.05 U		**21.58**	4.07	**38.43**	7.24	0.05 U		0.05 U		5.305
C2 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		**146.81**	4.85	**80.97**	2.68	0.15 U		0.15 U		30.24
C2 - PHENANTHRENE/ANTHRACENE	0.05 U		0.05 U		0.05 U		**51.34**	16.05	**93.37**	29.19	0.05 U		0.05 U		3.199
C3 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.1675
C3 - FLUORENE	0.06 U		0.06 U		0.06 U		**31.38**	16.38	**53.92**	28.14	0.06 U		0.06 U		1.916
C3 - NAPHTHALENE	0.05 U		0.05 U		0.05 U		**285.68**	25.74	**366.39**	33.01	0.05 U		0.05 U		11.1
C3 - PHENANTHRENE/ANTHRACENE	0.04 U		0.04 U		0.04 U		**37.7**	30.02	**75.08**	59.78	0.04 U		0.04 U		1.256
C4 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.07062
C4 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		**238.12**	54.06	**370.84**	84.19	0.15 U		0.15 U		4.4048
C4 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**55.79**	99.73	**78.43**	140.20	0.02 U		0.02 U		0.5594
CHRYSENE	0.001 U		0.001 U		0.001 U		**1.69**	0.83	**0.41**	0.20	0.001 U		0.001 U		2.042
DIBENZ(A,H)ANTHRACENE	0.002 U		0.002 U		0.002 U		**0.16**	0.57	**0.03**	0.11	0.002 U		0.002 U		0.2825
FLUORANTHENE	0.01 U		0.01 U		**0.03**	0.0042	**8.51**	1.20	**7.87**	1.11	0.01 U		0.01 U		7.109
FLUORENE	0.04 U		0.04 U		0.04 U		**17.99**	0.46	**11.58**	0.29	0.04 U		0.04 U		39.3
INDENO(1,2,3-C,D)PYRENE	0.001 U		0.001 U		0.001 U		**0.41**	1.49	**0.1**	0.36	0.001 U		0.001 U		0.275
NAPHTHALENE	**0.12**	0.0006	**0.22**	0.0011	**0.49**	0.0025	**3.49**	0.02	**2.4**	0.01	0.1 U		0.1 U		193.5
PERYLENE	0.004 U		0.004 U		0.004 U		**0.17**	0.19	**0.03**	0.03	0.004 U		0.004 U		0.9008
PHENANTHRENE	0.1 U		0.1 U		0.1 U		**36.72**	1.92	**31.27**	1.63	0.1 U		0.1 U		19.13
PYRENE	0.01 U		**0.02**	0.0020	0.01 U		**9.22**	0.91	**8.31**	0.82	0.01 U		0.01 U		10.11
Total USEPA Toxic Units	**<0.1**		**<0.1**		**<0.1**		**280**		**403**		**<0.1**		**<0.1**		

TABLE B11. Results of standard 28-day *Lumbriculus variegatus* bioaccumulation experiments on Lake Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (RTI 2014a).

Management Unit/Area	Replicate	Tissue Measurement			Total PCB Concentration in Sediment (µg/kg-sediment)
		Total PCBs (µg/kg-tissue)	Lipid (%)	Lipid-normalized Total PCBs (µg/kg-lipid)	
DMMU-1	A	216	1.6	13500	**67.9 (composite)**
	B	161	1.9	8474	
	C	125	1.8	6944	
	D	142	1.8	7889	
	E	137	2.1	6524	
MEAN		**156**	**1.84**	**8666**	
DMMU-2a	A	93.5	1.7	5500	**102 (composite)**
	B	96.1	2.1	4576	
	C	117	2.1	5571	
	D	126	2.1	6000	
	E	92.9	2.0	4645	
MEAN		**105**	**2.00**	**5259**	
DMMU-2b	A	96.5	1.9	5079	**144 (composite)**
	B	101	1.8	5611	
	C	109	1.9	5737	
	D	83.9	2.0	4195	
	E	125	2.2	5682	
MEAN		**103**	**1.96**	**5261**	
CLA-1[1]	A	269	2.4	11208	**156 (average)**
	B	120	2.7	4444	
	C	285	3.0	9500	
	D	107	2.4	4458	
	E				
MEAN		**195**	**2.63**	**7403**	
CLA-4	A	35.6	2.5	1424	**117 (composite)**
	B	34.1	2.3	1483	
	C	36.9	2.2	1677	
	D	32.8	2.1	1562	
	E	34.5	2.1	1643	
MEAN		**34.8**	**2.24**	**1558**	

[1] Values across four discrete sites; composite sample result was biased by one discrete sample with higher bulk sediment concentrations (above ambient lake conditions) of total PCBs (CLA-1-5, 1450 µg/kg).

TABLE B12. Results of standard 28-day *Lumbriculus variegatus* bioaccumulation experiments on Lake Erie sediments offshore of Cleveland (RTI 2014b).

Area	Replicate (R) or Discrete Site (D)	Tissue Measurement			Total PCB Concentration in Sediment (µg/kg-sediment)
		Total PCBs (µg/kg-tissue)	Lipid (%)	Lipid-normalized Total PCBs (µg/kg-lipid)	
CLA-1	R-A	650	4.1	15854	
	R-B	690	3.1	22258	
	R-C	668	3.2	20875	
	R-D	681	3.1	21968	
	R-E	721	4.2	17167	
MEAN		**682**	**3.54**	**19624**	**1240 (composite)**
CLA-1	D-1	269	2.4	11208	236
	D-2	120	2.7	4444	116
	D-3	285	3	9500	169
	D-4	107	2.4	4458	104
	D-5				1450*
MEAN		**195**	**2.63**	**7403**	**156**
CLA-14	D-1	91.6	3	3053	51.8
	D-2	145	2.3	6304	100
	D-3	163	2.3	7087	81.8
	D-4				156
	D-5	343	4	8575	291
MEAN		**186**	**2.90**	**6255**	**136**
CLA-4	R-A	35.6	2.5	1424	
	R-B	34.1	2.3	1483	
	R-C	36.9	2.2	1677	
	R-D	32.8	2.1	1562	
	R-E	34.5	2.1	1643	
MEAN		**34.8**	**2.24**	**1558**	**117 (composite)**
CLA-4	D-1	34.9	2.4	1454	109
	D-2	32.6	1.9	1716	74.6
	D-3	58.7	2.6	2258	102
	D-4	41.1	2.2	1868	77
	D-5	33.9	2.2	1541	89.2
MEAN		**40.2**	**2.26**	**1767**	**90.4**
CLA-7	R-A	37.3	2.5	1492	
	R-B	32.3	1.9	1700	
	R-C	33.1	2.3	1439	
	R-D	37.5	2.1	1786	
	R-E	34.6	1.9	1821	
MEAN		**35.0**	**2.14**	**1648**	**110 (composite)**
CLA-7	D-1	32.1	2	1605	103
	D-2	32.1	1.9	1689	123
	D-3	34.7	2	1735	109
	D-4	40.6	2.1	1933	131
	D-5	35.6	2	1780	121
MEAN		**35.0**	**2.00**	**1749**	**117**
CLAM	D-1	53.5	2.3	2326	136
	D-2	92.7	2.1	4414	262
	D-3	23.0	1.9	1211	10.9
	D-4	49.3	2	2465	109
	D-5	56.3	2.2	2559	155
MEAN		**55.0**	**2.10**	**2595**	**135**
CHLE	D-1	13.7	1.1	1245	28.6
	D2				105
	D-3	3151	1.2	262583*	5880*
	D-4				57.7
	D-6				38.6
	D-7				27.7
	D-10				400
	D-11	29.4	1	2940	9.36
	D-12	20.7	1	2070	101
	D-13	21.0	1.1	1909	15.8
	D-14				38.4
	D-16				968*
	D-19	19.3	0.9	2144	100
	D-20	19.7	1	1970	92
	D-21	20.1	1	2010	111
	D-22				117
	D-23				109
	D-24	40.6	1.1	3691	60.2
	D-25				152
MEAN		**371**	**1.04**	**2247**	**68**

*Value not included in mean.

TABLE B13: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PARTICLE SIZE (%)	UPPER RIVER CHANNEL																							
	DMMU-1								DMMU-2a								DMMU-2b							
	CH-1	CH-2	CH-3	CH-3 CORE	CH-4	CH-5	CH-5 CORE	DMMU-1 COMP	CH-6	CH-7	CH-7 CORE	CH-8	CH-9	CH-9 CORE	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-12 CORE	CH-13	CH-14	CH-15	CH-15 CORE	DMMU-2b COMP
CLAY	14	3.6	14	4.4	9.7	14	9.3	6.4	17	13	10	14	24	16	20	13	17	21	18	19	16	13	14	5.1
SILT	57	72	52	60	59	55	56	66	56	65	59	62	52	51	58	67	54	54	56	53	60	68	66	69
FINE SAND	19	16	18	13	22	16	25	12	11	11	18	8.1	5.9	8.3	6.5	9.7	8.2	3.7	5.7	4.6	5	5	4.6	5
MEDIUM SAND	9.1	6.7	6.6	13	5	7.8	4.6	8.1	8	5.3	5.7	6.8	7.8	6.6	7.4	6.1	12	7.4	6.3	9.4	8.4	7	5.1	6.4
COARSE SAND	0.9	1.7	7.6	7.8	3.9	6	4.6	5.1	7.7	5.9	6.2	9.2	9.6	17	6.7	4.2	8.2	13	14	14	9.9	6.8	9.3	14
FINE GRAVEL	0.1	0.1	1	2	0.3	0.9	0.7	1.8	0.3	0.2	0.4	0.4	1	1.3	0.4	0.1	0.7	0.3	0.7	0.8	0.5	0.5	0.3	0.9
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SILT/CLAY	**71**	**76**	**64**	**64**	**69**	**65**	**72**	**72**	**73**	**69**	**76**	**76**	**67**	**78**	**78**	**80**	**71**	**74**	**72**	**72**	**76**	**80**	**74**	**74**
TOTAL SAND/GRAVEL	**29**	**25**	**36**	**36**	**31**	**35**	**27**	**27**	**27**	**30**	**25**	**25**	**33**	**21**	**21**	**20**	**29**	**27**	**29**	**29**	**24**	**19**	**26**	**26**

PARTICLE SIZE (%)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
CLAY	6.7	15	13	7.1	10	6.5	17	7.1	44	15	16	16
SILT	40	7.8	14	16	11	23	8.7	16	0	5	11	8.5
FINE SAND	16	2.9	5.9	5.1	7.3	6.2	2.6	2.1	4.7	3.1	4.6	3
MEDIUM SAND	12	13	20	24	26	17	2.9	1.1	13	9.5	13	13
COARSE SAND	22	42	30	24	24	31	40	44	32	36	39	37
FINE GRAVEL	3.6	19	17	24	22	16	28	30	11	31	17	23
COARSE GRAVEL	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL SILT/CLAY	**47**	**23**	**27**	**23**	**21**	**30**	**26**	**23**	**44**	**20**	**27**	**25**
TOTAL SAND/GRAVEL	**54**	**77**	**73**	**77**	**79**	**70**	**74**	**77**	**61**	**80**	**74**	**76**

TABLE B14: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PARAMETER (mg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
CYANIDE	0.65 U[1]	0.63 U	0.78	0.54	0.66	0.6	1.2	0.68	0.7	0.79	0.73	0.54	0.87	0.61	0.75	0.91 U	0.76 U	0.61
NITROGEN, AMMONIA	140	32	150	140	200	93	340	260	170	200	200	240	340	210	290	380	220	250
NITROGEN, TOTAL KJELDAHL (TKN)	350	260	1,800	1,500	1,900	410	2,000	1,600	1,400	2,300	1,900	1,800	2,200	860	960	1,100	1,200	1,500
PHOSPHORUS, TOTAL (AS P)	50	54	170	180	210	170	240	220	170	170	190	220	190	190	190	190	250	210
TOTAL ORGANIC CARBON	4,600	1,900	5,900	6,600	29,000	12,000	22,000	20,000	16,000	23,000	21,000	20,000	20,000	20,000	19,000	18,000	18,000	20,000
PERCENT MOISTURE	25	24	48	35	46	32	46	42	39	47	44	43	45	43	44	45	44	44

PARAMETER (mg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
CYANIDE	1.6 U	1.9 U	1.8 U	1.8 U	1.9 U	2 U	1.9 U	1.6 U	1.8 U	1.6 U	1.8 U	1.6 U
NITROGEN, AMMONIA	250	420	210	290	340	300	3200	180	330	250	280	250
NITROGEN, TOTAL KJELDAHL (TKN)	2,500	3,700	2,900	4,400	5,400	3,200	2,600	3,000	52,000	840	2,400	3,100
PHOSPHORUS, TOTAL (AS P)	290	420	440	430	440	450	200	310	290	190	260	360
TOTAL OIL & GREASE	1,800	450	410 U	370 U	410 U	390 U	360 U	380 U	380 U	460	350 U	430
TOTAL ORGANIC CARBON	39,000	32,000	32,000	29,000	24,000	33,000	28,000	28,000	30,000	30,000	28,000	29,000
PERCENT MOISTURE	68	77	76	73	76	75	73	74	74	72	72	73

TABLE B15: Bulk metals data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

METAL (mg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
ALUMINUM	4,900	3,400	12,000	12,000	11,000	8,900	15,000	12,000	12,000	15,000	15,000	14,000	15,000	14,000	15,000	15,000	16,000	16,000
ANTIMONY	0.98	0.96	1.8	1.1	1.3	1.4	1.6	1.5	1.6	1.8	1.5	1.7	2.2	1	1.8	1.8	2	1.5
ARSENIC	10	6.1	18	14	17	13	19	18	18	21	21	18	20	20	19	20	20	21
BARIUM	25	18	76	72	67	49	94	71	66	83	78	76	88	75	83	81	84	81
BERYLLIUM	0.05 U[1]	0.044 U	0.069 U	0.049 U	0.063 U	0.062 U	0.064 U	0.061 U	0.057 U	0.06 U	0.067 U	0.061 U	0.062 U	0.051 U	0.069 U	0.058 U	0.071 U	0.058 U
CADMIUM	0.078	0.044 U	0.42	0.2	0.37	0.17	0.32	0.28	0.43	0.34	0.19	0.22	0.29	0.14	0.18	0.9	0.46	0.26
CALCIUM	7,200	4,200	11,000	11,000	11,000	11,000	17,000	12,000	12,000	14,000	13,000	13,000	16,000	12,000	13,000	12,000	14,000	15,000
CHROMIUM, TOTAL	18	6.3	19	17	18	13	22	18	17	22	20	20	24	19	22	24	22	23
COBALT	5.6	4.1	10	9.3	9.9	7.6	11	10	10	12	12	11	12	12	12	11	12	12
COPPER	14	13	39	30	37	28	43	37	34	43	36	39	41	34	37	39	41	40
IRON	18,000	19,000	30,000	26,000	29,000	23,000	34,000	32,000	32,000	37,000	34,000	33,000	34,000	31,000	31,000	36,000	42,000	38,000
LEAD	12	14	32	22	31	21	35	31	28	33	29	30	33	24	28	33	37	32
MAGNESIUM	3,100	1,800	5,200	5,900	5,200	3,800	8,400	6,800	6,800	8,100	7,800	7,200	8,500	7,100	7,400	7,800	8,700	8,900
MANGANESE	390	210	830	700	650	500	830	710	720	860	810	760	820	670	690	860	1,000	820
MERCURY	0.013	0.007	0.11	0.11	0.1	0.054	0.099	0.091	0.069	0.07	0.078	0.064	0.076	0.07	0.065	0.11	0.12	0.077
NICKEL	24	16	29	28	28	26	37	29	29	35	33	32	38	32	36	33	33	35
POTASSIUM	770	520	1,900	2,200	1,900	1,300	2,500	1,900	1,800	2,500	2,500	2,300	2,900	2,200	2,900	2,400	2,300	2,600
SELENIUM	1.5 U	1.3 U	2.1 U	1.5 U	1.9 U	1.9 U	1.9 U	1.8 U	1.7 U	1.8 U	2 U	1.8 U	1.9 U	1.5 U	2.1 U	1.7 U	2.1 U	1.7 U
SILVER	0.25 U	0.22 U	0.34 U	0.25 U	0.32 U	0.31 U	0.32 U	0.31 U	0.29 U	0.3 U	0.33 U	0.3 U	0.31 U	0.25 U	0.34 U	0.29 U	0.36 U	0.29 U
SODIUM	100	88	240	220	220	160	280	240	240	260	250	240	310	270	280	280	260	280
THALLIUM	0.99 U	0.87 U	1.4 U	0.98 U	1.3 U	1.2 U	1.3 U	1.2 U	1.1 U	1.2 U	1.3 U	1.2 U	1.2 U	1 U	1.4 U	1.2 U	1.4 U	1.2 U
VANADIUM	17	8.7	25	25	25	18	29	25	24	30	29	29	33	29	32	29	28	31
ZINC	84	82	160	120	160	120	180	150	140	170	140	150	170	130	140	190	180	170

METAL (mg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
ALUMINUM	25,000	34,000	30,000	32,000	33,000	31,000	32,000	33,000	34,000	28,000	27,000	27,000
ANTIMONY	3.7	1.6	2.3	3.8	3.5	2.4	1.8	2.7	1.8	1.5	2.7	1.3
ARSENIC	13	7.5	13	9.2	9.8	13	5.5	7.6	7.8	8.4	7.8	7.1
BARIUM	120	140	150	150	150	150	140	150	150	130	130	140
BERYLLIUM	0.14 U	0.087	0.077	0.16 U	0.17 U	0.13 U	0.69	0.63	0.53	0.45	0.46	0.45
CADMIUM	1.7	1.5	2.1	1.9	1.9	2.2	1.5	1.7	1.7	1.5	1.4	1.6
CALCIUM	890	1,100	1,200	1,300	1,200	13,000	15,000	16,000	14,000	13,000	13,000	14,000
CHROMIUM, TOTAL	53	55	60	59	60	61	56	61	58	53	49	54
COBALT	14	16	17	18	17	17	16	17	17	15	14	16
COPPER	73	50	62	62	61	65	50	55	53	49	46	51
IRON	80,000	43,000	49,000	48,000	47,000	46,000	44,000	46,000	45,000	41,000	40,000	38,000
LEAD	62	53	66	62	63	66	46	52	51	45	41	47
MAGNESIUM	900	1,300	15,000	1,300	1,300	16,000	16,000	17,000	14,000	15,000	14,000	14,000
MANGANESE	660	600	580	650	560	640	560	580	610	530	690	570
MERCURY	0.26	0.33	0.4	0.33	0.29	0.31	0.35	0.28	0.28	0.75	0.25	0.27
NICKEL	56	64	71	69	68	70	61	67	65	60	56	63
POTASSIUM	5,000	7,100	6,900	6,300	7,100	6,400	6,900	6,900	7,300	6,500	5,300	4,900
SELENIUM	4.3 U	4.9 U	4.2 U	4.8 U	5 U	3.9 U	4.2 U	4.5 U	5 U	3.9 U	3.4 U	3.6 U
SILVER	0.72 U	0.81 U	0.69 U	0.8 U	0.83 U	0.65 U	0.71 U	0.75 U	0.84 U	0.65 U	0.57 U	0.6 U
SODIUM	170	240	250	220	250	250	260	280	240	230	220	240
THALLIUM	2.9 U	3.2 U	2.8 U	3.2 U	3.3 U	2.6 U	2.8 U	3 U	3.3 U	2.6 U	2.3 U	2.4 U
VANADIUM	61	77	73	74	79	78	71	78	74	67	63	66
ZINC	250	220	270	270	260	280	200	220	210	190	180	200

[1] Not detected at the specified detection limit

TABLE B16: AVS/SEM data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

AVS/SEM (µmol/g)	UPPER RIVER CHANNEL			LAKE AREA						
	DMMU-1 COMP	DMMU-2a COMP	DMMU-2b COMP	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1-COMP	CLA4-COMP
CADMIUM	0.0013	0.00232	0.00234	0.01	0.003	0.004	0.004	0.004	0.00382	0.00316
COPPER	0.116	0.151	0.148	0.186	0.087	0.075	0.098	0.081	0.0895	0.0874
LEAD	0.0504	0.0591	0.0582	0.139	0.041	0.062	0.059	0.061	0.056	0.0509
MERCURY	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
NICKEL	0.0696	0.107	0.0816	0.122	0.069	0.092	0.211	0.089	0.207	0.0891
ZINC	0.513	0.579	0.595	1.76	0.336	0.516	0.541	0.53	0.479	0.397
∑SEM	0.750	0.898	0.885	2.217	0.536	0.749	0.913	0.765	0.835	0.628
AVS	**0.63U**	**0.63U**	**0.63U**	4.424	1.069	1.494	1.822	1.526	5.1	3.8
∑SEM-AVS[2,3]	**0.75**	**0.898**	**0.885**	-2.207	-0.533	-0.745	-0.909	-0.761	-4.265	-3.172
Foc	0.012	0.02	0.02	0.039	0.032	0.032	0.029	0.024	0.033	0.029
(∑SEM-AVS)/Foc[4]	**63**	**45**	**44**							

[1] Not detected at the specified detection limit

[2] Sediment metal concentrations are protective of benthic organisms if ∑SEM-AVS ≤ 0 µmol/g

[3] Toxicity is unlikely when ∑SEM-AVS < 1.7 µmol/g

[4] Toxicity is unlikely when (∑SEM-AVS)/Foc < 130 µmol/g-oc

TABLE B17: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

AROCLOR (µg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
AROCLOR-1016	8.8 U[1]	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1221	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1232	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1242	**20**	**18**	**23**	**21**	12 U	**58**	12 U	**15**	**17**	12 U	12 U	12 U	**30**	11 U	12 U	**29**	**13**	**20**
AROCLOR-1248	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1254	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
AROCLOR-1260	**8.9**	**4.2**	**27**	**15**	**18**	**15**	**31**	**17**	**31**	**27**	**12**	**36**	**32**	**19**	**13**	**29**	**24**	**53**
AROCLOR-1262	8.8 U	8.7 U	13 U	10 U	12 U	9.5 U	12 U	11 U	11 U	12 U	12 U	12 U	12 U	11 U	12 U	12 U	12 U	12 U
TOTAL PCBs	**29**	**23**	**50**	**36**	**18**	**73**	**31**	**32**	**48**	**27**	**12**	**36**	**62**	**19**	**13**	**58**	**37**	**73**
TOC (%)	0.46	0.19	0.59	0.66	2.9	1.2	2.2	2	1.6	2.3	2.1	2	2	2	1.9	1.8	1.8	2
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**6304**	**12105**	**8475**	**5455**	**621**	**6083**	**1409**	**1600**	**3000**	**1174**	**571**	**1800**	**3100**	**950**	**684**	**3222**	**2056**	**3650**

AROCLOR (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
AROCLOR-1016	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1221	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1232	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1242	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1248	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1254	**89**	28 U	28 U	**61**	**110**	**150**	**52**	**46**	**42**	**50**	**51**	**41**
AROCLOR-1260	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
AROCLOR-1262	20 U	28 U	28 U	24 U	27 U	26 U	25 U	25 U	26 U	24 U	23 U	24 U
TOTAL PCBs	**89**	28 U	28 U	**61**	**110**	**150**	**52**	**46**	**42**	**50**	**51**	**41**
TOC (%)	3.9	3.2	3.2	2.9	2.4	3.3	2.8	2.8	3	3	2.8	2.9
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**2282**	**875**	**875**	**2103**	**4583**	**4545**	**1857**	**1643**	**1400**	**1667**	**1821**	**1414**

TABLE B18: PCB congener distributions and total PCB congener sums for Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PCB CONGENER (ng/g)	UPPER RIVER CHANNEL			LAKE AREA	
	DMMU-1 COMP	DMMU-2a COMP	DMMU-2b COMP	CLA1 COMP	CLA4 COMP
2,2',3,3',4,4',5,5',6,6'-DECACHLOROBIPHENYL	0.231	0.469	0.463	0.94	0.341
2,2',3,3',4,4',5,5',6-NONACHLOROBIPHENYL	0.276	0.647	0.581	0.66	0.289
2,2',3,3',4,4',5,5'-OCTACHLOROBIPHENYL	0.853	2.04	1.92	0.904	0.579
2,2',3,3',4,4',5,6,6'-NONACHLOROBIPHENYL	0.04	0.093	0.074 U[1]	0.121	0.063
2,2',3,3',4,4',5',6-OCTACHLOROBIPHENYL	0.502	1.16	1.07	0.471	0.312
2,2',3,3',4,4',5,6-OCTACHLOROBIPHENYL	0.368	0.905	0.8	0.349	0.239
2,2',3,3',4,4',5-HEPTACHLOROBIPHENYL	1.43	3.27	3.27	1.46	1.05
2,2',3,3',4,4',6,6'-OCTACHLOROBIPHENYL	0.054	0.094	0.063	0.034	0.023
2,2',3,3',4,4',6-HpCB & 2,2',3,3',4,5,6-HpCB (PCB171&PCB173)	0.464	1.08	1.06	0.447	0.303
2,2',3,3',4,4'-HxCB1 & 2,3,4,4',5,6-HxCB (PCB128&PCB166)	0.494	0.934	0.845	1.15	0.756
2,2',3,3',4,5,5',6,6'-NONACHLOROBIPHENYL	0.073	0.175	0.15	0.249	0.101
2,2',3,3',4,5,5',6-OcCB & 2,2',3,3',4,5,5',6'-OcCB (PCB198&PCB199)	1.04	2.45	2.27	1.26	0.753
2,2',3,3',4,5,5'-HEPTACHLOROBIPHENYL	0.273	0.598	0.616	0.303	0.221
2,2',3,3',4,5,6,6'-OCTACHLOROBIPHENYL	0.089	0.306	0.294	0.122	0.063
2,2,3,3,4,5,6,6-OCTACHLOROBIPHENYL	0.126	0.304	0.28	0.137	0.079
2,2',3,3',4,5',6'-HEPTACHLOROBIPHENYL	0.952	2.24	2.2	0.973	0.656
2,2',3,3',4,5',6-HEPTACHLOROBIPHENYL	0.102	0.173	0.161	0.065	0.052
2,2',3,3',4,5,6'-HEPTACHLOROBIPHENYL	1.87	4.44	4.37	1.53	1.01
2,2',3,3',4,5'-HEXACHLOROBIPHENYL	0.198	0.384	0.348	0.567	0.394
2,2',3,3',4,5-HxCB & 2,2',3,4,4',5'-HxCB1 & 2,3,3',4',5,6-HxCB (PCB129&PCB138&PCB163)	4.78	9.61	9.47	7.86	5.31
2,2',3,3',4,6,6'-HEPTACHLOROBIPHENYL	0.237	0.548	0.554	0.17	0.109
2,2',3,3',4,6'-HEXACHLOROBIPHENYL	1.57	2.97	2.91	2.31	1.46
2,2',3,3',4,6-HEXACHLOROBIPHENYL	0.049	0.096	0.082	0.087	0.047
2,2',3,3',4-PENTACHLOROBIPHENYL	0.375	0.487	0.466	0.849	0.597
2,2',3,3',5,5',6,6'-OCTACHLOROBIPHENYL	0.151	0.363	0.33	0.225	0.11
2,2',3,3',5,5',6-HEPTACHLOROBIPHENYL	0.338	0.819	0.826	0.348	0.223
2,2',3,3',5,5'-HEXACHLOROBIPHENYL	0.044	0.105	0.1	0.11 U	0.072
2,2',3,3',5,6,6'-HEPTACHLOROBIPHENYL	0.809	1.75	1.77	0.557	0.362
2,2',3,3',5,6-HxCB & 2,2',3,4,5,6'-HxCB (PCB134&PCB143)	0.202	0.401	0.356	0.311	0.17
2,2',3,3',5,6'-HxCB & 2,2',3,5,5',6-HxCB (PCB135&PCB151)	1.96	4.15	4.19	1.87	1.18
2,2',3,3',5-PeCB & 2,2',4,4',5-PeCB (PCB83&PCB99)	1.51	2.12	2.03	3.25	2.15
2,2',3,3',6,6'-HEXACHLOROBIPHENYL	0.7	1.33	1.32	0.559	0.318
2,2',3,3',6-PENTACHLOROBIPHENYL	0.867	0.983	0.969	1.37	0.851
2,2',3,3'-TeCB & 2,2',3,4-TeCB & 2,3',4',6-TeCB (PCB40&PCB41&PCB71)	1.67	1.62	1.8	1.54	1.07
2,2',3,4,4',5,5',6-OCTACHLOROBIPHENYL	0.6	1.47	1.39	0.728	0.397
2,2',3,4,4',5,5'-HpCB1 & 2,3,3',4',5,5',6-HpCB (PCB180&PCB193)	3.83	8.3	8.51	3.37	2.37
2,2',3,4,4',5,6,6'-OCTACHLOROBIPHENYL	0.002 U	0.005 U	0.006 U	0.004 U	0.001 U
2,2',3,4,4',5',6-HEPTACHLOROBIPHENYL	1.14	2.3	2.31	0.847	0.636
2,2',3,4,4',5,6'-HEPTACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.013	0.003 U
2,2',3,4,4',5,6-HEPTACHLOROBIPHENYL	0.011 U	0.007 U	0.009 U	0.017 U	0.004 U
2,2',3,4,4',5-HEXACHLOROBIPHENYL	0.13 U	0.233	0.16	0.257	0.225
2,2',3,4,4',6,6'-HEPTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.004 U	0.002 U
2,2',3,4,4',6-HxCB & 2,2',3,4,4',6'-HxCB (PCB139&PCB140)	0.045	0.083	0.07	0.11	0.062
2,2',3,4,4'-PeCB & 2,3,4,5,6-PeCB & 2,3,4',5,6-PeCB (PCB85&PCB116&PCB117)	0.665	0.718	0.563	1.01	0.828
2,2',3,4',5,5',6-HEPTACHLOROBIPHENYL	2.02	5.04	5.2	2.03	1.3
2,2',3,4,5,5',6-HEPTACHLOROBIPHENYL	0.002 U	0.008 U	0.01 U	0.008 U	0.004 U
2,2',3,4',5,5'-HEXACHLOROBIPHENYL	0.551	1.11	1.1	1.09	0.773
2,2',3,4,5,5'-HEXACHLOROBIPHENYL	1.05	2.38	2.34	1.04	0.646
2,2',3,4',5,6,6'-HEPTACHLOROBIPHENYL	0.003	0.004 U	0.005 U	0.005 U	0.003
2,2',3,4,5,6,6'-HEPTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.004 U	0 U
2,2',3,4',5,6'-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.003 U	0.009	0.006
2,2',3,4,5',6-HEXACHLOROBIPHENYL	0.184	0.549	0.543	0.226	0.088
2,2',3,4,5,6-HEXACHLOROBIPHENYL	0.002 U	0.006 U	0.007 U	0.009 U	0.001 U
2,2',3,4',5,6-HxCB & 2,2',3,4',5',6-HxCB (PCB147&PCB149)	4.25	8.45	8.38	4.67	3.04
2,2',3,4',5-PeCB & 2,2',4,5,5'-PeCB1 & 2,3,3',5',6-PeCB (PCB90&PCB101&PCB113)	3.19	4.9	4.88	5.32	3.51
2,2',3,4',6,6'-HEXACHLOROBIPHENYL	0.003	0.005 U	0.002 U	0.007 U	0.004 U
2,2',3,4,6,6'-HEXACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.003 U	0.001 U
2,2',3,4,6-PeCB & 2,2',3,4',6-PeCB (PCB88&PCB91)	0.524	0.593	0.595	0.758	0.506
2,2',3,4,6'-PENTACHLOROBIPHENYL	0.056	0.059	0.06	0.077	0.048
2,2',3,4'-TETRACHLOROBIPHENYL	1.12	1.08	1.19	0.98	0.758
2,2',3,5,5'-PENTACHLOROBIPHENYL	0.554	0.783	0.785	1.03	0.701
2,2',3,5,6,6'-HEXACHLOROBIPHENYL	0.002 U	0.003 U	0.002 U	0.003 U	0.002 U
2,2',3,5,6-PeCB & 2,2',3',4,6-PeCB & 2,2',4,4',6-PeCB & 2,2',4,5,6'-PeCB (PCB93&PCB98&PCB100&PCB102)	0.164	0.176	0.177	0.211	0.135
2,2',3,5,6'-PENTACHLOROBIPHENYL	0.023 U	0.024	0.026	0.026 U	0.015 U
2,2',3,5'-TeCB1 & 2,2',3,4'-TeCB & 2,3,5,6-TeCB (PCB44&PCB47&PCB65)	3.43	3.26	3.49	2.77	2.13
2,2',3,5-TETRACHLOROBIPHENYL	0.169	0.158	0.164	0.109	0.075
2,2',3,6,6'-PENTACHLOROBIPHENYL	0.035	0.031	0.033	0.028	0.014
2,2',3,6-TeCB & 2,2',4,6'-TeCB (PCB45&PCB51)	0.787	0.645	0.685	0.355	0.234
2,2',3,6'-TETRACHLOROBIPHENYL	0.222	0.171	0.191	0.14	0.09
2,2',3-TRICHLOROBIPHENYL	0.771	0.54	0.569	0.287	0.247
2,2',4,4',5,5'-HxCB1 & 2,3',4,4',5',6-HxCB (PCB153&PCB168)	4.14	8.8	8.8	5.55	3.74
2,2,4,4,5,6-HEXACHLOROBIPHENYL	0.011	0.032 U	0.02 U	0.059 U	0.04
2,2',4,4',6,6'-HEXACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.003 U	0.001 U
2,2',4,5',6-PENTACHLOROBIPHENYL	0.021	0.022	0.026	0.046	0.028
2,2',4,5'-TeCB & 2',3,3',4,5-PeCB (PCB49&PCB69)	2.14	2.17	2.37	1.83	1.38
2,2',4,5-TETRACHLOROBIPHENYL	0.504	0.451	0.514	0.424	0.282
2,2',4,6,6'-PENTACHLOROBIPHENYL	0.001 U	0.002 U	0.002 U	0.002 U	0.001 U
2,2',4,6-TeCB & 2,2',5,6'-TeCB (PCB50&PCB53)	0.591	0.495	0.541	0.326	0.202
2,2',4-TRICHLOROBIPHENYL	0.863	0.699	0.655	0.326	0.288
2,2',5,5'-TETRACHLOROBIPHENYL	3.46	3.36	3.6	3.29	2.27
2,2',5-TrCB1 & 2,4,6-TrCB (PCB18&PCB30)	1.44	1.08	1.16	0.684	0.509
2,2',6,6'-TETRACHLOROBIPHENYL	0.016	0.005 U	0.008 U	0.007 U	0.002
2,2',6-TRICHLOROBIPHENYL	0.353	0.253	0.257	0.061	0.045
2,2'-DICHLOROBIPHENYL	0.567	0.459	0.405	0.137	0.102
2,3,3',4,4',5,5',6-OCTACHLOROBIPHENYL	0.035	0.097	0.107	0.035 U	0.028
2,3,3',4,4',5,5'-HEPTACHLOROBIPHENYL	0.048	0.129	0.128	0.082	0.054
2,3,3',4,4',5',6-HEPTACHLOROBIPHENYL	0.058	0.135	0.141	0.054	0.03
2,3,3',4,4',5,6-HEPTACHLOROBIPHENYL	0.309	0.71	0.7	0.301	0.21
2,3,3',4,4',5-HxCB2 & 2,3,3',4,4',5'-HxCB2 (PCB156&PCB157)	0.365	0.793	0.703	0.839	0.573
2,3,3',4,4',6-HEXACHLOROBIPHENYL	0.377	0.779	0.757	0.578	0.383
2,3,3',4,4'-PENTACHLOROBIPHENYL	0.944	1.59	1.35	2.49	1.91
2,3,3',4,5,5',6-HEPTACHLOROBIPHENYL	0.002 U	0.006 U	0.008 U	0.006 U	0.003 U
2,3,3',4',5,5'-HEXACHLOROBIPHENYL	0.007 U	0.011 U	0.013	0.048	0.03
2,3,3',4,5,5'-HEXACHLOROBIPHENYL	0.065	0.004 U	0.005 U	0.054	0.037
2,3,3',4',5',6-HEXACHLOROBIPHENYL	0.313	0.652	0.668	0.502	0.315
2,3,3',4,5',6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.006 U	0.001 U
2,3,3',4,5,6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.007 U	0.001 U
2,3,3',4,5'-PeCB & 2',3,4,5,5'-PeCB (PCB108&PCB124)	0.082	0.136	0.122	0.23	0.161
2',3,3',4,5-PENTACHLOROBIPHENYL	0.034	0.059	0.051	0.092	0.065
2,3,3',4',5-PENTACHLOROBIPHENYL	0.135	0.234	0.22	0.465	0.368
2,3,3',4,5-PENTACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.006 U	0.001 U
2,3,3',4',6-PeCB & 2,3,4,4',6-PeCB (PCB110&PCB115)	3.81	6.1	6.11	9.22	5.76
2,3,3',4'-TETRACHLOROBIPHENYL	1.34	1.55	1.76	2.35	1.73
2,3,3',4-TETRACHLOROBIPHENYL	0.016	0.012 U	0.028 U	0.004 U	0.002 U
2,3,3',5,5',6-HEXACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.007 U	0.003 U
2,3,3',5,5'-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.005 U	0.004 U
2,3',3,5,6-PENTACHLOROBIPHENYL	2.86	3.91	3.94	3.45	2.09
2,3,3',5,6-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.003 U	0 U
2,3,3',5'-TETRACHLOROBIPHENYL	0.001 U	0.004 U	0.005 U	0.16	0.096
2,3,3',5-TETRACHLOROBIPHENYL	0.001 U	0.011	0.015	0.019	0.015
2,3,3',6-TeCB & 2,3,4,6-TeCB & 2,4,4',6-TeCB (PCB59&PCB62&PCB75)	0.328	0.315	0.323	0.313	0.236
2,3,3'-TrCB & 2,4,4'-TrCB1 (PCB20&PCB28)	3.13	3.28	3.62	2.79	2.46
2,3',4,4',5,5'-HEXACHLOROBIPHENYL	0.128	0.289	0.228	0.345	0.239
2,3',4,4',5'-PENTACHLOROBIPHENYL	0.046	0.075	0.039	0.094	0.049
2,3',4,4',5-PENTACHLOROBIPHENYL	2.03	3.29	3.14	5.73	4
2,3,4,4',5-PENTACHLOROBIPHENYL	0.043	0.091	0.07	0.109	0.077
2,3',4,4'-TETRACHLOROBIPHENYL	2.48	2.98	3.27	4.55	3.33
2,3,4,4'-TETRACHLOROBIPHENYL	0.56	0.659	0.787	0.886	0.705
2,3',4,5,5'-PENTACHLOROBIPHENYL	0.003 U	0.008	0.006 U	0.035	0.024
2,3',4,5',6-PENTACHLOROBIPHENYL	0 U	0.003 U	0.004 U	0.004 U	0 U
2,3,4,5-TeCB & 2,3',4',5-TeCB & 2,4,4',5-TeCB & 2',3,4',5-TeCB (PCB61&PCB70&PCB74&PCB76)	3.81	4.4	4.9	7.01	5.06
2,3',4,5'-TETRACHLOROBIPHENYL	0.014	0.014	0.018	0.042	0.029
2,3',4,5-TETRACHLOROBIPHENYL	0.071	0.084	0.096	0.112	0.083
2,3,4',5-TETRACHLOROBIPHENYL	0.089	0.104	0.107	0.138	0.102
2,3,4',6-TETRACHLOROBIPHENYL	1.69	1.68	1.82	1.67	1.28
2,3,4-TrCB & 2',3,4-TrCB (PCB21&PCB33)	0.683	0.595	0.722	0.841	0.581
2,3',4-TRICHLOROBIPHENYL	0.317	0.324	0.333	0.259	0.249
2,3,4'-TRICHLOROBIPHENYL	0.928	0.877	1.07	0.662	0.571
2,3',5,5'-TETRACHLOROBIPHENYL	0.022	0.024	0.028	0.059	0.04
2,3',5',6-TETRACHLOROBIPHENYL	0.001 U	0.002 U	0.003 U	0.003 U	0 U
2,3',5-TrCB & 2,4,5-TrCB (PCB26&PCB29)	0.547	0.583	0.578	0.412	0.374
2',3,5-TRICHLOROBIPHENYL	0.012	0.011 U	0.013 U	0.018	0.001 U
2,3,5-TRICHLOROBIPHENYL	0.002 U	0.006 U	0.008 U	0.003 U	0.001 U
2,3',6-TRICHLOROBIPHENYL	0.218	0.18	0.178	0.084	0.072
2,3,6-TRICHLOROBIPHENYL	0.001 U	0.008 U	0.011 U	0.009 U	0.002 U
2,3'-DICHLOROBIPHENYL	0.263	0.188	0.197	0.16 U	0.099
2,3-DICHLOROBIPHENYL	0.031 U	0.006 U	0.008 U	0.025 U	0.006 U
2,4',5-TRICHLOROBIPHENYL	2.13	2.13	2.33	1.79	1.57
2,4',6-TRICHLOROBIPHENYL	0.829	0.723	0.757	0.238	0.203
2,4'-DICHLOROBIPHENYL	0.493	0.54	0.566	0.43	0.225
2,4-DICHLOROBIPHENYL	0.04	0.033 U	0.032	0.03 U	0.018 U
2,5-DICHLOROBIPHENYL	0.055	0.038	0.037	0.033 U	0.019 U
2,6-DICHLOROBIPHENYL	0.03 U	0.022	0.013 U	0.015 U	0.006 U
2-CHLOROBIPHENYL	0.073	0.057	0.064	0.044	0.029
3,3',4,4',5,5'-HEXACHLOROBIPHENYL	0.002 U	0.005 U	0.006 U	0.005 U	0.001 U
3,3',4,4',5-PENTACHLOROBIPHENYL	0.008 U	0.019	0.011 U	0.051 U	0.045
3,3',4,4'-TETRACHLOROBIPHENYL	0.268	0.369	0.411	0.837	0.645
3,3',4,5,5'-PENTACHLOROBIPHENYL	0.002 U	0.006	0.005	0.005 U	0.005
3,3',4,5'-TETRACHLOROBIPHENYL	0.024	0.028	0.03	0.087	0.054
3,3',4,5-TETRACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.003 U	0.002 U
3,3',4-TRICHLOROBIPHENYL	0.029	0.036	0.039	0.079	0.065
3,3',5,5'-TETRACHLOROBIPHENYL	0.001 U	0.003 U	0.004 U	0.003 U	0.002 U
3,3',5-TRICHLOROBIPHENYL	0 U	0.005 U	0.006 U	0.002 U	0.001 U
3,3'-DICHLOROBIPHENYL	0.113	0.132	0.169	0.362	0.454
3,4,4',5-TETRACHLOROBIPHENYL	0.008 U	0.012 U	0.013 U	0.014	0.013
3,4,4'-TRICHLOROBIPHENYL	0.884	1.1	1.23	1.48	1.2
3,4',5-TRICHLOROBIPHENYL	0.014	0.012 U	0.014	0.013 U	0.014
3,4,5-TRICHLOROBIPHENYL	0.002 U	0.006 U	0.007 U	0.002 U	0.002 U
3,4-DiCB & 3,4-DiCB (PCB12&PCB13)	0.113	0.098	0.119	0.22	0.155
3,5-DICHLOROBIPHENYL	0.004 U	0.005 U	0.007 U	0.022 U	0.006 U
3-CHLOROBIPHENYL	0.005 U	0.002 U	0.008 U	0.099	0.062
4,4'-DICHLOROBIPHENYL	0.672	0.652	0.705	0.959	0.792
4-CHLOROBIPHENYL	0.025	0.019	0.028	0.096	0.039
PentaCB-PCB86 & PCB87 & PCB97 & PCB109 & PCB119 & PCB125	1.94	2.62	2.52	3.62	2.54
TOTAL PCBs	**100**	**155**	**157**	**131**	**90.6**
TOC (%)	**1.2**	**2**	**2**	**3.3**	**2.9**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**8333**	**7750**	**7850**	**3970**	**3124**

TABLE B19: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PESTICIDE (µg/kg)	UPPER RIVER CHANNEL																	
	DMMU-1						DMMU-2a						DMMU-2b					
	CH-1	CH-2	CH-3	CH-4	CH-5	DMMU-1 COMP	CH-6	CH-7	CH-8	CH-9	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-13	CH-14	CH-15	DMMU-2b COMP
ALDRIN	4.4 U[1]	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA ENDOSULFAN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ALPHA-CHLORDANE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
BETA ENDOSULFAN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
CHLORDANE	88 U	87 U	130 U	100 U	120 U	95 U	120 U	110 U	110 U	120 U	120 U	120 U	120 U	110 U	120 U	120 U	120 U	120 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DIELDRIN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDOSULFAN SULFATE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN ALDEHYDE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
ENDRIN KETONE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
GAMMA BHC (LINDANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
GAMMA-CHLORDANE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
HEPTACHLOR	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
HEPTACHLOR EPOXIDE	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
METHOXYCHLOR	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
TOXAPHENE	88 U	87 U	130 U	100 U	120 U	95 U	120 U	110 U	110 U	120 U	120 U	120 U	120 U	110 U	120 U	120 U	120 U	120 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4.4 U	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**2.9**	4.4 U	6.3 U	**16**	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	**4**	4.4 U	6.3 U	5.1 U	6 U	4.8 U	6.1 U	5.8 U	5.3 U	6.3 U	5.8 U	5.8 U	6.1 U	5.7 U	5.8 U	6 U	5.8 U	6 U
∑DDT	**6.9**	**ND**	**ND**	**16**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**	**ND**
TOC (%)	**0.46**			**0.66**														
TOC-NORMALIZED ∑DDT CONCENTRATIONS (µg/kg-TOC)	**1500**			**2424**														

PESTICIDE (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
ALDRIN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA ENDOSULFAN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ALPHA-CHLORDANE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
BETA ENDOSULFAN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
CHLORDANE	40 U	56 U	55 U	49 U	54 U	51 U	250 U	250 U	260 U	240 U	230 U	240 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
DIELDRIN	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ENDOSULFAN SULFATE	3.5	2.8 U	2.8 U	1.8	2.5	3.4	12 U	13 U	13 U	12 U	12 U	12 U
ENDRIN	2 U	2.8 U	2.8 U	2.2	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
ENDRIN ALDEHYDE	2 U	2.8 U	2.8 U	1.8	2.7 U	3.4	20	13 U	13 U	12 U	12 U	12 U
ENDRIN KETONE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
GAMMA BHC (LINDANE)	2 U	2.8 U	2.8 U	1.7	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
GAMMA-CHLORDANE	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
HEPTACHLOR	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
HEPTACHLOR EPOXIDE	2 U	2.8 U	2.8 U	1.5	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
METHOXYCHLOR	2 U	2.8 U	2.8 U	2.4 U	2.7 U	2.6 U	12 U	13 U	13 U	12 U	12 U	12 U
TOXAPHENE	40 U	56 U	55 U	49 U	54 U	51 U	**R**	**R**	**R**	**R**	**R**	**R**
DDD (DICHLORODIPHENYLDICHLORETHANE)	**5.1**	**4**	2.8 U	**3**	**4.7**	**4.5**	12 U	13 U	13 U	12 U	**12**	12 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	2 U	**4.3**	2.8 U	**4.9**	**7.6**	**5.5**	12 U	13 U	**27**	12 U	**18**	12 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	2 U	2.8 U	2.8 U	**7.9**	2.7 U	2.6 U	12 U	13 U	13 U	12 U	**19**	12 U
∑DDT	**5.1**	**8.3**	**ND**	**15.8**	**12.3**	**10**	**ND**	**ND**	**27**	**ND**	**49**	**ND**
TOC (%)	**3.9**	**3.2**		**2.9**	**2.4**	**3.3**			**3**		**2.8**	
TOC-NORMALIZED ∑DDT CONCENTRATIONS (µg/kg-TOC)	**131**	**259**		**545**	**513**	**303**			**900**		**1750**	

[1] Not detected at the specified detection limit

[2] Rejected data (MS/MSD and LCS %REC < LCL, high potential of low bias)

TABLE B20: Bulk PAH data (sum of 16 USEPA Priority Pollutants) on Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments (RTI 2015)

PAH COMPOUND (µg/kg)	UPPER RIVER CHANNEL																							
	DMMU-1								DMMU-2a								DMMU-2b							
	CH-1	CH-2	CH-3	CH-3 CORE	CH-4	CH-5	CH-5 CORE	DMMU-1 COMP	CH-6	CH-7	CH-7 CORE	CH-8	CH-9	CH-9 CORE	CH-10	DMMU-2a COMP	CH-11	CH-12	CH-12 CORE	CH-13	CH-14	CH-15	CH-15 CORE	DMMU-2b COMP
2-METHYLNAPHTHALENE	11	27	53	220	68	35	87	29	40	30	59	36	33	52	27	28	35	24	78	35	39	37	56	30
ACENAPHTHENE	5.7	63	52	15	91	34	50	31	56	22	22	20	27	26	20	20	39	17	51	24	20	20	31	23
ACENAPHTHYLENE	4	6	26	6.9	39	20	22	16	25	19	19	20	27	18	14	18	24	15	32	14	16	21	22	19
ANTHRACENE	15	100	150	40	290	110	160	85	170	74	76	75	100	81	58	72	94	51	140	72	68	71	89	75
BENZO(A)ANTHRACENE	74	240	480	74	670	480	430	290	650	320	330	320	390	360	280	300	510	260	480	350	250	250	400	340
BENZO(A)PYRENE	79	310	550	65	650	570	450	350	790	400	400	400	480	450	350	390	750	360	580	510	340	300	500	490
BENZO(B)FLUORANTHENE	120	370	890	110	900	1100	820	580	1600	720	750	760	890	970	650	790	1400	640	1300	950	600	500	1100	960
BENZO(G,H,I)PERYLENE	66	220	270	36	260	290	170	130	410	200	150	210	250	160	200	160	450	200	200	270	160	140	200	230
BENZO(K)FLUORANTHENE	44	110	260	29	330	310	220	250	450	210	250	260	310	250	240	250	420	210	300	250	210	160	310	320
CHRYSENE	88	230	560	76	640	640	480	350	940	410	430	420	530	500	400	410	850	400	650	580	340	310	590	510
DIBENZ(A,H)ANTHRACENE	12	50	69	15	76	70	60	44	120	47	54	60	59	49	43	56	120	61	58	75	51	47	62	70
FLUORANTHENE	180	510	1100	210	1400	1300	1200	760	1900	810	900	870	1100	970	800	830	1700	830	1300	1200	670	630	1100	1000
FLUORENE	6.2	38	63	21	130	49	80	33	72	27	39	34	37	44	25	26	53	25	81	36	27	28	54	30
INDENO(1,2,3-C,D)PYRENE	53	180	250	36	250	37	190	140	390	190	180	200	210	150	170	160	430	180	210	270	150	130	210	220
NAPHTHALENE	8.8	40	50	140	70	35	67	24	44	29	52	33	28	43	24	26	50	28	93	31	38	31	53	32
PHENANTHRENE	82	370	670	150	1100	620	690	410	890	370	390	380	470	440	350	380	730	360	660	490	310	270	530	460
PYRENE	170	460	1000	160	1200	1100	970	640	1500	720	780	710	870	1100	700	710	1300	610	1500	920	570	520	1300	870
TOTAL PAHs	**1,008**	**3,297**	**6,440**	**1,184**	**8,096**	**6,765**	**6,059**	**4,133**	**10,007**	**4,568**	**4,822**	**4,772**	**5,778**	**5,611**	**4,324**	**4,598**	**8,920**	**4,247**	**7,635**	**6,042**	**3,820**	**3,428**	**6,551**	**5,649**
TOC (%)	0.46	0.19	2.4	0.59	0.66	2.3	2.9	1.2	2.2	1.7	2	1.6	2.3	1.8	2.1	2	2	1.8	2	1.9	1.8	1.8	1.8	2
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	219	1735	268	201	1227	294	209	344	455	269	241	298	251	312	206	230	446	236	382	318	212	190	364	282

PAH COMPOUND (µg/kg)	LAKE AREA											
	CLA-1						CLA-4					
	CLA1-1	CLA1-2	CLA1-3	CLA1-4	CLA1-5	CLA1 COMP	CLA4-1	CLA4-2	CLA4-3	CLA4-4	CLA4-5	CLA4 COMP
2-METHYLNAPHTHALENE	190	17	33	86	110	78	9.8	14	12	9.4	8.3	13
ACENAPHTHENE	360	21 U	34	140	150	120	18 U	19 U	19 U	18 U	18 U	18 U
ACENAPHTHYLENE	390	11	44	84	150	85	11	7.7	9.1	11	7.1	9.6
ANTHRACENE	930	21	88	480	320	250	16	14	18	19	17	22
BENZO(A)ANTHRACENE	1900	71	220	670	740	500	74	67	66	89	74	79
BENZO(A)PYRENE	2000	90	260	640	1000	640	85	67	79	95	83	91
BENZO(B)FLUORANTHENE	2400	120	320	790	1200	770	130	98	120	130	130	130
BENZO(G,H,I)PERYLENE	1200	84	200	420	720	440	100	67	71	80	79	68
BENZO(K)FLUORANTHENE	760	53	95	230	390	300	48	38	39	56	47	60
CHRYSENE	2000	73	220	620	740	540	73	60	78	90	84	81
DIBENZ(A,H)ANTHRACENE	350	15	57	110	170	110	38	18	25	26	22	19
FLUORANTHENE	3100	150	350	1300	1200	1000	150	120	140	160	150	160
FLUORENE	390	9.8	33	180	120	120	12	7.7	9.1	7	11	9.6
INDENO(1,2,3-C,D)PYRENE	1100	64	170	360	630	420	82	55	58	70	65	63
NAPHTHALENE	580	39	120	250	390	230	21	22	22	18	20	22
PHENANTHRENE	1800	60	180	900	630	550	47	45	49	54	53	65
PYRENE	2900	140	320	1100	1100	860	110	110	120	140	140	150
Total PAHs	**22,160**	**1,001**	**2,711**	**8,274**	**9,650**	**6,935**	**997**	**796**	**903**	**1,045**	**982**	**1,029**
TOC (%)	3.9	3.2	3.2	2.9	2.4	3.3	2.8	2.8	3	3	2.8	2.9
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	568	31.3	84.7	285	402	210	35.6	28.4	30.1	34.8	35.1	35.5

[1] Not detected at the specified detection limit

TABLE B21: PAH (34: 18 non-alkylated parent compounds and 16 groups of generic alkylated forms) pore water concentrations in Cleveland Harbor Upper Cuyahoga River Channel and Lake Erie sediments with calculated USEPA Toxic Units (RTI 2015)

PAH COMPOUND (µg/L)	UPPER RIVER CHANNEL						UPPER RIVER CHANNEL (DISCRETE CORE SAMPLES)											
	DMMU-1		DMMU-2a		DMMU-2b		CH-3		CH-5		CH-7		CH-9		CH-12		CH-15	
1-METHYLNAPHTHALENE	0.05 U[1]		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
2-METHYLNAPHTHALENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
ACENAPHTHENE	0.1 U		0.1 U		0.1 U		**0.24**	**0.004**	0.1 U		0.1 U		0.1 U		**0.1**	**0.002**	0.1 U	
ACENAPHTHYLENE	0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U		0.2 U	
ANTHRACENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
BENZO(A)ANTHRACENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	
BENZO(A)PYRENE	0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U		0.008 U	
BENZO(B,K)FLUORANTHENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	
BENZO(E)PYRENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	
BENZO(G,H,I)PERYLENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	
C1 - CHRYSENE	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	
C1 - FLUORANTHENE/PYRENE	0.01 U		0.01 U		0.01 U		**0.11**	**0.023**	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	
C1 - FLUORENE	0.02 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	
C1 - PHENANTHRENE/ANTHRACENE	0.02 U		0.02 U		0.02 U		**0.3**	**0.040**	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U	
C2 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	
C2 - FLUORENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
C2 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U	
C2 - PHENANTHRENE/ANTHRACENE	0.05 U		0.05 U		0.05 U		**1.66**	**0.519**	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
C3 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	
C3 - FLUORENE	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	
C3 - NAPHTHALENE	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	
C3 - PHENANTHRENE/ANTHRACENE	0.04 U		0.04 U		0.04 U		**1.33**	**1.059**	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U	
C4 - CHRYSENE	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	
C4 - NAPHTHALENE	0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U		0.15 U	
C4 - PHENANTHRENE/ANTHRACENE	0.02 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	
CHRYSENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	
DIBENZ(A,H)ANTHRACENE	0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U		0.002 U	
FLUORANTHENE	**0.09**	**0.013**	**0.09**	**0.013**	**0.09**	**0.013**	**0.05**	**0.007**	**0.07**	**0.010**	**0.05**	**0.007**	**0.06**	**0.008**	**0.06**	**0.008**	**0.05**	**0.007**
FLUORENE	0.04 U		0.04 U		0.04 U		**0.07**	**0.002**	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U	
INDENO(1,2,3-C,D)PYRENE	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	
NAPHTHALENE	**0.31**	**0.002**	0.1 U		0.1 U		**0.23**	**0.001**	**0.15**	**0.001**	0.1 U		0.1 U		**0.24**	**0.001**	**0.13**	**0.001**
PERYLENE	0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U		0.004 U	
PHENANTHRENE	**0.13**	**0.007**	0.1 U		0.1 U		**0.27**	**0.014**	0.1 U		0.1 U		0.1 U		**0.11**	**0.006**	0.1 U	
PYRENE	**0.07**	**0.007**	**0.07**	**0.007**	**0.07**	**0.007**	**0.09**	**0.009**	**0.1**	**0.010**	**0.11**	**0.011**	**0.13**	**0.013**	**0.12**	**0.012**	**0.12**	**0.012**
ΣTU	<0.1		<0.1		<0.1		1.7		<0.1		<0.1		<0.1		<0.1		<0.1	

PAH COMPOUND (µg/L)	LAKE AREA												PAH FCV (µg/L)
	CLA1-1		CLA1-2	CLA1-3		CLA1-4		CLA1-5		CLA1-COMP		CLA4-COMP	
1-METHYLNAPHTHALENE	0.05 U		0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	75.37
2-METHYLNAPHTHALENE	0.05 U		0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	72.16
ACENAPHTHENE	**2.47**	**0.044**	0.1 U	0.1 U		**0.24**	**0.004**	0.1 U		0.1 U		0.1 U	55.85
ACENAPHTHYLENE	**0.52**	**0.002**	0.2 U	0.2 U		0.2 U		0.2 U		0.2 U		0.2 U	306.9
ANTHRACENE	**0.39**	**0.019**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	20.73
BENZO(A)ANTHRACENE	**0.05**	**0.022**	0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	2.227
BENZO(A)PYRENE	0.008 U		0.008 U	0.008 U		0.008 U		0.008 U		0.008 U		0.008 U	0.9573
BENZO(B,K)FLUORANTHENE	0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.6415
BENZO(E)PYRENE	0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.9008
BENZO(G,H,I)PERYLENE	0.001 U		0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.4391
C1 - CHRYSENE	0.005 U		0.005 U	0.005 U		0.005 U		0.005 U		0.005 U		0.005 U	0.8557
C1 - FLUORANTHENE/PYRENE	**0.53**	**0.108**	0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	4.887
C1 - FLUORENE	**2.25**	**0.161**	0.02 U	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U	13.99
C1 - PHENANTHRENE/ANTHRACENE	**2.62**	**0.352**	0.02 U	0.02 U		**0.39**	**0.052**	0.02 U		**0.48**	**0.065**	0.02 U	7.436
C2 - CHRYSENE	0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.4827
C2 - FLUORENE	**3.09**	**0.582**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	5.305
C2 - NAPHTHALENE	**7.06**	**0.233**	0.15 U	0.15 U		**1.19**	**0.039**	0.15 U		**1.61**	**0.053**	0.15 U	30.24
C2 - PHENANTHRENE/ANTHRACENE	**5.18**	**1.619**	0.05 U	0.05 U		0.05 U		0.05 U		0.05 U		0.05 U	3.199
C3 - CHRYSENE	0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.1675
C3 - FLUORENE	**3.39**	**1.769**	0.06 U	0.06 U		0.06 U		0.06 U		0.06 U		0.06 U	1.916
C3 - NAPHTHALENE	**27.78**	**2.503**	0.05 U	0.05 U		**2.81**	**0.253**	0.05 U		**1.64**	**0.148**	0.05 U	11.1
C3 - PHENANTHRENE/ANTHRACENE	**4.27**	**3.400**	0.04 U	0.04 U		0.04 U		0.04 U		0.04 U		0.04 U	1.256
C4 - CHRYSENE	0.01 U		0.01 U	0.01 U		0.01 U		0.01 U		0.01 U		0.01 U	0.07062
C4 - NAPHTHALENE	**24.21**	**5.981**	0.15 U	0.15 U		**2.64**	**0.652**	0.15 U		0.15 U		0.15 U	4.048
C4 - PHENANTHRENE/ANTHRACENE	**2.81**	**5.023**	0.02 U	0.02 U		0.02 U		0.02 U		0.02 U		0.02 U	0.5594
CHRYSENE	**0.08**	**0.039**	0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	2.042
DIBENZ(A,H)ANTHRACENE	0.002 U		0.002 U	0.002 U		0.002 U		0.002 U		0.002 U		0.002 U	0.2825
FLUORANTHENE	**0.95**	**0.134**	0.01 U	**0.02**	**0.003**	**0.09**	**0.013**	**0.04**	**0.006**	**0.05**	**0.007**	0.01 U	7.109
FLUORENE	**1.48**	**0.038**	0.04 U	0.04 U		**0.09**	**0.002**	0.04 U		**0.07**	**0.002**	0.04 U	39.3
INDENO(1,2,3-C,D)PYRENE	0.001 U		0.001 U	0.001 U		0.001 U		0.001 U		0.001 U		0.001 U	0.275
NAPHTHALENE	**0.42**	**0.002**	0.1 U	0.1 U		0.1 U		0.1 U		**0.11**	**0.001**	0.1 U	193.5
PERYLENE	0.004 U		0.004 U	0.004 U		0.004 U		0.004 U		0.004 U		0.004 U	0.9008
PHENANTHRENE	**2.09**	**0.109**	0.1 U	0.1 U		**0.2**	**0.010**	0.1 U		**0.15**	**0.008**	0.1 U	19.13
PYRENE	**0.76**	**0.075**	0.01 U	**0.03**	**0.003**	**0.08**	**0.008**	**0.04**	**0.004**	**0.05**	**0.005**	0.01 U	10.11
ΣTU	22.2		<0.1	<0.1		1.0		<0.1		0.3		<0.1	

[1] Not detected at the specified detection limit

TABLE B22. Results of standard 10-day *Hyalella azteca* and *Chironomus dilutus* solid phase bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2015).

Test Species	Measurement Endpoint	Bioassay	Upper River Channel			Lake Area		Control
			DMMU-1	DMMU-2a	DMMU-2b	CLA-1	CLA-4	
H. azteca	**Mean Survival (%)**	**Initial**	92±8.4	**50±25.5**[1]	**58±13**[1]	98±4.5	94±13.4	98±4.5
		Follow-up[2]		92±8.4	86±11.4	94±5.5	92±8.4	90±10
C. dilutus	**Mean Survival (%)**	**Initial**	92±4.5	88±13	88±13	92±11	96±8.9	100
	Mean Growth (mass, mg DW)	**Initial**	2.638±0.580	1.448±0.283	0.798±0.040	1.864±0.158	1.849±0.376	1.986±0.185

[1] Lower survival was statistically significant.
[2] Bioassay re-run following removal of native worms from sediment samples.

TABLE B23. Results of standard 28-day *Lumbriculus variegatus* PCB bioaccumulation experiments on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2016).

AREA	MANAGEMENT UNIT/LAKE AREA	REPLICATE	TOTAL PCB CONCENTRATION IN TISSUE (µg/kg-tissue)	TOTAL PCB CONCENTRATION IN SEDIMENT (COMPOSITE SAMPLE) (µg/kg-sediment)
UPPER RIVER CHANNEL	DMMU-1	A	151	**100**
		B	132	
		C	134	
		D	143	
		E	205	
	MEAN		**153**	
	DMMU-2a	A	125	**156**
		B	189	
		C	136	
		D	168	
		E	200	
	MEAN		**164**	
	DMMU-2b	A	155	**157**
		B	137	
		C	140	
		D	186	
		E	288	
	MEAN		**181**	
LAKE	CLA-1	A	75.0	**131**
		B	97.4	
		C	83.8	
		D	109	
		E	120	
	MEAN		**97.0**	
	CLA-4	A	34.8	**90.6**
		B	34.9	
		C	31.4	
		D	30.7	
		E	38.1	
	MEAN		**34.0**	

TABLE B24. Results of standard 28-day *Lumbriculus variegatus* pesticides bioaccumulation experiments on Cleveland Harbor Upper Cuyahoga River Channel and open-lake area sediments (USAERDC 2016).

AREA	MANAGEMENT UNIT/LAKE AREA	PESTICIDE	CONCENTRATION IN TISSUE (µg/kg)					
			REPLICATE					MEAN
			A	B	C	D	E	
UPPER RIVER CHANNEL	DMMU-1	DDD	4.6U[1]	4.7U	3.8U	3.9U	4.4U	
		DDE	8.3 P[2]	**8.8**	**8.8**	**7.6**	**8.5**	8.4
		DDT	4.6U	4.7U	3.8U	3.9U	4.4U	
		ALPHA-CHLORDANE	2.6U	2.6U	2.1U	2.2U	2.4U	
		ALPHA-BHC	2.0U	2.0U	1.7U	1.7U	1.9U	
		METHOXYLCHLOR	2.6U	2.7U	2.2U	2.2U	2.5U	
		DIELDRIN	2.5U	2.5U	2.1U	2.1U	2.4U	
	DMMU-2a	DDD	3.3U	3.4U	3.5U	2.7U	4.1U	
		DDE	**7.4**	**6**	5.7 Pm[3]	6.0 P	8.3 P	6.7
		DDT	3.3U	3.4U	3.5U	2.7U	4.1U	
		ALPHA-CHLORDANE	1.9U	1.9U	2.0U	1.5U	17 P	4.5
		ALPHA-BHC	1.5U	1.5U	2.7 J[4]P	2.1 JP	2.7 JP	1.8
		METHOXYLCHLOR	1.9U	1.9U	29 P	7.5 P	8.8 P	9.4
		DIELDRIN	1.8U	1.8U	9.9 P	6.9 P	15 P	6.7
	DMMU-2b	DDD	3.4U	3.1U	3.2U	4.3U	3.1U	
		DDE	7.6 P	6.3 P	6.1 P	7.4 P	9.0 P	7.3
		DDT	3.4U	3.1U	3.2U	4.3U	3.1U	
		ALPHA-CHLORDANE	9.4 m	3.3 JP	**4.6**	**6.7**	6.1 m	6
		ALPHA-BHC	2.1 JP	2.2 JP	1.4U	2.5 JP	2 JP	1.9
		METHOXYLCHLOR	2.0U	**5**	3.1 J	**5.4**	42 P	11.3
		DIELDRIN	6.7 P	8.3 P	7.7 P	9.4 P	13 P	9
LAKE	CLA-1	DDD	5.3U	4.3U	4.1U	4.2U	3.5U	
		DDE	5.3U	**7**	**5.9**	**6.1**	**6.5**	6.4
		DDT	5.3U	4.3U	4.1U	4.2U	3.5U	
		ALPHA-CHLORDANE	2.9U	2.4U	2.3U	2.4U	2.0U	
		ALPHA-BHC	2.3U	1.9U	1.8U	1.8U	1.5U	
		METHOXYLCHLOR	3.0U	2.5U	2.3U	2.4U	2.0U	
		DIELDRIN	2.8U	2.3U	2.2U	2.3U	1.9U	
	CLA-4	DDD	5.2U	4.9U	3.8U	3.7U	3.8U	
		DDE	5.2U	4.9U	3.8U	3.7U	3.8U	
		DDT	5.2U	4.9U	3.8U	3.7U	3.8U	
		ALPHA-CHLORDANE	2.9U	2.7U	2.1U	2.1U	2.1U	
		ALPHA-BHC	2.3U	2.1U	1.7U	1.6U	1.7U	
		METHOXYLCHLOR	3.0U	2.8U	2.2U	2.1U	2.2U	
		DIELDRIN	2.8U	2.6U	2.1U	2.0U	2.0U	

[1] Not detected at the specified detection limit
[2] Second GC column RPD exceeds 40%
[3] Manual Integration used to determine area response
[4] Estimated value

TABLE B25: Metal SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

METAL (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALUMINUM	0.018	0.043	0.3	0.12	0.44	
ANTIMONY	0.001 U[1]	0.001 U	0.001 U	0.001 U	0.001 U	0.9
ARSENIC	0.001	0.001	0.018	0.035	0.047	0.34
BARIUM	0.021	0.017	0.25	0.25	0.28	2
BERYLLIUM	R[2]	0.001 U	0.001 U	0.001 U	0.001 U	
CADMIUM	0.001 U	0.001	0.001 U	0.001 U	0.001 U	0.0043
CALCIUM	37	32	52	74	80	
CHROMIUM, TOTAL	0.001	0.001	0.001	0.001	0.003	0.57
COBALT	0.001 U	0.001 U	0.001	0.001	0.002	0.22
COPPER	0.002	0.001	R	R	R	0.013
IRON	0.12 U	0.092	3.1	5.3	9.9	
LEAD	0.001 U	0.001 U	0.003	0.002	0.004	0.097
MAGNESIUM	9	8.7	11	15	16	
MANGANESE	0.002	0.001	1.9	2.8	2.5	
MERCURY	0	0	0	0 U	0 U	0.0014
NICKEL	0.002	0.002	0.006	0.006	0.006	0.47
POTASSIUM	1.4	1.3	4.9	6.1	7.5	
SELENIUM	0.003 U	0.003 U	0.003 U	0.002	0.003 U	
SILVER	R	0.001 U	0.001 U	0.001 U	0.001 U	
SODIUM	9.4	9.2	25	32	35	
THALLIUM	0.001 U	0.001 U	0.001 U	0.001 U	0.001 U	0.079
VANADIUM	0.001 U	0.001 U	0.001	0.001	0.002	0.15
ZINC	0.003	0.003	0.021	0.021	0.023	0.12

[1] Not detected at the specified detection limit.

[2] Strong method blank bias.

TABLE B26: Nutrient and cyanide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PARAMETER (mg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (mg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
CYANIDE	0.014	0.009	0.016	0.015	0.014	0.022
NITROGEN, AMMONIA	0.1	0.1	**5.7**	**8.7**	**19**	4.5
NITROGEN, TOTAL KJELDAHL (TKN)	6.9	0.95	5	8	14	
PHOSPHORUS, TOTAL (AS P)	0.011	0.008	0.19	0.28	0.32	1

TABLE B27: PCB SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PCB (µg/L)	LAKE WATER		UPPER RIVER CHANNEL		
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b
Aroclor 1016	0.041 U[1]	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1221	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Arcolor 1232	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1242	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1248	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1254	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1260	0.041 U	0.042 U	0.043 U	0.043 U	0.043 U
Aroclor 1262	0.051 U	0.053 U	0.053 U	0.054 U	0.054 U
Aroclor 1268	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U
TOTAL PCBs (SUM OF AROCLORS)	0 U	0 U	0 U	0 U	0 U

[1] Not detected at the specified detection limit.

TABLE B28: Pesticide SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PESTICIDE (µg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (µg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
ALDRIN	0.004 U[1]	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ALPHA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	**0.009**	
ALPHA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
BETA ENDOSULFAN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
CHLORDANE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	
DDD (DICHLORODIPHENYLDICHLORETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	0.004 U	0.004 U	0.004 U	0.004 U	**0.024**	1.1 [2]
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
DIELDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDOSULFAN SULFATE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN ALDEHYDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
ENDRIN KETONE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA BHC (LINDANE)	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
GAMMA-CHLORDANE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
HEPTACHLOR EPOXIDE	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
METHOXYCHLOR	0.004 U	0.004 U	0.004 U	0.004 U	0.004 U	
TOXAPHENE	0.1 U	0.11 U	0.11 U	0.11 U	0.11 U	

[1] Not detected at the specified detection limit.

[2] Federal criteria maximum concentration (CMC).

TABLE B29: PAH SET data on Cleveland Harbor Upper Cuyahoga River Channel sediments (RTI 2015)

PAH COMPOUND (µg/L)	LAKE WATER		UPPER RIVER CHANNEL			OMZM WATER QUALITY CRITERION (µg/L)
	CLA-1	CLA-4	DMMU-1	DMMU-2a	DMMU-2b	
2-METHYLNAPHTHALENE	0.15 U[1]	**0.08**	0.16 U	0.16 U	0.16 U	
ACENAPHTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
ACENAPHTHYLENE	0.15 U	**0.04**	0.16 U	0.16 U	0.16 U	
ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(A)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(A)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(B)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(G,H,I)PERYLENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
BENZO(K)FLUORANTHENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
CHRYSENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
DIBENZ(A,H)ANTHRACENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
FLUORANTHENE	0.15 U	0.15 U	**0.19**	**0.19**	**0.19**	3.7
FLUORENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
INDENO(1,2,3-C,D)PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	
NAPHTHALENE	0.15 U	**0.21**	0.16 U	0.16 U	0.16 U	
PHENANTHRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	31
PYRENE	0.15 U	0.15 U	0.16 U	0.16 U	0.16 U	42

[1] Not detected at the specified detection limit.

TABLE B30. Results of 48-hour *Ceriodaphnia dubia* and 96-hour *Pimephales promelas* elutriate bioassays (±1 standard deviation [SD] from the mean) on Cleveland Harbor Upper Cuyahoga River Channel sediments and lake water (USAERDC 2015).

Sample	Elutriate Concentration (%)	Test Species							
		C. dubia				*P. promelas*			
		Measurement Endpoint				Measurement Endpoint			
		Survival (%)	NOEC (%)	LC50 (%)	Survival (%), TRE[1]	Survival (%)	NOEC (%)	LC50 (%)	Survival (%), TRE[1]
DMMU-1	13	N/A	100	N/A	N/A	98±4	50	>100	N/A
	25	N/A			N/A	88±4			N/A
	50	92±11			N/A	92±8			N/A
	100	96±9			N/A	**80±23**[2]			N/A
DMMU-2a	13	N/A	50	>100	N/A	98±4	50	68	N/A
	25	84±9			N/A	100			N/A
	50	84±22			N/A	90±7			N/A
	100	**64±33**			100	**22±44**			93±6
DMMU-2b	13	N/A	100	N/A	N/A	96±9	50	75	N/A
	25	92±18			N/A	98±4			N/A
	50	100			N/A	88±13			N/A
	100	100			100	**22±26**			97±6
Control	N/A	100	N/A	N/A	N/A	98±4	N/A	N/A	N/A
Lake Site Water	N/A	96±9	N/A	N/A	N/A	100	N/A	N/A	N/A

[1]Survival following toxicity reduction evaluation (TRE) bioassay using zeolite-treated 100% elutriates to reduce ammonia concentrations; zeolite removed all acute toxicity observed in initial bioassay. Sediment elutriate data re-confirm no other contaminant cause of acute toxicity.
[2]Boldface denotes reduced values that are ≥10% or statistically significant from lake site water.

TABLE B31. Bulk sediment contaminant concentrations at open-lake reference areas offshore of Cleveland, Ohio (based on data from USACE 2013a, USACE 2015a, OEPA 2015d and OEPA 2015e).

CONTAMINANT	UNITS	REFERENCE SEDIMENT[1]			
		CLA-1 (REFERENCE)		LAKE ERIE	
		MINIMUM	MAXIMUM	MINIMUM	MAXIMUM
ALUMINUM	mg/kg	14,400	34,000	5,720	34,000
ANTIMONY	mg/kg	1.6	3.8	1.5	2.7
ARSENIC	mg/kg	7.5	15.7	4.77	76.9
BARIUM	mg/kg	105	150	47.7	188
BERYLLIUM	mg/kg	0.077	0.96	0.321	1.07
CADMIUM	mg/kg	1.5	4.66	0.728	2.88
CALCIUM	mg/kg	1,100	14,100	4,340	16,000
CHROMIUM, TOTAL	mg/kg	43.8	60.6	12.6	61
COBALT	mg/kg	11.9	18	6.08	17
COPPER	mg/kg	50	69.1	12.2	55
IRON	mg/kg	33,900	49,000	18,300	70,900
LEAD	mg/kg	53	108	15.7	73.5
MAGNESIUM	mg/kg	1,300	15,000	3,710	17,000
MANGANESE	mg/kg	528	981	401	1540
MERCURY	mg/kg	0.07	0.4	0.04	0.75
MOLYBDENUM	mg/kg	1.07	1.69	1.1	1.3
NICKEL	mg/kg	44.6	71	16.7	67
POTASSIUM	mg/kg	2,610	7,100	2,900	7,300
SELENIUM	mg/kg	1.36	1.76	1.51	1.57
SILVER	mg/kg	0.5	0.79	0.47	5.38
SODIUM	mg/kg	172	250	161	280
THALLIUM	mg/kg	0.46	0.53	0.45	0.48
TITANIUM	mg/kg	73	73	37	93
VANADIUM	mg/kg	30.6	79	32.9	78
ZINC	mg/kg	220	466	72.9	261
CYANIDE	mg/kg	0.8	1	0.89	0.91
NITROGEN, AMMONIA	mg/kg	104	420	60.4	3200
NITROGEN, TOTAL KJELDAHL (TKN)	mg/kg	1,850	5,400	840	52,000
PHOSPHORUS, TOTAL (AS P)	mg/kg	420	1280	44	1130
TOTAL OIL & GREASE	mg/kg	450	450	460	460
TOTAL ORGANIC CARBON (TOC)	%	2.4	3.2	0.19	4.4
ENDOSULFAN SULFATE	µg/kg	1.8	2.5		
ENDRIN	µg/kg	2.2	2.2		
ENDRIN ALDEHYDE	µg/kg	1.8	1.8	20	20
GAMMA BHC (LINDANE)	µg/kg	1.7	1.7		
HEPTACHLOR EPOXIDE	µg/kg	1.5	1.5		
TOTAL PAHs	µg/kg	1,003	27,230	193	33,399
TOC-NORMALIZED TOTAL PAHs	mg/kg-OC	31	939	7	1,336
TOTAL PCBs	µg/kg	58.1	236	9.36	400
TOC-NORMALIZED TOTAL PCBs	µg/kg-OC	2,003	8,138	248	25,000
∑DDT	µg/kg	7.55	17.6	7.11	49
TOC-NORMALIZED ∑DDT	µg/kg-OC	259	704	284	1,750

[1] Excludes all bottom core samples and samples that are potentially toxic to benthic organisms.

TABLE B32: Bulk grain size distribution on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER		
	DMMU-1	DMMU-2a	DMMU-2b
	302808 (COMP)	302809 (COMP)	302810 (COMP)
CLAY	11	12	11
CLAYPAN SOIL	5.7	5.9	5.6
MEDIUM CLAY	3.8	5.9	5.6
VERY FINE SILT	5.7	9.8	11
FINE SILT	27	29	28
MEDIUM SILT	11	12	11
COARSE SILT	35	25	27
TOTAL SILT/CLAY	**99**	**100**	**99**
TOTAL COARSE SAND	0	0	0

TABLE B33: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
NITROGEN, AMMONIA	270	380	450	240	320	290	280	340	210	190	250	290
PHOSPHORUS, TOTAL (AS P)	1,050	1,350	1,560	952	1,240	1,170	1,170	1,110	989	794	1,210	1,100
TOTAL ORGANIC CARBON (%)	2.7	3.5	3.3	2.2	3.9	2.9	2.7	2.9	2.3	2	2.6	2.8

TABLE B34: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ALUMINUM	10700	11200	10400	10100	9420	9630	9610	12000	11200	6190	14400	9770
ANTIMONY	2.45 U[1]	1.37 U	2.09 U	1.55 U	1.71 U	1.58 U	1.63 U	1.52 U	1.37 U	1.17 U	1.73 U	1.55 U
ARSENIC	19.4	16.2	19.8	15.5	16.6	16.5	16.9	15.9	16.2	11.7	18.3	15.2
BARIUM	89.9	73.2	97.2	72	79.2	75.2	76.9	78	73.2	51.4	95	92.7
BERYLLIUM	0.602	0.572	0.642	0.553	0.568	0.536	0.586	0.61	0.572	0.39	0.693	0.49
CADMIUM	1.44	1.41	1.62	1.26	1.8	1.24	1.16	1.21	1.41	0.857	1.54	1.21
CALCIUM	16000	14700	16700	14900	18500	14500	14900	14500	14700	12000	16100	44200
CHROMIUM, TOTAL	25.8	62.6	26.4	34.8	25.6	22.6	23	24.5	62.6	15.9	29.6	255
COBALT	12.5	10.9	12.9	10.7	10.6	10.9	11.4	10.2	10.9	7.94	11.8	9.14
COPPER	54.1	83.3	67.4	66.4	54.6	54.1	49.8	52.7	83.3	54.4	57.5	46.9
IRON	33400	29900	33600	29300	28600	29000	29900	29000	29900	21000	33500	45900
LEAD	55.2	48.4	62.4	47.9	54	51.3	48.9	46.9	48.4	37.4	54.4	37.9
MAGNESIUM	6940	6490	7180	6290	6210	6180	6320	6180	6490	4580	7120	14500
MANGANESE	910	661	1100	653	747	808	765	739	661	478	740	3660
MERCURY	0.12	0.133	0.163	0.098	0.196	0.116	0.167	0.115	0.133	0.085	0.121	0.124
NICKEL	34.8	35.8	35.9	30.5	30.6	30.7	31.5	30.6	35.8	25.1	33.3	26.1
POTASSIUM	2450 U	1790	2090 U	1550 U	1710 U	1580 U	1630 U	2260	1790	1170 U	2780	1550 U
SELENIUM	2.45 U	1.37 U	2.09 U	1.55 U	1.71 U	1.58 U	1.63 U	1.52 U	1.37 U	1.17 U	1.73 U	1.55 U
SILVER	0.245 U	0.151	0.228	0.161	0.199	0.177	0.194	0.159	0.151	0.124	0.196	0.159
SODIUM	6120 U	3420 U	5230 U	3860 U	4280 U	3940 U	4080 U	3790 U	3420 U	2930 U	4330 U	3870 U
STRONTIUM	37 U	32	38	32	37	31	32	34	32	24	39	53
TITANIUM	61 U	34 U	52 U	39 U	43 U	39 U	41 U	41	34 U	29 U	44	298
VANADIUM	61 U	34 U	52 U	39 U	43 U	39 U	41 U	38 U	34 U	29 U	43 U	193
ZINC	243	395	253	284	218	202	202	196	395	152	238	181

[1] Not detected at the specified detection limit

TABLE B35: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
AROCLOR 1016	36.1 U[1]	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1221	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1232	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1242	43	43.1 U	56.2	55.5	51.6	37.3	52.4	58	43.5	72.8	80.5	50.9
AROCLOR 1248	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	38.9 U	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1254	36.1 U	43.1 U	43.3 U	34.3 U	42.5 U	33.7 U	38.3 U	2,110	37.5 U	29.5 U	56.8 U	41.5 U
AROCLOR 1260	88.9	106	106	98.3	112	82.9	163	251	104	71.1	163	118
TOTAL PCBs	132	106	162	154	164	120	215	2419	148	144	244	169
TOC (%)	2.7	3.5	3.3	2.2	3.9	2.9	2.7	2.9	2.3	2	2.6	2.8
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	4,885	3,029	4,915	6,991	4,195	4,145	7,978	83,414	6,413	7,195	9,365	6,032

[1] Not detected at the specified detection limit

TABLE B36: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ALDRIN	7.2 U[1]	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ALPHA ENDOSULFAN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
BETA ENDOSULFAN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DIELDRIN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDOSULFAN SULFATE	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDRIN	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
ENDRIN ALDEHYDE	7.2 UJ	8.6 UJ	8.7 UJ	6.9 U	8.5 UJ	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 UJ
GAMMA BHC (LINDANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
HEPTACHLOR	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
HEPTACHLOR EPOXIDE	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
METHOXYCHLOR	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
MIREX	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	**9.2**	7.5 U	5.9 U	11.4 U	8.3 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**13.9**	**16.4**	**16.8**	**14.3**	**16**	**12.8**	7.7 U	7.8 U	**15.4**	5.9 U	11.4 U	**13.5**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	7.2 U	8.6 U	8.7 U	6.9 U	8.5 U	6.7 U	7.7 U	7.8 U	7.5 U	5.9 U	11.4 U	8.3 U
TOTAL DDT	**13.9**	**16.4**	**16.8**	**14.3**	**16**	**12.8**		**9.2**	**15.4**			**13.5**
TOC (%)	**2.7**	**3.5**	**3.3**	**2.2**	**3.9**	**2.9**	**2.7**	**2.9**	**2.3**	**2**	**2.6**	**2.8**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	**515**	**469**	**509**	**650**	**410**	**441**		**317**	**670**			**482**

[1] Not detected at the specified detection limit

TABLE B37: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
ACENAPHTHENE	0.18 U[1]	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ACENAPHTHYLENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ANTHRACENE	0.25	0.27	0.25	0.2	0.42	0.21	0.61	0.23	0.19 U	0.28	0.34	0.22
BENZO(A)ANTHRACENE	0.84	0.9	0.87	0.71	1.34	0.69	0.73	0.8	0.63	0.88	1.11	0.75
BENZO(A)PYRENE	0.77	0.95	0.89	0.82	1.2	0.95	0.9	0.83	0.82	1.12	1.42	0.69
BENZO(B)FLUORANTHENE	1.22	1.26	1.3	1.17	1.75	1.02	1.17	1.32	1.17	1.37	1.88	1.04
BENZO(G,H,I)PERYLENE	0.29	0.37	0.33	0.31	0.45	0.35	0.33	0.33	0.38	0.4	0.52	0.26
BENZO(K)FLUORANTHENE	0.57	0.81	0.69	0.61	0.92	0.71	0.83	0.58	0.71	0.8	1.12	0.63
CHRYSENE	1.25	1.32	1.29	1.06	1.86	1.09	1.11	1.22	0.95	1.2	1.66	1.17
DIBENZ(A,H)ANTHRACENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
FLUORANTHENE	2.2	2.25	2.17	1.68	3.37	1.81	1.77	1.99	1.41	2.21	2.74	1.9
FLUORENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.18	0.28 U	0.21 U
INDENO(1,2,3-C,D)PYRENE	0.3	0.37	0.33	0.32	0.45	0.34	0.35	0.33	0.39	0.44	0.55	0.27
NAPHTHALENE	0.18 U	0.22 U	0.22 U	0.31	0.21 U	0.17 U	1.9	0.41 U	0.073 U	0.51	0.42	0.21 U
PHENANTHRENE	1.17	1.28	1.2	1.02	2.3	0.98	1.15	1.16	0.82	1.37	1.61	1.06
PYRENE	1.84	2.01	1.8	1.37	3.32	1.48	1.42	1.65	1.15	1.78	2.22	1.61
TOTAL PAHs	**10.7**	**11.8**	**11.1**	**9.6**	**17.4**	**9.6**	**12.3**	**10.4**	**8.4**	**12.5**	**15.6**	**9.6**
TOTAL ORGANIC CARBON (%)	**2.7**	**3.5**	**3.3**	**2.2**	**3.9**	**2.9**	**2.7**	**2.9**	**2.3**	**2**	**2.6**	**2.8**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**396**	**337**	**337**	**435**	**446**	**332**	**454**	**360**	**367**	**627**	**600**	**343**

[1] **Not detected at the specified detection limit**

TABLE B38: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
1,1,1,2-TETRACHLOROETHANE	0.37 U[1]	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1,2,2-TETRACHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1,2-TRICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROETHENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,1-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,3-TRICHLOROBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,3-TRICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2,4-TRIMETHYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DIBROMO-3-CHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,2-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
1,3-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2,2-DICHLOROPROPANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2-CHLOROTOLUENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
2-HEXANONE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
4-CHLOROTOLUENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ACETONE	0.37 U	0.46 U	0.45 U	0.095	0.45 U	0.4 U	0.37 U	0.41 U	**0.092**	**0.14**	**0.089**	0.4 U
BENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOFORM	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
BROMOMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CARBON DISULFIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CARBON TETRACHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CHLOROFORM	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CIS-1,2-DICHLOROETHYLENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CIS-1,3-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
CYMENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DIBROMOCHLOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DIBROMOMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
DICHLORODIFLUOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ETHYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
ISOPROPYLBENZENE (CUMENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
M+P-XYLENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYL ETHYL KETONE (2-BUTANONE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
METHYLENE CHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
N-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
N-PROPYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
SEC-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
STYRENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
T-BUTYLBENZENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TETRACHLOROETHYLENE(PCE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TOLUENE	**8.61**	**11.9**	**15.3**	0.055 U	**6.68**	**9.09**	**1.11**	**5.57**	0.073 U	**0.066**	**0.056**	**12.1**
TRANS-1,2-DICHLOROETHENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRANS-1,3-DICHLOROPROPENE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROETHYLENE (TCE)	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
TRICHLOROFLUOROMETHANE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U
VINYL CHLORIDE	0.37 U	0.46 U	0.45 U	0.055 U	0.45 U	0.4 U	0.37 U	0.41 U	0.073 U	0.061 U	0.05 U	0.4 U

[1] **Not detected at the specified detection limit**

TABLE B39: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples) (OEPA 2013) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	200013	200016	F01A21	302810 (COMP)	F01W50	302581	F01S08	302809 (COMP)	302578	302580	F01A41	302808 (COMP)
1,2,4,5-TETRACHLOROBENZENE	0.18 U[1]	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
1,2,4-TRICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,2-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,3-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,3-DINITROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
1,4-DICHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
1,4-NAPHTHOQUINONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,3,4,6-TETRACHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4,5-TRICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4,6-TRICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DIMETHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,4-DINITROPHENOL	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
2,4-DINITROTOLUENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,6-DICHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2,6-DINITROTOLUENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-ACETYLAMINOFLUORENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-CHLORONAPHTHALENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-CHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-METHYLNAPHTHALENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.24	0.19 U	0.19 U	0.16	0.28 U	0.21 U
2-METHYLPHENOL (O-CRESOL)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-NITROANILINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-NITROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
2-PICOLINE (ALPHA-PICOLINE)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
3,3'-DICHLOROBENZIDINE	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
3-METHYLCHOLANTHRENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4,6-DINITRO-2-METHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 UJ	0.21 U	0.17 U	0.19 UJ	0.19 U	0.19 UJ	0.15 UJ	0.28 UJ	0.21 U
4-BROMOPHENYL PHENYL ETHER	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-CHLORO-3-METHYLPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-CHLOROPHENOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-METHYLPHENOL (P-CRESOL)	**6.07**	**8.21**	**8.18**	**0.23**	**4.54**	**2.82**	**0.41**	**2.53**	0.19 U	0.15 U	**0.85**	**7.47**
4-NITROANILINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
4-NITROPHENOL	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
ACETOPHENONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	0.9 U	1.1 U	1.1 U	0.9 U	1.1 U	0.8 U	1 U	1 U	0.9 U	0.7 U	1.4 U	1 U
BENZYL ALCOHOL	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BENZYL BUTYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROETHOXY) METHANE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-CHLOROISOPROPYL) ETHER	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
BIS(2-ETHYLHEXYL) PHTHALATE	**0.85**	**1.11**	**1.17**	**0.84**	**1.06**	**0.85**	**0.94**	**0.94**	**0.85**	**0.51**	**1.57**	**1.07**
DIBENZOFURAN	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIETHYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIMETHYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DI-N-BUTYL PHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DI-N-OCTYLPHTHALATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DINOSEB	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
DIPHENYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ETHYL METHANESULFONATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROBUTADIENE	0.18 U	0.22 U	0.22 U	0.055 U	0.21 U	0.17 U	0.19 U	0.41 U	0.073 U	0.061 U	0.05 U	0.21 U
HEXACHLOROCYCLOPENTADIENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROETHANE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
HEXACHLOROPROPENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
ISOPHORONE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
METHYL METHANESULFONATE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
NITROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSO-DI-N-BUTYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSODI-N-PROPYLAMINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOMORPHOLINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOPIPERIDINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
N-NITROSOPYRROLIDINE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
P-DIMETHYLAMINOAZOBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PENTACHLOROBENZENE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PENTACHLOROPHENOL	0.18 UJ	0.22 UJ	0.22 UJ	0.17 UJ	0.21 UJ	0.17 UJ	0.19 UJ	0.19 UJ	0.19 UJ	0.15 UJ	0.28 UJ	0.21 UJ
PHENACETIN	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
PHENOL	**0.18**	**0.52**	**0.35**	0.17 U	**0.5**	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	**0.39**
PRONAMIDE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U
SAFROLE	0.18 U	0.22 U	0.22 U	0.17 U	0.21 U	0.17 U	0.19 U	0.19 U	0.19 U	0.15 U	0.28 U	0.21 U

[1] Not detected at the specified detection limit

TABLE B40: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
NITROGEN, AMMONIA	100	43	170	220	1,100	680	210	320	91
PHOSPHORUS, TOTAL (AS P)	699	441	623	793	670	798	790	674	705
TOTAL ORGANIC CARBON (%)	3.8	1.2	1.4	1.5	1.3	2.0	1.8	1.7	1.6

TABLE B41: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ALUMINUM	5,590	3,500	4,970	7,860	7,900	10,100	9,040	10,300	5,860
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	14.4	9.2	10.5	15	15	17.4	16	17.6	12.8
BARIUM	62.4	31.1	44.5	69.6	67.1	85.7	75.3	83.3	59.7
BERYLLIUM	0.409	0.268	0.327	0.484	0.501	0.596	0.533	0.583	0.434
CADMIUM	0.725	0.387	0.502	0.641	0.657	0.992	0.732	0.669	0.594
CALCIUM	8,110	5,330	7,400	9,400	10,600	13,300	11,300	11,600	9,420
CHROMIUM, TOTAL	14	8.62	10.9	14.5	14.4	44.5	16.7	16.2	12.3
COBALT	7.9	4.95	5.86	8.78	8.8	10.2	9.33	10.6	7.59
COPPER	25.8	14.3	20.5	24.9	24.1	33.5	25.9	26.5	24.1
IRON	22,300	14,500	17,700	25,200	25,600	33,200	30,500	31,100	21,700
LEAD	28.4	16.5	23.2	26.7	25.6	34.8	30.4	28.4	27.1
MAGNESIUM	3,750	2,390	3,170	4,640	5,030	6,450	5,710	5,980	4,130
MANGANESE	666	312	428	679	650	652	640	787	561
MERCURY	0.095	0.037	0.064	0.079	0.066	0.132	0.079	0.109	0.077
NICKEL	19.4	12.9	15.2	21.5	21.9	27.7	24.2	26.3	19
POTASSIUM	800 U	800 U	800 U	800 U	800 U	1380	1270	1500	800 U
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.177	0.08 U	0.149	0.152	0.137	0.179	0.166	0.144	0.147
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	12 U	17	24	24	29	25	28	22
TITANIUM	20 U	20 U	25	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	138	92.7	112	131	127	246	151	138	127

[1] Not detected at the specified detection limit

TABLE B42: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	20 U	34	28.6	45.4	36.3	38.5	20 U	20 U	33.6
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	56.4	32	36.4	54.3	122	83.9	68.4	46.8	116
TOTAL PCBs	56.4	66	65	99.7	158	122	68.4	46.8	150
TOC (%)	3.8	1.2	1.4	1.5	1.3	2	1.8	1.7	1.6
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	1,484	5,500	4,643	6,647	12,177	6,120	3,800	2,753	9,350

[1] Not detected at the specified detection limit

TABLE B43: Bulk pesticide data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	17.8	12.5	19.8	18	18.3	21	19.3	14.3	19.4
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	21.3	14.4	22.3	22.4	16.2	22.1	34.3	16.8	24.7
TOTAL DDT	39.1	26.9	42.1	40.4	34.5	43.1	53.6	31.1	44.1
TOC (%)	3.8	1.2	1.4	1.5	1.3	2	1.8	1.7	1.6
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	1,029	2,242	3,007	2,693	2,654	2,155	2,978	1,829	2,756

[1] Not detected at the specified detection limit

TABLE B44: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
ACENAPHTHENE	0.72 U[1]	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
ACENAPHTHYLENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(A)ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(A)PYRENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(B)FLUORANTHENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	**0.74**	0.68 U	0.71 U	0.63 U
BENZO(G,H,I)PERYLENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
BENZO(K)FLUORANTHENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
CHRYSENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
DIBENZ(A,H)ANTHRACENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
DIBENZOFURAN	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
FLUORANTHENE	**0.95**	**0.57**	**1.04**	**1.05**	**0.66**	**1.17**	**0.8**	0.71 U	**0.92**
FLUORENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
INDENO(1,2,3-C,D)PYRENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
NAPHTHALENE	0.72 U	0.54 U	0.56 U	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
PHENANTHRENE	0.72 U	0.54 U	**0.61**	0.76 U	0.64 U	0.70 U	0.68 U	0.71 U	0.63 U
PYRENE	**0.79**	0.54 U	**0.86**	**0.86**	0.64 U	**0.91**	0.68 U	0.71 U	**0.77**
TOTAL PAHs	**0.95**	**0.57**	**1.65**	**1.05**	**0.66**	**1.91**	**0.8**		**0.92**
TOTAL ORGANIC CARBON (%)	**3.8**	**1.2**	**1.4**	**1.5**	**1.3**	**2**	**1.8**	**1.7**	**1.6**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	**25**	**48**	**118**	**70**	**51**	**96**	**44**		**58**

[1] Not detected at the specified detection limit

TABLE B45: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOCs (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
2-HEXANONE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ACETONE	0.05 U	0.05 U	0.05 U	**0.099**	**0.097**	0.2 U	0.2 U	0.05 U	**0.097**
BENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
BROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CARBON DISULFIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DIBROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
M+P-XYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
NAPHTHALENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
STYRENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	**3.11**	**0.35**	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U
VINYL CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B46: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in May) (OEPA 2014a) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER								
	DMMU-1			DMMU-2a		DMMU-2b			
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580	302581
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	R	R	2 U	2 U	2 U	R	R	R	R
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	**0.83**	0.4 U	**2.2**	**3.37**	**1.82**	**4.97**	**2.71**	**0.73**	**1.46**
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 UJ	2 UJ	2 U	2 U	2 U	2 UJ	2 UJ	2 UJ	2 UJ
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	R	R	0.4 U	0.4 U	0.4 U	R	R	R	R
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B47: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

INORGANIC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
NITROGEN, AMMONIA	390	900	26	450	980	320	280	630	420	540	380	440	510	330	680	330	370	470	390	320	740
PHOSPHORUS, TOTAL (AS P)	734	288	374	858	885	941	824	911	672	935	953	1,010	921	1,100	**2,620**	947	832	869	893	1,030	1070
TOTAL ORGANIC CARBON (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9

TABLE B48: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

METAL (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ALUMINUM	6,680	2,800	3,620	8,410	8,460	7,800	6,550	7,990	8,660	7,970	8,340	9,230	8,470	8,990	10,800	8,850	9,410	7,080	7,180	6,100	9,770
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	1.15	0.8 U	0.8 U	0.8 U	**8.48**	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	12.4	6.83	8.01	14.8	14.4	14.5	13.6	14.2	14.5	15.2	14.9	16.3	15.5	14.8	20.1	15.6	15.8	13.7	13.7	11.5	14.9
BARIUM	60.8	29.7	31.2	72.1	77.6	76.2	66.5	66.2	65.9	73.5	75	83.2	75.6	73.1	150	82.6	77	69.4	68.5	66.6	80.2
BERYLLIUM	0.404	0.225	0.321	0.53	0.515	0.503	0.423	0.553	0.496	0.483	0.49	0.556	0.543	0.517	0.674	0.56	0.569	0.447	0.465	0.46	0.584
CADMIUM	0.867	0.488	1.13	0.959	1.15	1.05	0.957	1.08	1.68	1.03	0.998	1.13	1.17	1.12	**16.9**	1.14	0.98	0.94	1.08	1.11	1.15
CALCIUM	10,100	4,600	6,940	13,300	13,400	10,200	10,700	14,500	12,600	11,000	14,700	15,100	15,300	14,000	18,900	14,100	13,400	13,600	13,400	14,800	14,500
CHROMIUM, TOTAL	15	7.84	7.83	17.9	19.2	18.5	15.9	20.9	16.2	18	18.5	21.7	19.1	22.8	**141**	20.3	18.9	17	17.7	18.4	20.7
COBALT	7.13	4.19	4.45	9.54	9.04	8.31	7.84	8.8	8.88	8.2	8.99	9.87	9.69	9.39	**13.4**	9.53	10.1	8.29	8.69	8.47	9.13
COPPER	35.4	13.3	22	38.3	38.7	36.1	35.4	37.9	35.6	35.2	44.8	45.3	40.6	39.6	**138**	40.2	36.7	39.7	44.9	42.1	41.9
IRON	22,600	11,900	13,900	27,300	25,400	24,300	23,400	26,400	27,200	26,400	27,300	30,400	28,100	29,300	74,300	29,400	30,100	25,800	25,600	22,800	27,800
LEAD	33.6	16.8	31.4	50.9	40.1	36.6	37.6	36.8	42.7	38.4	40.7	45.3	40.2	39.6	**240**	41.1	36.6	37	40.2	37.9	42.1
MAGNESIUM	4,560	2,030	2,530	5,760	5,360	4,740	4,540	5,460	5,600	5,090	5,780	6,230	5,950	6,200	5,820	6,200	6,230	5,400	5,530	5,250	5,970
MANGANESE	518	222	279	786	681	534	602	681	653	614	712	761	698	630	952	699	784	566	566	620	605
MERCURY	0.07	0.036	0.08 U	0.085	0.226	0.094	0.091	0.115	0.091	0.1	0.088	0.098	0.087	0.072	**0.224**	0.093	0.092	0.93	0.094	0.148	0.097
NICKEL	21.7	15.2	15.1	28	27.9	25.1	23.6	27.1	29.8	24.5	27.5	27.9	31.1	26.6	**80.2**	27.9	28.8	24.3	26.1	23.6	33
POTASSIUM	800 U	800 U	800 U	1,290	1,490	1,440	800 U	1,190	1,320	1,300	1,280	1,510	1,360	1,370	1,820	1,400	1,440	800 U	800 U	800 U	1,760
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.233	0.08 U	0.09	0.252	0.267	0.197	0.201	0.284	0.29	0.289	0.234	0.269	0.255	0.279	2.24	0.278	0.228	0.242	0.3	0.279	0.318
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	24	12 U	12 U	28	31	27	25	30	26	28	33	33	33	29	45	34	30	28	28	30	32
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	31	20 U	20 U	20 U	20 U	37	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	28	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	156	78.9	86.1	173	183	180	175	186	173	171	171	206	191	239	**865**	200	183	175	186	179	197

[1] Not detected at the specified detection limit

TABLE B49: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

AROCLOR (µg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	63.2	37.4	26.6	45.6	62.3	58.6	50	46.9	152	48.2	43.4	43	41	47.9	2,620	45.3	36.3	56.3	66.3	61.5	59.9
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	97.5	20 U	20 U	84.9	77.1	64.5	79.6	89.8	97.7	90.3	93.1	97.7	79.2	84.8	741	68.9	66.5	86.5	92.5	103	82.5
TOTAL PCBs	160.7	37.4	26.6	130.5	139.4	123.1	129.6	136.7	249.7	138.5	136.5	140.7	120.2	132.7	3,361	114.2	102.8	142.8	158.8	164.5	142.4
TOC (%)	2	1.2	1	2.2	2	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2	2	3.8	2.4	2.2	1.7	1.6	2	1.9
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	8,035	3,117	2,660	5,932	6,970	5,129	4,181	7,195	124,850	6,295	7,184	7,817	6,010	6,635	88,447	4,758	4,673	8,400	9,925	8,225	7,495

[1] Not detected at the specified detection limit

TABLE B50: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

PESTICIDE (µg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		302581		F01S08		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	11.7	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	8.6	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	7.4	4 U	4 U	4 U	4 U	4 U	6.4	4 U	8.8	4 U	4 U	8.5	4 U	7.2	8.1	4 U	7.2	7.2	4 U	4 U	7.4
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	15.5	5.8	6.6	13	17.6	21.5	14.5	21.1	13	15.6	15.4	22.8	18.3	17	4 U	18.2	16.3	18	13.7	18.5	17.5
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	8.1	4 U	7.5	4 U	4 U	24.4	8.5	13.8	4 U	10.7	7.2	22.9	8	7.4	4 U	11.4	6.8	8.8	4 U	12.6	4 U
TOTAL DDT	31	5.8	14.1	13	17.6	45.9	29.4	34.9	21.8	26.3	22.6	54.2	26.3	31.6	8.1	29.6	30.3	34	13.7	31.1	24.9
TOC (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	1,550	483	1,410	591	880	1,913	948	1,837	10,900	1,195	1,189	3,011	1,315	1,580	213	1,233	1,377	2,000	856	1,555	1,311

[1] Not detected at the specified detection limit

TABLE B51: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

PAH COMPOUND (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	1.75	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	2.94	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.74	0.4 U	0.4 U	0.4 U	0.69	0.4 U	0.72	1.55	1.43	0.67	0.87	0.79	0.92	0.4 U	4.3	0.4 U	0.4 U	1.76	1.4	0.72	0.77
BENZO(A)PYRENE	1	0.4 U	0.4 U	0.88	1.1	0.83	0.88	1.82	1.69	0.98	1.34	1.09	1.31	1.75	4.03	1.92	1.41	1.92	1.83	1	1.11
BENZO(B)FLUORANTHENE	1.14	0.4 U	0.4 U	1.08	1.36	1.11	0.98	2.11	2.07	1.1	1.76	1.43	1.41	2.25	4.43	2.54	1.92	2.34	2.21	1.22	1.32
BENZO(G,H,I)PERYLENE	0.93	0.4 U	0.4 U	0.84	1.12	0.86	0.82	1.36	1.24	0.96	1.34	1.03	1.3	1.42	1.41	1.46	0.4 U	1.42	1.39	0.98	1.11
BENZO(K)FLUORANTHENE	0.87	0.4 U	0.4 U	0.75	1.03	0.4 U	0.84	1.45	1.37	0.89	1.09	0.79	1.19	1.72	3.4	1.95	0.4 U	1.38	1.78	0.85	1.06
CHRYSENE	1.08	0.4 U	0.4 U	0.92	1.23	1.1	1.09	2.12	1.98	1.06	1.42	1.16	1.46	2.08	5.42	2.46	1.79	2.23	2.27	1.1	1.24
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	1.98	1.11	0.59	1.55	2.19	2.21	1.99	4.87	4.14	1.9	2.54	2.05	2.51	3.69	11.2	4.65	3.27	4.68	4.21	1.82	2.14
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	3.78	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.79	0.4 U	0.4 U	0.71	1	0.74	0.71	1.32	1.22	0.82	1.17	0.94	1.08	0.4 U	1.44	1.41	0.4 U	1.3	1.36	0.88	0.95
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	2.84	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	1.25	0.4 U	0.4 U	0.7	0.93	1.13	0.94	3.68	3.04	0.96	1.21	1.2	0.98	1.65	10.5	2.34	1.4	3.54	2.09	1.02	1.06
PYRENE	1.65	0.4 U	0.4 U	1.29	1.75	1.7	1.6	3.74	3.46	1.51	2.02	1.61	2.33	2.95	9.79	3.64	2.64	3.66	3.37	1.5	1.73
TOTAL PAHs	11.43	1.11	0.59	8.72	12.4	9.68	10.57	24.02	21.64	10.85	14.76	12.09	14.49	17.51	67.23	22.37	12.43	24.23	21.91	11.09	12.49
TOTAL ORGANIC CARBON (%)	2.0	1.2	1.0	2.2	2.0	2.4	3.1	1.9	0.2	2.2	1.9	1.8	2.0	2.0	3.8	2.4	2.2	1.7	1.6	2.0	1.9
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	572	93	59	396	620	403	341	1,264	10,820	493	777	672	725	876	1,769	932	565	1,425	1,369	555	657

[1] Not detected at the specified detection limit

TABLE B52: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

VOC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 UJ	0.2 U	0.2 U	0.04 UJ	0.04 U	0.2 U	0.04 UJ	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.208**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.116**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.2 U	0.2 U	0.2 U	**0.068**	0.2 U	0.2 U	**0.072**	**0.121**	0.2 U	**0.139**	0.2 U	**0.092**	**0.105**	**0.129**	0.2 U	0.05 U	**0.098**	**0.076**	**0.102**	**0.083**
BENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 UJ	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	**0.069**	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TOLUENE	**0.83**	**0.78**	**1.86**	**10**	0.04 U	**2.86**	**4.41**	0.04 UJ	0.04 U	**7.21**	0.04 U	**0.88**	0.04 U	0.04 U	0.04 U	**7.69**	0.04 U	**0.083**	0.04 U	**0.061**	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U	0.04 U	0.04 U	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.04 U	0.04 UJ	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B53: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (core samples collected in April) (OEPA 2014b) (highlighting indicates that sediment sample was not collected from the channel dredging prism; yellow is outside the DMMU boundary while orange is below the dredging depth).

SVOC (mg/kg)	UPPER RIVER																				
	DMMU-1							DMMU-2a						DMMU-2b							
	200013	200016	F01A21	F01A42		302582		F01W50		F01S08		302581		302578		302579		302580		F01A41	
				TOP	BOTTOM	TOP	BOTTOM	DISCRETE	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	**3.57**	0.4 U	**1.72**	**0.83**	0.4 U	**18.6**	**3.73**	0.4 U	0.4 U	**11.9**	0.4 U	**2.93**	0.4 U	**1.5**	0.4 U	**22.2**	0.4 U	**2.15**	0.4 U	**2.09**	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	**0.67**	0.4 U	0.4 U	0.4 U	**0.89**	**0.94**	**0.79**	**0.84**	**1.68**	**0.84**	**0.88**	**0.95**	**0.97**	**1.96**	**19.7**	**2.09**	**1.61**	**1.01**	**2.07**	**1.12**	**1.05**
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**1.69**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 U	0.4 UJ	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] **Not detected at the specified detection limit**

TABLE B54: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER					
	DMMU-1	DMMU-2a		DMMU-2b		
	F01A42	F01W50	F01S08	302578	302579	302580
NITROGEN, AMMONIA	230	120	190	190	220	270
PHOSPHORUS, TOTAL (AS P)	744	590	624	750	43.7	49.5
TOTAL ORGANIC CARBON (%)	2.2	1.9	1.9	2	1.5	2

TABLE B55: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER					
	DMMU-1	DMMU-2a		DMMU-2b		
	F01A42	F01W50	F01S08	302578	302579	302580
ALUMINUM	12,100	6,770	9,930	11,400	7,560	9,300
ANTIMONY	0.8 U[1]	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
ARSENIC	20.9	15.1	15.6	17	12.9	16.1
BARIUM	87	63.3	74.6	74.7	54.9	66
BERYLLIUM	0.687	0.485	0.594	0.622	0.473	0.556
CADMIUM	1.01	1.05	0.965	3.52	0.729	1.08
CALCIUM	14,400	23,100	13,000	14,500	11,700	14,600
CHROMIUM, TOTAL	21.1	22.3	19	52.5	15.4	18.6
COBALT	12.3	8.23	9.3	11	8.08	9.95
COPPER	36.5	35.1	32	40.4	24.4	36.7
IRON	36,100	26,800	29,700	33,000	24,800	30,400
LEAD	35.2	33.3	32.9	39.4	24.8	35.2
MAGNESIUM	7,210	6,120	5,890	6,970	5,450	6,460
MANGANESE	960	740	723	703	502	660
MERCURY	0.064	0.196	0.107	0.06	0.069	0.09
NICKEL	32.4	25.1	25.8	35	21.9	28
POTASSIUM	2,210	800 U	1,760	1,960	800 U	1,550
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SILVER	0.225	0.19	0.193	0.21	0.157	0.245
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	35	36	29	30	23	29
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	182	187	188	260	146	179

[1] Not detected at the specified detection limit

TABLE B56: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AR0CLOR (µg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	**42**	**49.2**	20 U	**61.2**	20 U	20 U	20 U	**38.9**
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	**248**	**81.2**	**126**	**115**	**65.5**	**103**	**67.6**	**144**
TOTAL PCBs	**290**	**130.4**	**126**	**176.2**	**65.5**	**103**	**67.6**	**182.9**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)			**5,727**	**9,274**	**3,447**	**5,150**	**4,507**	**9,145**

[1] Not detected at the specified detection limit

TABLE B57: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**10.3**	**13.1**	4 U	**10.1**	**14.4**	**11.2**	**15.5**	**11.8**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	**15.6**	4 U
TOTAL DDT	**10.3**	**13.1**		**10.1**	**14.4**	**11.2**	**31.1**	**11.8**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)				**532**	**758**	**560**	**2073**	**590**

[1] Not detected at the specified detection limit

TABLE B58: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.4 U	0.4 U	0.4 U	**1.24**	0.4 U	0.4 U	0.4 U	**0.78**
BENZO(A)PYRENE	0.4 U	0.4 U	0.4 U	**1.38**	**0.7**	**0.79**	**0.7**	**1**
BENZO(B)FLUORANTHENE	**0.95**	**1.05**	**0.93**	**1.57**	**0.97**	**1.16**	**1**	**1.32**
BENZO(G,H,I)PERYLENE	0.4 U	0.4 U	0.4 U	**1.12**	**0.7**	**0.79**	**0.72**	**0.98**
BENZO(K)FLUORANTHENE	0.4 U	0.4 U	0.4 U	**1.22**	0.4 U	0.4 U	0.4 U	**0.89**
CHRYSENE	**0.8**	**0.92**	**0.82**	**1.6**	**0.88**	**1**	**0.83**	**1.14**
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	**1.38**	**1.72**	**1.46**	**3.3**	**1.59**	**1.76**	**1.5**	**1.99**
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.4 U	0.4 U	0.4 U	**0.95**	0.4 U	0.4 U	0.4 U	**0.8**
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	0.4 U	0.4 U	0.4 U	**1.62**	0.4 U	0.4 U	**0.64**	**0.81**
PYRENE	**1.12**	**1.35**	**1.17**	**2.63**	**1.27**	**1.38**	**1.15**	**1.61**
TOTAL PAHs	**4.25**	**5.04**	**4.38**	**16.63**	**6.11**	**6.88**	**6.54**	**11.32**
TOTAL ORGANIC CARBON (%)			**2.2**	**1.9**	**1.9**	**2.0**	**1.5**	**2.0**
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)			**199**	**875**	**322**	**344**	**436**	**566**

[1] Not detected at the specified detection limit

TABLE B59: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01W50	F01S08	302578	302579	302580
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.2 U	**0.096**	0.05 U	**0.079**	**0.094**	0.05 U	**0.071**
BENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 UJ	0.2 UJ	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	**0.48**	**0.38**	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	**1.37**	**3.41**	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B60: Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in August) (OEPA 2014c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER							
	DMMU-1			DMMU-2a		DMMU-2b		
	200013	F01A21	F01A42	F01S08	F01W50	302578	302579	302580
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.89**	0.4 U	**0.82**
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B61: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER				
	DMMU-1			DMMU-2a	DMMU-2b
	200016	F01A21-EAST	302810 Composite 1	302809 Composite 2	302808 Composite 3
FINE CLAY	9.9	2	9.9	9.9	12
MEDIUM CLAY	4	2	7.9	6	4
COARSE CLAY	6	2	2	6	7.9
VERY FINE SILT	8	2	6	12	12
FINE SILT	9.9	4	7.9	32	34
MEDIUM SILT	16	10	18	12	12
COARSE SILT	4	2	6	23	19
COARSE SAND	42	76	42	0	0

TABLE B62. Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	F01S08	302581	302809 Composite 2	302578	302579	302580	302808 Composite 3
NITROGEN, AMMONIA	140	87	320	370	230	330	240	210	240	140	140	320	170
PHOSPHORUS, TOTAL (AS P)	637	566	1330	757	751	827	811	757	791	639	672	963	810
TOTAL ORGANIC CARBON	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2	2.4	2.2
pH	7.2	7.8	7.2	7.2	7.3	7.3	7.5	7.5	7.4	7.6	7.8	7.8	7.5

TABLE B63. Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METAL (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	F01S08	302581	302809 Composite 2	302578	302579	302580	302808 Composite 3
ALUMINUM	6,350	4,280	10,300	9,440	7,350	10,700	10,300	11,100	9,050	9,850	8,900	10,200	8,670
ARSENIC	14.5	10.2	18.6	18.5	16.8	19.1	16.9	19	17.2	15.5	13.1	16.6	14.9
BARIUM	49	35.2	94.9	73.4	62	79.4	76.1	76.9	72.3	70.8	61.9	78.5	68
BERYLLIUM	0.392	0.333	0.668	0.552	0.487	0.632	0.652	0.64	0.575	0.595	0.582	0.618	0.565
CADMIUM	0.641	0.679	2.02	0.925	0.825	1.07	1.09	1.01	0.952	1.42	0.93	1.23	1.19
CALCIUM	8,920	11,800	18,800	12,300	11,700	14,800	16,000	14,700	14,600	15,200	13,700	17,000	15,200
CHROMIUM, TOTAL	12.1	11.7	23	18.1	21.2	20.3	20.2	19.4	18.2	84.5	20.9	20.6	44.8
COBALT	8	5.82	11.3	9.7	8.84	10.6	10.5	10.5	10.4	10.1	8.93	10.2	10.1
COPPER	33.1	24.5	45.3	31.6	35.9	40.3	43.4	38.9	39.3	40.2	28.6	44	40.4
IRON	24,200	16,900	33,400	30,500	28,400	33,400	32,000	33,200	31,100	30,700	26,600	32,000	29,500
LEAD	42.7	22.1	39.1	33.3	30.4	41	35.4	35.6	35.1	38.5	28.1	36.7	34.1
MAGNESIUM	4,390	4,680	7,180	5,890	5,360	6,680	6,730	6,850	6,400	6,630	6,050	6,840	6,490
MANGANESE	609	370	947	811	802	813	729	830	753	658	552	676	630
MERCURY	0.066	0.045	0.096	0.066	0.085	0.09	0.089	0.079	0.088	0.089	0.067	0.065	0.079
NICKEL	22.2	27.3	35.3	26.3	26.4	28.8	31.6	29.9	29.2	28.8	25.3	30.6	29
POTASSIUM	800 U[1]	800 U	800 U	1,580	800 U	1,830	1,760	1,970	1,410	1,590	1,560	1,850	800 U
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	18	19	39	26	23	32	32	30	29	29	27	35	29
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	152	143	232	174	186	195	204	188	194	330	186	213	255

[1] **Not detected at the specified detection limit**

TABLE B64. Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AR0CLOR (µg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
AROCLOR 1016	20 U[1]	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1221	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1232	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1242	41.2	64	68.3	59.2	66	65.1	71.2	78.7	69.7	65.5	44.8	47.4	74.4
AROCLOR 1248	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1254	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
AROCLOR 1260	128	42.2	86	235	158	131	165	105	123	95.8	69.6	89.6	94.4
TOTAL PCBs	169	106	154	294	224	196	236	184	193	161	114	137	169
TOTAL ORGANIC CARBON (%)	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2.0	2.4	2.2
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	9,400	5,900	5,321	12,258	10,182	8,914	9,842	7,987	8,029	7,681	5,720	5,708	7,673

[1] Not detected at the specified detection limit

TABLE B65. Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
ALDRIN	4 U[1]	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ALPHA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
BETA ENDOSULFAN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DIELDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDOSULFAN SULFATE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
ENDRIN ALDEHYDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
GAMMA BHC (LINDANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEPTACHLOR EPOXIDE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
HEXACHLOROBENZENE	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
METHOXYCHLOR	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
MIREX	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U	4 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	8.2	10.2	14.6	11.5	10.2	14.4	10.7	14.5	12.1	10.3	11.9	13.5	12.5
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	4 U	10.8	9.4	4 U	4 U	4 U	4 U	4 U	13.7	4 U	6.4	7.2	12.7
TOTAL DDT	8.2	21	24	11.5	10.2	14.4	25.2	10.3	14.5	18.3	20.7	10.7	25.8
TOTAL ORGANIC CARBON (%)	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2.0	2.4	2.2
TOC-NORMALIZED CONCENTRATION (µg/kg-TOC)	456	1,167	828	479	464	655	1,050	448	604	871	1,035	446	1,173

[1] Not detected at the specified detection limit

TABLE B66. Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
ACENAPHTHENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ACENAPHTHYLENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZO(A)ANTHRACENE	0.4 U	**1.04**	0.4 U	0.4 U	**0.63**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.64**	0.4 U	0.4 U
BENZO(A)PYRENE	0.4 U	**1.12**	**0.83**	**0.75**	**0.84**	0.4 U	0.4 U	0.4 U	**0.86**	0.4 U	**0.81**	**0.72**	**0.74**
BENZO(B)FLUORANTHENE	**0.61**	**1.17**	**1**	**0.88**	**0.91**	0.4 U	**0.84**	**0.76**	**1**	**0.81**	**0.95**	**0.87**	**0.89**
BENZO(G,H,I)PERYLENE	0.4 U	**0.84**	**0.83**	**0.79**	**0.8**	0.4 U	0.4 U	0.4 U	**0.86**	0.4 U	**0.76**	**0.72**	0.4 U
BENZO(K)FLUORANTHENE	0.4 U	**0.93**	0.4 U	**0.68**	**0.69**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.69**	0.4 U	0.4 U
CHRYSENE	**0.64**	**1.19**	**0.92**	**0.88**	**0.86**	0.4 U	**0.83**	**0.86**	**0.84**	**0.82**	**0.93**	**0.9**	**0.87**
DIBENZ(A,H)ANTHRACENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
FLUORANTHENE	**1.21**	**2.88**	**1.68**	**1.68**	**1.68**	**1.13**	**1.39**	**1.47**	**1.52**	**1.39**	**1.72**	**1.78**	**1.53**
FLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
INDENO(1,2,3-C,D)PYRENE	0.4 U	**0.72**	0.4 U	0.4 U	**0.65**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.64**	0.4 U	0.4 U
NAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENANTHRENE	**0.67**	**1.88**	0.4 U	**0.9**	**0.83**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.7**	**0.77**	0.4 U
PYRENE	**0.95**	**2.19**	**1.38**	**1.32**	**1.3**	**0.87**	**1.1**	**1.15**	**1.18**	**1.15**	**1.32**	**1.38**	**1.19**
Total PAHs	4.08	13.96	6.64	7.88	9.19	2.00	4.16	4.24	6.26	4.17	9.16	7.14	5.22
TOTAL ORGANIC CARBON (%)	1.8	1.8	2.9	2.4	2.2	2.2	2.4	2.3	2.4	2.1	2.0	2.4	2.2
TOC-NORMALIZED CONCENTRATION (mg/kg-TOC)	227	776	229	328	418	91	173	184	261	199	458	298	237

[1] Not detected at the specified detection limit

TABLE B67. Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01W50	302581	F01S08	302809 Composite 2	302578	302579	302580	302808 Composite 3
1,1,1,2-TETRACHLOROETHANE	0.2 U[1]	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 UJ
1,1-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.2 U	0.05 U	0.2 U	0.05 U	0.05 U	0.05 U	0.2 U	0.2 U	0.2 U	**0.106**	**0.075**	**0.175**	**0.119**
BENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	**0.39**	0.04 U	**0.66**	0.04 U	0.04 U	0.04 U	**0.42**	**0.63**	**0.74**	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	**0.55**	0.04 U	**0.92**	**0.069**	**0.133**	0.04 U	**0.93**	**1**	**0.86**	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.2 U	0.04 U	0.2 U	0.04 U	0.04 U	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B68. Bulk SVOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface samples collected in October) (OEPA 2014d) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

SVOC (mg/kg)	UPPER RIVER												
	DMMU-1					DMMU-2a				DMMU-2b			
	200016	F01A21-EAST	F01A21-WEST	F01A42	302810 Composite 1	F01S08	302581	F01W50	302809 Composite 2	302578	302579	302580	302808 Composite 3
1,2,4,5-TETRACHLOROBENZENE	0.4 U[1]	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2,4-TRICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,2-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,3-DINITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-DICHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
1,4-NAPHTHOQUINONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,3,4,6-TETRACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,5-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4,6-TRICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DIMETHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,4-DINITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2,4-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DICHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2,6-DINITROTOLUENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-ACETYLAMINOFLUORENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLORONAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-CHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLNAPHTHALENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-METHYLPHENOL (O-CRESOL)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-NITROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
2-PICOLINE (ALPHA-PICOLINE)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3,3'-DICHLOROBENZIDINE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
3/4-METHYLPHENOL	0.4 U	0.4 U	**5.68**	0.4 U	**0.65**	**0.93**	**0.84**	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
3-METHYLCHOLANTHRENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4,6-DINITRO-2-METHYLPHENOL	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 UJ	0.4 UJ	0.4 UJ	0.4 UJ
4-BROMOPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLORO-3-METHYLPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
4-CHLOROPHENYL PHENYL ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROANILINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
4-NITROPHENOL	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
7,12-DIMETHYLBENZ(A)ANTHRACENE	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
ACETOPHENONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ANILINE (PHENYLAMINE, AMINOBENZENE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U	2 U
BENZYL ALCOHOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BENZYL BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHOXY) METHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROETHYL) ETHER (2-CHLOROETHYL ETHER)	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-CHLOROISOPROPYL) ETHER	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
BIS(2-ETHYLHEXYL) PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	**0.75**	0.4 U	0.4 U	0.4 U	**0.77**	0.4 U	**0.75**	0.4 U
DIBENZOFURAN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIMETHYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-BUTYL PHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DI-N-OCTYLPHTHALATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DINOSEB	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
DIPHENYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ETHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROBUTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROCYCLOPENTADIENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROETHANE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
HEXACHLOROPROPENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
ISOPHORONE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
METHYL METHANESULFONATE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
NITROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSO-DI-N-BUTYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSODI-N-PROPYLAMINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOMORPHOLINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPIPERIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
N-NITROSOPYRROLIDINE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
P-DIMETHYLAMINOAZOBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROBENZENE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PENTACHLOROPHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENACETIN	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
PHENOL	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 UJ	0.4 U	0.4 U	0.4 U	0.4 U
PRONAMIDE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U
SAFROLE	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U	0.4 U

[1] Not detected at the specified detection limit

TABLE B69: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PARTICLE SIZE (%)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
FINE CLAY	8	6.1	12	12	12	12
MEDIUM CLAY	2	2	6.1	8.1	4	6
COARSE CLAY	2	4	4	4	6.1	4
VERY FINE SILT	4	2	6.1	8.1	8.1	12
FINE SILT	6	6.1	28	32	34	38
MEDIUM SILT	14	12	10	14	14	14
COARSE SILT	4	4	33	21	21	13
SILT/CLAY	**40**	**36.2**	**99.2**	**99.2**	**99.2**	**99**
COARSE SAND	**60**	**64**	**0**	**0**	**0**	**0**

TABLE B70: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
NITROGEN, AMMONIA	100	130	210	170	190	610
PHOSPHORUS, TOTAL (AS P)	658	616	865	796	844	867
TOTAL ORGANIC CARBON (%)	2.2	2.2	2.5	1.7	1.8	2.3
pH (SU)	7.4	7.3	7.4	7.6	7.6	7.5

TABLE B71: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METALS (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ALUMINUM	4,660	4,830	7,850	7,710	7,420	9,110
ARSENIC	9.48	9.92	13.9	13.9	13.4	15.5
BARIUM	44.8	41.5	65.8	63.5	62.3	76.6
BERYLLIUM	0.281	0.291	0.447	0.419	0.379	0.472
CADMIUM	0.551	0.562	0.718	0.626	0.729	1.33
CALCIUM	6,550	7,140	9,910	9,820	9,800	11,400
CHROMIUM, TOTAL	9.79	10.1	15.1	13.6	13.9	26.3
COBALT	5.55	5.67	7.87	7.97	7.63	9.21
COPPER	19.5	21	26.6	23.3	25.4	33.1
IRON	16,200	16,300	24,000	24,100	23,600	27,800
LEAD	20.5	21.1	27.3	24.4	28.6	53.9
MAGNESIUM	2,930	2,960	4,630	4,750	4,610	5,470
MANGANESE	390	367	563	548	509	589
MERCURY	0.049	0.032	0.094	0.068	0.08	0.087
NICKEL	14.1	15.8	21	20.4	20.4	24.9
POTASSIUM	800 U[1]	800 U	800 U	800 U	800 U	1340
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	19	24	23	23	27
TITANIUM	20 U	20 U	20 U	20 U	20 U	20 U
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	105	111	146	131	141	222

[1] Not detected at the specified detection limit

TABLE B72: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302578	302580
AROCLOR 1016	29.7 U[1]	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1221	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1232	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1242	54.3	36	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1248	29.7 U	29 U	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1254	29.7 U	409	33.1 U	32.3 U	33.8 U	32.3 U
AROCLOR 1260	63	142	130	139	151	116
TOTAL PCBs	117	587	130	139	151	116
TOC (%)	2.2	2.2	2.5	1.7	1.8	2.3
TOC-NORMALIZED PCBs (µg/kg-TOC)	5,332	26,682	5,200	8,176	8,389	5,043

[1] Not detected at the specified detection limit

TABLE B73: Bulk pesticide data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ALDRIN	5.9 U[1]	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ALPHA ENDOSULFAN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
BETA ENDOSULFAN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DIELDRIN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDOSULFAN SULFATE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDRIN	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
ENDRIN ALDEHYDE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
GAMMA BHC (LINDANE)	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEPTACHLOR	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEPTACHLOR EPOXIDE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
HEXACHLOROBENZENE	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
METHOXYCHLOR	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
MIREX	5.9 U	5.8 U	6.6 U	6.5 U	6.5 U	6.8 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	5.9 U	**6.4**	6.6 U	6.5 U	6.5 U	6.8 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**16.2**	**11.7**	**20.6**	**19.8**	**19.6**	**19.4**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	**10.3**	4 U	**14.4**	**14.7**	**14.2**	**14.3**
TOTAL DDT	**26.5**	**18.1**	**35**	**34.5**	**33.8**	**33.7**
TOC (%)	**2.2**	**2.2**	**2.5**	**1.7**	**1.8**	**2.3**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)	**1,205**	**823**	**1,400**	**2,029**	**1,878**	**1,465**

[1] Not detected at the specified detection limit

TABLE B74: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (µg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
ACENAPHTHENE	58	55	29	24	27	35
ACENAPHTHYLENE	37	55	46	25	35	46
ANTHRACENE	220	160	120	86	88	110
BENZO(A)ANTHRACENE	600	460	400	350	320	390
BENZO(A)PYRENE	580	480	470	420	380	480
BENZO(B)FLUORANTHENE	780	590	700	690	570	760
BENZO(G,H,I)PERYLENE	650	530	570	610	520	690
BENZO(K)FLUORANTHENE	280	290	180	180	250	200
CHRYSENE	840	630	600	540	510	630
DIBENZ(A,H)ANTHRACENE	140	120	100	120	100	110
FLUORANTHENE	1,500	1,300	1,200	1,100	1,100	1,300
FLUORENE	95	74	45	37	40	59
INDENO(1,2,3-C,D)PYRENE	500	420	480	440	390	490
NAPHTHALENE	32	41	19	19	28	44
PHENANTHRENE	860	660	520	470	440	540
PYRENE	1,100	820	780	720	640	780
TOTAL PAHs	**8,272**	**6,685**	**6,259**	**5,831**	**5,438**	**6,664**
TOC (%)	**2.2**	**2.2**	**2.5**	**1.7**	**1.8**	**2.3**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**376**	**304**	**250**	**343**	**302**	**290**

TABLE B75: Bulk VOC data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in April) (OEPA 2015b) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

VOC (mg/kg)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21	200013	F01W50	302581	302580	302578
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1,2-TRICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROETHENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,1-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,2-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,3-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
1,4-DICHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2,2-DICHLOROPROPANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2-CHLOROTOLUENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
2-HEXANONE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
4-CHLOROTOLUENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ACETONE	0.05 U	0.2 U	0.2 U	**0.118**	**0.59**	0.2 U
BENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOCHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMODICHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOFORM	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
BROMOMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CARBON DISULFIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CARBON TETRACHLORIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROFORM	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CHLOROMETHANE	0.04 U	0.2 U	**0.37**	0.04 U	**0.32**	0.2 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DIBROMOCHLOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DIBROMOMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
DICHLORODIFLUOROMETHANE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ETHYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
HEXACHLOROBUTADIENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
M+P-XYLENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.29
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
METHYLENE CHLORIDE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
NAPHTHALENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
N-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
N-PROPYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
SEC-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.04 U	0.2 U	0.2 U
STYRENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
T-BUTYLBENZENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TOLUENE	0.04 U	**9.44**	**11.4**	**3.8**	**0.112**	**2.56**
TRANS-1,2-DICHLOROETHENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROETHANE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
TRICHLOROFLUOROMETHANE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U
VINYL CHLORIDE	0.04 U	0.2 U	0.2 U	0.2 U	0.04 U	0.2 U

[1] Not detected at the specified detection limit

TABLE B76: Bulk grain size data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in October) (OEPA 2015c)

PARTICLE SIZE (%)	UPPER RIVER					
	DMMU-1		DMMU-2a		DMMU-2b	
	F01A21 Grab	200013 Grab	F01W50 Grab	302581 Grab	302580 Grab	302578 Grab
FINE CLAY	6	12	14	8.1	8.1	15
MEDIUM CLAY	4	4.1	4	14	6.1	7.6
COARSE CLAY	2	6.1	6.1	4	4	7.6
VERY FINE SILT	4	2	10	8.1	8.1	15
FINE SILT	4	8.1	24	28	26	31
MEDIUM SILT	10	16	10	12	14	7.6
COARSE SILT	2	4.1	31	25	33	16
SILT/CLAY	32	52.4	99.1	99.2	99.3	99.8
COARSE SAND	68	47	0	0	0	0

TABLE B77: Bulk inorganics data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

INORGANIC (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
NITROGEN, AMMONIA	240	79	93	79	160	110	230	170	230	120	230	110
PHOSPHORUS, TOTAL (AS P)	659	539	515	638	812	960	819	799	774	615	931	753
TOTAL ORGANIC CARBON (%)	1.4	2.3	2.0	2.6	2.1	2.0	1.5	1.6	1.6	7.3	1.8	1.8
pH (SU)	7.3	7.7	7.2	7.4	7.4	7.5	7.4	7.4	7.4	1.8	7.4	7.5

TABLE B78: Bulk metals data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core composite samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

METALS (mg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
ALUMINUM	3,890	4,580	4,480	5,120	7,680	6,790	5,890	7,300	5,800	6,340	8,670	9,090
ARSENIC	8.7	9.86	10.6	10.6	14.9	12.7	12	13.2	12.3	13.1	15	15.2
BARIUM	36	34	36.1	45.7	61.1	52.6	51.5	54.8	47.8	49.5	63.3	63.3
BERYLLIUM	0.254	0.298	0.344	0.382	0.508	0.42	0.35	0.448	0.373	0.387	0.549	0.529
CADMIUM	0.455	0.55	0.627	0.741	0.749	0.785	0.673	0.752	0.633	0.711	0.93	0.896
CALCIUM	9,170	8,230	8,050	10,200	13,100	12,800	10,300	11,900	9,120	10,700	11,800	12,500
CHROMIUM, TOTAL	37.9	12.8	11.8	14.4	18.1	17.8	13.5	18.4	12.6	14.1	32.4	46.7
COBALT	5.18	7.08	6.26	6.58	10.8	9.5	6.88	9.31	6.91	7.74	9.47	9.92
COPPER	18.7	26.4	24.7	32	36	35.4	25.7	35.8	25.2	32.2	40.6	31.5
IRON	19,000	18,700	18,500	19,600	28,400	24,200	22,500	25,100	21,600	23,500	29,200	30,700
LEAD	17.7	20.9	27	27.5	29.2	33.6	25.3	33.8	26.6	28.9	39.3	30.9
MAGNESIUM	3,190	3,270	3,400	3,860	5,540	4,900	4,430	5,050	4,240	4,800	5,740	6,000
MANGANESE	2210	424	396	416	678	564	467	514	464	493	602	605
MERCURY												
NICKEL	16.2	24.3	18.2	22.9	29.6	27.1	19.7	26.5	19.3	21.6	31.9	26.9
POTASSIUM	975 U[1]	923 U	994 U	1390 U	1200 U	1130 U	555	1130	1150 U	1050 U	1250 U	1420 U
SELENIUM	.98 U	.92 U	.99 U	1.39 U	1.2 U	1.13 U	1110 U	1.03 U	1.15 U	1.05 U	1.25 U	1.42 U
SODIUM	2440 U	2310 U	2490 U	3470 U	2990 U	2830 U	1.11 U	2570 U	2870 U	2620 U	3130 U	3560 U
STRONTIUM	18	16	18	23	28	27	23	26	21	24	27	28
TITANIUM	35	23 U	25 U	35 U	30 U	28 U	28 U	26 U	29 U	26 U	31 U	36 U
VANADIUM	24	23 U	25 U	35 U	30 U	28 U	28 U	26 U	29 U	26 U	31 U	36 U
ZINC	101	140	116	141	141	160	128	154	137	240	290	158

[1] Not detected at the specified detection limit

TABLE B79: Bulk PCB data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

AROCLOR (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
AROCLOR 1016	27.7 U[1]	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1221	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1232	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1242	**32.4**	**31.3**	31 U	35 U	35 U	**36.5**	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1248	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1254	27.7 U	29.9 U	31 U	35 U	35 U	35.5 U	31.2 U	32.2 U	30.4 U	32.8 U	33.7 U	36 U
AROCLOR 1260	**194**	**36.4**	**129**	**56.4**	**56.1**	**60**	**81.8**	**79**	**76.9**	**71.4**	**64.5**	**51**
TOTAL PCBs	**226.4**	**67.7**	**129**	**56.4**	**56.1**	**96.5**	**81.8**	**79**	**76.9**	**71.4**	**64.5**	**51**
TOC (%)	**1.4**	**2.3**	**2.0**	**2.6**	**2.1**	**2.0**	**1.5**	**1.6**	**1.8**	**1.8**	**1.6**	**7.3**
TOC-NORMALIZED PCBs (µg/kg-TOC)	**16,171**	**2,943**	**6,450**	**2,169**	**2,671**	**4,825**	**5,453**	**4,938**	**4,272**	**3,967**	**4,031**	**699**

[1] Not detected at the specified detection limit

TABLE B80: Bulk pesticides data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PESTICIDE (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Core	F01A21 Grab	200013 Core	200013 Grab	F01W50 Core	F01W50 Grab	302581 Core	302581 Grab	302580 Core	302580 Grab	302578 Core	302578 Grab
ALDRIN	5.5 U[1]	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ALPHA ENDOSULFAN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
BETA ENDOSULFAN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DIELDRIN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDOSULFAN SULFATE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDRIN	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
ENDRIN ALDEHYDE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
GAMMA BHC (LINDANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEPTACHLOR	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEPTACHLOR EPOXIDE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
HEXACHLOROBENZENE	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
METHOXYCHLOR	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
MIREX	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	5.5 U	6.0 U	6.2 U	7.0 U	7.0 U	7.1 U	6.2 U	6.4 U	6.1 U	6.6 U	6.7 U	7.2 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	**8**	**6.3**	**8**	**7.6**	**11.1**	**10**	**11.6**	**11.1**	**12.2**	**10.3**	**11**	**10.7**
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	5.5 U	6.0 U	6.2 U	7.0 U	**8.4**	**8.9**	**7.3**	**7**	**7.5**	6.6 U	6.7 U	7.2 U
TOTAL DDT	**8**	**6.3**	**8**	**7.6**	**19.5**	**18.9**	**18.9**	**18.1**	**19.7**	**10.3**	**11**	**10.7**
TOC (%)	**1.4**	**2.3**	**2.0**	**2.6**	**2.1**	**2.0**	**1.5**	**1.6**	**1.6**	**7.3**	**1.8**	**1.8**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)	**571**	**274**	**400**	**292**	**929**	**945**	**1,260**	**1,131**	**1,231**	**141**	**611**	**594**

[1] Not detected at the specified detection limit

TABLE B81: Bulk PAH data on Cleveland Harbor Upper Cuyahoga River sediments (surface and core samples collected in October) (OEPA 2015c) (yellow highlight indicates that sediment sample was not collected from the channel dredging prism).

PAH COMPOUND (µg/kg)	UPPER RIVER											
	DMMU-1				DMMU-2a				DMMU-2b			
	F01A21 Cores	F01A21 Grabs	200013 Cores	200013 Grabs	F01W50 Cores	F01W50 Grabs	302581 Cores	302581 Grabs	302580 Cores	302580 Grabs	302578 Cores	302578 Grabs
ACENAPHTHENE	550 U[1]	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
ACENAPHTHYLENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
ANTHRACENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
BENZO(A)ANTHRACENE	550 U	600 U	610 U	870	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
BENZO(A)PYRENE	550 U	600 U	610 U	1,060	690 U	720	650	740	710	690	680 U	720 U
BENZO(B)FLUORANTHENE	590	600 U	720	1,270	840	890	920	1,000	910	870	870	720 U
BENZO(G,H,I)PERYLENE	550 U	600 U	610 U	1,060	690 U	730	710	790	700	680	710	720 U
BENZO(K)FLUORANTHENE	550 U	600 U	610 U	1,000	690 U	710 U	620 U	740	650	660 U	680 U	720 U
CHRYSENE	580	600 U	630	1,170	750	800	760	890	820	810	760	720 U
DIBENZ(A,H)ANTHRACENE	550 U	600 U	610 U	700 U	690 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
FLUORANTHENE	1,090	620	1,210	2,210	1,340	1,520	1,450	1,640	1,630	1,440	1,330	1,070
FLUORENE	550 U	600 U	610 U	700 U	690 U	710U	620 U	640 U	610 U	660 U	680 U	720 U
INDENO(1,2,3-C,D)PYRENE	550 U	600 U	610 U	1,120	691 U	760	720	830	740	720	720	720 U
NAPHTHALENE	550 U	600 U	610 U	700 U	692 U	710 U	620 U	640 U	610 U	660 U	680 U	720 U
PHENANTHRENE	550 U	600 U	610 U	1,070	693 U	710 U	620 U	640 U	760	660 U	680 U	720 U
PYRENE	860	600 U	880	1,640	1,070	1,190	1,140	1,180	1,290	1,170	1,030	760
TOTAL PAHs	**3,120**	**620**	**3,440**	**12,470**	**4,000**	**4,400**	**6,350**	**7,070**	**8,210**	**6,380**	**5,420**	**1,830**
TOC (%)	**1.4**	**2.3**	**2.0**	**2.6**	**2.1**	**2.0**	**1.5**	**1.6**	**1.6**	**7.3**	**1.8**	**1.8**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**223**	**27**	**172**	**480**	**190**	**220**	**423**	**442**	**513**	**87**	**301**	**102**

[1] Not detected at the specified detection limit

TABLE B82: Bulk grain size data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PARTICLE SIZE (%)	LAKE ERIE	
	Composite 1 LE-1-6	Composite 2 LE-7-11
FINE CLAY	22	33
MEDIUM CLAY	6.1	12
COARSE CLAY	6.1	6.2
VERY FINE SILT	6.1	14
FINE SILT	10	6.2
MEDIUM SILT	2	0
COARSE SILT	2	28
SILT/CLAY	**54.3**	**99.4**
COARSE SAND	**45**	**0**

TABLE B83: Bulk grain size data on CLA-1 vicinity sediments (core composite samples collected in June) (OEPA 2015e)

PARTICLE SIZE (%)	CLA-1 AND ADJACENT AREAS	
	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
FINE CLAY	30	29
MEDIUM CLAY	13	12
COARSE CLAY	6.4	8.2
VERY FINE SILT	15	16
FINE SILT	6.4	8.2
MEDIUM SILT	0	6.1
COARSE SILT	29	20
SILT/CLAY	**99.8**	**99.5**
COARSE SAND	**0**	**0**

TABLE B84: Bulk inorganics data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

INORGANIC (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
NITROGEN, AMMONIA	330	270	870	85	190	160	230	65	130	190	700	210
PHOSPHORUS, TOTAL (AS P)	991	952	913	622	1,130	800	1,020	743	116	881	936	814
TOTAL ORGANIC CARBON (%)	2.9	2.7	2.6	1.6	2.7	2.5	2.1	1.6	2.2	2.6	2.3	3.8
pH (SU)	7.5	7.6	7.4	7.5	7.5	7.7	7.8	7.4	7.7	7.5	7.6	7.5

TABLE B85: Bulk inorganics data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

INORGANIC (mg/kg)	CLA-1 & ADJACENT AREAS																	
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
NITROGEN, AMMONIA	300	350	230	270	230	230	310	220	180	210	150	690	260	470	110	180	170
PHOSPHORUS, TOTAL (AS P)	1,190	1,180	1,280	977	1,370	1,170	1,280	841	1,100	709	1,050	991	1,120	703	751	1,150	970
TOTAL ORGANIC CARBON (%)	2.9	3.2	2.9	2.7	3.1	2.7	3.1	2.0	2.8	1.9	3.0	2.2	3.0	1.2	3.2	3.3	5.9
pH (SU)	7.5	7.5	7.6	7.4	7.5	7.2	7.6	7.4	7.5	7.5	7.5	7.6	7.5	7.5	7.8	7.6	7.5

TABLE B86: Bulk metals data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

METALS (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ALUMINUM	18600	19600	20300	5720	18800	10200	13900	6250	9910	15600	10100	14300
ARSENIC	8.48	8.37	7.73	4.77	7.53	21.6	11.6	12	76.9	12.5	17.3	6.21
BARIUM	127	126	131	60.1	125	97	97.5	47.7	188	130	97.4	97.7
BERYLLIUM	1.01	0.973	1.07	0.321	1.01	0.687	0.782	0.441	0.75	0.87	0.647	0.744
CADMIUM	2.59	2.86	2.61	0.728	2.38	1.64	1.7	0.928	1.39	2.38	1.9	1.82
CALCIUM	12,200	14200	13200	4340	12000	8360	12000	4890	7730	11500	8950	9250
CHROMIUM, TOTAL	44.4	44.6	43.7	12.6	39.3	25.4	27.9	21.3	20.8	38	27	31.6
COBALT	12.4	11.6	12	6.08	11.5	9.56	10.1	6.36	12.6	10.9	10	9.18
COPPER	42.3	41.4	39.4	12.2	37.8	28	28	22	21.3	42.9	30.1	29.1
IRON	33400	34200	34600	18300	33000	37100	31500	31700	70900	40600	34900	25800
LEAD	57	56.8	50.8	15.7	46.6	51.9	32.6	39.6	38.9	58.8	44.2	38.2
MAGNESIUM	11600	12600	11800	3810	11000	6800	9100	3710	6330	9320	7260	8380
MANGANESE	557	531	530	401	531	701	664	402	1540	640	696	432
MERCURY	0.1	0.196	0.277	0.042	0.234	0.16	0.183	0.112	0.112	0.229	0.163	0.232
NICKEL	48	47.5	47.1	16.7	43.5	33.2	33.2	20.8	35.3	38.8	34.9	34.2
POTASSIUM	3410	3600	3590	800 U	3380	800 U[1]	800 U	800 U	800 U	2880	800 U	2660
SELENIUM	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U	0.8 U
SODIUM	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U	2000 U
STRONTIUM	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	33	12 U	12 U
TITANIUM	89	93	78	39	81	20 U	20 U	37	20 U	83	20 U	69
VANADIUM	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U	20 U
ZINC	227	231	218	72.9	204	183	153	126	175	259	191	158

[1] Not detected at the specified detection limit

TABLE B87: Bulk metals data on CLA-1 vicinity sediments (core Samples collected in June) (OEPA 2015e)

METALS (mg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
ALUMINUM	14,900	12,600	15,600	10,900	13,800	12,300	19,800	18,100	15,300	14,400	16,000	14,300	16,700	14,200	5840	17200	16700
ARSENIC	7.71	12.3	13.6	9.31	13.7	17.9	17.8	8.88	7.98	6.26	8.84	8.81	9.21	4.39	17.5	12.1	17
BARIUM	122	139	125	119	115	111	143	127	122	109	128	118	132	109	90.9	113	137
BERYLLIUM	0.827	0.826	0.86	0.908	0.842	0.823	1.05	0.888	0.921	0.779	0.917	0.858	0.948	0.706	0.37	0.897	0.843
CADMIUM	2.8	5.77	3.55	2.86	3.81	5.37	5.18	2.56	2.84	1.98	2.84	3.02	2.88	1.28	8.02	3.46	8.89
CALCIUM	13,600	11,800	14,100	12,500	13,100	11,400	12,600	8,630	11,900	8,690	12,100	8,930	11,900	7,710	7760	10500	11600
CHROMIUM, TOTAL	40.4	53.8	43.8	35.6	49.7	49	61.4	31.7	43.3	27.6	43.6	33.2	45.3	22.3	57.6	45.8	67.4
COBALT	11.8	11.7	11.9	9.49	11.3	11.1	13	11.9	12.4	11.8	12.6	11.8	12.6	12.3	7.53	10.6	10.8
COPPER	45.3	78.5	54.7	43.5	78.3	80.5	62.1	37	46	32.4	45.7	43.4	47.1	26	79.3	47.2	88.6
IRON	35,100	38,100	41,600	28,100	44,100	44,800	46,000	34,800	32,300	30,300	34,200	32,100	34,400	29,400	40400	40500	50400
LEAD	62.8	121	92.9	79.4	93.4	135	125	62.5	65.6	41.7	62.8	79.6	66.7	28.1	188	71.3	186
MAGNESIUM	11,400	9,480	10,700	8,940	10,200	8,630	10,800	9,670	11,100	9,500	11,200	9,210	11,300	9,100	2970	9050	8040
MANGANESE	759	722	981	663	763	782	793	601	586	510	708	573	689	488	628	678	722
MERCURY	0.332	0.377	0.379	0.266	0.354	0.311	0.44	0.186	0.314	0.118	0.324	0.186	0.324	0.072	0.327	0.311	0.299
NICKEL	45.5	51	44.6	41.3	48	43.2	54.6	37	50.7	37.1	48.8	39.1	50.2	34.7	56.5	41.4	67
POTASSIUM	1,510	1,255	2,670	800 U	1,350	1,075	3,710	3,130	1,605	1,270	1,470	1,230	1,720	2,320	800 U	3480	3190
SELENIUM	1.51	1.26	0.8 U[1]	0.8 U	1.35	1.08	0.8 U	0.8 U	1.605	1.27	1.47	1.23	1.72	1	0.8 U	0.8 U	0.8 U
SODIUM	3,780	3,140	2000 U	2000 U	3,380	2,690	2000 U	2000 U	4,015	3,170	3,680	3,080	4,295	2,505	2000 U	2000 U	2000 U
STRONTIUM	22.5	19	12 U	12 U	20.5	16	12 U	12 U	24	19	22	18.5	26	15	21	12 U	35
TITANIUM	76 U	63 U	73	20 UJ	68 U	54 U	107	67	80 U	63 U	74 U	62 U	86 U	50 U	46	102	92
VANADIUM	76 U	63 U	20 U	20 U	68 U	54 U	20 U	20 U	80 U	63 U	74 U	62 U	86 U	50 U	20 U	20 U	20 U
ZINC	284	534	406	270	436	555	667	265	247	188	258	320	261	143	879	396	867

[1] Not detected at the specified detection limit

TABLE B88: Bulk PCB data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

AROCLOR (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	Composite (LE-1-LE6)	LE-7	LE-8	LE-9	LE-10	LE-11	Composite (LE7-LE11)
AROCLOR 1016	82.6 U[1]	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1221	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1232	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1242	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1248	82.6 U	76.1 U	73.0 U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1254	82.6 U	**87.7**	**76.5**	31.3 U	**77.7**	51.0 U	59.1 U	**35.7**	45.8 U	54.6 U	48.2 U	65.8 U
AROCLOR 1260	82.6 U	76.1 U	76.1U	31.3 U	74.6 U	51.0 U	59.1 U	35.2 U	45.8 U	54.6 U	48.2 U	65.8 U
Total PCBs		**87.7**	**76.5**		**77.7**			**35.7**				
TOC (%)	**2.9**	**2.7**	**2.6**	**1.6**	**2.7**	**2.5**	**2.1**	**1.6**	**2.2**	**2.6**	**2.3**	**3.8**
TOC-NORMALIZED PCBs (µg/kg-TOC)		**3,248**	**2,942**		**2,878**			**2,231**				

[1] Not detected at the specified detection limit

TABLE B89: Bulk PCB data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

AROCLOR (µg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
AROCLOR 1016	77 U[1]	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1221	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1232	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1242	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1248	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	25.2 U	84.4 U	79.4 U
AROCLOR 1254	77 U	**248**	**58.1**	**88.8**	**260**	47 U	**181**	67.8	**88.7**	64 U	87 U	68 U	87 U	60 U	25.2 U	**104**	79.4 U
AROCLOR 1260	77 U	69 U	49.4 U	57.9 U	68 U	47 U	73.8 U	67.8	85 U	64 U	87 U	68 U	87 U	60 U	**37.6**	84.4 U	79.4 U
TOTAL PCBs		**248**	**58.1**	**88.8**	**260**		**181**		**88.7**						**37.6**	**104**	
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**	**3.3**	**5.9**
TOC-NORMALIZED PCBs (µg/kg-TOC)		**7,750**	**2,003**	**3,289**	**8,387**		**5,839**		**3,168**						**1,175**	**3,152**	

[1] Not detected at the specified detection limit

TABLE B90: Bulk pesticides data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PESTICIDE (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ALDRIN	16.5 U[1]	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
ALPHA ENDOSULFAN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
BETA ENDOSULFAN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DIELDRIN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ENDOSULFAN SULFATE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
ENDRIN	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
ENDRIN ALDEHYDE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
GAMMA BHC (LINDANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
HEPTACHLOR	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
HEPTACHLOR EPOXIDE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
HEXACHLOROBENZENE	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
METHOXYCHLOR	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
MIREX	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2U	11.8 U	7.0 U	9.2 U	10.9 U	9.6U	13.2 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	16.5 U	15.2 U	14.6 U	6.3 U	14.9 U	10.2 U	11.8 U	7.0 U	9.2 U	10.9 U	9.6 U	13.2 U
TOTAL DDT												
TOC (%)	2.9	2.7	2.6	1.6	2.7	2.5	2.1	1.6	2.2	2.6	2.3	3.8
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)												

[1] Not detected at the specified detection limit

TABLE B91: Bulk pesticides data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

PESTICIDE (µg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
ALDRIN	15.4 U[1]	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ALPHA BHC (ALPHA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ALPHA ENDOSULFAN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
BETA BHC (BETA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
BETA ENDOSULFAN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DIELDRIN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDOSULFAN SULFATE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDRIN	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
ENDRIN ALDEHYDE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
GAMMA BHC (LINDANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEPTACHLOR	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEPTACHLOR EPOXIDE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
HEXACHLOROBENZENE	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
METHOXYCHLOR	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
MIREX	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDD (DICHLORODIPHENYLDICHLORETHANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDE (DICHLORODIPHENYLDICHLORETHYLENE)	15.4 U	**18.3**	9.9 U	11.6 U	13.7 U	9.4 U	**32.9**	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
DDT (DICHLORODIPHENYLTRICHLOROETHANE)	15.4 U	13.8 U	9.9 U	11.6 U	13.7 U	9.4 U	14.8 U	13.6 U	17 U	12.8 U	17.3 U	13.6 U	17.3 U	12.0 U	5 U	16.9 U	15.9 U
TOTAL DDT		**18.3**					**32.9**										
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**	**3.3**	**5.9**
TOC-NORMALIZED TOTAL DDT (µg/kg-TOC)		**572**					**1,061**										

[1] Not detected at the specified detection limit

TABLE B92: Bulk PAH data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

PAH COMPOUND (µg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
ACENAPHTHENE	6.8 U[1]	10	11	9	13	180	13	610	59	380	160	12
ACENAPHTHYLENE	10	15	11	19	18	300	15	220	130	800	290	16
ANTHRACENE	21	25	29	43	27	620	33	1,000	200	1,500	430	27
BENZO(A)ANTHRACENE	59	74	83	120	110	1,400	85	1,600	470	3,600	1,100	81
BENZO(A)PYRENE	79	100	100	150	130	1,800	110	1,700	550	3,900	1,300	100
BENZO(B)FLUORANTHENE	110	150	180	190	210	1,800	160	1,800	610	4,300	1,300	170
BENZO(G,H,I)PERYLENE	82	90	81	94	120	1,300	88	1,200	410	2,900	940	99
BENZO(K)FLUORANTHENE	47	38	34	46	52	780	44	710	230	1,800	540	52
CHRYSENE	92	100	110	130	130	1,500	110	1,500	600	3,700	1,000	110
DIBENZ(A,H)ANTHRACENE	17	25	28	21	32	320	23	290	120	750	230	27
FLUORANTHENE	120	140	160	160	190	1,900	170	2,500	630	4,500	1,600	150
FLUORENE	9.3 U	14	16	12	19	180	20	310	73	380	150	17
INDENO(1,2,3-C,D)PYRENE	64	74	75	86	100	1,100	76	1,100	370	2,600	860	80
NAPHTHALENE	23	27	29	21	33	440	28	310	130	920	310	26
PHENANTHRENE	57	62	72	66	78	950	78	1,500	330	2,200	830	67
PYRENE	130	160	190	190	230	1,600	190	2,000	570	3,700	1,300	180
TOTAL PAHs	**911**	**1,104**	**1,209**	**1,357**	**1,492**	**16,170**	**1,243**	**18,350**	**5,482**	**37,930**	**12,340**	**1,214**
TOC (%)	**2.9**	**2.7**	**2.6**	**1.6**	**2.7**	**2.5**	**2.1**	**1.6**	**2.2**	**2.6**	**2.3**	**3.8**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**31**	**41**	**47**	**85**	**55**	**647**	**59**	**1,147**	**249**	**1,459**	**537**	**32**

[1] Not detected at the specified detection limit

TABLE B93: Bulk PAH data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

PAH COMPOUND (µg/kg)	CLA-1 AND ADJACENT AREAS																	
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S		TOP COPE SAMPLE	BOTTOM CORE SAMPLE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	DISCRETE		
ACENAPHTHENE	110	690	600	2,500	970	570	530	160	17	17	17	42	17	6	6,200	8,100	510	5,600
ACENAPHTHYLENE	54	310	470	790	2,700	730	160	85	17	22	20	57	9.1 U[1]	7	1,200	1,200	290	760
ANTHRACENE	200	740	1,200	5,700	9,800	1,600	710	160	32	43	43	120	22	18	7,400	9,200	1,200	5,900
BENZO(A)ANTHRACENE	280	1,500	2,200	7,800	49,000	3,400	1,100	320	97	110	95	310	74	56	7,900	7,700	2,600	5,800
BENZO(A)PYRENE	300	1,300	2,300	5,400	36,000	3,900	950	320	120	120	130	330	80	62	5,500	4,700	3,100	4,100
BENZO(B)FLUORANTHENE	360	1,500	2,500	6,400	43,000	4,200	1,100	460	190	200	190	410	150	120	6,500	5,300	3,300	5,200
BENZO(G,H,I)PERYLENE	230	1,000	1,800	3,600	19,000	2,800	700	330	120	130	130	260	97	69	3,500	2,700	2,200	2,500
BENZO(K)FLUORANTHENE	160	640	1,000	2,400	16,000	1,300	420	160	57	73	68	160	40	36	2,400	1,700	1,300	1,600
CHRYSENE	330	1,500	2,300	6,700	48,000	3,400	1,300	390	130	110	130	350	64	57	7,900	7,600	2,800	6,100
DIBENZ(A,H)ANTHRACENE	44	260	450	880	3,800	660	190	100	8.4 U	6.2 U	8.3 U	76	8.8 U	5.5 U	1,100	720	430	650
FLUORANTHENE	590	2,600	3,600	18,000	64,000	5,500	2,500	650	190	200	170	420	170	120	18,000	21,000	3,200	14,000
FLUORENE	120	470	680	3,300	1,100	510	230	84	17	26	19	60	19	6.6 U	7,300	9,400	590	5,400
INDENO(1,2,3-C,D)PYRENE	200	870	1,400	3,100	18,000	2,600	580	290	100	110	110	220	83	63	2,900	2,200	2,000	2,100
NAPHTHALENE	180	750	780	2,200	14,000	1,300	410	160	38	50	39	140	86	19	1,600	1,200	610	1,200
PHENANTHRENE	480	2,500	2,900	21,000	5,600	3,700	2,300	480	89	120	97	280	84	49	30,000	36,000	3,000	22,000
PYRENE	600	2,000	3,500	13,000	72,000	4,000	2,200	520	200	190	200	470	140	97	15,000	16,000	3,000	14,000
TOTAL PAHs	**4,238**	**18,630**	**27,680**	**102,770**	**402,970**	**40,170**	**15,380**	**4,669**	**1,414**	**1,521**	**1,458**	**3,705**	**1,126**	**780**	**124,400**	**134,720**	**30,130**	**96,910**
TOC (%)	**2.9**	**3.2**	**2.9**	**2.7**	**3.1**	**2.7**	**3.1**	**2.0**	**2.8**	**1.9**	**3.0**	**2.2**	**3.0**	**1.2**	**3.2**		**3.3**	**5.9**
TOC-NORMALIZED PAHs (mg/kg-TOC)	**146**	**582**	**954**	**3,806**	**12,999**	**1,488**	**496**	**233**	**51**	**80**	**49**	**168**	**38**	**65**	**3,888**		**913**	**1,643**

[1] Not detected at the specified detection limit

TABLE B94: Bulk VOC data on Lake Erie sediments (surface samples collected in May) (OEPA 2015d)

VOC (mg/kg)	LAKE ERIE											
	LE-1	LE-2	LE-3	LE-4	LE-6	LE-COMP-1 (LE 1-6)	LE-7	LE-8	LE-9	LE-10	LE-11	LE-COMP-2 (LE 7-11)
1,1,1,2-TETRACHLOROETHANE	0.04 U[1]	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2,2-TETRACHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1,2-TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,1-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,3-TRICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2,4-TRIMETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMO-3-CHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DIBROMOETHANE (ETHYLENE DIBROMIDE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3,5-TRIMETHYLBENZENE (MESITYLENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,3-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
1,4-DICHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2,2-DICHLOROPROPANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
2-HEXANONE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
4-CHLOROTOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ACETONE	0.172	**0.184**	0.05 U	0.05 U	**0.168**	0.05 U	0.05 U	**0.096**	0.05 U	0.05 U	0.05 U	**0.16**
BENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMODICHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
BROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON DISULFIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CARBON TETRACHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROFORM	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,2-DICHLOROETHYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
CIS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOCHLOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DIBROMOMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
DICHLORODIFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ETHYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
HEXACHLOROBUTADIENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
ISOPROPYLBENZENE (CUMENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
M+P-XYLENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ETHYL KETONE (2-BUTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
METHYLENE CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
NAPHTHALENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
N-PROPYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
O-XYLENE (1,2-DIMETHYLBENZENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
P-CYMENE (P-ISOPROPYLTOLUENE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
SEC-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
STYRENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
T-BUTYLBENZENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TETRACHLOROETHYLENE(PCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TOLUENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,2-DICHLOROETHENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRANS-1,3-DICHLOROPROPENE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROETHYLENE (TCE)	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
TRICHLOROFLUOROMETHANE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U
VINYL CHLORIDE	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U	0.04 U

[1] Not detected at the specified detection limit

TABLE B95: Bulk VOC data on CLA-1 vicinity sediments (core samples collected in June) (OEPA 2015e)

VOC (mg/kg)	CLA-1 AND ADJACENT AREAS																
	CLA 1-0		CLA 1-0.5E		CLA 1-1.5E		CLA 1-0.5W		CLA 1-1.5W		CLA 1-1N		CLA1-2N		CLA1-1S	TOP CORE COMPOSITE	BOTTOM CORE COMPOSITE
	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP	BOTTOM	TOP		
4-CHLOROTOLUENE	ND[1]	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.139**	**0.144**
ACETONE	ND	ND	ND	**0.156**	ND	**0.163**	**0.18**	**0.223**	ND	ND	ND	ND	**0.13**	ND	**0.156**	ND	ND
CHLOROMETHANE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
METHYL ETHYL KETONE (2-BUTANONE)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.055**	ND	ND
N-BUTYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.07**	ND	ND
SEC-BUTYLBENZENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	**0.058**	ND	ND
TOLUENE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

[1] Not detected at the specified detection limit

TABLE B96: Results of 10-day *H. azteca* bioassay on Cleveland Harbor Upper Cuyahoga River and lake sediments (OEPA 2015f)

MEASUREMENT ENDPOINT	UPPER RIVER (SURFACE GRAB AND CORE COMPOSITE SAMPLES, APRIL)							LAKE ERIE (SURFACE GRAB AND CORE SAMPLES, MAY AND JUNE)					
	LAB CONTROL	DMMU-1		DMMU-2a		DMMU-2b		LAB CONTROL	LAKE ERIE (SURFACE GRAB COMPOSITE SAMPLES)		LAB CONTROL	CLA-1 AND ADJACENT (CORE COMPOSITE SAMPLES)	
		F01A21	200013	F01W50	302581	302580	302578		LE 1-LE-6	LE 7-LE-11		TOP	BOTTOM
MEAN SURVIVAL (%)	86	40	38	36	16	26	24	100	100	100	100	100	100

TABLE B97: *L. variegatus tissue* PCB data generated from 28-day bioaccumulation testing on Cleveland Harbor Upper Cuyahoga River and Lake sediments (OEPA 2015f)

PCB CONGENER (µg/kg)	UPPER RIVER (SURFACE GRAB AND CORE COMPOSITE SAMPLES, APRIL)						LAKE ERIE (SURFACE GRAB AND CORE SAMPLES, MAY AND JUNE)			
	DMMU-1		DMMU-2a		DMMU-2b		SURFACE GRAB COMPOSITE SAMPLES		CLA-1 AND ADJACENT CORE COMPOSITE SAMPLES	
	F01A21	200013	F01W50	302581	302580	302578	LE 1-LE-6	LE 7-LE-11	TOP	BOTTOM
PCB209	0.16	0.21	0.067	0 U	0 U	0.15	0.41	0.16	0.23	0.25
PCB206	0.28	0.26	0.21	0.19	0.13	0.23	0.21	0.12	0.16	0.18
PCB194	1.2	0.93	1.1	1	0.65	1	0.21	0.14	0.13	0.094
PCB207	0.033	0.025	0.031	0 U	0.026	0.038	0.03	0.031	0.024	0.024
PCB196	0.58	0.44	0.57	0.55	0.33	0.52	0.11	0.053	0.07	0.059
PCB195	0.64	0.48	0.59	0.52	0.34	0.56	0.12	0.084	0.1	0.057
PCB170	3.3	2.7	3.1	2.8	1.8	2.8	0.39	0.26	0.4	0.31
PCB197	0.048	0.046	0.068	0.029	0.019	0.06	0.016	0.015	0.011	0.011
PCB171	1	0.89	1.1	0.89	0.52	0.98	0.12	0.085	0.14	0.13
PCB128	1.1	1.3	1.2	0.82	0.63	1.1	0.3	0.17	0.43	0.43
PCB208	0.086	0.062	0.069	0.053	0.042	0.076	0.11	0.074	0.091	0.13
PCB199	2.1	1.7	1.9	1.7	1	2	0.51	0.44	0.55	0.42
PCB198	2.1	1.7	1.9	1.7	1	2	0.51	0.44	0.55	0.42
PCB172	0.77	0.51	0.63	0.54	0.36	0.6	0.088	0.058	0.076	0.055
PCB200	0.21	0.17	0.19	0.19	0.099	0.21	0.038	0.037	0.045	0.032
PCB201	0.21	0.15	0.17	0.12	0.1	0.21	0.048	0.044	0.059	0.039
PCB177	2.4	2.3	2.6	2.3	1.4	2.4	0.33	0.29	0.34	0.32
PCB175	0.14	0.13	0.19	0.11	0.083	0.16	0.016	0.015	0.018	0.013
PCB174	4.8	4.2	4.8	3.8	2.6	4.2	0.4	0.25	0.4	0.37
PCB173	1	0.89	1.1	0.89	0.52	0.98	0.12	0.085	0.14	0.13
PCB130	0.36	0.43	0.44	0.26	0.27	0.36	0.15	0.1	0.2	0.18
PCB129	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB176	0.62	0.57	0.68	0.51	0.29	0.62	0.075	0.056	0.084	0.06
PCB132	2.9	3.2	3.5	3.1	2.3	2.7	0.56	0.36	0.87	0.81
PCB131	0.077	0.11	0.13	0.059	0 U[1]	0.091	0.019	0.013	0.036	0.033
PCB82	0.43	0.55	0.39	0.27	0.23	0.37	0.2	0.12	0.37	0.25
PCB202	0.32	0.25	0.34	0.21	0.17	0.33	0.12	0.086	0.095	0.11
PCB178	0.93	0.89	1.1	0.85	0.48	0.99	0.14	0.12	0.16	0.13
PCB133	0.16	0.18	0.23	0.082	0.12	0.17	0.043	0.038	0.052	0.045
PCB179	2.4	2.2	2.7	2.3	1.4	2.4	0.27	0.22	0.31	0.29
PCB135	8.8	9.5	10	7.4	5.1	10	1	0.65	1.9	1.8
PCB134	0.54	0.72	0.8	0.6	0.41	0.56	0.097	0.07	0.16	0.16
PCB83	1.9	3.1	2	1.2	1.3	1.9	0.9	0.49	1.8	1.4
PCB136	1.8	2	2.4	2.1	1.5	2	0.18	0.17	0.41	0.41
PCB84	0.8	1.2	0.82	0.71	0.91	0.77	0.32	0.16	0.67	0.6
PCB40	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB203	1.1	0.77	0.9	0.8	0.49	0.95	0.29	0.21	0.26	0.22
PCB180	7.1	5.3	5.9	6.2	3.8	5.2	0.57	0.22	0.4	0.35
PCB204	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB183	3.6	2.8	3.3	2.9	1.7	3	0.33	0.2	0.39	0.36
PCB182	0 U	0 U	0 U	0.041	0.051	0 U	0 U	0.005	0 U	0.013
PCB181	0.024	0.032	0.035	0 U	0 U	0.021	0 U	0.007	0.006	0 U
PCB137	0.15	0.22	0.13	0.086	0.1	0.15	0.058	0.032	0.052	0.05
PCB138	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB184	0 U	0 U	0 U	0 U	0 U	0.007	0.004	0 U	0 U	0 U
PCB140	0.064	0.13	0.11	0 U	0 U	0.079	0.031	0.014	0.055	0.052
PCB139	0.064	0.13	0.11	0 U	0 U	0.079	0.031	0.014	0.055	0.052
PCB85	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB187	13	14	15	11	6.9	15	1.7	1.2	2.4	2.2
PCB185	3.6	2.8	3.3	2.9	1.7	3	0.33	0.2	0.39	0.36
PCB146	2.2	1.9	2	1.4	1.2	1.8	0.39	0.29	0.57	0.46
PCB141	4.1	2.8	3.1	2.5	1.8	2.4	0.19	0.084	0.19	0.18
PCB188	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB186	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB149	14	17	19	15	10	16	1.8	1.2	3.5	3.4
PCB148	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB147	14	17	19	15	10	16	1.8	1.2	3.5	3.4
PCB144	0.66	0.65	0.91	0.77	0.43	0.72	0.08	0.045	0.15	0.15
PCB143	0.54	0.72	0.8	0.6	0.41	0.56	0.097	0.07	0.16	0.16
PCB142	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB97	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB90	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB87	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB86	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB150	0 U	0 U	0 U	0 U	0 U	0.007	0 U	0 U	0 U	0 U
PCB145	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB91	0.55	0.84	0.61	0.37	0.52	0.58	0.2	0.14	0.48	0.43
PCB89	0.041	0.078	0.044	0 U	0 U	0.047	0.018	0.01	0.041	0.016
PCB88	0.55	0.84	0.61	0.37	0.52	0.58	0.2	0.14	0.48	0.43
PCB98	0.12	0.22	0.17	0.13	0.085	0.15	0.051	0.029	0.12	0.096
PCB42	0.58	0.9	0.61	0.46	0.63	0.51	0.099	0.074	0.21	0.11
PCB41	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB151	8.8	9.5	10	7.4	5.1	10	1	0.65	1.9	1.8
PCB92	0.81	1.2	1	0.76	0.61	0.95	0.31	0.2	0.62	0.47
PCB152	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB94	0.014	0.023	0 U	0 U	0 U	0.026	0 U	0 U	0.015	0 U
PCB93	0.027	0.034	0.1	0.09	0.078	0.034	0 U	0.008	0.033	0.028
PCB44	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB43	0.098	0.15	0.13	0.08	0.19	0.1	0.017	0.007	0.038	0.023
PCB96	0.02	0.036	0.024	0 U	0 U	0.023	0 U	0.006	0.014	0 U
PCB46	0.14	0.19	0.17	0.13	0.25	0.14	0.023	0.017	0.058	0.037
PCB45	0.46	0.71	0.57	0.41	0.85	0.45	0.056	0.04	0.16	0.11
PCB16	0.27	0.27	0.22	0.15	0.39	0.25	0.04	0.023	0.084	0.056
PCB153	13	13	14	11	7.8	11	1.6	1.1	2.5	2.1
PCB154	0 U	0.083	0.11	0 U	0 U	0.059	0.009	0.03	0.044	0.037
PCB99	1.9	3.1	2	1.2	1.3	1.9	0.9	0.49	1.8	1.4
PCB155	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB100	0.027	0.034	0.1	0.09	0.078	0.034	0 U	0.008	0.033	0.028
PCB47	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB101	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB103	0.021	0.027	0 U	0 U	0 U	0.036	0 U	0 U	0.03	0.025
PCB102	0.12	0.22	0.17	0.13	0.085	0.15	0.051	0.029	0.12	0.096
PCB49	1.5	2.2	1.5	1.4	2.1	1.2	0.21	0.15	0.61	0.35
PCB48	0.39	0.55	0.42	0.33	0.57	0.31	0.053	0.047	0.15	0.067
PCB104	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB51	0.46	0.71	0.57	0.41	0.85	0.45	0.056	0.04	0.16	0.11
PCB50	0.38	0.58	0.39	0.47	0.61	0.34	0.054	0.036	0.15	0.12
PCB17	0.34	0.42	0.3	0.23	0.66	0.33	0.049	0.024	0.12	0.081
PCB52	3.2	4.8	3.4	3.3	4.5	2.7	0.54	0.35	1.7	1.1
PCB53	0.38	0.58	0.39	0.47	0.61	0.34	0.054	0.036	0.15	0.12
PCB18	0.68	0.79	0.59	0.63	1.3	0.63	0.11	0.054	0.24	0.15
PCB54	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB19	0.13	0.13	0.086	0.082	0.19	0.12	0 U	0.008	0.033	0.03
PCB4	0.11	0.12	0.09	0 U	0.19	0.11	0.021	0 U	0.021	0.021
PCB205	0.072	0.09	0.09	0.061	0 U	0.088	0.02	0.018	0.016	0.011
PCB189	0.1	0.09	0.091	0.065	0.041	0.094	0.021	0.015	0.02	0.021
PCB191	0.17	0.15	0.22	0.12	0.072	0.17	0.017	0.007	0.011	0 U
PCB190	0.74	0.64	0.75	0.62	0.46	0.74	0.12	0.071	0.13	0.089
PCB157	0.58	0.75	0.63	0.41	0.34	0.57	0.2	0.091	0.28	0.24
PCB156	0.58	0.75	0.63	0.41	0.34	0.57	0.2	0.091	0.28	0.24
PCB158	0.87	1	1	0.79	0.5	0.78	0.15	0.067	0.21	0.21
PCB105	0.94	1.4	0.79	0.53	0.58	0.77	0.41	0.19	0.8	0.62
PCB193	7.1	5.3	5.9	6.2	3.8	5.2	0.57	0.22	0.4	0.35
PCB192	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB162	0.013	0.029	0.02	0 U	0 U	0.032	0.013	0.011	0.017	0.012
PCB159	0.11	0.12	0.18	0.14	0.067	0.13	0.009	0.008	0.006	0.011
PCB164	0.89	1	1.1	0.67	0.44	0.88	0.15	0.1	0.25	0.22
PCB163	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB161	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB160	13	15	14	11	7.7	12	2.1	1.3	3.6	3.3
PCB122	0.05	0.077	0.055	0 U	0 U	0.042	0.021	0.014	0.037	0.017
PCB107	0.14	0.29	0.17	0.11	0.13	0.19	0.1	0.054	0.21	0.13
PCB108	0.12	0.19	0.1	0.069	0 U	0.13	0.056	0.034	0.11	0.082
PCB106	0 U	0.005	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB110	4.9	7.1	5	3.5	3.8	4.8	1.9	1	4	3.7
PCB109	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB56	0.79	1	0.64	0.53	0.64	0.54	0.18	0.13	0.39	0.19
PCB55	0.044	0.074	0.09	0 U	0.12	0.051	0.013	0.003	0.024	0.014
PCB165	0.01	0.013	0 U	0 U	0 U	0.006	0 U	0 U	0.003	0 U
PCB111	0 U	0.018	0.006	0 U	0 U	0 U	0.005	0.002	0.007	0 U
PCB95	5.3	7.6	6.4	5.8	4.5	5.8	1.1	0.64	3	2.9
PCB113	6.5	7.8	6.8	5.8	5	5.7	1.4	0.78	3.2	2.4
PCB112	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB58	0.005	0.034	0 U	0 U	0 U	0.004	0 U	0 U	0.054	0 U
PCB57	0.012	0.02	0 U	0 U	0 U	0.01	0 U	0 U	0 U	0 U
PCB59	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB20	1.3	1.8	1	0.94	1.8	0.89	0.21	0.15	0.44	0.27
PCB167	0.25	0.29	0.25	0.13	0.15	0.25	0.073	0.04	0.1	0.082
PCB168	13	13	14	11	7.8	11	1.6	1.1	2.5	2.1
PCB166	1.1	1.3	1.2	0.82	0.63	1.1	0.3	0.17	0.43	0.43
PCB123	0.045	0.084	0.043	0 U	0.049	0.06	0.018	0.013	0.046	0.048
PCB118	2.4	4.2	2.5	1.6	1.9	2.1	0.99	0.45	2.2	1.6
PCB114	0.062	0.094	0.074	0 U	0 U	0.063	0.018	0.013	0.048	0.036
PCB119	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB115	4.9	7.1	5	3.5	3.8	4.8	1.9	1	4	3.7
PCB66	1.8	2.5	1.5	1.2	1.5	1.2	0.36	0.27	0.9	0.51
PCB60	0.37	0.54	0.34	0.24	0.29	0.27	0.069	0.059	0.17	0.1
PCB124	0.12	0.19	0.1	0.069	0 U	0.13	0.056	0.034	0.11	0.082
PCB120	0.016	0.025	0.007	0 U	0 U	0.007	0.015	0.01	0.015	0.013
PCB125	2.2	3.2	2.3	1.5	1.8	2	0.81	0.45	1.8	1.2
PCB121	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB117	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB116	0.6	0.89	0.59	0.35	0.41	0.61	0.27	0.15	0.58	0.47
PCB76	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB70	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB68	0.013	0.016	0.014	0 U	0 U	0.013	0 U	0.003	0.009	0.007
PCB67	0.054	0.067	0.06	0 U	0.045	0.05	0.009	0.009	0.032	0.014
PCB63	0.064	0.11	0.076	0.06	0.081	0.063	0.02	0.01	0.04	0.019
PCB61	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB71	1.2	1.7	1.1	1	1.6	0.94	0.2	0.14	0.46	0.27
PCB69	1.5	2.2	1.5	1.4	2.1	1.2	0.21	0.15	0.61	0.35
PCB64	0.92	1.5	0.99	0.91	1.3	0.86	0.18	0.14	0.45	0.28
PCB62	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB33	0.39	0.45	0.32	0.27	0.64	0.25	0.082	0.049	0.17	0.1
PCB25	0.12	0.18	0.12	0.072	0.15	0.095	0.013	0.015	0.039	0.013
PCB22	0.35	0.53	0.3	0.28	0.39	0.23	0.051	0.044	0.11	0.06
PCB21	0.39	0.45	0.32	0.27	0.64	0.25	0.082	0.049	0.17	0.1
PCB72	0.019	0.05	0.035	0 U	0 U	0.02	0.008	0.008	0.018	0.01
PCB73	0.098	0.15	0.13	0.08	0.19	0.1	0.017	0.007	0.038	0.023
PCB65	2.3	3.3	2.3	2.2	3	1.9	0.35	0.24	0.92	0.49
PCB34	0 U	0.013	0 U	0 U	0 U	0.005	0.002	0 U	0.005	0 U
PCB26	0.24	0.33	0.21	0.15	0.33	0.18	0.04	0.024	0.086	0.044
PCB23	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB27	0.085	0.094	0.091	0.075	0.099	0.083	0.012	0.006	0.027	0 U
PCB24	0.007	0.014	0.012	0 U	0 U	0.018	0 U	0 U	0.004	0 U
PCB6	0.052	0.049	0.03	0.08	0.085	0.052	0.016	0.009	0.029	0.009
PCB5	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB74	2.9	4.2	2.4	1.9	2.8	2.1	0.62	0.4	1.8	0.99
PCB75	0.22	0.35	0.22	0.17	0.3	0.19	0.044	0.031	0.092	0.071
PCB28	1.3	1.8	1	0.94	1.8	0.89	0.21	0.15	0.44	0.27
PCB31	1	1.4	0.82	0.84	1.4	0.71	0.14	0.097	0.35	0.2
PCB29	0.24	0.33	0.21	0.15	0.33	0.18	0.04	0.024	0.086	0.044
PCB32	0.39	0.53	0.34	0.28	0.55	0.39	0.035	0.018	0.11	0.064
PCB30	0.68	0.79	0.59	0.63	1.3	0.63	0.11	0.054	0.24	0.15
PCB8	0.17	0.13	0.11	0.15	0.3	0.13	0.037	0.018	0.061	0.042
PCB7	0.011	0.017	0 U	0 U	0 U	0.011	0 U	0 U	0.009	0.014
PCB9	0.011	0.014	0 U	0.034	0 U	0.019	0.008	0.007	0.012	0.017
PCB10	0.013	0.014	0.011	0 U	0 U	0.011	0 U	0 U	0.004	0 U
PCB1	0.008	0 U	0 U	0 U	0 U	0.008	0 U	0 U	0.006	0.008
PCB169	0.025	0.012	0.051	0 U	0 U	0.044	0.016	0.019	0.026	0 U
PCB126	0.013	0.013	0.011	0 U	0 U	0.009	0.003	0.003	0.009	0.008
PCB77	0.13	0.14	0.11	0.072	0.082	0.097	0.05	0.035	0.084	0.044
PCB127	0 U	0.013	0.007	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB79	0.016	0.033	0.021	0 U	0 U	0.022	0.009	0.004	0.016	0.017
PCB78	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB35	0.015	0.022	0.012	0 U	0 U	0.005	0.01	0.004	0.013	0.009
PCB80	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0 U
PCB36	0 U	0.008	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0.012
PCB11	0.056	0.068	0.08	0.21	0.19	0.062	0.054	0.069	0.059	0.081
PCB81	0.009	0.013	0.007	0 U	0 U	0.007	0.002	0 U	0.004	0 U
PCB37	0.28	0.29	0.21	0.18	0.26	0.2	0.067	0.047	0.13	0.076
PCB39	0.008	0.02	0.015	0 U	0 U	0.01	0 U	0.002	0.009	0 U
PCB38	0 U	0.01	0 U	0 U	0 U	0 U	0 U	0 U	0.003	0 U
PCB13	0.022	0.031	0.024	0 U	0.063	0.024	0.009	0 U	0.018	0.014
PCB12	0.022	0.031	0.024	0 U	0.063	0.024	0.009	0 U	0.018	0.014
PCB14	0 U	0.008	0 U	0 U	0 U	0 U	0.003	0 U	0 U	0.007
PCB2	0 U	0 U	0 U	0 U	0 U	0 U	0 U	0.004	0.008	0 U
PCB15	0.12	0.11	0.088	0.057	0.17	0.082	0.037	0.027	0.055	0.03
PCB3	0.005	0.008	0 U	0 U	0 U	0 U	0 U	0.002	0.009	0 U
TOTAL PCBs	**311**	**362**	**329**	**263**	**225**	**289**	**56.6**	**34.9**	**108**	**86.2**
LIPID (%)	**1**	**0.88**	**1**	**1.5**	**0.77**	**0.89**	**0.9**	**0.64**	**0.6**	**0.8**
LIPID-NORMALIZED PCBs (µg/kg-lipid)	**31052**	**41093**	**32934**	**17534**	**29196**	**32469**	**6285**	**5457**	**18043**	**10780**

[1] Not detected at the specified detection limit