Data Gap Analysis
Eighteenmile Creek Superfund Site
Operable Unit 3
City of Lockport, Niagara County
New York

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Revision 1

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List of Abbreviations and Acronyms

95% UCL	95% upper confidence limit
AMSL	above mean sea level
AOC	area of concern
AVS/SEM	acid volatile sulfides/simultaneously extracted metals
BERA	Baseline Ecological Risk Assessment
BSGLC	Buffalo State Great Lakes Center
BUI	beneficial use impairment
Canal	New York State Erie Canal
Canal Corp.	New York State Canal Corporation
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CIP	Community Involvement Plan
COPC	chemicals of potential concern
Cr	chromium
DDE	dichlorodiphenyldichloroethylene
DDT	dichlorodiphenyltrichloroethane
DEM	digital elevation model
DNAPL	dense non-aqueous phase liquid
E & E	Ecology and Environment, Inc.
EFDC	Environmental Fluid Dynamics Code
EPA	(United States) Environmental Protection Agency
Erie Canal	New York State Erie Canal
FS	feasibility study
GIS	geographic information system
GLLA	Great Lakes Legacy Act
GLNPO	Great Lakes National Program Office
GLRI	Great Lakes Restoration Initiative

List of Abbreviations and Acronyms (cont.)

GPS	Global Positioning System
HSPF	Hydrological Simulation Program
IJC	International Joint Commission
LIDAR	light detection and ranging
mg/kg	milligrams per kilogram
mm	millimeters
MNR	monitored natural recovery
NCSWCD	Niagara County Soil and Water Conservation District
ng/L	nanograms per liter
NGVD 29	National Geodetic Vertical Datum of 1929
NPL	National Priorities List
NRCS	Natural Resource Conservation Service
NYSDEC	New York State Department of Environmental Protection
NYSDOH	New York State Department of Health
NYSDOS	New York State Department of State
OU	Operable Unit
PAC	powdered activated carbon
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppm	parts per million
RAP	Remedial Action Plan
RI	Remedial Investigation
SEDA	Sediment Erosion and Deposition Analysis
SLERA	Screening Level Ecological Risk Assessment
Site	Eighteenmile Creek Superfund Site Operable Unit 3
SVOC	semivolatile organic compound
TAL	Target Analyte List
TASC	Technical Assistance Services for Communities
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedures
TOC	total organic carbon
TSS	total suspended solids

List of Abbreviations and Acronyms (cont.)

USACE	United States Army Corps of Engineers
USGS	U.S. Geological Survey
VDM	VanDeMark Chemical, Inc.
VOC	volatile organic compound
WWTP	Waste Water Treatment Plant

1 OU3 Background

This report for the Eighteenmile Creek Superfund Site Operable Unit 3 (OU3) (the Site) was prepared by Ecology and Environment, Inc. (E & E) for the United States Environmental Protection Agency (EPA) under the United States Army Corps of Engineers (USACE) Northwestern Division Contract W912DQ-15-D-3015, Delivery Order 0002. This report describes the existing environmental data for OU3 and identifies where data gaps exist relative to future environmental studies and actions planned for the Site. This section includes a description of OU3 and a summary of existing conditions and previous investigations. The documents reviewed for this report are listed in Appendix A, Table A-1.

1.1 Overview

The Site is located in Niagara County, New York, on the south side of Lake Ontario (see Figure 1-1). The main channel of Eighteenmile Creek flows north from the New York State Erie Canal (Canal) for approximately 15 miles and discharges into Lake Ontario in Olcott, New York. The Eighteenmile Creek watershed also includes the two main tributaries: East Branch and Gulf Creek. The Site is a National Priorities List (NPL) hazardous waste site under investigation pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund. On September 16, 2011, the EPA proposed to place the Site on the NPL and on March 15, 2012, the EPA placed the Site on the NPL.

1.2 Site OU3 Description

The EPA has divided Eighteenmile Creek into three separate OUs, as shown on Figure 1-2. OU1 includes residential properties on Water Street in the city of Lockport. OU2, also known as the Eighteenmile Creek Corridor site (the creek corridor), is the part of the Eighteenmile Creek project area that extends from the Erie Canal to Harwood Street in the city of Lockport. The creek corridor includes Eighteenmile Creek and adjacent upland properties. OU3 is defined as the portion of Eighteenmile Creek channel downstream of OU2, or the creek channel north of Harwood Street. Eighteenmile Creek was designated as an Area of Concern (AOC) in 1985 by the International Joint Commission (IJC). The AOC extends upstream from Olcott Harbor to an area just downstream of Burt Dam. The remainder of OU3 is considered the impact/source area for the AOC. The Eighteenmile Creek AOC Remedial Action Committee was established in 1993, and a Remedial Action Plan (RAP) was completed in 1997.

Downstream of Harwood Street, Eighteenmile Creek within OU3 drops down the Niagara Escarpment and winds through approximately 12 miles of rural Niagara County to Burt Dam. This portion of Eighteenmile Creek within OU3 passes through the towns of Lockport and Newfane. Land use within this portion of the Eighteenmile Creek watershed consists primarily of cropland and orchards, with residential, commercial, and small industrial areas located closer to the city of Lockport and around Newfane. (Newfane includes the hamlet of Newfane on Route 78, which is centrally located within the town and on the east bank of Eighteenmile Creek [see Figure 1-2]). Several other industrial facilities and inactive hazardous waste sites are located along or in the vicinity of Eighteenmile Creek within OU3, including the City of Lockport Wastewater Treatment Plant, VanDeMark Chemical, Inc., and the Old Upper Mountain Road Landfill site on Gulf Creek.

Several dams were constructed to provide power in the more level areas near Newfane, two of which remain today. Newfane Dam was built in the 1830s near the end of McKee Street and Ewings Road to provide power for the Newfane mill district. Burt Dam was built farther north of Newfane in 1924, creating a 95-acre impoundment within the Eighteenmile Creek gorge; the impoundment extends approximately 2 miles upstream of the dam. The original dam generated power until the 1950s; it was restored in 1988 and still operates.

Two major tributaries flow into the main channel of Eighteenmile Creek within OU3: (1) the stream that drains the northwestern part of Lockport and flows through a ravine known as the Gulf (hereinafter referred to as Gulf Creek); and (2) the East Branch of Eighteenmile Creek (see Figure 1-1). Gulf Creek enters the main channel just north of the Lockport Wastewater Treatment Plant. The East Branch of Eighteenmile Creek enters the main channel just north of Ridge Road.

Eighteenmile Creek within OU3 was divided into smaller investigation areas, or reaches, based on the physical characteristics of the creek observed during previous investigations (see Figure 1-2). The length of Eighteenmile Creek within OU3 was determined by digitizing a center line based on review of aerial photographs. The center line was used to establish distance markers along the length of the creek, with zero starting at the Erie Canal (using the Headwaters West Branch) and ending at the mouth of the creek at Lake Ontario.

- **Reach 1** consists of the creek channel from Burt Dam to the mouth of the creek at Lake Ontario. Fisherman's Park is located immediately below the dam and extends through the shallow areas of the channel. This reach deepens and flows approximately 2 miles into Olcott Harbor and is deemed to have "Archaeological Sensitivity" by the New York State Historic Preservation Office (accessed at http://pwa.parks.ny.gov/nr/). Olcott Harbor has two parallel foot piers at the entrance with a 12-foot-deep and 140-foot-wide federally maintained navigation channel.

- **Reach 2** consists of the impoundment immediately upstream of Burt Dam. A bathymetric survey conducted by the EPA in 2009 reported shorelines with steep to near vertical slopes and water depths ranging up to about 35 feet. The historic creek channel is still evident throughout most of the survey area. Measurements along transects at the upstream end of the impoundment found sediment thicknesses averaging about 13 feet. The area is similar to a lake environment. Access is available off Ide Road, and this reach is used by boaters and anglers.
- **Reach 3** is characterized by the historical channel that was flooded after installation of the dam. The delineation between Reaches 2 and 3 is an estimated boundary marking the separation of the deeper water from the portion of the creek where the impounded water meets the upstream creek flow. Large sediment deposition areas have formed where the swiftly moving upstream creek flows into the impoundment area and the flow velocities drop quickly. This reach has surrounding marsh and forested wetland areas that were historically flooded. Access is available off Ide Road, and this reach is used by boaters and anglers.
- **Reach 4** is the portion of the creek immediately below Newfane Dam. In this reach, the creek is relatively swift moving and includes comparatively few sediment depositional areas of shallower depths. Sampling locations include areas where sediment was deposited due to obstructions or decreases in flow velocities, near the marshes and old floodplains, and near outfalls. The reach has surrounding marsh and forested wetland areas near Ide Road that were historically flooded. Access is available off Ewing Road, and this reach is used by swimmers and anglers.
- **Reach 5** consists of the impoundment upstream of Newfane Dam and includes deep water and sediment that is several feet thick. The dam is privately owned but non-functional for power generation, and there is the potential for the dam to be removed in the future. The deep-water impoundment extends approximately 0.7 miles upstream from Newfane Dam. Access is available off Ewing Road; the activity in this reach is unknown.
- **Reach 6** extends from the confluence of the main channel and East Branch of Eighteenmile Creek to the upstream end of the Newfane Dam pool. The reach is characterized by limited access, relatively shallow (< 1 foot thick) sediment deposition areas, and higher flow velocities. There are two isolated creek oxbow channels and one forested wetland where contaminated sediment may have been deposited during historical overbank flooding. Several outfalls from the Newfane area and agricultural drainage areas also may have contributed contaminants to the creek. The added flow from the East Branch generally increases the flow velocity and reduces the potential for sediment deposition in this reach.
- **Reach 7** begins at the bottom of the Niagara Escarpment and continues downstream for almost 5 miles to the East Branch confluence. The reach is characterized by limited access and large stretches of slowly moving

water and high sediment deposition. There are wide areas of floodplain along this reach of the creek.

- **Reach 8** is an approximately 2,000-foot-long section of the creek that cascades down the steep gradient of the Niagara Escarpment that separates OU2 from OU3. There is minimal sediment deposition in this reach due to high water velocity.

As indicated in the Proposed Plan for OU2 (EPA 2016a), OU3 also will address the groundwater within the creek corridor investigated as part of the Supplemental Remedial Investigation (RI) for OU2 (E & E 2016a).

1.3 OU3 Summary of Existing Site Conditions

Detailed descriptions of the existing site conditions are provided in previous study reports listed in Appendix A, Table A-1. A summary of key features is provided below.

The most prominent topographic feature in the Eighteenmile Creek watershed is the Niagara Escarpment. The watershed is located within both the Ontario and Huron plains, two relatively flat plains that are separated by the escarpment, which runs generally east-west along the northern portion of the city of Lockport. OU3 lies within the Ontario Plain (from Lake Ontario to the Niagara Escarpment), and elevations range from 245 feet above mean sea level (AMSL) at the Lake Ontario shoreline to approximately 400 feet AMSL at the toe of the escarpment. The creek channel meanders within a broader Eighteenmile Creek floodplain that is incised into the general topography of the Lake Ontario plain north of the Niagara escarpment. Within the Eighteenmile Creek floodplain the banks of the creek channel are generally fairly shallow and broad. There are a number of historic creek channel sections (oxbows) and wetlands adjacent to the current creek channel.

OU3 is also influenced by man-made structures on the creek, including two dams. Burt Dam is a 600-kilowatt hydro-generating facility currently owned by the Algonquin Power and Utilities Corporation. This run-of-river facility consists of a dam with an integrated intake structure, powerhouse, and tailrace. The facility was reconstructed in 1987 from an old hydroelectric generating plant at the site of an existing dam. Under terms of an agreement with the Federal Energy Regulatory Commission, the New York State Department of Transportation issued a permit in which they agreed to provide a diversion of excess water from the Erie Canal to augment the natural flow of Eighteenmile Creek to maintain a flow of 400 cubic feet per second (cfs) at the dam. During operation, the New York State Canal Corporation (Canal Corp.) estimates that the Erie Canal discharges approximately 50 cfs of water into the east and west branches of the creek, well below the 400 cfs expected to support Burt Dam (New York State Department of Environmental Conservation [NYSDEC] 2006). The maintenance of this flow to the dam will need to be considered during the development of any remedial alternative. The height of the dam at the crest elevation is 49 feet, which raises the water elevation up to 49 feet above the natural elevation of the creek. The bathymetry survey behind the dam indicates the current water depth is 30 to 35 feet (CH2M Hill et al. 2015). Newfane Dam is privately owned and not operational for electrical power generation, but the dam does restrict flow and retains water and sediment behind it.

Throughout much of its length, the Eighteenmile Creek channel within OU3 and/or its floodplain is bordered by agricultural areas; however, a number of residential, commercial, and industrial properties also border the creek channel or floodplain.

Sediment contaminated with polychlorinated biphenyls (PCBs) and metals has been identified along the entire 15-mile length of the main branch of Eighteenmile Creek, including OU3. OU2 has been identified as the source area for these PCBs and metals.

As part of the Phase 1 reconnaissance conducted for the EPA Great Lakes National Program Office (GLNPO) in 2009 and 2010, 36 drainage areas and eight outfalls were identified and mapped along Reaches 3 to 7. The potential for these outfalls as sources of contamination was investigated by locating sampling points downstream of the outfalls. The sample results indicated that the outfalls could be potential sources of lead and polynuclear aromatic hydrocarbon (PAHs).

Eighteenmile Creek within OU3 provides important fish and wildlife habitat. A portion of Eighteenmile Creek 1.5 miles downstream of Burt Dam (Reach 1) is designated by the New York State Department of State (NYSDOS) as Significant Coastal Fish and Wildlife Habitat, and the creek's estimated 65 acres of emergent and submerged aquatic vegetation comprise one of the largest coastal wetlands along the southwestern shore of Lake Ontario (NYSDOS 1987). The portion of Eighteenmile Creek downstream of Burt Dam (Reach 1) is considered a significant recreational resource due to the large numbers of Coho and Chinook salmon and brown trout that migrate into the creek from Lake Ontario each fall, when these fish swim upstream to spawn. Because of the fish habitat, Eighteenmile Creek in Reach 1 is one of the most visited fishing destinations in the Lake Ontario basin, as documented in the Lake Ontario Tributary angler surveys (NYSDEC 2016). The creek habitat in most of the upstream reaches has not been characterized, and the potential impacts of remediation on habitat have not been evaluated.

1.3.1 Demographics and Land Use

The Eighteenmile Creek watershed encompasses portions of the towns of Cambria, Lockport (including a portion of the city of Lockport), Royalton, Hartland, Newfane, and Wilson, all of which are located in Niagara County. Land use in the watershed consists primarily of cropland and orchards, with residential, commercial, and industrial areas in and around Lockport, Newfane, and Olcott Harbor. The city of Lockport is the most densely populated area within the watershed.

Land use along the length of OU3 was initially evaluated based on current Niagara County Real Property parcel data obtained in September 2016. The Real Property parcel data were not verified for accuracy based on aerial photographs or visual surveys, but the data provide a general overview of land use in OU3. Table 1-1 summarizes land use for the OU3 site based on the property boundaries and linear feet along each bank, and Table 1-2 summarizes the same data by reach. Figure 1-3 shows an overview of land use along the OU3 site. The land use classifications were based on Niagara County Real Property Data and were not adjusted for this initial evaluation. Vacant land accounts for the largest percentage of land use (41%), followed by residential at 30%. Commercial and agricultural land use account for 12% and 8%, respectively. The remaining land use categories are all less than 5%. The percentages of land use vary slightly from reach to reach. For example, residential properties account for the highest percentage of land use in more populous areas along Reaches 1, 2, and 4. Vacant land accounts for the highest percentage of land use in less populous areas along Reaches 3, 5, 6, 7, and 8. Commercial use is the highest near the town of Newfane in Reaches 5 and 6. Recreational fishing and boating are concentrated in Reach 1 near Olcott Harbor and below Burt Dam in Fisherman’s Park where anglers fish for lake-run salmon and trout migrating upstream. Figure 1-4 provides a detailed view of the land use and sampling locations along the length of Eighteenmile Creek within OU3. It should be noted that the shoreline lengths in the figure account for inlets, oxbows, and other features that need to be verified as actual available shoreline during future field investigations. Recommendations for specific updates to the land use data are provided in Section 4.6.

1.3.2 Geology

The Supplemental RI for the Eighteenmile Creek Superfund Site OU2 provides a detailed description of the regional geology (E & E 2016a). No site-specific geological data have been collected as part of previous OU3 investigations.

1.3.3 Groundwater

The Eighteenmile Creek basin occupies approximately 85 square miles. According to an environmental impact statement for Olcott Harbor (Department of the Army 1978), as expected, groundwater levels in the low-lying west harbor area north of Lake Street are controlled by rising and falling lake levels. Thus, in the vicinity of Olcott Harbor, it appears that when lake/creek levels are high, the creek would be a losing stream. The report also states that a public water system was installed in the hamlet of Olcott in the 1950s, although the domestic users of groundwater are unknown.

The New York and New England Carbonate Rock Aquifer is the principal aquifer underlying the southern half of Niagara County (outside the study area). This aquifer contains three bedrock aquifers that typically yield small to moderate quantities of water (Niagara River Greenway Commission 2007).

Groundwater has not been investigated as part of previous investigations. The New York State well inventory identified two wells that are located within the

Eighteenmile Creek watershed (NI1203 and NI1244). A third well (NI1212) is located within the watershed of the East Branch. The only attributes recorded are well depth and average yield.

For OU2, a groundwater investigation was conducted as part of the Supplemental RI due to the uncertain nature of the source of the elevated levels of chlorinated volatiles present in MW05 (Former United Paperboard Company, west side of the Eighteenmile Creek) and MW14 (Upson Park) (E & E 2016a). The investigation is described in Section 2.2 of the Supplemental RI Report, and the physical characteristics of the groundwater are described in Section 3.4.2 of the Supplemental RI Report.

1.3.4 Surface Water

There are approximately 230 miles of streams within the Eighteenmile Creek watershed; the largest are Eighteenmile Creek main channel, the East Branch of Eighteenmile Creek, Gulf Creek, and the Erie Canal.

U.S. Fish and Wildlife Service National Wetland Inventory maps and NYSDEC freshwater wetland maps were evaluated as part of the *Eighteenmile Creek State of the Basin Report* (see E & E 2007a, Section 7.2). More than 4,300 acres of wetlands at 698 locations have been mapped within the watershed. The largest groups of freshwater ponds are located approximately 0.5 to 1 mile west of Eighteenmile Creek on both sides of Ewings Road, south of Chestnut Road. Several other smaller lakes/ponds are located within 1,000 feet of Eighteenmile Creek within OU3. NYSDEC wetlands are shown on Figure 1-2.

U.S. Geological Survey stream flow gage data are available at one location at Burt Dam in Reach 1 for the period August 2011 to the current year. The gage is a water-stage recorder at an elevation of 275 feet AMSL (using the National Geodetic Vertical Datum of 1929 [NGVD 29]). The water levels are subject to considerable regulation by power generation at Burt Dam, which is 150 feet upstream from the gage. Maximum discharge for the time period measured was 2,050 cfs, on December 22, 2013, at a gage height of 6.44 feet. Minimum discharge was 1.1 cfs on November 8, 2014, at a gage height of 1.93 feet (a result of regulation).

1.3.5 Sediment

Many sediment samples were collected from Eighteenmile Creek within OU3 during previous investigations, as described in Section 1.4.

Sediment cores retrieved from Reach 1 contained variable amounts of organic material (higher organic content in the southern part of the reach). Harbor sediment cores are described as organic-rich sediment on top of sand clay with a maximum soft sediment depth of over 4 feet. Black silty sediments were encountered in the middle part of the reach, and gravel was encountered near Burt Dam.

Sediment in Reaches 2, 3, and 5 consisted of varying amounts of decayed organic material (mostly rootlets, leaves, wood, and other vegetative matter), grading into varying proportions of fine sand, silt, and clay, with occasional fine gravel (less than 10%). Sediment color usually ranged from gray to brown or black. Particle size analysis of Reach 2 sediments identified the presence of primarily silty/clayey sediments, with approximately 20% of sandy mixes of silt and/or clay. Particle size distribution of the sediments in Reaches 3 and 5 is similar to that in Reach 2, with predominantly silty/clayey sediments and some sandy mixtures. Gravel (over 10%) was found at more locations in these reaches. Sediment thickness was found to be the greatest in Reach 2, followed by Reaches 3 and 5. The maximum sediment depths observed were: 15 feet in Reach 2; 12 feet in Reach 3; and 9 feet in Reach 5.

Sediment in Reaches 4, 6, and 7 consisted of varying amounts of decayed organic material (mostly rootlets, leaves, wood, and other vegetative matter), grading into varying proportions of fine sand, silt, and clay, with occasional fine gravel. Sediment color usually ranged from gray to brown. In most cases, stratification was not observed. At some locations, sand or fine gravel was found without sufficient fine-grained sediment to yield an adequate sample. Reach 4 is characterized predominantly by silt or clay sediments (more than 90% fines present in the sample). Some sandy sediment mixed with varying amounts of gravel and silt-size material was also present in Reaches 4, 6, and 7. Sediment containing more than 10% gravel was very rare in Reach 4 but was found at some locations along Reaches 6 and 7. The maximum sediment depths observed were: 1.8 feet in Reach 4; 5.6 feet in Reach 6; and 4.5 feet in Reach 7.

A sediment thickness survey was conducted in November 2010 as part of the EPA Great Lakes Legacy Act (GLLA) RI. The survey was conducted for shallow portions of the creek up to the Burt Dam impoundment (Reaches 3 through 7) and included taking measurements of bank-to-bank (bankfull) width (i.e., the width that water begins to leave the channel and discharge onto the floodplain), water depths, and sediment thickness. The width of Eighteenmile Creek within OU3 is defined as the creek channel within the bankfull width.

Table 1-3 presents an estimate of the sediment thickness based on field measurements of sediment core locations. The results show the increase in sediment behind the dams and in Olcott Harbor.

1.3.6 Soils

The Niagara County area soils, including the Eighteenmile Creek watershed soils, were mapped by soil type by the U.S. Department of Agriculture, Natural Resource Conservation Service [NRCS] (formerly the Soil Conservation Service). Sensitive soil types include hydric soils, prime farmland, farmland of statewide importance, and soils with high erosion potential. The soil survey identifies 94 soil types within the Eighteenmile Creek watershed (NRCS 1972).

Approximately 57% of the land within the Eighteenmile Creek watershed is classified as prime farmland. The U.S. Department of Agriculture defines prime farmland as areas containing soils that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. A majority of the prime farmland is found adjacent to Eighteenmile Creek and its major tributaries. Seventeen soil types within the watershed are designated as farmland of statewide importance. These 17 soil types comprise approximately 24% of the land area within the watershed, half of which is adjacent to Eighteenmile Creek within OU3 and its major tributaries.

The Niagara County Soil Survey indicates that there are three soil types (Dunkirk, Arkport, and Ontario) in areas adjacent to Eighteenmile Creek main channel, the East Branch of Eighteenmile Creek, and Gulf Creek that are considered to have high erosion potential. Dunkirk and Arkport soils (12 to 20% slope, eroded) and Ontario loam (15 to 30% slope, eroded) have potential for erosion due to their locations in steeply sloped areas and evidence of past and continuing erosion. Although Dunkirk silt loam (6 to 12% slope, eroded) is not necessarily located in areas with steep slopes, this soil type displays historic and continuing erosion.

Approximately 14% of the land within the Eighteenmile Creek watershed is classified as hydric soil. The NRCS defines hydric soil as “a soil that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part” (NRCS 2004). An additional 20% of the land contains soils with the potential for hydric inclusions, meaning that small areas of a hydric soil may be present within the larger mapped unit.

The *Eighteenmile Creek State of the Basin Report* (E & E 2007a) provides a detailed description of the soils in the Eighteenmile Creek watershed.

1.3.7 Ecological Characteristics

Information regarding the ecological characteristics of the Eighteenmile Creek AOC and watershed are available in the *Eighteenmile Creek State of the Basin Report* (E & E 2007a). Several wildlife surveys also were completed for Reach 1. The available ecological data are described in the ecological risk assessment (see Section 2.3).

1.4 OU3 Summary of Existing Data

Detailed descriptions of previous study reports are provided in Appendix A, Table A-1. The usability of data for evaluating fate and transport and assessing risk is summarized in Table A-1 and discussed below. Figure 1-4 presents the locations of the sampling points in the main channel as discussed in the previous studies. The number of samples, by matrix, for each study is summarized in Table 1-4. The number of analyses (by matrix and test parameter) included in each study is summarized in Table 1-5. Significant findings of the previous studies are discussed in Section 1.5 by sample matrix.

Early investigations by NYSDEC in the 1990s focused on the evaluation of sediment and water quality to address impacts on the creek below Burt Dam within the Eighteenmile Creek AOC and Reach 1 (NYSDEC 1998, 2001). A limited number of samples were collected between Burt Dam and Lockport, New York (Reaches 2 through 7). These investigations were completed under standard, statewide monitoring protocols implemented by the New York State Department of Health (NYSDOH). The data are useful for understanding the fate and transport of contaminants of concern through the watershed. The earlier studies demonstrated the link between the Erie Canal and a broad list of contaminants transported in water that may have originated as far away as Lake Erie and the Niagara River, and migrated to Eighteenmile Creek via the Erie Canal.

The USACE performed two studies that focused on bioaccumulation and food web modeling that established a significant bioaccumulation potential for PCBs in fish tissue. The earliest studies focused on Reach 1 below Burt Dam, but more recent investigations included collection of fish tissue data from samples obtained upstream of Burt Dam and Newfane Dam (Reaches 2 and 5) (USACE 2004, 2010).

Several studies were completed under projects funded by EPA Region 2, EPA GLLA, and EPA Great Lakes Restoration Initiative (GLRI). The EPA completed an RI under the GLLA program for contaminated sediment in the creek channel (CH2M Hill et al. 2015). The EPA GLLA RI for contaminated sediment also compiled historical sediment data that included some of the NYSDEC sediment data from OU2. Past studies, site information, and existing analytical data from these and other studies were evaluated as part of this RI report to determine whether additional data are needed to develop a complete conceptual model for OU3 and understand fate and transport of sediment in the creek. The RI did not assess risk to human and ecological receptors. A limited number of soil samples were collected from the banks and historical creek channels.

For the Niagara County Soil and Water Conservation District (NCSWCD), several studies were completed to evaluate beneficial use impairments (BUIs) in the Eighteenmile Creek AOC. A PCB trackdown study was performed in 2006 to evaluate whether PCBs and metals continued to migrate from upstream source areas and to identify other potential sources of contamination (E & E 2007b). Another investigation was conducted in 2007 in Reach 1 (below Burt Dam) to determine whether the Eighteenmile Creek AOC was impaired with regard to the existence of fish tumors and other deformities; the status of fish and wildlife populations; and the status of bird or mammal deformities or reproductive impairment (E & E 2009). The findings of this study are discussed in Section 1.5.5. Finally, baseline benthic community and fish sampling and a pilot study on the use of powdered activated carbon to reduce PCB bioavailability in Eighteenmile Creek sediment were completed in 2012 (E & E 2012a, 2012b, 2013).

Surface water has not been extensively sampled as part of previous sediment investigations, but water quality has been evaluated as part of regional studies by the EPA and NYSDEC. Historical samples collected to measure concentrations of PCBs, mercury, and dioxins/furans (i.e., polychlorinated dibenzodioxins and dibenzofurans) were obtained in 1993 and 1994 as part of a NYSDEC study to track down contaminants to Lake Ontario using passive, in situ concentration-extraction sampler techniques for PCBs (NYSDEC 1996). The EPA has conducted semiannual monitoring of the surface water discharge from Eighteenmile Creek and several other tributaries (EPA 2011). The current analytical program includes PCBs, mercury, and total suspended solids (TSS). Earlier monitoring events included dichlorodiphenyltrichloroethane (DDT) metabolites (2002 to 2006) and dioxins/furans (2002 to 2003). NYSDEC evaluated the monitoring data from 2002 to 2008 to provide estimates of loading of synthetic chemicals into Lake Ontario from several New York tributaries, with special emphasis on dioxins (NYSDEC 2009). The data indicate that since 2002, Eighteenmile Creek had the highest PCB concentrations in surface water relative to other major tributaries to Lake Ontario. Further discussion of PCBs is provided in Section 1.5. The data from the Makarewicz and Lewis study and the U.S. Geological Survey (USGS) gaging station at Burt Dam characterizes the nutrient contributions to the creek and concentrations in the creek, including all forms of nitrogen and phosphorus as well as suspended and dissolved solids (Makarewicz and Lewis 2010; USGS 2016). The Makarewicz and Lewis study analyzed the results of seven samples collected from multiple locations from March through December 2009.

The early studies also identified potential sources of PCBs and metals in the OU2 creek corridor. The subsequent studies completed in the OU3 portion of the creek focused on the nature and extent of these specific contaminants. During the OU2 creek corridor site investigations, contaminants such as volatile organic compounds (VOCs), pesticides, and dioxins/furans were not detected at levels considered significant by NYSDEC. Therefore, these compounds were not considered contaminants of concern for the OU3 portion of the creek and not many samples from OU3 were analyzed for these compounds.

Previous investigations focused on PCBs and select metals as the primary site-related contaminants. More limited data are available for semivolatile organic compounds (SVOCs), other metals, and pesticides. Very limited data are available for dioxins/furans and VOCs. SVOC analyses were often limited to a list of 16 PAHs.

1.5 Nature and Extent of Contaminants

1.5.1 Groundwater

There is no information on groundwater aquifers or the interaction of groundwater with the creek in OU3. Groundwater was not evaluated in OU3 because previous OU3 investigations focused on the creek channel as a receptor of contaminated sediment from OU2. Groundwater as a potential source of contamination to the creek was evaluated as part of the corrective measures project at VanDeMark Chemical, Inc. (VDM) described in Section 1.6.1.

For OU2, the supplemental RI included tasks to further characterize the nature and extent of groundwater contamination, identify the source(s) of the chlorinated VOCs to the overburden groundwater at MW05 and MW14, and identify gradients and flow directions of groundwater within OU2 (E & E 2016a). VOCs were detected in groundwater during the supplemental RI monitoring rounds at levels comparable to those detected in the VOC plume delineated during the NYSDEC 2009 Supplemental RI. An upgradient source of VOCs was not found, and contamination appears to be localized to the same wells as previously identified. Additional investigation of the groundwater is included as part of OU3.

1.5.2 Surface Water

Historical studies demonstrate that high concentrations of PCBs and mercury have been discharging to Lake Ontario since before 1993. The 1993/1994 NYSDEC study tracking down contaminants to Lake Ontario (NYSDEC 1996) established that manufacturing operations along the New York State Barge Canal were potential sources of dioxins/furans and PCBs. PCBs were identified at their highest concentrations near Jacques Road, upstream of Burt Dam in Reach 6. One location in Reach 6 at Jacques Road (i.e., DEC-JAQ_BR) was sampled again in 2007 and 2008 as part of a NYSDEC study of tributaries to Lake Ontario (NYSDEC 2009) and analyzed for PCBs. As part of the EPA tributary study, PCBs, mercury, and TSS have been measured since 2002 at one location (i.e., USGS-SW1) in Olcott Harbor in Reach 1. Earlier monitoring events included measurements of DDT and its metabolites (2002 to 2006) and dioxins/furans (2002 to 2003). The data indicate that, since 2002, Eighteenmile Creek has had the highest PCB concentrations in surface water relative to other major tributaries to Lake Ontario in New York State.

Other historical data include the results of surface water nutrient analyses performed during each season in 2009, which identified agricultural land as a source of phosphorus to the creek (Makarewicz and Lewis 2010).

1.5.3 Sediment

Sediment was extensively sampled during previous investigations and is discussed further as part of the human health and ecological risk evaluation (see Sections 2.2 and 2.3). Sediment transport and erosion are discussed in Section 2.5.

Reach 1 and Early Studies

Early sediment studies focused on the sediment in Reach 1 and the impoundments behind Burt Dam and Newfane Dam. NYSDEC conducted a systematic investigation of the sediments in 1994 and confirmed the presence of high levels of metals and PCBs and identified DDT metabolites, dioxins/furans, and PAHs (NYSDEC 1998). The investigation also detected high concentrations of contaminants immediately upstream of the Burt and Newfane dams and in upstream sediments close to the Erie Canal. An additional sediment study was conducted in 1998 as a follow-up to the 1994 investigation (NYSDEC 2001).

Three sediment cores were collected in 1998 and radiometrically dated to establish a chronology of contamination in the Erie Canal and the depositional pools immediately upstream of the Burt and Newfane dams. This 1998 study, which confirmed the results of the 1994 investigation, found that the highest concentrations of contaminants were in subsurface sediments at depths of 70 to 80 centimeters dating from the early 1950s to mid-1960s (NYSDEC 2001). Both studies identified upstream areas in the city of Lockport and the Erie Canal as potential sources of contamination.

In 1994 NYSDEC collected subsurface sediment samples from Olcott Harbor; PCBs were not detected in the samples. The concentrations of metals in the subsurface sediment samples were the same as in the surface sediment samples. Therefore, based on the results of the 1994 study, subsequent studies did not evaluate subsurface sediments in this area.

Surficial sediment samples were collected by the USACE from below Burt Dam to support bioaccumulation studies (USACE 2004a, 2004b, 2008; E Risk Sciences 2012). In 2003, the USACE collected a total of 20 surface sediments and analyzed them for PCBs, pesticides, and metals. In 2010, the USACE collected a total of 16 surface samples and analyzed them for PCBs and total organic carbon (TOC). PCBs concentrations were less than 2 milligrams per kilogram (mg/kg). The PCB concentrations were lowest in the surface sediment in the Olcott Harbor marina area. In 2013, sediment surface samples were collected in the federal navigation channel at the mouth of the creek by the USACE to address the contaminant determination portion (40 CFR 230.11[d]) of the larger Clean Water Act Section 404 (b)(1) evaluation of a proposed dredged material discharge to waters of the United States (USACE 2013). Based on the requirements in the USACE guidance, the sediment was suitable for open lake disposal. Composite sediment cores of 5 feet were collected by the Town of Newfane in Olcott Harbor to determine the suitability of dredge material for disposal. PCB concentrations in the composite cores were less than 0.3 mg/kg, but the material was not suitable for open lake disposal.

Reaches 2 to 7

A PCB trackdown study was performed in 2006 in Reach 7 to evaluate whether PCBs and metals were continuing to migrate down from upstream source areas and to identify whether other potential sources of contamination existed (E & E 2007b). The results indicate that most of the sediment in Eighteenmile Creek within OU3 is contaminated with PCBs, and only the underlying soils in the creek bed is free of PCB contamination. The EPA sampled upstream of Burt Dam (Reach 2) to where the trackdown study ended in Reach 7. Based on a Phase 1 reconnaissance survey, the sampling locations in the EPA GLLA RI were originally chosen to be representative of sediment deposition zones or to be downstream from potential sources, such as tributaries, outfalls, or drainage ditches. Based on the expected areas of sediment deposition and thickness, the original sampling plan proposed to target one sample per 500 feet of creek in Reach 4, one sample per 200 feet of depositional area in Reach 6, and one sample per 100 feet of depositional area in Reach 7. The findings of the first phase of sampling indicated that depositional zones are present throughout creek bed in Reaches 6 and 7 and that targeting of specific depositional zones may not be representative of contaminate levels of the sediment in the entire area. Statistically, evaluation of the sample location data attempted several scenarios, such as a Visual Sampling Plan and a geo-statistical approach using Voronai polygons. Because of the winding, narrow, linear features of the main creek channel, a statistical approach to selecting sampling locations was not effective. Therefore, as part of a second phase of sampling, sampling locations were selected to fill data gaps as follows:

- The distance between existing sampling locations was evaluated. New sampling locations targeted areas with large distances between sampling locations (i.e., greater than 500 feet) to provide a greater extent of coverage.
- Sampling locations also were chosen near samples that had higher concentrations of PAHs and metals and potential sources that were not related to upstream areas in Lockport.
- Confirmation sampling locations were selected to be near samples with hazardous levels of PCBs (i.e., greater than 50 parts per million [ppm]) and lead. In addition, the difference between concentrations in a sample and the sample's nearest neighbor also were evaluated. Samples were added between these locations to better define the extent of contamination.
- Additional samples also were collected upstream in the East Branch and Gulf Creek to establish background conditions and evaluate other potential sources.

The EPA GLLA RI concluded that the PCBs concentrations at the confirmation sampling locations were lower, but high PCBs concentrations were identified at new locations. The results indicate the high variability of the PCB concentrations in the Reach 7 sediment.

For the EPA GLLA, a variation of "systematic point sampling" was implemented over 9 miles of creek to collect additional sediment thickness data and develop an accurate digital shoreline. An ArcGIS extension "spatial analyst" was used to perform a spatial interpolation of thickness points using the inverse-distance weighted method of interpolation. The elevation was estimated in a geographic information system (GIS) using the most precise elevation data available—2008 light detection and ranging (LIDAR) data, which was originally developed by the Federal Emergency Management Agency for floodplain delineation and is now in the public domain. The sediment thickness, water depth, and area were modeled for Reaches 2 through 7, and volume was estimated based on the model. The creek was divided into 500-foot intervals (because that length was the basis for the sampling design), and the average sediment thickness and water depth was determined. The volume was calculated for each interval based on the area of the 500-foot interval and average sediment thickness. These volume estimates can be combined with the existing chemical data to estimate volumes for evaluation of remedial alternatives.

1.5.4 Soils

To determine whether contaminated sediment was deposited on the banks during flooding events, historical creek channels and wetlands were sampled during the

EPA GLLA project. Based on the sample analytical results, the concentrations of the chemicals of potential concern (COPCs) in the soil samples are comparable to or lower than the concentrations in sediments in the main channel. The EPA GLLA RI concluded that the limited wetland and historical channel data suggest that bank soils have not been extensively impacted by contaminated sediments and that contamination of bank soils did not appear to pose a concern. However, this conclusion was based on comparison of the analytical data with screening values, but a formal risk assessment screening was not completed.

1.5.5 Biota

The RAP describes historical studies of fish tissue that indicated high levels of PCBs (NYSDEC 1997). The NYSDOH has included Eighteenmile Creek under its most stringent "Do Not Eat" fish advisory on the basis of PCB contamination (NYSDOH 2011). Lake Ontario is subject to other less stringent, species-specific advisories related to the presence of PCBs, Mirex, and dioxins/furans. In 2003, the USACE Buffalo District evaluated the toxicity and bioaccumulation of persistent organic compounds in surface sediment samples collected from below Burt Dam (Reach 1) (USACE 2004a, 2004b, 2008). These studies indicated that metals and dichlorodiphenyldichloroethylene (DDE) presented a potential chronic toxicity risk relative to selected freshwater toxicity threshold values and DDE bioaccumulated at higher-than-anticipated levels (USACE 2008). PCBs were found to be highly bioavailable and were predicted to cause wildlife bioaccumulation risks. Dioxins/furans were detected in sediment samples and were predicted to cause potential wildlife bioaccumulation risks based on the equilibrium partitioning approach used by New York State.

A BUI investigation was conducted in 2007 in the creek below Burt Dam (Reach 1) to determine whether Eighteenmile Creek within OU3 is impaired with regard to the existence of fish tumors and other deformities; the status of fish and wildlife populations; and the status of bird or mammal deformities or reproductive impairment (E & E 2009). The BUI investigation concluded that bird and amphibian populations in the Eighteenmile Creek AOC are not impaired, but that fish and mammal populations likely are. The possible impairment of fish and mammal populations results from high levels of PCBs in fish. Whole-body concentrations of Aroclors 1248, 1254, and 1260, and total PCBs were an order of magnitude greater in brown bullheads from Eighteenmile Creek AOC than in brown bullheads from Oak Orchard Creek (E & E 2009). Whole-body concentrations of dioxins/furans (expressed as the 2,3,7,8-tetrachlorodibenzo-p-dioxin [TCDD] toxic equivalents) in bullheads from Eighteenmile Creek were approximately five times greater than in bullheads from Oak Orchard Creek. No impairment was evident at the Eighteenmile Creek AOC (the reach of the creek downstream from Burt Dam) compared with Oak Orchard Creek with regard to liver tumors in the brown bullhead.

In 2011, the USACE Engineer Research and Development Center completed a Trophic Trace Food Web model for Eighteenmile Creek (E Risk Sciences 2012). The objective of the project was to evaluate organic contaminant bioaccumulation, trophic transfer, and consequent risks in creek sections above and below Burt Dam. The project included collection of fish tissue from creek sections below Burt Dam in Reach 1 and above Burt Dam in Reaches 2 and 3. The study concluded that PCBs in fish were present at levels that may pose a potential risk to fish and wildlife that consume fish. Potential risks were found to be greater upstream from Burt Dam compared with below Burt Dam.

In 2013, a study designed to establish current baseline levels of PCBs in fish from different trophic levels in Eighteenmile Creek within OU3 was completed (E & E 2013). Brown bullhead and largemouth bass fillets, and whole-body composite samples of sunfish and crayfish were collected and analyzed for PCB Aroclors and congeners to provide data that could be used to evaluate spatial and temporal trends in PCB levels in fish from the creek and support the Trophic Trace Food Web model. The brown bullhead, sunfish, and crayfish samples were collected from three locations in Eighteenmile Creek: downstream of Burt Dam (Reach 1); between Newfane and Burt dams (Reaches 2 and 3); and upstream of Newfane Dam (Reach 5). Largemouth bass samples were collected only upstream of Newfane Dam.

Average total Aroclor concentrations in the bullhead, crayfish, and largemouth bass samples exceeded the critical tissue concentration for PCBs for effects on fish (0.44 mg/kg wet weight) in all reaches from which these species were collected (Dyer et al. 2000). The average total Aroclor concentration in sunfish upstream of Newfane Dam (Reach 5) also exceeded the critical tissue concentration, but the average concentration in sunfish between the two dams (Reaches 2 and 3) and below Burt Dam (Reach 1) did not exceed the critical tissue concentration. Total Aroclors and total congeners in sunfish and crayfish were significantly greater upstream of Newfane Dam than in the two other creek reaches. No differences among reaches were observed for total Aroclors or total congeners in bullhead fillets. In general, the 2012 data were comparable to historical data, with the exception that the sunfish congener concentrations from 2012 were lower than sunfish congener concentrations from 2010 collected for the USACE Trophic-Trace studies (E Risk Sciences 2012). This difference between studies may be due to lower lipid levels in sunfish from 2012 (average 0.45%) compared with sunfish from 2010 (average 2.4%).

1.5.6 Analytical Parameters

Table 1-5 summarizes the type of analytical data available for samples in various media by study and reach. Most samples were analyzed for PCB and metals, primarily lead. PCBs were analyzed as PCB Aroclors and PCB congeners. The Aroclor and congener data were both included in the EPA GLLA RI database. Analysis of the existing data indicate 97 samples were analyzed for both Aroclors and congeners and that total PCBs calculated using Aroclors did not correlate with the total PCBs estimated using the congener data. A comparison of the data showed over half of the samples had relative percent differences of over 50%, with the total PCBs based on congener data being generally higher than the Aroclor total. In general, this comparison suggests that total PCB levels estimated by summing Aroclors may underestimate the true total PCB concentration in environmental media at the site.

PCB Aroclor data were historically used for evaluating the nature and extent of contamination because the majority of the existing sediment samples were analyzed for Aroclors. PCB Aroclor data will be used for future evaluation of the nature and extent of contamination. Aroclor data are adequate for this purpose and are less expensive to collect than congener data. Because the potential bias in total PCB concentrations based on Aroclors versus congeners is not fully understood from existing data, future total PCB concentrations based on Aroclors should be evaluated for uncertainty and relative risk factors by analyzing a portion of the samples for PCB congeners. PCB congener data were used for the bioaccumulation modeling performed by the USACE in 2008 and 2010 and may be useful for ecological risk assessment as described below (USACE 2008; E Risk Sciences 2012). PCB congeners were analyzed in place of PCB Aroclors in situations where the Aroclor patterns are expected to be weathered (e.g., in low-level water analysis and fish tissue analysis).

Most samples were analyzed for lead or select metals, including mercury, arsenic, chromium, copper, lead, and zinc. For the EPA GLLA RI, all samples were analyzed for Target Analyte List (TAL) metals. Select samples also were analyzed for acid volatile sulfides/simultaneously extracted metals (AVS/SEM) and TOC to assess the bioavailability of divalent metals, including cadmium, copper, lead, nickel, zinc, and monovalent silver.

Select samples were analyzed for lead by Toxicity Characteristic Leaching Procedures (TCLP), and the results were compared to hazardous waste levels (6 NYCRR 371). Only one sample with high lead concentrations collected near Reach 5 was analyzed for TCLP metals, and the results exceeded hazardous waste criteria. A comparison of the TCLP data to the total lead concentrations showed inconsistent correlation, suggesting that the leachability of the lead varies with the type of source material.

Dioxins/furans were considered COPCs in some historical studies because these contaminants are identified as critical in the lake-wide management plan for Lake Ontario. Dioxins/furans were included in the Eighteenmile Creek AOC RAP, and select sediment samples from several early NYSDEC investigations were analyzed for dioxins/furans or 2,3,7,8-TCDD only. Dioxins/furans were detected in the samples, but no sources of dioxins/furans in Eighteenmile Creek were identified, except potentially the Erie Canal (NYSDEC 2001). Dioxins/furans were not analyzed as part of the NYSDEC RI for the OU2 Corridor Site because dioxin and furans were not detected in the ash waste samples collected during the site investigation at the former Flintkote Plant site (NYSDEC 2000). Dioxins/furans were not analyzed for the EPA GLLA RI project because the investigation focused on determining the extent of primary COPCs identified in the OU2 Corridor Site.

1.6 Potential Source Areas

1.6.1 Hazardous Waste Sites

Upper Mountain Road and Gulf Creek

The Old Upper Mountain Road site was reportedly operated as a municipal dump by the city of Lockport from 1921 to the 1950s. The site includes the former municipal dump area, which covers approximately 7 acres northeast of the intersection between NYS Route 93 and NY Route 31, and a ravine and Gulf Creek, which lie north of the former dump and run northeast towards Eighteenmile Creek. The site is currently divided by seven Niagara County tax parcels owned by various private owners and entities. The site is currently unoccupied and vacant (EA Engineering 2011).

The Old Upper Mountain Road site has undergone a number of environmental investigations since the site's discovery in 1993 and was listed on the NYSDEC Registry of Inactive Hazardous Waste Disposal Sites in New York State as a Class 2 site (932112). A site investigation conducted at the Old Upper Mountain Road site in 2007 revealed that consequential amounts of hazardous wastes (D008 - lead) were present at the site. The investigation report suggested that these hazardous wastes had adversely impacted surface water and sediment in Gulf Creek adjacent to the site. The site was divided into three OUs: OU1 - approximately 6 acres of landfill wastes; OU2 - surface water and sediment within Gulf Creek; and OU3 - approximately 1 acre of land fill wastes. A supplemental RI was completed in 2011 to further define the nature and extent of contamination in the sediment/surface water of Gulf Creek. The findings related to impacts on Eighteenmile Creek within OU3 include (EA Engineering 2011):

- Analytical results of surface water samples (i.e., SW-05 and SW-06) collected from downstream locations in Gulf Creek reported low levels of VOCs. In addition, only iron was detected at concentrations above soil cleanup guidance values for Class D waters within Gulf Creek.
- Nine TAL metals were identified at concentrations above their respective severe effect levels in the sediment of Gulf Creek, with the most prevalent metals detected being lead and zinc. TAL metals impacts were observed throughout Gulf Creek sediment, including sediment samples collected at the farthest reaches of Gulf Creek.
- The TAL metals reported in sediment samples are similar to TAL metals observed within the on-site fill material (OU1 and OU3), and likely migrate to the sediments of Gulf Creek via erosional runoff and groundwater transport pathways.

NYSDEC issued a proposed RAP in 2013 for OU1 and OU2 that includes capping of the landfill and complete excavation of sediments in Gulf Creek (NYSDEC 2013). Remedial activities in Gulf Creek have not been completed, and NYSDEC is currently conducting pre-design investigations.

Sediment samples were collected from five locations in Gulf Creek during the EPA GLLA RI. Sediment samples had average lead, other COPC metals, and PAH concentrations that were equivalent to average concentrations in Reach 7 sediments, and PCBs were detected at less than 1 mg/kg in one sample. The results indicate the Gulf Creek sediments could be a potential source of contamination to Eighteenmile Creek within OU3.

VanDeMark Chemical, Inc.

VDM is a custom chemical batch manufacturer located in Lockport, New York, and manufactures phosgene and phosgene derivatives at this location. The company is located just downstream of the creek corridor (OU2) on the east bank of the creek. VDM completed Interim Corrective Measures remedial activities at the plant site in 2012 to remove coal tar and address dense non-aqueous phase liquid (DNAPL) contamination of the groundwater (Golder 2012). VDM identified coal tar residuals and solidified coal tar seeps along the creek bank that historically could have impacted the creek. VDM completed a Corrective Measures Implementation with remediation activities that were conducted from September 6 to November 15, 2012, to address the cleanup and containment of coal tar residuals and DNAPL located in soil and bedrock along a portion of VDM’s property adjacent to the north bank of Eighteenmile Creek and located south of VDM’s manufacturing facility in Lockport, New York (Golder 2012). The activities included construction of the DNAPL interception trench on the bank. Additional monitoring activities have been completed to verify no impacts on the creek (Golder 2015 and 2016).

1.6.2 East Branch and other Tributaries

There are approximately 230 miles of streams within the Eighteenmile Creek watershed, outside of the Eighteenmile Creek main channel, the East Branch of Eighteenmile Creek and Gulf Creek are the largest tributaries. The East Branch of Eighteenmile Creek enters the main branch at about 5.3 miles from the Erie Canal and contributes significant flow to the main channel. The East Branch of Eighteenmile Creek, Gulf Creek, and several small unnamed tributaries were sampled as part of the NYSDEC 1998 and the EPA GLLA 2010 investigations to determine whether major tributaries could be potential sources of contamination to the main channel (see CH2M Hill et al. 2015). Sediment samples had lower lead and PAH concentrations than the main channel, and PCBs were not detected. The results indicate the East Branch sediments are not a potential source of contamination to Eighteenmile Creek main channel within OU3.

1.6.3 State Pollutant Discharge Elimination System Permitted Sites

Only one site within OU3 of Eighteenmile Creek, the City of Lockport Wastewater Treatment Plant (WWTP), has an active State Pollutant Discharge Elimination System permit. The primary outfall for the WWTP is located at the upstream limit of OU3. The permit includes a monitoring program for various physical properties (e.g., temperature), biological variables (e.g., dissolved oxygen), and the following metals, nutrients, and VOC/SVOCs: mercury, lead, chromium, copper, lead, nickel, zinc, nitrogen, selenium, phosphorus, bromodichloromethane, dibromochloromethane, chloroform, trichloroethylene, and bis(2-ethylhexyl)phthalate. There is no monitoring done for organic COPCs. EPA Aquatic Life Criteria is available for metals, all of which have effluent limits at or below the criteria, except selenium, for which the effluent limit is a maximum daily concentration (4.6 µg/L) and the criteria is a 30-day exposure limit (3.1 µg/L) (EPA 2016b). There have been no exceedances of these limits reported by NYSDEC, indicating that this site is not a source of contamination to Eighteen-mile Creek within OU3.

2 RI Data Gaps

This section identifies data gaps regarding the nature and extent of contamination, human health risk, ecological risk, background areas, sediment erosion and deposition, and other items required to complete an RI for OU3. The information is discussed under six main headings: 1) Extent of Contaminated Media; 2) Human Health Risk Assessment; 3) Ecological Risk Assessment; 4) Background and Reference Areas; 5) Sediment Erosion and Deposition Analysis (SEDA) and Modeling; and 6) Supporting Information. Recommendations for collection of additional data are provided in Section 4.

The usability of data for evaluating fate and transport and assessing risk is summarized on Table A-1. Data generated within approximately the last 10 years are considered potentially usable and representative of current Site conditions. Data are considered usable if the results were generated under acceptable quality practices and methods. Not all of the data have been formally validated, but if supporting analytical reports were available to perform validation, then validation was performed as part of this task. Appendix B contains a discussion of the data validation process and the data validation memoranda completed for the historical data. All validated data are considered usable for risk assessment purposes. Table A-1 indicates the studies that contain data that were imported into the OU3 data and data from reports that were validated prior to being imported into the OU3 database. Sample locations are shown on Figure 1-4.

2.1 Extent of Contaminated Media

As part of previous investigations, as presented in Section 1, samples of all media were collected and analyzed as summarized on Tables 2-1a through 2-1e. PCBs and metals (particularly lead) were identified as the primary COPCs based on historical studies. Mercury, PAHs, DDT metabolites, and dioxins/furans also were considered as COPCs. Existing data were reviewed and validated and flagged as usable for risk assessment in the OU3 database. Summary statistics for surface water data are included in Appendix A, Table A-2a. Updated summary statistics for sediment, soil, and fish for only the validated data that are to be utilized in the risk assessments are included Appendix A, Tables A-2b through A-2d. Only parameters with greater than 10 positive results in any of the reaches are included in these tables to focus the summary on the most frequently detected compounds. In the risk assessments, all detected results will be considered so that no potential Site-related contaminants are overlooked.

2.1.1 Groundwater

For VOCs in OU2, also known as the creek corridor site, the groundwater samples collected in 2007 and 2009 from 18MC-MW14 contained elevated levels of TCE and cis-1,2-DCE along with lesser amounts of other chlorinated solvents (see Figure 5-3 of E & E 2016a). Low levels of chlorinated solvents were also detected in 18MC-MW15. Well 18MC-MW05 contained elevated levels of cis-1,2-DCE and trace levels of vinyl chloride in 2007, but the levels of cis-1,2-DCE doubled in 2015 while vinyl chloride was non-detect. Since cis-1,2-DCE is a breakdown product of TCE, the increased levels could be the result of the TCE breakdown. The new well (18MC-MW18), upgradient of 18MC-MW05, did not contain any chlorinated solvents. Since there are no wells upgradient of 18MC-MW14 and no chlorinated solvents were detected in 18MC-MW18, the source of the chlorinated solvents still remains unknown. Additional data are required to identify the source in OU2.

There are no groundwater data for OU3, but this is not considered a data gap. Groundwater is not expected to be a source of PCBs, PAHs, lead, and other COPCs to the Eighteenmile Creek within OU3 based on our understanding of the site, land use in the watershed, and groundwater sample results in the creek corridor, which is believed to be at or near the potential contaminant source areas.

2.1.2 Surface Water

The number of samples collected for each analytical test for surface water are summarized in Table 2-1a. The available data for surface water is summarized on Table A-2a. Data for potential COPCs is only available from one location in Reach 1 in Olcott Harbor and one location in Reach 6 at Jacques Road. The data could not be validated because the raw data files were not available. As shown on Figure 2-1, the results from Reach 1 show consistent PCB concentrations ranging from 19 to 93 nanograms per liter (ng/L, parts per trillion) collected between 2002 and 2012. Data from 2011 and 2012 show that the dissolved PCB concentration accounts for approximately 70% of the total PCBs concentration from Eighteenmile Creek as measured at Olcott Harbor. Mercury and pesticides also were consistently detected in the samples, but the pesticide monitoring was suspended in 2005 because the concentrations were at low levels. In Reach 6, the total PCB congener concentrations are higher than in Reach 1, with an average of 89.3 ng/L in Reach 6 versus an average of 39.6 ng/L in Reach 1 (see Table A-2a). The location of the two surface water samples are shown on Figure 4-1. All concentrations exceed the EPA Aquatic Life Criteria of 14 ng/L for PCBs (EPA 2016b). Additional data are required to evaluate the nature and extent of other contaminants and PCBs in surface water in other reaches. Concentrations of PCBs in the surface water in Reach 7 before the confluence of the East Branch are also unknown.

2.1.3 Sediment

The sediment in the creek bed has been sampled and analyzed extensively throughout most of OU3, and the sampling results are summarized on Table 2-1b. The number of samples for grain size and physical parameters are summarized on

Table 2-1c. COPCs were detected in sediments of Eighteenmile Creek through its entire length from the Erie Canal to Lake Ontario. Tables 6 to 12 of the EPA GLLA RI provide summary statistics for COPCs in sediment, including the average and maximum detected results by reach. Updated summary statistics for sediment are included Appendix A, Table A-2b. PCBs, PAHs, and metals were the most frequently detected COPCs. The average concentrations (shown on the left y-axis) and maximum concentrations (shown on the right y-axis) for these compounds are plotted by reach on Figures 2-2a and 2-2b.

All COPC metals show a similar average and maximum concentration pattern of contamination by reach. The average concentrations of COPC metals are lower immediately below the creek corridor site (Reach 7) and increase to Reach 5 in the depositional area behind Newfane Dam. The average concentrations for all COPC metals except mercury are the highest in Reaches 2 and 3 behind Burt Dam, decreasing to background levels in Reach 1 below Burt Dam. The maximum concentrations follow the same general pattern of contamination. High concentrations of lead and other metals in subsurface sediments in Reaches 2 and 3 result in higher average concentrations behind the dam. Radio carbon-dated sediment cores taken from the Burt Dam pool indicate that there was a significant historical metals source from the early 1950s to the mid-1960s. The average and maximum concentrations also show an increase in Reach 5 behind Newfane Dam, but subsurface concentrations of metals in these cores are generally lower than Reaches 2 and 3 (CH2M Hill et al. 2015).

PCBs and PAHs show similar average and maximum concentration patterns of contamination by reach. PCB average and maximum concentrations are relatively higher in reaches immediately downstream of the creek corridor site and then decrease to levels below 1 mg/kg in Reach 1. PCB concentrations do not increase in the Reach 5 depositional area behind Newfane Dam. PCB average and maximum concentrations increase slightly in Reach 3. The data suggest (as expected) that where the creek meets the impoundment waters behind Burt Dam there is a significant area of sediment deposition caused by the decreased flow rates. However, the PCB concentration profiles with depth indicate a significant amount of mixing in this area. In the deeper sediments of Reach 2 closer to Burt Dam, there is a much more distinct change in PCB concentration, with depth and maximum concentrations at depth indicating an historical source coinciding with deposition in the late 1960s to the mid-1970s.

In general, PAH concentrations decrease toward Lake Ontario. However, PAH average and maximum concentrations increase in Reaches 4 and 7, which are located in more populated areas and may be attributed to urban runoff. The findings from the EPA GLLA RI suggest that PAH contamination is ubiquitous throughout the watershed and is related to common anthropogenic sources. PAHs do not appear to be an appropriate indicator of PCB contamination from sources believed to be in the creek corridor site (OU2). Lower concentrations and more uniform distribution of the mercury and DDT metabolites also indicate anthropogenic sources not directly related to the contaminants originating in creek corridor site (OU2).

Figures 2-3a through 2-3c show the distribution of total PCBs, total PAHs, and lead, respectively, in sediments along the reaches of the creek. The samples are color-coded by concentration, with all concentrations characterized by sediment guidance values as defined by NYSDEC in the guidance document "Screening and Assessment of Contaminated Sediment" (NYSDEC 2014). Class A sediments are characterized as presenting little or no potential for risk to aquatic life; Class B sediments require additional information to determine potential risk to aquatic life (such as bioaccumulation and toxicity data); and Class C sediments have a high potential to be toxic to aquatic life. For samples designated as "High" concentration, the measured concentrations are above values derived from hazardous waste guidelines of 1,000 mg/kg.

For lead, most of the sample concentrations are Class C sediments in the surface interval. Higher concentrations of lead are found at depth in cores collected behind the dams. The lowest concentrations of lead are found at the very deepest interval in the cores.

For PCBs, generally sample concentrations in Reach 7 and the subsurface in Reaches 2 and 3 exceed concentrations of 1 mg/kg. Sample concentrations in Reach 1 and the surface of Reaches 2 and 3 have concentrations that are generally less than 1 mg/kg. PCBs were also detected at samples at depth in Reaches 2, 3 and 5. PCB sediment concentrations exceed 50 mg/kg only in selected areas within Reach 7. Figure 4-1 shows the locations of sediment samples and the sample locations are color-coded based on the maximum PCB concentrations present in the surface interval.

Concentrations of PAHs in sediment follow a similar pattern to PCBs, but the concentrations are generally below 35 mg/kg (Class B and below requiring additional information to be evaluated). Concentrations of lead in sediment also follow a similar pattern to PCBs but the concentrations are generally higher than 130 mg/kg (Class C and above with a high potential to be toxic to aquatic life).

In 1998 NYSDEC collected two sediment cores in the depositional pools immediately upstream of the Burt Dam (Reach 2) and Newfane Dam (Reach 5). The cores were radiometrically dated to establish a chronology of deposition and associated contamination at a site (NYSDEC 2001). Radio-dating results show the maximum copper (2,450 ppm) and lead (4,490 ppm) concentrations in the Burt Dam depositional pool (Station No. 6C) occur in sediments deposited sometime between the middle 1950s and early 1960s (70 to 80 cm subsample). Radio-dating results from the core collected at Station No. 7C indicate the 20 to 24 cm depth corresponds to the 1963 to 1964 period. The complete results are included in Appendix C. Evaluation of the quality of the cores for the purposes of radio-dating indicates that the core from Reach 1 is excellent and the core from Reach 5 is very good in terms of continuous sediment deposition; thus there is a high confidence levels in the dating. The results of cores collected in EPA GLLA RI confirm these results. Therefore, the results can be used to establish historical deposition patterns and no additional radiodating is needed.

Based on current distribution of COPCs in sediment in OU3, collection of additional data to evaluate the nature and extent of contamination in sediment is considered unnecessary.

2.1.4 Soils

The soils in the creek bank and floodplains have not been sampled extensively throughout most of Eighteenmile Creek within OU3 and were only collected in Reaches 4 to 7, where flood areas were identified. Samples are summarized in Table 2-1d. The number of samples for grain size and physical parameters are summarized in Table 2-1c. Figure 4-1 shows elevation contours estimated in GIS using the 2008 LIDAR data and the most 100-year floodplain contour from the Federal Emergency Management Agency (https://www.fema.gov/national-flood-hazard-layer-nfhl). Figure 4-1 shows large areas in Reaches 4 to 7 that have the potential to transport contaminated sediment during flood events. Figure 4-1 shows the locations of 10 existing samples. The sample locations are color-coded based on sample concentrations at the surface using the same criteria used for the sediment. The available data for soils are summarized on Table A-2c. Additional data are needed to evaluate the nature and extent of floodplain soils.

2.1.5 Biota

The available data for fish tissue is summarized on Table 2-1e and Table A-2d in Appendix A. Existing fish tissue samples were analyzed almost exclusively for PCBs; little or no data are available for other chemicals in fish. PCBs were detected in all fish tissue samples, with the highest concentrations in the fish collected from Reaches 2, 3, and 4. Additional biota data needs are discussed in Section 2.2.

2.2 Human Health Risk Assessment

A Human Health Risk Assessment was not completed for OU3. In previous studies, Eighteenmile Creek within OU3 was divided into seven reaches for investigation and characterization purposes, as described in Section 1. The reaches were numbered beginning at the north end of the creek where it empties into Lake Ontario. Numerous studies have been conducted of the sediment and biota in various reaches of OU3 as discussed in Section 1 and listed in Tables 2-1a through 2-1e. In general terms, contaminants that have been found in the area that may pose health risks to humans that come into contact with sediment include PCBs, metals, PAHs, and pesticides. Biota have been sampled primarily for PCBs, and high concentrations in biota tissue have been identified in all reaches sampled.

2.2.1 Preliminary Human Health Conceptual Site Model and Exposure Pathways

Potential exposure pathways and receptors are summarized in Table 2-2, and a preliminary conceptual site model is presented in Figure 2-4. Potential receptors include:

- Recreational users of the creek – swimmers, waders, boaters, and anglers and their families who might eat their catch;
- Residents whose properties border the creek, portions of which may be in the floodplain and may have been subject to contaminated sediment deposition during high water events; and
- Consumers of agricultural products, such as beef and dairy products, from animals grazed on land irrigated with creek water or fed fodder grown on such land.

The recreational receptors could be exposed to site contaminants through dermal contact with and incidental ingestion of surface water, sediment, and bank soil. Anglers and their families who might eat their catch could also ingest contaminants in the fish tissue. These activities appear likely to occur in different ways and to different degrees in the various reaches of OU3, based on land use and the exposure areas. Wading and swimming by recreational users is most likely to occur in the shallower Reaches 1, 3, and 4 along public access areas. Wading and swimming by residents is most likely to occur along residential properties with bank access in Reaches 1, 2, 4, 6, and 7. Boating is most likely to occur in deeper areas of Reaches 1, 2, and 3. Fishing is most popular in the shallow area downstream of Burt Dam in Reach 1, but could occur anywhere in Reaches 1 through 7. Significant sediment contact is most likely to occur in the shallow reaches and along the banks of the creek in areas with public access. Physical access is limited in Reaches 1 and 2 due to bank height and slope and in Reaches 5, 6, and 7 because of difficult access due to the woody debris and brush present. However, the woody debris has been noted to cause localized flooding during high water events that may have deposited contaminated sediment on portions of these and similar properties most prone to flooding. Therefore, soil in the floodplain areas will need to be evaluated for risk. Significant contact with bottom sediment is unlikely to occur in the deeper water in the impoundments, i.e., Reaches 2 and 5.

Residents living along the Eighteenmile Creek within OU3 may frequent portions of their properties lying in the creek's floodplain where contaminated sediments may have been deposited during high-water events. Residents could be exposed to these contaminants through direct contact with contaminated soils/sediments in their yards. They may also swim, wade, or fish in the creek from their properties, with resulting exposures similar to those described for recreational users of the creek. Residential land use has been documented at various locations in Reaches 1 through 7 from the Niagara Escarpment to Lake Ontario

Potential exposure pathways from agricultural, commercial, and industrial areas also need to be evaluated based on a detailed review of the shoreline. NCSWCD input indicates that the agriculture is predominantly land farming with a few dairy/cattle operations. There are no dairy farms located directly on the main channel, but there are five dairy farms in the watershed, two of which are near the main channel. E & E is not aware of any farms within OU3 that use Eighteenmile

Creek waters for irrigation; however, what appeared to be an irrigation pipe/hose was observed and photographed on the creek bank during the detailed creek survey conducted in 2011. NCSWCD is not aware of any farms that are irrigating with Eighteenmile Creek surface water. Finally, exposure to contaminated crops may occur in any areas where plowed fields occur within the Federal Emergency Management Agency 100-year floodplain. Such a situation exists in Reach 6, based on our preliminary review of aerial photographs and floodplain maps for OU3.

From a human exposure standpoint, OU3 can be divided into relatively homogeneous exposure areas based on land use and reach:

- Reach 1 - Recreational Areas (boating and fishing), Commercial Properties and Residential Properties;
- Reaches 2 and 5 - Impoundment Areas;
- Reaches 3 and 4 - Shoreline Access Areas; and
- Reaches 6 and 7 - Residential and Agricultural Properties.

Contaminant concentrations also would be compared across reaches to see if reaches differ. If concentrations differ substantially, it may be appropriate to assess areas that differ as separate exposure areas or combine areas that are not significantly different.

Assessing potential exposures to site contaminants requires that sufficient data be available to make reliable estimates of contaminant concentrations in the various potential exposure areas. The EPA estimates potential exposures based on a conservative estimate, typically the 95% upper confidence limit (95% UCL) on the average contaminant concentrations within an exposure area. The lesser of the 95% UCL and the maximum detected concentration for a dataset will be used as the exposure point concentration in accordance with EPA guidance. The EPA has developed the ProUCL statistical software package (USEPA 2015) to evaluate the analytical data and make the appropriate statistical calculations. The ProUCL Technical Guidance document recommends that at least 8 to 10 detected values be available in order to calculate reliable estimates of the 95% UCL values.

2.2.2 Data Evaluation for the Human Health Risk Assessment

Surface Water

Only two surface water samples for contaminant analysis have been collected in Reaches 1 and 6 and only for a limited number of contaminants (see Section 2.1.2). The results were not validated and therefore not usable for risk assessment. A sufficient number of surface water samples are needed to assess potential exposures to swimmers, waders, and boaters as described in Section 4.1.2. Samples should be unfiltered to represent actual exposure.

Sediment

The sediment in the creek bed has been sampled and analyzed extensively throughout most of OU3. Since the EPA has not developed exposure factors for sediment, EPA's general recommendation is to use soil exposure factor values for sediment as well; however, EPA's Dermal Exposure Guidance Manual (*Risk Assessment Guidance for Superfund* Part E) cautions against using these assumptions for sediments that are not exposed at least part of the year:

> "Sediment samples must be located in areas in which individuals are likely to come into direct contact with the sediments. For wading and swimming, this includes areas which are near shore and in which sediments are exposed at some time during the year. Sediments which are consistently covered by considerable amounts of water are likely to wash off before the individual reaches the shore."

Most of the sediment samples available were collected from the creek bed and do not meet these criteria. Also, the historic creek and wetland samples collected are generally not from locations likely to be frequented by human receptors.

There are many more than 10 detected values for PCB Aroclors and metals in surface sediment samples collected from all of the homogenous exposure areas described in the previous section (see Table A-2b). There are fewer analyses for PAHs and pesticides, but greater than 10 positive detect values in most of the exposure areas, except for pesticides in Reaches 2 through 5. Most of the available historical PCB data are for the various Aroclor mixtures. There are some PCB congener results available for sediment samples and fish tissue collected downstream of the Newfane Dam to the mouth of the creek at Olcott.

Specific recommendations for additional sediment samples are presented in Section 4.1

Bank Soils

The few available soil samples were collected from historical stream channels and wetlands along the creek banks of Eighteenmile Creek within OU3. Most of these were from Reaches 4, 5, 6, and 7. Assuming most of the contaminants are transported mainly with suspended particles, it is not clear the extent to which these particles are likely to have travelled to the sampled locations. Also, the areas sampled were historic creek channels, drainage areas, and wetlands and were not focused on areas likely to be used by anglers or by swimmers, waders, and boaters to enter or leave the stream, nor are they from stream-side residential properties. Bank samples are needed from areas likely to be frequented by these receptor groups. Samples should be collected from near the bank full line in areas likely to flood most often. For human health evaluation, samples are needed from 0 to 2 to 0 to 6 inches below ground surface as these are the soils most likely to be contacted by human receptors. In order to evaluate whether substantially elevated contaminant concentrations are present in these areas, ten samples are needed from each potentiall exposure area. Ten comparable samples also will be needed from an appropriate reference location. Samples should be analyzed for the full Target Compound List (TCL)/TAL list of contaminants. The recommendations for additional soil samples are detailed in Section 4.1 and Table 4-2.

Fish

Fish samples have been collected throughout OU3, mainly for ecological risk assessment purposes. Consequently, most samples were analyzed as whole fish or as composite samples, and most were analyzed only for PCB Aroclors and/or congeners. A few fish samples were analyzed for dioxins/furans.

For the human health assessment, samples of edible tissue (fillets) from sport/game fish are needed. The game fish species most prevalent in Eighteenmile Creek within OU3 are brown bullheads and largemouth bass. The available analytical data for whole fish indicates that PCB concentrations vary by reach and by species, with bass having higher concentrations than bullheads and fish collected from the more upstream reaches having higher PCB concentrations than those from downstream reaches. Bullhead fillet samples were collected from Reaches 1, 2 ,and 5. The concentration of PCBs in the fillet are similar in all three reaches (see Table A-2d).

Anglers may have favorite fishing spots and tend to catch and eat fish mainly from those areas rather than uniformly from throughout OU3. The two dams form barriers, at least to upstream fish movement, so the fish populations are likely to be more homogeneous within each of the pools (above Newfane Dam [Reach 5], between the Burt and Newfane dams [Reaches 2 and 3], and below Burt Dam [Reach 1]) than between pools. To assess contaminant exposure from consumption of fish caught from OU3, 10 fillet samples are needed for each species from each of the three OU3 pools plus another 10 samples of each species from a comparable reference area, probably Oak Orchard Creek. The bullhead samples should be prepared as skin-off fillets, since the skin is not usually eaten, while the largemouth bass fillets should be prepared as skin-on since the bass may be eaten that way. The fish samples should be analyzed for the full range of TCL/TAL contaminants. PCBs should be analyzed both as Aroclors and congeners. Congener data are preferred for understanding bioaccumulation because PCB congeners bioaccumulate independently based on their individual log K_{ow} values. In addition, PCB congener data are needed for fish samples to evaluate potential human-health risks from dioxin-like congeners in fish.

2.2.3 Additional Analytical Parameters

In order to comply with EPA risk assessment guidance, full TCL organic and TAL inorganic analyses are needed for at least some fraction of the samples to provide assurance that no significant contaminants are missed in the RI process. Some analytical parameters have limited data as described below.

Dioxins/furans have been detected in fish collected near the northern end of the creek at concentrations higher than Oak Orchard Creek, a reference creek to the east. Environmental media in the creek were not analyzed for dioxins/furans as part of the GLLA RI, because that study evaluated transport of contamination from OU2. Earlier NYSDEC studies of the Erie Canal and creek channel indicate that dioxins/furans are present in sediments in OU3 and, therefore, could contribute to cumulative risks. Although no sources have been identified in Eighteenmile Creek, a portion of future samples (i.e., 10%) should be analyzed for dioxins/furans to provide current, representative data for risk assessment purposes and to have a few representative samples with a full suite of parameters.

Total chromium concentrations appear to be elevated in environmental media in Eighteenmile Creek. Chromium (Cr) can exist in two valence states, Cr(III), and Cr(VI). Cr(VI) is generally much less common in environmental media, but it is more toxic than Cr(III); therefore, it is important to know the chemical form of the chromium present. Historical evaluation of the industries in OU2 did not indicate any potential sources of Cr(VI) in sediment and surface water and, therefore, Cr(VI) is not expected to be present in the sediments and surface water of OU3. Samples collected by EPA's Removal Program in the soils at the Water Street residential yards did not find Cr(VI). Therefore, further analyses for Cr(VI) for all samples are not recommended.

2.2.4 Additional Environmental Media

The potential for contaminated sediments to impact the floodplain along OU3 has been assessed at only a few locations by collecting "soil" samples from historical creek channel areas (where visible) and from some, but not all, wetlands adjacent to the creek channel in OU3. Sediment transport and the potential for flooding have not been documented in OU3. Recommended sampling to address this data gap is described in Section 4.2 and Table 4-2.

2.3 Ecological Risk Assessment

An Ecological Risk Assessment has not been completed for OU3. This section presents a preliminary conceptual site model and preliminary list of assessment endpoints, model species, measures, and risk questions for the ecological risk assessment process at Eighteenmile Creek within OU3. This information was developed to help understand the sufficiency of existing data to support the ecological risk assessment process for OU3 and identify additional data needs. Recommendations for additional data collection are presented in Section 4.3.

2.3.1 Preliminary Ecological Conceptual Site Model

Several investigations found elevated levels of PCBs, PAHs, chlorinated pesticides, and metals, including lead, copper, and zinc, in creek sediments and bank soils within OU2 (E & E 2016b; EEEPC 2009; NYSDEC 2006). These contaminants also have been found at elevated levels in sediment, fish, floodplain soil, and/or other media in OU3 (E & E 2012a, b; E & E 2013; CH2M Hill et al. 2015).

Eighteenmile Creek and its floodplain within OU3 include an abundance of aquatic, wetland, and terrestrial habitats that support a variety of birds, mammals, amphibians, reptiles, fish, and other aquatic organisms (E & E 2009). Based on available information, the following groups of ecological receptors have the potential to be exposed to chemical contamination within OU3:

- Plants and soil invertebrates living in the floodplain of the creek;
- Mammals, birds, and reptiles that use the creek and its floodplain to satisfy their food and habitat needs; and
- Aquatic organisms (i.e., fish, amphibians, benthic invertebrates, and aquatic plants) in the water column and sediments of the creek.

Potential ecological receptors and exposure pathways are summarized in the conceptual site model shown in Figure 2-5. Terrestrial plants and soil invertebrates in the floodplain may be exposed to contaminants by direct contact with contaminated soil and bioaccumulation of contaminants from soil. Birds, mammals, and reptiles that use OU3 may be exposed to contaminants by incidental ingestion of contaminated soil and sediment, consumption of contaminated food sources, and consumption of contaminated creek water. However, for wildlife, consumption of contaminated surface water typically accounts for only a minor fraction of total exposure. Direct contact with contaminated soil, sediment, and water also is considered a minor route of exposure for birds, mammals, and reptiles due to the protection provided by their external coverings (i.e., fur, feathers, and scales). Fish, amphibians, and benthic invertebrates using the creek may be affected by direct contact with contaminated water and sediment and ingestion of contaminated water, sediment, and food items. Aquatic plants may be exposed to site-related contaminants in surface water and sediment.

2.3.2 Preliminary Assessment Endpoints, Model Species, Risk Questions, and Measures

Based on the conceptual model and site ecology, assessment endpoints, model species, risk questions, and measures were selected for the risk assessment process for OU3 (see Table 2-3). Aquatic and terrestrial assessment endpoints are being considered at this time. Based on available data and information, E & E cannot conclude that the creek floodplain within OU3 is free of site-related contamination and poses no ecological risk. In total, four community-level assessment endpoints and 12 population-level assessment endpoints were selected. These assessment endpoints are:

Community-Level Assessment Endpoints

- Aquatic biota (e.g., fish, amphibians, plankton, and macrophytes);
- Benthic macroinvertebrates;
- Terrestrial plants; and
- Soil invertebrates.

Population-Level Assessment Endpoints

- Aquatic-dependent herbivorous birds;
- Aquatic-dependent insectivorous birds;
- Aquatic-dependent piscivorous birds;
- Aquatic-dependent herbivorous mammals;
- Aquatic-dependent insectivorous mammals;
- Aquatic-dependent piscivorous mammals;
- Terrestrial herbivorous birds;
- Terrestrial invertivorous birds;
- Terrestrial carnivorous birds;
- Terrestrial herbivorous mammals;
- Terrestrial invertivorous mammals; and
- Terrestrial carnivorous mammals.

Community-level assessment endpoints will be evaluated by comparing contaminant concentrations in soil, sediment, surface water, and fish tissue with media screening levels. In addition, surface water and sediment bioassays will be used as an additional measure for the benthic and aquatic community assessment endpoints. Wildlife assessment endpoints will be evaluated by calculating hazard quotients. Representative wildlife model species are listed in Table 2-3 (third column). The wildlife species selected for evaluation are common in western New York State and are expected to be present in OU3. Reptiles are called out in the conceptual model figure; however, because toxicity data for reptiles are very limited, a quantitative assessment of potential risks to reptiles from OU3-related contaminants will not be undertaken. Risk estimates for birds and mammals are expected to be protective of reptiles, but this is an uncertainty.

The above-listed assessment endpoints will first be evaluated in a Screening Level Ecological Risk Assessment (SLERA) for OU3. Assessment endpoints that are found not to be at risk in the SLERA will be omitted from quantitative evaluation in the Baseline Ecological Risk Assessment (BERA) for OU3, if the EPA decides to conduct a BERA for the site.

E & E proposes that OU3 be divided into three exposure areas for ecological risk assessment purposes: 1) downstream from Burt Dam (Reach 1); 2) between Burt and Newfane Dams (Reaches 2, 3, and 4); and 3) upstream from Newfane Dam (Reaches 5, 6, and 7). There are two main reasons for proposing these exposure areas. First, the dams form effective barriers that limit the movement of fish and other aquatic organism within the creek. Second, existing data for sediment and fish from OU3 show that contaminant levels in these media typically are lowest downstream from Burt Dam and greatest upstream from Newfane Dam.

2.3.3 Data Evaluation for the Ecological Risk Assessment Process at OU3

A SLERA for OU3 can be conducted with the available data. The SLERA results will be used to select final assessment endpoints for a BERA and identify a final list of data gaps to be filled for the BERA. However, because a SLERA is not available at this time, E & E identified preliminary data gaps to support a BERA for OU3 based on:

- The preliminary ecological conceptual model for OU3 (see Figure 2-5);
- The preliminary assessment endpoints, risk questions, and measures (see Table 2-3); and
- A review of the available data for OU3 as presented in recent site investigation reports, including CH2M Hill et al. (2015) and the other reports listed in Table A-1.

2.3.3.1 Sufficiency of Available Data to Support a BERA for OU3

Tables 2-1a, 2-1b, 2-1d, and 2-1e provide a summary of available surface water, sediment, soil, and fish sample numbers for OU3. The following points are noteworthy regarding the sufficiency of the available data to support a BERA for OU3:

- Existing sediment chemistry data are adequate for determining the nature and extent of contamination and for estimating exposure for benthic macroinvertebrates, wildlife, and other ecological receptor groups.
- Subchronic sediment bioassay results are available for the reach of Eighteenmile Creek downstream from Burt Dam (Reach 1). Specifically, 10-day survival and growth bioassays with *Hyalella azteca* (amphipod) and *Chironomus dilutus* (midge) were conducted in 2012 and 2015; however, longer exposures capable of assessing chronic effects on reproduction have not been conducted in OU3.
- In 2003, bioaccumulation tests (28-day *Lumbriculus* exposures) for PCBs, PAHs, and metals were conducted with sediment samples collected below Burt Dam (Reach 1 [USACE 2004a,b]). In addition, in 2012, *Lumbriculus* bioaccumulation tests were conducted for PCBs in three areas of Eighteenmile Creek within OU3: downstream from Burt Dam (Reach 1), between Burt and Newfane dams (Reaches 2 and 3); and upstream from Newfane Dam (Reach 5) (E & E 2012b). Lastly, in 2016, *Lumbriculus* bioaccumulation tests for a wide range of contaminants were conducted with sediment from OU2 (E & E 2016b). Collectively, E & E considers these data adequate for understanding bioaccumulation of contaminants from sediment to benthos within the Eighteenmile Creek system.
- Limited surface water data exist for some reaches and parameters only. Specifically, surface water data are available for PCB congeners, mercury, and other metals, pesticides, and dioxins/furans for only two samples in

Reaches 1 and 6 (see Table 2-1a). No surface water data are available for PAHs or other SVOCs. Collectively, these data are not adequate for understanding exposure of ecological receptors to chemicals in surface water.

- Fish tissue data (fillet and whole-body) are available for Reach 1 (below Burt Dam) and behind Burt Dam (Reach 2) and Newfane Dam (Reach 5); however, the available fish contaminant data are nearly all for PCBs only (see Table 2-1e).
- Few floodplain soil samples were collected in past site investigations. Specifically, 10 samples were collected from wetland areas bordering the creek channel and historical creek channel areas. This number of samples is not sufficient to characterize the nature and extent of contamination of floodplain soils in OU3. It should be noted that the water level of Eighteenmile Creek within OU3 varies naturally in response to storm events and spring snowmelt and in response to the annual draining of the Barge Canal in November each year. The latter process typically results in an increase in creek water level of about 2 feet for several days while the canal drains. The natural and anthropogenic processes that elevate water level in the creek have likely introduced site-related contaminants into the floodplain. The magnitude of this contamination in OU3 is unknown.

Section 4.3 discusses recommended additional sampling to address deficiencies in the available OU3 data for ecological risk assessment purposes.

2.4 Background and Reference Areas

A number of the contaminants found in OU3 are naturally occurring (metals), or are ubiquitous in environmental media (PAHs and dioxins/furans) as a result of natural processes like combustion or other regional or global human activities. Consequently, it is important to collect analytical data for environmental media in nearby reference or background areas in order to distinguish site-specific concentrations, exposures, and risks from those generally present in the Lake Ontario watersheds. Some fish tissue samples were collected from Oak Orchard Creek in 2007 (E & E 2009). Basin-wide monitoring programs also can be used as references for surface water and historical sediment data. The EPA has developed several guidance documents describing:

- How background locations should be identified;
- How background concentrations should be determined (statistical procedures);
- How contaminant concentrations in site soil and other media should be compared with background concentrations; and
- How background concentrations should be taken into consideration in CERCLA remedy selection decisions.

All of this guidance will be taken into consideration in developing and using background concentrations and selecting background or reference areas.

One possible reference area for OU3 is Oak Orchard Creek, which was used as a reference area for the *Eighteenmile Creek AOC Beneficial Use Impairment Investigation* conducted in 2007 (E & E 2009). Oak Orchard Creek has many similarities to Eighteenmile Creek. Both creeks are tributaries of Lake Ontario, are of similar size and surrounding topography, and are subject to water-level fluctuations due to changes in lake water levels. In addition, each creek has a hydroelectric dam located some distance from their confluences with the lake. Oak Orchard Creek is not a Great Lakes AOC and was recommended as a suitable reference location by NYSDEC for the 2007 BUI investigation. Average whole-body levels of total PCBs in brown bullheads collected from Reach 1 of Eighteenmile Creek (3.2 mg/kg wet weight) were 10 times greater than in bullheads collected from Oak Orchard Creek (0.2 mg/kg wet weight) and exceeded critical PCB tissue concentrations for effects on fish (E & E 2009). No sediment or surface water data were collected from Oak Orchard Creek as part of the BUI investigation, but the bullhead data suggest that Oak Orchard Creek is a clean system with respect to PCBs.

2.5 Sediment Erosion and Deposition Assessment and Modeling

Migration of PCBs and lead from OU2 downstream to Lake Ontario is well-documented. The highest lead contamination in sediments in OU3 is detected at depths of 2 to 8 feet in the impoundment behind Burt Dam. Radiochemical dating of the sediment cores indicates the sediment at this depth was deposited prior to 1954. The highest PCB contamination in sediments is shallower in sediment that was deposited in the mid-1960s. Persistent higher concentrations of both PCBs and lead in shallow sediments throughout the creek indicate continued migration of contamination downstream from OU2. Therefore, understanding sediment transport is of primary concern for determining remedial alternatives in OU3. The source of contaminated sediment is believed to be primarily located in OU2 that migrated downstream through deposition, re-suspension due to scour, and settling; however, these processes have not been modeled.

Sediment thickness, water depth, and sediment surface area were estimated from existing OU3 data, and sediment volume was estimated as part of the GLNPO RI; however, the data for Reach 1 were limited. The average sediment thickness and water depths in the depositional areas behind the dams increase from upstream to downstream. The average sediment thickness and water depths in the rest of the main channel decrease from upstream to downstream. The data from the GLNPO RI is shown on Figure 2-6.

The existing sediment data can be used to qualitatively evaluate sediment deposition. Current bathymetry of the reservoir behind Burt Dam (Reaches 2 and 3) shows a significant sediment deposition area where main channel creek flow enters the impoundment. As the water depth increases closer to the dam, the sediment scour appears to decrease. Sediment capping in this area is a potential remedial alternative, and sediment transport in this area needs to be evaluated. Sediment deposition also is present behind Newfane Dam (Reach 5), but the varying concentration profiles at depth indicate sediment contaminant movement after deposition.

Olcott Harbor within Reach 1 also is a depositional area, but the water and sediment depths in the marina are not well-documented. Water depth in the harbor is monitored and maintained by the USACE as a federal navigational channel. The USACE recently conducted maintenance dredging in the navigation channel to a depth of 12 feet below low water datum.

Sediment depositional areas were identified in shallower areas of the Eighteenmile Creek within OU3, with higher concentrations of PCBs and lead at the bottom of the cores. However, the extent of the isolated PCB and lead “hot spots” have not been delineated, and the results from subsequent confirmatory samples have been inconsistent. The findings suggest that the distribution of PCB and lead contamination in sediments varies significantly and conditions change over time. Deposition in the shallow areas is also caused by the significant amount of woody debris obstructing the water flow throughout these portions of the Eighteenmile Creek within OU3.

Sediment deposition onto the banks and adjacent floodplain due to flooding is not well-documented, but limited sampling of the historical creek channels and wetlands indicate limited impacts based on the low concentrations of contamination.

Two major tributaries, East Branch of Eighteenmile Creek and Gulf Creek, contribute significant flow to the main channel. Many smaller tributaries and drainage areas throughout the flat agricultural portion of Eighteenmile Creek within OU3 from the escarpment to Newfane have been documented to contribute intermittent flow to the main channel. The impact of the tributaries on sediment transport has not been established and needs to be determined via modeling. However, a preliminary model of hydrology and sediment transport within the watershed was developed for the USACE in 2005 using the Soil and Water Assessment Tool (Buffalo State Great Lakes Center [BSGLC] 2005). The model estimated the annual total surface water runoff to the creek and sub-basins to be 412 millimeters (mm), while the annual runoff ratio (i.e., total surface water runoff divided by precipitation amounts) was 0.45. The sub-basins with the largest proportion of urban development produced the greatest amounts of runoff. Across all sub-basins, the annual average runoff ranged from 369 to 461 mm (BSGLC 2005). The model is limited because USGS stream flow gage data are limited to below Burt Dam for the Eighteenmile Creek watershed, and the artificially controlled flow from the Erie Canal presents unique challenges to modeling the hydrology within the Eighteenmile Creek watershed.

EPA semi-annual monitoring of Lake Ontario tributaries indicate that the highest PCB concentrations in surface water have been observed in Eighteenmile Creek since 2002. In 2008, PCB concentrations in Eighteenmile Creek surface water were more than 40 times greater than observed in other Lake Ontario tributaries and two to three orders of magnitude higher than observed in any other tributary in 2009 to 2010. Both the EPA and NYSDEC estimated loadings for Eighteenmile Creek based on estimated flow rates. The EPA estimated the PCB loadings to be 10 to 20 grams per day. Limited NYSDEC surface water sampling for dissolved PCBs in OU2 indicate the highest concentration of dissolved PCBs are present downstream of the Flintkote property. The relationship between the dissolved PCBs in the surface water and sediment transport of contamination in OU3 is not understood. Based on previous assessments and this evaluation, sediment transport will need to be examined in the areas of variable contaminant distributions and the sediment-water partitioning of contaminants needs to be analyzed. Data gaps and needs for the SEDA are discussed in Section 3.2.

2.6 Supporting Data

2.6.1 Cultural Resources

A Phase IA archaeological investigation for the RI/Feasibility Study (FS) Eighteenmile Creek OU2 was completed in 2015 (Hartgen 2015). The investigation was conducted to comply with Section 106 of the National Historic Preservation Act and was submitted for review by the New York State Office of Parks, Recreation, and Historic Preservation. The survey report identifies four new archaeological sites and recommends a Phase IB field reconnaissance survey of the OU2 area of potential effects to further identify and record the archaeological features and deposits found there.

A Phase IA survey was not completed for OU3. Based on the Phase IA survey for OU2, it is presumed that the significance of the historic features along the creek will need to be addressed as cultural resources. A Phase IA survey will be need to be performed during the development of future remedial alternatives for OU3. Specific recommendations are included in Section 4.5.

2.6.2 Community Involvement

As part of OU1 activities, a Community Involvement Plan (CIP) was prepared to ensure that the local community is informed about the progress of remedial activities at the Site and has the opportunity to provide input into decision-making processes. The EPA and E & E interviewed members of the community in August 2013 to seek input on local concerns and preferences for community outreach pertaining to the Site. The initial interviews were focused in the Lockport area, and residents in the OU3 area were not included. In addition, Town of Newfane officials requested that Site-related documentation be provided to the Newfane Public Library in the future. An initial discussion with community members was held on July 18, 2013, to discuss the potential for forming a Technical Assistance Services for Communities (TASC) group. The group decided that formation of the community group would be postponed until activities in OU3 began. Formation of the TASC group will need to be reconsidered as part of the OU3 RI/FS. Specific recommendations for OU3 community involvement and updates to the CIP are included in Section 4.5.

2.6.3 Property Access

To coordinate access with property owners and to notify the public of the planned field activities during the GLNPO RI, the local RAP Coordinator at the NCSWCD was notified of the field schedule. The RAP Coordinator completed informational mailings and identified property owners for access. The drilling subcontractor was responsible for negotiated access for Reaches 2, 3, and 5. During sampling of the other reaches, access was approved by the property owner or limited to road crossings and other public areas for boat access. The individual property owners adjacent to the Eighteenmile Creek within OU3 were not notified. No formal access agreements were completed by the EPA during the GLNPO RI. If residential properties will be sampled, then property access agreements will be needed during the OU3 RI/FS activities. Specific recommendations for property access are included in Section 4.5.

2.6.4 Other

There is limited information on creek usage in Reaches 2 to 7. A reconnaissance survey was completed in winter 2008 and spring 2009 to investigate site access, identify areas of sediment deposition, measure sediment thickness, and map sensitive habitats and other areas of potential ecological concern (CH2M Hill et al. 2015). Observations and field notes were recorded in the handheld Trimble global positioning system (GPS) unit, which also automatically recorded location information. Photographs were taken and noted in the GPS unit as photo points, and photo logs are provided as appendices to the reports. GPS locations and field notes were imported into an ArcGIS geodatabase. In addition the following physical features were noted:

- **Wetland Areas** identified adjacent to the creek could potentially be impacted by contaminated sediments due to flooding. Wetland areas that were directly on the banks of the main channel were identified. Representative areas in each wetland were sampled by collecting surface grabs in depositional areas.
- **Historic Creek Channels** and 35 drainage areas that were directly connected to the main channel of the creek were identified during the Phase 1 reconnaissance. The historic creek channels represent areas that may have been influenced by historic creek flows. Sampling locations were selected based on review of historic aerials and drainage locations. Samples were collected from locations based on observations of where sediment had accumulated on the surface. If multiple sediment areas are present in a wetland, the sediment was composited to characterize a larger area.
- **Tributaries** of Eighteenmile Creek were identified during the Phase 1 reconnaissance and verified on aerial photographs. A total of seven samples were collected from sediment deposits located about 50 feet upstream from the mouth of each tributary. The selected sampling location in each tributary was from an area that is not influenced by the main stem of the Eighteenmile Creek and represents background conditions. One surface

sample (0 to 6 inches below top of sediment) and a composite of the remaining sediment column were collected at each sampling location.

Section 4.5 provides recommendations regarding collection of supporting information for OU3.

3 FS Data Gaps

An FS or an engineering evaluation has not been completed for OU3. To prepare a new FS, existing reports and data were reviewed to assess whether sufficient information is available for identifying remedial technologies that could be implemented at the site. The evaluation of technologies was based on the FS completed for Eighteenmile Creek OU2 (E & E 2016c), but the scope and size of OU3 necessitated the evaluation of additional technologies. This section includes the following:

- Evaluation of existing data and the approach to the FS;
- Preliminary identification of technologies;
- Data required to evaluate technologies, such as the need for treatability studies to better estimate costs and performance capabilities of specific remedial technologies in the FS and geotechnical investigations needed to evaluate remedial technologies; and
- Modeling needed to complete an accurate characterization of the distribution and movement of site contamination.

3.1 Existing Data and FS Approach

Based on the existing data presented in Section 2, the preliminary conceptual site model establishes that the primary source of contamination to the Eighteenmile Creek OU3 are the surface waters and sediment from upstream sources, including Eighteenmile Creek OU2 and the Erie Canal. Additional sources such as hazardous waste sites and tributaries (see Section 1.6) do not appear to be potential sources except for the Upper Mountain Road contribution to contaminated sediments in Gulf Creek. The EPA is addressing cleanup at Eighteenmile Creek OU2 and NYSDEC is addressing cleanup at the Upper Mountain Road site. For purposes of the preliminary evaluation of FS technologies, it was assumed these sources will be substantively reduced as part of the cleanups.

The preliminary conceptual site model indicates that contaminated sediment is present throughout Eighteenmile Creek OU3. The primary COPCs are PCBs and lead, but the risks associated with the COPCs are not determined. For purposes of this evaluation, it is assumed the subsurface contamination at high concentrations behind Burt Dam and Newfane Dam (Reaches 2, 3 and 5) will need to be addressed separately from surface sediment contamination in the remaining reaches.

The remaining contaminated sediments in Reaches 1, 4, 6, and 7 are in shallow waters at shallow sediment depths. The highest concentrations of surface sediment contamination are in Reach 7, upstream of the confluence of the East Branch of Eighteenmile Creek (see Figures 2-3a, b). The nature and extent of contamination in the surface water and floodplain soils cannot be established from existing data. Therefore, remedial technologies for these media were not considered as part of the preliminary evaluation of technologies. Technologies addressing contaminated sediment also could be applied to the floodplains soils. Source- control measures are assumed to address the primary surface water contamination.

The following sections identify the available data to support the FS for OU3. Data gaps and needs identified in Section 3.3 will be used to complete the conceptual model of Eighteenmile Creek contaminant fate and transport and will be used to evaluate remedial alternatives.

3.1.1 Physical and Chemical Data

The following physical and chemical data are currently available from previous investigations:

- Sediment chemical data along the entire creek from 1998 through 2014;
- Surface water chemical data in Olcott Harbor, downstream of Burt/Newfane dams and between the East Branch/Newfane Dam from 2002 through 2016;
- Bathymetry information for 7,000 feet of creek upstream of Burt Dam;
- Sediment thickness data from Burt Dam upstream to Harwood Street, Lockport;
- Geotechnical data (grain size, bulk density, and moisture content) from Olcott Harbor and some pools downstream of Burt Dam and select sediments from Reaches 1 to 7;
- Daily flow data from 2011 through 2016 and stage data from 2016, 150 feet downstream of Burt Dam; and
- Floodplain extent for 100-year flood for the entire creek.

3.1.2 Ex Situ Pilot Study for Testing of Powdered Activated Carbon

In 2012, E & E completed an ex situ pilot study for testing the effectiveness of powdered activated carbon (PAC) in reducing bioavailability of PCBs in sediment. Sediment samples were collected from three locations in the creek: (1) downstream from Burt Dam; (2) between Burt and Newfane dams; and (3) upstream from Newfane Dam. The sediment from each area was then augmented with PAC concentrations of 1%, 3%, and 6% in a laboratory. The study found that treatments of 1%, 3%, and 6% PAC resulted in 99%, 97%, and 84% respective reductions of summed PCB congener concentrations in *Lumbriculus* organisms when compared with organisms exposed to untreated Eighteenmile Creek sediment (E & E 2012).

3.2 Preliminary Technologies

To identify and evaluate technologies that would be appropriate for OU3, E & E considered the technologies that were part of the recently completed FS for Eighteenmile Creek OU2 (E & E 2016c) as well as the EPA guidance for contaminated sediment remediation at hazardous waste sites (EPA 2005). The preliminary technologies that would be appropriate for addressing contaminated sediments were identified and will be evaluated as part of the FS. As discussed in Section 3.1, surface water contamination will be addressed by implementing the remedial cleanups that control the source of contamination as well as by addressing contaminated sediments using these technologies. The technologies that have been identified are:

- Institutional controls;
- Monitored natural recovery (MNR);
- Excavation/dredging (removal);
- Capping (barrier without amendments/barrier with amendments);
- Ex situ treatment (to address principal threat waste concern); and
- In situ treatment (to address principal threat waste concern).

3.3 Data Required to Evaluate Technologies

To evaluate these technologies as part of the FS, site-specific information will be required. Most of the data needed to evaluate these technologies will be collected during the remedial investigation activities for OU3 or can be found in existing case studies. However, it is anticipated that additional data will need to be collected or analyses completed to evaluate these technologies. Table 3-1 presents the data needs for evaluating the technologies described above as well as a summary of the available data and data gaps.

3.3.1 Modeling

As identified in Table 3-1, modeling will be required to evaluate the following technologies: MNR, excavation/dredging (removal), capping, and in situ treatment. Additionally, based on the previous assessments and the SEDA presented in Section 2.4, sediment transport will need to be examined in the areas of variable contaminant distributions, and the sediment-water partitioning of contaminants needs to be analyzed. As such, hydrodynamic sediment transport and contaminant fate and transport modeling will be required; the data needs for these modeling efforts are discussed in the following subsections.

3.3.1.1 Hydrodynamic Modeling

To simulate the processes associated with sediment transport for a complex site such as the creek, a hydrodynamic model will be required. The Environmental Fluid Dynamics Code (EFDC) model has been used successfully for many hydrodynamic and sediment transport modeling applications and will be used for the site. EFDC is a linked hydrodynamic and sediment transport model that can represent the site in three-dimensions. EFDC also has the capability to simulate the fate and transport of the contamination at the site. EFDC is available open-source in Fortran through EPA. The datasets that will be needed to build a hydrodynamic model and the availability of the data is included below:

- Bathymetry and shoreline geometry – this data is currently available for Reach 2 and at low resolution for the entire creek through a digital elevation model (DEM). To build the model, a bathymetric survey will be needed for all other areas within the creek in order to establish accurate creek bottom cross sections;
- Upstream flows, preferably from a reliable gage with a lengthy historical record – the USGS gage downstream of Burt Dam will be useful for Reach 1 and for calibrating data to be collected in the upstream reaches. Flow data will need to be collected for upstream reaches at 4 locations for a period of 3 months;
- Watershed drainage areas of important ungaged tributaries – area values can be calculated using the DEM for Gulf Creek and East Branch of Eighteenmile Creek;
- Watershed model: To simulate the watershed hydrology and water quality as well as to establish the upstream and tributary boundary conditions, the Hydrological Simulation Program-FORTRAN (HSPF) model will be used as the watershed model for this analysis. HSPF is a comprehensive model that uses information such as time history of rainfall, temperature, land surface characteristics and land management practices to simulate the processes that occur in the watershed.
- Water levels at any downstream boundaries (e.g. Lake Ontario), preferably from a reliable gage with lengthy historical record – this data exists as hourly water levels measured from 1967 to the present at NOAA gage 9052076 in Olcott Harbor and intermittent levels recorded at the USGS Burt Dam gage. These data are sufficient for water level boundary conditions;
- Hydraulic characteristics of Burt and Newfane Dam, which includes the spillway elevation and width and flow-stage rating curve. Some of this information (spillway width, flow-stage rating curve for Burt Dam) is available through the New York State Dam Inventory and the USGS gage below Burt Dam. The remaining data could be obtained from NYSDEC or the party operating the dams; if the data are unavailable, the dams will be surveyed.
- Stream velocities – these values can be estimated using flow, water level, and stream cross sections; and
- Water surface elevations – these can be calculated using water levels and bathymetric/elevation data.

3.3.1.2 Sediment Erosion and Deposition Assessment

In addition to the data needs identified for setting up the hydrodynamic model, additional data would typically be needed to complete the sediment transport analysis required for the SEDA. Typical additional data needed, applicability, and availability of the data are discussed below:

- Wave properties (height, period, direction) – due to the nature of the creek system, this is not applicable to this modeling;
- Wind velocity – mean daily wind velocity data is available at Olcott Harbor from 2007 to the present. No more data should be needed;
- Salinity – this is only necessary for estuaries or saline waters and thus is not applicable to this modeling effort;
- Water temperature – some data between 2011 and 2016 exists and is associated with flow and stage data. No additional data is needed;
- Sediment bed erodibility – will need to be calculated using existing data;
- Grain size distribution in sediment bed – an average of 60 subsurface and surface samples of grain size data are available per reach and should be sufficient;
- Bulk density of sediment bed – bulk density data are available only in Reaches 1, 3, and 5. At least four samples per remaining reaches will need to be collected, with four additional samples collected in the Reach 1 harbor;
- Settling velocity of cohesive sediment – can be estimated using sediment bulk density and grain size; and
- Suspended sediment concentration – 48 samples are available and associated with flow and stage data, but only for a single location (USGS-SW2). At least three samples per reach, each at three different flow levels (high and low flows as defined under "Surface Water" in Section 2.2.1, average flow defined as 80 to 120 cfs) will need to be collected and associated with stage and flow data upstream of Newfane and Burt Dams.

3.3.1.3 Contaminant Fate and Transport Assessment

The data required for a fate and transport model typically expands upon a hydrodynamic model, pairing it with sediment transport, partitioning coefficients, and bioaccumulation equations. E & E recommends assessing fate and transport in order to ensure the effectiveness of remedial actions. An understanding of fate and transport can be gained through the use of EFDC. The data required for this analysis would be collected as part of the RI and additional data needs, which are listed in Sections 3.3.1.1, 3.3.1.2, and 3.3.2.

3.3.2 Additional Data Needs for Sediment Cap Modeling

To evaluate the effectiveness of capping as a technology, modeling of the sediment cap with and without amendments will need to be completed. To complete this modeling, additional information will be required. The information from the previous subsection and the following information would be needed to model the effectiveness of a sediment cap:

- COPC pore water concentrations – these samples will be collected to develop an understanding of the sediment-water partitioning of contaminants in the areas where a cap would be feasible (Reaches 2, 3, and 5). Ten pore water samples will be collected with sediment samples in Reaches 2, 3, and 5. Three pore water samples will be collected with sediment samples in Reaches 1, 4, 6, and 7 to estimate partitioning coefficients between surface water and sediment. In total, 42 pore water and 42 sediment samples will be collected, as listed in Table 4-1
- Sediment layer thickness – these data have already been obtained for Reaches 2 through 7 and will be collected for Reach 1. This available data and the newly collected data will be sufficient for modeling the effectiveness of a cap and/or treatment methods;
- Seepage – groundwater seepage is unknown and required to understand potential contaminant migration through a cap. Five measurements will be taken per reach where capping is feasible (Reaches 2, 3, and 5); and
- Porosity – these data can be estimated using grain size and sediment sample volume measurements. Hence, no additional data are needed.

3.3.3 In situ Treatability Study for Testing Powdered Activated Carbon

As discussed in Section 3.1.2, an ex situ pilot study was completed to test the effectiveness of PAC in reducing the bioavailability of PCBs in sediment. The study showed significant reductions in summed PCB congener concentrations in *Lumbriculus* organisms when compared with organisms exposed to untreated Eighteenmile Creek sediment. To further evaluate the effectiveness of PAC in reducing bioavailability of PCBs in the creek, an insitu treatability study will be completed to confirm the results of the pilot study and to consider this technology for treatment of contaminants in the sediment.

3.4 Recommendations for FS Data Collection

Based on the evaluation completed in this section, additional data will need to be collected to support the FS process for OU3. Additional data collection recommendations are summarized in Section 4.6 and Table 4-3.

4 Summary and Recommendations

This section summarizes recommended additional data collection and sampling to support the RI/FS process for OU3. Recommendations for additional sample collection are summarized on Table 4-1. The total number of samples by matrix and recommended analytical methods are included on Table 4-2. The sample locations are shown on Figure 4-1.

4.1 Nature and Extent of Contamination

The extent of contamination indicated by previous investigations was evaluated for groundwater, surface water, sediment, soils, and biota as presented in Section 2.1. Recommendations for additional sampling are summarized below.

4.1.1 Groundwater

Based on the data collected for OU2, it is believed that the VOC contamination is originating either off-site (upgradient to the west of the creek corridor) or from the Canal Corp. property. The source was not determined. In order to make this determination, additional wells should be installed in the approximate locations are shown on Figure 4-2. One well should be installed near the intersection of Clinton Street and Jackson Street to determine water quality entering the creek corridor from the west. Two wells on the Erie Canal Heritage Trail and one well on the Canal Corp. property should be installed to determine water quality entering the creek corridor for the Canal Corp. property (see Figure 4-2). All of the proposed wells should be screened at the same interval elevation as MW-14, and thus they will all be bedrock wells to depths of approximately 45 feet below ground surface (the two wells on the trail and one on the Canal Corp. property) to 55 feet (the well on Clinton Street). Once the new wells are installed and developed, they will be sampled along with seven existing wells (MW05, MW09 [if sufficient water is present], MW14, MW15, MW16, MW17 [if possible since this well is damaged], and MW18) for TCL VOCs.

Groundwater has not been evaluated outside of the creek corridor and there is no data to support impacts on or from groundwater to Eighteenmile Creek within OU3. The preliminary conceptual site model will assume groundwater is not a potential exposure pathway. Groundwater impacts should be assessed further to confirm this assumption once additional data collection for surface water and modeling are completed.

4.1.2 Surface Water

Surface water was not evaluated during the GNLPO RI. The data from the tributary study that was completed by the EPA and NYSDEC from 2002 to 2012 data show no change in PCB concentrations over the 10-year period. Additional data are needed to understand the nature and extent of the surface water contaminants. Samples of both total and dissolved are needed to support a better understanding of sediment transport mechanism. The samples proposed to evaluate nature and extent of contamination also can support risk assessment and can be used as long as unfiltered samples are collected and samples are analyzed for all TCL/TAL parameters. For the nature and extent of contamination, surface water in Reach 7 prior to the confluence of the East Branch of Eighteenmile Creek needs to be collected to assess contributions from upstream sources in the creek corridor.

Human health risk assessment data will be used to assess incidental exposure to surface water by anglers while fishing and residents using creek-side properties. Samples should be collected during the warmer months of the year when swimming, wading, and boating are feasible. Samples should be analyzed for the full suite of TCL/TAL contaminants. PCBs should be analyzed as Aroclors and as congeners.

Collection of surface water from multiple reaches and during high and low flow events is recommended. In general, a high-flow condition is greater than 200 feet cfs, and a low-flow condition is less than 80 cfs. However, flow measurements are only available in Reach 1 and flow data in the rest Eighteenmile Creek within OU3 needs to collected. A potential sampling scheme is provided below. The proposed sample locations are shown on Figure 4-1.

Number of Surface Water Samples required per Reach

Reach → Stage ↓	1	2	3	4	5	6	7	Background
High Flow	4	2	1	2	1	3	2	3
Low Flow	4	2	1	2	1	3	2	3

4.1.3 Sediment

The nature and extent of contamination in the sediment was well-documented as part of previous investigations, and additional sediment sampling is not required to delineate contamination for an FS estimate. Sediment transport mechanisms are not well understood, and contaminated sediment at the surface and in shallower reaches could be re-distributed over time. Previous sampling rounds were not able to replicate hot spot locations. Additional sediment samples, as discussed below, are expected to be useful for understanding changes in sediment PCB concentrations over time. Sediment geotechnical data as required for the FS will be co-located with sediment samples collected as discussed in Sections 4.3 and 4.6, or spaced evenly within the reaches sampled.

The sediment pore water also is an important medium in relation to biological availability and sediment and surface water contaminant migration. Bioavailability for the purposes of risk assessment will be determined by other methods. However, an understanding of pore water concentrations is needed to support the evaluation of capping as a potential remedial technology in support of the FS. A pore water study is recommended to fill this data gap. Ten pore water samples per reach will be collected in Reaches 2, 3, and 5, where capping is a potential remedial technology. In addition, three pore water samples will be collected per reach in Reaches 1, 4, 6, and 7 to characterize sediment-water partitioning of contaminants along the creek, totaling 42 pore water samples to be paired with 42 sediment samples (see Table 4-1). These samples will be co-located with sediment and surface water samples discussed in Section 4.3, with the samples in Reaches 2, 3, and 5 spaced evenly throughout the areas under consideration for capping. These samples will be analyzed for PCB congeners only. Further discussion of the rationale for these samples can be found in Section 3.3.2.

4.1.4 Soils

The potential for contaminated sediment to transfer to the soil on the banks and floodplains has not been sufficiently documented in previous investigations. Exposure to bank soils and sediment also is important for evaluating risks to human health. Because of the long shoreline and number of individual properties, a more detailed survey of the properties and shoreline is required. Figure 4-1 shows elevation contours estimated in GIS using the 2008 LIDAR data and the 100-year floodplain contour from the Federal Emergency Management Agency (https://www.fema.gov/national-flood-hazard-layer-nfhl). Figure 4-1 shows large areas in Reaches 4 to 7 that have the potential for transport of contaminated sediment during flood events.

A phased approach to the floodplain soils is recommended. A more detailed topographic map of the survey based on the elevation data will need to be developed to identify elevations of two- or five-year flooding. These potential higher exposure areas will need to be evaluated based on additional factors such as land use, vegetation cover, existing habitat, substrate/soil type, width of the near-shore area, and signs of potential use. These potential exposure areas will need to be categorized and a set of representative areas of the highest potential exposure will be sampled in the first phase. The number of samples will need to be sufficient to provide statistical evaluation of the concentrations to reduce uncertainty in the risk assessment. Data should be available for the screening-level risk assessments. Additional characterization activities will be recommended pending the screening-level risk assessments. Soil sampling on the banks will be used to address human health and ecological risk assessments as described in Sections 4.2 and 4.3, respectively.

Preliminary sample locations are identified on Figure 4-1. Representative exposure areas were chosen as follows:

- Ide Road access area (Reach 3);
- Newfane Dam (Reaches 4 and 5) – access area next to the dam;
- Residential area near Ewings Road; and
- Agricultural area south of Ridge Road.

For costing purposes, we assume that 40 floodplain soil samples will be collected from OU3 and 10 such samples will be collected from a background area and analyzed for TCL/TAL contaminants (see Table 4-1).

4.1.5 Biota

Historical studies have concluded that PCBs in fish are present at levels that may pose a potential risks to fish as well as people and wildlife that consume fish in Reaches 1, 2, 3, and 5. Potential risks were found to be greater upstream from Burt Dam compared with below Burt Dam. However, additional fish data are needed to quantify exposure for human health and ecological risk assessment as discussed in Sections 2.2.1 and 2.3.3, respectively.

4.2 Human Health Risk Assessment

Based on review of available data for OU3, the following sample types and numbers of samples are recommended to support a human health risk assessment for OU3:

- Collection of 10 bank soil samples (0 to 6 inches below ground surface) from OU3 representative exposure areas frequented by waders, swimmers, and other human receptors is recommended. Samples should be collected from near the bank full line in areas likely to flood most often. Ten samples also are needed from a background area. Samples should be analyzed for the full TCL/TAL list of contaminants and a portion of the samples should be analyzed for PCB congener and dioxin/furans to assess relative risk factors. Inadequate information is available at this time to select specific high-use areas per reach for sampling bank soils.
- Collection of surface water samples from OU3 from representative exposure locations used by waders, swimmers, and other human receptors is recommended (see Section 4.1.2 for suggested sampling locations). The samples should be collected during both low- and high-flow conditions. Samples should be analyzed for the full TCL/TAL list of contaminants. Collection of six reference area samples (three low-flow samples and three high-flow samples) also is recommended.
- Collection of 60 game fish fillet samples (30 brown bullhead and 30 largemouth bass) from OU3 and 20 game fish fillet samples (10 bullhead and 10 largemouth bass) from a background area (Oak Orchard Creek) for

analysis of metals, chlorinated pesticides, SVOCs, PCBs, dioxins/furans, lipids, and moisture content is recommended. Twenty (20) game fish fillet samples (10 brown bullhead and 10 largemouth bass) should be collected from each of three general areas of OU3: below Burt Dam (Reach 1), between Burt and Newfane dams (Reaches 2 and 3, and upstream from Newfane Dam (Reaches 5).

Table 4-1 provides additional details regarding the above recommendations.

4.3 Ecological Risk Assessment

Based on review of available data for OU3, the following sample types and numbers of samples are recommended to support a BERA for OU3:

- Chronic sediment bioassays with *Hyalella azteca* (28-day exposure, EPA Method 100.4) and *Chironomus dilutus* (20-day exposure, EPA Method 100.5) are recommended at three locations downstream from Burt Dam, three locations between Burt and Newfane dams, three locations upstream from Newfane Dam, and one reference location (Oak Orchard Creek). Sediment samples for analysis of metals, SVOCs, PCBs, pesticides, dioxins/furans, TOC, AVS/SEM, and grain size should be collected at each sediment toxicity station to help identify causative agents of toxicity, if any.
- Chronic surface water bioassays with *Ceriodaphnia dubia* (EPA Method 1002.0) and fathead minnow (*Pimephales promelas*) larvae (EPA Method 1000.0) are recommended at three locations below Burt Dam, three locations between the Burt and Newfane dams, three locations upstream from Newfane Dam, and one reference location (Oak Orchard Creek). Surface water samples for analysis of metals (total and dissolved), SVOCs, PCBs, pesticides, dioxins/furans, dissolved organic carbon, and field parameters (pH, temperature, dissolved oxygen, and conductivity) should be collected at each surface water toxicity station to help identify the causative agents of toxicity, if any. E & E recommends co-locating surface water toxicity stations with sediment toxicity stations.
- Collection of 30 forage fish composite samples from OU3 and 10 forage fish composite samples from a reference area (Oak Orchard Creek) for analysis of metals, chlorinated pesticides, SVOCs, PCBs, dioxins/furans, lipids, and moisture content are recommended. Ten forage fish composite samples should be collected from each of three areas of OU3: below Burt Dam, between the Burt and Newfane dams, and upstream from Newfane Dam. Past forage fish sampling activities at Eighteenmile Creek have targeted juvenile bluegills (*Lepomis macrochirus*) and pumpkinseeds (*Lepomis gibbosus*). Both species are plentiful throughout Eighteenmile Creek and are recommended as target species for future sampling.
- Floodplain soil sampling is recommended to develop an understanding of the nature and extent of contamination in the floodplain. We suggest that

floodplain soil sampling be focused on areas that are regularly inundated when the water level rises, such as areas flooded each November when the Barge Canal is drained. For ecological risk assessment purposes, E & E recommends collecting 10 floodplain soil samples from representative areas of the creek: wetlands in Reach 3; Newfane Dam (Reaches 4 and 5) near the access area next to the dam; and wooded residential area near Ewings Road. The samples should be analyzed for metals, SVOCs, PCBs, pesticides, and TOC.

Table 4-1 provides additional details regarding the above recommendations.

4.4 Background or Reference Areas

Many of the expected COPCs within OU3 are also expected to be present in environmental media outside of the Eighteenmile Creek Superfund Site. Therefore, to interpret risk and hazard estimates for exposure areas within OU3, it is important to understand the relationship between background COPC concentrations and those found in OU3. Background locations need to be selected as outlined in the 2002 EPA *Role of Background in the CERCLA Cleanup Program* (EPA 2002).

E & E recommends using Oak Orchard Creek as a background and reference area for OU3. As discussed in Section 2.4, Oak Orchard Creek is similar to Eighteenmile Creek in terms of land use, ecology, and hydrology, and was recommended in the past as a background and reference area for Eighteenmile Creek by NYSDEC. Sample types and numbers are included in the sample counts listed in Tables 4-1 and 4-2.

4.5 Supporting Information

Additional data collection activities recommended include:

- Phase 1A survey for archaeological and architectural cultural resources is recommended for OU3 to comply with Section 106 of the National Historic Preservation Act.
- Detailed shoreline survey for land use and potential exposure areas is needed and will be accomplished through a review of recent aerial photography, zoning, and land use information, and community interviews.
- Updating the Community Involvement Plan for OU1 as part of the OU3 RI/FS process with the focus on OU3 is recommended. Community interviews are also recommended as part of this process to better understand community concerns and site use.
- Fish consumption data specific to OU3 is needed to develop reliable exposure estimates for people that fish at the site and consume their catch. Fishing locations, fish species consumed, amount consumed, and number of fish meals per month are key pieces of information that are poorly understood currently.

4.6 Recommendations for FS Data Collection

Based on the evaluation completed in Section 3.3 and the data listed for collection as part of the RI, data collection recommendations are summarized in Table 4-3 and include:

- Bathymetry from top of left bank to top of right bank for Reaches 1 and 3 through 7;
- Three months of water-velocity and -level measurements at four locations, including Newfane Dam and three other locations within Reaches 3-7;
- Four bulk density samples per reach in Reach 1 (Olcott Harbor only) and Reaches 2, 4, 6, and 7;
- Three suspended sediment concentrations per reach in Reaches 2 through 7;
- Sediment thickness samples in Reach 1, consisting of three samples per 1,000 feet, for a total of 36 samples within the reach;
- Five groundwater seepage measurements per reach in Reaches 2, 3, and 5; and
- Ten paired porewater and sediment samples per reach in Reaches 2, 3, and 5 and three paired porewater and sediment samples per reach in Reaches 1, 4, 6, and 7.

4.7 Summary

The remaining data gaps for OU2 groundwater will be addressed as part of OU3. In order to determine the source of the VOCs for OU2 groundwater, approximately four additional wells are warranted (see Figure 4-2) to determine if the source is off-site from the west of the corridor or from the Canal Corp. property. It is assumed that groundwater in OU3 is not impacted by contamination in the surface water and sediment.

Data gaps for the nature and extent of contamination are primarily in surface water and bank soils. Additional sampling is recommended to address these data gaps.

Data gaps for human health and ecological risk assessments were identified to address specific exposure pathways as well as site-specific toxicity.

Data gaps for the feasibility study were identified to address sediment fate and transport and evaluation of remedial technologies such as capping and treatment.

Potential data needs that require additional discussion include analysis of dioxin/furans; groundwater in OU3; and fate and transport modeling.

5 References

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Tables

Table 1-1 Summary of Land Use Types
Eighteenmile Creek OU3

Land Use	Reach	%	Bank Length (feet)		Bank Length (miles)	
			West	East	West	East
Agricultural	All	8%	8,721	5,249	1.7	1.0
Commercial	All	12%	14,002	6,565	2.7	1.2
Community Services	All	2%	839	1,971	0.2	0.4
Industrial	All	1%	900	881	0.2	0.2
Public Services	All	3%	0	4,837	0	0.9
Recreational and Entertainment	All	1%	595	457	0.1	0.1
Residential	All	30%	24,499	25,496	4.6	4.8
Street	All	1%	651	580	0.1	0.1
Vacant Land	All	41%	33,491	35,827	6.3	6.8
Without Code	All	1%	81	2,159	0.02	0.41
OU3 Total	**All**	**100%**	**83,778**	**84,023**	**15.9**	**15.9**

Notes:

Agricultural	Dairy Products, Field Crops and Orchards
Commercial	Auto Dealers, Greenhouses, Storage, Piers Facilities, Retail and Bars
Community Services	Cemeteries and Religious
Industrial	Manufacturing and Processing
Public Services	Electric Power Generation Facility and Sewage Treatment and Water Pollution Control
Recreational and Entertainment	Marinas and Social Organizations
Residential	Year Round and Seasonal, Single and Multiple Family
Street	
Vacant Land	Abandoned Agricultural, Industrial and Commercial; residential and rural.
Without Code	Somerset Railroad Corp

Source: Lisa Casy, Niagara County GIS Coordinator, Office of Real Property, 59 Park Ave, Lockport, NY 14094 (716-439-7121)

Table 1-2 Summary of Land Use Types by Reach

Eighteenmile Creek OU3

Land Use	Reach	%	Bank Length (feet)		Bank Length (miles)	
			West	East	West	East
Agricultural	01	2%	497	0	0.1	0
Commercial	01	11%	1,230	1,342	0.2	0.3
Community Services	01	2%	0	484	0	0.1
Public Services	01	9%	0	2,125	0	0.4
Recreational and Entertainment	01	4%	595	457	0.1	0.1
Residential	01	43%	3,871	6,426	0.7	1.2
Street	01	2%	258	207	0.05	0.04
Vacant Land	01	27%	5,785	830	1.1	0.2
Reach Subtotal	**1**	**100%**	**12,237**	**11,871**	**2.3**	**2.2**
Agricultural	02	7%	1,060	0	0.2	0
Commercial	02	1%	0	225	0	0.04
Public Services	02	13%	0	2,022	0	0.4
Residential	02	40%	2,041	4,327	0.4	0.8
Street	02	1%	50	40	0.01	0.01
Vacant Land	02	39%	4,947	1,340	0.9	0.3
Reach Subtotal	**2**	**100%**	**8,097**	**7,955**	**1.5**	**1.5**
Commercial	03	5%	0	295	0	0.1
Residential	03	15%	0	927	0	0.2
Vacant Land	03	80%	3,061	1,801	0.6	0.3
Reach Subtotal	**3**	**100%**	**3,061**	**3,022**	**0.6**	**0.6**
Agricultural	04	6%	880	0	0.2	0
Commercial	04	10%	274	1,119	0.1	0.2
Public Services	04	5%	0	690	0	0.1
Residential	04	41%	3,358	2,389	0.6	0.5
Street	04	1%	103	104	0.02	0.02
Vacant Land	04	37%	2,134	3,076	0.4	0.6
Reach Subtotal	**4**	**100%**	**6,749**	**7,378**	**1.3**	**1.4**
Agricultural	05	9%	1,083	0	0.2	0
Commercial	05	36%	3,747	451	0.7	0.1
Residential	05	4%	389	113	0.07	0.0
Vacant Land	05	50%	1,778	4,053	0.3	0.8
Reach Subtotal	**5**	**100%**	**6,997**	**4,617**	**1.3**	**0.9**
Agricultural	06	9%	196	4,055	0.04	0.8
Commercial	06	17%	6,655	848	1.3	0.2
Residential	06	32%	9,687	4,453	1.8	0.8
Street	06	0%	39	38	0.01	0.01
Vacant Land	06	38%	4,350	12,622	0.8	2.4
Without Code	06	4%	0	1,865	0	0.4
Reach Subtotal	**6**	**100%**	**20,928**	**23,880**	**4.0**	**4.5**

Table 1-2 Summary of Land Use Types by Reach
Eighteenmile Creek OU3

Land Use	Reach	%	Bank Length (feet)		Bank Length (miles)	
			West	East	West	East
Agricultural	07	13%	5,004	1,194	0.9	0.2
Commercial	07	8%	1,668	2,285	0.3	0.4
Community Services	07	5%	839	1,487	0.2	0.3
Industrial	07	1%	322	315	0.1	0.1
Residential	07	26%	5,153	6,861	1.0	1.3
Street	07	1%	201	192	0.04	0.04
Vacant Land	07	44%	10,191	10,445	1.9	2.0
Without Code	07	1%	81	295	0.0	0.06
Reach Subtotal	**7**	**100%**	**23,460**	**23,073**	**4.4**	**4.4**
Commercial	08	10%	427	0	0.1	0
Industrial	08	26%	578	566	0.1	0.1
Vacant Land	08	65%	1,244	1,660	0.2	0.3
Reach Subtotal	**8**	**100%**	**2,249**	**2,226**	**0.4**	**0.4**
Total	**All**		**83,778**	**84,023**	**15.9**	**15.9**

Source: Lisa Casy, Niagara County GIS Coordinator, Office of Real Property, 59 Park Ave, Lockport, NY 14094 (716-439-7121)

Notes:

Agricultural	Dairy Products, Field Crops and Orchards
Commercial	Auto Dealers, Greenhouses, Storage, Piers Facilities, Retail and Bars
Community Services	Cemeteries and Religious
Industrial	Manufacturing and Processing
Public Services	Electric Power Generation Facility and Sewage Treatment and Water Pollution Control
Recreational and Entertainment	Marinas and Social Organizations
Residential	Year Round and Seasonal, Single and Multiple Family
Street	
Vacant Land	Abandoned Agricultural, Industrial and Commercial; residential and rural.
Without Code	Somerset Railroad Corp

Table 1-3 Summary of Sediment Thickness, Eighteenmile Creek OU3

Sample Matrix	Reach	Number of Sample Cores	Sediment Thickness (ft)		Comments
			Maximum	Average	
Creek Sediment Samples					
SE	1	77	9.2	1.9	
SE	2	28	9.5	4.4	
SE	3	19	9.0	3.9	
SE	4	23	3.4	0.8	
SE	5	21	7.5	3.1	
SE	6	54	4.0	1.4	
SE	7	83	4.0	1.4	

Key:

SE = Sediment

Source: CH2M HILL et al. (2015).

Table 1-4 Summary of Previous Studies, Eighteenmile Creek OU3

Study Code	Valid(1)	Reaches	Sample Date Range		Number of Samples by Matrix					Comments
					SE	SO	TA	WS	WS/LU	
Creek Sediment Samples										
NCSWCD 2007	Y	7	8/23/2006	9/8/2006	30	-	-	-	-	
NCSWCD 2009	Y	1	8/28/2007	8/29/2007	-	-	8	-	-	
NCSWCD 2012a	Y	1	8/22/2012	8/23/2012	6	-	-	-	-	
NCSWCD 2012b	Y	1, 3, 5	8/29/2012	10/19/2012	12	-	12	-	-	
NCSWCD 2013	Y	1, 2, 5	8/20/2012	8/24/2012	-	-	43	-	-	
Olcott 2014	Y	1	10/22/2013	10/24/2013	22	-	-	-	-	
USACE 2004	Y	1	8/26/2003	8/27/2003	41	-	-	-	-	
USACE 2010	Y	1 to 6	9/13/2010	10/26/2010	34	-	60	-	-	
USACE 2013	Y	1	8/20/2013	8/21/2013	9	-	-	-	4	
USEPA GLNPO	Y	2 to 7	11/16/2009	7/2/2010	521	10	-	-	-	
ML 2010	N	1, 4, 6, 7	3/9/2009	12/3/2009	-	-	-	76	-	
NYSDEC 1998	N	1, 2, 5	5/25/1994	10/12/1994	30	-	-	-	-	
NYSDEC 2001	N	2 to 7	8/17/1998	8/19/1998	33	-	-	-	-	
NYSDEC 2009	N	6	5/1/2007	6/9/2008	-	-	-	8	-	
USEPA 2008	N	1	8/1/2008	8/1/2008	3	-	-	-	-	
USGS 2014	N	1	4/16/2002	10/16/2012	-	-	-	23	-	
USGS 2016	N	1	10/19/2011	9/7/2016	-	-	-	49	-	

Key:
SE = Sediment
SO = Soil
TA = Tissue

Notes:
WS = Surface Water
LU = Leachate

Notes:
(1) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 1-5 Summary of Analyses from Previous Studies, Eighteenmile Creek OU3

Study Code	Reach	Matrix	Valid$^{(1)}$	Sample Date Range		Number of Samples by Analysis										Comments
						PCB Aroclors	PCB Congeners	Metals	Mercury	PAH	Pesticides	Volatiles	Dioxins/Furans	TOC/%L	Nutrients	
Creek Sediment Samples																
NYSDEC 2009	6	WS	N	5/1/2007	6/9/2008	-	6	-	7	-	7	-	7	-	-	
ML 2010	1	WS	N	3/9/2009	12/3/2009	-	-	-	-	-	-	-	-	-	6	
ML 2010	4	WS	N	3/9/2009	12/3/2009	-	-	-	-	-	-	-	-	-	11	
ML 2010	6	WS	N	3/9/2009	12/3/2009	-	-	-	-	-	-	-	-	-	13	
ML 2010	7	WS	N	3/9/2009	12/3/2009	-	-	-	-	-	-	-	-	-	46	
USGS 2014	1	WS	N	4/16/2002	10/16/2012	-	27	-	23	-	18	-	-	-	23	
USGS 2016	1	WS	N	10/19/2011	9/7/2016	-	-	4	1	-	-	-	-	-	48	
NYSDEC 1998	1	SE	N	5/25/1994	10/12/1994	25	-	24	24	-	18	-	24	-	-	
NYSDEC 1998	2	SE	N	10/11/1994	10/11/1994	6	-	3	3	-	6	-	4	-	-	
NYSDEC 1998	5	SE	N	10/12/1994	10/12/1994	4	-	2	2	-	4	-	4	-	-	
NYSDEC 2001	2	SE	N	8/18/1998	8/18/1998	11	22	11	11	11	22	-	22	-	-	
NYSDEC 2001	3	SE	N	8/18/1998	8/18/1998	9	18	9	9	9	14	-	18	-	-	
NYSDEC 2001	4	SE	N	8/19/1998	8/19/1998	4	10	5	5	5	10	-	10	-	-	
NYSDEC 2001	5	SE	N	8/19/1998	8/19/1998	6	12	6	5	6	12	-	12	-	-	
NYSDEC 2001	7	SE	N	8/17/1998	8/18/1998	-	2	2	2	2	-	-	2	-	-	
USACE 2004	1	SE	Y	8/26/2003	8/27/2003	-	40	20	20	-	40	-	30	20	-	
NCSWCD 2007	7	SE	Y	8/23/2006	9/8/2006	60	-	10	10	-	-	-	-	10	-	
USEPA 2008	1	SE	N	8/1/2008	8/1/2008	-	-	3	3	-	-	-	-	3	-	
USEPA GLNPO	2	SE	Y	5/18/2010	5/25/2010	226	46	113	113	226	-	-	-	105	-	
USEPA GLNPO	3	SE	Y	11/16/2009	5/27/2010	150	40	75	75	144	2	-	-	63	-	
USEPA GLNPO	4	SE	Y	11/16/2009	6/23/2010	51	6	24	24	32	10	-	-	24	-	
USEPA GLNPO	5	SE	Y	11/18/2009	7/2/2010	148	10	74	74	142	2	-	-	63	-	
USEPA GLNPO	6	SE	Y	11/17/2009	7/2/2010	150	16	75	75	118	16	-	-	75	-	
USEPA GLNPO	7	SE	Y	11/23/2009	7/1/2010	160	34	80	80	119	28	-	-	80	-	
USEPA GLNPO	7T	SE	Y	11/23/2009	6/29/2010	38	-	19	19	38	20	-	-	19	-	
NCSWCD 2012a	1	SE	Y	8/22/2012	8/23/2012	6	6	6	6	-	3	-	-	3	3	
NCSWCD 2012b	1	SE	Y	8/29/2012	8/29/2012	8	8	-	-	-	-	-	-	4	-	
NCSWCD 2012b	3	SE	Y	8/29/2012	8/29/2012	8	8	-	-	-	-	-	-	4	-	
NCSWCD 2012b	5	SE	Y	8/29/2012	8/29/2012	8	8	-	-	-	-	-	-	4	-	
USACE 2010	1	SE	Y	10/26/2010	10/26/2010	16	16	-	-	-	-	-	-	16	-	
USACE 2013	1	SE	Y	8/20/2013	8/21/2013	9	-	9	9	9	9	-	-	9	9	
USACE 2013	1	LU	Y	8/20/2013	8/20/2013	3	-	3	3	3	3	-	-	-	3	
Olcott 2014	1	SE	Y	10/22/2013	10/24/2013	22	-	22	22	22	22	22	-	-	-	
USEPA GLNPO	4	SO	Y	11/16/2009	11/17/2009	4	-	2	2	2	2	-	-	2	-	

Table 1-5 Summary of Analyses from Previous Studies, Eighteenmile Creek OU3

Study Code	Reach	Matrix	Valid(1)	Sample Date Range		Number of Samples by Analysis										Comments
						PCB Aroclors	PCB Congeners	Metals	Mercury	PAH	Pesticides	Volatiles	Dioxins/Furans	TOC/%L	Nutrients	
USEPA GLNPO	5	SO	Y	11/18/2009	11/18/2009	2	-	1	1	2	2	-	-	1	-	
USEPA GLNPO	6	SO	Y	12/2/2009	12/2/2009	4	-	2	2	2	2	-	-	2	-	
USEPA GLNPO	7	SO	Y	11/23/2009	11/30/2009	10	2	5	5	2	2	-	-	5	-	
NCSWCD 2009	1	TA	Y	8/28/2007	8/29/2007	16	-	-	-	-	-	-	-	8	2	
NCSWCD 2012b	1	TA	Y	10/18/2012	10/18/2012	8	8	-	-	-	-	-	-	4	-	
NCSWCD 2012b	3	TA	Y	10/19/2012	10/19/2012	8	8	-	-	-	-	-	-	4	-	
NCSWCD 2012b	5	TA	Y	10/19/2012	10/19/2012	8	8	-	-	-	-	-	-	4	-	
NCSWCD 2013	1	TA	Y	8/20/2012	8/23/2012	26	26	-	-	-	-	-	-	13	-	
NCSWCD 2013	2	TA	Y	8/22/2012	8/24/2012	26	26	-	-	-	-	-	-	13	-	
NCSWCD 2013	5	TA	Y	8/21/2012	8/24/2012	34	34	-	-	-	-	-	-	17	-	
USACE 2010	1	TA	Y	9/14/2010	9/27/2010	38	-	-	-	-	-	-	-	19	-	
USACE 2010	2	TA	Y	9/13/2010	9/13/2010	14	-	-	-	-	-	-	-	7	-	
USACE 2010	3	TA	Y	9/29/2010	9/29/2010	30	-	-	-	-	-	-	-	15	-	
USACE 2010	4	TA	Y	9/21/2010	9/29/2010	18	-	-	-	-	-	-	-	9	-	
USACE 2010	6	TA	Y	9/14/2010	9/15/2010	20	-	-	-	-	-	-	-	10	-	

Key:	Notes:	Notes:
SE = Sediment	WS = Surface Water	(1) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.
SO = Soil	LU = Leachate	
TA = Tissue		

Table 2-1a Summary of Surface Water Samples, Eighteenmile Creek OU3

Sample Matrix	Reach	Sample Type(1)	Sample Date Range		Valid(2)	Analysis																			Comments
						PCB Congeners	Metals	Mercury	Pesticides	Dioxins/Furans	NITROGEN	NITROGEN, AMMONIA (AS N)	NITROGEN, NITRATE (AS N)	Nitrogen, Organic	Phosphorus	PHOSPHORUS, TOTAL ORTHOPHOSPHATE (AS PO4)	SODIUM	TOTAL DISSOLVED SOLIDS	Total Nitrogen, All Forms, Calculated	TOTAL SUSPENDED SOLIDS	CONDUCTIVITY	TEMPERATURE	PH	TURBIDITY	
Surface Water Samples						**33**	**4**	**31**	**25**	**7**	**96**	**20**	**76**	**20**	**76**	**52**	**76**	**47**	**20**	**145**	**22**	**23**	**44**	**14**	
WS	1	Creek	4/16/2002	9/7/2016	N	27	4	24	18	0	26	20	6	20	6	52	6	47	20	75	22	23	44	14	
WS	4	Creek	3/9/2009	12/3/2009	N	0	0	0	0	0	5	0	5	0	5	0	5	0	0	5	0	0	0	0	
WS	6	Creek	5/1/2007	6/9/2008	N	6	0	7	7	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
WS	7	Creek	3/9/2009	12/3/2009	N	0	0	0	0	0	19	0	19	0	19	0	19	0	0	19	0	0	0	0	
WS	6	East Branch	3/9/2009	12/3/2009	N	0	0	0	0	0	9	0	9	0	9	0	9	0	0	9	0	0	0	0	
WS	7	East Branch	3/9/2009	12/3/2009	N	0	0	0	0	0	6	0	6	0	6	0	6	0	0	6	0	0	0	0	
WS	4	Tributary	3/9/2009	12/3/2009	N	0	0	0	0	0	6	0	6	0	6	0	6	0	0	6	0	0	0	0	
WS	6	Tributary	3/9/2009	5/29/2009	N	0	0	0	0	0	4	0	4	0	4	0	4	0	0	4	0	0	0	0	
WS	7	Tributary	3/9/2009	12/3/2009	N	0	0	0	0	0	21	0	21	0	21	0	21	0	0	21	0	0	0	0	

Key:
WS = Surface Water

Notes:
(1) Tributary includes Gulf Creek and drainage areas
(2) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 2-1b Summary of Sediment Samples, Eighteenmile Creek OU3

						Analysis									
Sample Matrix	Reach	Sample Type(1)	Sample Date Range		Valid(2)	PCB Aroclors	PCB Congeners	Metals	Mercury	PAH	Pesticides	Volatiles	Dioxins/Furans	Total Organic Carbon	Comments
Creek Sediment Samples						**520**	**111**	**508**	**508**	**422**	**83**	**22**	**15**	**480**	**Total**
						335	**93**	**333**	**333**	**247**	**83**	**22**	**15**	**302**	**Total Surface**
SE	1	Surface	8/26/2003	10/24/2013	Y	38	27	57	57	31	54	22	15	52	
SE	2	Surface	5/18/2010	5/25/2010	Y	31	15	31	31	31	0	0	0	23	
SE	2	Subsurface	5/18/2010	5/25/2010	Y	82	8	82	82	82	0	0	0	82	
SE	3	Surface	11/16/2009	8/29/2012	Y	32	17	28	28	25	1	0	0	20	
SE	3	Subsurface	5/25/2010	5/27/2010	Y	47	7	47	47	47	0	0	0	47	
SE	4	Surface	11/16/2009	6/23/2010	Y	27	3	24	24	16	5	0	0	24	
SE	5	Surface	11/18/2009	8/29/2012	Y	32	6	28	28	25	1	0	0	22	
SE	5	Subsurface	5/20/2010	5/24/2010	Y	46	3	46	46	46	0	0	0	45	
SE	6	Surface	11/17/2009	7/2/2010	Y	75	8	75	75	59	8	0	0	75	
SE	7	Surface	8/23/2006	7/1/2010	Y	100	17	90	90	60	14	0	0	86	
SE	7	Subsurface	8/23/2006	9/8/2006	Y	10	0	0	0	0	0	0	0	4	
Creek Tributary						**19**	**0**	**19**	**19**	**19**	**10**	**0**	**0**	**19**	
SE	7T	Surface	11/23/2009	6/29/2010	Y	19	0	19	19	19	10	0	0	19	
Creek Sediment Samples - Not Validated						**14**	**31**	**65**	**64**	**0**	**44**	**0**	**49**	**3**	
SE	1	Surface	9/12/1994	8/1/2008	N	5	0	11	11	0	6	0	4	3	
SE	1	Subsurface	5/25/1994	9/12/1994	N	4	0	16	16	0	4	0	8	0	
SE	2	Surface	10/11/1994	8/18/1998	N	2	5	7	7	0	7	0	6	0	
SE	2	Subsurface	10/11/1994	8/18/1998	N	1	6	7	7	0	7	0	7	0	
SE	3	Surface	8/18/1998	8/18/1998	N	0	5	5	5	0	4	0	5	0	
SE	3	Subsurface	8/18/1998	8/18/1998	N	0	4	4	4	0	3	0	4	0	
SE	4	Surface	8/19/1998	8/19/1998	N	0	3	3	3	0	3	0	3	0	
SE	4	Subsurface	8/19/1998	8/19/1998	N	0	2	2	2	0	2	0	2	0	
SE	5	Surface	10/12/1994	8/19/1998	N	1	4	5	5	0	5	0	5	0	
SE	5	Subsurface	10/12/1994	8/19/1998	N	1	2	3	2	0	3	0	3	0	
SE	7	Surface	8/17/1998	8/18/1998	N	0	0	2	2	0	0	0	2	0	

Key:	Notes:
SE = Sediment	(1) Surface samples are (0-1 ft) and Subsurface (<1 ft)
SO = Soil	(2) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 2-1c Summary of Other Analyses, Eighteenmile Creek OU3

							Analysis					
Sample Matrix	**Reach**	**Sample Type(1)**	**Location Type(1)**	**Sample Date Range**		**Valid(2)**	**GRAIN SIZE**	**BULK DENSITY**	**AVS**	**SEM**	**D2216**	**Comments**
Sediment Samples							**463**	**16**	**39**	**39**	**364**	
SE	1	Surface	Creek	8/22/2012	8/29/2012	Y	4	8	4	4	0	
SE	1	Surface	Harbor	8/20/2013	10/24/2013	Y	25	0	0	0	0	
SE	1	Surface	Lake	8/21/2013	8/21/2013	Y	6	0	0	0	0	
SE	2	Surface	Creek	5/18/2010	5/25/2010	Y	23	0	2	2	23	
SE	3	Surface	Creek	5/25/2010	8/29/2012	Y	12	4	4	4	9	
SE	3	Surface	Wetland	11/16/2009	11/16/2009	Y	4	0	0	0	0	
SE	4	Surface	Creek	11/16/2009	6/23/2010	Y	22	0	4	4	15	
SE	4	Surface	Wetland	11/16/2009	11/18/2009	Y	2	0	0	0	0	
SE	5	Surface	Creek	5/20/2010	8/29/2012	Y	13	4	2	2	14	
SE	5	Surface	Wetland	11/18/2009	11/19/2009	Y	4	0	1	1	1	
SE	6	Surface	Creek	11/17/2009	7/2/2010	Y	74	0	8	8	59	
SE	6	Surface	Wetland	12/2/2009	12/2/2009	Y	1	0	0	0	0	
SE	7	Surface	Creek	11/23/2009	7/1/2010	Y	79	0	13	13	59	
SE	7	Surface	Wetland	11/30/2009	11/30/2009	Y	1	0	0	0	0	
SE	7T	Surface	Tributary	11/23/2009	6/29/2010	Y	19	0	1	1	10	
SE	2	Subsurface	Creek	5/18/2010	5/25/2010	Y	82	0	0	0	82	
SE	3	Subsurface	Creek	5/25/2010	5/27/2010	Y	47	0	0	0	47	
SE	5	Subsurface	Creek	5/20/2010	5/24/2010	Y	45	0	0	0	45	
Creek Historical Channel or Wetland							**10**	**0**	**1**	**1**	**1**	
SO	4	Surface	Historic Creek	11/16/2009	11/16/2009	Y	1	0	0	0	0	
SO	4	Surface	Tributary	11/17/2009	11/17/2009	Y	1	0	1	1	1	
SO	5	Surface	Historic Creek	11/18/2009	11/18/2009	Y	1	0	0	0	0	
SO	6	Surface	Historic Creek	12/2/2009	12/2/2009	Y	2	0	0	0	0	
SO	7	Surface	Historic Creek	11/23/2009	11/30/2009	Y	5	0	0	0	0	

Key:	Notes:
SE = Sediment	(1) Surface samples are (0-1 ft) and Subsurface (<1 ft)
SO = Soil	(2) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 2-1d Summary of Soil Samples, Eighteenmile Creek OU3

Sample Matrix	Reach	Sample Type(1)	Sample Date Range		Valid(2)	Analysis									Comments
						PCB Aroclors	PCB Congeners	Metals	Mercury	PAH	Pesticides	Volatiles	Dioxins/Furans	Total Organic Carbon	
Creek Historical Channel or Wetland						**10**	**1**	**10**	**10**	**4**	**4**	**0**	**0**	**10**	
SO	4	Surface	11/16/2009	11/17/2009	Y	2	0	2	2	1	1	0	0	2	
SO	5	Surface	11/18/2009	11/18/2009	Y	1	0	1	1	1	1	0	0	1	
SO	6	Surface	12/2/2009	12/2/2009	Y	2	0	2	2	1	1	0	0	2	
SO	7	Surface	11/23/2009	11/30/2009	Y	5	1	5	5	1	1	0	0	5	

Key:	Notes:
SE = Sediment	(1) Surface samples are (0-1 ft) and Subsurface (<1 ft)
SO = Soil	(2) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 2-1e Summary of Fish Tissue Samples, Eighteenmile Creek OU3

Sample Matrix	Reach	Sample Type(1)	Sample Date Range		Valid(2)	Analysis					Comments
						PCB Aroclors	PCB Congeners	Percent Lipids	Percent Solids	TEQ using 89-ITE-Factors	
Sport Fish Samples						**63**	**20**	**63**	**20**	**2**	
TA	1	Bullhead Fillet	8/20/2012	8/20/2012	Y	5	5	5	5	0	
TA	2	Bullhead Fillet	8/22/2012	8/22/2012	Y	5	5	5	5	0	
TA	5	Bullhead Fillet	8/21/2012	8/21/2012	Y	5	5	5	5	0	
TA	1	Bullhead Whole-Body	8/28/2007	9/15/2010	Y	13	0	13	0	2	
TA	2	Bullhead Whole-Body	9/13/2010	9/13/2010	Y	1	0	1	0	0	
TA	3	Bullhead Whole-Body	9/29/2010	9/29/2010	Y	6	0	6	0	0	
TA	4	Bullhead Whole-Body	9/29/2010	9/29/2010	Y	3	0	3	0	0	
TA	1	Largemouth Bass Whole-Body	9/14/2010	9/27/2010	Y	7	0	7	0	0	
TA	2	Largemouth Bass Whole-Body	9/13/2010	9/13/2010	Y	3	0	3	0	0	
TA	3	Largemouth Bass Whole-Body	9/29/2010	9/29/2010	Y	4	0	4	0	0	
TA	4	Largemouth Bass Whole-Body	9/29/2010	9/29/2010	Y	3	0	3	0	0	
TA	5	Largemouth Bass Whole-Body	8/21/2012	8/21/2012	Y	5	5	5	5	0	
TA	6	Largemouth Bass Whole-Body	9/14/2010	9/15/2010	Y	3	0	3	0	0	
Forage Fish Composites						**19**	**13**	**19**	**13**	**0**	
TA	1	Forage Whole-Body Composite	9/14/2010	8/20/2012	Y	12	5	12	5	0	
TA	2	Forage Whole-Body Composite	9/13/2010	8/22/2012	Y	8	5	8	5	0	
TA	3	Forage Whole-Body Composite	9/29/2010	9/29/2010	Y	5	0	5	0	0	
TA	4	Forage Whole-Body Composite	9/21/2010	9/29/2010	Y	3	0	3	0	0	
TA	5	Forage Whole-Body Composite	8/21/2012	8/21/2012	Y	5	5	5	5	0	
TA	6	Forage Whole-Body Composite	9/15/2010	9/15/2010	Y	3	0	3	0	0	
TA	1	Crayfish Whole-Body Composite	8/23/2012	8/23/2012	Y	3	3	3	3	0	
TA	2	Crayfish Whole-Body Composite	8/24/2012	8/24/2012	Y	3	3	3	3	0	
TA	5	Crayfish Whole-Body Composite	8/24/2012	8/24/2012	Y	2	2	2	2	0	

Key:	Notes:
TA = Tissue	(1) Fillets are skin-off
	(2) Y - Samples results were validated and usable for risk assessment. N - Samples results were not validated.

Table 2-2 Preliminary Selection of Human Health Exposure Media and Pathways
Eighteenmile Creek OU3

Scenario Timeframe	Receptor Population	Receptor Age	Medium	Exposure Medium	Exposure Point	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current and Future	Anglers	All ages	Surface Water	Surface Water	Eighteenmile Creek	Ingestion	Quantitative	Anglers may contact these media while fishing and eat fish caught from the Creek.
						Dermal Contact		
			Bank Soil	Bank Soil	Eighteenmile Creek Banks	Ingestion		
						Dermal Contact		
			Sediment	Sediment	Eighteenmile Creek Bed	Ingestion		
						Dermal Contact		
			Fish Tissue	Fish Tissue	Creek	Ingestion		
	Swimmers, Waders, Boaters and other Recreational Users of the Creek and its Floodplains	All ages	Surface Water	Surface Water	Eighteenmile Creek	Ingestion	Quantitative	Swimmers, Waders and Boaters may contact these media while using the Creek for recreational purposes.
						Dermal Contact		
			Bank Soil	Bank Soil	Eighteenmile Creek Banks	Ingestion		
						Dermal Contact		
			Sediment	Sediment	Eighteenmile Creek Bed	Ingestion		
						Dermal Contact		
	Creekside Residents	All ages	Bank Soil	Bank Soil	Eighteenmile Creek Banks	Ingestion	Quantitative	Residents may contact these media while using their yards for various purposes, may fish from the Creek Banks, and may eat fish caught from the Creek.
						Dermal Contact		
			Surface Water	Surface Water	Eighteenmile Creek	Ingestion		
						Dermal Contact		
			Sediment	Sediment	Eighteenmile Creek Bed	Ingestion		
						Dermal Contact		
			Fish Tissue	Fish Tissue	Creek	Ingestion		
	Agricultural Product Consumers	All ages	Surface Water used for Irrigation	Fruits, Vegetables, Meat and Dairy Products	Point of Product Use	Ingestion	Qualitative or Quantitative	There are some indications that Creek Water may be / have been used for irrigating crops at some locations. Pathway completeness requires further evaluation.

Table 2-3 Preliminary List of Candidate Assessment Endpoints, Model Species, Risk Questions, and Measures for the Ecological Risk Assessment Process, Eighteenmile Creek OU3

Assessment Endpoint (Attribute)	Level of Organization	Model Species	Risk Question	Measure	Analysis Approach
AQUATIC RECEPTORS					
Aquatic-Dependent Mammals (Herbivorous, Insectivorous, and Carnivorous)					
Aquatic-dependent mammals (survival, growth, reproduction [S,G,R])	Local Populations	Muskrat, Mink, Bat	Does the daily dose of contaminants received from ingestion of sediment, water, and food items exceed TRVs for survival, growth, or reproduction of mammals?	Contaminant concentrations in sediment, surface water, and food items.	Modeled dose from ingestion of sediment, surface water, and food items compared with literature-based TRVs.
Aquatic-Dependent Birds (Herbivorous, Insectivorous, and Carnivorous)					
Aquatic-dependent birds (S,G,R)	Local Populations	Mallard, Swallow, Heron	Does the daily dose of contaminants received from ingestion of sediment, water, and food items exceed TRVs for survival, growth, or reproduction of birds?	Contaminant concentrations in sediment, surface water, and food items.	Modeled dose from ingestion of sediment, surface water, and food items compared with literature-based TRVs.
Benthic Macroinvertebrates					
Benthic macroinvertebrates (S,G,R)	Local Community	Species present in habitat	Are contaminant concentrations in sediment greater than screening levels for effects on survival, growth, or reproduction of benthos?	Contaminant concentrations in sediment.	Compare sediment contaminant concentrations with literature-based sediment screening levels for effects on benthic macroinvertebrates.
			Are survival, growth, and reproduction of laboratory-reared benthic organisms in OU3 sediment less than in control and reference area sediment?	Sediment toxicity tests.	Compare survival, growth, and reproduction in OU3 sediment with the same endpoints in control and reference area sediment.
Aquatic Biota Exposed to Surface Water (Fish, Amphibians, Plankton, Macrophytes)					
Aquatic organisms exposed to surface water (S,G,R)	Local Communities	Species present in habitat	Are contaminant concentrations in surface water greater than water quality criteria for protection of aquatic organisms?	Surface-water contaminant concentrations.	Compare surface-water contaminant concentrations with water quality criteria and standards.
			Are survival, growth, and reproduction of laboratory-reared organisms in OU3 surface water less than in control and reference area surface water?	Surface water toxicity tests.	Compare survival, growth, and reproduction in OU3 surface water with the same endpoints in control and reference area surface water.
			Are contaminant levels in fish collected from OU3 greater than fish tissue screening concentrations (TSCs)	Contaminant concentrations in fish collected from OU3.	Compare contaminant levels in fish from OU3 with TSCs for effects on fish.

Table 2-3 Preliminary List of Candidate Assessment Endpoints, Model Species, Risk Questions, and Measures for the Ecological Risk Assessment Process, Eighteenmile Creek OU3

Assessment Endpoint (Attribute)	Level of Organization	Model Species	Risk Question	Measure	Analysis Approach
TERRESTRIAL (Floodplain) RECEPTORS					
Terrestrial Plants					
Terrestrial vegetation (S, G, R)	Local Community	All plants that obtain nutrients primarily from soil	Are contaminant concentrations in surface soil greater than screening levels for effects on survival, growth, or reproduction of plants?	Surface-soil contaminant concentrations.	Compare surface-soil contaminant concentrations with literature-based soil screening levels for effects on plants.
Terrestrial Invertebrates					
Terrestrial invertebrates (S, G, R)	Local Community	All soil invertebrates (e.g., earthworms)	Are contaminant concentrations in surface soil greater than screening levels for effects on survival, growth, or reproduction of soil invertebrates?	Surface-soil contaminant concentrations.	Compare surface-soil contaminant concentrations with literature-based soil screening levels for effects on soil invertebrates.
Terrestrial Mammals (Herbivorous, Insectivorous, and Carnivorous)					
Terrestrial mammals (S,G,R)	Local Populations	Vole, shrew, weasel	Does the daily dose of contaminants received from ingestion of soil, water, and food items exceed TRVs for survival, growth, or reproduction of mammals?	Contaminant concentrations in soil, surface water, and food items.	Modeled dose from ingestion of soil, surface water, and food items compared with literature-based TRVs.
Terrestrial Birds (Herbivorous, Insectivorous, and Carnivorous)					
Terrestrial birds (S,G,R)	Local Populations	Dove, robin, hawk	Does the daily dose of contaminants received from ingestion of soil, water, and food items exceed TRVs for survival, growth, or reproduction of birds?	Contaminant concentrations in soil, surface water, and food items.	Modeled dose from ingestion of soil, surface water, and food items compared with literature-based TRVs.

Key:
OU3 = Operational Unit 3
TRV = Toxicity Reference Value

Table 3-1 Data Needs for Evaluating Treatment Technologies for the Feasibility Study, Eighteenmile Creek OU3

Treatment Technology	Data Needs to Evaluate Technology	Data Available[1]	E & E Data Gaps[1]
Institutional Controls	1. Current zoning 2. Current fish consumption/use warnings	All necessary data is available (1, 2)	None
Monitored Natural Recovery (MNR)	1. Contaminants of potential concern (COPC) identification, location, depth & degradation potential 2. Sediment erosion and deposition areas 3. Depth of fill & depth to bedrock	■ COPC will be identified and located with depths as part of remedial investigation (RI) (1) ■ Some grain size, bulk density, fill depth, wind velocity and bathymetric data (2, 3) ■ Flow, water level, drainage area data (2) ■ Some suspended sediment and temperature data (2)	■ COPC degradation potential case studies (1) ■ Hydrodynamic modeling and sediment transport assessment (2): – Bathymetry – Flow data – Sediment bulk density – Suspended sediment concentrations ■ Sediment thickness (3)
Excavation/Dredging	1. COPC identification, location & depth 2. Sediment erosion and deposition areas 3. Depth of fill & depth to bedrock	Same as for MNR for (1, 2, 3)	Same as MNR for (2, 3)
Capping (without amendments)	1. COPC identification, location & depth 2. Sediment erosion and deposition areas 3. Groundwater seepage 4. Depth of contamination/fill, sediment homogeneity and other geotechnical data, such as sediment particle size distribution, Bulk density, Particle density, sediment permeability, Moisture Content, pH and Total Organic Carbon 5. COPC porewater concentration	Same as MNR for (1, 2)	■ Same as MNR for (2), which also addresses some of the geotechnical needs for (4) ■ In-situ seepage meter measurements at capping locations (3, 4) ■ Paired porewater-sediment samples at capping locations (4, 5)
Capping (with amendments)	1. COPC identification, location & depth 2. Sediment erosion and deposition areas 3. Groundwater seepage 4. Depth of contamination/fill, sediment homogeneity and other geotechnical data, such as sediment particle size distribution, Bulk density, Particle density, sediment permeability, Moisture Content, pH and Total Organic Carbon 5. COPC porewater concentrations 6. Amendment effectiveness	Same as for MNR for (1, 2)	■ Same as MNR for (2), which also addresses some of the geotechnical needs for (4) ■ In-situ seepage meter measurements at capping locations (3,4) ■ Paired porewater-sediment samples at capping locations (4, 5) ■ In-situ treatability study of PAC amendments in treating PCBs in sediment (6)
Ex-situ Treatment (to be paired with excavation/dredging)	1. COPC identification, location & depth 2. Treatments & effectiveness for COPC	COPC will be identified and located with depths as part of RI (1)	Treatment effectiveness case studies and technology reviews, dependent on COPC (2)
In-situ Treatment	1. COPC identification, location & depth 2. Sediment erosion and deposition areas 3. Depth of contamination/fill, depth to bedrock, sediment homogeneity and other geotechnical data, such as sediment particle size distribution, Bulk density, Particle density, sediment permeability, Moisture Content, pH and Total Organic Carbon 4. Treatments & effectiveness based on COPC	Same as for MNR for (1, 2, 3)	■ Same as MNR for (2, 3) ■ Treatment effectiveness case studies and technology reviews, dependent on COPC (4)

Notes:

[1] The number(s) in parentheses correspond(s) to the associated data need identified in the column "Data Needs to Evaluate Technology"

Key:

COPC = contaminants of potential concern
MNR = Monitored Natural Recovery
PCB = Poly-chlorinated biphenyl
RI = remedial investigation

Table 4-1 Summary of Data Gaps and Recommended Additional Sampling, Eighteenmile Creek OU3

				Number of Samples Recommended for Each Parameter								
Data Type	**Data Gap**	**Data Need**	**Location**	**Full Suite TCL/TAL(1)**	**PCB Congener**	**Dioxins/ Furans**	**TOC/ Lipids**	**Toxicity**	**AVS/ SEM**	**Geotechnical**	**Water Quality**	**Remarks**
Groundwater												
Groundwater	Previous investigations did not identify source of VOC contamination in OU2.	Determine the source of VOCs with the installation of four additional monitoring wells. Sampling of the 6 existing wells will also be completed.	Immediately west of MW-14 and east of MW-14 on the Erie Canal Heritage Trail and Canal Corp Property.	10	--	--	--	--	--	--	--	Samples only need to be analyzed for VOCs.
Surface Water												
Surface Water Chemistry	Historical data demonstrates PCBs in total and dissolved phases are transported by surface water to Lake Ontario. Limited data are available for other parameters. Surface water samples are not available to assess potential exposures of swimmers, waders, boaters, anglers, and shoreline residents for the HHRA.	The samples should be collected during both low- and high-flow conditions. Unfiltered surface water samples are needed to assess potential exposures for HHRA. Filtered samples are needed to assess dissolved components for contaminant fate and transport and ecological risk assessment. Full TCL/TAL scan recommended for Superfund. Other includes TSS, dissolved organic carbon, and water-quality parameters (field measured).	Sampling locations should be biased toward human use areas and may not coincide with the surface water samples collected to evaluate surface water toxicity to fish and other aquatic biota. Samples should be collected during the warmer months. Samples should collected from each reach and above and below the East Branch confluence.	36	36						36	Thirty (30) samples (15 locations) from various reaches of OU3 and six (6) background area samples (3 locations).
Surface Water Toxicity	Aquatic organisms are exposed to surface water and wildlife consume water from the creek. Surface water bioassays provide direct evidence of surface water toxicity, or lack thereof. Surface water chemistry samples (full suite of parameters) should be collected at locations were surface water toxicity is evaluated so causative agents of toxicity, if any, can be identified.	Surface water bioassays with laboratory-reared organisms have not been conducted in Eighteenmile Creek OU3. Bioassays with *Ceriodaphnia dubia* (EPA Method 1002.0) and fathead minnow (*Pimephales promelas*) larvae (EPA Method 1000.0) are recommended. Surface water chemistry recommended at locations were toxicity is evaluated. Full TCL/TAL scan recommended for Superfund. Dissolved and total metals should be measured. Other includes TSS, dissolved organic carbon, and water-quality parameters (field measured).	Representative locations from below Burt Dam, between Burt and Newfane Dams, up-stream from Newfane Dam, and one reference location (Oak Orchard Creek). Total and dissolved samples are needed for select parameters.	20	20	4	--	20	--	--	10	Ten (10) *Ceriodaphnia* and 10 fathead minnow tests for a total of 20 surface water tests (i.e., 18 site and 2 reference area samples).

Table 4-1 Summary of Data Gaps and Recommended Additional Sampling, Eighteenmile Creek OU3

				Number of Samples Recommended for Each Parameter								
Data Type	**Data Gap**	**Data Need**	**Location**	**Full Suite TCL/TAL(1)**	**PCB Congener**	**Dioxins/ Furans**	**TOC/ Lipids**	**Toxicity**	**AVS/ SEM**	**Geotech nical**	**Water Quality**	**Remarks**
Sediment												
Sediment Toxicity	Toxicity tests are required for the BERA to provide direct evidence of effects on survival, growth, and reproduction, and are a critical element of the sediment quality triad approach. Sediment chemistry samples for the full suite of analytes (TCL/TAL, TOC, AVS/SEM, and grain size) should be collect at each sediment toxicity station to help identify causative agents of toxicity, if any.	Chronic sediment toxicity tests (>10 days) with benthic macroinvertebrates have not been conducted in OU3. Chronic sediment bioassays with *Hyalella azteca* (28-day exposure, EPA Method 100.4) and *Chironomus dilutus* (20-day exposure, EPA Method 100.5) are recommended. Sediment chemistry is another element of the sediment quality triad approach. AVS/SEM is recommended to help evaluate metals bioavailability. Full TCL/TAL scan recommended for Superfund.	Three locations downstream from Burt Dam, three locations between Burt and Newfane Dams, three locations up-stream from Newfane Dam, and one reference location.	10	--	--	10	20	10	--	--	Ten (10) *Hyalella* and 10 *Chironomus* tests for a total of 20 sediment toxicity tests (i.e., 18 site and 2 reference area samples).
Sediment Pore Water and Surface Water Interaction	Concentrations in the pore water are needed to determine sediment to surface water partitioning for contaminant fate and transport.	Concentrations in both sediment and pore water are required to determine the partitioning of PCBs at each sample location.	Ten (10) sediment and porewater samples will be collected in reaches under consideration for capping (2, 3 and 5) and three (3) samples collected from the remaining reaches (1, 4, 6 and 7) for site characterization of sediment-porewater partitioning.		84		84					Forty two (42) sediment samples and 42 porewater samples from OU3. No reference area samples.
Sediment Transport	Sediment transport must be understood to assess contaminant fate and transport and FS technologies.	Grain size data are available but additional data on bulk density and other geotechnical tests are required.	To be determined as part of modeling plan.							TBD		See Table 4-3 for additional details.
Floodplain/Bank Soil												
Surface Soils and Near Shore Sediment	Nature and extent of floodplain contamination has not been evaluated. Need to understand nature and extent of contamination of floodplain soils and to estimate exposure for people and terrestrial ecological receptors that use the riparian zone of the creek.	Topographic survey of the creek bank is needed to determine areas with the highest potential for flooding and greatest potential for exposure. Enough samples in each area are needed to allow for statistical comparison and estimate of EPCs (assume to be 10). Analysis of samples should be for the full suite of parameters. A phased sampling approach is recommended.	Representative exposure areas were chosen from four locations and 10 samples will be collected at each area. Samples will also ne collected from a reference area (10 locations).	50	10	10	50					40 site samples (10 each from four areas) and 10 reference area samples. Assume 20% for PCB congeners and dioxin/furan.

Table 4-1 Summary of Data Gaps and Recommended Additional Sampling, Eighteenmile Creek OU3

				Number of Samples Recommended for Each Parameter								
Data Type	Data Gap	Data Need	Location	Full Suite TCL/TAL(1)	PCB Congener	Dioxins/ Furans	TOC/ Lipids	Toxicity	AVS/ SEM	Geotech nical	Water Quality	Remarks
Fish												
Forage Fish	Forage fish data for PCBs (Aroclors and congeners) have been collected throughout the creek, but little or no data are available for metals or other organic contaminants. Such data are needed to develop reliable exposure estimate for piscivorous wildlife to site-related contaminants for the BERA.	No data for metals and most organic contaminants in forage fish (e.g., juvenile sunfish) are available. Adequate data for PCBs (Aroclors and congeners) in forage fish are available. Other includes lipids and moisture content.	Ten (10) site samples should be collected from each of three general areas of OU3: below Burt Dam, between Burt and Newfane Dams, and upstream from Newfane Dam and 10 reference area samples.	40			40					Metals to be analyzed for may be limited to those that are highly elevated in creek sediment (lead, zinc, copper) and/or are bioaccumulative (Hg, Se). Recommended sampling may be modified based on SLERA results.
Game Fish (Fillet)	Game fish data for PCBs (Aroclors and congeners) have been collected throughout the creek, but little or no data are available for metals or other organic contaminants. Fillet contaminant data are limited. Such data are needed for two reasons: (1) to assess risks to adult fish from bioaccumulated contaminants and (2) to develop reliable exposure estimate for people to site-related contaminants in fish.	No data for metals and most organic contaminants in edible fish (e.g., largemouth bass, bullhead) are available. Inadequate data are available for PCBs in game fish fillets. Other includes lipids and moisture content. Sufficient samples of each species should be collected to allow for statistical comparison and calculation of EPCs (assumed to be 10).	Twenty (20) game fish fillet samples (10 brown bullhead and 10 largemouth bass) should be collected from each of three general areas of OU3: below Burt Dam, between Burt and Newfane Dams, and upstream from Newfane Dam. ten Samples of bullhead and bass should also be collected from a background area.	80	80		80					Metals to be analyzed for may be limited to those that are highly elevated in creek sediment (lead, zinc, copper) and/or are bioaccumulative (Hg, Se).

Key:

AVS/SEM = Acid Volatile Sulfur / Simultaneously Extracted Metals
BERA = Baseline ecological risk assessment
BSAF = Biota soil (or sediment) accumulation factor
EPC = Exposure Point Concentration
PAHs = Polycyclic aromatic hydrocarbons
PCBs = Polychlorinated biphenyls
SLERA = Screening level ecological risk assessment
SVOCs = Semivolatile organic compounds
TAL = Target analyte list
TCL = Target compound list
TOC = Total organic carbon
TSS = Total suspended solids

Notes:

(1) TCL VOCs are not a compounds of concern except for groundwater.

Table 4-2 Summary of Recommended Samples and Analysis, Eighteenmile Creek OU3

		Number of Samples						Number of Samples per Laboratory					
Sample Media	**Notes**	**Number of Locations**	**Number of Reference Locations**	**Samples Per Location**	**No. of Samples**	**No. of QA/QC Samples**	**Total**	**CLP Analysis Routine TCL/TAL(1)**	**CLP Analysis PCB Congeners**	**CLP Analysis Dioxin/ furans**	**TOC/ Lipids**	**Water Quality**	**Other**
Groundwater	Four new monitoring wells and six existing wells for TCL VOCs only	10	0	1	10	1	11	11					
Surface Water	Surface water samples for human health risk assessment and nature and extent. Total and dissolved for some parameters.	15	3	2	36	2	38	38	38			38	
	Surface water samples chemical analysis associated co-located with toxicity samples from nine locations in creek and one reference location.	9	1	2	20	2	22	22	22	4			
Surface Water Toxicity	EPA 1000.0 – Fathead Minnow Larval Survival and Growth Test. Nine site samples and one reference area sample.	9	1	1	10	0	10						10
	EPA 1000.2 – *Ceriodaphnia dubia* Survival and Reproduction Test. Nine site samples and one reference area sample.	9	1	1	10	0	10						10
Sediment	Sediment samples for chemical analysis associated co-located with toxicity samples from nine locations in creek and one reference location. Sample depth (0-6”)	9	1	1	10	0	10	10			10		10
	Sediment and sediment pore water to assess PCB partitioning.	42	0	2	84	0	84		84		84		
	Sediment samples anlayzed for geotechnical parameters to evaluate sediment transport.	TBD			TBD		TBD						TBD
Sediment Toxicity	EPA 100.4 – *Hyalella azteca* (amphipod), 42-day test. Nine site samples and one reference area sample.	9	1	1	10	0	10						10
	EPA 100.4 – *Chironomus dilutus* (midge), life-cycle test. Nine site samples and one reference area sample.	9	1	1	10	0	10						10
Soils	Bank soils will be collected from representative exposure areas for risk assessment. 10 samples will collected from each area.	4	1	10	50	4	54	54	10	10	54		
Fish	Forage Fish – Ten site samples and ten reference area samples.	3	1	10	40	4	44	44			44		
	Game Fish Fillets – Ten samples from three areas and ten reference area samples.	3	1	20	80	4	84	84	84		84		
IDW	Toxicity characteristic leaching procedure (TCLP) parameters except herbicides, PCBs, corrosivity, and ignitibility	1	0	10	10	0	10						10
	Totals						**397**	**263**	**238**	**14**	**276**	**38**	**60**

Key:

AVS/SEM = Acid Volatile Sulfur / Simultaneously Extracted Metals
PCBs = Polychlorinated biphenyls
TAL = Target analyte list
TCL = Target compound list
TOC = Total organic carbon
VOCs = Volatile organic compounds

Notes:

(1) TCL VOCs are not a compounds of concern except for groundwater.

Table 4-3 Summary of Data Gaps and Recommended Additional Sampling for the Feasibility Study, Eighteenmile Creek OU3

Data Gap [*Associated Technology*]	Location	Total Data to Be Collected
COPC degradation potential case studies [*MNR*]	N/A	Literature review
Bathymetry [*MNR, Excavation/Dredging, Capping (with and without amendments), In-situ Treatment*]	Reaches 1 and 3-7	Subcontractor will collect bathymetric data from Top of Bank (Right) to Top of Bank (Left) of the creek
Flow data [*MNR, Excavation/Dredging, Capping (with and without amendments), In-situ Treatment*]	Reaches 3-7 and Newfane Dam	Three water velocity/level meters in Reaches 3-7 and one below Newfane Dam deployed for three months each
Sediment Bulk Density [*MNR, Excavation/Dredging, Capping (with and without amendments), In-situ Treatment*]	Reaches 1, 2, 4, 6 and 7	Four samples each in Reaches 2, 4, 6 and 7 and four samples in Reach 1 Harbor, for a total of 20 samples
Suspended Sediment Concentrations [*MNR, Excavation/Dredging, Capping (with and without amendments), In-situ Treatment*]	Reaches 2-7	Three samples per reach, for a total of 18 samples
Sediment Thickness [*MNR, Excavation/Dredging, In-situ Treatment*]	Reach 1	Three samples per 1,000 feet, for a total of 36 samples in Reach 1 (11,000 feet in length)
In-situ seepage meter measurements [*Capping (with and without amendments)*]	Reaches 2, 3 and 5	Five measurements per reach, for a total of 15 measurements
Paired porewater-sediment samples [*Capping (with and without amendments)*]	Reaches 1-7	Eighty-four total samples, as detailed in Table 4-1
In-situ amendment/treatment study [*Capping (with amendments), In-situ Treatment*]	Reaches 2, 3 and/or 5	Subcontractor will design and perform in-situ treatability study

Key:

MNR = Monitored Natural Recovery

Figures

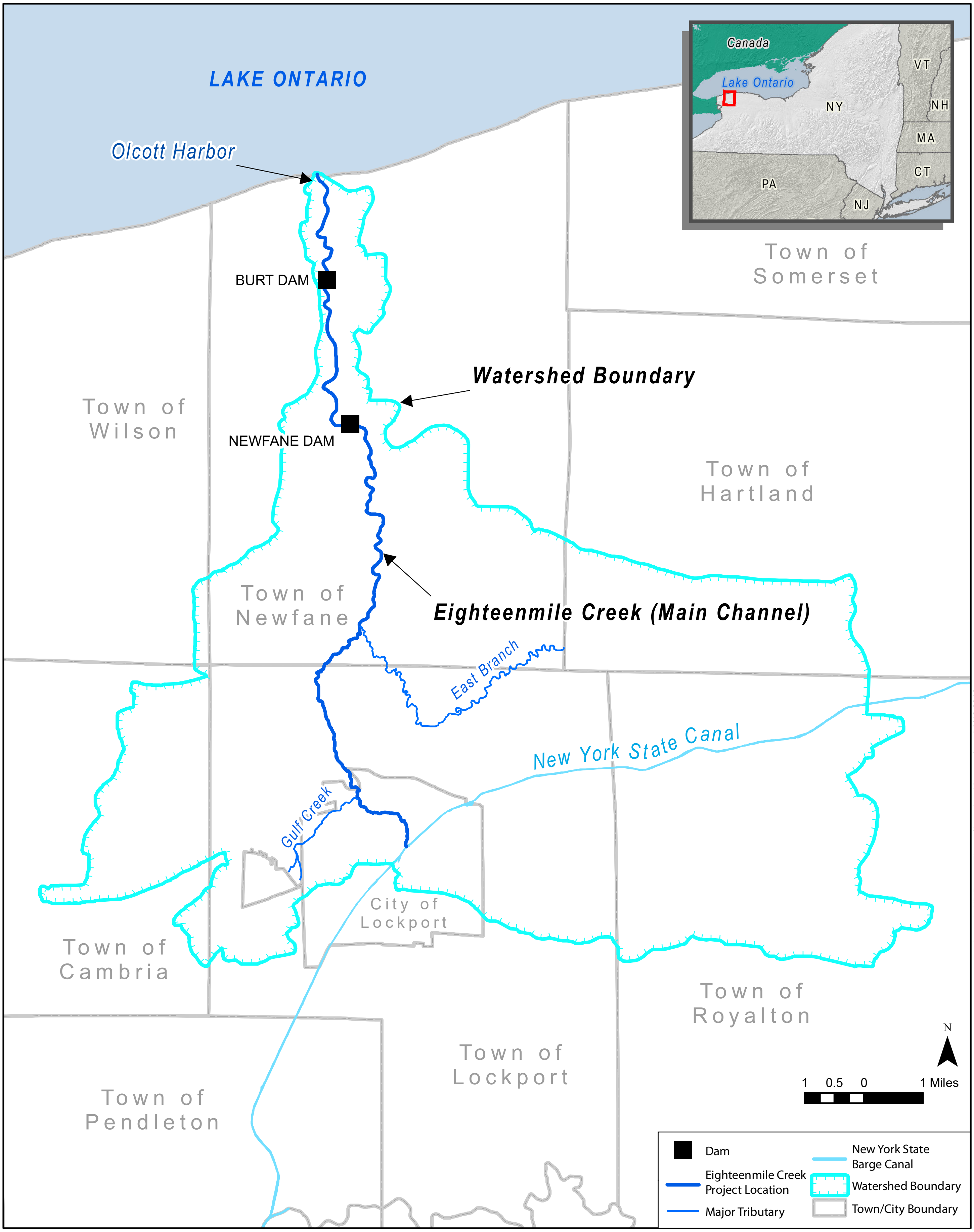

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Figure 1-1 Site Location Map
Eighteenmile Creek Superfund Site
Lockport, NY

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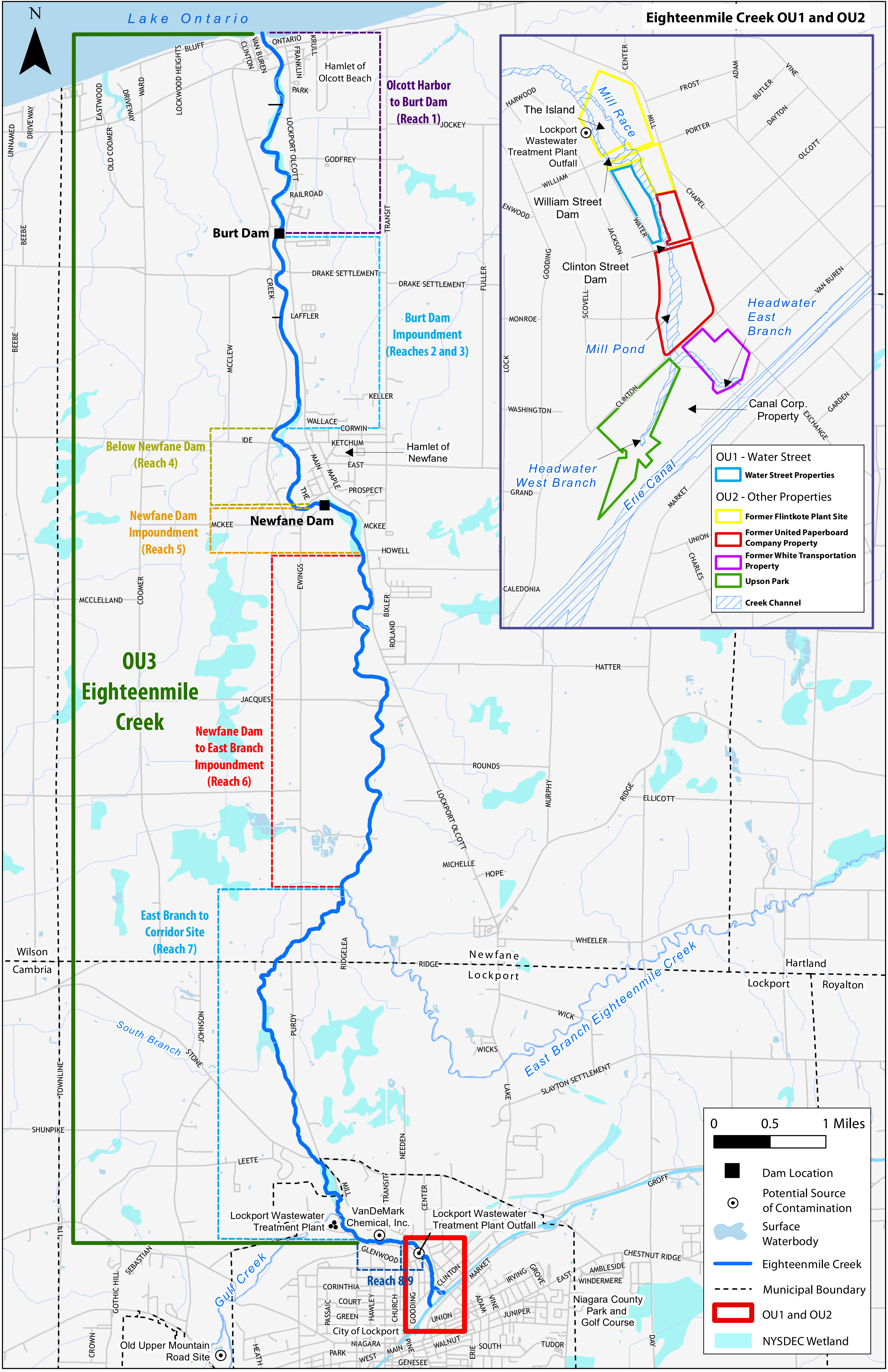

Figure 1-2 Operable Unit Overview, Eighteenmile Creek OU3

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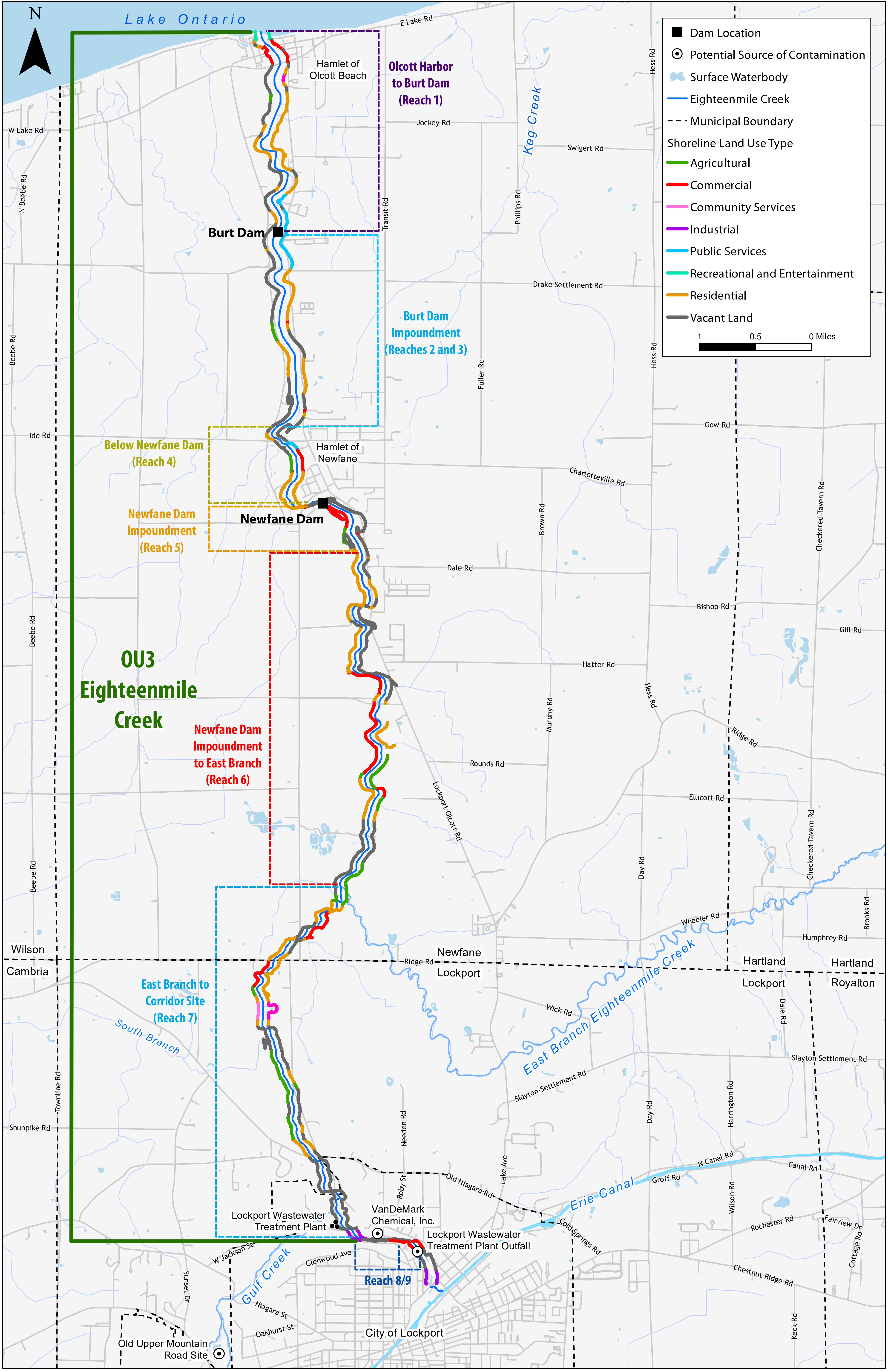

Figure 1-3 Preliminary Land Use, Eighteenmile Creek OU3

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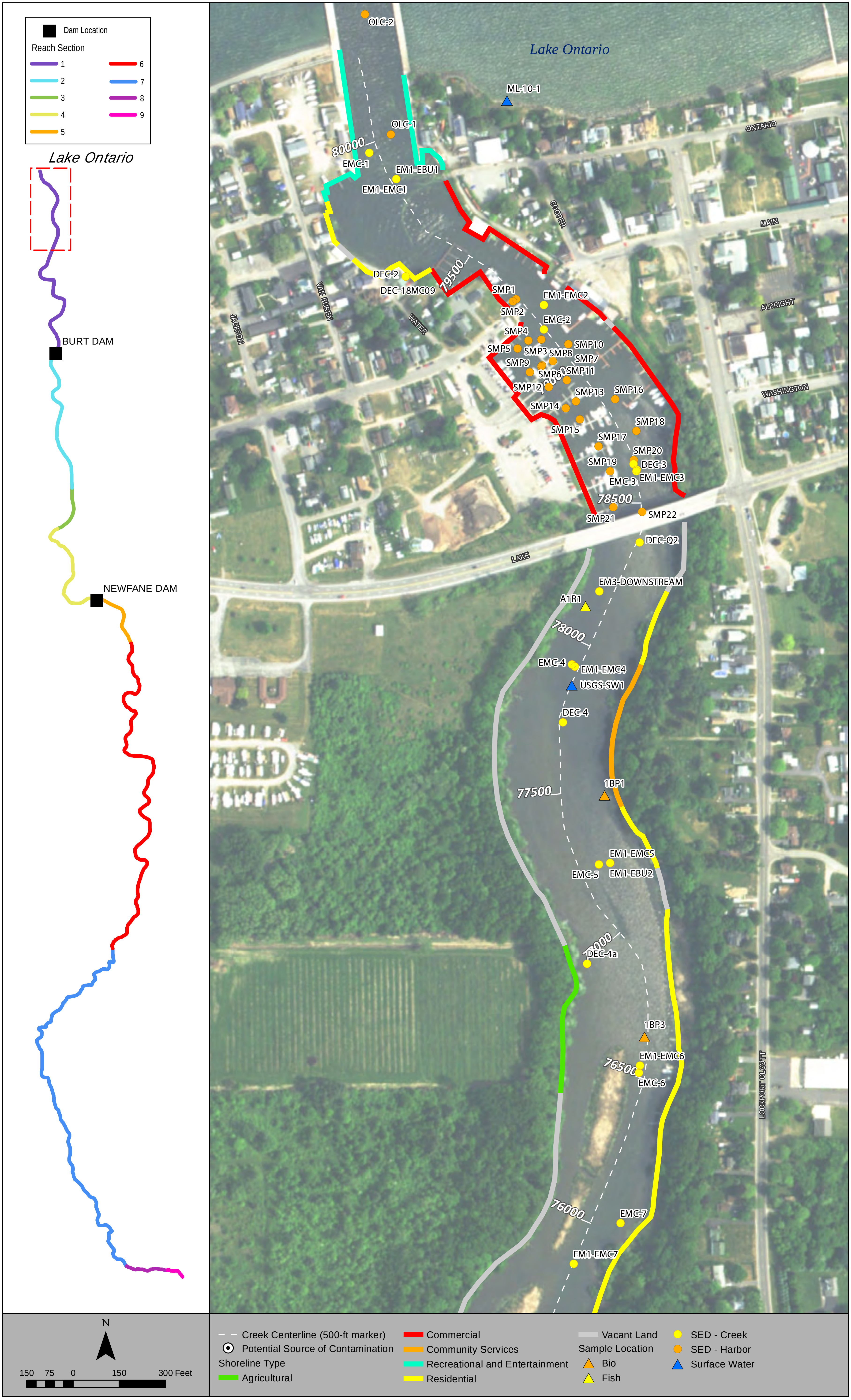

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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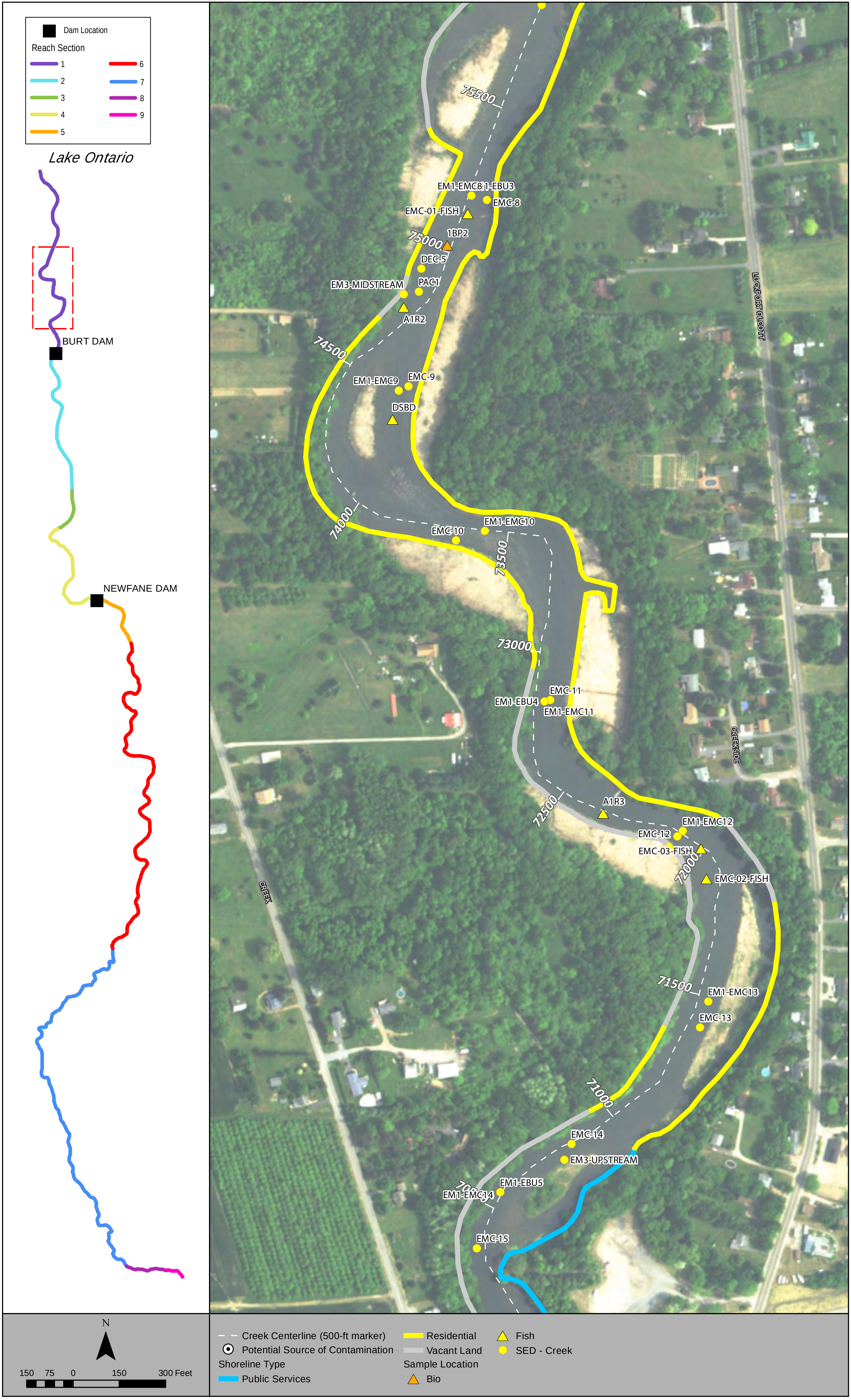

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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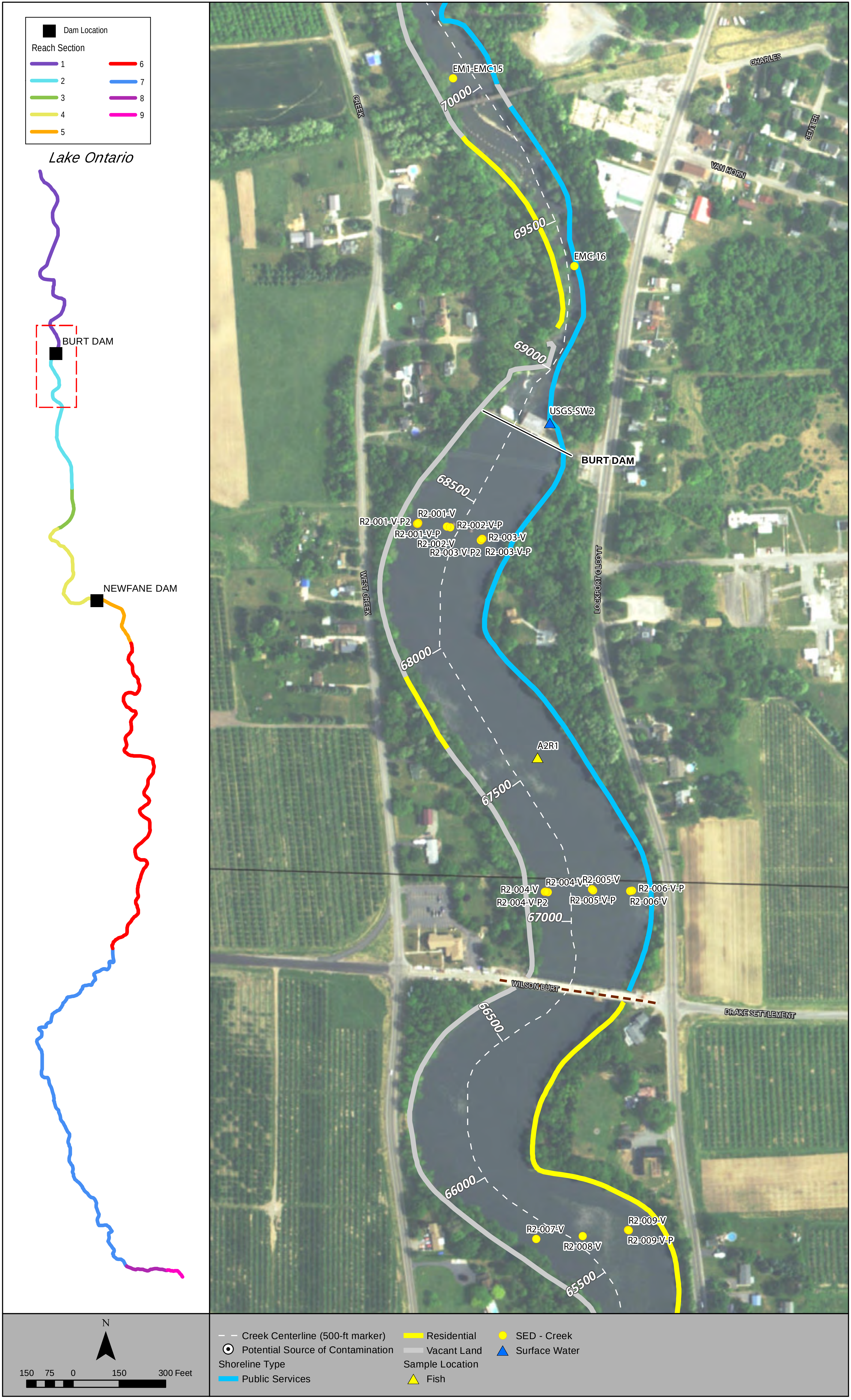

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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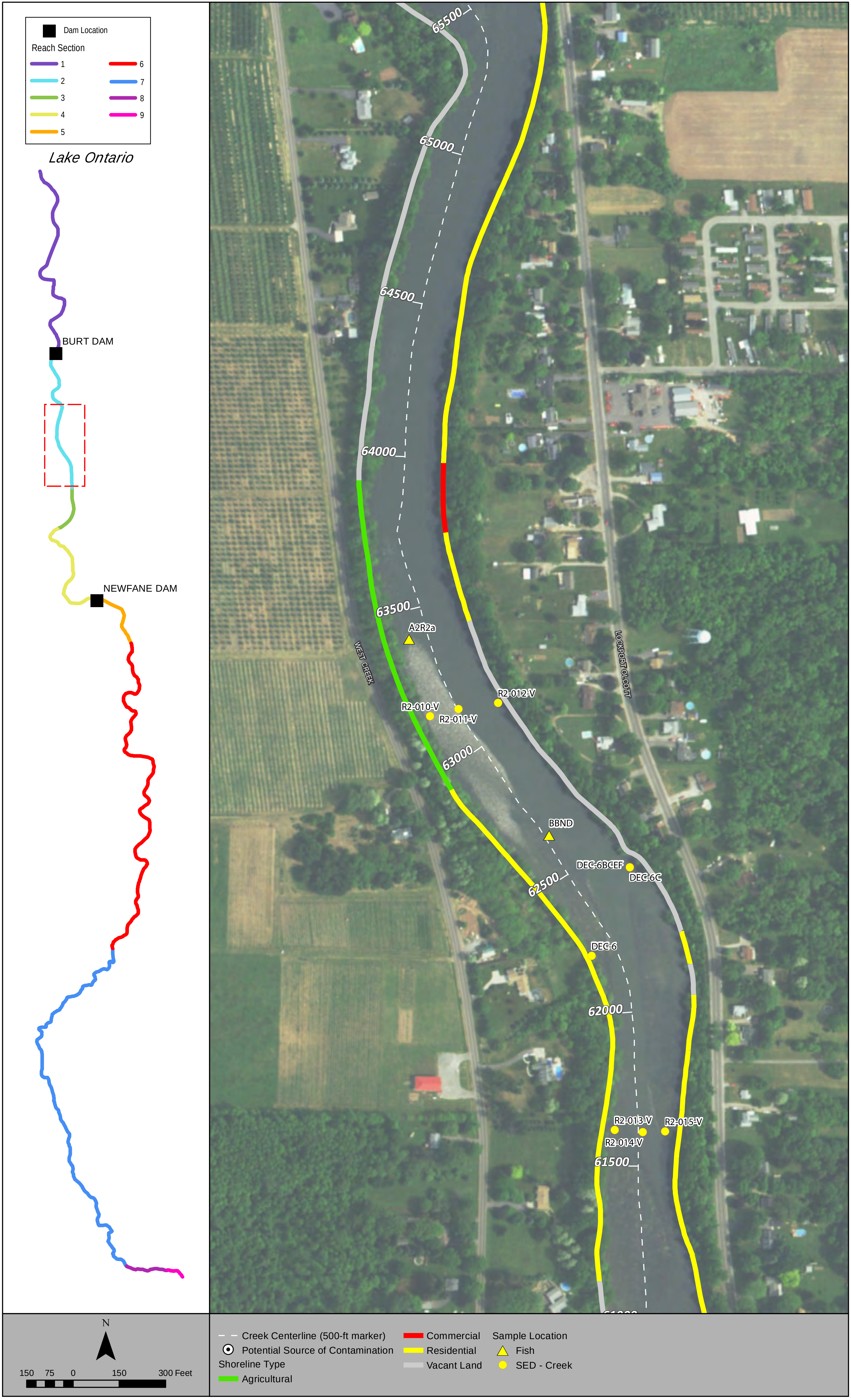

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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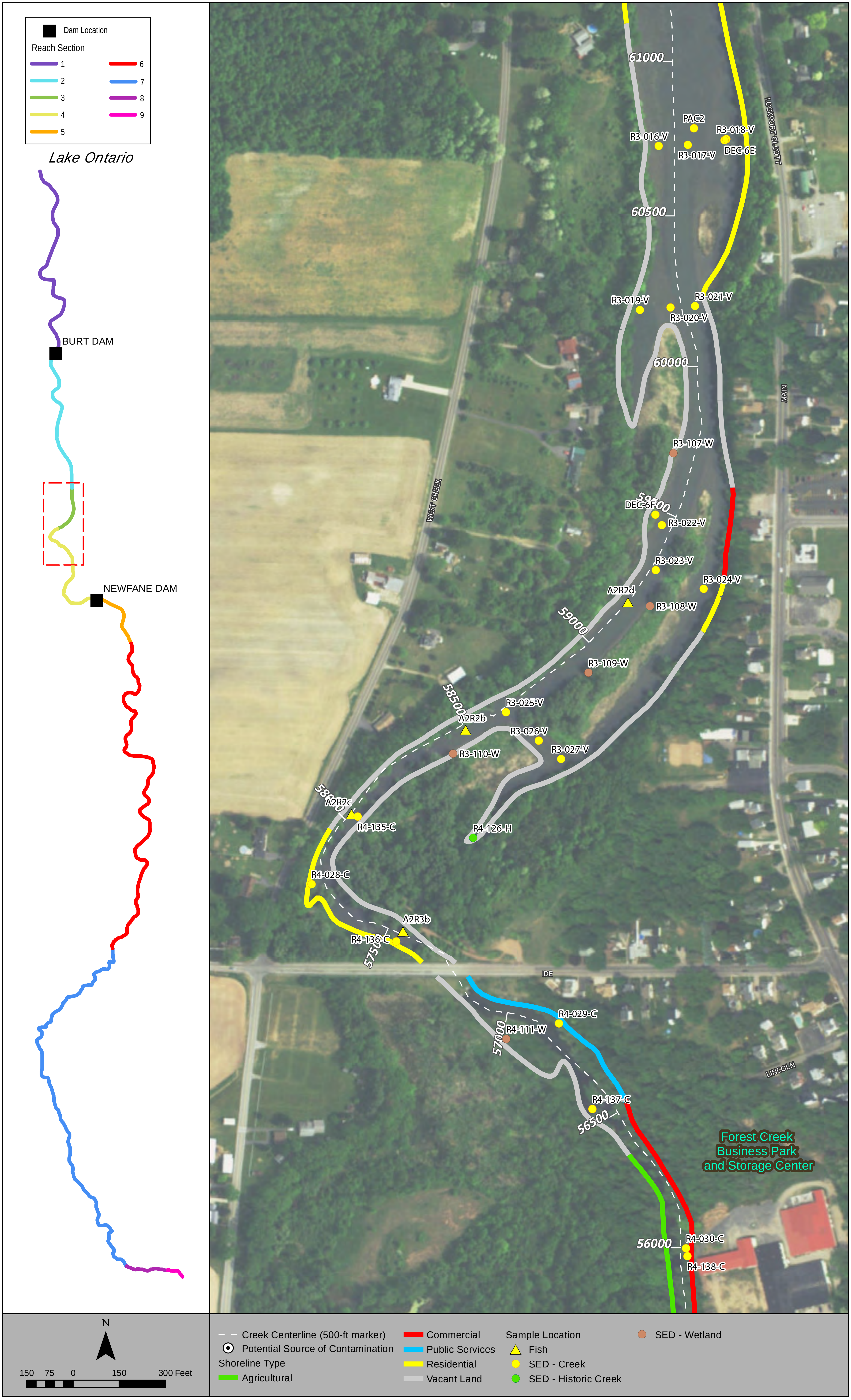

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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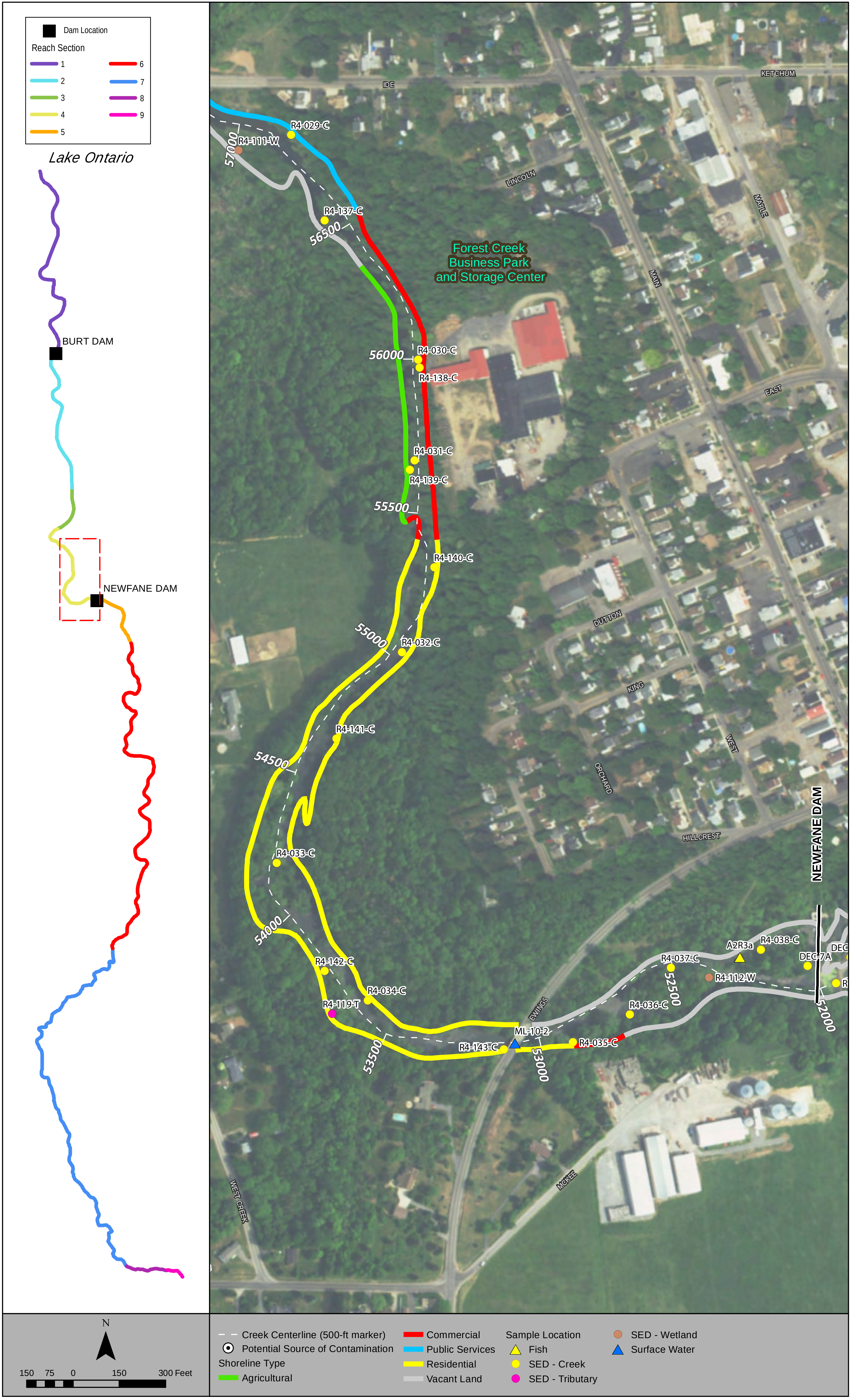

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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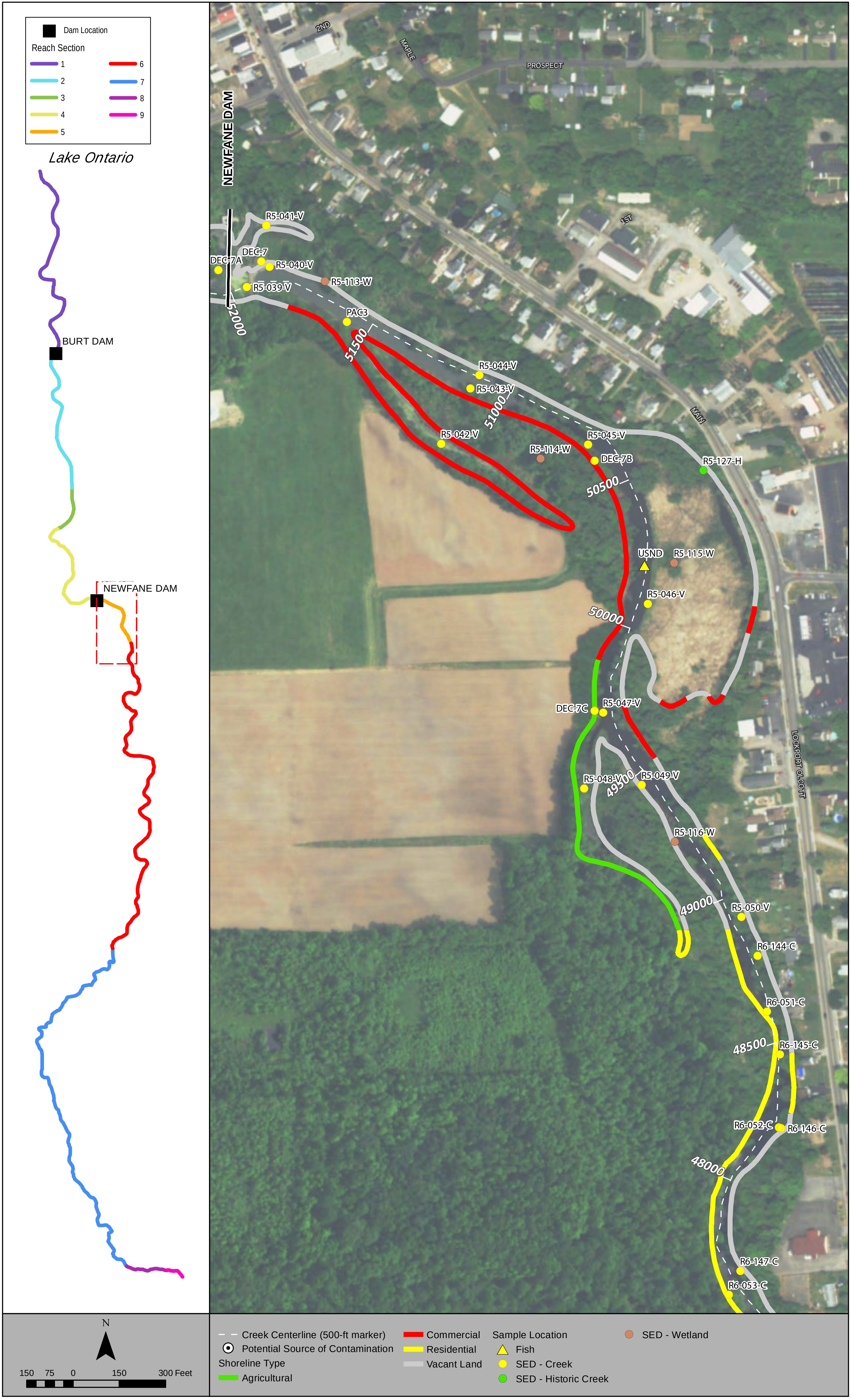

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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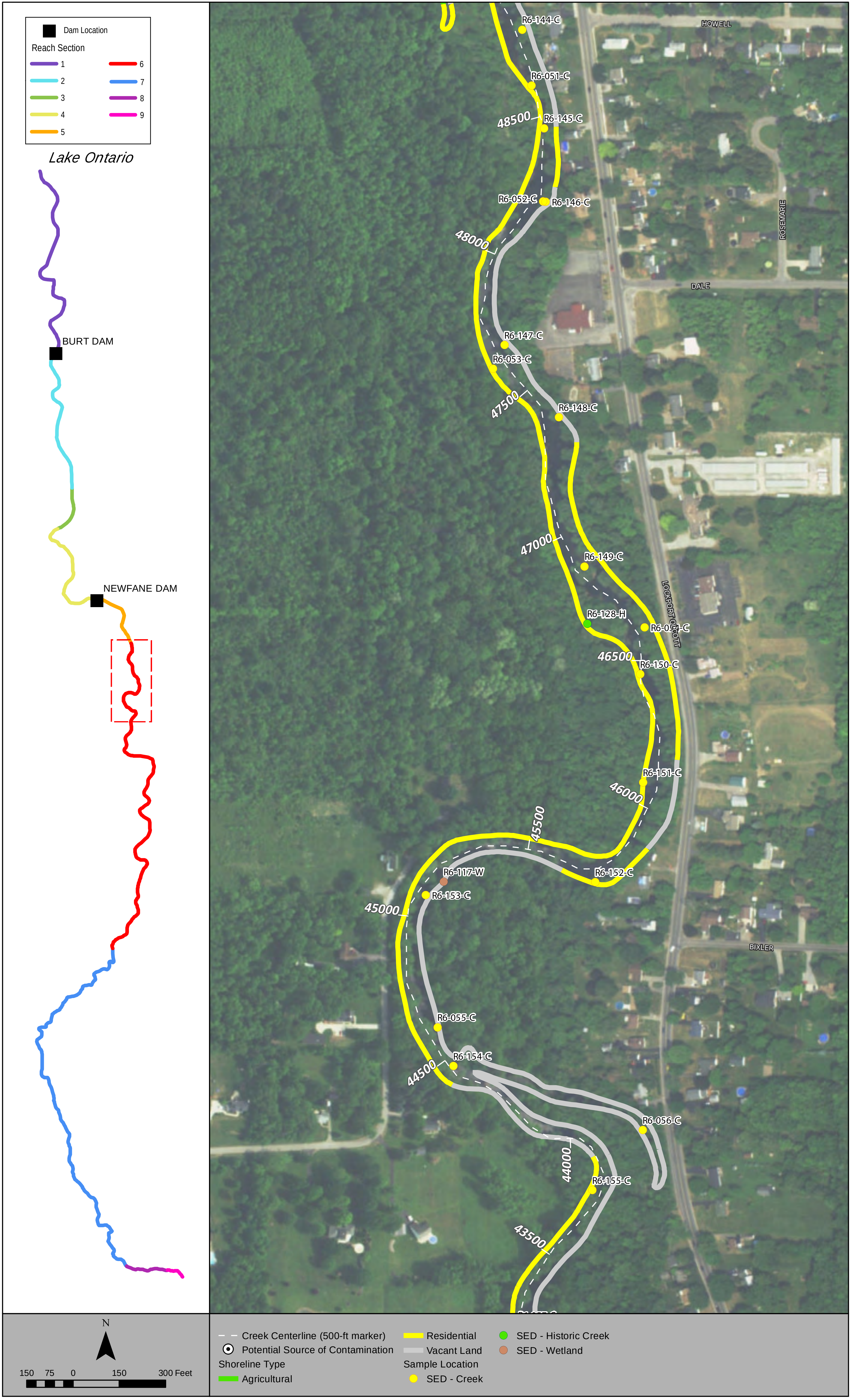

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

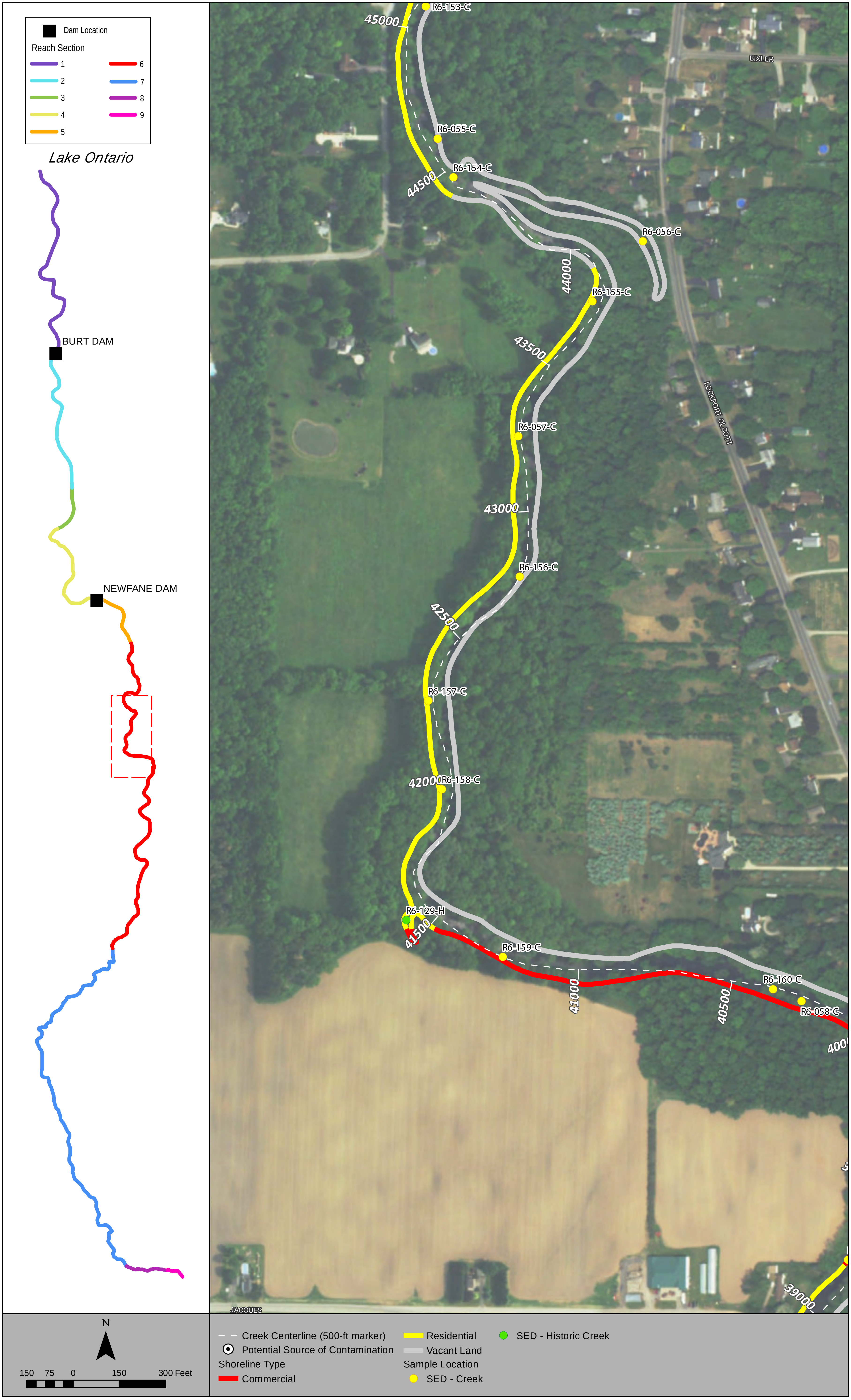

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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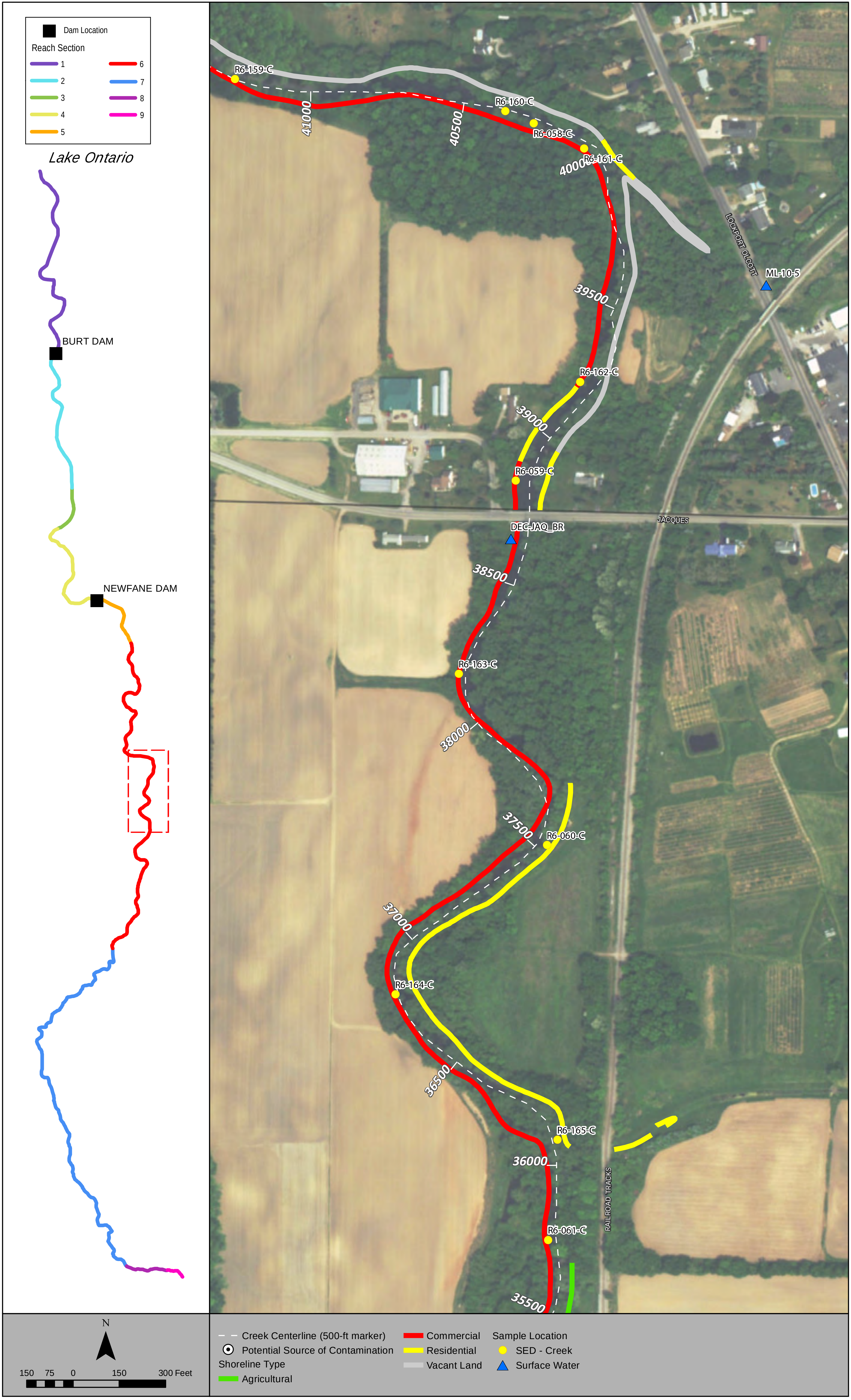

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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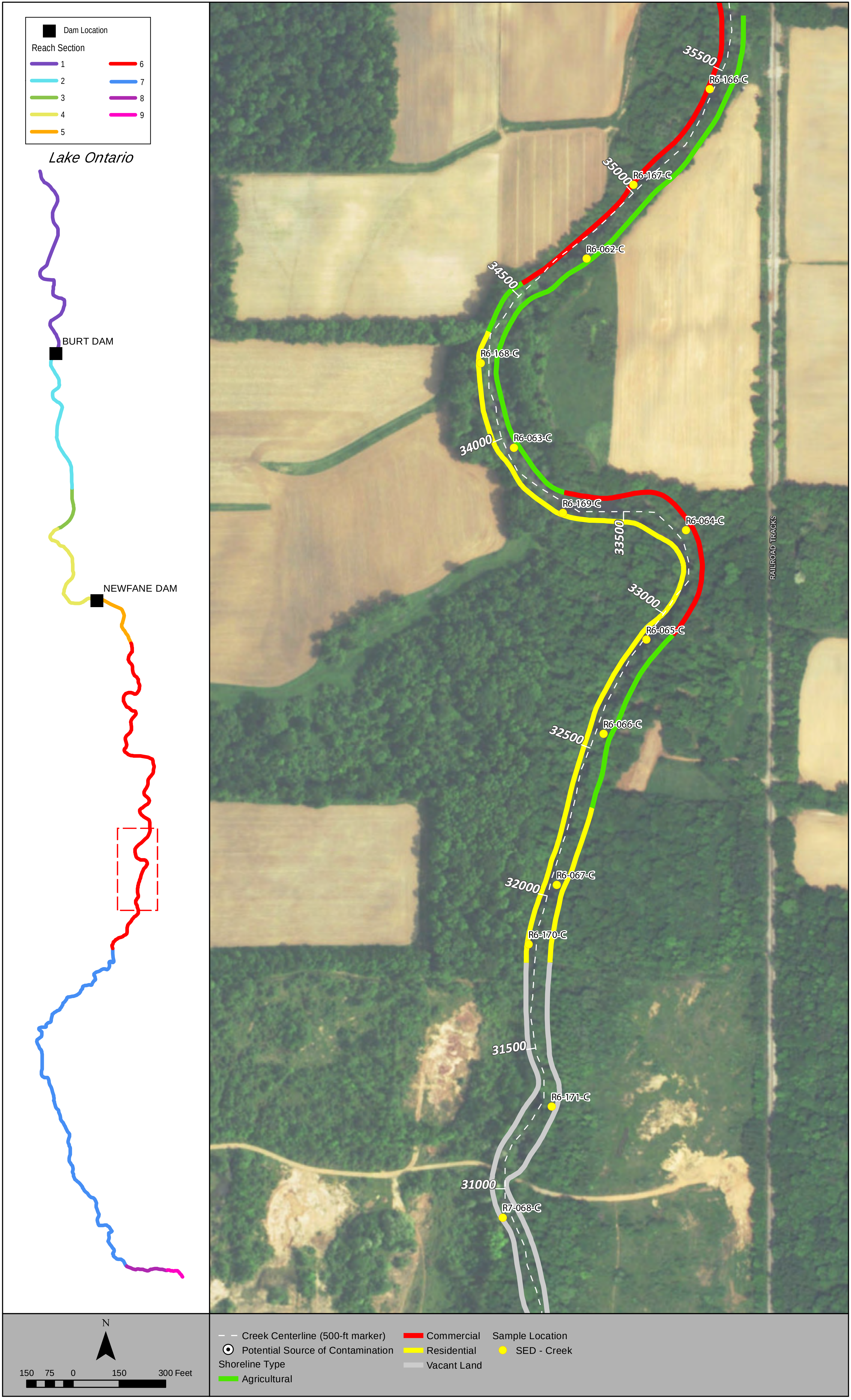
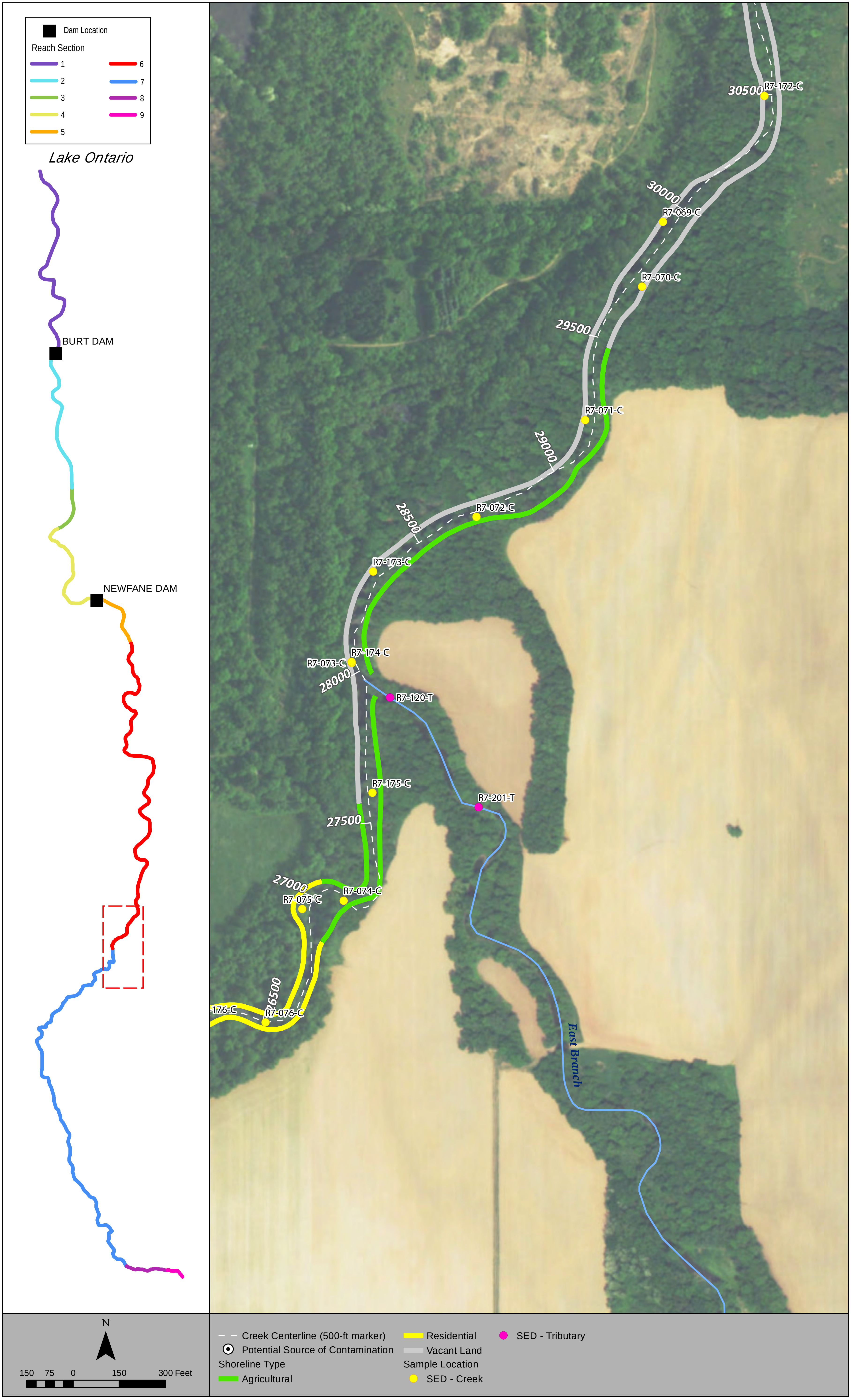


Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3



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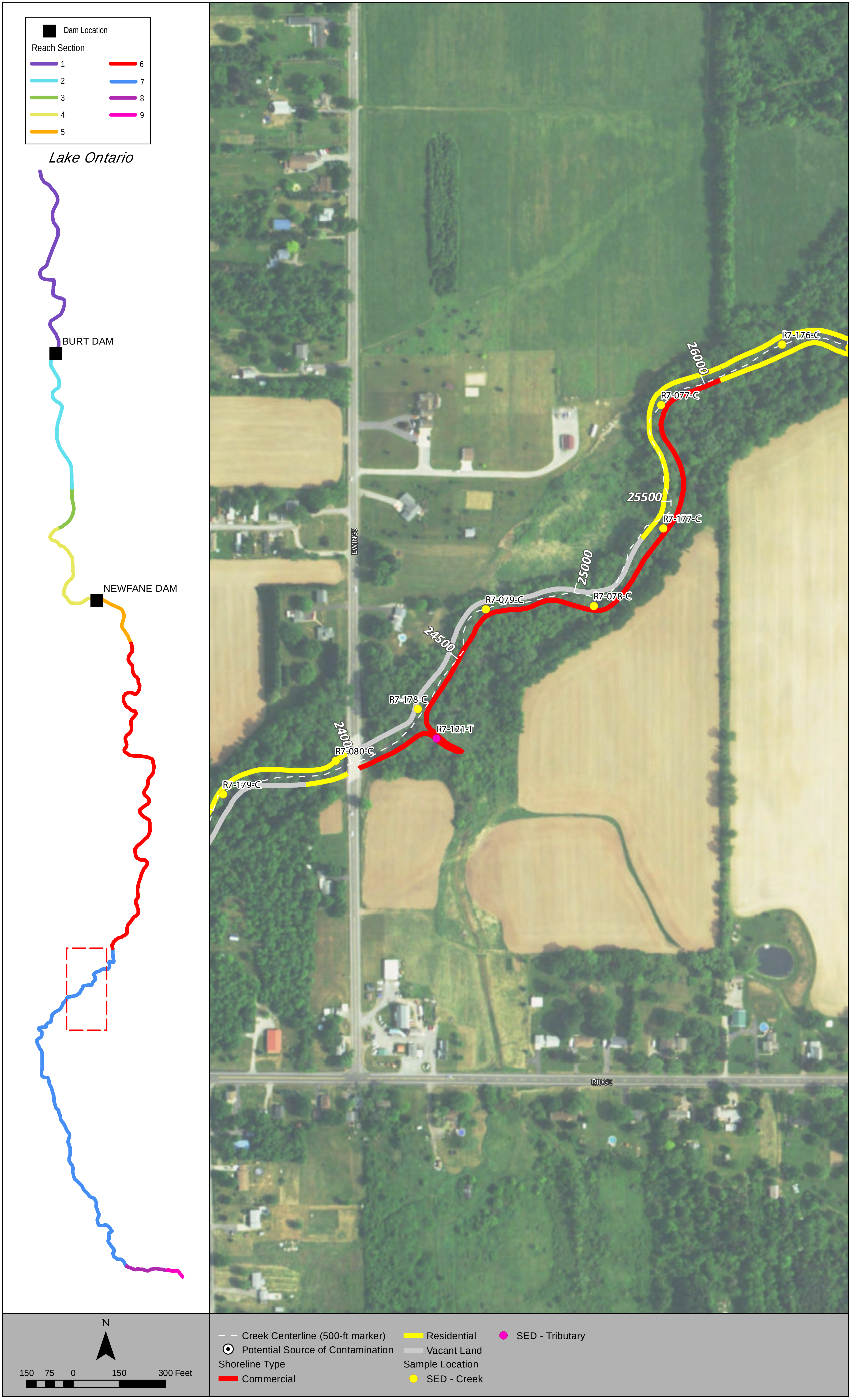

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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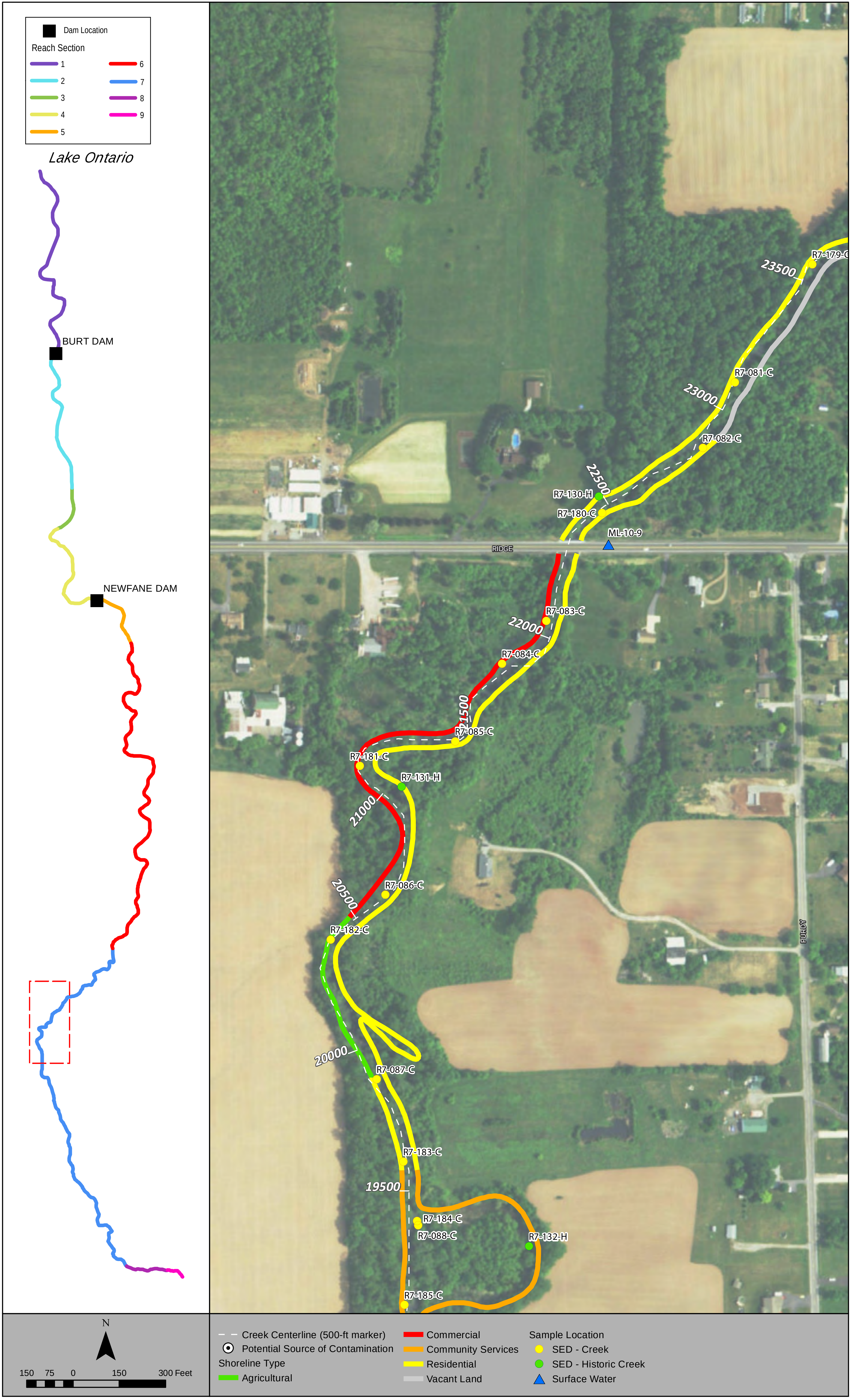

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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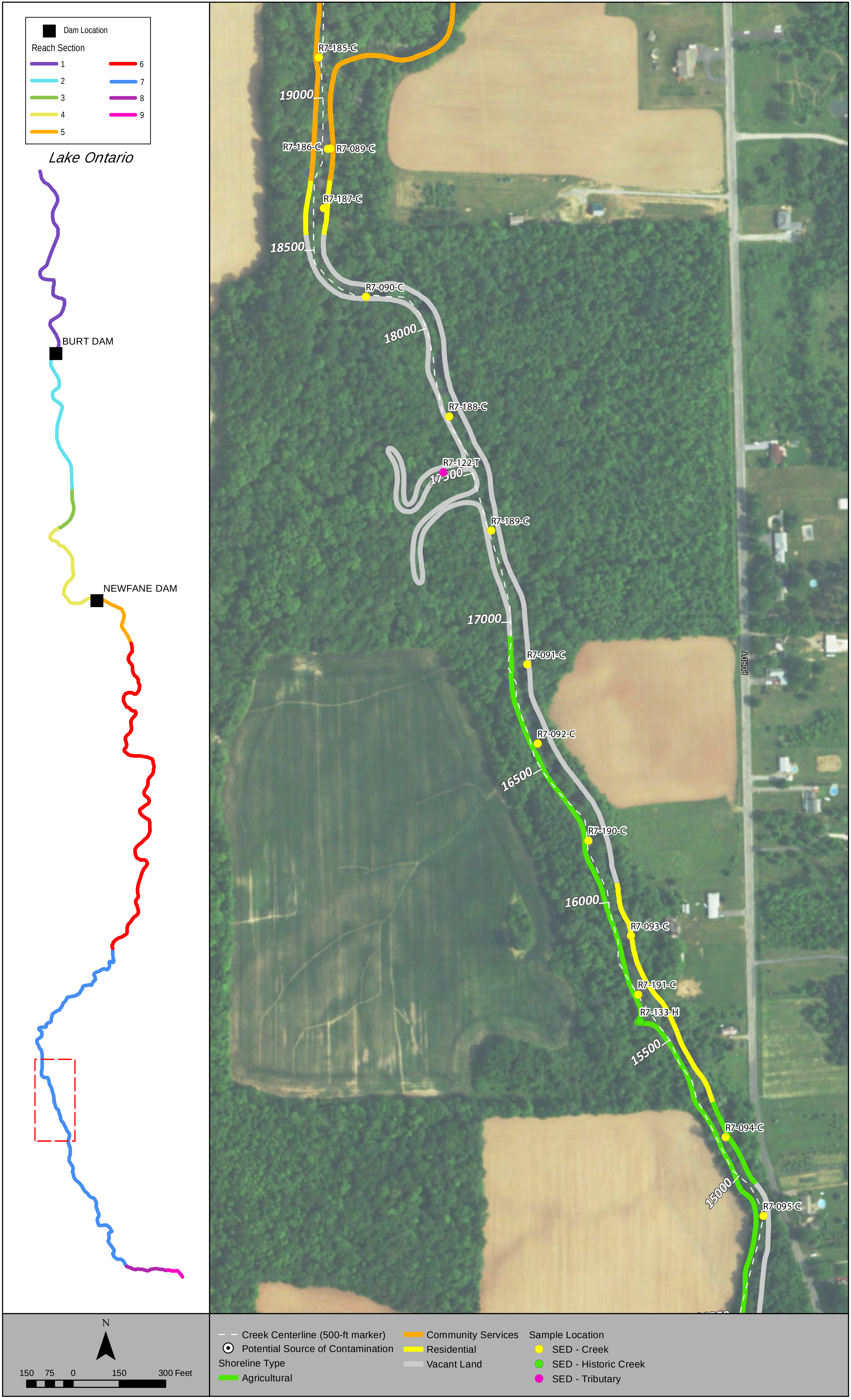

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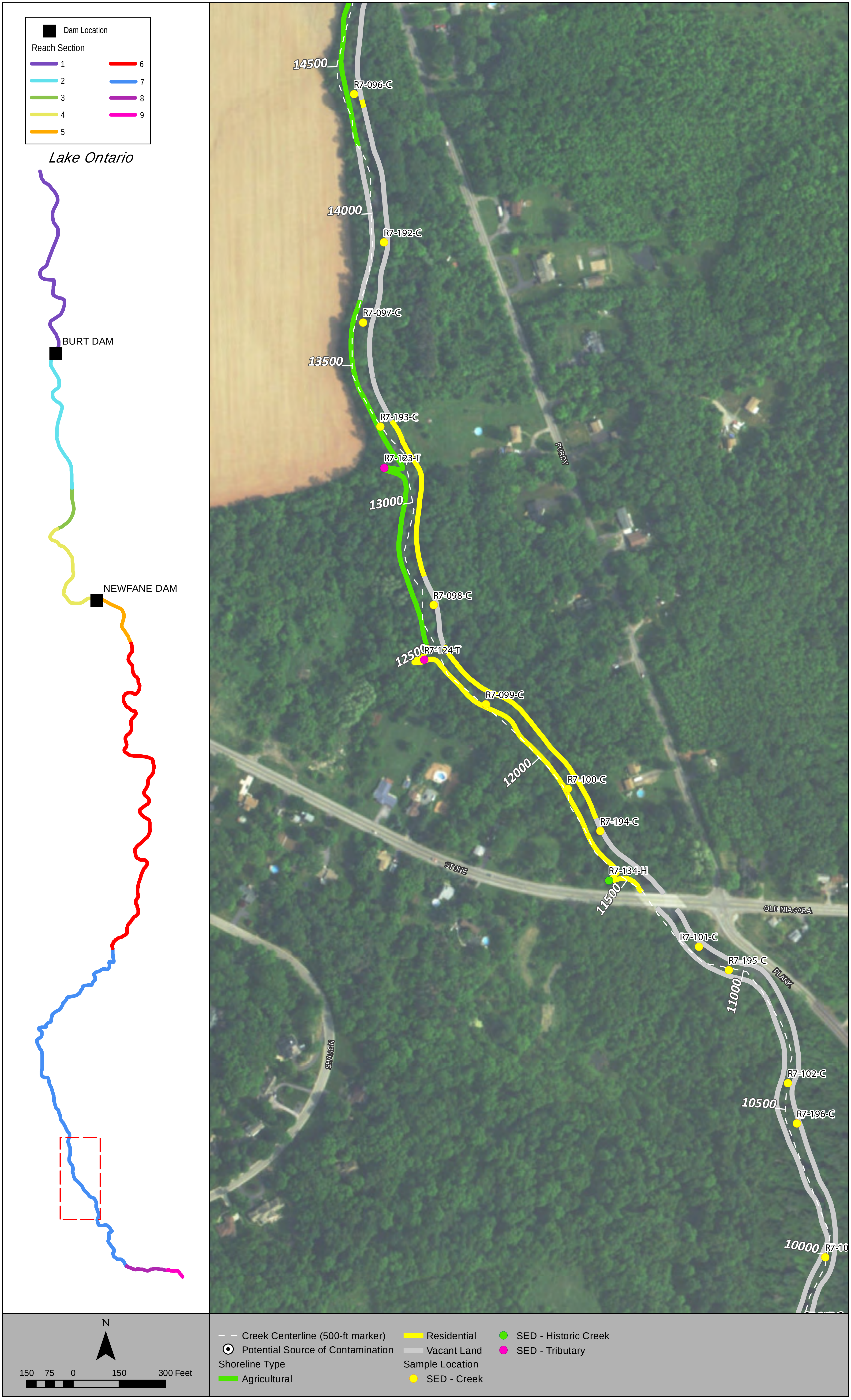

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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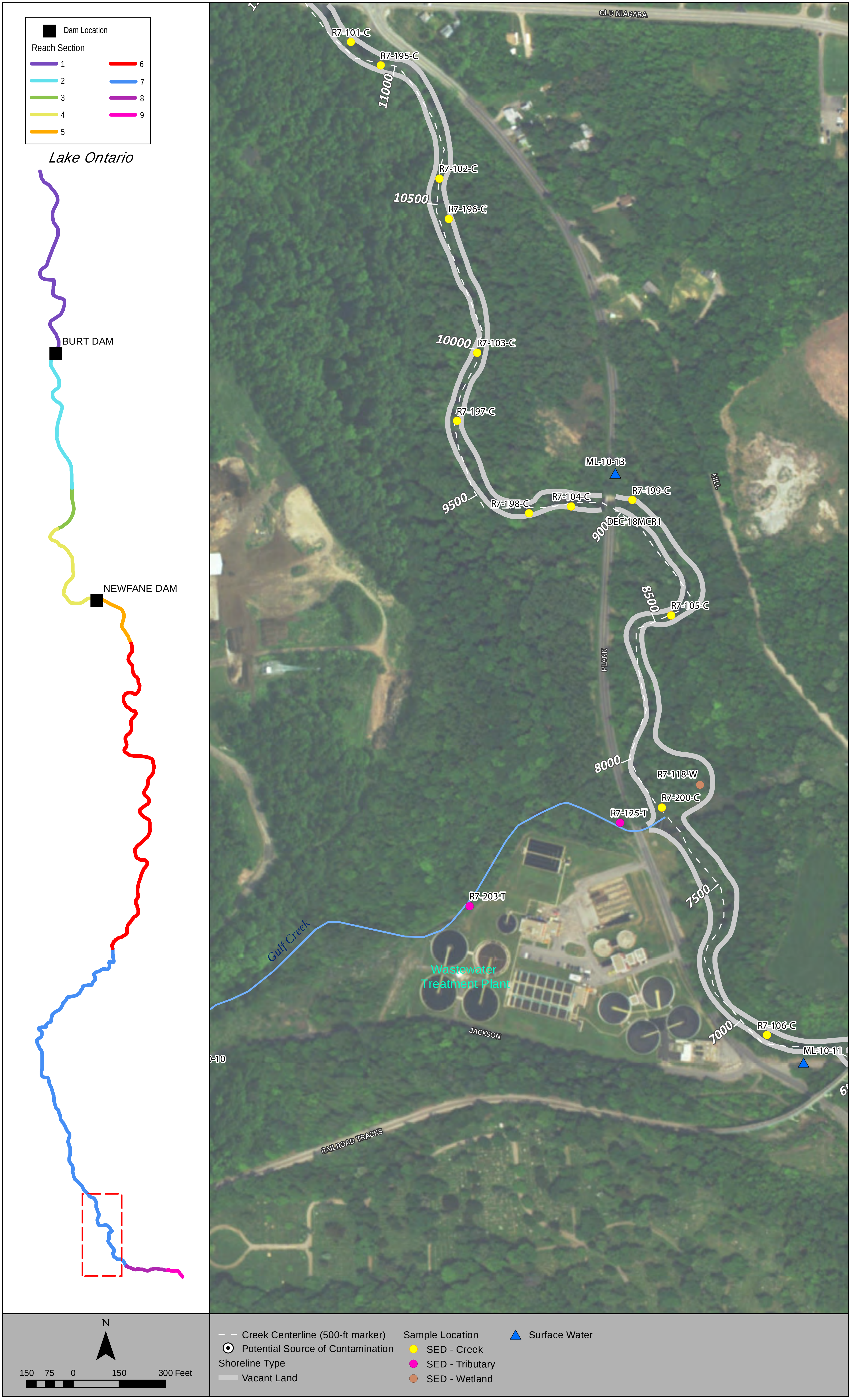

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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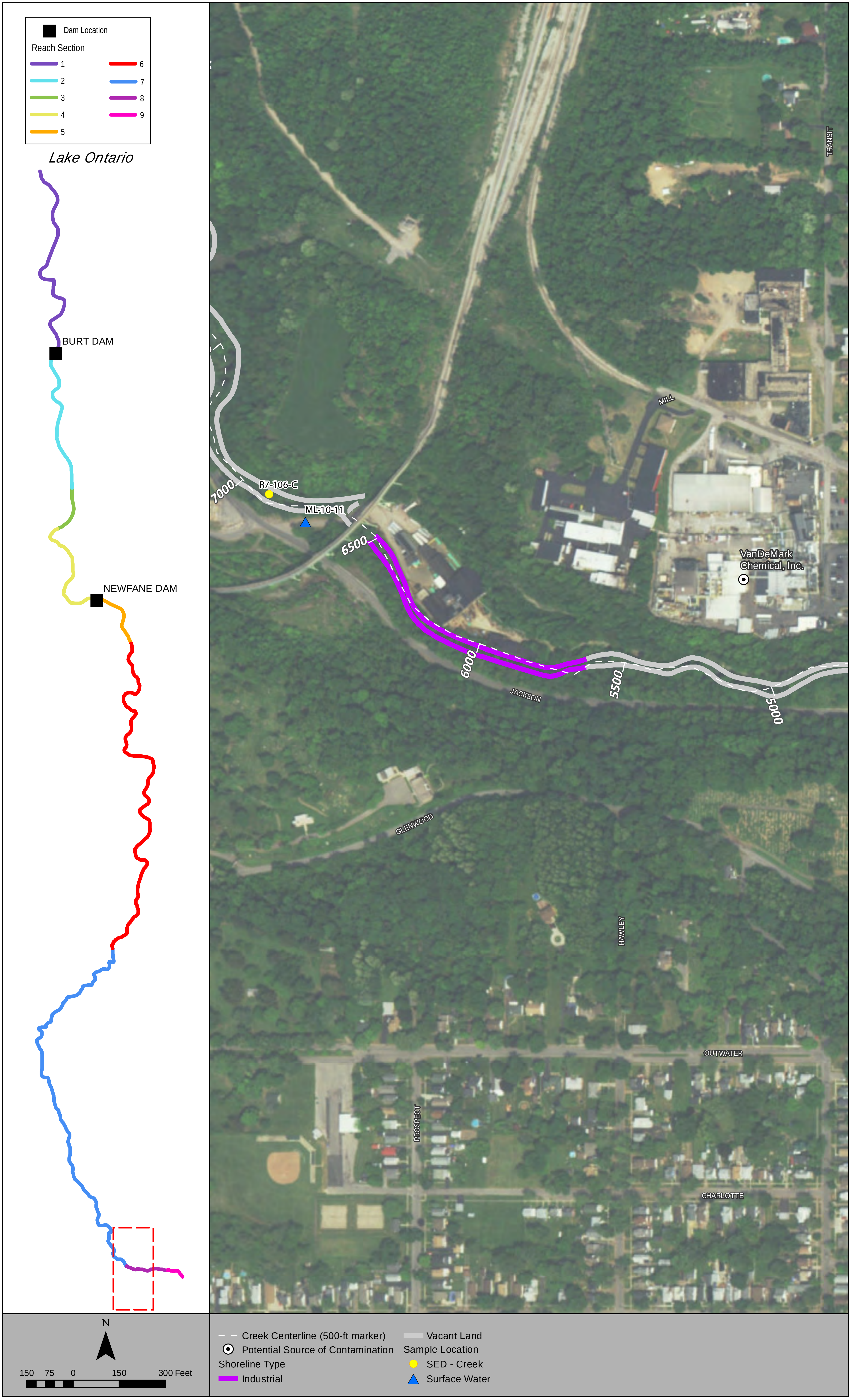

Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

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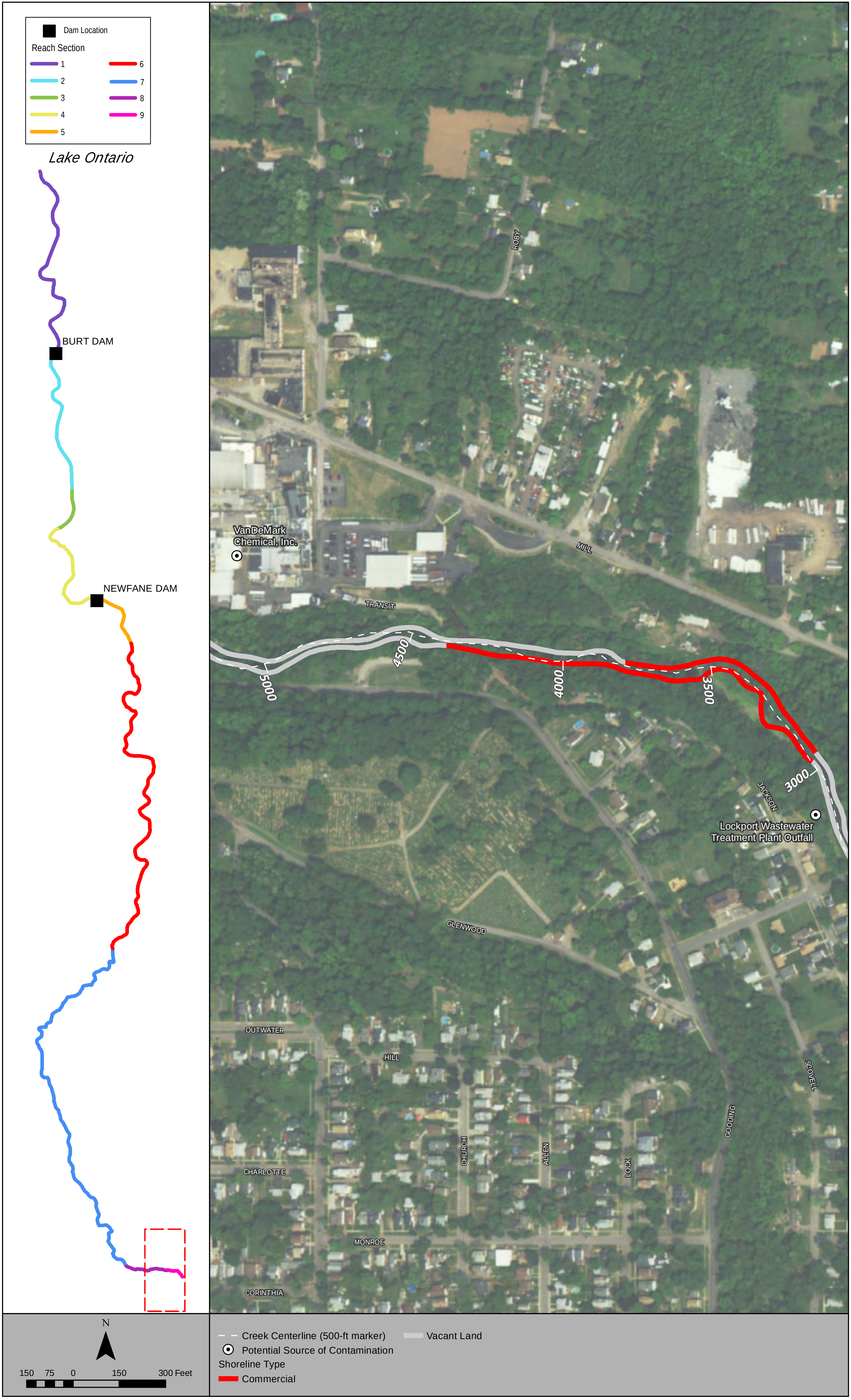


Figure 1-4 Existing Sampling Locations, Eighteenmile Creek OU3

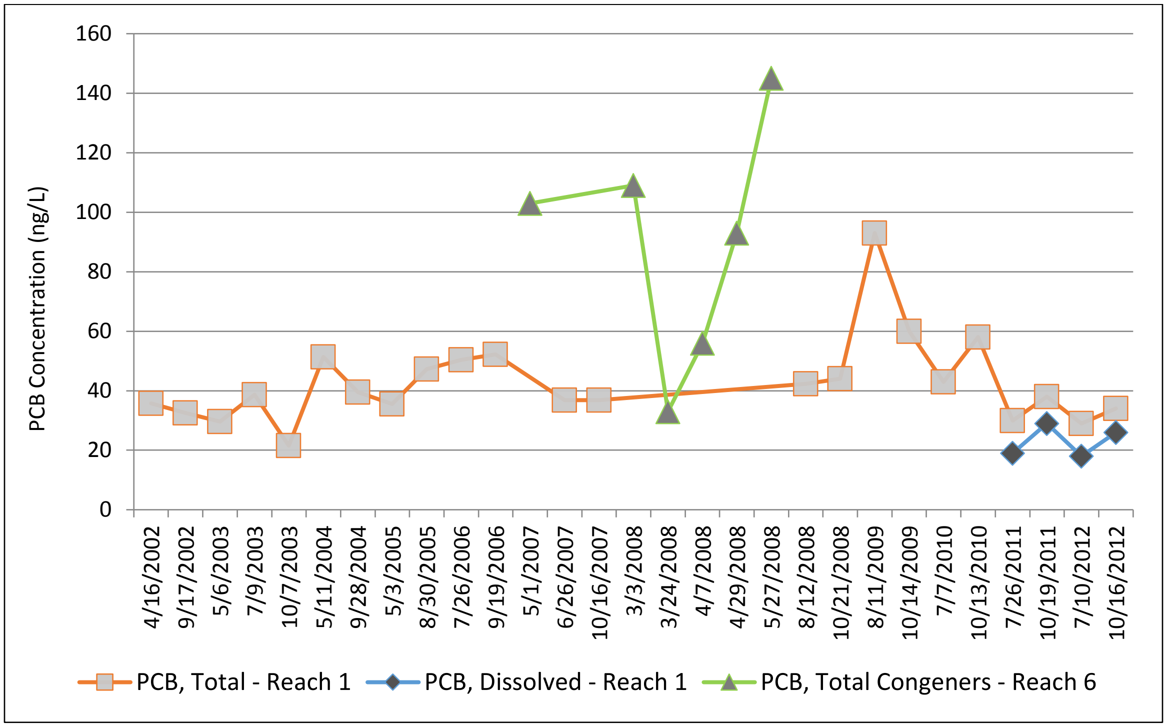


Figure 2-1 Eighteenmile Creek OU3 Surface Water PCB Concentration Trends in Reaches 1 and 6 by Date

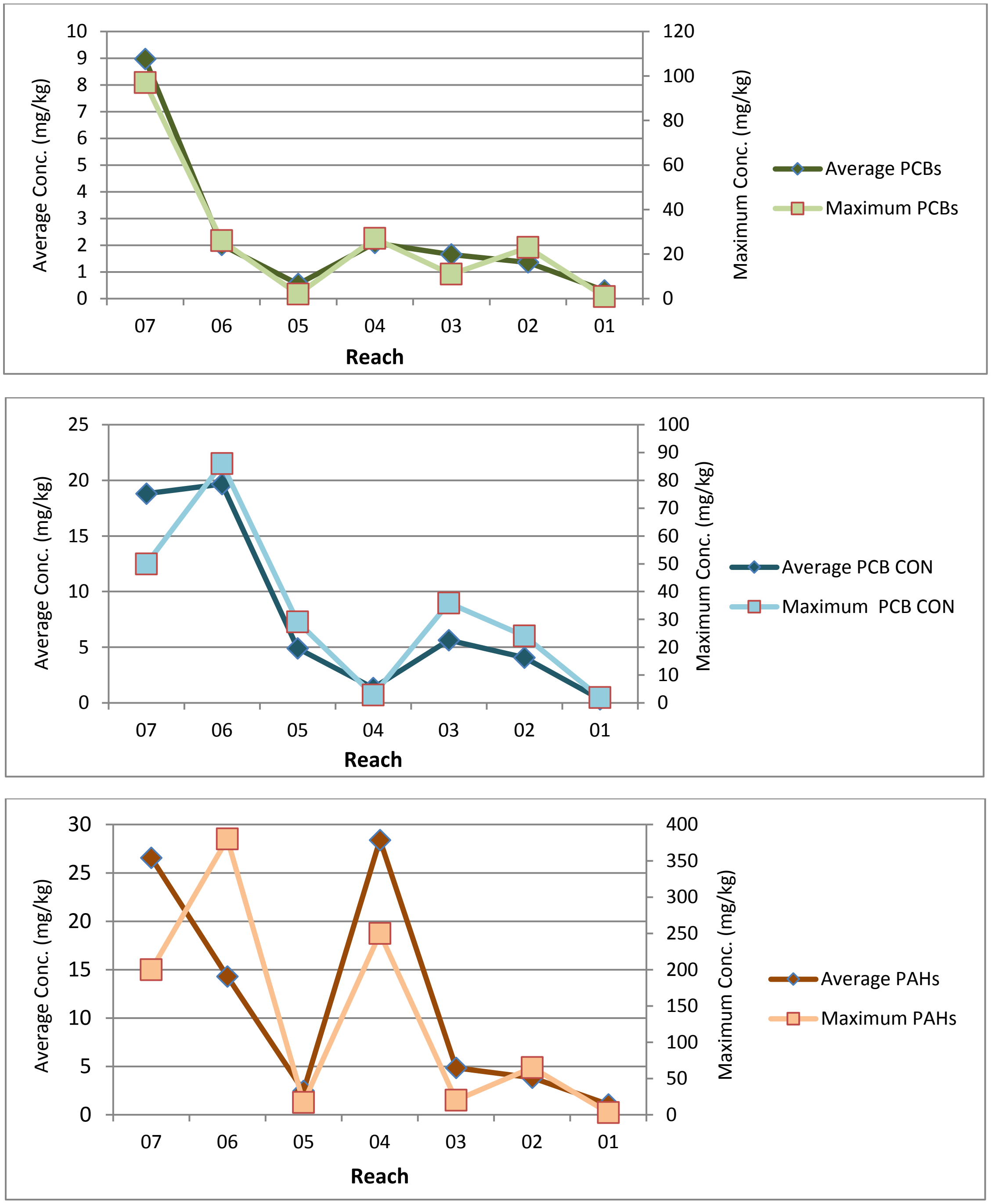


Figure 2-2a   Eighteenmile Creek OU3 Concentration Trends of Organic COPCs in Sediment by Reach

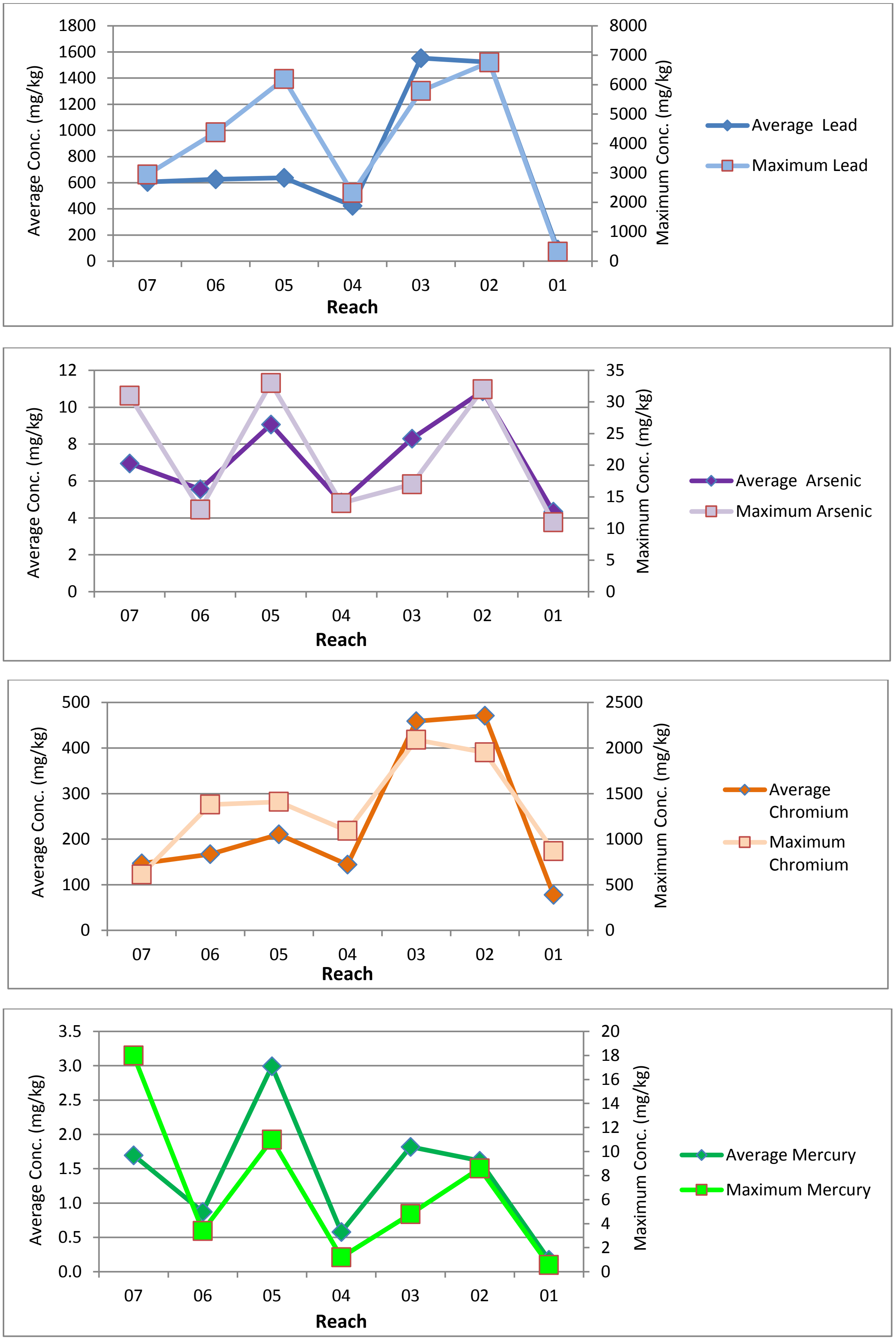


Figure 2-2b **Eighteenmile Creek OU3 Concentration Trends of Metal COPCs in Sediment by Reach**

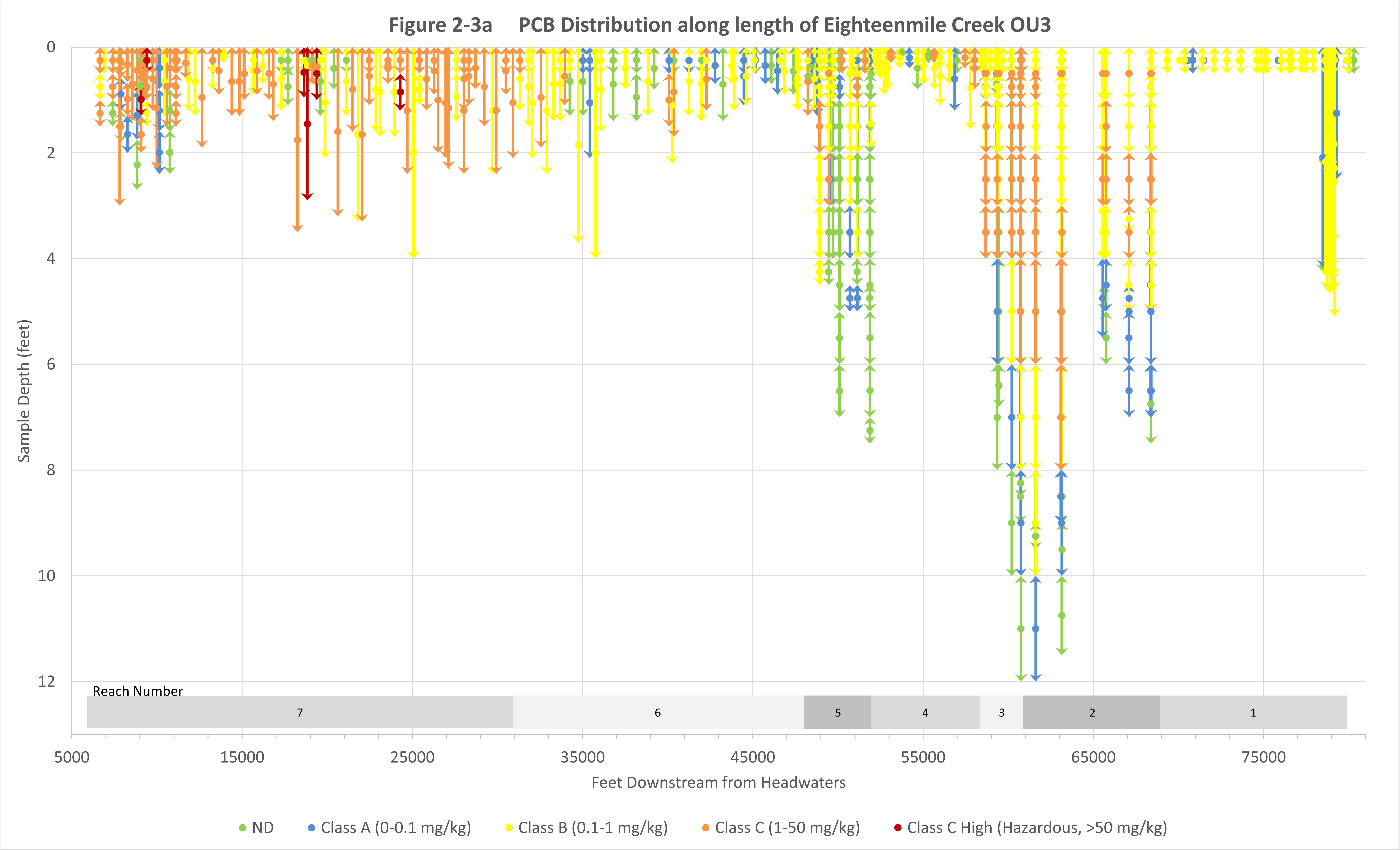


Figure 2-3a PCB Distribution along length of Eighteenmile Creek OU3

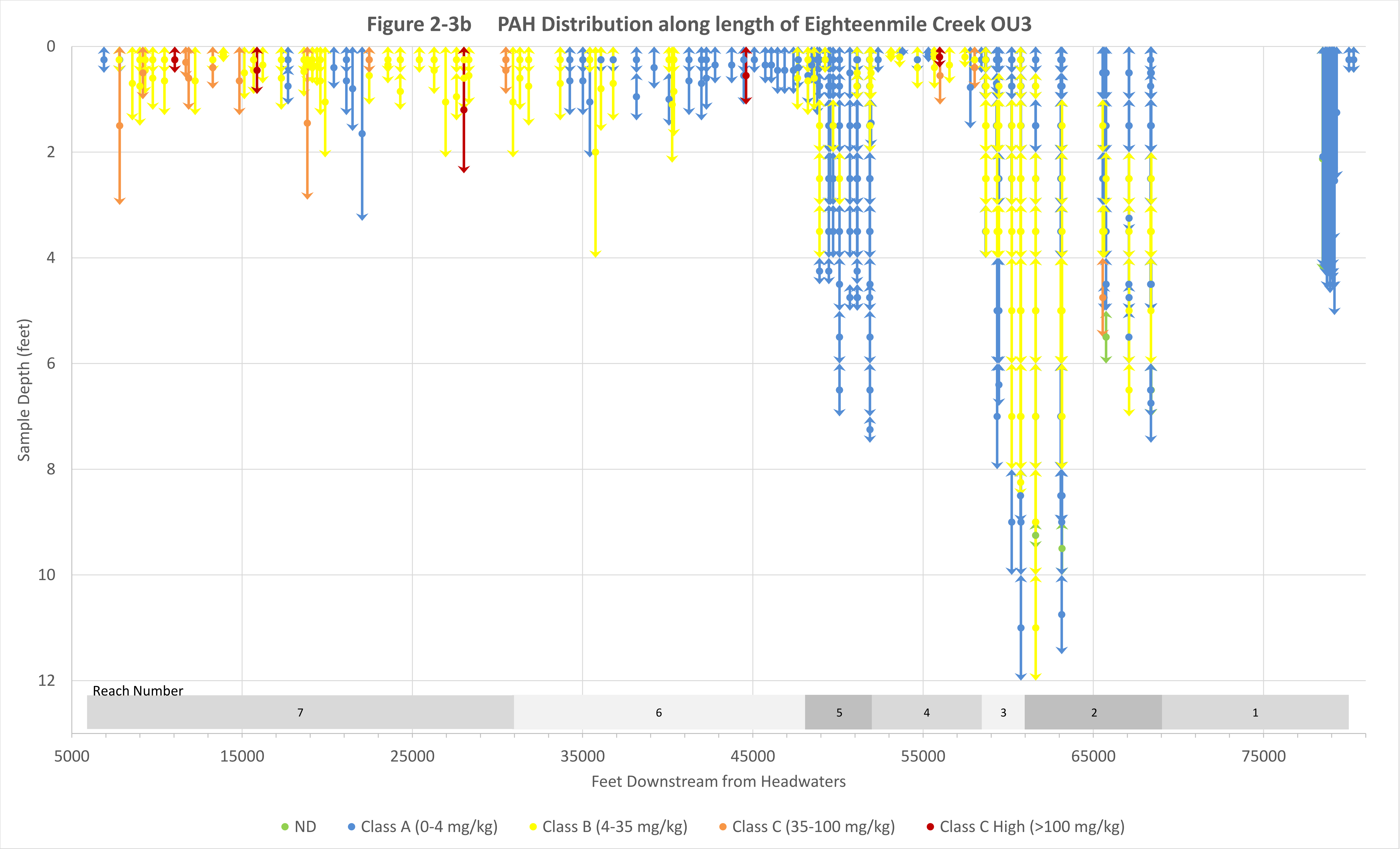


Figure 2-3b PAH Distribution along length of Eighteenmile Creek OU3
Sample Depth (feet)
0
2
4
6
8
10
12
Reach Number
7
6
5
4
3
2
1
5000
15000
25000
35000
45000
55000
65000
75000
Feet Downstream from Headwaters
ND
Class A (0-4 mg/kg)
Class B (4-35 mg/kg)
Class C (35-100 mg/kg)
Class C High (>100 mg/kg)

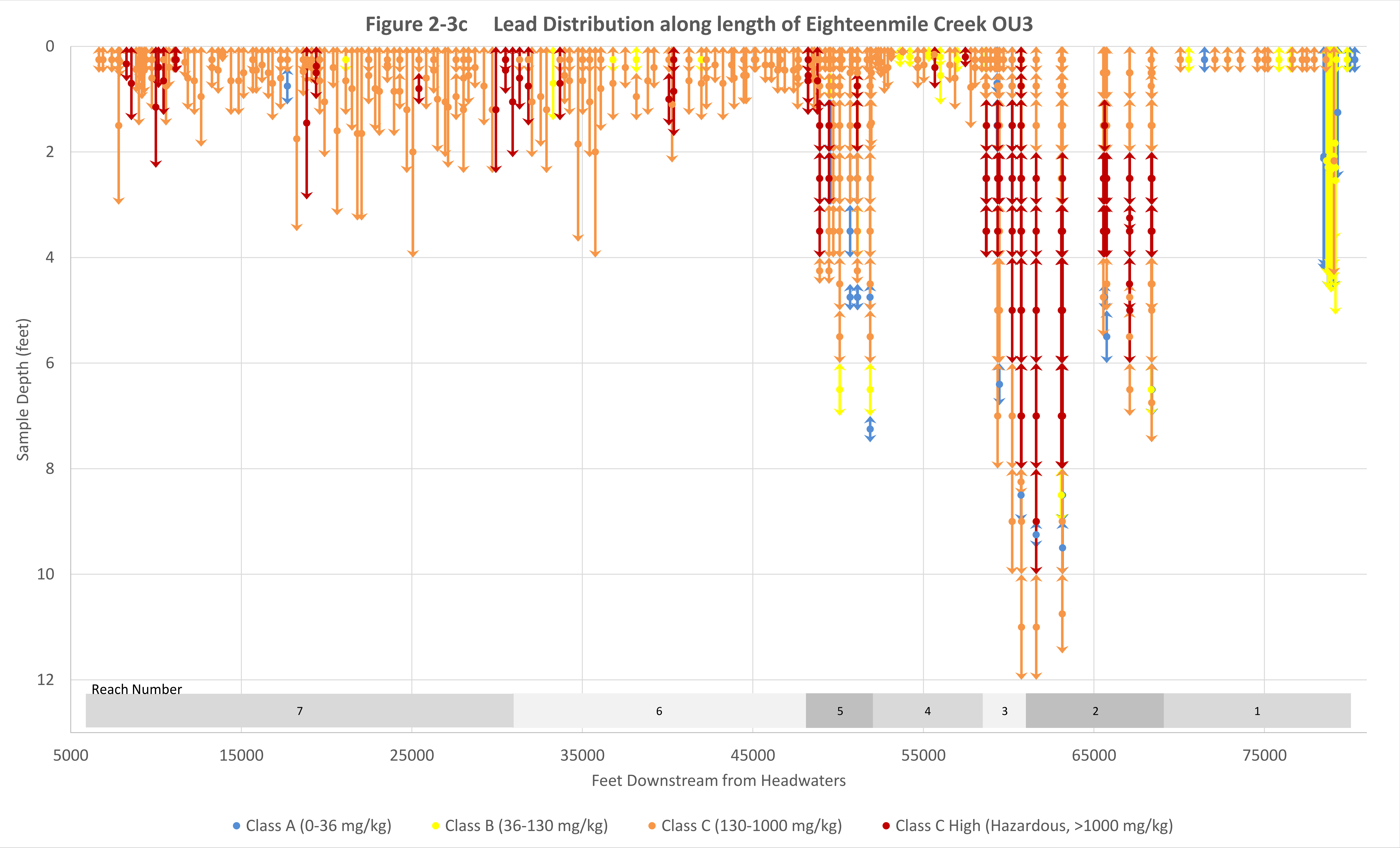
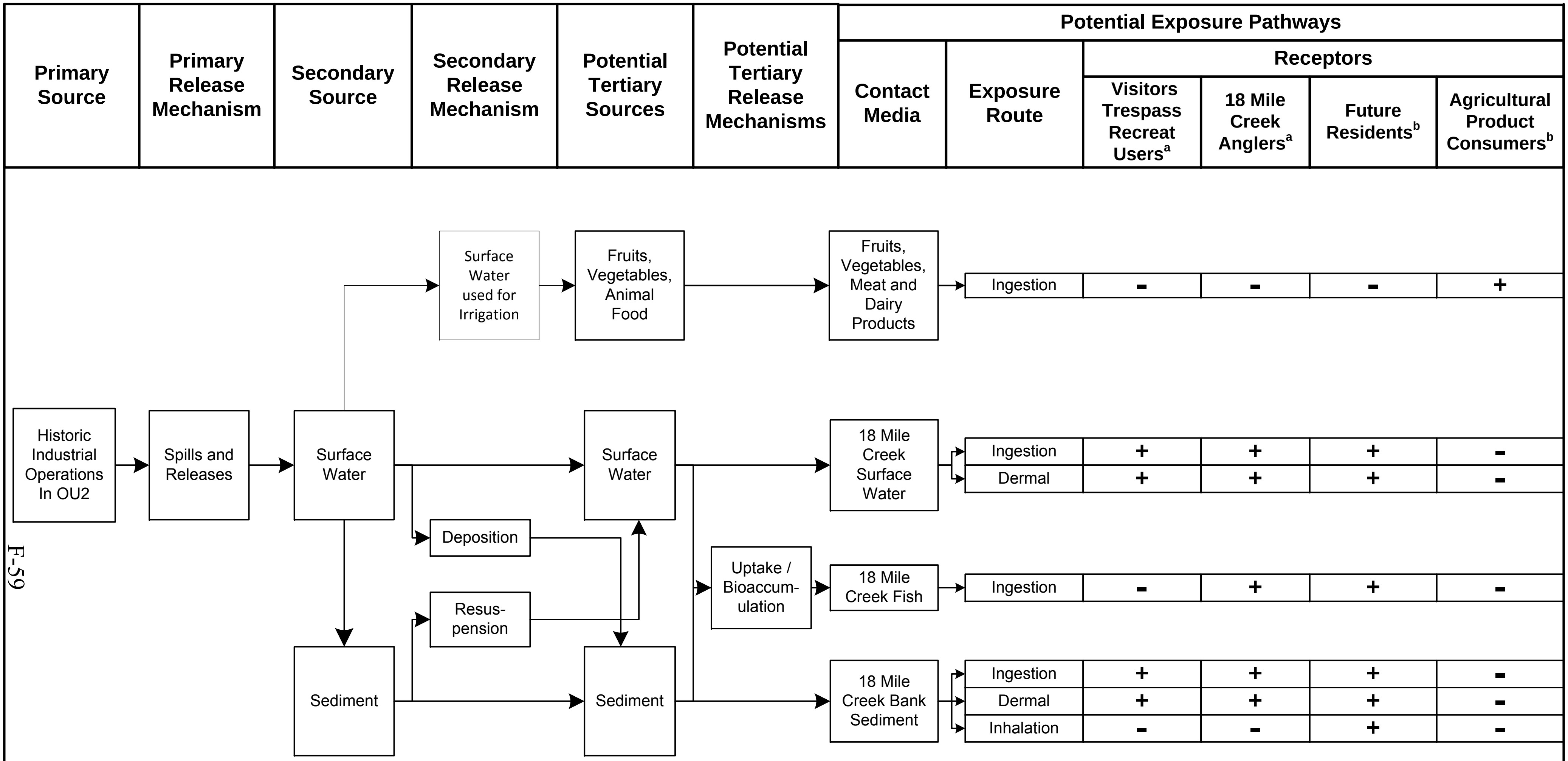


Figure 2-3c Lead Distribution along length of Eighteenmile Creek OU3
Sample Depth (feet)
0
2
4
6
8
10
12
Reach Number
7
6
5
4
3
2
1
5000
15000
25000
35000
45000
55000
65000
75000
Feet Downstream from Headwaters
Class A (0-36 mg/kg)
Class B (36-130 mg/kg)
Class C (130-1000 mg/kg)
Class C High (Hazardous, >1000 mg/kg)



Contact Media	Exposure Route	Visitors Trespass Recreat Users[a]	18 Mile Creek Anglers[a]	Future Residents[b]	Agricultural Product Consumers[b]
Fruits, Vegetables, Meat and Dairy Products	Ingestion	-	-	-	+
18 Mile Creek Surface Water	Ingestion	+	+	+	-
	Dermal	+	+	+	-
18 Mile Creek Fish	Ingestion	-	+	+	-
18 Mile Creek Bank Sediment	Ingestion	+	+	+	-
	Dermal	+	+	+	-
	Inhalation	-	-	+	-

KEY:

+	**Complete Exposure Pathway;**
-	**Incomplete or Minor Exposure Pathway;**

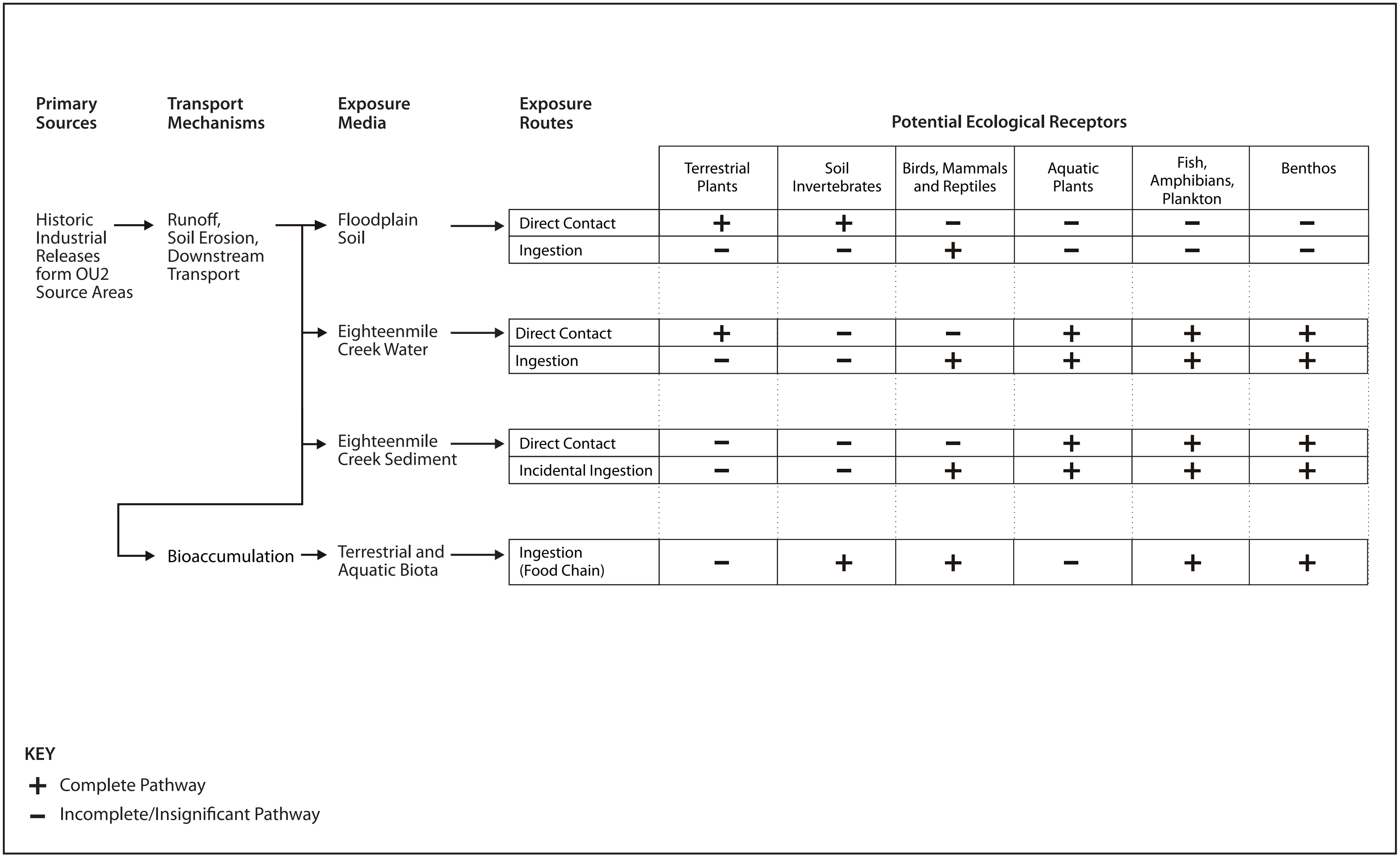
Notes:

a: **Visitor, Recreational User and Angler receptor groups include Young Children 1 to 6 years of age, Adolescents 12 to 18 years of age, and Adults 18 years of age and greater.**

b: **Future Residents and Agricultural Product Consumers include Young Children birth to 6 years of age and Adults 21 to 78 years of age.**

Figure 2-4 Preliminary Human Health Conceptual Site Model, Eighteenmile Creek OU3

02:1009345.0002.03-B4683/Figure 2-5 CSM OU3.ai-1/9/17-GRA



Exposure Media	Exposure Routes	Terrestrial Plants	Soil Invertebrates	Birds, Mammals and Reptiles	Aquatic Plants	Fish, Amphibians, Plankton	Benthos
Floodplain Soil	Direct Contact	+	+	−	−	−	−
	Ingestion	−	−	+	−	−	−
Eighteenmile Creek Water	Direct Contact	+	−	−	+	+	+
	Ingestion	−	−	+	+	+	+
Eighteenmile Creek Sediment	Direct Contact	−	−	−	+	+	+
	Incidental Ingestion	−	−	+	+	+	+
Terrestrial and Aquatic Biota	Ingestion (Food Chain)	−	+	+	−	+	+

KEY

\+ Complete Pathway

− Incomplete/Insignificant Pathway

SOURCE: Ecology and Environment, Inc., 2017

Figure 2-5 Preliminary Ecological Conceptual Site Model, Eighteenmile Creek OU3

02:1009345.0002.03-B4683/Figure 2-6 AOC Sediment Thickness.ai-1/9/17-GRA

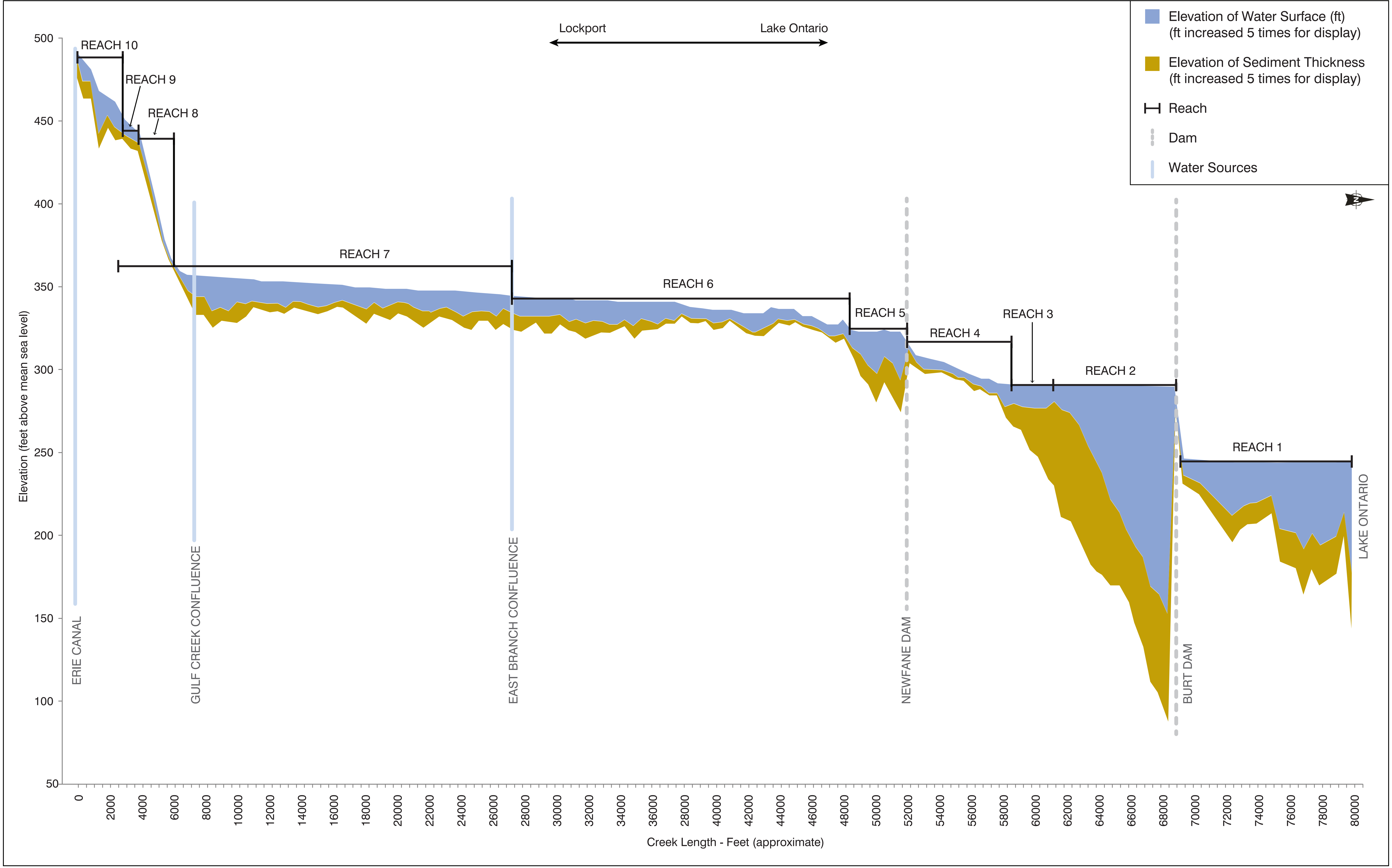


Figure 2-6 Sediment Thickness Cross Section, Eighteenmile Creek OU3

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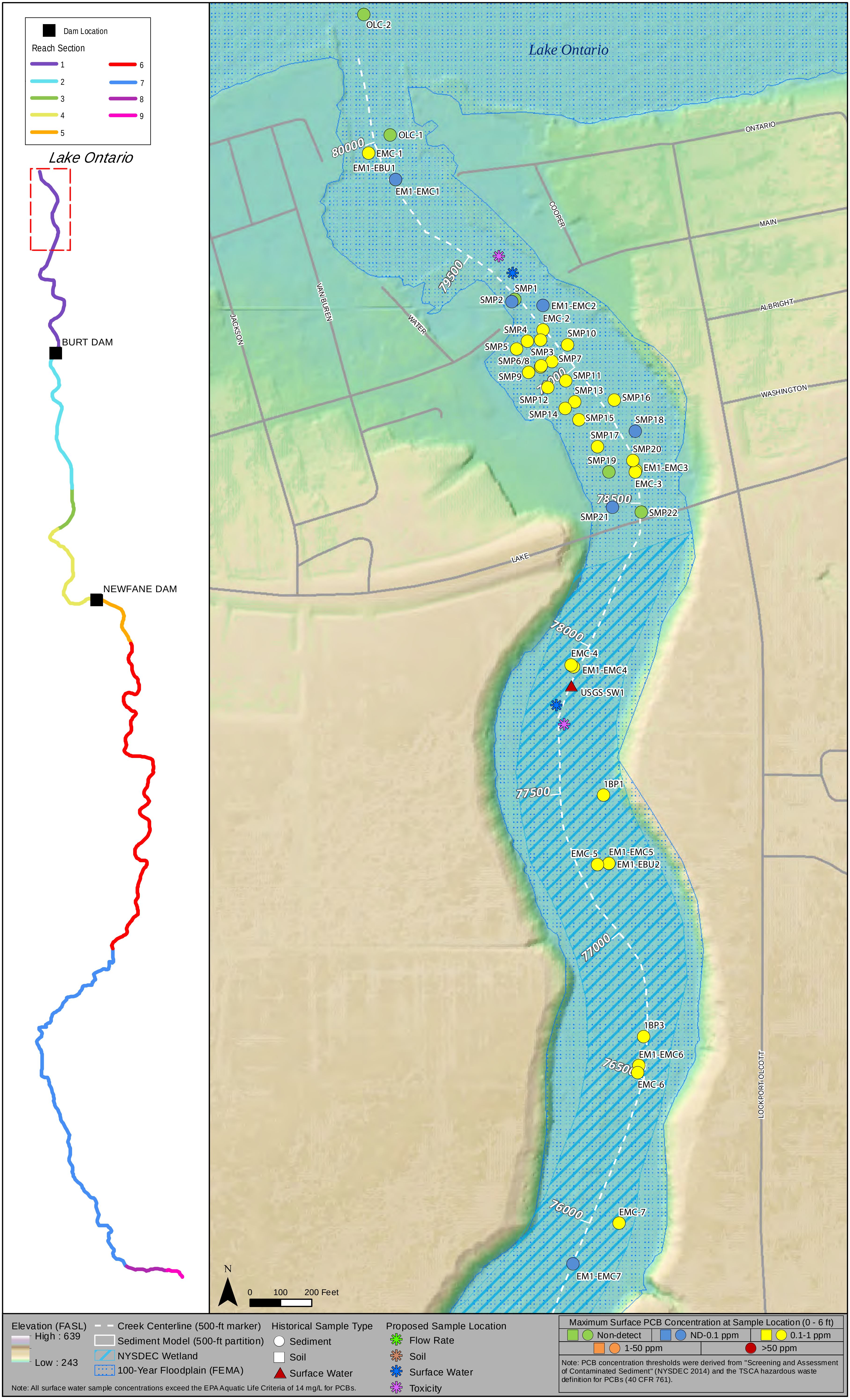

Note: All surface water sample concentrations exceed the EPA Aquatic Life Criteria of 14 mg/L for PCBs.

Note: PCB concentration thresholds were derived from "Screening and Assessment of Contaminated Sediment" (NYSDEC 2014) and the TSCA hazardous waste definition for PCBs (40 CFR 761).

Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow
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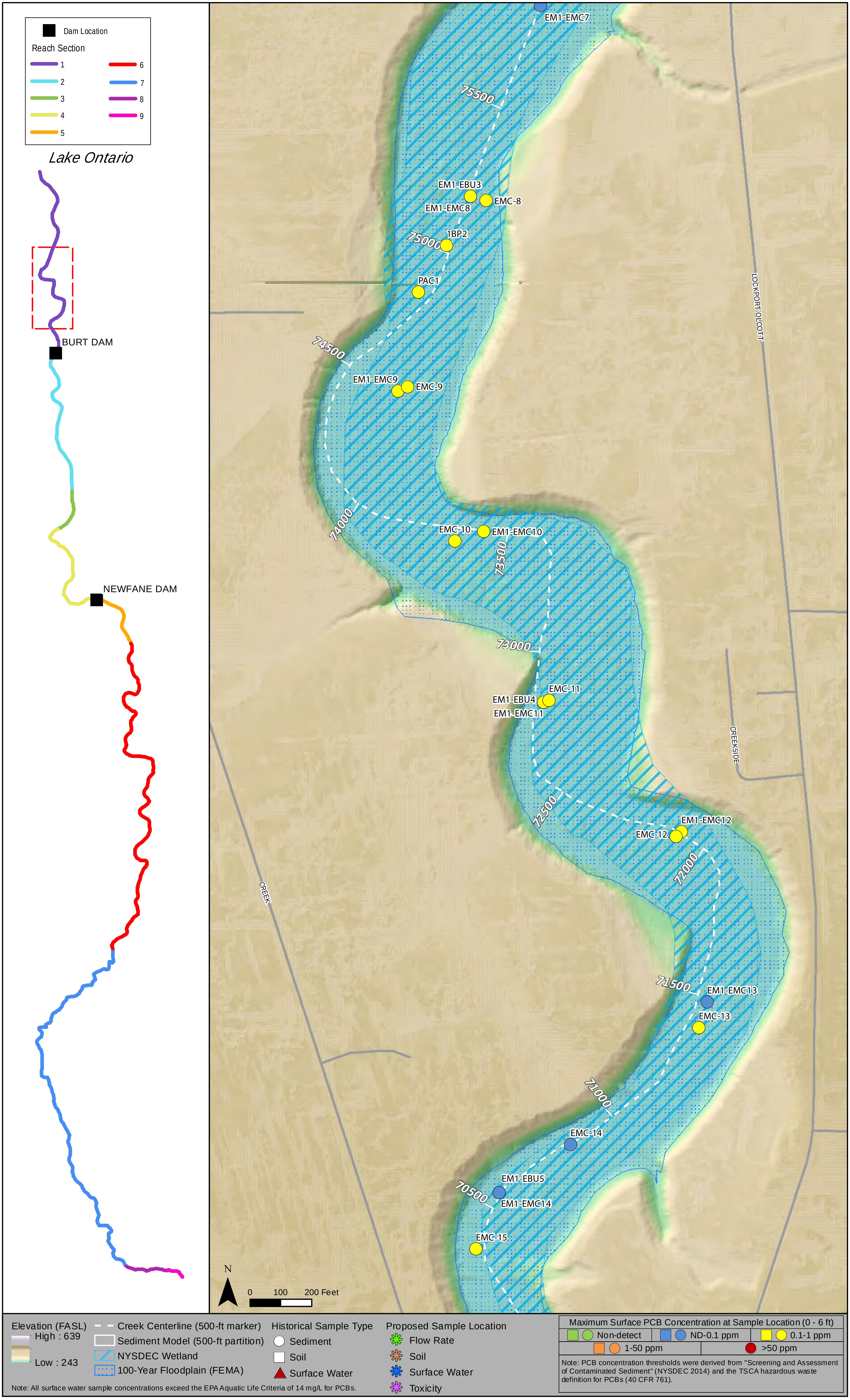

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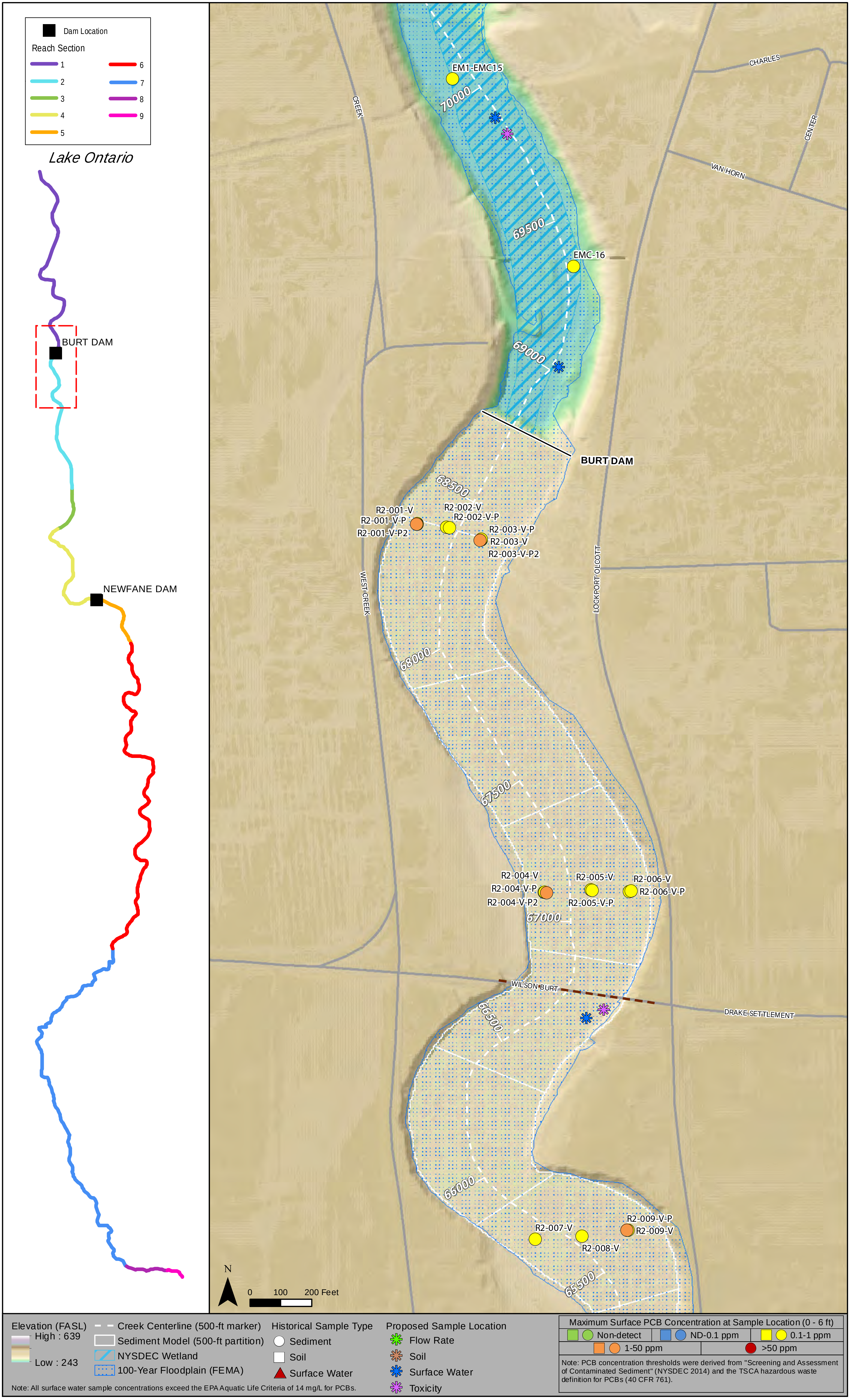

Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow
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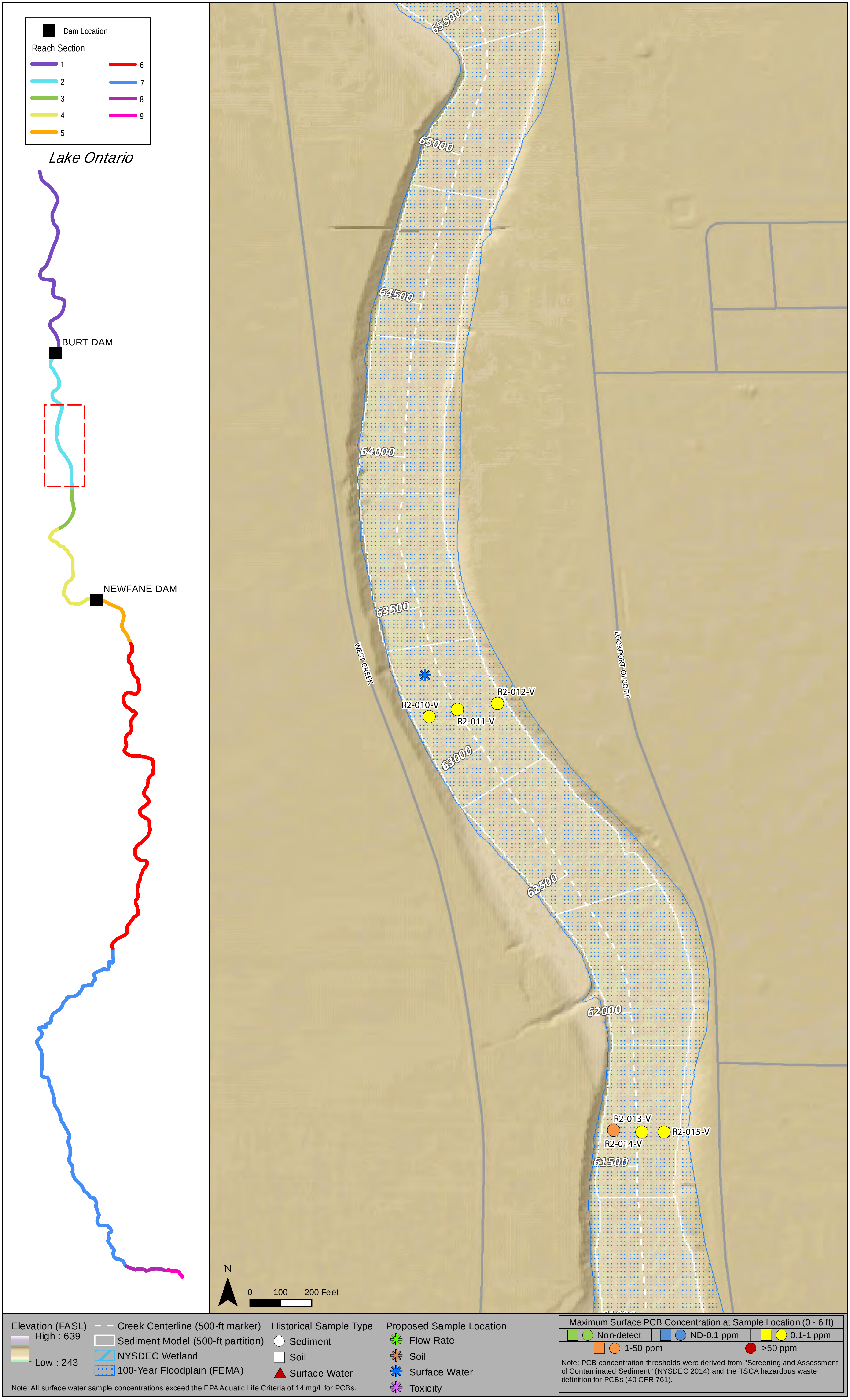

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Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow
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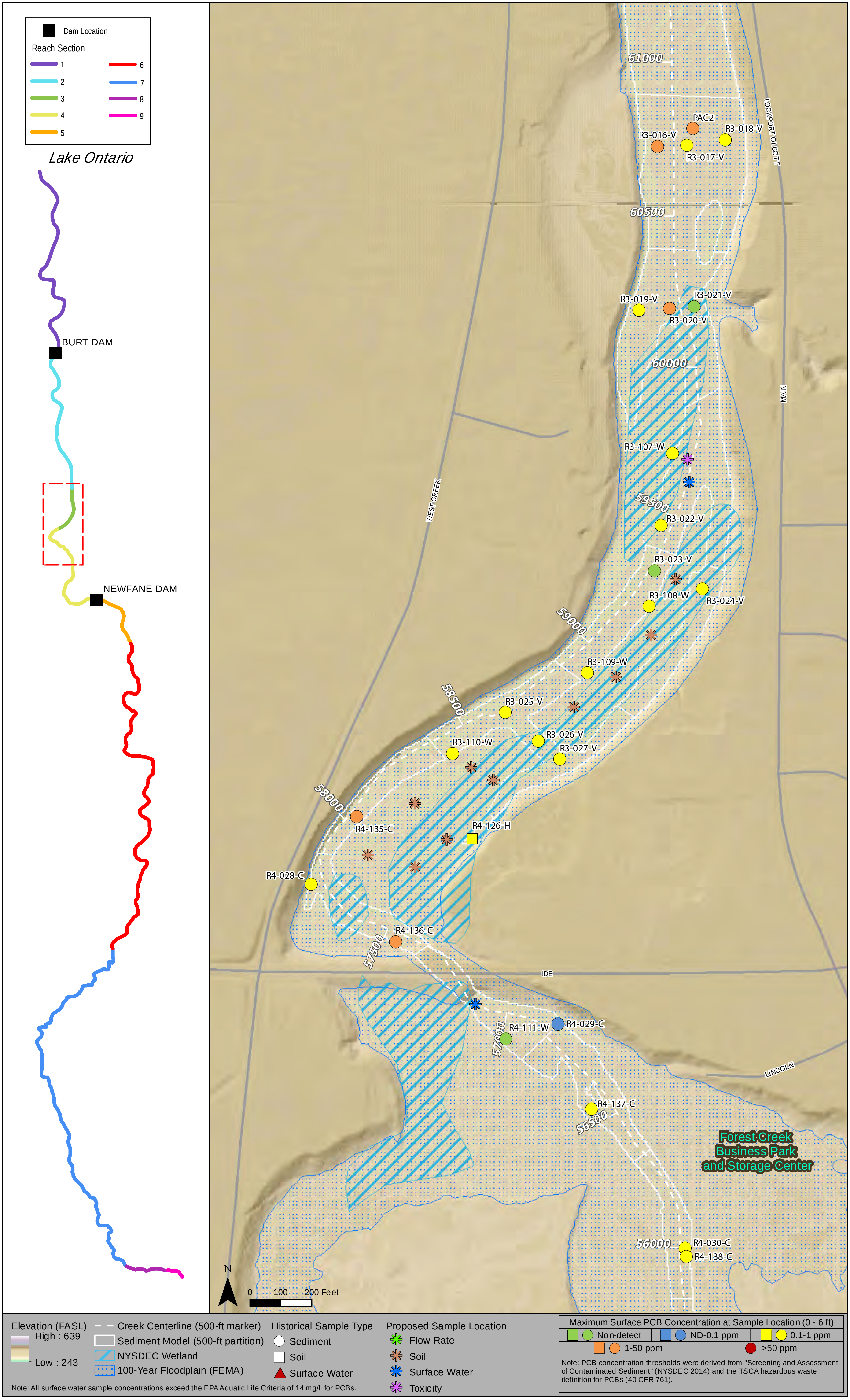

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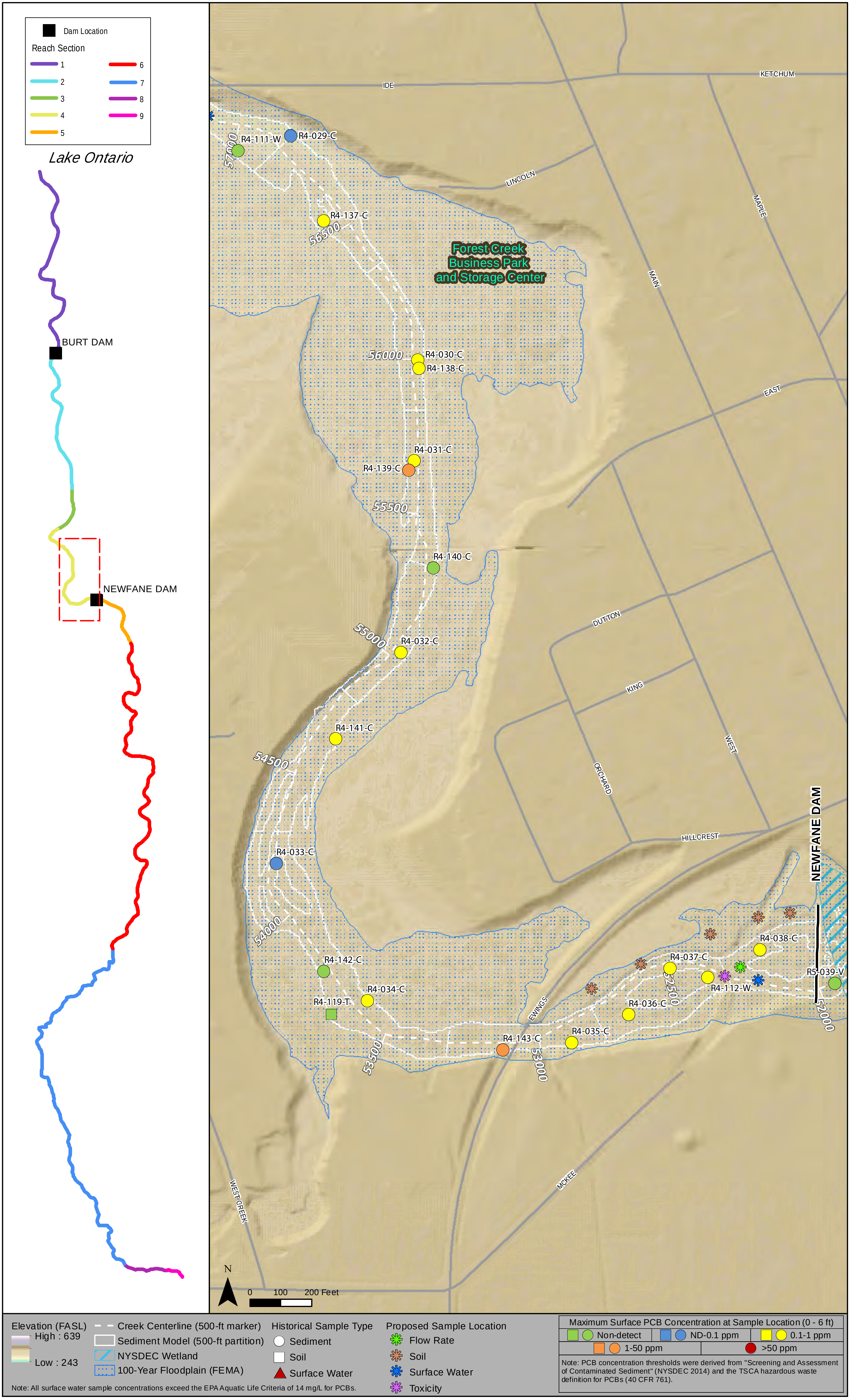

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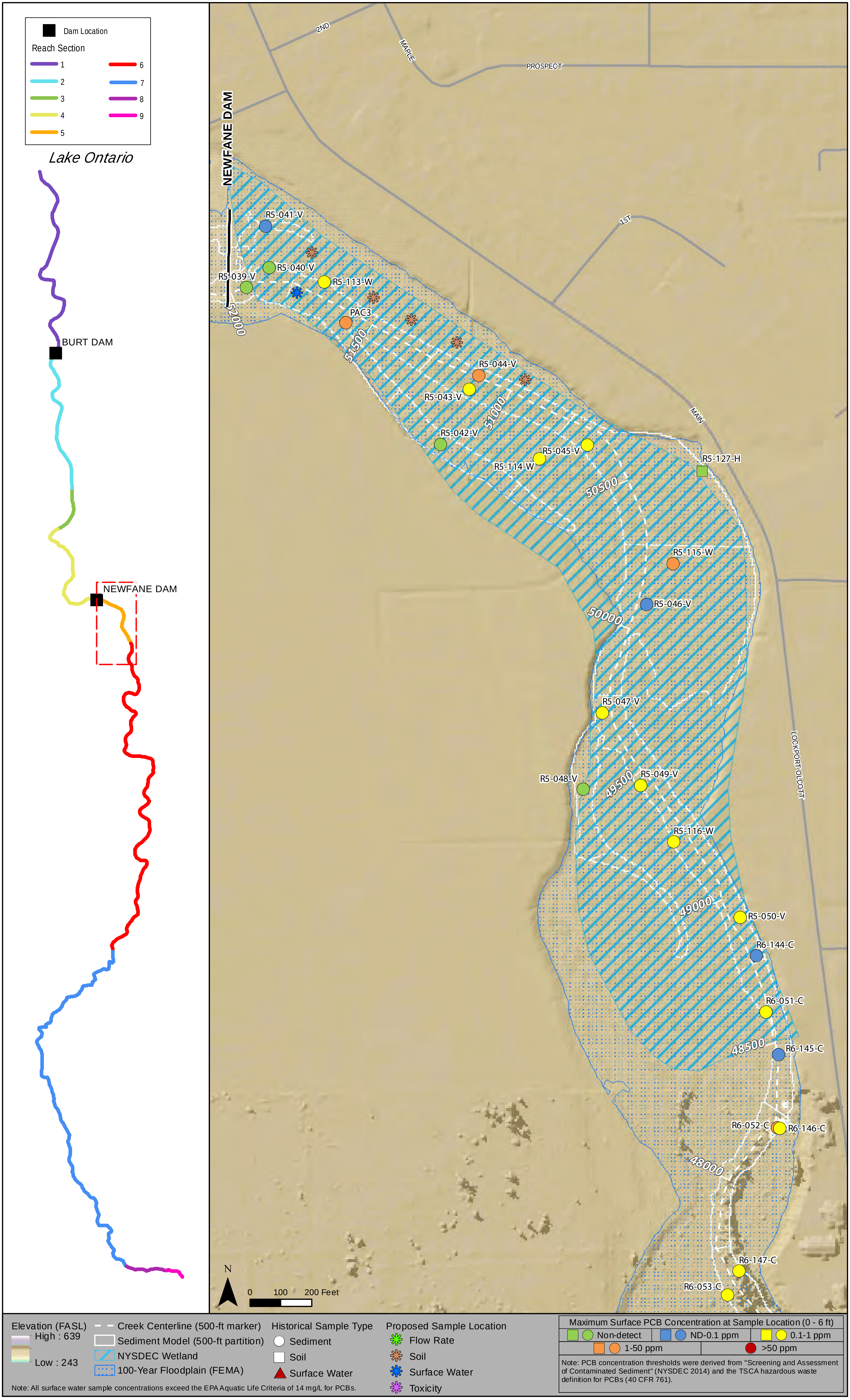

Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow
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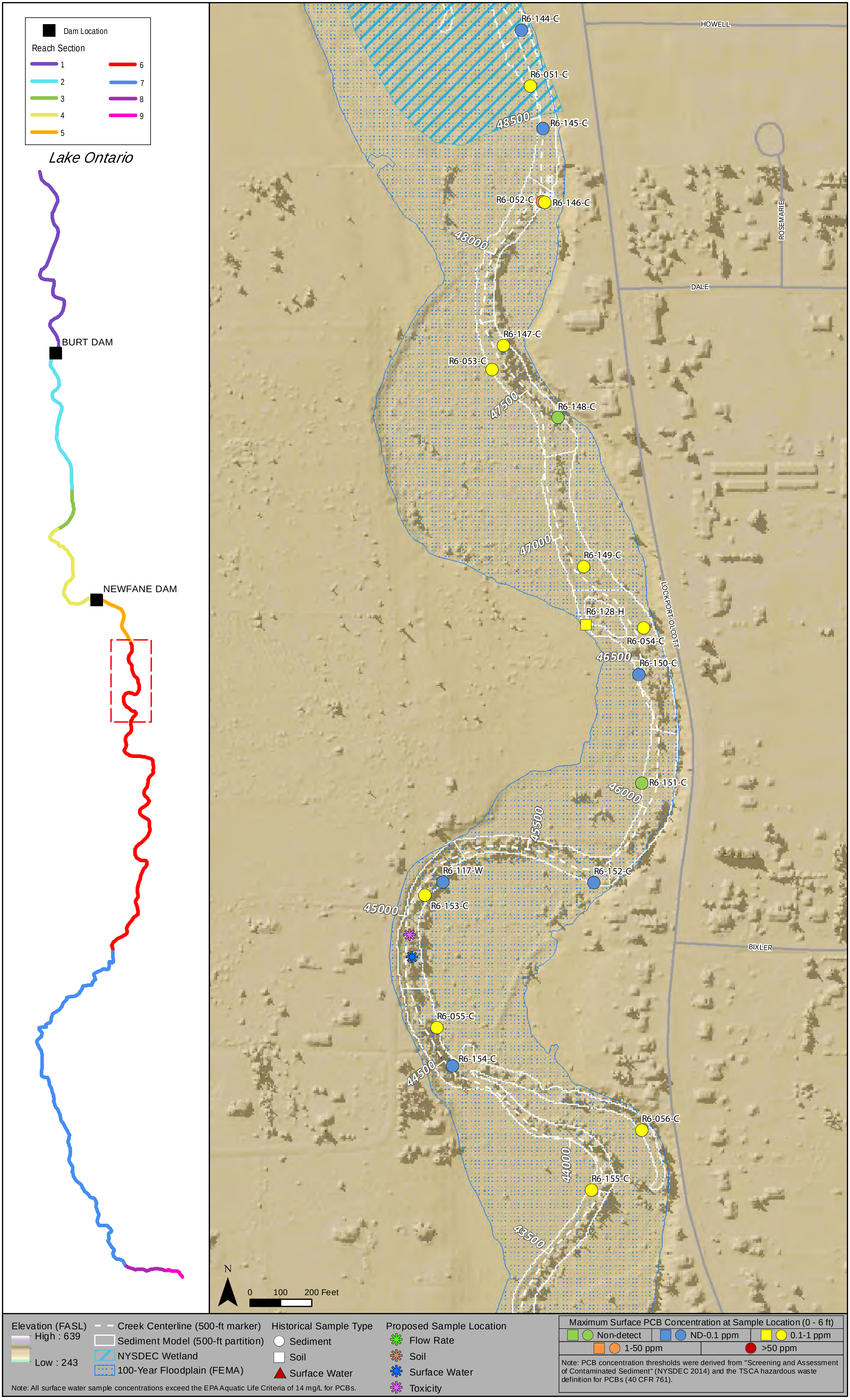

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Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow

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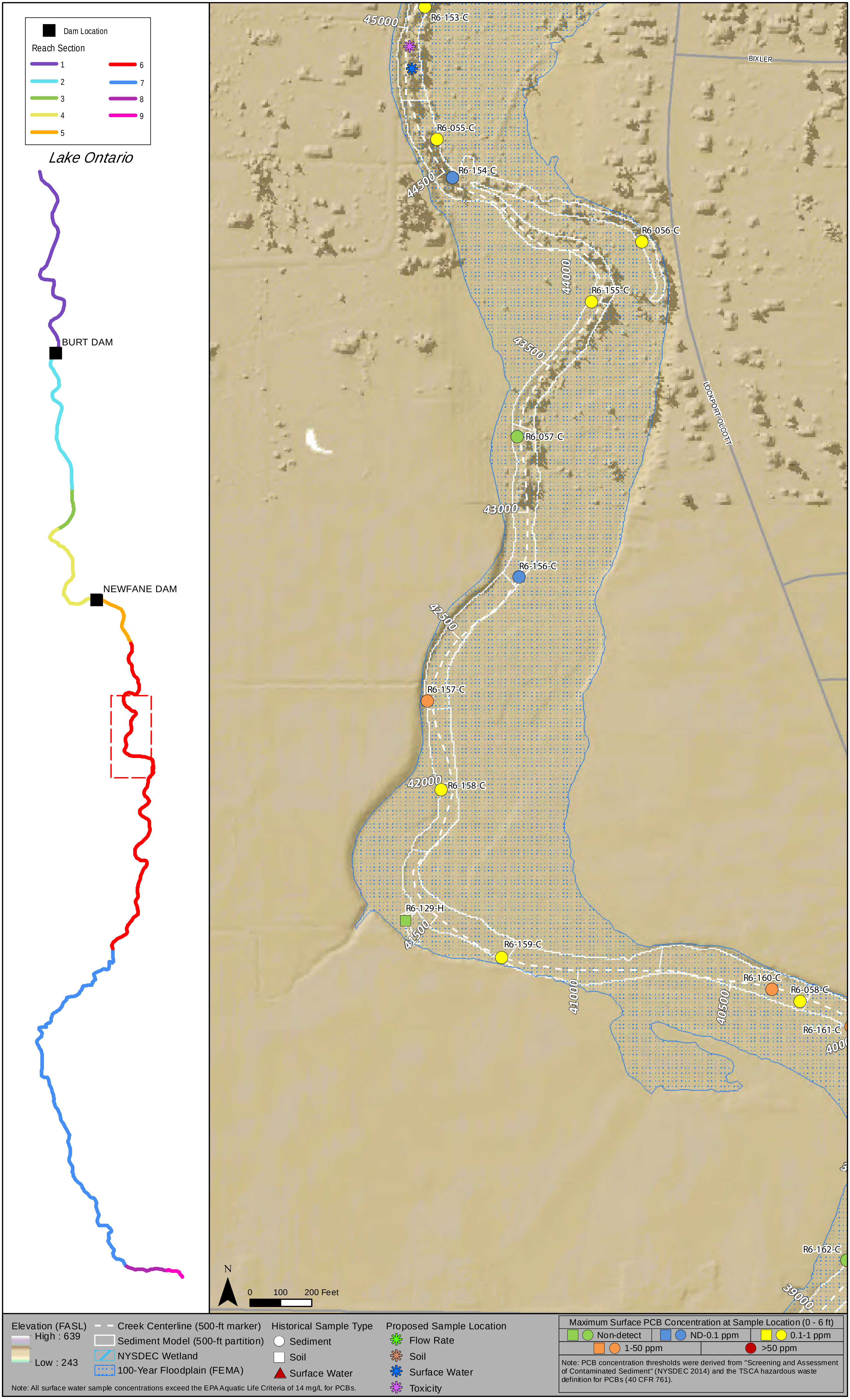

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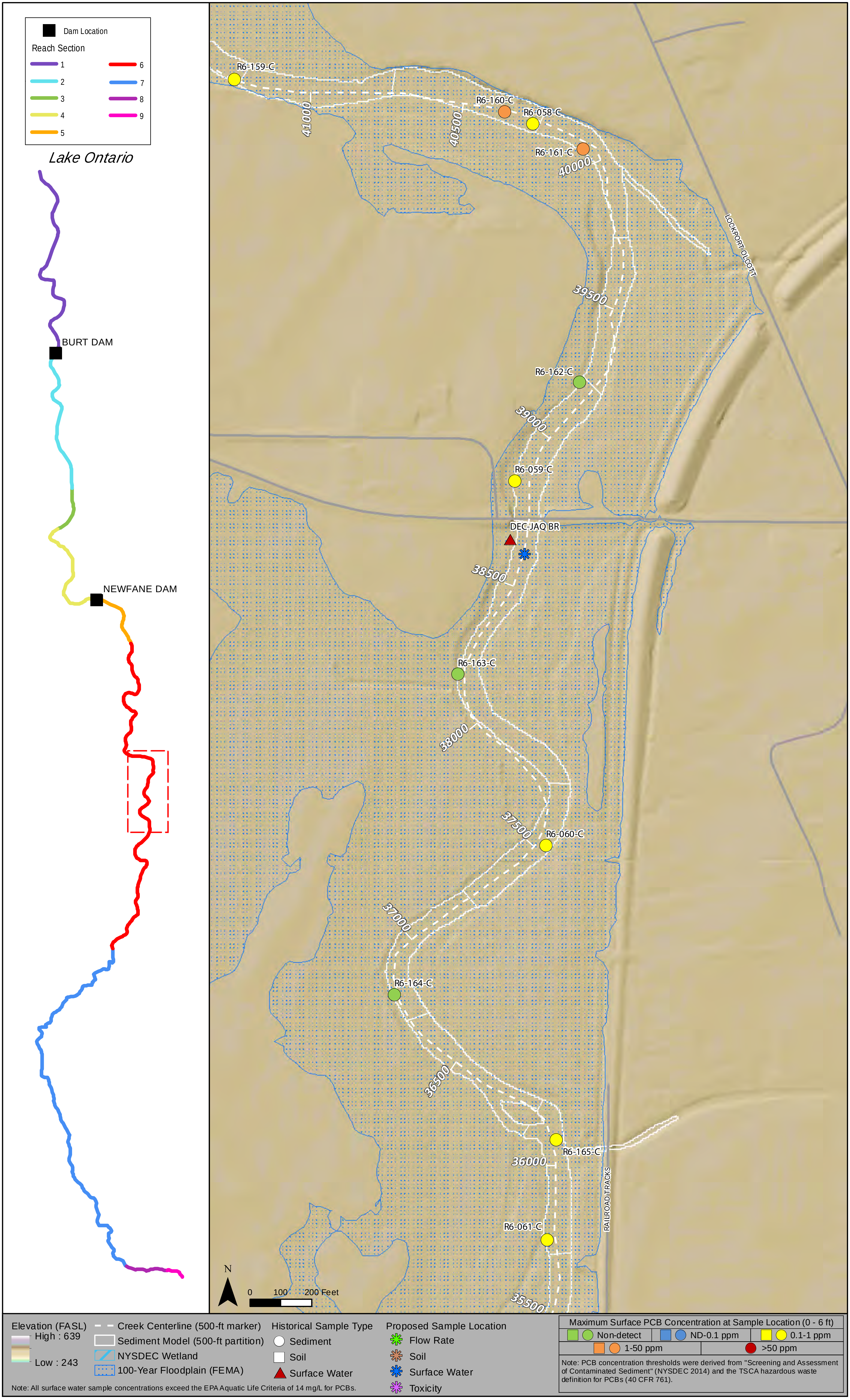

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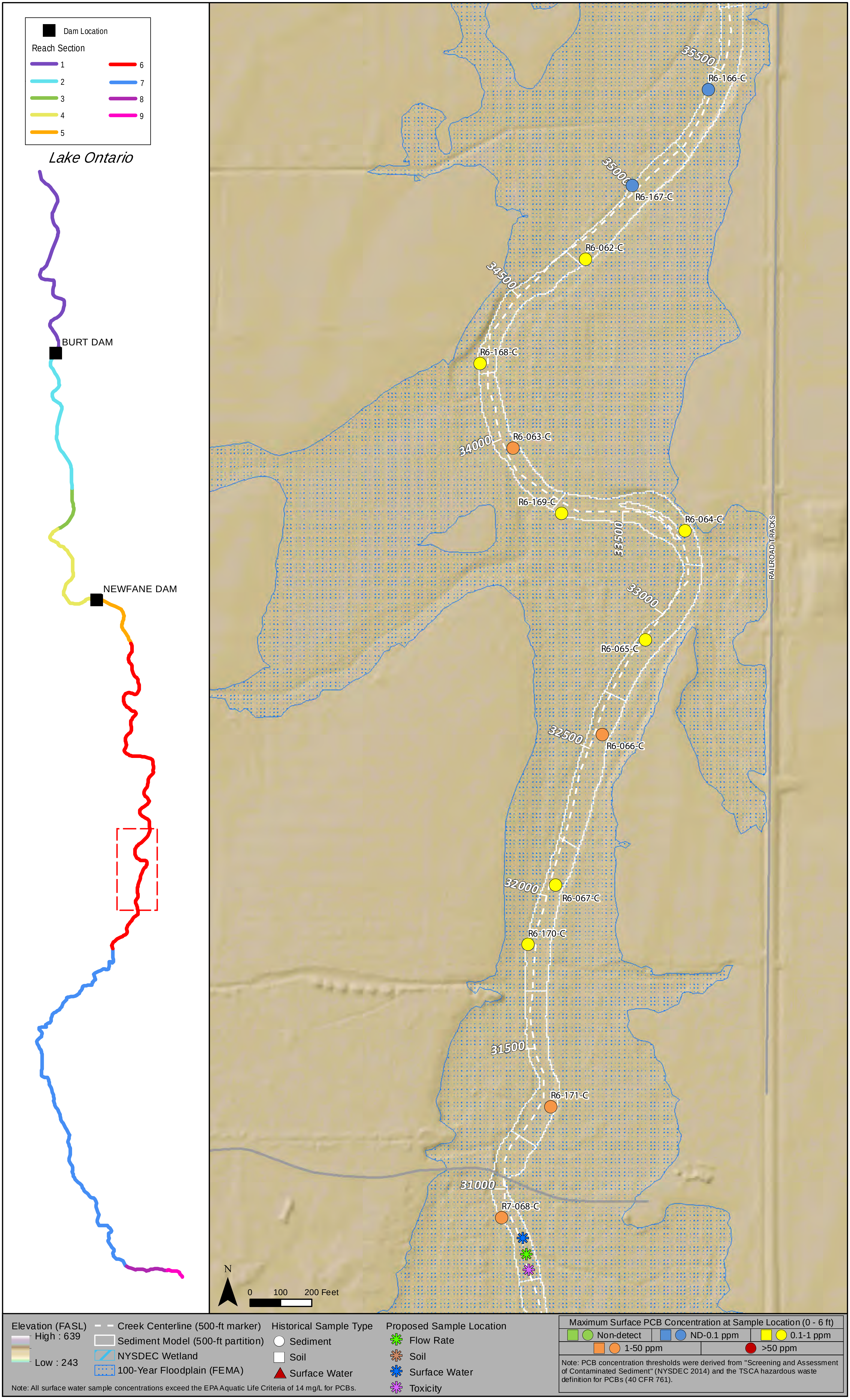

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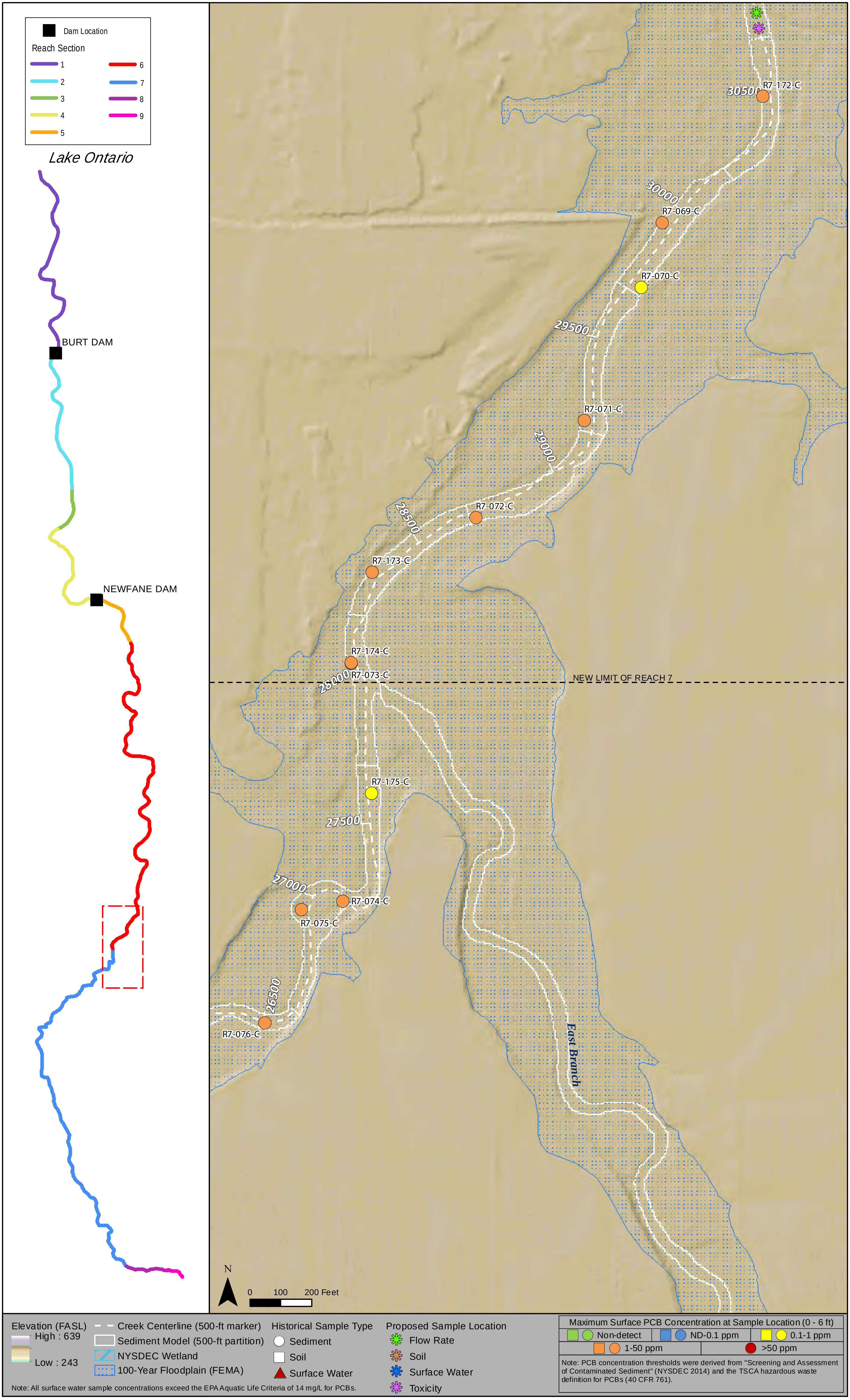

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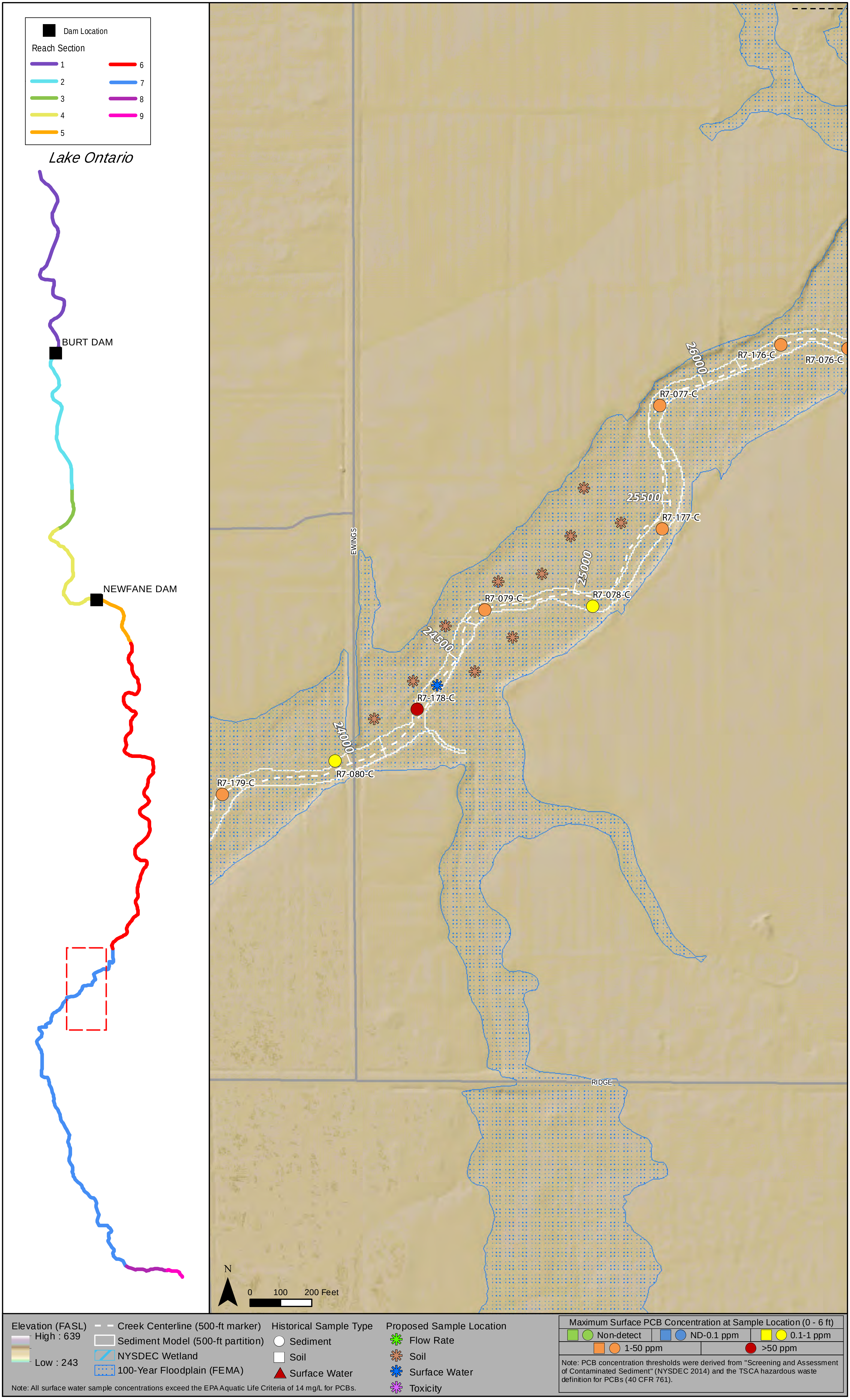

Note: All surface water sample concentrations exceed the EPA Aquatic Life Criteria of 14 mg/L for PCBs.

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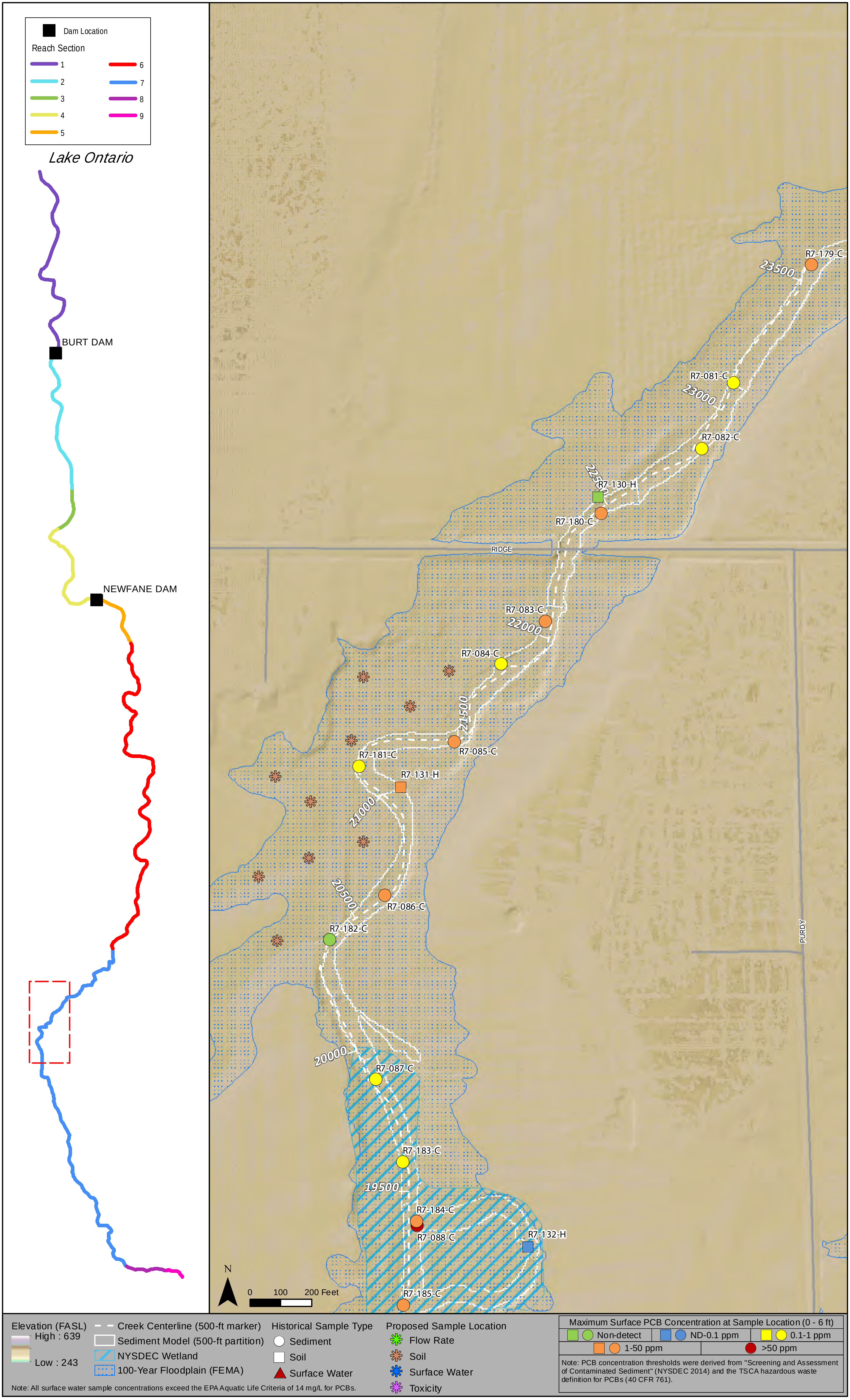

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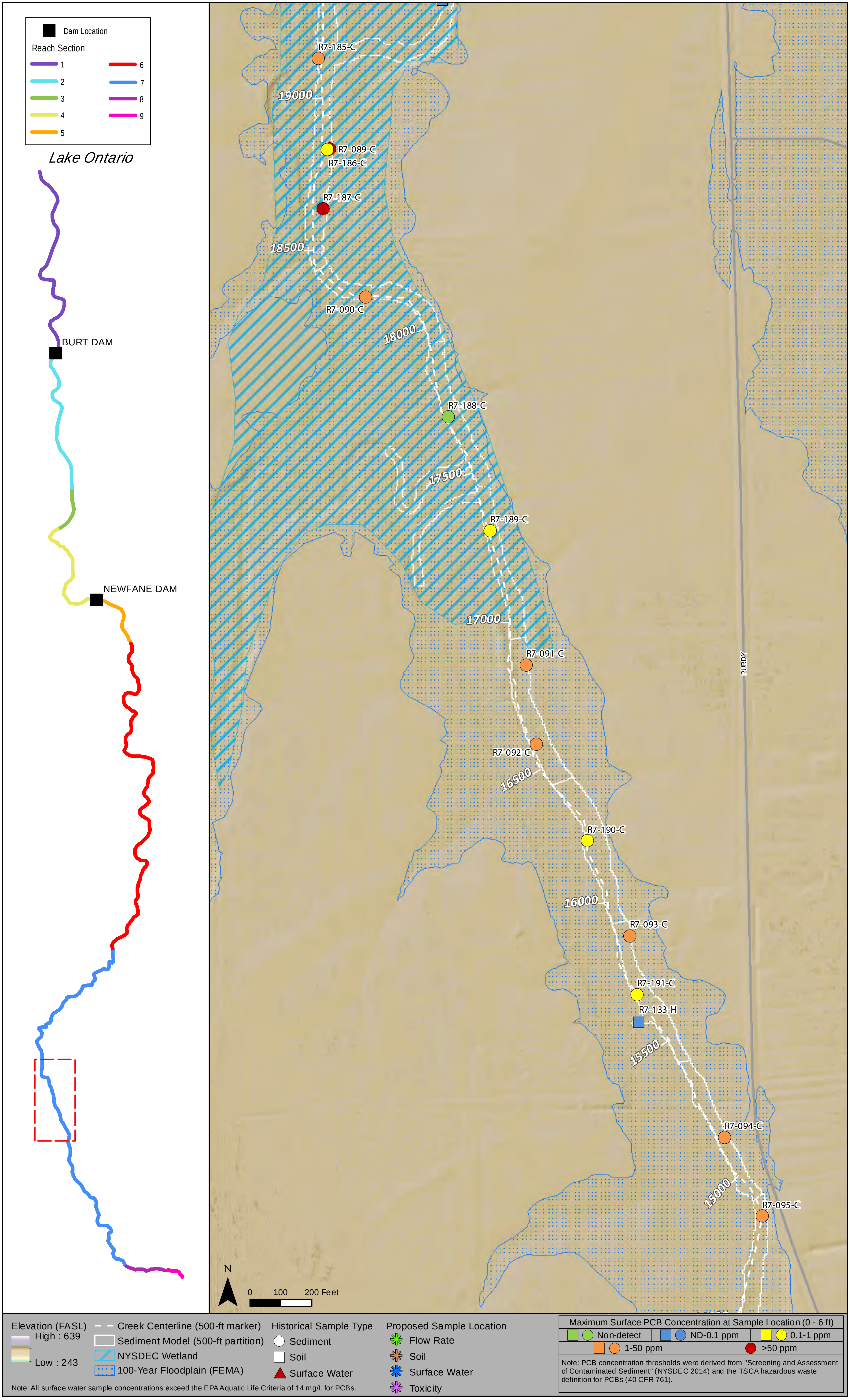

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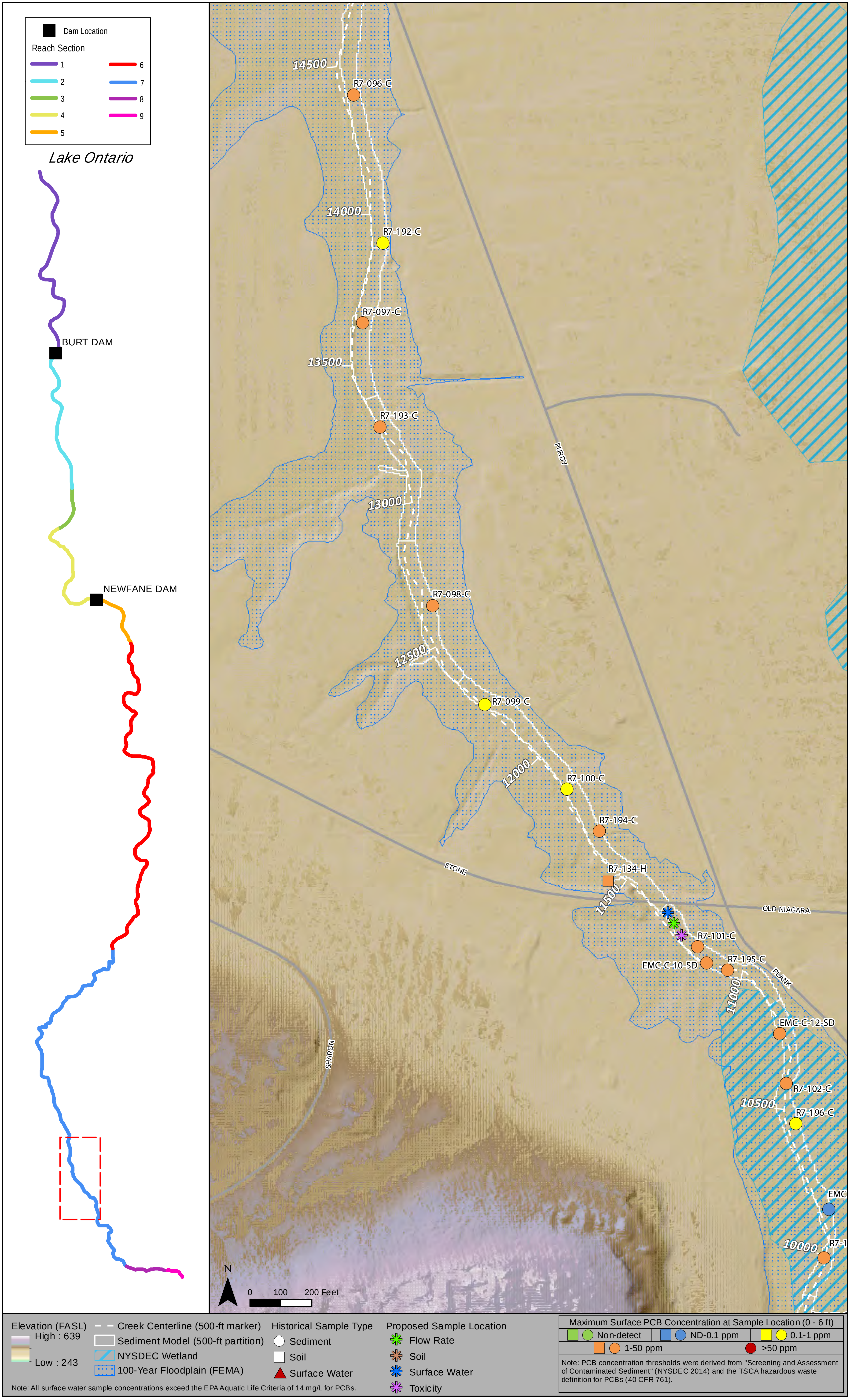

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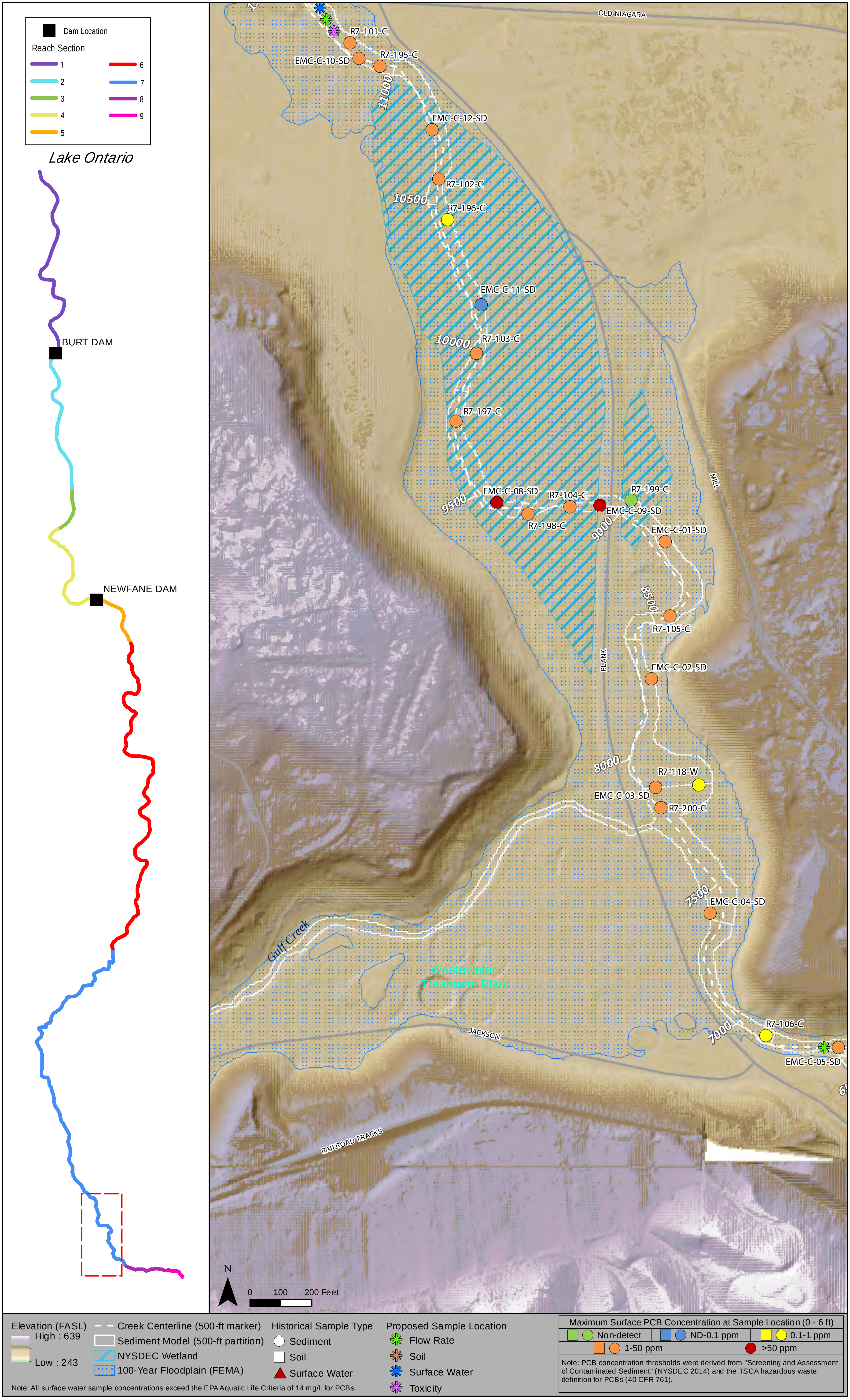

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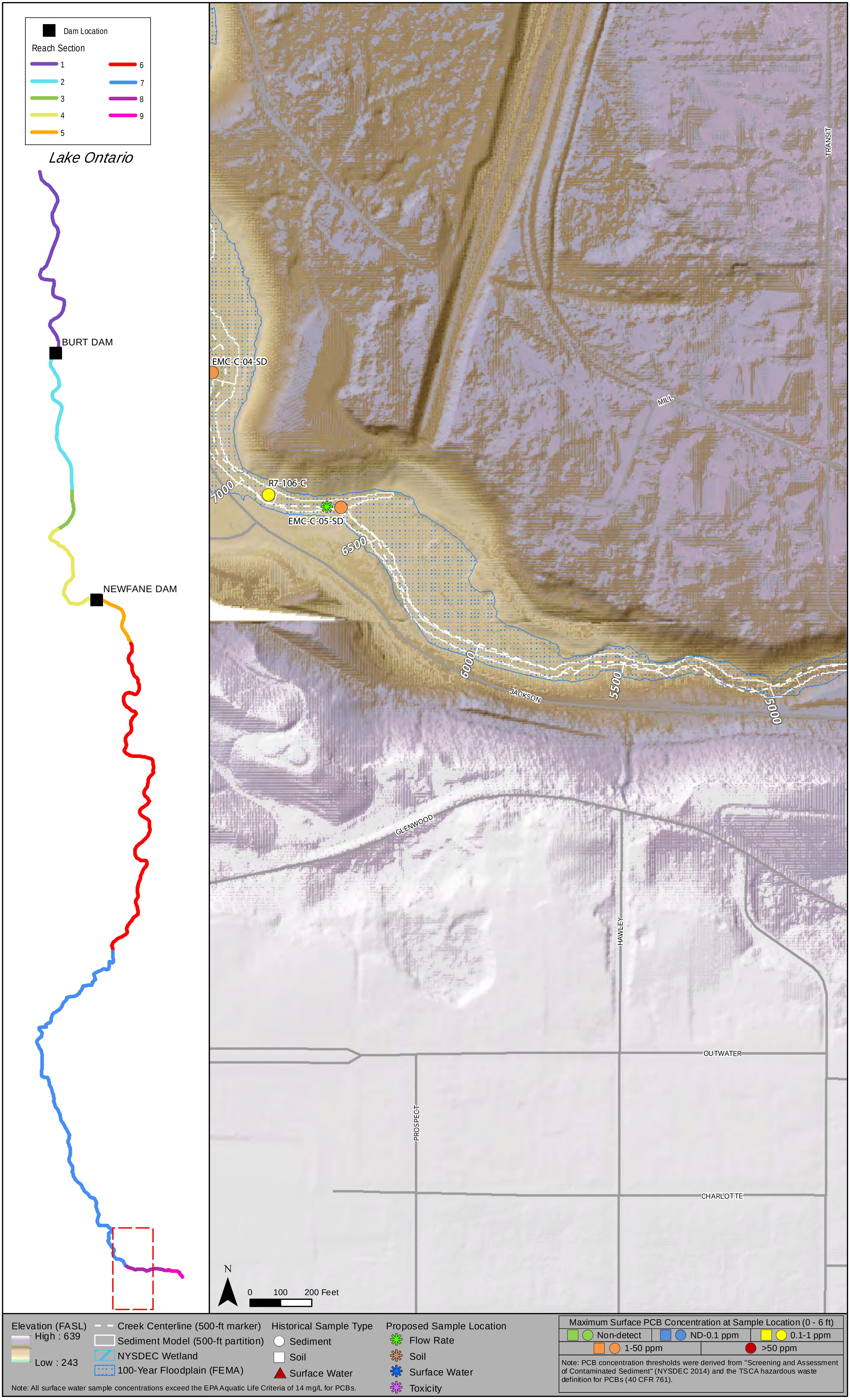

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Figure 4-1 Maximum Total PCB Concentrations at Historical Sampling Locations in Eighteenmile Creek OU3 and Proposed Future Sampling Locations for Surface Water Chemistry, Sediment and Surface Water Toxicity, Floodplain Soil, and Flow
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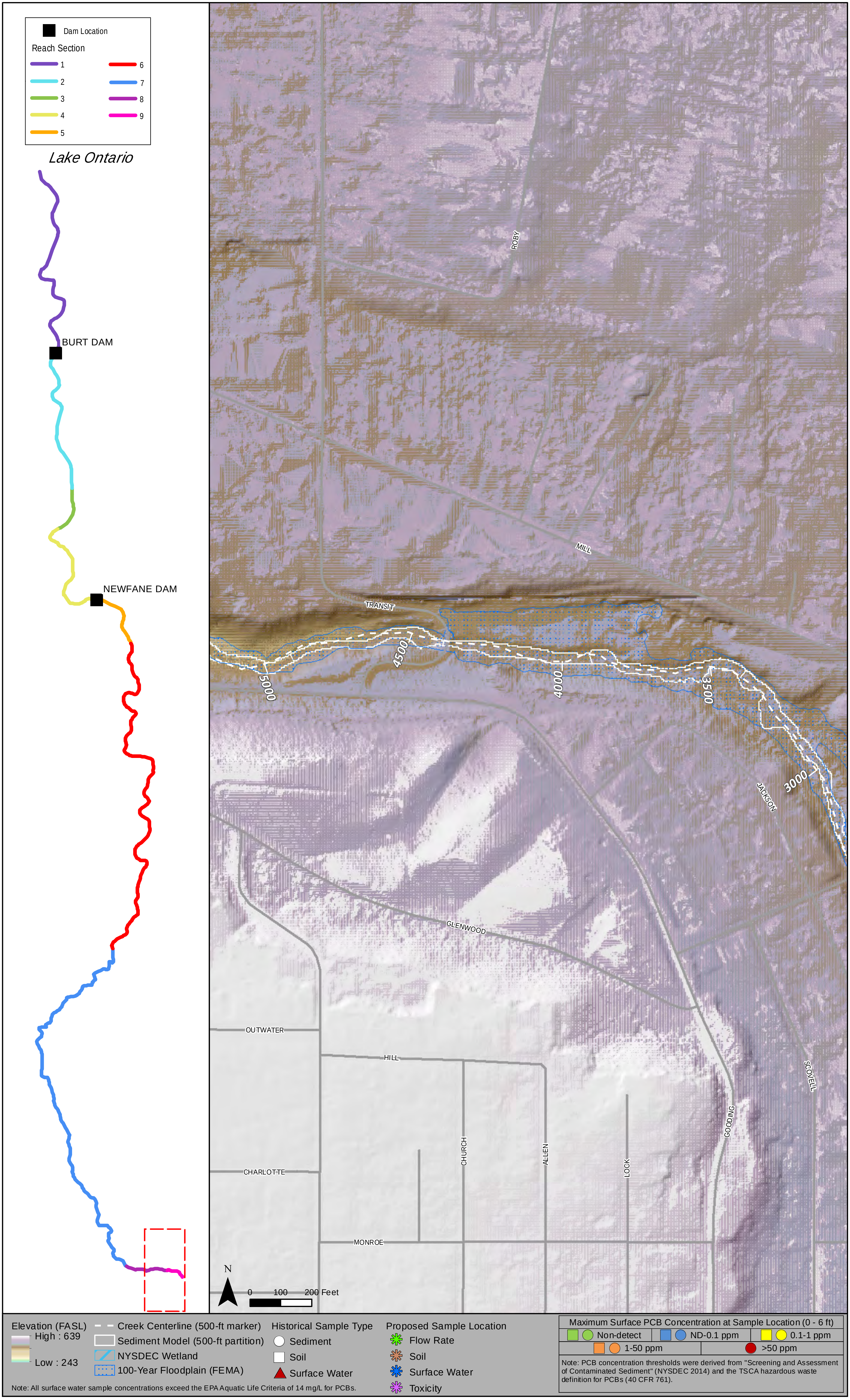

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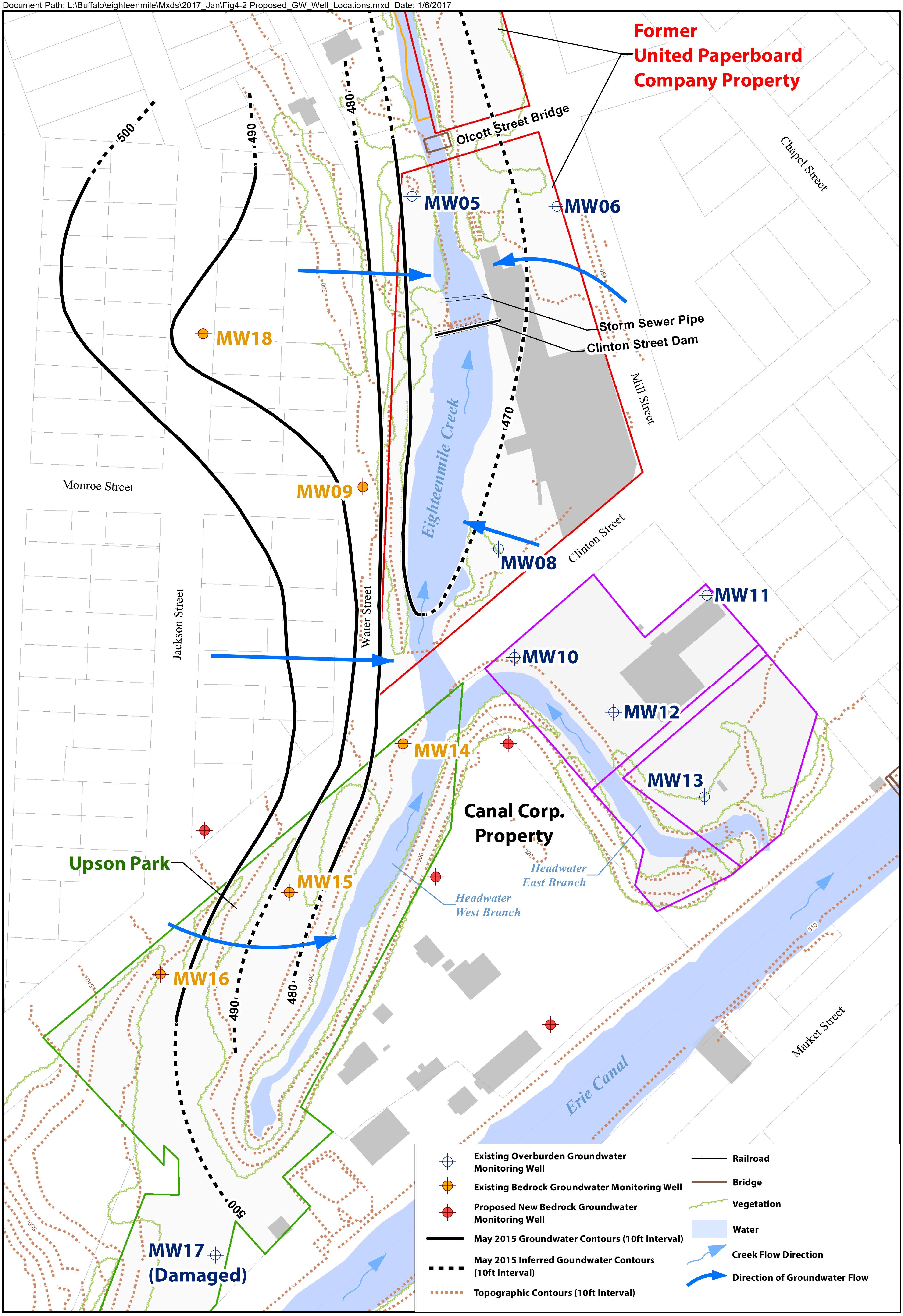

Figure 4-2
Proposed Groundwater Well Locations
Eighteenmile Creek OU2

A

Data Evaluation Supporting Material

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key (1)	Area	New Report(2)	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
NYSDEC Investigations for Area of Concern										
NYSDEC 1998. Eighteenmile Creek and Olcott Harbor Sediment Study.	NYSDEC 1998	OU 2 and 3	No	Sediment Toxicity testing on aquatic organisms in sediment Macroinverterbrates in sediment	Sediment sampling (cores and surficial) at eight sites on Eighteenmile Creek, tributaries, and Barge Canal in 1994. Samples tested for pesticides, dioxins/furans, PCBs (Aroclors and congeners), metals, mercury, PAHs, TOC, and particle size. Sediments and sediment elutriates were subjected to toxicity testing for the aquatic organisms *Hyalella azteca* and *Chironomus tentans.* Sediment was characterized/surveyed for macroinvertebrates.	The report describes data collection and data validation procedures. Laboratory results are attached in appendices. The data is only source of dioxin data for the sediment and, therefore, can be used for screening purposes. Surface contamination and toxicity results are greater than 10 years old and not representative of current conditions.	A partial dataset from TrophicTrace Model for dioxins/furans, PCBs, and some metals were imported into the GLNPO RI database. Additional data were entered from the original report for some missing COPCs. Only total concentrations were entered for PCBs, PAHs, and DDT metabolites. Data for some metals, TOC, and pesticides were not brought into the GLNPO RI database and will not at this time be added to the OU3 database.	Data was not validated or additional data added to OU3 database because data are over 20 years old. Results for select parameters in sediment were compiled as part of the GNLPO RI and can be used to evaluate trends.	Dioxin/furan data are usable for understanding historical context because there are very few current dioxin/furan samples. Subsurface sediment will be used for nature and extent historical deposition patterns because dated core samples were analyzed.	Available coordinates were entered and checked.
NYSDEC 2001. Final Report, Eighteenmile Creek Sediment Study, Summary of August 17-20 and November 3, 1998 Results.	NYSDEC 2001	OU 2 and 3	No	Sediment Water Toxicity testing on aquatic organisms in sediment	Sampling was conducted in 1998 as followup tothe NYSDEC 1998 study. Sediment sampling (cores and surficial) at 12 sites on Eighteenmile Creek, tributaries, and Barge Canal. Samples tested for pesticides, dioxins/furans, PCBs (congeners), metals, mercury, PAHs, TOC, and particle size. Some of the sampling sites were the same location as NYSDEC 1998 report. Provides a detailed description of dioxin/furan data. Three sediment cores were radiodated to establish chronology of contamination (behind Burt Dam and Newfane Dam and in the Erie Canal). Water column sampling was conducted to evaluate sediment transport from Barge Canal to Eighteenmile Creek. The samples were tested for TSS, TDS, metals, PCBs, and dioxins/furans. Sediments were subjected to toxicity testing for the aquatic organisms *Hyalella azteca and* Chironomus tentans.	The report describes data collection and data validation procedures. Results are tabulated in appendices. The data is only source of dioxin data for the sediment and, therefore, can be used for screening purposes. Surface contamination, water, and toxicity results are greater than 10 years old and not representative of current conditions.				
NYSDEC 2006. New York Status & Trends Report for Freshwater & Marine Sediments	--	18MC and other waters of NYS	Yes	Sediment	Review of NYS sediment studies. For 18MC, discusses the NYSDEC 1998 and NYSDEC 2001 reports and results; see above.	See above.	See above.		General information	
USACE Investigations for Area of Concern										
USACE 2004a. Volume I, Project Report Overview, Sediment Sampling, Biological Analyses, and Chemical Analyses for Eighteenmile Creek AOC.	USACE 2004	OU3	No	Sediment Tissue in Sediment (worms used in bioaccumul study) Bioaccumulation (averages of tissue results)	2004a: Sediment, tissue, and bioaccumulation testing for Reach 1 sediments. Fifteen sediment samples, five sediment composites, tissue/biological studies of worms exposed in the laboratory to five replicates of each of the five sediment composites, and bioaccumulation results from the worm studies. Sediment results consisted of PCB congener, PCB Aroclor, dioxin, TOC, metals, mercury, pesticide, and particle size. Tissue results consisted of PCB congener, metals, mercury, and pesticide analysis. Bioaccumulation results were reported from the tissue results (and included biomass and lipid content).	Sediment and worm tissue data for Reach 1. Analytical results are included in Volume II. Separate bioaccumulation study is discussed in USACE 2008. Sample location coordinates are included.	A partial dataset is available electronically for PCB, PCB congener, and dioxin/furan data from TrophicTrace Model. The available sediment data for pesticides, PCB (Aroclors) for one location, selected PCB congeners, dioxins, furans, metals, mercury, and TOC were imported into the GLNPO RI database. Additional data were entered from the original report.	Data were validated and data validation qualifiers were entered into the database.	Sediment data are usable for risk assessment and nature and extent of contamination. Tissue data are for bioaccumulation testing and are not usable for the RI.	Available coordinates were entered and checked.
USACE 2004b. Volume II, Laboratory Reports, Sediment Sampling, Biological Analyses, and Chemical Analyses for Eighteenmile Creek AOC.	USACE 2004	OU3	No	See above.	Laboratory reports for USACE 2004a. See above.	Data were not formally validated and no data validation memos are available. Laboratory data and associated QC results are available in the appendix of the report.				
USACE 2008. Eighteenmile Creek Great Lakes AOC Niagara County, New York. Concentrations, Bioaccumulation and Bioavailability of Contaminants in Surface Sediments.	USACE 2004	OU3		See above.	Bioaccumulation assessment related to USACE 2004a and 2004b (see above). No new data.	Same data addressed in USACE 2004a and 2004b.	See above.			

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key (1)	Area	New Report(2)	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
USACE and E Risk Sciences 2010. Eighteenmile Creek Area of Concern Food Web Modeling: Final Data Gaps Memorandum	USACE 2010	OU3		Sediment Water Biota	Broad summary of available data for OU3, focusing on the area below Burt Dam (Section 1/Reach 1, Lake Ontario to Burt Dam) and the area between Burt Dam and Newfane Dam (Section 2, Reach 2/3). The memo named the past studies with available sediment, water, and biota data and identified data gaps for the bioaccumulation study. Those data gaps were filled in 2010 and discussed in the E Risk Sciences 2012 Final Bioaccumulation Modeling document. See below.	The memo identifies reports of prior data but does not itself list that data. The source reports would have to be consulted.	The memo identifies reports of prior data but does not itself list that data. The source reports would have to be consulted.			
E Risk Sciences, LLP (ERS) and USACE 2012. Eighteenmile Creek Great Lakes Area of Concern (AOC), Niagara County, New York. Final Bioaccumulation Modeling and Ecological Risk Assessment.	USACE 2010	OU3	No	Sediment Fish Tissue Fish stomach contents	Sixteen surface sediment samples were collected by the USACE below Burt Dam (Section 1/Reach 1, between Burt Dam and Olcott Harbor) in 2010 and analyzed for PCB Aroclors, congeners and TOC. Various fish samples were collected below Burt Dam (Section 1/Reach 1, between Burt Dam and Olcott Harbor) and above Burt Dam (Section 2, Reach 2/3, between Burt Dam and Newfane Dam) in 2010 and analyzed for PCB congeners, Aroclors, and lipids. Stomach contents were analyzed for prey/food. Fish were assessed for age. Historical sediment and fish samples were collected above Burt Dam (Section 2, Reach 2/3, between Burt Dam and Newfane Dam) analyzed for PCB congeners and TOCs were compiled and added to the database. The results were directly reported original reports. Data build on the USACE 2004 data. The bioaccumulation model describes the movement of PCB congeners from sediment and water exposure sources through the aquatic food web.	The report summarizes, but does not itemize, the results for the 16 surficial sediment samples and the fish samples. The report does not discuss whether the data were validated. Raw data and QC data are available in supporting files in the report.	Sediment results for PCBs and lead were available electronically and were validated and imported into the OU3 database. The fish data were only available in summary tables and only the total PCB congeners were imported. If need the congeners could be hand entered into the OU3 database.	Data were validated and data validation qualifiers were entered into the database.	Data are usable for risk assessment and fate transport.	Coordinates provided for the 16 sediment samples. Fish samples georeferenced by at least a figure. Locations were entered and checked.
EPA Region 2 and Great Lakes National Program Office Funded Studies										
E & E, Inc. 2007. Final Report for Eighteenmile Creek PCB Source Trackdown Project, Niagara County, New York. Prepared for NCSWCD.	NCSWCD 2007	OU2 and OU3	No	Sediment	Presents sediment data (surficial and cores) from Reach 7 and tributaries. Samples analyzed for PCBs, TAL metals, and TOC.	Data were validated and data review memos are available. Sediment data from the cores are considered usable for the RI.	PCB and metals results from sediment cores and PCB screening results from sediment grab samples are available electronically and have been imported into GLNPO RI database.	Data were previously validated.	Data are usable for risk assessment and fate and transport.	Locations were previously checked.
USEPA 2008a. Field Data Report, Eighteenmile Creek Sediment.	USEPA 2008	OU3	No	Sediment	Three sediment samples collected downstream of Burt Dam and analyzed for PCBs, metals, mercury, pesticides, and TOC.	PCBs were non-detect, which is not consistent with other datasets. Pesticides also were non-detect. Samples were analyzed at the EPA laboratory in Edison, New Jersey. No discussion of data validation.	Sediment results for metals and TOC have been imported into the OU3 database. The individual non-detect PCB and pesticide results are not available in the report (text narrative describes all as non-detect) and will not be obtained for the OU3 database because those data are inconsistent with other datasets.	Data were not validated.	Data are not usable for risk assessment.	Locations were previously checked.
E & E, Inc. 2009. Eighteenmile Creek Beneficial Use Impairment Assessment. Niagara County, New York.	NCSWCD 2009	OU3	No	Fish Tissue Aquatic/terrestrial wildlife surveys	Fish and wildlife surveys for Eighteenmile Creek and PCB and dioxin/furan results for fish tissue from brown bullheads in Reach 1 are included.	Summaries of sample results are included in the report. The fish community survey data, wildlife survey data, bullhead analytical data for PCBs and dioxin/furans, bullhead liver pathology report, and bullhead sampling field data sheets are included in the appendices of the report. No sediment data presented in this report. Tissue data were validated and memo is available.	Fish tissue data are available electronically were imported into the OU3 database.	Data were previously validated.	Data are usable for risk assessment and fate and transport.	General fish locations were established based on figures.
CH2MHILL and E & E, Inc. 2015. Remedial Investigation Report. Eighteenmile Creek Area of Concern. Niagara County, New York, Remedial Investigation. Prepared for EPA GLNPO.	USEPA GLNPO	OU3	No	Sediment	Sediment data from Reaches 2 through 7 in the AOC, including PCB Aroclor, metals, PAHs, PCB congener, and pesticide data. Additional data for grain size and AVS/SEM for select samples.	Summary of sediment results for PCB Aroclor, metals, PAHs, PCB congeners, and pesticide analysis is available in RI report. Results were validated by various parties and memos are available.	RI report is available electronically along with data packages. Sediment data were imported in the OU3 database.	Data were previously validated.	Data are usable for risk assessment and fate and transport.	Locations were previously checked.

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key [(1)]	Area	New Report[(2)]	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
E & E, Inc. 2012. Draft Eighteenmile Creek Baseline Benthic Community Sampling Report	NCSWCD 2012a	OU3	Yes	Sediment Water Benthic macroinvertebrates Toxicity testing on aquatic organisms in sediment	Study conducted in 2012 to evaluate the current condition of the benthic macroinvertebrate community in the Eighteenmile Creek AOC. Four surficial sediment samples from pool habitats were analyzed for TOC, grain size, PCB Aroclors, PCB congeners, TAL metals, and AVS/SEM metals. Water chemistry (temp, conductivity, pH, DO, and TDS) was measured in the field at sampling sites. Benthic macroinvertebrates in five various riffle and run/glide habitats and pool habitats were characterized/surveyed. Three sediment samples from pool habitats were subjected to toxicity testing for *Hyalella azteca* and *Chironomus dilutus*.	Summary of sample results are included in the report. Field data sheets, electronic data deliverables, chemistry lab report, toxicity lab report, and REIC benthic report are included in the appendices of the report. Report does not state that analytical data were validated, but DUSR is available.	Report is available electronically along with data packages. Analytical data are available in EQuIS format and imported into the OU3 database.	Data were previously validated.	Data are usable for risk assessment and fate and transport.	Available coordinates were entered and checked.
E & E, Inc. 2013. Draft Eighteenmile Creek Baseline Fish Sampling Report.	NCSWCD 2013	OU3	Yes	Fish and crayfish tissue	Established current baseline levels of PCBs in fish from different trophic levels in Eighteenmile Creek. Fish and crayfish samples and composite samples were collected in 2012 from three general OU3 areas: upstream of Newfane Dam, between Burt and Newfane dams, and downstream of Burt Dam. Samples were analyzed for PCB Aroclors and congeners.	Summary of sample results are included in the report. The final data sheets, field observations, analytical data, laboratory data report with QA/QC results, and data usability summary reports are included in the appendices of the report.	Report is available electronically along with data packages. Analytical data are available in EQuIS format and imported into the OU3 database.	Data were previously validated.	Data are usable for risk assessment and fate and transport.	General fish locations were established based on figures.
E & E 2012. Draft Eighteenmile Creek Powdered Activated Carbon (PAC) Pilot Study Report	NCSWCD 2012b	OU3	Yes	Sediment Lumbriculus tissue	Composite sediment grab samples were collected in August 2012 from Reach 1 (between Burt Dam and Lake Ontario), Reach 3 (upstream end of Burt Dam pool), and Reach 5 (Newfane Dam pool) and analyzed for PCBs (Aroclors and congeners) and TOCs prior to and after various treatments with powdered activated carbon (PAC). Bioaccumulation testing also was conducted for PCBs (Aroclors and congeners) in *Lumbriculus variegatus.*	Summary of sample results are included in the report. The final data sheets, field observations, analytical data, laboratory data report with QA/QC results, and DUSRs are included in the appendices of the report.	Report is available electronically along with data packages. Analytical data are available in EQuIS format and imported into the OU3 database.	Data were previously validated.	Sediment data are usable for risk assessment and fate transport. Tissue data are for bioaccumulation testing and are not usable for the RI.	Available coordinates were entered and checked.

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key (1)	Area	New Report(2)	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
Olcott Harbor										
USACE 2013. Ocott Harbor, Niagara County, New York - 40 CFR 230.11(d) Contaminant Determinations. Memorandum for CELRB-PM-EA.	USACE 2013	OU3	Yes	Sediment	Three sediment grab samples were collected from Olcott Harbor in 2013 prior to dredging and analyzed for grain size, percent moisture, TAL metals, total cyanide, ammonia-nitrogen, total phosphorus, TKN, TOC, oil and grease, PCBs as Aroclors, pesticides, and PAHs. Elutriate tests were conducted on the three harbor sediment samples for the same parameters. The harbor sediment samples also were subjected to toxicity testing using *Hyalella azteca*, *Chironomus dilutus*, *Ceriodaphnia dubia*, and *Pimephales promelas*. (Sediment samples also were collected in Lake Ontario in reference areas and disposal areas, which are north of OU3.)	Sample locations are in the lake and federal navigation channel. The results are usable to assess migration of sediments from the harbor. Sediment results also may be from the lake.	Electronic data and PDF laboratory data packages received 6-14-16. Data validation summaries were requested but not received. Presume that data were not validated (report/memo does not discuss data validation).	Data were validated and data validation qualifiers were entered into the database.	Data are usable for risk assessment and fate transport.	Available coordinates were entered and checked.
Wendel 2014. Olcott Harbor Sediment Sampling Results. Memo from Wendel to Tim Horanburg, Supervisor, Town of Newfane	Olcott 2014	OU3	Yes	Sediment	Twenty-two sediment samples (cores) were collected from Olcott Harbor in 2013 prior to dredging and analyzed for metals (five), petroleum-related VOCs (benzene and BTEX), PAHs, selected pesticides, PCBs (Aroclors), and one dioxin.	Sediment in the harbor was evaluated at depth for areas that were dredged in 2015.	Requested electronic data via NYSDEC, Town of Newfane, Wendel, and the laboratory; received electronic data 6/24/16. Data validation summaries also were requested but presumably do not exist.	Data were validated and data validation qualifiers were entered into the database.	Data are usable for risk assessment and fate transport.	Available coordinates were entered and checked.
NYSDEC 2008. Lake Ontario Tributary Creel Survey, Fall 2005 - Sprng 2006, Fall 2006 - Spring 2007.	--	OU3, other 18MC areas, and non-18MC Lake Ontario tributaries	No	Fishing activity	Survey of anglers using tributaries to Lake Ontario. Number and length of fishing trips per tributary, time of year, etc.	--			May be useful for understanding exposure of anglers to chemicals in sport fish for the HHRA.	
NYSDEC 2016. Fall 2015 Lake Ontario Tributary Angler Survey.	--	OU3, other 18MC areas, and non-18MC Lake Ontario tributaries	Yes	Fishing activity	Survey of anglers using tributaries to Lake Ontario. Number and length of fishing trips per tributary, time of year, etc.	--			May be useful for understanding exposure of anglers to chemicals in sport fish for the HHRA.	
Water Quality Studies										
NYSDEC 1996. Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries.		OU3 (and non-18MC locations)	No	Surface Water	Water: PCBs, mercury, and dioxins/furans were taken at multiple locations in 1993 and 1994 as part of a NYSDEC study tracking down contaminants to Lake Ontario. The report contains sufficient information on the study methods and procedures but does not contain laboratory data. The samples were analyzed on a research vessel by team of scientists using PISCSES and high volume filtration.	The report provides historical context for the relative loading of PCBs and mercury to Lake Ontario.	Summary data are tabulated in the report. Data were not imported into the OU3 database because the results were too old.	Data reports not available and no validation was performed.	Data are not usable for risk assessment because the data have not been and likely cannot be easily validated. Data could be used to evaluate historical trends and sources of contamination.	Loosely, via figures.
NYSDEC 2009. Toxics Chemicals in NYS Tributaries to Lake Ontario: A Report on Sampling Undertaken in 2007 and 2008 with Special Emphasis on the Polychlorinated Dibenzodioxins and Furans.	NYSDEC 2009	OU3 (and non-18MC locations)	Yes	Surface Water Sediment	Water: 18MC was sampled at Jacques Road, Corwin, New York, seven times in 2007/2008 for certain dioxins/furans, PCBs, pesticides, mercury, and particulate organic carbon. Depending on the analyte, analytical results are provided as filtered, total, and otherwise. Sediment: The sediment data discussed in the report are historical and from the NYSDEC Sediment Inventory; not sure what dates.	Hard copy data are tabulated in the report. Report does not discuss whether data were validated (they likely were not).	Hard copy data are tabulated in the report. E & E received some electronic (Excel) data from NYSDEC on 7/7/16. The data were checked to ensure completeness and determine whether any additional hand-entering will be necessary. Data were imported into the OU3 database but flagged as not validated.	Data reports not available and no validation was performed.	Data are not usable for risk assessment because the data have not been and likely cannot be easily validated. Data could be used to evaluate historical trends and sources of contamination.	Available coordinates were entered and checked.
USEPA 2008b. Field Data Report Lake Ontario Tributaries 2005-2006	See below	OU3 (and non-18MC locations)	Yes	Water	Data for one sampling point near Olcott. Data are included in NYSDEC and USGS 2014 raw data spreadsheet. See below.	Report discusses the collection of some field blanks (usually for mercury) and analysis of lab method blanks. No other QC samples or data validation are discussed.	Hard copy data in report is included in NYSDEC and USGS 2014 raw data spreadsheet. See below.	Data reports not available and no validation was performed.	See below.	See below.

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key (1)	Area	New Report(2)	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
USEPA 2011. Field Data Report Lake Ontario Tributaries 2009 - 2010.	See below	OU3 (and non-18MC locations)	Yes	Water	Data for one sampling point near Olcott. Data are included in NYSDEC and USGS 2014 raw data spreadsheet. See below.	Report discusses the collection of some field blanks (usually for mercury) and analysis of laboratory method blanks. No other QC samples or data validation are discussed.	Hard copy data in report is included in NYSDEC and USGS 2014 raw data spreadsheet. See below.	Data reports not available and no validation was performed.	See below.	See below.
USGS 2014. Raw data for tributaries sampling program through 2013 (18MC location through 2012).	USGS 2014	OU3 (and non-18MC locations)	Yes	Water	Data for one sampling point near Olcott, sampled approximately twice/year from April 2002 through Oct 2012. Sampled over that time for pH, TSS, total Hg, and total PCBs. Sampled 2002 through 2005 additionally for some pesticides and dioxin. Sampled 2011/2012 additionally for total P.	Same data as addressed in EPA 2008 and EPA 2011 above. No QC samples or data validation are discussed in the EPA reports.	Raw data spreadsheet received from David Clarke, NYSDEC. The data were checked to ensure completeness and determine whether any additional hand-entering will be necessary. Data were imported into the OU3 database but flagged as not validated.	Data reports not available and no validation was performed.	Data are not usable for risk assessment because the data have not been and likely cannot be easily validated. Data could be used for other purposes.	Available coordinates were entered and checked.
USGS National Water Information System (NWIS) 2016. Water quality data for USGS location 04219768 Eighteenmile Creek at Burt NY. http://waterdata.usgs.gov/nwis/inventory?agency_code=USGS&site_no=04219768	USGS 2016	OU3	Yes	Water	Samples were collected at one location (Burt, NY) on 46 dates from October 2011 to September 2016 and analyzed for pH, nitrate, nitrite, phosphate, phosphorus, metals (infrequently), and TDS. Daily stream flow data for same time period also were obtained.	Analytical data itemized in spreadsheet, without qualifiers. NWIS description on website does not say that data were validated.	Downloaded to Excel 9/19/16 and saved in project files. The data were checked to ensure completeness and determine whether any additional hand-entering will be necessary. Data were imported into the OU3 database but flagged as not validated.	Data reports not available and no validation was performed.	Data are not usable for risk assessment because the data have not been and likely cannot be easily validated. Data may be useful for understanding system hydrology and fate and transport.	Available coordinates were entered and checked.
USGS National Water Information System 2016. Water Quality Data for various Eighteenmile Creek East Embayment locations. (This table entry is from R Meissner)		Lake Ontario shoreline	Yes	Water	Time series of water quality for three dates. Data includes nutrients and algae/biomass.	Most recent sample only includes turbidity, temperature, specific conductivity, H ion, pH, and DO; others also include TSS, TDS, nitrogen/nitrate/nitrite/orthophosphate/phosphorus, biomass, and algae data. Qualifiers included with values when applicable.	Available as Excel sheet or for most recent data download from nwis.waterdata.usgs.gov. The data will not be imported to the OU3 database at this time.		Data may be useful for understanding system hydrology and fate and transport.	Coordinates on website and in download metadata.
Makarewicz and Lewis 2010. Eighteenmile Creek Watershed, The Location of Sources of Pollution.	ML 2010	OU3 and other 18MC locations (including East Branch)	Yes	Water	Samples were collected from approximately 30 locations in 18MC and tributaries. Approximately six locations seem to be in OU3. Sampling was conducted on seven dates in 2009. Samples analyzed for total P, soluble reactive P, TKN, Nitrate+nitrite, sodium and TSS.	Hard copy data are not tabulated in the report and would have to be picked out from text sections and figures. The report talks about data quality and the elements of a QC program but does not specifically say which of those elements were used for the study and does not say that the data were validated. No data qualifiers are present.	Hard copy data are not tabulated in the report and would have to be picked out from text sections and figures. Electronic data file was requested from Ted Lewis, but not received. Data were tabulated in Excel from figures and text in report. Data were imported into the OU3 database but flagged as not validated.	Data reports not available and no validation was performed.	Data are not usable for risk assessment because the data cannot be validated. Data may be useful for understanding system hydrology and fate and transport.	Available coordinates were entered and checked.

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key (1)	Area	New Report(2)	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
Additional Hazardous Waste Sites in Watershed										
NYSDEC 2013. Record of Decision. Old Upper Mountain Road Site, Operable Unit Number 01: Landfill - Old Upper Mountain Road Parcel, Operable Unit Number 02: Gulf Creek, State Superfund Project, Lockport, Niagarra County, Site No. 932112.		Outside of (southwest of) 18MC OU1, OU2, and OU3; closer to Gulf Creek	Yes		Gulf Creek was sampled as part of the RI for Operable Unit 2 in 2009 and 2010. The RI report indicates the data was validated. We have recent data from 2014 for a pre-design investigation but there was no data report or validation for these results.	OU2 Sediment data are relavent for establishing a potential source but not for the RI or risk assessment. The sediment results are significantly upstream from the main channel.	Electronic data received from Dan Eaton/NYSDEC on 7-13-16. The data was not loaded into the OU3 database at this time.	Validated data were loaded into NYSDEC Equis database.	Reports can be evaluated as potential sources.	Yes. Coordinates in electronic data file.
2014 and 2015 Annual Monitoring and Inspection Reports, SNPE- VDM Creek Bank Corrective Actions VanDeMark Chemical Inc. – Lockport, New York Order on Consent: R9-20080205-5		VanDeMark	Yes		The corrective action at VanDeMark was to create a barrier to restrict and contain the migration of dense non-aqueous phase liquid (DNAPL) consisting of coal tar residuals that have been exiting the fractured bedrock formation at, or near, the toe of the Creek Bank area slope; and promote the collection of the DNAPL in a defined permeable trench for subsequent mechanical removal. The report includes visual inspections and results of two groundwater piezometers.	Data are relavent for establishing a potential source but not for the RI or risk assessment.	Electronic data are not available. The data was not loaded into the OU3 database at this time.	Data reports not available and no validation was performed.	Reports can be evaluated as potential sources.	Loosely, via figures.
Additional Studies										
NYSDEC 2013. STORET Sediment database. Part of NYS Sediment Inventory.		18MC and other waters of NYS	Yes	Sediment	Statewide results for the Rotating Basin Studies (RIBS) for 1970-2013 in Access database were obtained, which include two stations on Eighteenmile Creek. Database includes results for general chemistry, metals, pesticides, SVOCs, some PCBs, and some dioxins/furans but the reports or supporting inforamtion was not available.	Historical data compilation. Data use and validation are not addressed.	Statewide sediment results for 1970-2013 in Access database have not been imported but are available in a separate database.	Data reports not available and no validation was performed.	Data are not usable for risk assessment. The RIBS data are part of overall basin monitoring report and not directly related to the RI. Data could be used for other purposes.	Yes. Coordinates in database.
E & E, Inc. 2005. Qualitative Habitat Characterization Within Eighteenmile Creek Watershed. Eighteenmile Creek Restoration Project, Town of Newfane, Niagara County, New York.	--	OU3 and other 18MC and East Branch locations	Yes	Terrestrial and aquatic habitat	No contamination data. Study did not involve environmental sampling. It involved terrestrial and aquatic habitat survey/characterization in eight locations, some directly in OU3. Fish were shocked to inventory them and then were released.	Data are not available electronically and will be assessed as part of the ecological risk assessment process.	The asessments are greater than 10 years old and may reflect current conditions.	Not applicable.	Use to describe site ecological characteristics in SLERA and BERA	Via a figure.
NYSDEC 2014. Screening and Assessment of Contaminated Sediment	--	General study	Yes	Sediment	Guidance document. Contains no data.	--	--	Not applicable.	Not applicable.	Not applicable.
Niagara County Department of Health 2015. 2011 Eighteenmile Creek Watershed Study. (see next document below)	--	OU3 and other 18MC locations	Yes	Bacteria in water	This study is part of Appendix A to Niagara County Department of Health 2015. Samples were collected from approximately 20 total locations in 18MC (including OU3) and plumes in Lake Ontario in 2011. The samples were analyzed for termp, pH, fecal coliform, and *E. coli* .	Hard copy data are tabulated in the report. Data qualifiers are not present and report does not discuss whether data were validated.	Hard copy data are tabulated in the report. The data will not be imported into the OU3 database because the data are not of direct interest at this time.		General information	Yes. Coordinates in report.

Table A-1 Summary and Evaluation of Historical Data, Eighteenmile Creek OU3

Investigation	Study Key [(1)]	Area	New Report[(2)]	Matrix Addressed	Data Summary	Data Evaluation	Data Status	Data Validation	Data Use	Location Coordinates
Niagara County Dept. of Health 2015. Olcott Beach Sanitary Survey Report.	--	Mouth of 18MC and other Lake Ontario beach locations	Yes	Bacteria in water	Samples from the mouth of 18MC were collected from 2012 to 2014 and tested for *E. coli*. A few samples from the mouth of 18MC also were tested for Bacteroides *sp* . and *Helicobacter sp.* associated with animal fecal contaminant contributions to the creek. (The 2011 watershed study, which is part of this report, is addressed separately above because the study exists as a separate RAP document.)	The 2012-2014 bacteriological data are summarized but not itemized in the report. The report refers to the laboratory data packages, which presumably are available if requested.	The 2012-2014 bacteriological data are summarized but not itemized in the report. The data will not be imported into the OU3 database because the data are not of direct interest at this time.		General information	Loosely, via figures.

Notes:

(1) = Study key indicates the code assigned to the data in the project database.

(2) = New reports were not evaluated in the previous data gap report in 2014.

KEY: 18MC = Eighteenmile Creek; AOC = Area of Concern; AVS/SEM = acid volatile sulfides/simultaneously extracted metals; BERA = baseline ecological risk assessment; EPA = Environmental Protection Agency; GLNPO = Great Lakes National Program Office; HHRA = human health risk assessment; NYSDEC = New York State Department of Environmental Conservation; OU2 = operable unit 2; OU3 = operable unit 3; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenyl; SLERA = screening level ecological risk assessment; RAP = remedial action plan; RI = remedial investigation; TAL = target analyte list; TKN = total kjeldahl nitrogen; TOC = total organic carbon; TSS = total suspended solids; USACE = U.S. Army Corps of Engineers.

Table A-2a Statistical Summary of Positive Surface Water Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
1	Creek	Pesticides	DIELDRIN	µg/L	0.00033	0.00028	0.00038	2/9
1	Creek	Mercury	MERCURY	µg/L	0.0027	0.00031	0.012	22/25
1	Creek	Mercury	MERCURY	µg/L	0.0027	0.00031	0.012	22/25
1	Creek	PCB Congeners	Total PCB Congener	ng/L	39.68	18	93	27/27
6	Creek	Pesticides	DIELDRIN	µg/L	0.00061	0.00019	0.0023	7/7
6	Creek	Pesticides	P,P'-DDD	µg/L	0.0011	0.00016	0.0062	7/7
6	Creek	Pesticides	P,P'-DDE	µg/L	0.0060	0.00023	0.039	7/7
6	Creek	Pesticides	P,P'-DDT	µg/L	0.018	0.00019	0.072	4/7
6	Creek	Mercury	MERCURY	µg/L	0.0055	0.00056	0.030	14/14
6	Creek	Mercury	MERCURY	µg/L	0.0055	0.00056	0.030	14/14
6	Creek	PCB Congeners	Total PCB Congener	ng/L	89.83	33	145	6/6

Notes:

(1) Surface water results are not validated.

(2) µg/l = microgram/liter; ng/l = nanogram/liter

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
1	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.30	0.024	0.87	86/110
1	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.21	0.026	0.42	26/38
1	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.20	0.17	0.22	4/38
1	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/38
1	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.022	0.020	0.023	2/9
1	Surface	PAH	ACENAPHTHENE	mg/kg	0.00	0.00	0.00	0/31
1	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.023	0.020	0.026	5/53
1	Surface	PAH	ANTHRACENE	mg/kg	0.038	0.021	0.063	10/31
1	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.084	0.014	0.22	28/31
1	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.11	0.031	0.29	26/31
1	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.20	0.013	0.42	21/31
1	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.079	0.026	0.16	22/31
1	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.090	0.030	0.18	17/31
1	Surface	PAH	CHRYSENE	mg/kg	0.12	0.028	0.31	27/31
1	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0	0	0	0/31
1	Surface	PAH	FLUORANTHENE	mg/kg	0.17	0.020	0.50	28/31
1	Surface	PAH	FLUORENE	mg/kg	0.028	0.025	0.030	4/31
1	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.060	0.017	0.15	23/31
1	Surface	PAH	NAPHTHALENE	mg/kg	0.047	0.032	0.056	6/31
1	Surface	PAH	PHENANTHRENE	mg/kg	0.090	0.024	0.28	25/31
1	Surface	PAH	PYRENE	mg/kg	0.20	0.022	0.61	29/31
1	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0.0019	0.0018	0.0020	3/32
1	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.0017	0.0017	0.0017	1/32
1	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0	0	0	0/29
1	Surface	Pesticides	DIELDRIN	mg/kg	0.0053	0.0050	0.0055	3/76
1	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0.0030	0.00027	0.0049	7/32
1	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0	0	0	0/32
1	Surface	Pesticides	HEPTACHLOR	mg/kg	0	0	0	0/32
1	Surface	Pesticides	P,P'-DDD	mg/kg	0.0062	0.0013	0.014	61/120
1	Surface	Pesticides	P,P'-DDE	mg/kg	0.014	0.0015	0.037	29/32
1	Surface	Pesticides	P,P'-DDT	mg/kg	0.0033	0.0012	0.0093	13/76
1	Surface	Pesticides	Sum of DDT+DDE+DDD	mg/kg	0.018	0.0030	0.051	21/21
1	Surface	Pesticides	Trans-Chlordane	mg/kg	0	0	0	0/97
1	Surface	Mercury	MERCURY	mg/kg	0.17	0.010	0.56	54/54
1	Surface	Metals	ALUMINUM	mg/kg	11610	2900	16000	32/32
1	Surface	Metals	ANTIMONY	mg/kg	0.54	0.14	2.97	23/32
1	Surface	Metals	ARSENIC	mg/kg	4.35	1.24	11	51/54
1	Surface	Metals	BARIUM	mg/kg	99.9	14	158	32/32
1	Surface	Metals	BERYLLIUM	mg/kg	0.54	0.12	0.86	29/32
1	Surface	Metals	CADMIUM	mg/kg	1.74	0.090	4.70	32/32
1	Surface	Metals	CALCIUM	mg/kg	21953	6500	59200	32/32
1	Surface	Metals	CHROMIUM, TOTAL	mg/kg	77.59	3.70	867	32/32
1	Surface	Metals	COBALT	mg/kg	10.48	1.80	17	32/32
1	Surface	Metals	COPPER	mg/kg	66.87	6.20	245	54/54
1	Surface	Metals	IRON	mg/kg	25379	8300	88400	32/32
1	Surface	Metals	LEAD	mg/kg	89.92	2.10	322	54/54
1	Surface	Metals	MAGNESIUM	mg/kg	7419.4	4200	12000	32/32
1	Surface	Metals	MANGANESE	mg/kg	515.1	313	790	32/32
1	Surface	Metals	NICKEL	mg/kg	45.7	5.2	172	32/32
1	Surface	Metals	POTASSIUM	mg/kg	2744.6	370	4290	32/32
1	Surface	Metals	SELENIUM	mg/kg	0.68	0.081	3.53	23/32
1	Surface	Metals	SILVER	mg/kg	0.58	0.076	3.80	32/32
1	Surface	Metals	SODIUM	mg/kg	217.6	106	653	32/32
1	Surface	Metals	THALLIUM	mg/kg	0.56	0.056	2.78	32/32
1	Surface	Metals	VANADIUM	mg/kg	22.5	4.90	33	32/32
1	Surface	Metals	ZINC	mg/kg	385.7	13	1350	32/32
1	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	26686.8	3300	48000	53/53

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type$^{(1)}$	Method	Parameter	Unit$^{(2)}$	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
1	Surface	PCB Congeners	Total PCB Congener	mg/kg	0.34	0.021	1.96	44/44
1	Surface	Volatiles	BENZENE	mg/kg	0.00048	0.00015	0.0013	19/22
1	Surface	Volatiles	m,p-Xylene	mg/kg	0.00064	0.00039	0.00085	11/19
1	Surface	Volatiles	TOLUENE	mg/kg	0.0036	0.0013	0.0087	11/22
2	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.41	0.10	2.20	58/62
2	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.39	0.066	1.90	29/31
2	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0	0	0	0/31
2	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.13	0.033	0.33	3/31
2	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.013	0.0084	0.023	11/31
2	Surface	PAH	ACENAPHTHENE	mg/kg	0.013	0.0054	0.021	8/31
2	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.024	0.011	0.049	26/31
2	Surface	PAH	ANTHRACENE	mg/kg	0.036	0.012	0.10	29/31
2	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.16	0.062	0.42	31/31
2	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.16	0.059	0.32	31/31
2	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.16	0.039	0.33	31/31
2	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.12	0.026	0.26	31/31
2	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.12	0.039	0.30	31/31
2	Surface	PAH	BENZO[E]PYRENE	mg/kg	0.17	0.072	0.29	8/8
2	Surface	PAH	CHRYSENE	mg/kg	0.21	0.088	0.59	31/31
2	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.045	0.017	0.13	28/31
2	Surface	PAH	FLUORANTHENE	mg/kg	0.32	0.11	1.00	31/31
2	Surface	PAH	FLUORENE	mg/kg	0.018	0.0093	0.034	19/31
2	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.096	0.031	0.29	31/31
2	Surface	PAH	NAPHTHALENE	mg/kg	0.012	0.0062	0.017	10/31
2	Surface	PAH	PAH MIXTURES	mg/kg	1.80	0.77	4.60	31/31
2	Surface	PAH	PERYLENE	mg/kg	0.037	0.014	0.060	8/8
2	Surface	PAH	PHENANTHRENE	mg/kg	0.10	0.042	0.23	31/31
2	Surface	PAH	PYRENE	mg/kg	0.27	0.12	0.73	28/31
2	Surface	Mercury	MERCURY	mg/kg	0.71	0.30	1.50	31/31
2	Surface	Metals	ALUMINUM	mg/kg	19332	13500	26300	31/31
2	Surface	Metals	ANTIMONY	mg/kg	0.53	0.53	0.53	1/31
2	Surface	Metals	ARSENIC	mg/kg	6.17	3.50	8.10	31/31
2	Surface	Metals	BARIUM	mg/kg	207.6	162	248	31/31
2	Surface	Metals	BERYLLIUM	mg/kg	0.57	0.37	0.83	27/31
2	Surface	Metals	CADMIUM	mg/kg	2.18	1.30	4.40	28/31
2	Surface	Metals	CALCIUM	mg/kg	17490.3	13700	25200	31/31
2	Surface	Metals	CHROMIUM, TOTAL	mg/kg	105	70	162	31/31
2	Surface	Metals	COBALT	mg/kg	13.84	11	16	19/31
2	Surface	Metals	COPPER	mg/kg	224.90	145	325	31/31
2	Surface	Metals	IRON	mg/kg	27329	20900	34000	31/31
2	Surface	Metals	LEAD	mg/kg	301.10	188	475	31/31
2	Surface	Metals	MAGNESIUM	mg/kg	7897.42	6430	9060	31/31
2	Surface	Metals	MANGANESE	mg/kg	636.5	403	951	31/31
2	Surface	Metals	NICKEL	mg/kg	57.23	42	82	31/31
2	Surface	Metals	POTASSIUM	mg/kg	2570	1940	3420	31/31
2	Surface	Metals	SELENIUM	mg/kg	1.77	1.30	3.50	11/31
2	Surface	Metals	SILVER	mg/kg	1.24	0.93	1.50	8/31
2	Surface	Metals	SODIUM	mg/kg	507.6	167	967	27/31
2	Surface	Metals	THALLIUM	mg/kg	0	0	0	0/31
2	Surface	Metals	VANADIUM	mg/kg	29.32	23	36	31/31
2	Surface	Metals	ZINC	mg/kg	931.58	579	1560	31/31
2	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	46470	29600	93100	23/23
2	Surface	PCB Congeners	Total PCB Congener	mg/kg	2.27	1.42	2.98	15/15
2	Subsurface	PCB Aroclors	PCB, TOTAL	mg/kg	1.75	0.0090	23	142/164
2	Subsurface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.01	0.022	22	58/82
2	Subsurface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0	0	0	0/82
2	Subsurface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.17	0.0090	0.84	41/82
2	Subsurface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.090	0.0044	0.85	55/82

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
2	Subsurface	PAH	ACENAPHTHENE	mg/kg	0.082	0.0045	2.10	59/82
2	Subsurface	PAH	ACENAPHTHYLENE	mg/kg	0.058	0.0066	0.36	69/82
2	Subsurface	PAH	ANTHRACENE	mg/kg	0.16	0.0052	4.00	70/82
2	Subsurface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.42	0.0047	6.20	78/82
2	Subsurface	PAH	BENZO(A)PYRENE	mg/kg	0.39	0.0052	4.60	77/82
2	Subsurface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.30	0.0046	3.10	76/82
2	Subsurface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.27	0.0047	2.60	76/82
2	Subsurface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.21	0.0044	2.00	77/82
2	Subsurface	PAH	BENZO[E]PYRENE	mg/kg	0.32	0.0060	0.91	22/22
2	Subsurface	PAH	CHRYSENE	mg/kg	0.57	0.0055	6.30	78/82
2	Subsurface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.10	0.0077	1.40	72/82
2	Subsurface	PAH	FLUORANTHENE	mg/kg	0.69	0.0058	7.70	78/82
2	Subsurface	PAH	FLUORENE	mg/kg	0.12	0.0090	1.60	65/82
2	Subsurface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.17	0.014	2.10	73/82
2	Subsurface	PAH	NAPHTHALENE	mg/kg	0.04	0.0055	0.63	51/82
2	Subsurface	PAH	PAH MIXTURES	mg/kg	4.62	0.048	65	78/82
2	Subsurface	PAH	PERYLENE	mg/kg	0.052	0.011	0.13	19/22
2	Subsurface	PAH	PHENANTHRENE	mg/kg	0.53	0.0048	11	78/82
2	Subsurface	PAH	PYRENE	mg/kg	0.65	0.0068	9.70	78/82
2	Subsurface	Mercury	MERCURY	mg/kg	1.97	0.050	8.60	81/82
2	Subsurface	Metals	ALUMINUM	mg/kg	17747.8	9350	24600	82/82
2	Subsurface	Metals	ANTIMONY	mg/kg	2.87	0.79	6.20	6/82
2	Subsurface	Metals	ARSENIC	mg/kg	12.65	1.60	32	82/82
2	Subsurface	Metals	BARIUM	mg/kg	303.50	81	420	82/82
2	Subsurface	Metals	BERYLLIUM	mg/kg	0.55	0.20	0.78	69/82
2	Subsurface	Metals	CADMIUM	mg/kg	8.57	0.059	23	77/82
2	Subsurface	Metals	CALCIUM	mg/kg	15349.3	1680	29300	82/82
2	Subsurface	Metals	CHROMIUM, TOTAL	mg/kg	608.7	14	1950	82/82
2	Subsurface	Metals	COBALT	mg/kg	18.4	9.90	33	82/82
2	Subsurface	Metals	COPPER	mg/kg	1190.1	8.70	3790	82/82
2	Subsurface	Metals	IRON	mg/kg	27495.1	15500	44800	82/82
2	Subsurface	Metals	LEAD	mg/kg	1984.8	5.50	6760	82/82
2	Subsurface	Metals	MAGNESIUM	mg/kg	6839.9	4030	8520	82/82
2	Subsurface	Metals	MANGANESE	mg/kg	490.0	279	1910	82/82
2	Subsurface	Metals	NICKEL	mg/kg	218.9	20	619	82/82
2	Subsurface	Metals	POTASSIUM	mg/kg	2082.4	967	3010	82/82
2	Subsurface	Metals	SELENIUM	mg/kg	2.37	0.74	6.40	43/82
2	Subsurface	Metals	SILVER	mg/kg	4.11	0.90	10	63/82
2	Subsurface	Metals	SODIUM	mg/kg	348.5	38	821	66/82
2	Subsurface	Metals	THALLIUM	mg/kg	0.84	0.36	1.70	7/82
2	Subsurface	Metals	VANADIUM	mg/kg	47.3	15	102	82/82
2	Subsurface	Metals	ZINC	mg/kg	4216.5	57	15100	82/82
2	Subsurface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	72267.1	2470	150000	82/82
2	Subsurface	PCB Congeners	Total PCB Congener	mg/kg	7.47	0.12	24.10	8/8
3	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	1.28	0.07	10.00	56/64
3	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.26	0.07	9.50	24/32
3	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.56	0.20	1.10	8/32
3	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.19	0.018	0.50	6/32
3	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.023	0.0043	0.055	16/25
3	Surface	PAH	ACENAPHTHENE	mg/kg	0.040	0.0037	0.20	18/25
3	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.030	0.007	0.086	18/25
3	Surface	PAH	ANTHRACENE	mg/kg	0.088	0.013	0.30	21/25
3	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.34	0.025	1.50	21/25
3	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.21	0.0095	0.78	20/25
3	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.25	0.0079	0.86	21/25
3	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.17	0.0068	1.10	21/25
3	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.17	0.013	0.47	21/25
3	Surface	PAH	BENZO[E]PYRENE	mg/kg	0.39	0.077	0.80	4/6

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
3	Surface	PAH	CHRYSENE	mg/kg	0.46	0.034	2.70	21/25
3	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.072	0.0053	0.37	18/25
3	Surface	PAH	FLUORANTHENE	mg/kg	0.41	0.0046	1.00	23/25
3	Surface	PAH	FLUORENE	mg/kg	0.060	0.0041	0.36	18/25
3	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.11	0.0050	0.42	21/25
3	Surface	PAH	NAPHTHALENE	mg/kg	0.037	0.0039	0.19	16/25
3	Surface	PAH	PAH MIXTURES	mg/kg	2.84	0.0041	12.00	24/25
3	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.0086	0.0086	0.009	1/1
3	Surface	PAH	PERYLENE	mg/kg	0.017	0.0089	0.032	4/6
3	Surface	PAH	PHENANTHRENE	mg/kg	0.29	0.036	1.00	21/25
3	Surface	PAH	PYRENE	mg/kg	0.48	0.0044	2.40	23/25
3	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0	0	0	0/1
3	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0	0	0	0/1
3	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.0089	0.0089	0.0089	1/1
3	Surface	Pesticides	DDT TOTAL	mg/kg	0	0	0	0/1
3	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0.0065	0.0065	0.0065	1/1
3	Surface	Pesticides	DIELDRIN	mg/kg	0.0070	0.0070	0.0070	1/1
3	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0	0	0	0/1
3	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0	0	0	0/1
3	Surface	Pesticides	HEPTACHLOR	mg/kg	0	0	0	0/1
3	Surface	Pesticides	P,P'-DDD	mg/kg	0	0	0	0/1
3	Surface	Pesticides	P,P'-DDE	mg/kg	0	0	0	0/1
3	Surface	Pesticides	P,P'-DDT	mg/kg	0	0	0	0/1
3	Surface	Mercury	MERCURY	mg/kg	0.82	0.16	2.00	24/28
3	Surface	Metals	ALUMINUM	mg/kg	13366.8	9390	20700	28/28
3	Surface	Metals	ANTIMONY	mg/kg	2.78	1.80	4.20	4/28
3	Surface	Metals	ARSENIC	mg/kg	5.36	2.00	17	28/28
3	Surface	Metals	BARIUM	mg/kg	171.75	72.00	338	28/28
3	Surface	Metals	BERYLLIUM	mg/kg	0.48	0.28	0.72	20/28
3	Surface	Metals	CADMIUM	mg/kg	4.52	0.67	24	24/28
3	Surface	Metals	CALCIUM	mg/kg	14006.8	2160	29300	28/28
3	Surface	Metals	CHROMIUM, TOTAL	mg/kg	239.50	12	1940	28/28
3	Surface	Metals	COBALT	mg/kg	14.81	8.20	29	25/28
3	Surface	Metals	COPPER	mg/kg	338.36	8.00	2320	28/28
3	Surface	Metals	IRON	mg/kg	20828.6	13600	28000	28/28
3	Surface	Metals	LEAD	mg/kg	564	5.30	4650	28/28
3	Surface	Metals	MAGNESIUM	mg/kg	6042.1	3700	7920	28/28
3	Surface	Metals	MANGANESE	mg/kg	510.9	292	884	28/28
3	Surface	Metals	NICKEL	mg/kg	112.6	15	486	28/28
3	Surface	Metals	POTASSIUM	mg/kg	1860.4	1070	3240	28/28
3	Surface	Metals	SELENIUM	mg/kg	1.78	0.63	3.20	18/28
3	Surface	Metals	SILVER	mg/kg	1.79	0.29	4.30	9/28
3	Surface	Metals	SODIUM	mg/kg	309.33	221	481	6/28
3	Surface	Metals	THALLIUM	mg/kg	0	0	0	0/28
3	Surface	Metals	VANADIUM	mg/kg	28	17	73	28/28
3	Surface	Metals	ZINC	mg/kg	2031.8	47	16700	28/28
3	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	48360.5	3400	80000	20/20
3	Surface	PCB Congeners	Total PCB Congener	mg/kg	2.36	0.0017	8.30	17/17
3	Subsurface	PCB Aroclors	PCB, TOTAL	mg/kg	1.96	0.015	11	68/94
3	Subsurface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.04	0.040	10	30/47
3	Subsurface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.00	0.00	0.00	0/47
3	Subsurface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.20	0.015	0.57	24/47
3	Subsurface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.088	0.014	0.61	37/47
3	Subsurface	PAH	ACENAPHTHENE	mg/kg	0.067	0.012	0.22	39/47
3	Subsurface	PAH	ACENAPHTHYLENE	mg/kg	0.087	0.014	0.36	34/47
3	Subsurface	PAH	ANTHRACENE	mg/kg	0.21	0.029	0.82	39/47
3	Subsurface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.54	0.011	1.10	43/47

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
3	Subsurface	PAH	BENZO(A)PYRENE	mg/kg	0.46	0.084	1.70	42/47
3	Subsurface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.37	0.063	1.10	42/47
3	Subsurface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.27	0.028	0.72	42/47
3	Subsurface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.27	0.0044	0.83	43/47
3	Subsurface	PAH	BENZO[E]PYRENE	mg/kg	0.52	0.25	0.98	9/10
3	Subsurface	PAH	CHRYSENE	mg/kg	0.85	0.0051	3.80	44/47
3	Subsurface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.10	0.014	0.35	40/47
3	Subsurface	PAH	FLUORANTHENE	mg/kg	0.85	0.0053	3.70	44/47
3	Subsurface	PAH	FLUORENE	mg/kg	0.16	0.016	0.61	36/47
3	Subsurface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.17	0.016	0.51	41/47
3	Subsurface	PAH	NAPHTHALENE	mg/kg	0.040	0.0070	0.14	39/47
3	Subsurface	PAH	PAH MIXTURES	mg/kg	5.90	0.010	20	45/47
3	Subsurface	PAH	PERYLENE	mg/kg	0.029	0.023	0.034	3/10
3	Subsurface	PAH	PHENANTHRENE	mg/kg	0.68	0.0043	3.80	44/47
3	Subsurface	PAH	PYRENE	mg/kg	1.06	0.0051	4.40	45/47
3	Subsurface	Mercury	MERCURY	mg/kg	2.36	0.13	4.80	44/47
3	Subsurface	Metals	ALUMINUM	mg/kg	15195.7	10900	18600	47/47
3	Subsurface	Metals	ANTIMONY	mg/kg	5.50	0.30	24	18/47
3	Subsurface	Metals	ARSENIC	mg/kg	10.06	2.00	17	47/47
3	Subsurface	Metals	BARIUM	mg/kg	281.3	111	396.00	47/47
3	Subsurface	Metals	BERYLLIUM	mg/kg	0.46	0.20	0.63	26/47
3	Subsurface	Metals	CADMIUM	mg/kg	9.17	1.20	28	42/47
3	Subsurface	Metals	CALCIUM	mg/kg	11063.8	1760	17200	47/47
3	Subsurface	Metals	CHROMIUM, TOTAL	mg/kg	589.7	15	2090	47/47
3	Subsurface	Metals	COBALT	mg/kg	17.30	9.30	45	47/47
3	Subsurface	Metals	COPPER	mg/kg	1246.2	5.90	3170	47/47
3	Subsurface	Metals	IRON	mg/kg	22936.2	17700	31400	47/47
3	Subsurface	Metals	LEAD	mg/kg	2142.5	4.50	5790	47/47
3	Subsurface	Metals	MAGNESIUM	mg/kg	6457.4	4670	10000	47/47
3	Subsurface	Metals	MANGANESE	mg/kg	365.0	249	1070	47/47
3	Subsurface	Metals	NICKEL	mg/kg	220.6	20.00	490	47/47
3	Subsurface	Metals	POTASSIUM	mg/kg	1960.4	1300	2580	47/47
3	Subsurface	Metals	SELENIUM	mg/kg	2.48	0.55	5.70	35/47
3	Subsurface	Metals	SILVER	mg/kg	4.22	0.83	7.90	34/47
3	Subsurface	Metals	SODIUM	mg/kg	578	69	3650	14/47
3	Subsurface	Metals	THALLIUM	mg/kg	0.92	0.34	1.50	2/47
3	Subsurface	Metals	VANADIUM	mg/kg	41.8	18	97	47/47
3	Subsurface	Metals	ZINC	mg/kg	5593.6	60	20000	47/47
3	Subsurface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	78749.8	1240	141000	47/47
3	Subsurface	PCB Congeners	Total PCB Congener	mg/kg	13.63	0.00032	35.90	7/7
4	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	2.08	0.067	27	40/48
4	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.56	0.32	1.10	7/26
4	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.79	0.067	19	17/27
4	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	2.90	0.13	8.30	3/27
4	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.60	0.0057	7.50	15/16
4	Surface	PAH	ACENAPHTHENE	mg/kg	1.14	0.0082	13	15/16
4	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.09	0.0063	0.65	14/16
4	Surface	PAH	ANTHRACENE	mg/kg	0.98	0.013	5.20	16/16
4	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	1.72	0.072	7.50	16/16
4	Surface	PAH	BENZO(A)PYRENE	mg/kg	1.42	0.11	6.80	16/16
4	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	1.06	0.065	5.20	16/16
4	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.83	0.009	4.90	16/16
4	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.99	0.035	5.20	16/16
4	Surface	PAH	BENZO[E]PYRENE	mg/kg	2.88	0.15	8.10	5/5
4	Surface	PAH	CHRYSENE	mg/kg	2.15	0.11	11	16/16
4	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.38	0.017	2.70	16/16
4	Surface	PAH	FLUORANTHENE	mg/kg	4.99	0.12	51	16/16
4	Surface	PAH	FLUORENE	mg/kg	0.96	0.0048	11	15/16

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
4	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.78	0.032	4.00	16/16
4	Surface	PAH	NAPHTHALENE	mg/kg	0.39	0.0047	5.10	16/16
4	Surface	PAH	PAH MIXTURES	mg/kg	28.40	0.86	250	16/16
4	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.033	0.0032	0.059	3/4
4	Surface	PAH	PERYLENE	mg/kg	1.07	0.036	3.80	5/5
4	Surface	PAH	PHENANTHRENE	mg/kg	5.98	0.028	73.00	16/16
4	Surface	PAH	PYRENE	mg/kg	4.75	0.12	44	16/16
4	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0.0098	0.0098	0.0098	1/5
4	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.0091	0.0053	0.014	3/5
4	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.020	0.0065	0.045	4/5
4	Surface	Pesticides	DDT TOTAL	mg/kg	0.025	0.013	0.060	4/5
4	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0.029	0.010	0.063	4/5
4	Surface	Pesticides	DIELDRIN	mg/kg	0.012	0.0037	0.019	3/5
4	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0.0088	0.0046	0.013	2/5
4	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0.0063	0.0036	0.010	3/5
4	Surface	Pesticides	HEPTACHLOR	mg/kg	0	0	0	0/5
4	Surface	Pesticides	P,P'-DDD	mg/kg	0.0049	0.0027	0.0069	3/5
4	Surface	Pesticides	P,P'-DDE	mg/kg	0.013	0.0071	0.028	4/5
4	Surface	Pesticides	P,P'-DDT	mg/kg	0.016	0.0077	0.025	2/5
4	Surface	Mercury	MERCURY	mg/kg	0.58	0.13	1.20	24/24
4	Surface	Metals	ALUMINUM	mg/kg	9435	5930	14100	24/24
4	Surface	Metals	ANTIMONY	mg/kg	1.75	1.20	2.30	2/24
4	Surface	Metals	ARSENIC	mg/kg	4.84	2.60	14.00	24/24
4	Surface	Metals	BARIUM	mg/kg	137.25	65.00	315.00	24/24
4	Surface	Metals	BERYLLIUM	mg/kg	0.46	0.29	0.62	24/24
4	Surface	Metals	CADMIUM	mg/kg	2.36	0.18	11.00	23/24
4	Surface	Metals	CALCIUM	mg/kg	12886.25	5910	25100	24/24
4	Surface	Metals	CHROMIUM, TOTAL	mg/kg	144.08	19	1090	24/24
4	Surface	Metals	COBALT	mg/kg	11.75	6.70	24	24/24
4	Surface	Metals	COPPER	mg/kg	245.67	26	1230	24/24
4	Surface	Metals	IRON	mg/kg	19508.33	14900	27100	24/24
4	Surface	Metals	LEAD	mg/kg	423.79	47	2320	24/24
4	Surface	Metals	MAGNESIUM	mg/kg	5534.58	3450	10500	24/24
4	Surface	Metals	MANGANESE	mg/kg	532.67	248	1290	24/24
4	Surface	Metals	NICKEL	mg/kg	89.83	27	484	24/24
4	Surface	Metals	POTASSIUM	mg/kg	1263.88	399	2160	24/24
4	Surface	Metals	SELENIUM	mg/kg	2.25	0.87	4.60	18/24
4	Surface	Metals	SILVER	mg/kg	1.43	0.31	2.80	7/24
4	Surface	Metals	SODIUM	mg/kg	226.15	121	404	13/24
4	Surface	Metals	THALLIUM	mg/kg	0	0	0	0/24
4	Surface	Metals	VANADIUM	mg/kg	20.88	14	49	24/24
4	Surface	Metals	ZINC	mg/kg	1378.29	183	8670	24/24
4	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	57675	16000	147000	24/24
4	Surface	PCB Congeners	Total PCB Congener	mg/kg	1.35	0.29	2.80	3/3
5	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.63	0.011	2.00	42/64
5	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.56	0.050	1.10	14/32
5	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.58	0.030	1.20	9/32
5	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.068	0.011	0.14	5/32
5	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.029	0.009	0.06	13/25
5	Surface	PAH	ACENAPHTHENE	mg/kg	0.041	0.0083	0.20	15/25
5	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.041	0.0088	0.21	23/25
5	Surface	PAH	ANTHRACENE	mg/kg	0.086	0.016	0.47	23/25
5	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.37	0.022	2.40	25/25
5	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.30	0.034	1.70	24/25
5	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.25	0.015	0.93	25/25
5	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.17	0.015	0.85	25/25
5	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.22	0.020	1.40	25/25

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type$^{(1)}$	Method	Parameter	Unit$^{(2)}$	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
5	Surface	PAH	BENZO[E]PYRENE	mg/kg	0.35	0.028	0.79	8/8
5	Surface	PAH	CHRYSENE	mg/kg	0.45	0.028	2.60	25/25
5	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.075	0.013	0.41	23/25
5	Surface	PAH	FLUORANTHENE	mg/kg	0.54	0.034	2.20	25/25
5	Surface	PAH	FLUORENE	mg/kg	0.047	0.0099	0.20	23/25
5	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.13	0.014	0.56	25/25
5	Surface	PAH	NAPHTHALENE	mg/kg	0.024	0.0064	0.071	16/25
5	Surface	PAH	PAH MIXTURES	mg/kg	3.52	0.21	17	25/25
5	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.040	0.040	0.040	1/1
5	Surface	PAH	PERYLENE	mg/kg	0.042	0.014	0.078	8/8
5	Surface	PAH	PHENANTHRENE	mg/kg	0.26	0.025	0.95	25/25
5	Surface	PAH	PYRENE	mg/kg	0.58	0.038	3.70	25/25
5	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0	0	0	0/1
5	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.0069	0.0069	0.0069	1/1
5	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.011	0.011	0.011	1/1
5	Surface	Pesticides	DDT TOTAL	mg/kg	0.039	0.039	0.039	1/1
5	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0	0	0	0/1
5	Surface	Pesticides	DIELDRIN	mg/kg	0.011	0.011	0.011	1/1
5	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0	0	0	0/1
5	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0	0	0	0/1
5	Surface	Pesticides	HEPTACHLOR	mg/kg	0	0	0	0/1
5	Surface	Pesticides	P,P'-DDD	mg/kg	0	0	0	0/1
5	Surface	Pesticides	P,P'-DDE	mg/kg	0.023	0.023	0.023	1/1
5	Surface	Pesticides	P,P'-DDT	mg/kg	0.016	0.016	0.016	1/1
5	Surface	Mercury	MERCURY	mg/kg	1.92	0.24	7.80	28/28
5	Surface	Metals	ALUMINUM	mg/kg	14943.2	8310	18900	28/28
5	Surface	Metals	ANTIMONY	mg/kg	0.64	0.64	0.64	1/28
5	Surface	Metals	ARSENIC	mg/kg	9.30	1.80	20	28/28
5	Surface	Metals	BARIUM	mg/kg	276.9	65	626	28/28
5	Surface	Metals	BERYLLIUM	mg/kg	0.60	0.37	0.84	24/28
5	Surface	Metals	CADMIUM	mg/kg	3.61	0.70	15	24/28
5	Surface	Metals	CALCIUM	mg/kg	13022.5	5570	37300	28/28
5	Surface	Metals	CHROMIUM, TOTAL	mg/kg	216.68	26	1280	28/28
5	Surface	Metals	COBALT	mg/kg	14.23	9	21	14/28
5	Surface	Metals	COPPER	mg/kg	344.75	28	1350	28/28
5	Surface	Metals	IRON	mg/kg	23250	14100	27000	28/28
5	Surface	Metals	LEAD	mg/kg	516.5	42	2720	28/28
5	Surface	Metals	MAGNESIUM	mg/kg	6700.4	3910	9360	28/28
5	Surface	Metals	MANGANESE	mg/kg	420.4	179	959	28/28
5	Surface	Metals	NICKEL	mg/kg	81.3	25	419	28/28
5	Surface	Metals	POTASSIUM	mg/kg	1929.3	1070	2480	28/28
5	Surface	Metals	SELENIUM	mg/kg	2.81	1.30	5.50	23/28
5	Surface	Metals	SILVER	mg/kg	2.24	0.87	6.10	17/28
5	Surface	Metals	SODIUM	mg/kg	539.3	225	1160	20/28
5	Surface	Metals	THALLIUM	mg/kg	0.42	0.34	0.49	2/28
5	Surface	Metals	VANADIUM	mg/kg	28.7	12	75	28/28
5	Surface	Metals	ZINC	mg/kg	1666.6	319	8890	21/28
5	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	67600	41200	175000	22/22
5	Surface	PCB Congeners	Total PCB Congener	mg/kg	1.21	0.18	4.94	6/6
5	Subsurface	PCB Aroclors	PCB, TOTAL	mg/kg	0.43	0.0049	1.10	30/92
5	Subsurface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.52	0.14	1.10	11/46
5	Subsurface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.00	0.00	0.00	0/46
5	Subsurface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.085	0.0049	0.33	8/46
5	Subsurface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.030	0.0064	0.10	23/46
5	Subsurface	PAH	ACENAPHTHENE	mg/kg	0.032	0.0054	0.13	23/46
5	Subsurface	PAH	ACENAPHTHYLENE	mg/kg	0.030	0.0062	0.19	30/46
5	Subsurface	PAH	ANTHRACENE	mg/kg	0.060	0.0078	0.38	35/46

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
5	Subsurface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.23	0.0045	1.50	41/46
5	Subsurface	PAH	BENZO(A)PYRENE	mg/kg	0.20	0.014	1.50	38/46
5	Subsurface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.15	0.0038	0.92	39/46
5	Subsurface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.083	0.0076	0.52	38/46
5	Subsurface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.13	0.011	0.93	38/46
5	Subsurface	PAH	BENZO[E]PYRENE	mg/kg	0.42	0.022	1.90	14/15
5	Subsurface	PAH	CHRYSENE	mg/kg	0.29	0.0039	2.30	43/46
5	Subsurface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.045	0.0067	0.30	29/46
5	Subsurface	PAH	FLUORANTHENE	mg/kg	0.33	0.0041	2.20	41/46
5	Subsurface	PAH	FLUORENE	mg/kg	0.028	0.0063	0.20	32/46
5	Subsurface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.073	0.0087	0.45	35/46
5	Subsurface	PAH	NAPHTHALENE	mg/kg	0.020	0.0062	0.07	28/46
5	Subsurface	PAH	PAH MIXTURES	mg/kg	1.90	0.0039	12	46/46
5	Subsurface	PAH	PERYLENE	mg/kg	0.058	0.0048	0.16	12/15
5	Subsurface	PAH	PHENANTHRENE	mg/kg	0.20	0.0042	1.40	39/46
5	Subsurface	PAH	PYRENE	mg/kg	0.30	0.0047	2	43/46
5	Subsurface	Mercury	MERCURY	mg/kg	3.66	0.052	11	45/46
5	Subsurface	Metals	ALUMINUM	mg/kg	13740	7980	18300	46/46
5	Subsurface	Metals	ANTIMONY	mg/kg	0.48	0.35	0.54	5/46
5	Subsurface	Metals	ARSENIC	mg/kg	8.92	1.20	33	46/46
5	Subsurface	Metals	BARIUM	mg/kg	365.20	46.00	971	46/46
5	Subsurface	Metals	BERYLLIUM	mg/kg	0.54	0.37	0.78	35/46
5	Subsurface	Metals	CADMIUM	mg/kg	3.60	0.67	17	36/46
5	Subsurface	Metals	CALCIUM	mg/kg	10449.1	1690	18100	46/46
5	Subsurface	Metals	CHROMIUM, TOTAL	mg/kg	206.35	16.00	1410	46/46
5	Subsurface	Metals	COBALT	mg/kg	13.45	9.70	29	39/46
5	Subsurface	Metals	COPPER	mg/kg	347.37	4.80	3000	46/46
5	Subsurface	Metals	IRON	mg/kg	21439.13	13600	29900	46/46
5	Subsurface	Metals	LEAD	mg/kg	712.83	6	6190	46/46
5	Subsurface	Metals	MAGNESIUM	mg/kg	6718.04	3830	10200	46/46
5	Subsurface	Metals	MANGANESE	mg/kg	356.09	200	802	46/46
5	Subsurface	Metals	NICKEL	mg/kg	76.35	20	523	46/46
5	Subsurface	Metals	POTASSIUM	mg/kg	1760.24	912	2750	46/46
5	Subsurface	Metals	SELENIUM	mg/kg	2.13	0.65	4.70	28/46
5	Subsurface	Metals	SILVER	mg/kg	2.27	0.19	6.90	29/46
5	Subsurface	Metals	SODIUM	mg/kg	463.50	144	1030	20/46
5	Subsurface	Metals	THALLIUM	mg/kg	0.35	0.27	0.46	7/46
5	Subsurface	Metals	VANADIUM	mg/kg	27.67	13	110	46/46
5	Subsurface	Metals	ZINC	mg/kg	1391.06	68	10900	34/46
5	Subsurface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	56140.23	3990	130000	44/45
5	Subsurface	PCB Congeners	Total PCB Congener	mg/kg	12.32	0.21	29.10	3/3
6	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	2.01	0.018	26	122/150
6	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.01	0.089	10	26/75
6	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.58	0.030	25	55/75
6	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.31	0.018	3.70	30/74
6	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.082	0.0047	2.10	48/59
6	Surface	PAH	ACENAPHTHENE	mg/kg	0.24	0.0070	5.70	58/59
6	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.15	0.011	4.80	59/59
6	Surface	PAH	ANTHRACENE	mg/kg	0.57	0.020	14	59/59
6	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	1.44	0.036	40	59/59
6	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.96	0.024	22	59/59
6	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.96	0.025	25	59/59
6	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.21	0.011	2.10	59/59
6	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.68	0.027	16	59/59
6	Surface	PAH	BENZO[E]PYRENE	mg/kg	0.43	0.034	3.20	15/15
6	Surface	PAH	CHRYSENE	mg/kg	1.37	0.051	28	59/59
6	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.40	0.0056	16	58/59
6	Surface	PAH	FLUORANTHENE	mg/kg	2.40	0.099	72	59/59

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
6	Surface	PAH	FLUORENE	mg/kg	0.21	0.0072	5.20	58/59
6	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.85	0.011	33	58/59
6	Surface	PAH	NAPHTHALENE	mg/kg	0.07	0.0047	1.40	56/59
6	Surface	PAH	PAH MIXTURES	mg/kg	14.29	0.49	380	59/59
6	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.11	0.012	0.35	6/6
6	Surface	PAH	PERYLENE	mg/kg	0.12	0.017	0.92	15/15
6	Surface	PAH	PHENANTHRENE	mg/kg	1.46	0.050	37	59/59
6	Surface	PAH	PYRENE	mg/kg	2.21	0.061	54	59/59
6	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0.017	0.0058	0.036	4/8
6	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.029	0.011	0.094	7/8
6	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.057	0.019	0.18	7/8
6	Surface	Pesticides	DDT TOTAL	mg/kg	0.079	0.014	0.20	6/8
6	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0.076	0.019	0.33	7/8
6	Surface	Pesticides	DIELDRIN	mg/kg	0.031	0.011	0.078	4/8
6	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0.036	0.015	0.054	3/8
6	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0.041	0.0059	0.11	4/8
6	Surface	Pesticides	HEPTACHLOR	mg/kg	0.14	0.14	0.14	1/8
6	Surface	Pesticides	P,P'-DDD	mg/kg	0.020	0.020	0.020	1/8
6	Surface	Pesticides	P,P'-DDE	mg/kg	0.043	0.014	0.078	6/8
6	Surface	Pesticides	P,P'-DDT	mg/kg	0.091	0.019	0.20	3/8
6	Surface	Mercury	MERCURY	mg/kg	0.87	0.15	3.40	75/75
6	Surface	Metals	ALUMINUM	mg/kg	11607.3	6020	18200	75/75
6	Surface	Metals	ANTIMONY	mg/kg	3.84	1.40	5	5/69
6	Surface	Metals	ARSENIC	mg/kg	5.55	2.90	13	75/75
6	Surface	Metals	BARIUM	mg/kg	170	45	409	75/75
6	Surface	Metals	BERYLLIUM	mg/kg	0.52	0.13	0.85	50/75
6	Surface	Metals	CADMIUM	mg/kg	3.14	0.19	14	53/75
6	Surface	Metals	CALCIUM	mg/kg	11448.4	2250	27700	75/75
6	Surface	Metals	CHROMIUM, TOTAL	mg/kg	167.11	13	1380	75/75
6	Surface	Metals	COBALT	mg/kg	12.27	8.80	19	48/75
6	Surface	Metals	COPPER	mg/kg	379.19	28	2710	75/75
6	Surface	Metals	IRON	mg/kg	19892.8	9260	27700	75/75
6	Surface	Metals	LEAD	mg/kg	626.29	76	4380	75/75
6	Surface	Metals	MAGNESIUM	mg/kg	5582.93	1860	7980	75/75
6	Surface	Metals	MANGANESE	mg/kg	395.04	172	749	75/75
6	Surface	Metals	NICKEL	mg/kg	79.19	11	302	75/75
6	Surface	Metals	POTASSIUM	mg/kg	1514.52	755	2120	71/75
6	Surface	Metals	SELENIUM	mg/kg	1.97	0.63	4	52/75
6	Surface	Metals	SILVER	mg/kg	2.28	0.49	6	27/75
6	Surface	Metals	SODIUM	mg/kg	272.92	78	728	49/75
6	Surface	Metals	THALLIUM	mg/kg	0.00	0	0	0/75
6	Surface	Metals	VANADIUM	mg/kg	24.09	11	67	75/75
6	Surface	Metals	ZINC	mg/kg	1303.57	82	9760	75/75
6	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	55660	12000	116000	75/75
6	Surface	PCB Congeners	Total PCB Congener	mg/kg	19.66	1	86	8/8
7	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	8.97	0.016	97	176/200
7	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	6.06	0.016	69	47/99
7	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	5.23	0.024	97	78/100
7	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	2.67	0.024	42	28/100
7	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.16	0.00087	2.10	58/60
7	Surface	PAH	ACENAPHTHENE	mg/kg	0.41	0.00052	9.00	58/60
7	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.21	0.00073	1.90	59/60
7	Surface	PAH	ANTHRACENE	mg/kg	0.80	0.00070	7.40	59/60
7	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	2.70	0.0026	18	60/60
7	Surface	PAH	BENZO(A)PYRENE	mg/kg	1.95	0.0024	12	58/60
7	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	1.65	0.0035	13	59/60
7	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.72	0.0052	5.20	59/60

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
7	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	1.57	0.0027	12	59/60
7	Surface	PAH	BENZO[E]PYRENE	mg/kg	1.85	0.061	10	11/11
7	Surface	PAH	CHRYSENE	mg/kg	2.86	0.0018	16	60/60
7	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.55	0.0059	11	59/60
7	Surface	PAH	FLUORANTHENE	mg/kg	4.06	0.0013	32	60/60
7	Surface	PAH	FLUORENE	mg/kg	0.41	0.00047	6.40	58/60
7	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	1.32	0.0070	17	59/60
7	Surface	PAH	NAPHTHALENE	mg/kg	0.20	0.0019	4.30	58/60
7	Surface	PAH	PAH MIXTURES	mg/kg	26.56	0.037	200	59/59
7	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.078	0.021	0.13	11/14
7	Surface	PAH	PERYLENE	mg/kg	0.26	0.040	0.61	11/11
7	Surface	PAH	PHENANTHRENE	mg/kg	2.86	0.0020	37	59/60
7	Surface	PAH	PYRENE	mg/kg	4.18	0.0013	29	60/60
7	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0.035	0.0032	0.11	6/14
7	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.14	0.0075	0.62	10/14
7	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.40	0.0086	3	13/14
7	Surface	Pesticides	DDT TOTAL	mg/kg	0.70	0.018	5.68	12/14
7	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0.31	0.021	2.1	12/14
7	Surface	Pesticides	DIELDRIN	mg/kg	0.093	0.0074	0.44	13/14
7	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0.13	0.0071	0.32	8/14
7	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0.092	0.0070	0.59	12/14
7	Surface	Pesticides	HEPTACHLOR	mg/kg	0.19	0.0079	0.99	9/14
7	Surface	Pesticides	P,P'-DDD	mg/kg	0.025	0.0057	0.042	4/14
7	Surface	Pesticides	P,P'-DDE	mg/kg	0.093	0.0085	0.38	12/14
7	Surface	Pesticides	P,P'-DDT	mg/kg	0.65	0.017	5.30	11/14
7	Surface	Mercury	MERCURY	mg/kg	1.70	0.21	18	87/90
7	Surface	Metals	ALUMINUM	mg/kg	9701.88	5910	14800	80/80
7	Surface	Metals	ANTIMONY	mg/kg	5.15	1.60	21	23/72
7	Surface	Metals	ARSENIC	mg/kg	6.96	2.20	31	89/90
7	Surface	Metals	BARIUM	mg/kg	268.05	110	869	79/80
7	Surface	Metals	BERYLLIUM	mg/kg	0.45	0.20	1	69/80
7	Surface	Metals	CADMIUM	mg/kg	3.87	0.35	50	72/80
7	Surface	Metals	CALCIUM	mg/kg	17055.4	3810	29900	80/80
7	Surface	Metals	CHROMIUM, TOTAL	mg/kg	146.6	13	612	90/90
7	Surface	Metals	COBALT	mg/kg	10.8	7	19	67/80
7	Surface	Metals	COPPER	mg/kg	549.3	18	1620	90/90
7	Surface	Metals	IRON	mg/kg	18368.8	12300	25000	80/80
7	Surface	Metals	LEAD	mg/kg	606.4	11	2940	90/90
7	Surface	Metals	MAGNESIUM	mg/kg	7224.9	2910	10800	80/80
7	Surface	Metals	MANGANESE	mg/kg	321.3	189	563	80/80
7	Surface	Metals	NICKEL	mg/kg	90.8	15	459	80/80
7	Surface	Metals	POTASSIUM	mg/kg	1166	539	2210	72/80
7	Surface	Metals	SELENIUM	mg/kg	2.42	0.72	7	66/80
7	Surface	Metals	SILVER	mg/kg	2.49	0.24	10	68/80
7	Surface	Metals	SODIUM	mg/kg	319.64	120	1080	50/80
7	Surface	Metals	THALLIUM	mg/kg	0	0	0	0/80
7	Surface	Metals	VANADIUM	mg/kg	20.18	11	48	80/80
7	Surface	Metals	ZINC	mg/kg	1115.9	76	4540	90/90
7	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	69469.8	14500	159000	86/86
7	Surface	PCB Congeners	Total PCB Congener	mg/kg	18.81	4.90	50	17/17
7	Subsurface	PCB Aroclors	PCB, TOTAL	mg/kg	8.92	0.064	48	12/20
7	Subsurface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	10.48	0.064	48	5/10
7	Subsurface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.42	0.14	0.70	2/10
7	Subsurface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.17	0.17	0.17	1/9
7	Subsurface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	48507.5	8630	86400	4/4
7T	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.25	0.11	0.39	4/38
7T	Surface	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.063	0.063	0.063	1/19

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results Average	Minimum	Maximum	Frequency of Detection
7T	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.21	0.034	0.39	2/19
7T	Surface	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.012	0.012	0.01	1/19
7T	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.044	0.0047	0.43	14/19
7T	Surface	PAH	ACENAPHTHENE	mg/kg	0.20	0.0012	2.40	14/19
7T	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.030	0.0012	0.16	15/19
7T	Surface	PAH	ANTHRACENE	mg/kg	0.31	0.0031	3.30	16/19
7T	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.55	0.0045	6.30	19/19
7T	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.52	0.0070	6.20	17/19
7T	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.49	0.018	5.10	16/19
7T	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.21	0.0075	1.80	14/19
7T	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.55	0.010	6.30	16/19
7T	Surface	PAH	BENZO[E]PYRENE	mg/kg	0.16	0.023	0.34	4/4
7T	Surface	PAH	CHRYSENE	mg/kg	0.70	0.0042	7.40	19/19
7T	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.10	0.0067	0.51	14/19
7T	Surface	PAH	FLUORANTHENE	mg/kg	1.57	0.0057	19	19/19
7T	Surface	PAH	FLUORENE	mg/kg	0.23	0.0015	2.70	14/19
7T	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.26	0.0032	2.30	17/19
7T	Surface	PAH	NAPHTHALENE	mg/kg	0.07	0.0058	0.80	14/19
7T	Surface	PAH	PAH MIXTURES	mg/kg	7.63	0.046	97	19/19
7T	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.006	0.0014	0.012	6/10
7T	Surface	PAH	PERYLENE	mg/kg	0.072	0.031	0.13	4/4
7T	Surface	PAH	PHENANTHRENE	mg/kg	1.37	0.0071	19	18/19
7T	Surface	PAH	PYRENE	mg/kg	1.09	0.0079	14	19/19
7T	Surface	Pesticides	ALPHA ENDOSULFAN	mg/kg	0	0	0	0/10
7T	Surface	Pesticides	BETA ENDOSULFAN	mg/kg	0.040	0.040	0.040	1/10
7T	Surface	Pesticides	BETA-CHLORDANE	mg/kg	0.031	0.031	0.031	1/10
7T	Surface	Pesticides	DDT TOTAL	mg/kg	0.059	0.015	0.13	3/10
7T	Surface	Pesticides	DELTA BHC (DELTA HEXACHLOROCYCLOHEXANE)	mg/kg	0.011	0.011	0.011	1/10
7T	Surface	Pesticides	DIELDRIN	mg/kg	0.026	0.023	0.028	2/10
7T	Surface	Pesticides	ENDOSULFAN SULFATE	mg/kg	0.020	0.020	0.020	1/10
7T	Surface	Pesticides	GAMMA BHC (LINDANE)	mg/kg	0.014	0.014	0.014	1/10
7T	Surface	Pesticides	HEPTACHLOR	mg/kg	0.018	0.018	0.018	1/10
7T	Surface	Pesticides	P,P'-DDD	mg/kg	0.0040	0.0040	0.0040	1/10
7T	Surface	Pesticides	P,P'-DDE	mg/kg	0.023	0.011	0.034	2/10
7T	Surface	Pesticides	P,P'-DDT	mg/kg	0.064	0.029	0.098	2/10
7T	Surface	Mercury	MERCURY	mg/kg	0.161	0.083	0.26	11/19
7T	Surface	Metals	ALUMINUM	mg/kg	9895.8	4900	15000	19/19
7T	Surface	Metals	ANTIMONY	mg/kg	0	0	0	0/17
7T	Surface	Metals	ARSENIC	mg/kg	4.69	1	8	19/19
7T	Surface	Metals	BARIUM	mg/kg	98.21	35	170	19/19
7T	Surface	Metals	BERYLLIUM	mg/kg	0.53	0.31	0.85	15/19
7T	Surface	Metals	CADMIUM	mg/kg	0.72	0.14	1.60	12/19
7T	Surface	Metals	CALCIUM	mg/kg	19580	3080	53600	19/19
7T	Surface	Metals	CHROMIUM, TOTAL	mg/kg	61.51	7.80	201	19/19
7T	Surface	Metals	COBALT	mg/kg	9.14	5.00	13	16/19
7T	Surface	Metals	COPPER	mg/kg	102.66	8.60	292	19/19
7T	Surface	Metals	IRON	mg/kg	17663.16	11100	25800	19/19
7T	Surface	Metals	LEAD	mg/kg	263.40	4.60	823	19/19
7T	Surface	Metals	MAGNESIUM	mg/kg	5992.11	1810	10500	19/19
7T	Surface	Metals	MANGANESE	mg/kg	544.37	184	1070	19/19
7T	Surface	Metals	NICKEL	mg/kg	24.37	8	41	19/19
7T	Surface	Metals	POTASSIUM	mg/kg	1232.68	557	2170	19/19
7T	Surface	Metals	SELENIUM	mg/kg	1.65	0.86	2.60	10/19
7T	Surface	Metals	SILVER	mg/kg	0	0	0	0/19
7T	Surface	Metals	SODIUM	mg/kg	295.17	89	530	12/19
7T	Surface	Metals	THALLIUM	mg/kg	0	0	0	0/19
7T	Surface	Metals	VANADIUM	mg/kg	17.42	11	24	19/19

Table A-2b Statistical Summary of Positive Sediment Results, Eighteenmile Creek OU3

					Summary of Positive Results			
Reach	Sample Type[(1)]	Method	Parameter	Unit[(2)]	Average	Minimum	Maximum	Frequency of Detection
7T	Surface	Metals	ZINC	mg/kg	556.26	39	1850	19/19
7T	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	41668.4	11000	112000	19/19

Notes:

(1) Surface samples are (0-1 ft) and Subsurface (<1 ft)

(2) mg/kg = milligram/kilogram

Table A-2c Statistical Summary of Positive Soil Results, Eighteenmile Creek OU3

Reach	Sample Type$^{(1)}$	Method	Parameter	Unit$^{(2)}$	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
4	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.15	0.15	0.15	1/2
4	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.15	0.15	0.15	1/2
4	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.013	0.013	0.013	1/1
4	Surface	PAH	ACENAPHTHENE	mg/kg	0.0028	0.0028	0.0028	1/1
4	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.0025	0.0025	0.0025	1/1
4	Surface	PAH	ANTHRACENE	mg/kg	0.0043	0.0043	0.0043	1/1
4	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.028	0.028	0.028	1/1
4	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.04	0.04	0.04	1/1
4	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.054	0.054	0.054	1/1
4	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.008	0.008	0.008	1/1
4	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.039	0.039	0.039	1/1
4	Surface	PAH	CHRYSENE	mg/kg	0.036	0.036	0.036	1/1
4	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.0081	0.0081	0.0081	1/1
4	Surface	PAH	FLUORANTHENE	mg/kg	0.046	0.046	0.046	1/1
4	Surface	PAH	FLUORENE	mg/kg	0.004	0.004	0.004	1/1
4	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.034	0.034	0.034	1/1
4	Surface	PAH	NAPHTHALENE	mg/kg	0.0097	0.0097	0.0097	1/1
4	Surface	PAH	PAH MIXTURES	mg/kg	0.40	0.4	0.4	1/1
4	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.01	0.01	0.01	1/1
4	Surface	PAH	PHENANTHRENE	mg/kg	0.032	0.032	0.032	1/1
4	Surface	PAH	PYRENE	mg/kg	0.047	0.047	0.047	1/1
4	Surface	Pesticides	DDT TOTAL	mg/kg	0.0064	0.0064	0.0064	1/1
4	Surface	Pesticides	P,P'-DDE	mg/kg	0.0064	0.0064	0.0064	1/1
4	Surface	Mercury	MERCURY	mg/kg	0.28	0.053	0.50	2/2
4	Surface	Metals	ALUMINUM	mg/kg	7755	7410	8100	2/2
4	Surface	Metals	ARSENIC	mg/kg	3.35	2.6	4.1	2/2
4	Surface	Metals	BARIUM	mg/kg	111	81	141	2/2
4	Surface	Metals	BERYLLIUM	mg/kg	0.50	0.49	0.51	2/2
4	Surface	Metals	CALCIUM	mg/kg	8955	5710	12200	2/2
4	Surface	Metals	CHROMIUM, TOTAL	mg/kg	39	13	65	2/2
4	Surface	Metals	COBALT	mg/kg	9.7	9.5	9.9	2/2
4	Surface	Metals	COPPER	mg/kg	81.25	9.5	153	2/2
4	Surface	Metals	IRON	mg/kg	19750	19700	19800	2/2
4	Surface	Metals	LEAD	mg/kg	106.5	20	193	2/2
4	Surface	Metals	MAGNESIUM	mg/kg	4450	4350	4550	2/2
4	Surface	Metals	MANGANESE	mg/kg	324	266	382	2/2
4	Surface	Metals	NICKEL	mg/kg	37.5	20	55	2/2
4	Surface	Metals	VANADIUM	mg/kg	19.5	19	20	2/2
4	Surface	Metals	ZINC	mg/kg	477.5	63	892	2/2
4	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	62500	22000	103000	2/2
5	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0	0	0	0/1
5	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0	0	0	0/1
5	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.041	0.041	0.041	1/1
5	Surface	PAH	ACENAPHTHENE	mg/kg	0.21	0.21	0.21	1/1
5	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.097	0.097	0.097	1/1
5	Surface	PAH	ANTHRACENE	mg/kg	1.8	1.8	1.8	1/1
5	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	2.9	2.9	2.9	1/1
5	Surface	PAH	BENZO(A)PYRENE	mg/kg	3	3	3	1/1
5	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	3.9	3.9	3.9	1/1
5	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.53	0.53	0.53	1/1
5	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	3.8	3.8	3.8	1/1
5	Surface	PAH	CHRYSENE	mg/kg	4.3	4.3	4.3	1/1
5	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	5.1	5.1	5.1	1/1
5	Surface	PAH	FLUORANTHENE	mg/kg	9.7	9.7	9.7	1/1

Table A-2c Statistical Summary of Positive Soil Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
5	Surface	PAH	FLUORENE	mg/kg	0.36	0.36	0.36	1/1
5	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	3.1	3.1	3.1	1/1
5	Surface	PAH	NAPHTHALENE	mg/kg	0.038	0.038	0.038	1/1
5	Surface	PAH	PAH MIXTURES	mg/kg	49	49	49	1/1
5	Surface	PAH	PHENANTHRENE	mg/kg	3.7	3.7	3.7	1/1
5	Surface	PAH	PYRENE	mg/kg	6.4	6.4	6.4	1/1
5	Surface	Pesticides	DDT TOTAL	mg/kg	0.016	0.016	0.016	1/1
5	Surface	Pesticides	P,P'-DDE	mg/kg	0.0081	0.0081	0.0081	1/1
5	Surface	Mercury	MERCURY	mg/kg	0	0	0	0/1
5	Surface	Metals	ALUMINUM	mg/kg	4870	4870	4870	1/1
5	Surface	Metals	ARSENIC	mg/kg	3.2	3.2	3.2	1/1
5	Surface	Metals	BARIUM	mg/kg	65	65	65	1/1
5	Surface	Metals	BERYLLIUM	mg/kg	0.30	0.30	0.30	1/1
5	Surface	Metals	CALCIUM	mg/kg	32000	32000	32000	1/1
5	Surface	Metals	CHROMIUM, TOTAL	mg/kg	14	14	14	1/1
5	Surface	Metals	COBALT	mg/kg	4.1	4.1	4.1	1/1
5	Surface	Metals	COPPER	mg/kg	24	24	24	1/1
5	Surface	Metals	IRON	mg/kg	11100	11100	11100	1/1
5	Surface	Metals	LEAD	mg/kg	31	31	31	1/1
5	Surface	Metals	MAGNESIUM	mg/kg	14700	14700	14700	1/1
5	Surface	Metals	MANGANESE	mg/kg	332	332	332	1/1
5	Surface	Metals	NICKEL	mg/kg	9.7	9.7	9.7	1/1
5	Surface	Metals	VANADIUM	mg/kg	14	14	14	1/1
5	Surface	Metals	ZINC	mg/kg	309	309	309	1/1
5	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	54000	54000	54000	1/1
6	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	0.48	0.48	0.48	1/2
6	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.48	0.48	0.48	1/2
6	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.024	0.024	0.024	1/1
6	Surface	PAH	ACENAPHTHENE	mg/kg	0.014	0.014	0.014	1/1
6	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.016	0.016	0.016	1/1
6	Surface	PAH	ANTHRACENE	mg/kg	0.035	0.035	0.035	1/1
6	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	0.37	0.37	0.37	1/1
6	Surface	PAH	BENZO(A)PYRENE	mg/kg	0.35	0.35	0.35	1/1
6	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	0.34	0.34	0.34	1/1
6	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.25	0.25	0.25	1/1
6	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	0.32	0.32	0.32	1/1
6	Surface	PAH	CHRYSENE	mg/kg	0.42	0.42	0.42	1/1
6	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.095	0.095	0.095	1/1
6	Surface	PAH	FLUORANTHENE	mg/kg	0.55	0.55	0.55	1/1
6	Surface	PAH	FLUORENE	mg/kg	0.017	0.017	0.017	1/1
6	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	0.29	0.29	0.29	1/1
6	Surface	PAH	NAPHTHALENE	mg/kg	0.026	0.026	0.026	1/1
6	Surface	PAH	PAH MIXTURES	mg/kg	4	4	4	1/1
6	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.013	0.013	0.013	1/1
6	Surface	PAH	PHENANTHRENE	mg/kg	0.22	0.22	0.22	1/1
6	Surface	PAH	PYRENE	mg/kg	0.64	0.64	0.64	1/1
6	Surface	Pesticides	DDT TOTAL	mg/kg	0.0364	0.0364	0.0364	1/1
6	Surface	Pesticides	P,P'-DDE	mg/kg	0.027	0.027	0.027	1/1
6	Surface	Mercury	MERCURY	mg/kg	1.27	0.64	1.9	2/2
6	Surface	Metals	ALUMINUM	mg/kg	10385	9270	11500	2/2
6	Surface	Metals	ARSENIC	mg/kg	8.65	5.3	12	2/2
6	Surface	Metals	BARIUM	mg/kg	206	128	284	2/2

Table A-2c Statistical Summary of Positive Soil Results, Eighteenmile Creek OU3

Reach	Sample Type[(1)]	Method	Parameter	Unit[(2)]	Summary of Positive Results: Average	Minimum	Maximum	Frequency of Detection
6	Surface	Metals	BERYLLIUM	mg/kg	0.695	0.62	0.77	2/2
6	Surface	Metals	CALCIUM	mg/kg	5385	4850	5920	2/2
6	Surface	Metals	CHROMIUM, TOTAL	mg/kg	147	95	199	2/2
6	Surface	Metals	COBALT	mg/kg	11.5	11	12	2/2
6	Surface	Metals	COPPER	mg/kg	255.5	210	301	2/2
6	Surface	Metals	IRON	mg/kg	21650	20000	23300	2/2
6	Surface	Metals	LEAD	mg/kg	396	359	433	2/2
6	Surface	Metals	MAGNESIUM	mg/kg	4030	3990	4070	2/2
6	Surface	Metals	MANGANESE	mg/kg	553	512	594	2/2
6	Surface	Metals	NICKEL	mg/kg	72	38	106	2/2
6	Surface	Metals	VANADIUM	mg/kg	26	24	28	2/2
6	Surface	Metals	ZINC	mg/kg	918.5	557	1280	2/2
6	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	28000	23000	33000	2/2
7	Surface	PCB Aroclors	PCB, TOTAL	mg/kg	1.17	0.035	3.3	4/5
7	Surface	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.17	0.035	3.3	4/5
7	Surface	PAH	2-METHYLNAPHTHALENE	mg/kg	0.19	0.19	0.19	1/1
7	Surface	PAH	ACENAPHTHENE	mg/kg	0.25	0.25	0.25	1/1
7	Surface	PAH	ACENAPHTHYLENE	mg/kg	0.21	0.21	0.21	1/1
7	Surface	PAH	ANTHRACENE	mg/kg	0.82	0.82	0.82	1/1
7	Surface	PAH	BENZO(A)ANTHRACENE	mg/kg	3.2	3.2	3.2	1/1
7	Surface	PAH	BENZO(A)PYRENE	mg/kg	1.9	1.9	1.9	1/1
7	Surface	PAH	BENZO(B)FLUORANTHENE	mg/kg	2.4	2.4	2.4	1/1
7	Surface	PAH	BENZO(G,H,I)PERYLENE	mg/kg	0.25	0.25	0.25	1/1
7	Surface	PAH	BENZO(K)FLUORANTHENE	mg/kg	1.6	1.6	1.6	1/1
7	Surface	PAH	CHRYSENE	mg/kg	2.6	2.6	2.6	1/1
7	Surface	PAH	DIBENZ(A,H)ANTHRACENE	mg/kg	0.61	0.61	0.61	1/1
7	Surface	PAH	FLUORANTHENE	mg/kg	4.6	4.6	4.6	1/1
7	Surface	PAH	FLUORENE	mg/kg	0.33	0.33	0.33	1/1
7	Surface	PAH	INDENO(1,2,3-C,D)PYRENE	mg/kg	3.9	3.9	3.9	1/1
7	Surface	PAH	NAPHTHALENE	mg/kg	0.20	0.20	0.20	1/1
7	Surface	PAH	PAH MIXTURES	mg/kg	29	29	29	1/1
7	Surface	PAH	PENTACHLOROPHENOL	mg/kg	0.045	0.045	0.045	1/1
7	Surface	PAH	PHENANTHRENE	mg/kg	2.6	2.6	2.6	1/1
7	Surface	PAH	PYRENE	mg/kg	3.9	3.9	3.9	1/1
7	Surface	Pesticides	DDT TOTAL	mg/kg	0	0	0	0/1
7	Surface	Pesticides	P,P'-DDE	mg/kg	0	0	0	0/1
7	Surface	Mercury	MERCURY	mg/kg	0.764	0.16	1.5	5/5
7	Surface	Metals	ALUMINUM	mg/kg	11234	9050	13100	5/5
7	Surface	Metals	ARSENIC	mg/kg	6.3	3.6	11	5/5
7	Surface	Metals	BARIUM	mg/kg	179.6	116	255	5/5
7	Surface	Metals	BERYLLIUM	mg/kg	0.702	0.51	0.83	5/5
7	Surface	Metals	CALCIUM	mg/kg	10614	4650	22800	5/5
7	Surface	Metals	CHROMIUM, TOTAL	mg/kg	63	26	109	5/5
7	Surface	Metals	COBALT	mg/kg	9.16	8.1	11	5/5
7	Surface	Metals	COPPER	mg/kg	158.4	42	272	5/5
7	Surface	Metals	IRON	mg/kg	20580	17600	24600	5/5
7	Surface	Metals	LEAD	mg/kg	236.2	57	400	5/5
7	Surface	Metals	MAGNESIUM	mg/kg	5410	3160	9670	5/5
7	Surface	Metals	MANGANESE	mg/kg	342	126	526	5/5
7	Surface	Metals	NICKEL	mg/kg	43.6	22	77	5/5
7	Surface	Metals	VANADIUM	mg/kg	24.8	19	31	5/5
7	Surface	Metals	ZINC	mg/kg	526.8	159	1030	5/5

Table A-2c Statistical Summary of Positive Soil Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
7	Surface	Total Organic Carbon	TOTAL ORGANIC CARBON	mg/kg	61800	35000	97000	5/5
7	Surface	PCB Congeners	Total PCB Congener	mg/kg	15	15	15	1/1

Notes:

(1) Surface samples are (0-1 ft) and Subsurface (<1 ft)

(2) mg/kg = milligram/kilogram

Table A-2d Statistical Summary of Positive Fish Tissue Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
1	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	4.21	0.87	10.71	7/7
1	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	3.10	0.58	8.16	7/7
1	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.10	0.287	2.55	7/7
1	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/7
1	Largemouth Bass Whole-Body	Percent Lipids	PERCENT LIPIDS	%	2.60	1.21	4.65	7/7
1	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	2.45	0.25	5.79	12/12
1	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.64	0.15	4.44	12/12
1	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.81	0.095	2.7	12/12
1	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/12
1	Forage Whole-Body Composite	Percent Lipids	PERCENT LIPIDS	%	3.21	2.21	3.85	7/7
1	Forage Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	0.62	0.42	0.85	5/5
1	Crayfish Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	0.47	0.35	0.71	3/3
1	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0	0	0	0/3
1	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.47	0.35	0.71	3/3
1	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
1	Crayfish Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	1.13	1	1.2	3/3
1	Bullhead Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	3.34	0.88	6.1	13/13
1	Bullhead Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.24	0.65	4.1	13/13
1	Bullhead Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.08	0.23	2	13/13
1	Bullhead Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.18	0.12	0.23	2/13
1	Bullhead Whole-Body	Percent Lipids	PERCENT LIPIDS	%	3.34	1.29	5.52	13/13
1	Bullhead Fillet	PCB Aroclors	PCB, TOTAL	mg/kg	2.01	0.94	3.8	5/5
1	Bullhead Fillet	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.12	0.50	2.2	5/5
1	Bullhead Fillet	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.87	0.44	1.6	5/5
1	Bullhead Fillet	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/5
1	Bullhead Fillet	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	1.41	0.67	2.4	5/5
2	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	19.39	2.79	45	3/3
2	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	14.38	1.63	34.4	3/3
2	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	5.01	1.16	10.6	3/3
2	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
2	Largemouth Bass Whole-Body	Percent Lipids	PERCENT LIPIDS	%	3.82	2.53	5.1	3/3
2	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	1.99	0.25	6.68	8/8
2	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.54	1.47	3.35	3/8
2	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.01	0.21	3.33	8/8
2	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.051	0.042	0.057	4/8
2	Forage Whole-Body Composite	Percent Lipids	PERCENT LIPIDS	%	2.21	2.04	2.36	3/3
2	Forage Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	0.37	0.28	0.51	5/5
2	Crayfish Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	0.50	0.48	0.51	3/3
2	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0	0	0	0/3
2	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.39	0.37	0.40	3/3
2	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.11	0.11	0.11	3/3
2	Crayfish Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	0.60	0.58	0.62	3/3
2	Bullhead Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	3.24	3.24	3.24	1/1
2	Bullhead Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.01	2.01	2.01	1/1
2	Bullhead Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.23	1.23	1.23	1/1
2	Bullhead Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/1
2	Bullhead Whole-Body	Percent Lipids	PERCENT LIPIDS	%	1.49	1.49	1.49	1/1
2	Bullhead Fillet	PCB Aroclors	PCB, TOTAL	mg/kg	2.52	1.7	4	5/5
2	Bullhead Fillet	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.44	1	2.3	5/5
2	Bullhead Fillet	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.09	0.74	1.7	5/5
2	Bullhead Fillet	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/5
2	Bullhead Fillet	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	1.31	0.65	1.8	5/5
3	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	12.69	4.39	16.05	4/4
3	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	9.01	2.52	12	4/4

Table A-2d Statistical Summary of Positive Fish Tissue Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results			
					Average	Minimum	Maximum	Frequency of Detection
3	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	3.69	1.87	4.95	4/4
3	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/4
3	Largemouth Bass Whole-Body	Percent Lipids	PERCENT LIPIDS	%	2.54	1.67	3.34	4/4
3	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	4.89	1.82	10.026	5/5
3	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	4.58	2.75	7.76	5/5
3	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.53	0.99	2.25	5/5
3	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/6
3	Forage Whole-Body Composite	Percent Lipids	PERCENT LIPIDS	%	1.59	1.02	2.09	5/5
3	Bullhead Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	5.91	3.87	9.92	6/6
3	Bullhead Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	4.25	2.59	7.48	6/6
3	Bullhead Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.66	0.88	2.44	6/6
3	Bullhead Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/6
3	Bullhead Whole-Body	Percent Lipids	PERCENT LIPIDS	%	3.67	2.36	4.54	6/6
4	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	18	15.69	19.22	3/3
4	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	13.33	10.8	14.6	3/3
4	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	4.66	4.48	4.89	3/3
4	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
4	Largemouth Bass Whole-Body	Percent Lipids	PERCENT LIPIDS	%	2.58	1.58	3.23	3/3
4	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	4.97	4.29	6.12	3/3
4	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	3.27	3.06	3.41	3/3
4	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.70	0.96	3.06	3/3
4	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
4	Forage Whole-Body Composite	Percent Lipids	PERCENT LIPIDS	%	1.30	1.18	1.4	3/3
4	Bullhead Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	3.30	1.94	4.022	3/3
4	Bullhead Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.19	1.20	3.11	3/3
4	Bullhead Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.11	0.74	1.68	3/3
4	Bullhead Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
4	Bullhead Whole-Body	Percent Lipids	PERCENT LIPIDS	%	3.14	2.17	4.8	3/3
5	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	1.25	0.60	2.1	5/5
5	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.71	0.41	1	4/5
5	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.66	0.34	1.1	5/5
5	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0.12	0.12	0.12	1/5
5	Largemouth Bass Whole-Body	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	0.36	0.23	0.52	5/5
5	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	0.69	0.59	0.79	5/5
5	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0.36	0.31	0.41	5/5
5	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.33	0.28	0.38	5/5
5	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/5
5	Forage Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	0.37	0.35	0.39	5/5
5	Crayfish Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	0.93	0.76	1.1	2/2
5	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	0	0	0	0/2
5	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.93	0.76	1.1	2/2
5	Crayfish Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/2
5	Crayfish Whole-Body Composite	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	1.25	1.1	1.4	2/2
5	Bullhead Fillet	PCB Aroclors	PCB, TOTAL	mg/kg	2.82	0.69	5.4	5/5
5	Bullhead Fillet	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.57	0.43	2.9	5/5
5	Bullhead Fillet	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.26	0.26	2.5	5/5
5	Bullhead Fillet	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/5
5	Bullhead Fillet	Percent Lipids	TOTAL EXTRACTABLE LIPIDS	%	1.31	0.54	1.8	5/5
6	Largemouth Bass Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	5.33	0.51	9.37	3/3
6	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	3.43	0.27	7.09	3/3
6	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.90	0.24	3.17	3/3
6	Largemouth Bass Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3

Table A-2d Statistical Summary of Positive Fish Tissue Results, Eighteenmile Creek OU3

Reach	Sample Type(1)	Method	Parameter	Unit(2)	Summary of Positive Results: Average	Minimum	Maximum	Frequency of Detection
6	Largemouth Bass Whole-Body	Percent Lipids	PERCENT LIPIDS	%	3.21	2.17	4.9	3/3
6	Forage Whole-Body Composite	PCB Aroclors	PCB, TOTAL	mg/kg	4.74	3.41	5.88	3/3
6	Forage Whole-Body Composite	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	2.79	2.55	3.15	3/3
6	Forage Whole-Body Composite	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	1.95	0.74	2.73	3/3
6	Forage Whole-Body Composite	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/3
6	Forage Whole-Body Composite	Percent Lipids	PERCENT LIPIDS	%	2.94	2.22	3.44	3/3
6	Bullhead Whole-Body	PCB Aroclors	PCB, TOTAL	mg/kg	2.58	1.24	4.86	4/4
6	Bullhead Whole-Body	PCB Aroclors	PCB-1248 (AROCLOR 1248)	mg/kg	1.60	0.86	3.37	4/4
6	Bullhead Whole-Body	PCB Aroclors	PCB-1254 (AROCLOR 1254)	mg/kg	0.98	0.37	1.49	4/4
6	Bullhead Whole-Body	PCB Aroclors	PCB-1260 (AROCLOR 1260)	mg/kg	0	0	0	0/4
6	Bullhead Whole-Body	Percent Lipids	PERCENT LIPIDS	%	2.04	0.55	4.05	4/4

Notes:

(1) Forage fish include include juvenile pumpkinseeds (Lepomis gibbosus) and bluegills (L. macrochirus).

(2) mg/kg = milligram/kilogram

B Data Validation

B-1 Data Validation

Recent studies conducted within the Eighteenmile Creek operable unit (OU) 3 boundaries were evaluated against United States Environmental Protection Agency (EPA) quality assurance (QA)/quality control (QC) requirements to assess the usability of the sample and analytical data for evaluating nature and extent and or assessing risk. In general, data were considered usable if the following criteria were met:

- Data generated within the last 10 years are considered potentially usable and representative of current Site conditions;
- It should be noted that there was a limited amount of data available for Reach 1. Data that was older than 10 years was also evaluated and subsequently determined to be considered usable;
- Sampling locations were within the OU3 boundaries or major tributary and the coordinates of the locations were provided or mapped with sufficient detail so that the locations could be digitally recorded in the geographic information system (GIS) geodatabase;
- The depths from which the samples were collected were provided or could be easily inferred based on the sampling technique (e.g., samples collected with a Ponar were assumed to be from a depth of 0 to 0.5 feet);
- Analytical data were reported for the Site-related chemicals of concern, and analytical methods and reporting limits were comparable to those used during the previous remedial investigation (RI) data collection activities;
- Analytical data were available in various electronic formats, and the data was imported to the RI database;
- Samples were collected under an approved sampling plan and Quality Assurance Project Plan (QAPP) or the samples were analyzed by a government research laboratory or certified commercial laboratory; and
- Data quality review process or formal data validation was completed for most datasets; however, if the data was not reviewed, the data packages and sampling logs were retrieved and a formal data validation was performed.

A summary of the reports reviewed and data quality assessment is presented in Appendix A, Table A-1. Datasets that were validated are summarized on Table B-1 and data validation memos are included in this Appendix B. Electronic data and analytical data packages will be provided on a compact disk. The qualifiers were added to the data summarized on Table B-2.

Table B-1 Summary of Validation of Historical Data Eighteenmile Creek Superfund Site - Operable Unit 3

Investigation	Study Key	Area	Data Summary	Data Validation	Electronic Data
USACE Investigations for Area of Concern					
USACE 2004b. Volume II, Laboratory Reports, Sediment Sampling, Biological Analyses, and Chemical Analyses for Eighteenmile Creek AOC.	USACE 2004	Reach 1	Sediment, tissue, and bioaccumulation testing for Reach 1 sediments. 15 sediment samples, 5 sediment composites, tissue/biological studies of worms exposed in the laboratory to 5 replicates of each of the 5 sediment composites, and bioaccumulation results from the worm studies. Sediment results consisted of PCB congener, PCB Aroclor, dioxin, TOC, metals, mercury, pesticide, and particle size. Tissue results consisted of PCB congener, metals, mercury, and pesticide analysis.	Data were validated based on laboratory data and associated QC results are available in the appendix of the report.	Available sediment data for pesticides, PCB (Aroclors) for one location, selected PCB congeners, dioxins, furans, metals, mercury, and TOC were imported into OU3 RI database. Additional data were entered from the original report. Data qualifiers were entered from the report. Tissue data was not entered because the results were from laboratory testing and environmental samples.
E Risk Sciences, LLP (ERS) and USACE 2012. Eighteenmile Creek Great Lakes Area of Concern (AOC), Niagara County, New York. Final Bioaccumulation Modeling and Ecological Risk Assessment.	USACE 2010	Reaches 1, 2 and 3	16 surface sediment samples collected by USACE below Burt Dam (Section 1/Reach 1, between Burt Dam and Olcott Harbor) in 2010 and analyzed for PCB Aroclors, congeners and TOC. Various fish samples collected below Burt Dam (Section 1/Reach 1, between Burt Dam and Olcott Harbor) and above Burt Dam (Section 2, Reach 2/3, between Burt Dam and Newfane Dam) in 2010 and analyzed for PCB congeners, Aroclors, and lipids.	Data validation was based on raw data and QC data are available in supporting files in the report.	Sediment results for PCBs and lead were available electronically and were imported into the OU3 database. The fish data were only available in summary tables and only the total PCB congeners were imported. If need the congeners could be hand entered into the OU3 database. Data validation qualifiers were added to the EDD before importing.

Table B-1 Summary of Validation of Historical Data Eighteenmile Creek Superfund Site - Operable Unit 3

Investigation	Study Key	Area	Data Summary	Data Validation	Electronic Data
Olcott Harbor					
USACE 2013. Ocott Harbor, Niagara County, New York - 40 CFR 230.11(d) Contaminant Determinations. Memorandum for CELRB-PM-EA.	USACE 2013	OU3	3 sediment grab samples were collected from Olcott Harbor in 2013 prior to dredging and analyzed for grain size, percent moisture, TAL metals, total cyanide, ammonia-nitrogen, total phosphorus, TKN, TOC, oil & grease, PCBs as Aroclors, pesticides, and PAHs. Elutriate tests were conducted on the 3 harbor sediment samples for the same parameters. The harbor sediement samples also were subjected to toxicity testing using *Hyalella azteca* , *Chironomus dilutus* , *Ceriodaphnia dubia,* and *Pimephales promelas* . Sediment samples also were collected in Lake Ontario in reference areas and disposal areas, which are north of	Data validation was based on electronic data and PDF lab data packages received from USACE 6-14-16.	Qualifiers were added to the electronic data before importing.
Wendel 2014. Olcott Harbor Sediment Sampling Results. Memo from Wendel to Tim Horanburg, Supervisor, Town of Newfane	Olcott 2014	OU3	22 sediment samples (cores) were collected from Olcott Harbor in 2013 prior to dredging and analyzed for metals (five), petroleum-related VOCs (benzene and BTEX), PAHs, selected pesticides, PCBs (Aroclors), and one dioxin.	Data validation was based on electronic data and PDF lab data packages received from USACE 6-24-16.	Qualifiers were added to the electronic data before importing.

▨ = new Study Key assigned in 2016.

Table B-2 Summary of Data Qualifiers Used

Qualifier	INORGANICS	ORGANICS
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted Contract-Required Quantitation Limit (CRQL) for sample and method
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	
J−	The result is an estimated quantity, but the result may be biased low.	
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.

B-2 Data Management

Data management consisted of compiling location and analytical data into a Microsoft Access project-specific database for OU3. All location data were compiled in EQuIS Region 2 format. All of the analytical data were translated into the Contract Laboratory Procedure (CLP) format in a Microsoft Access database that was the same as that used for OU2. Ecology and Environment, Inc. (E & E) does not anticipate that this historical data will be submitted to EPA Region 2 database administrator. However this format will allow for new CLP data to be readily merged with the historical data. Table B-3 summarizes the total number of samples for each matrix for the four studies that we validated.

Analytical data from all historical reports were verified as follows:

- Chemical names, Chemical Abstract Service numbers, and analytical methods were verified against the EPA Region 2 valid value list and updated if necessary;
- Reporting units for results and method detection limits were standardized to match units used in the OU2 database;
- Fields for sample matrix, sample type, result type code, detect flag, reportable flag, and validated flag were added if missing or verified against EPA Region 2 valid values;
- Sample description fields for reach location and sample type were added or verified; and
- Data were checked against the original hard copy report to verify electronic values.

In addition to the analytical results, data related to the sample location and depth were also included. The sample locations were established based on Global Positioning System coordinates provided in the individual reports, and the locations were verified on the GIS-derived Eighteenmile Creek OU3 base map. Each sample location was coded by reach, matrix, and area. For sediment samples the distance of the sample location relative to the start of Eighteenmile Creek's main channel at the New York State Erie Canal was also determined. For fish samples collected over a range of the creek, one location in the middle of the range was selected and entered into the location file.

For each sample collected at a location, the sample start and end depths were added in units of feet, and the sample was coded as to whether the depth was surface or subsurface. Surface samples were samples collected with a start depth of less than 0.5 feet below ground surface (BGS). Subsurface samples were samples collected with a start depth greater than 0.5 feet BGS or samples that were collected at depths greater than the surface sample. The sample also was coded to indicate the type of sample collected (e.g., OU3 creek corridor, tributary, and harbor).

B.2.1 PCB and PAH Total Concentrations

All data imported into the OU3 database were checked for whether total polychlorinated biphenyl (PCB) or polynuclear aromatic hydrocarbon (PAH) concentrations were included or new sums were calculated. Sums included in the historical data were verified for consistency with the following approach. A total PCB Aroclor concentration was calculated for each sample by summing together the concentrations of detected values and assuming a value of zero for non-detect Aroclors. A total PCB congener concentration was calculated for each sample by summing together the concentrations of detected values and assuming a value of zero for a non-detect congeners. Each sample was reported as the total concentration with two significant figures to maintain laboratory accuracy.

Total PAHs were calculated for each sample by summing together the concentrations of detected compounds. For the ecological risk assessment, total PAHs also were summed by adding a value of one-half the reporting limit for non-detected compounds for the 16 Target Compound List PAHs. Each sample was reported as the total concentration with two significant figures to maintain laboratory accuracy.

Table B-3 Summary of Validated Data Imported

Study	Range of Sample Dates		Number of Samples by Matrix			
			Sediment	Fish Tissue	Leachate	Surface Water
Olcott 2014	10/22/2013	10/24/2013	22			
USACE 2004	8/26/2003	8/27/2003	41			
USACE 2010	9/13/2010	10/26/2010	34	60		
USACE 2013	8/20/2013	8/21/2013	9		3	1

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EXECUTIVE NARRATIVE

Project ID: NYSDEC 2014
Site: Eighteenmile Creek Superfund Site OU3

Laboratory SDG No.: *1310935*
Laboratory: *RTI Laboratories, Inc.*

Number of Samples	Matrix	Sampling dates	Analysis
22	Sediment	10/22/13 10/23/13 10/24/13	Metals – EPA Method 6010 Mercury – EPA Method 7471 Volatile Organic Compounds – EPA Method 8260 Semi-Volatile Organic Compounds (PNAs) – EPA Method 8270 Organochlorine Pesticides - EPA Method 8081 Polychlorinated Biphenyls – EPA Method 8082 Percent Moisture – ASTM D2216 Particle Size (with Hydrometer) – ASTM D422
0	QA	N/A	No field QC.

QAPP: No QAPP was provided.
HWSS #: Not applicable.
Contractor Document: Wendel Memo, 1/28/2014, Olcott Harbor Sediment Sampling Results

SUMMARY:

The most current version of the USEPA Region II Data Validation SOPs were used for guidance. The data were evaluated against the analytical method requirements.

Critical: Results have an unacceptable level of uncertainty and should not be used for making decisions. Data has been qualified "R" rejected.

Major: A level of uncertainty exists that may not meet the data quality objectives for the project. A bias is likely to be present in the results. Data has been qualified "J" estimated.

Minor: The level of uncertainty is acceptable. No significant bias in the data was observed.

Critical Findings: Total chlordane organochlorine pesticide in LCS-31264 recovery was below control limits; sample results were non-detect, and therefore, were qualified with R as rejected.

Major Findings:

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for PAH/Pest/PCB for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect. Metals or mercury sample results not qualified on this basis.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ) except Percent Moisture and Particle Size (with Hydrometer).

Lead recoveries were outside control limits for two sample MS/MSDs and precision was outside control limits for the PDS; parent sample results were qualified with J as estimated.

MS/MSD accuracy and/or precision for mercury for samples SMP15 – (0-52″), SMP3 – (0-44″), and SMP19 – (0-50″) were outside control limits; therefore, the parent sample results were qualified with J as estimated.

Laboratory duplicate analysis precision for mercury for sample SMP15 – (0-52″) was above control limits; therefore, the parent sample result was qualified with J as estimated.

The case narrative states that for VOCs batch ID R62613: CCV and ICV have multiple analytes that exceed the 20% criteria"; associated results (for three samples) were nondetects and were qualified with UJ as estimated nondetect.

For SVOC surrogate compound Terphenyl-d14, recoveries were above control limits for five sediment samples; detected associated compounds were qualified with J + as estimated with a high bias and non-detects were not qualified.

MS and/or MSD SVOC recoveries were above control limits for benzo(a)pyrene and benzo(b)fluoranthene for SMP1 – (0-30″) and for benzo(b)fluoranthene for SMP19 – (0-51″); therefore, the parent sample detected associated compound results were qualified with J + as estimated with a high bias and non-detects were not qualified.

MS/MSD recoveries for organochlorine pesticides for sample SMP2 – (0-30″) and for SMP21 – (0-50″) were below control limits for several analytes; therefore, detected results for those compounds were qualified with J – as estimated with a low bias and nondetects were qualified with UJ as estimated non-detect.

Minor Findings:

Copper was detected in the method blanks; however, associated sample results were greater than 10x the blank concentration; therefore, no qualification of sample results was required.

For three sediment samples the surrogate recovery for VOCs for dibromofluoromethane was outside the acceptance criteria. The reported compounds are not represented by dibromofluoromethane but by 4-BFB and toluene-d8, which were within control limits; therefore, no qualifications for surrogate recovery were needed.

The laboratory narrative stated that for three samples, VOC internal standard areas exceeded control limits. The methanol vial was used for reporting purposes due to the internal standards failing in the initial analysis, which caused elevated reporting limits for these sample results. No data qualification was required on this basis.

For SVOC LCS-31249, recoveries were above control limits for benzo(b)fluoranthene and dibenzo(a,h)anthracene. For LCS-31250, recoveries were above control limits for benzo(a)pyrene, benzo(b)fluouranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Associated sample detect results for those samples qualified with J + as estimated with a high bias and non-detect results were not qualified.

MS/MSD PCB recovery for Aroclor 1016 was above control limits; however, the parent sample result was nondetect and no qualification was required on the basis of MS/MSD.

COMMENTS:

Reviewer Name(s): Joanna Christopher

Date: 8/10/2016

Approver Name: Marcia M. Galloway

Affiliation: Ecology and Environment, Inc.

Data Qualifier Definitions (National Functional Guidelines)

Qualifier Symbol	Explanation		
	INORGANICS	**ORGANICS**	**CHLORINATED DIOXIN/FURAN**
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted CRQL for sample and method	The analyte was analyzed for but not detected. The value preceding the "U" may represent the adjusted Contract Required Quantitation Limit (see DLM02.X, Exhibit D, Section 1.2 and Table 2), or the sample specific estimated detection limit (EDL, see Method 8290A, Section 11.9.5).
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to an issue with the quality of the data generated because certain QC criteria were not met, or the concentration of the analyte was below the adjusted CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	-	
J−	The result is an estimated quantity, but the result may be biased low.		
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.	The analyte was not detected (see definition of "U" flag, above). The reported value should be considered approximate.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
N		*The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.*	
NJ		The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	
C		This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).	
X		This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.	

ANALYSIS: METALS

Metals 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for PAH/Pest/PCB for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect. Metals sample results were not qualified on this basis.

Metals 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the metals on the Inorganic TAL. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

Metals 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and

during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

The associated preparation blank analyte results are greater than or equal to MDLs but less than reporting limits for: copper in method blanks (MB-31278: 120 J µg/kg; MB-31239: 270 J µg/kg) for sediment samples. Associated sample results for copper were greater than 10x the blank concentration; therefore, no qualification was required.

Metals 4. INTERFERENCE CHECK SAMPLE

The Interference Check Sample (ICS) verifies the analytical instrument's ability to overcome interferences typical of those found in samples. The laboratory should have analyzed and reported ICS results for all elements being reported from the analytical run and for all interferents (target and non-target) for these reported elements. The ICS consists of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents. Results for the analysis of ICS Solution must fall within the control limits of ± 20% or ±CRQL (whichever is greater) of the true value for the analytes and interferents included in the solution. If results that are ≥ MDL are observed for analytes that are not present in the ICS solution, the possibility of false positives exists. If negative results are observed for analytes that are not present in the ICS solution, and their absolute value is ≥ MDL, the possibility of false negatives in the samples exists. In general, ICP sample data can be accepted if the concentrations of Al, Ca, Fe, and Mg in the sample are found to be less than or equal to their respective concentrations in the ICS. Qualifications were applied to the samples and analytes as shown below.

ICS recoveries were acceptable. No qualification was needed on the basis of ICS recoveries.

Metals 5. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed for sediment samples SMP19 – (0-51″) and SMP2 – (0-30″).

- Lead recoveries were outside control limits for the MS and/or MSD. For sediment sample SMP19 – (0-51”) recovery was below control limits; therefore, the parent sample result was qualified with J - as estimated with a low bias. For sediment sample SMP2 – (0-30”): recovery was above control limits; therefore, the parent sample result was qualified with J + as estimated with a high bias.

Metals 6. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

A laboratory control sample duplicate analysis was not performed; however, serial dilution recoveries were acceptable and precision was acceptable except for lead for one pair of MS/MSD analyses and the PDS for SMP2 – (0-30″); therefore, the parent sample result for lead was qualified with J as estimated on the basis of duplicate precision.

Metals 7. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Metals 8. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%, except for Sb and Ag which must fall within the control limits of 50-150%. Qualifications were applied to the samples and analytes as shown below.

LCS recoveries were acceptable. No qualification was needed on the basis of LCS recoveries.

Metals 9. ICP SERIAL DILUTION

The serial dilution of samples quantitated by Inductively Coupled Plasma determines whether or not significant physical or chemical interferences exist due to sample matrix. If the analyte concentration is sufficiently high [concentration in the original sample is > 50 times (50x) the MDL, the %D between the original determination and the serial dilution analysis (a five-fold dilution) after correction for dilution shall be less than 10 (15-120% for soils/sediments). For a serial dilution analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the serial dilution sample.

Data were not provided to evaluate serial dilution criteria. No problems were noted in the laboratory narrative or report. No qualification was needed on the basis of serial dilution recovery.

Metals 10. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

ANALYSIS: MERCURY

Mercury 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time, pH (aqueous samples), or cooler temperature are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (28 days) and pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects (sample quantitation limits) will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for PAH/Pest/PCB for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect. Mercury sample results were not qualified on this basis.

Mercury 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for mercury. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be employed to establish the analytical curve. At least one of the calibration standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The calibration curves for mercury shall possess a correlation coefficient of ≥ 0.995 to ensure the linearity over the calibrated range. The percent differences calculated for all of the non-zero standards must fall within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. All sample results shall be reported from an analysis within the calibrated range. Qualifications were applied to the samples and analytes as shown below.

Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for mercury by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every hour during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 85 – 115%. Qualifications were applied to the samples and analytes as shown below.

Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

Mercury 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-

contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

Mercury 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed on sediment samples SMP15 – (0-52″), SMP3 – (0-44″), and SMP19 – (0-50″). For sample SMP15 – (0-52″), the MS recovery was below control limits and the MSD recovery and RPD were above control limits; therefore, the parent sample result was qualified with J as estimated. For samples SMP3 – (0-44″) and SMP19 – (0-50″), the MS and MSD recoveries were below control limits; therefore, the parent sample results were qualified with J - as estimated with a low bias. .

Mercury 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Laboratory duplicate analysis precision was acceptable for two of the three MS/MSD sample pairs. For sample SMP15 – (0-52″), the RPD was above control limits; therefore, the parent sample result was qualified with J as estimated.

Mercury 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Mercury 7. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ)..

ANALYSIS: VOCs

VOC 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sediment samples were analyzed within the specified 14 day holding time and with temperatures within preservation control limits. (4 ± 2 °C). No qualifications for holding time issues were needed.

VOC 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

The case narrative stated that for "samples 1310935-001, 004, 015 and MBLK-1102 the surrogate recovery for dibromofluoromethane was outside the acceptance criteria." The reported compounds are not represented by dibromofluoromethane but by 4-BFB and toluene-d8, which were within control limits; therefore, no qualifications for surrogate recovery were needed.

VOC 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for sediment sample SMP4 – (0-55") with acceptable accuracy and precision. No qualifications were needed based upon this evaluation.

VOC 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

The LCS/LCSD accuracy and precision were within the laboratory's established in-house performance criteria. No qualifications were needed based upon this evaluation.

VOC 5. BLANK CONTAMINATION:

QA blanks, i.e., method, trip, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Trip blanks measure cross- contamination of samples during shipment. Field and rinse blanks measure cross-contamination of samples during field operations. If the concentration of the analyte is less than 5 times the blank contaminant level (10 times for common contaminants), the analytes are qualified as non-detects, "U". The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No compounds were detected in the method blanks. No qualifications were needed based upon the method blank evaluations.

Field blank contamination:
No field blank was collected.

VOC 6. MASS SPECTROMETER TUNING:

Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds and to some degree, sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, these criteria should be met in all circumstances. The tuning standard for volatile organics is Bromofluorobenzene (BFB). If the mass calibration is in error, all associated data will be classified as unusable "R".

Data were not provided to evaluate tuning. No problems were noted in the laboratory narrative or report.

VOC 7. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Response Factor GC/MS:

The response factor measures the instrument's response to specific chemical compounds. The response factor for the TCL and for SPCC compounds must be ≥ 0.05, in both the initial and continuing calibrations. A value < 0.05, indicates a serious detection and quantitation problem (poor sensitivity). Analytes detected in the sample will be qualified as estimated, "J". All non-detects for that compound will be rejected "R".

Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

Calibration Checks %RSD and %D:

Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. Percent RSD must be < 20% for target analytes, <30% for CCC compounds. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

The following analytes in the sample shown were qualified for %RSD and %D:

Data were not provided to evaluate calibration criteria. The case narrative states that for "batch ID R62613: CCV and ICV have multiple analytes that exceed the 20% criteria"; associated sample results (SMP1 - (0-30"), SMP11 - (0-52"), and SMP4 - (0-55") were nondetects and were qualified with UJ as estimated nondetect.

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VOC 8. INTERNAL STANDARDS PERFORMANCE GC/MS

Internal standards performance criteria ensure that the GC/MS sensitivity and response are stable during every experimental run. The internal standard area count must not vary by more than a factor of 2 (-50% to +100%) from the associated continuing calibration standard. The retention time of the internal standard must not vary more than 30 seconds from the associated continuing calibration standard. If the area count is outside the (-50% to +100%) range of the associated standard, all of the positive results for compounds quantitated using that IS are qualified as

estimated, "J", and all non-detects as "UJ", or "R" if there is a severe loss of sensitivity. If an internal standard retention time varies by more than 30 seconds, the reviewer will use professional judgment to determine either partial or total rejection of the data for that sample fraction.

Data were not provided to evaluate calibration criteria. The laboratory narrative stated that for "samples 1310935-001, 004 and 015, internal standard areas exceeded control limits. Matrix interference was confirmed by re-analysis. The methanol vial was used for reporting purposes due to the internal standards failing in the initial analysis. This has caused elevated reporting limits for these samples." No data qualification was required on this basis.

VOC 9. CONTRACT PROBLEMS NON-COMPLIANCE: No applicable.

VOC 10. FIELD DOCUMENTATION: No problems.

VOC 11. OTHER PROBLEMS: PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and
SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ)..

VOC 12. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: SVOCs

SVOCS 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect.

SVOCS 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

For surrogate compound Terphenyl-d14, recoveries were above control limits for sediment samples SMP7 – (0-53″), SMP10 – (0-50″), SMP20 – (0-52″), SMP22 – (0-51″), and SMP14 – (0-56″); detected associated compounds were qualified with J + as estimated with a high bias and non-detects were not qualified.

SVOCS 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for samples SMP1 – (0-30″) and SMP19 – (0-51″). MS and/or MSD recoveries were above control limits for benzo(a)pyrene and benzo(b)fluoranthene for SMP1 – (0-30″) and for benzo(b)fluoranthene for SMP19 – (0-51″); therefore, the parent sample detected associated compound results were qualified with J + as estimated with a high bias and non-detects were not qualified.

SVOCS 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

For LCS-31249, recoveries were above control limits for benzo(b)fluoranthene and dibenzo(a,h)anthracene. For LCS-31250, recoveries were above control limits for benzo(a)pyrene, benzo(b)fluouranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Associated sample detect results for those samples qualified with J + as estimated with a high bias and non-detect results were not qualified.

SVOCS 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method

blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No target analytes were detected in method blanks. No data qualifications were needed based upon blank evaluations.

Field blank contamination:

No field blank was collected.

SVOCS 6. MASS SPECTROMETER TUNING:

Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds and to some degree, sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, these criteria should be met in all circumstances. The tuning standard for semi-volatiles Decafluorotriphenyl-phosphine (DFTPP). If the mass calibration is in error, all associated data will be classified as unusable "R".

Data were not provided to evaluate MS tuning parameters. No problems were noted in the case narrative/report. No qualifications were added based on MS tuning.

SVOCS 7. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Response Factor GC/MS:

The response factor measures the instrument's response to specific chemical compounds. The response factor for the most TCL and for SPCC compounds must be ≥ 0.05, in both the initial and continuing calibrations. The exception being the twenty-five (25) poor performing compounds which require a value < 0.01. A low RRF value indicates a serious detection and quantitation problem (poor sensitivity). Analytes detected in the sample will be qualified as estimated, "J". All non-detects for that compound will be rejected "R".

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Calibration Checks %RSD and %D:

Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. Percent RSD must be < 20% for target analytes, <30% for CCC compounds. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R". The following analytes in the sample shown were qualified for %RSD and %D:

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

SVOCS 8. INTERNAL STANDARDS PERFORMANCE GC/MS

Internal standards performance criteria ensure that the GC/MS sensitivity and response are stable during every experimental run. The internal standard area count must not vary by more than a factor of 2 (-50% to +100%) from the associated continuing calibration standard. The retention time of the internal standard must not vary more than 30 seconds from the associated continuing calibration standard. If the area count is outside the (-50% to +100%) range of the associated standard, all of the positive results for compounds quantitated using that IS are qualified as estimated, "J", and all non-detects as "UJ", or "R" if there is a severe loss of sensitivity. If an internal standard retention time varies by more than 30 seconds, the reviewer will use professional judgment to determine either partial or total rejection of the data for that sample fraction.

Data were not provided to evaluate internal standards criteria. No problems were noted in the case narrative/report. No qualifications were added based on internal standards.

SVOCS 9. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

SVOCS 10. FIELD DOCUMENTATION: No problems.

SVOCS 11. OTHER PROBLEMS: PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

SVOCS 12. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: ORGANOCHLORINE PESTICIDES

Pest 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect.

Pest 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Surrogate recoveries were within control limits; therefore, no qualification was needed on the basis of surrogate recovery. (The case narrative incorrectly stated that tetrachloro-m-xylene [TCMX] recovery was above control limits for two samples.)

Pest 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for sediment samples SMP2 – (0-30″), and SMP21 – (0-50″). MS/MSD recoveries for sample SMP2 – (0-30″) were below control limits for 2,4′-DDT, 4,4′-DDE, 4,4′-DDT, and chlordane, total; and for SMP21 – (0-50″) below control limits for chlordane, total; therefore, detected results for those compounds were qualified with J – as estimated with a low bias and nondetects were qualified with UJ as estimated non-detect.

Pest 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS accuracy was within laboratory control limits except total chlordane in LCS-31264 recovery was below control limits for both analytical runs; sample results were non-detect, and therefore, were qualified with R as rejected.

Pest 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No analytes were detected in the method blank. No data qualification was required based on blank contamination. .

Field blank contamination:

No field blank was collected.

Pest 6. CALIBRATION:
Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Initial Calibration and %RSD:
Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent RSD must be:

< 20.0% for single component target compounds except alpha-BHC and delta-BHC.
< 25.0% for alpha-BHC and delta-BHC.
< 30.0% for Toxaphene peaks.
< 30.0% for surrogates (tetrachloro-m-xylene and decachlorobiphenyl).

A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Continuing Calibration and %D:
Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Pest 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

Pest 8. FIELD DOCUMENTATION:
No problems were identified.

Pest 9. OTHER PROBLEMS: PERCENT SOLIDS
The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and

SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

Pest 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: PCB

PCB 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample bottles for PAH/Pest/PCB/Metals analyses were received at a temperature outside control limits at >6 °C for samples: SMP1 – (0-30″), SMP2 – (0-30″), SMP4 – (0-55″), SMP5 – (0-61″), SMP6 – (0-55″), SMP9 – (0-52″), SMP10 – (0-50″), SMP11 – (0-52″), SMP12 – (0-53″), SMP16 – (0-50″), SMP20 – (0-52″), and SMP22 – (0-51″). Sample detect results for those samples qualified with J as estimated and non-detect results qualified with UJ as estimated non-detect.

PCB 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Surrogate decachlorobiphenyl recovery was above laboratory control limits and within and within the control limits stated in USEPA Region II Data Validation SOP HW-36A for sample SMP3 - (0-44″) and SMP22 – (0-51″); therefore, no qualification was needed on the basis of surrogate recovery.

PCB 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for non-project samples with acceptable accuracy and precision and for sample SMP17 – (0-55″); recovery for Aroclor 1016 was above control limits; however, the parent sample result was nondetect and no qualification was required on the basis of MS/MSD.

PCB 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS accuracy was within laboratory control limits; therefore, no data qualification was required on the basis of the LCS.

PCB 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No Aroclors were detected in method backs. No data qualifications were needed on the basis of blank contamination.

Field blank contamination:

No field blank was collected.

PCB 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. 2nd Order Non Linear calibration model is used. The Calibration Verification checks document that the instrument is giving satisfactory daily performance.

Correlation coefficient R^2 and Percent RSD:

For the initial calibration, if the value of the correlation coefficient R^2 is below 0.99 for any PCB or any surrogate or if the %RSD of the CFs for the three to five major peaks of each of the Aroclor compounds and the two surrogates must be less than or equal to 20.0% If not, qualify all associated positive results "J" and non-detects "UJ". Qualifiers are applied based on primary column calibration only.

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Percent Drift (%Drift):

For the Calibration Verification checks, if Percent Drift exceeds 15% for any PCB or any surrogate, qualify all associated positive results “J” and non-detects “UJ”. Qualifiers are applied based on primary column calibration only.

Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

PCB 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

PCB 8. FIELD DOCUMENTATION:

No problems were identified.

PCB 9. OTHER PROBLEMS: PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples SMP3 - (0-44"), SMP4 - (0-55"), SMP5 - (0-61"), SMP6 - (0-55"), SMP7 - (0-53"), SMP8 - (0-52"), SMP9 - (0-52"), SMP10 - (0-50"), SMP11 - (0-52"), SMP12 - (0-53"), SMP13 - (0-51"), SMP14 - (0-56"), SMP15 - (0-52"), SMP17 - (0-55"), SMP18 - (0-55"), SMP19 - (0-51"), and SMP20 - (0-52") had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

PCB 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: GENERAL CHEMISTRY

General Chemistry 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

General Chemistry 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the target analytes. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Initial calibrations were acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of initial or continuing calibration verifications.

General Chemistry 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

Not applicable.

General Chemistry 4. SPIKE SAMPLE ANALYSIS
The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

Not applicable.

General Chemistry 5. DUPLICATE SAMPLE ANALYSIS
The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Laboratory sample duplicate analyses were performed for sediment samples SMP1 – (0-30″), SMP16 – (0-50″), and SMP19 – (0-51″) for Method D2216 (Percent Moisture) and for samples SMP4 – (0-55″) and SMP21 – (0-50″) for Method D-422 with acceptable precision. No qualification was required on the basis of duplicate precision.

General Chemistry 6. FIELD DUPLICATE
Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted.

General Chemistry 7. LABORATORY CONTROL SAMPLE
The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%. Qualifications were applied to the samples and analytes as shown below.

All LCS analytes were within control limits.

General Chemistry 8. PERCENT SOLIDS
The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Not applicable.

ACROYMN LIST

ACROYMNS

TCL – Target Compound List
RPD – Relative Percent Difference
%D – Percent Difference
LCS – Laboratory Control Sample
%R – Percent Recovery
CCC – calibration check compound
CCV – Continuing Calibration Verification
CRQL Contract Required Quantitation Limit
DQO – data quality objective
EDD – electronic data deliverable
EPA – (United States) Environmental Protection Agency
EQM – Environmental Quality Management, Inc.
FSP – Field Sampling Plan
GLLA – Great Lakes Legacy Act
GLSED – Great Lakes Sediment Database
GPS – global positioning system
ICS Interference Check Sample
ICV Initial Calibration Verification
ID – Inner Diameter
MDL – Method detection limit
mm – millimeters
NELAC National Environmental Laboratory Accreditation Conference
PCB – polychlorinated biphenyl
ppm – parts per million
PQL – project quantitation limit
QA/QC – Quality assurance/quality control
QAPP – Quality Assurance Project Plan
RRF Relative response factor
SOP – standard operating procedure
TAL Target Analyte List
TCLP – toxicity characteristic leaching procedure
TOC – Total organic carbon
TSCA – Toxic Substances Control Act

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EXECUTIVE NARRATIVE

Project ID: USACE 2004

Site: Eighteenmile Creek Superfund Site OU3

Laboratory SDG No.: *H3I060138 (STL Knoxville) (and others with unknown numbers for EPC and EPR)*

Laboratory: The U.S. Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory Environmental Processes Chemistry Branch (EPC) and Environmental Processes Risk Assessment Branch (EPR); STL Knoxville

Number of Samples	Matrix	Sampling dates	Analysis
15	Sediment	8/26/03 8/27/03	Metals – EPA Method 6010B Mercury – EPA Method 7471 Total Organic Carbon – EPA Method 9060 Modified Dioxin – EPA Method 8290 Organochlorine Pesticides - EPA Method 8081A Polychlorinated Biphenyls, Congeners – EPA Method 8082 [Percent Moisture – ASTM D2216] Particle Size (with Hydrometer) – ASTM D422
5	Sediment composite		
1	QA	8/27/03	Polychlorinated Biphenyls, Congeners – EPA Method 8082
25	Tissue	8/26/03 8/27/03	Metals – EPA Methods 6020/6010B Mercury – EPA Method 7470A Organochlorine Pesticides - EPA Method 8081A Polychlorinated Biphenyls, Summation of Ind. Congeners – EPA Method 8082 [Percent Moisture – ASTM D2216] Lipid – Van Handel (1985)-IR
3	QA	N/A	Polychlorinated Biphenyls, Congeners – EPA Method 8082

QAPP: No QAPP was provided.
HWSS #: Not applicable.
Contractor Document: USACE 2004a. Volume I, Project Report Overview, Sediment Sampling, Biological Analyses, and Chemical Analyses for Eighteenmile Creek AOC; USACE 2004b; and Volume II, Laboratory Reports, Sediment Sampling, Biological Analyses, and Chemical Analyses for Eighteenmile Creek AOC.

SUMMARY:
The most current version of the USEPA Region II Data Validation SOPs were used for guidance. The data were evaluated against the analytical method requirements.

Critical: Results have an unacceptable level of uncertainty and should not be used for making decisions. Data has been qualified "R" rejected.

Major: A level of uncertainty exists that may not meet the data quality objectives for the project. A bias is likely to be present in the results. Data has been qualified "J" estimated.

Minor: The level of uncertainty is acceptable. No significant bias in the data was observed.

Critical Findings:
Tissue samples: For PCB congener analysis, Congener 70 was not reported for the samples due to %RSD above control limits. No data was reported for congeners 15, 141, 153, 156, 159, 171, and 187 due to coelutions with other congeners on both columns except for samples that were at or below the laboratory reporting limit and for congener 187 LCS failure was also a factor. (These are listed as critical findings because "not reported" means essentially the same thing as "rejected".)

Major Findings:
Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. The laboratory report did not specify which samples were received above 6 °C; therefore, sample detect results were qualified with J as estimated and non-detect results were qualified with UJ as estimated non-detect for Pest/PCB/Dioxin analyses. Metals or mercury sample results not qualified on this basis.

Sediment samples: Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 had < 50% solids. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ) except Particle Size.

Sediment samples -- dioxin analyses: Low levels of 1,2,3,7,8-PeCDD, Total PeCDD, OCDD, 2,3,4,7,8-PeCDF, Total PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, Total HxCDF, 1,2,3,4,6,7,8-HpCDF, Total HpCDF, and OCDF were detected in the method blank. Associated sample results that were less than 5x the blank concentration were qualified with U as nondetect and the sample result was elevated to the detection limit.

Sediment samples: MS/MSD analyses for sediment sample EMC 4 were within control limits except for antimony (Sb) in the matrix spike. Recovery was below control limits; therefore, the parent sample result was qualified with J - as estimated with a low bias.

Sediment samples: MS/MSD analyses performed for sediment sample EMC 4 were within control limits for all compounds except for low recoveries of aldrin, d-BHC, and a-BHC. For the parent sample, results for those compounds were nondetects and were already qualified with UJ as estimated non-detect due to sample receipt temperature. No further qualification was required.

Sediment samples: The Pesticide Sediment Summary Report Table 1 indicates that %D on two columns was >40% for PPDDE for samples EBU 3 and EBU 5. The results were already qualified with J based on sample preservation; no further qualification was required.

Sediment samples dioxin analysis: MS/MSD analyses performed for sediment sample EMC 2 were outside control limits (low) for OCDF; therefore, the parent sample result was qualified with J – as estimated with a low bias.

Sediment samples dioxin analysis: All positive 2378-TCDF results were reported as the highest amount of TCDF present or estimated maximum possible concentration (EMPC). Analyte concentrations qualified by the laboratory with Q as an EMPC were qualified with J as estimated. Analytes qualified by the laboratory with S may have exhibited ion suppression of the analytical signal due to a matrix interference; therefore, the results were qualified with a J – as estimated with a low bias.

Tissue samples: Chromium, copper, nickel, zinc, barium, cobalt, iron, and manganese were detected in method blanks at low concentrations. Associated sample detected results <5x the blank result were qualified with U as nondetect and the detection limit was elevated to the sample result.

Tissue samples: The MS recoveries for EBU2 3-1 for Be, Cd, Co, Mn, Ni, and Zn were within control limits and all other elements were below the range; therefore, the parent sample results for those metals were qualified with J – as estimated with a low bias or UJ as estimated nondetect. The MS recoveries for EBU4 4-1 for As, Cu, Mn, Pb, Sb, and Zn were within control limits and all other elements were outside of the range; therefore, the parent sample results for those metals were qualified with J + as estimated with a high bias or UJ as estimated nondetect.

Tissue samples: The duplicate RPDs for EBU2 3-1 were < 20% for Al, Ag, Be, Cd, Cu, Na, and Se and all other elements were > 20%. The RPDs for EBU4 4-1 were < 20% for As, Ag, Cu, Mg, and Tl and all other elements were > 20%. The RPD criteria for sediment samples in USEPA SOP HW-3a was also applied to the tissue samples, 35% ≤ RPD ≤ 120 were qualified with a J as estimated; nondetect results were not qualified.

Tissue samples: MS/MSD analyses performed for tissue sample EBU3 2-1 were within laboratory control limits except for D-BHC in the MS and Heptachlor Epoxide in the MS and MSD (recoveries below control limits); MS/MSD precision was outside control limits as well. The parent sample results were nondetects and were qualified with UJ as estimated nondetect for those analytes.

Tissue samples: The Pesticide Tissue Summary Report Table 1 indicates the %D on two columns was >40% for PPDDE for the samples except EBU1 1-2, EBU1 1-4, EBU3 3-1, and EBU5 5-1. The reported results were from the primary column, were above the reporting limit, and were qualified with J as estimated.

Minor Findings:

Sediment samples metals analysis: Continuing calibration blanks (CCBs) were below the detection limits except for copper, lead, chromium, cobalt, nickel, zinc, aluminum, iron, sodium, and magnesium. The analytes detected in the CCBs were low concentrations compared to the high sample concentrations, which resulted in minimal sample bias; therefore, no qualification was required on the basis of CCB contamination.

Sediment samples dioxin analysis: The laboratory narrative/report stated that sample EMC 15 exhibited internal standard recoveries that were outside QC limits; however, since the internal standard signal-to-noise ratios were sufficient, no qualifications were added based on internal standard recoveries.

Tissue samples organochlorine pesticides analysis: Surrogate decachlorobiphenyl recovery was below laboratory criteria but within USEPA SOP HW-36A criteria for tissue sample EBU4 2-1; therefore, no qualification was required.)

COMMENTS:

Data for percent solids for sediment samples were provided only in the dioxin data package. Data for lipids analyses for tissue samples were not provided.

No EDD was provided for this report; therefore, annotated copies of data tables are attached that specify the qualification of results.

Reviewer Name(s): **Joanna Christopher**

Date: **8/23/2016**

Approver Name: **Marcia M. Galloway**

Affiliation: **Ecology and Environment, Inc.**

Data Qualifier Definitions (National Functional Guidelines)			
Qualifier Symbol	**Explanation**		
	INORGANICS	**ORGANICS**	**CHLORINATED DIOXIN/FURAN**
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted CRQL for sample and method	The analyte was analyzed for but not detected. The value preceding the "U" may represent the adjusted Contract Required Quantitation Limit (see DLM02.X, Exhibit D, Section 1.2 and Table 2), or the sample specific estimated detection limit (EDL, see Method 8290A, Section 11.9.5).
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to an issue with the quality of the data generated because certain QC criteria were not met, or the concentration of the analyte was below the adjusted CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	-	
J−	The result is an estimated quantity, but the result may be biased low.		
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.	The analyte was not detected (see definition of "U" flag, above). The reported value should be considered approximate.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
N		*The analysis indicates the presence of an analyte for which there is presumptive evidence to make a “tentative identification”.*	
NJ		The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	
C		This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).	
X		This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.	

ANALYSIS: METALS

Metals 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. Metals sample results were not qualified on this basis.

Tissue samples: The samples were received into the lab at 0°C for processing. No qualifications were added based on sample preservation or holding times.

Metals 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the metals on the Inorganic TAL. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory narrative/report stated that the calibrations met laboratory acceptance criteria. No qualification was added on the basis of calibration.

Tissue samples: The laboratory narrative/report stated that the samples were analyzed against a three level calibration curve. The correlation coefficient for all of the curves was 0.999 or better. The samples were diluted 1:9 - 1:99 to obtain concentrations within the calibration curve. No qualification was added on the basis of calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory narrative/report stated that all continuing calibration verifications (CCVs) were within the ± 10% limits. All continuing calibration blanks (CCBs) were below the detection limits except for copper, lead, chromium, cobalt, nickel, zinc, aluminum, iron, sodium, and magnesium. The analytes detected in the CCBs were low concentrations compared to the high sample concentrations, which resulted in minimal sample bias; therefore, no qualification was required on the basis of CCB contamination.

Tissue samples: The laboratory narrative/report stated that CCVs were within the ± 10% limits. No qualification was added on the basis of continuing calibration.

Metals 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Data were not provided to evaluate method blanks. No problems were noted in the case narrative/report. No qualifications were added based on blank contamination.

Tissue samples: Chromium, copper, nickel, zinc, barium, cobalt, iron, and manganese were detected in method blanks at low concentrations. Associated sample detected results <5x the blank result were qualified with U as nondetect and the detection limit was elevated to the sample result.

Metals 4. INTERFERENCE CHECK SAMPLE

The Interference Check Sample (ICS) verifies the analytical instrument's ability to overcome interferences typical of those found in samples. The laboratory should have analyzed and reported ICS results for all elements being reported from the analytical run and for all interferents (target and non-target) for these reported elements. The ICS consists of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents. Results for the analysis of ICS Solution must fall within the control limits of ± 20% or ±CRQL (whichever is greater) of the true value for the analytes and interferents included in the solution. If results that are ≥ MDL are observed for analytes that are not present in the ICS solution, the possibility of false positives exists. If negative results are observed for analytes that are not present in the ICS solution, and their absolute value is ≥ MDL, the possibility of false negatives in the samples exists. In general, ICP sample data can be accepted if the concentrations of Al, Ca, Fe, and Mg in the sample are found to be less than or equal to their respective concentrations in the ICS. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: Data were not provided to evaluate ICS recoveries. No problems were noted in the case narrative/report. No qualification was needed on the basis of ICS recoveries.

Metals 5. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

Sediment samples: MS/MSD analyses were performed for sediment sample EMC 4. All analytes in the MS were within the method range for analyte recovery of 75-125% except for antimony (Sb) in the matrix spike. The low recovery of antimony is due to the digestion methodology requiring the use of nitric acid. Recovery was below control limits; therefore, the parent sample result was qualified with J - as estimated with a low bias.

Tissue samples: The MS for EBU2 3-1 for Be, Cd, Co, Mn, Ni, and Zn was within the 75 – 125% method range and all other elements were below the range; therefore, the parent sample results for those metals were qualified with J – as estimated with a low bias or UJ as estimated nondetect. The MS for EBU4 4-1 for As, Cu, Mn, Pb, Sb, and Zn were within the 75 – 125% method range and all other elements were outside of the range; therefore, the parent sample results for those metals were qualified with J + as estimated with a high bias or UJ as estimated nondetect. (Note: Post digest duplicates and spikes were a better indicator of instrument performance for the tissue samples and were analyzed for samples EBU2 3-1 and EBU4 4-1. For EBU2 3-1, the RPD for all elements was < 20% and the post digest spike for all elements was within the 75 – 125% method range. For EBU4 4-1, the RPD for all elements was < 20% except for Al and Zn and the post digest spike for all elements was within the 75 – 125% method range except for Zn.)

Metals 6. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Sediment samples: MS/MSD analyses were performed with acceptable precision; therefore, the parent sample results were not qualified on the basis of duplicate precision.

Tissue samples: Because the tissue sample replicates were three separate samples versus a split composite, many of the RPDs were not within the 20% limits. The RPDs for EBU2 3-1 were < 20% for Al, Ag, Be, Cd, Cu, Na, and Se and all other elements were > 20%. The RPDs for EBU4 4-1 were < 20% for As, Ag, Cu, Mg, and Tl and all other elements were > 20%. The RPD criteria for sediment samples in USEPA SOP HW-3a was also applied to the tissue samples, 35% ≤ RPD ≤ 120 were qualified with a J as estimated; nondetect results were not qualified.

Metals 7. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Sediment and tissue samples: Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Metals 8. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%, except for Sb and Ag which must fall within the control limits of 50-150%. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: LCS recoveries were acceptable. No qualification was needed on the basis of LCS recoveries.

Metals 9. ICP SERIAL DILUTION

The serial dilution of samples quantitated by Inductively Coupled Plasma determines whether or not significant physical or chemical interferences exist due to sample matrix. If the analyte concentration is sufficiently high [concentration in the original sample is > 50 times (50x) the

MDL, the %D between the original determination and the serial dilution analysis (a five-fold dilution) after correction for dilution shall be less than 10 (15-120% for soils/sediments). For a serial dilution analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the serial dilution sample.

Sediment and tissue samples: Data were not provided to evaluate serial dilution criteria. No problems were noted in the laboratory narrative or report. No qualification was needed on the basis of serial dilution recovery.

Metals 10. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

ANALYSIS: MERCURY

Mercury 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time, pH (aqueous samples), or cooler temperature are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (28 days) and pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects (sample quantitation limits) will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. Mercury sample results were not qualified on this basis.

Tissue samples: The samples were received into the lab at 0 °C for processing. No qualifications were added based on sample preservation or holding times.

Mercury 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for mercury. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be employed to establish the analytical curve. At least one of the calibration standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The calibration curves for mercury shall possess a correlation coefficient of ≥ 0.995 to ensure the linearity over the calibrated range. The percent differences calculated for all of the non-zero standards must fall within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. All sample results shall be reported from an analysis within the calibrated range. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

Tissue samples: The laboratory narrative/report stated that a seven level calibration curve was used that had correlation coefficients of 0.999. No qualifications were added based on calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for mercury by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every hour during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 85 – 115%. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report.

Tissue samples: The laboratory narrative/report stated that CCVs were within the ± 10% limits and CCBs were below the detection limits. No qualifications were added based on calibration.

Mercury 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

Mercury 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

Sediment samples: MS/MSD analyses were performed on sediment sample EBU 5 with acceptable accuracy and precision. No qualifiers were added on the basis of MS/MSD.

Tissue samples: MS/MSD analyses were performed on tissue sample EBU1 1- with acceptable accuracy and precision. No qualifiers were added on the basis of MS/MSD.

Mercury 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Sediment and tissue samples: MS/MSD analyses were performed with acceptable precision; a matrix duplicate analysis was performed with acceptable precision for tissue sample EBU1 1-1; therefore, the parent sample results were not qualified on the basis of duplicate precision.

Mercury 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Sediment and tissue samples: Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Mercury 7. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

ANALYSIS: ORGANOCHLORINE PESTICIDES

Pest 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. The laboratory report did not specify which samples were received above 6 °C; therefore, sample detect results for those samples were qualified with J as estimated and non-detect results were qualified with UJ as estimated non-detect.

Tissue samples: The samples were received into the lab at 0°C for processing. No qualifications were added based on sample preservation or holding times.

Pest 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: The laboratory narrative/report stated that surrogate recoveries were within control limits. No qualifications were added based on surrogate recoveries. (Note: Surrogate decachlorobiphenyl was below laboratory criteria but within USEPA SOP HW-36A criteria for tissue sample EBU4 2-1; therefore, no qualification was required.)

Pest 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

Sediment samples: MS/MSD analyses were performed for sediment sample EMC 4. The matrix spike/matrix spike duplicate (MS/MSD) for sample 115078 (EMC 4) was within control limits for all compounds except for low recoveries of aldrin, d-BHC, and a-BHC. The recovery for DDE was 0% and 13%. The sample concentrations for DDE were significantly higher than spiked amounts resulting in erratic recoveries for these analytes; therefore, for the parent sample, results for those compounds were nondetects and were already qualified with UJ as estimated non-detect due to sample receipt temperature. No further qualification was required.

Tissue samples: MS/MSD analyses performed for tissue sample EBU3 2-1 were within laboratory control limits except for D-BHC in the MS (recovery = 27.2%) and Heptachlor Epoxide in the MS and MSD which (recovery of 33.7% and 34.7%, respectively -- the laboratory control limits range from 40-140%; MS/MSD precision was outside control limits as well). The parent sample results were nondetects and were qualified with UJ as estimated nondetect for those analytes.

Pest 4. Laboratory Control Samples (LCS):
The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

Sediment and tissue samples: The case narrative/report stated that LCS accuracy was within laboratory control limits. No qualifications were added based on LCS recoveries.

Pest 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

Sediment and tissue samples: The laboratory narrative/report stated that no analytes were detected in the method blank. No data qualification was required based on blank contamination. .

Field blank contamination:

Sediment and tissue samples: No field blank was collected.

Pest 6. CALIBRATION:
Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Initial Calibration and %RSD:
Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent RSD must be:

< 20.0% for single component target compounds except alpha-BHC and delta-BHC.
< 25.0% for alpha-BHC and delta-BHC.
< 30.0% for Toxaphene peaks.
< 30.0% for surrogates (tetrachloro-m-xylene and decachlorobiphenyl).

A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Continuing Calibration and %D:
Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Pest 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

Pest 8. FIELD DOCUMENTATION:

No problems were identified.

Pest 9. OTHER PROBLEMS:

%D PRIMARY/SECONDARY COUMN

Sediment samples: The Pesticide Sediment Summary Report Table 1 indicates that %D on two columns was >40% for PPDDE for samples EBU 3 and EBU 5. The results were already qualified with J based on sample preservation.

Tissue samples: The Pesticide Tissue Summary Report Table 1 indicates the %D on two columns was >40% for PPDDE for the samples except EBU1 1-2, EBU1 1-4, EBU3 3-1, and EBU5 5-1. The reported results were from the primary column, were above the reporting limit, and were qualified with J as estimated.

PERCENT SOLIDS

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

Pest 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

Sediment and tissue samples: None.

ANALYSIS: PCBs

PCB 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. The laboratory report did not specify which Samples were received above 6 □C; therefore, sample detect results for those samples were qualified with J as estimated and non-detect results were qualified with UJ as estimated non-detect.

Tissue samples: The samples were received into the lab at 0°C for processing. No qualifications were added based on sample preservation or holding times.

PCB 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: The laboratory narrative/report stated that surrogate recoveries were within control limits. No qualifications were added based on surrogate recoveries.

PCB 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

Sediment samples: MS/MSD analyses were performed for aroclors for sediment sample EMC 4 QA. The recoveries for PCB1016 in sample 115018 (EMC 4 QA)-matrix spike and matrix spike duplicate (MS/MSD) were 161% and 164%, which exceeded the laboratory QC limit of 140%; therefore, for the parent sample, the result was nondetect and was previously qualified with UJ as estimated non-detect due to sample receipt temperature; no further qualification was required.

MS/MSD analyses were performed for congeners for sediment sample EMC 4. No MS/MSD recoveries were reported for congeners 18, 31, 44, 49, and 52 because sample concentrations were significantly higher than spiked amounts resulting in erratic recoveries for these analytes; therefore, for the parent sample, the results were previously qualified with J as estimated due to sample receipt temperature and no further qualification was required.

Tissue samples: MS/MSD analyses performed for tissue sample EBU2 1-1 were within laboratory control limits except for congener 138 which had a RPD of 67.3%; therefore, the parent sample result was qualified with J as estimated.

PCB 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

Sediment samples: The laboratory narrative/report stated that LCS/LCSD precision and accuracy were within laboratory control limits. No qualifications were added based on LCS recoveries.

Tissue samples: All LCS recoveries and RPDs were within laboratory control limits except for no spike recovery due to matrix interferences for congener 187 in LCS 2; therefore, no sample results were reported for congener 187 (result = NR); no qualification was added on the basis of LCS recovery.

PCB 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

Sediment and tissue samples: No PCB aroclors or congeners were detected in method backs. No data qualifications were needed on the basis of blank contamination.

Field blank contamination:

Sediment and tissue samples: No field blank was collected.

PCB 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. 2nd Order Non Linear calibration model is used. The Calibration Verification checks document that the instrument is giving satisfactory daily performance.

Correlation coefficient R^2 and Percent RSD:

For the initial calibration, if the value of the correlation coefficient R^2 is below 0.99 for any PCB or any surrogate or if the %RSD of the CFs for the three to five major peaks of each of the Aroclor compounds and the two surrogates must be less than or equal to 20.0% If not, qualify all associated positive results "J" and non-detects "UJ". Qualifiers are applied based on primary column calibration only.

Sediment samples: The laboratory narrative/report stated that the calibration for congener 77 had a RSD of 27.1% on the SPB-octyl column; however, the analyte had a linear coefficient of 0.994. Therefore, the reported values that were at or below the response of the low standard were manually calculated. No qualifications were added based on calibration.

Tissue samples: The laboratory narrative/report stated that in the PCB congener analysis, the lowest standard was not used for some of the analytes, which is reflected in the reported detection limits. The calibration curve analyzed on 12 December 2003 had an average RSD of <20% or a r2 >0.99 for all analytes on both columns except for congener 70 which had a RSD of 21.2% on the SPB column. Congener 70 is not reported for the samples; elevated reporting limits are provided for the affected analytes. Linear calibration was used for congeners 77 and 101 and the reported values that were at or below the response of the low standard were manually calculated. No qualifiers were added on the basis of linear calibration.

Percent Drift (%Drift):

For the Calibration Verification checks, if Percent Drift exceeds 15% for any PCB or any surrogate, qualify all associated positive results “J” and non-detects “UJ”. Qualifiers are applied based on primary column calibration only.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

PCB 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

PCB 8. FIELD DOCUMENTATION:

No problems were identified.

PCB 9. OTHER PROBLEMS:

PERCENT SOLIDS

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

DUPLICATES

Sediment samples: All MS/MSD RPDs were <40%. A sample duplicate was extracted and analyzed for site EMC 4 with RPD <40% for all detectable analytes present in the sample. All LCS recoveries and RPDs were within laboratory limits.

Tissue samples: MS/MSD analyses performed for tissue sample EBU2 1-1 were within laboratory control limits except for congener 138 which had a RPD of 67.3%; therefore, the parent sample result was qualified with J as estimated.

COELUTION

Sediment samples: The laboratory narrative/report stated that no data were reported for congeners 15, 87, 153, 171, 159, and 86 due to coelutions with other congeners on both columns. Congener 97 is reported as a total of 86 and 97. Congener 101 is reported as a total of 101 and 90. Congeners flagged with a C are estimated values because they co-elute with other congeners on one of the columns and were qualified with J as estimated. The presence of the congener is confirmed but the concentration is not confirmed due to the co-elution.

Tissue samples: The laboratory narrative/report stated that no data were reported for congeners 15, 141, 153, 156, 159, 171, and 187 due to coelutions with other congeners on both columns except for samples that were at or below the laboratory reporting limit. Congener 101 is reported as a total of 101 and 90, and congener 97 is reported as a total of 97 and 86. Congeners flagged with a C are estimated values because they coelute with other congeners on one of the columns and were qualified with J as estimated. The presence of the congener is confirmed but the concentration is not due to the coelution.

%D PRIMARY/SECONDARY COUMN

Tissue samples: The PCB Congener Tissue Summary Report Table 2 indicates the %D on two columns was >40% for several samples by flagging with a #. The reported results were from the primary column, were above the reporting limit, and were qualified with J as estimated.

PCB 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

Sediment and tissue samples: None.

ANALYSIS: DIOXIN

Dioxin 1. HOLDING TIME :

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sediment samples: Samples were received initially by the laboratory EPC-Omaha before shipment to STL Knoxville at temperatures ranging from 6 to 15 °C, above the limit specified USEPA Region II Data validation SOP HW-19; therefore, sample detect results for those samples were qualified with J as estimated and non-detect results were qualified with UJ as estimated non-detect.

Dioxin 2. INTERNAL STANDARDS

All samples are spiked with internal standard compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured internal standards concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory narrative/report stated that sample EMC 15 exhibited internal standard recoveries that were outside QC limits (40-135%). The value for 13C-OCDD in sample EMC-15 was 38%. The 10:1 internal standard signal-to-noise ratio criterion was met in all cases. When properly applied, results from isotope dilution analyses are independent of internal standard percent recoveries. Therefore, since the internal standard signal-to-noise ratios were sufficient, the analysis results are not adversely affected and no qualifications were added based on internal standard recoveries.

Dioxin 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

Sediment samples: MS/MSD analyses were performed for sediment sample EMC 2. The MS/MSD for sample EMC 2 was outside control limits (low) for OCDF; therefore, the parent sample result was qualified with J – as estimated with a low bias.

Dioxin 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

Sediment samples: The laboratory narrative/report stated that LCS accuracy was within laboratory control limits. No qualifications were added based on LCS recoveries.

Dioxin 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the

analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

Sediment samples: Low levels of 1,2,3,7,8-PeCDD, Total PeCDD, OCDD, 2,3,4,7,8-PeCDF, Total PeCDF, 1,2,3,4,7,8-HxCDF, 1,2,3,6,7,8-HxCDF, Total HxCDF, 1,2,3,4,6,7,8-HpCDF, Total HpCDF, and OCDF were detected in the method blank. Associated sample results that were less than 5x the blank concentration were qualified with U as nondetect and the sample result was elevated to the detection limit. The detected compounds were below the MCLs listed on Table 1 of Method SW-846 8290A.

Field blank contamination:

Sediment samples: No field blank was collected.

Dioxin 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Sediment samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Continuing Calibration:

Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Sediment samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

Dioxin 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

Dioxin 8. FIELD DOCUMENTATION:

No problems were identified.

Dioxin 9. OTHER PROBLEMS:

COELUTION

Sediment samples: All positive 2378-TCDF results were confirmed on a DB-225 chromatography column. The analysis of the sample extract EMC-2, EMC-4, and EMC-10 on the DB-225 column exhibited co-eluting interferences which prevented accurate results. The 2378-TCDF results reported were obtained from the Rtx-5 analysis. The Rtx-5 column is not isomer specific for 2378-TCDF; therefore, the reported value for 2378-TCDF is considered the highest amount of TCDF present or estimated maximum possible concentration (EMPC). Analyte concentrations qualified by the laboratory with Q as an EMPC were qualified with J as estimated.

SUPPRESSION

Sediment samples: Analytes qualified by the laboratory with “S” may have exhibited ion suppression of the analytical signal due to a matrix interference; therefore, the results were qualified with a J – as estimated with a low bias.

PERCENT SOLIDS

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

Dioxin 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

Sediment samples: None.

ANALYSIS: GENERAL CHEMISTRY

General Chemistry 1. HOLDING TIME AND PRESERVATION
The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Samples were received by the laboratory at temperatures ranging from 6 to 15 °C. TOC and particle size analysis sample results were not qualified on this basis.

Tissue samples: The samples were received into the lab at 0°C for processing. No qualifications were added based on sample preservation or holding times.

General Chemistry 2. CALIBRATION
Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the target analytes. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION
A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report. No qualification was added on the basis of calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION
Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report. No qualification was added on the basis of calibration.

General Chemistry 3. BLANK CONTAMINATION
QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse

blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

General Chemistry 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

Sediment and tissue samples: No spikes were analyzed for these analyses.

General Chemistry 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Sediment samples: Laboratory sample duplicate analyses were performed for sediment sample EBU 5 with acceptable precision. No qualification was required on the basis of duplicate precision.

Tissue samples: No information was provided about duplicate analyses for lipids analysis. No qualification was added on the basis of duplicate precision.

General Chemistry 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Sediment and tissue samples: Field duplicate samples were not submitted.

General Chemistry 7. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: All LCS analytes were within control limits.

Tissue samples: No information was provided about LCS recoveries for lipids analyses. No qualification was added on the basis of LCS results.

General Chemistry 8. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

ACROYMN LIST

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. Percent moisture results were included in the dioxin analysis report. Samples EMC 2, EMC 3, EMC 4, EMC 5, EMC 7, EMC 8, EMC 9, EMC 10, EMC 12, EMC 13, and EMC 15 were < 50% solids; affected sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

ACROYMNS

TCL	–	Target Compound List
RPD	–	Relative Percent Difference
%D	–	Percent Difference
LCS	–	Laboratory Control Sample
%R	–	Percent Recovery
CCC	–	calibration check compound
CCV	–	Continuing Calibration Verification
CRQL		Contract Required Quantitation Limit
DQO	–	data quality objective
EDD	–	electronic data deliverable
EPA	–	(United States) Environmental Protection Agency
EQM	–	Environmental Quality Management, Inc.
FSP	–	Field Sampling Plan
GLLA	–	Great Lakes Legacy Act
GLSED	–	Great Lakes Sediment Database
GPS	–	global positioning system
ICS		Interference Check Sample
ICV		Initial Calibration Verification
ID	–	Inner Diameter
MDL	–	Method detection limit
mm	–	millimeters
NELAC		National Environmental Laboratory Accreditation Conference
PCB	–	polychlorinated biphenyl
ppm	–	parts per million
PQL	–	project quantitation limit
QA/QC	–	Quality assurance/quality control
QAPP	–	Quality Assurance Project Plan
RRF		Relative response factor
SOP	–	standard operating procedure
TAL		Target Analyte List
TCLP	–	toxicity characteristic leaching procedure
TOC	–	Total organic carbon
TSCA	–	Toxic Substances Control Act

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EXECUTIVE NARRATIVE

Project ID: USACE 2010
Site: Eighteenmile Creek Superfund Site OU3

Laboratory SDG No.: *0092802 and 0102702*
Laboratory: The U.S. Army Corps of Engineers, Engineer Research and Development Center, Environmental Laboratory Environmental Processes Chemistry Branch (EPC) and Environmental Processes Risk Assessment Branch (EPR)

Number of Samples	Matrix	Sampling dates	Analysis
60	Tissue	9/13/10, 9/14/10, 9/15/10, 9/21/10, 9/27/10, and 9/29/10	Polychlorinated Biphenyls, Aroclors – EPA Method 8082 % Lipids
16	Sediment	10/26/10	Polychlorinated Biphenyls, Aroclors – EPA Method 8082 Total Organic Carbon – EPA Method 9060 Percent Solids
2	QA	10/26/10	Polychlorinated Biphenyls, Aroclors – EPA Method 8082

QAPP: Field Sampling Plan: Eighteen Mile Creek Fish Collection for Tissue Contaminant Analysis
Work Plan. Sediment Sampling for Contaminant Analysis in the Eighteenmile Creek AOC

HWSS #: Not applicable.

Contractor Document: Memo, 03 February 2011, RE: Gustavson Great Lakes, from Patty Tuminello

SUMMARY:

The most current version of the USEPA Region II Data Validation SOPs were used for guidance. The data were evaluated against the analytical method requirements.

Critical: Results have an unacceptable level of uncertainty and should not be used for making decisions. Data has been qualified "R" rejected.

Major: A level of uncertainty exists that may not meet the data quality objectives for the project. A bias is likely to be present in the results. Data has been qualified "J" estimated.

Minor: The level of uncertainty is acceptable. No significant bias in the data was observed.

Critical Findings:
None.

Major Findings:
Sediment samples: Sample results were reported based on dry weights. All samples except EMC – 13, EMC – 14, EMC – 15, and EMC - 16 were < 50% solids; affected PCB and TOC sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Surrogate recoveries for Decachlorobiphenyl for 23 samples were outside laboratory limits. Recoveries for 11 samples were above SOP HW-37A control limits; therefore, the detected target compounds were qualified with J + as estimated with a high bias and the nondetects were not qualified for samples A1R3 - BB2, A1R3 - BB1, A1R1 - LMB10, A2R2 - LMB10, A2R1 - LMB3, A2R2 - BB4, A2R2 - BB8, A1R3 - LMB6, A2R2 - BB5, A2R2 - LMB6, and A2R2 - LMB8.

Minor Findings:

Sediment samples: Surrogate recoveries for 2,4,5,6 Tetrachloro-m-xylene for three samples were below laboratory control limits but within USEPA Region II SOP HW-37A control limits; recovery for Decachorobiphenyl for one sample was above laboratory control limits but within USEPA Region II SOP HW-37A control limits; therefore, no qualifications were added based on surrogate recoveries.

Tissue samples: Surrogate recoveries for Decachlorobiphenyl for 23 samples were outside laboratory limits; 12 of those recoveries were within USEPA Region II SOP HW-37A control limits; therefore, no qualifications were added for those samples based on surrogate recoveries.

COMMENTS:

None.

Reviewer Name(s): Joanna Christopher

Date: 8/25/2016

Approver Name: Marcia M. Galloway

Affiliation: Ecology and Environment, Inc.

Data Qualifier Definitions (National Functional Guidelines)

Qualifier Symbol	Explanation		
	INORGANICS	**ORGANICS**	**CHLORINATED DIOXIN/FURAN**
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted CRQL for sample and method	The analyte was analyzed for but not detected. The value preceding the "U" may represent the adjusted Contract Required Quantitation Limit (see DLM02.X, Exhibit D, Section 1.2 and Table 2), or the sample specific estimated detection limit (EDL, see Method 8290A, Section 11.9.5).
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to an issue with the quality of the data generated because certain QC criteria were not met, or the concentration of the analyte was below the adjusted CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	-	
J−	The result is an estimated quantity, but the result may be biased low.		
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.	The analyte was not detected (see definition of "U" flag, above). The reported value should be considered approximate.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
N		*The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".*	
NJ		The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	
C		This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).	
X		This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.	

ANALYSIS: PCBs

PCB 1. HOLDING TIME :

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sediment and tissue samples: Data were not provided to evaluate sample receipt criteria. No qualifications were added based on sample preservation or holding times.

PCB 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Sediment samples: Surrogate recoveries for 2,4,5,6 Tetrachloro-m-xylene for three samples were below laboratory control limits but within USEPA Region II SOP HW-37A control limits; recovery for Decachorobiphenyl for one sample was above laboratory control limits but within USEPA Region II SOP HW-37A control limits; therefore, no qualifications were added based on surrogate recoveries.

Tissue samples: Surrogate recoveries for Decachlorobiphenyl for 23 samples were outside laboratory limits; 12 of those recoveries were within USEPA Region II SOP HW-37A control limits; therefore, no qualifications were added for those samples based on surrogate recoveries. Recoveries for 11 samples were above SOP HW-37A control limits; therefore, the detected target compounds were qualified with J + as estimated with a high bias and the nondetects were not qualified for samples A1R3 - BB2, A1R3 - BB1, A1R1 - LMB10, A2R2 - LMB10, A2R1 - LMB3, A2R2 - BB4, A2R2 - BB8, A1R3 - LMB6, A2R2 - BB5, A2R2 - LMB6, and A2R2 - LMB8.

PCB 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

Sediment and tissue samples: MS/MSD analyses were not performed for aroclors.

PCB 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

Sediment and tissue samples: LCS/LCSD precision and accuracy were within laboratory control limits. No qualifications were added based on LCS results.

PCB 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

Sediment and tissue samples: No PCB aroclors were detected in method blanks. No data qualifications were needed on the basis of blank contamination.

Field blank contamination:

Sediment and tissue samples: No field blank was collected.

PCB 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. 2nd Order Non Linear calibration model is used. The Calibration Verification checks document that the instrument is giving satisfactory daily performance.

Correlation coefficient R^2 and Percent RSD:

For the initial calibration, if the value of the correlation coefficient R^2 is below 0.99 for any PCB or any surrogate or if the %RSD of the CFs for the three to five major peaks of each of the Aroclor compounds and the two surrogates must be less than or equal to 20.0% If not, qualify all associated positive results "J" and non-detects "UJ". Qualifiers are applied based on primary column calibration only.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report. No qualification was added on the basis of calibration.

Percent Drift (%Drift):

For the Calibration Verification checks, if Percent Drift exceeds 15% for any PCB or any surrogate, qualify all associated positive results “J” and non-detects “UJ”. Qualifiers are applied based on primary column calibration only.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the case narrative/report. No qualifications were added based on calibration.

PCB 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

PCB 8. FIELD DOCUMENTATION:

No problems were identified.

PCB 9. OTHER PROBLEMS:

PERCENT SOLIDS

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. All samples except EMC – 13, EMC – 14, EMC – 15, and EMC - 16 were < 50% solids; affected TOC sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

DUPLICATES

Sediment and tissue samples: All LCS recoveries and RPDs were within laboratory control limits. All field duplicate RPDs were within control limits.

PCB 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

Sediment and tissue samples: None.

ANALYSIS: GENERAL CHEMISTRY

General Chemistry 1. HOLDING TIME AND PRESERVATION
The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: Data were not provided to evaluate initial sample receipt criteria. No qualifications were added based on sample preservation or holding times. Samples were received by the laboratory at 7 °C for reanalysis with results reported as mg/kg. No qualifications were added based on sample preservation or holding times.

Tissue samples: Data were not provided to evaluate sample receipt criteria. No qualifications were added based on sample preservation or holding times.

General Chemistry 2. CALIBRATION
Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the target analytes. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION
A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report. No qualification was added on the basis of calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: Data were not provided to evaluate calibration criteria. No problems were noted in the laboratory narrative or report. No qualification was added on the basis of calibration.

General Chemistry 3. BLANK CONTAMINATION
QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the

analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

Sediment and tissue samples: No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

General Chemistry 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

Sediment and tissue samples: No spikes were analyzed for these analyses.

General Chemistry 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Sediment samples: Laboratory sample duplicate analyses were not performed for sediment samples. No qualification was required on the basis of duplicate precision.

Tissue samples: Laboratory sample duplicate analyses were performed for tissue samples A1R3 – BB2, A2R2 – PKN1, A1R2 – LMB3, A2R2 – BB8, and A2R2 – LMB4 for lipids analysis with acceptable precision. No qualification was added on the basis of duplicate precision.

General Chemistry 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Sediment samples: Field duplicate samples submitted for samples EMC-4 and EMC-12 were analyzed with acceptable precision.

Tissue samples: Field duplicate samples were not submitted.

General Chemistry 7. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%. Qualifications were applied to the samples and analytes as shown below.

Sediment samples: No information was provided about LCS recoveries for TOC or % solids analyses. No qualification was added on the basis of LCS results.

Tissue samples: No information was provided about LCS recoveries for lipids analyses. No qualification was added on the basis of LCS results.

General Chemistry 8. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Sediment samples: The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Sample results were reported based on dry weights. All samples except EMC – 13, EMC – 14, EMC – 15, and EMC - 16 were < 50% solids; affected TOC sample results were qualified with J as estimated or UJ as estimated nondetect on the basis of percent solids.

Tissue samples: Not applicable; results were reported with respect to wet weight.

ACROYMNS

TCL – Target Compound List
RPD – Relative Percent Difference
%D – Percent Difference
LCS – Laboratory Control Sample
%R – Percent Recovery
CCC – calibration check compound
CCV – Continuing Calibration Verification
CRQL Contract Required Quantitation Limit
DQO – data quality objective
EDD – electronic data deliverable
EPA – (United States) Environmental Protection Agency
EQM – Environmental Quality Management, Inc.
FSP – Field Sampling Plan
GLLA – Great Lakes Legacy Act
GLSED – Great Lakes Sediment Database
GPS – global positioning system
ICS Interference Check Sample
ICV Initial Calibration Verification
ID – Inner Diameter
MDL – Method detection limit
mm – millimeters
NELAC National Environmental Laboratory Accreditation Conference
PCB – polychlorinated biphenyl
ppm – parts per million
PQL – project quantitation limit
QA/QC – Quality assurance/quality control
QAPP – Quality Assurance Project Plan
RRF Relative response factor
SOP – standard operating procedure
TAL Target Analyte List
TCLP – toxicity characteristic leaching procedure
TOC – Total organic carbon
TSCA – Toxic Substances Control Act

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EXECUTIVE NARRATIVE

Project ID: USACE 2013
Site: Eighteenmile Creek Superfund Site OU3

Laboratory SDG No.: ***1308870***
Laboratory: *RTI Laboratories, Inc.*

Number of Samples	Matrix	Sampling dates	Analysis
9	Sediment	8/20/13 8/21/13	Metals – EPA Method 3050B/6010C Mercury – EPA Method 7471A Semi-Volatile Organic Compounds (PNAs) – EPA Methods 3550C/8270D Organochlorine Pesticides - EPA Method 3550C/8081B Polychlorinated Biphenyls – EPA Methods 3550C/8082A Total Organic Carbon – EPA Method 9060A Total Cyanide – EPA Method 9012B Hexane Extractable Materials (Oil and Grease) – EPA Methods 3540C/9071B Total Phosphorus – Standard Methods 4500-P-F Percent Moisture – ASTM D2216 Total Kjeldahl Nitrogen – EPA Method 351.2 Ammonia-Nitrogen – EPA Method 350.1 Particle Size (with Hydrometer) – ASTM D422
0	QA	N/A	No field duplicates or splits. Laboratory QC samples were analyzed.

QAPP: No QAPP was provided
HWSS #: Not applicable.
Contractor Document : Olcott Harbor, Niagara County, New York – 4- CFR 230.11 (d) Contaminant Determinations, 21 November 2013

SUMMARY:

The most current version of the USEPA Region II Data Validation SOPs were used for guidance. The data were evaluated against the analytical method requirements.

Critical: Results have an unacceptable level of uncertainty and should not be used for making decisions. Data has been qualified “R” rejected.

Major: A level of uncertainty exists that may not meet the data quality objectives for the project. A bias is likely to be present in the results. Data has been qualified “J” estimated.

Minor: The level of uncertainty is acceptable. No significant bias in the data was observed.

EXECUTIVE NARRATIVE (continued)

Critical Findings: No critical findings.
Major Findings:
Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ) except Percent Moisture and Particle Size (with Hydrometer).

Three arsenic results (samples OLC-2 and OLC-3) were qualified with U as non-detect and the detection limit was elevated to the sample result value; one arsenic result was qualified with U as non-detect and the reporting limit was elevated to the sample result (sample OLC-1) due to method blank contamination.

The iron, cadmium, and thallium results for sample OLC-2 was qualified with J as estimated due to MS/MSD/PDS recoveries.

Several semivolatile compounds were qualified with J+ as estimated with a high bias for samples OLC-1, OLC-2, OLC-3, OLCR-1, OLCD-1, and OLCD-2 due to high surrogate recovery.

Several semivolatile compounds were qualified with J+ as estimated with a high bias for sample OLC-1 due to high MS/MSD recoveries.

Several semivolatile compounds were qualified with J+ as estimated with a high bias for associated samples due to high LCS recoveries.

Several semivolatile compounds were qualified with J as estimated for associated samples due to high %Ds for CCVs.

The total phosphorus result for sample OLC-1 was qualified with J as estimated due to MS/MSD recoveries.

The particle size result for sample OLC-1 for the analyte “clay” was qualified with J as estimated due to laboratory duplicate precision.

Minor Findings:
The cooler containing samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP was received at a temperature of 6.5 °C (0.5 °C above the required temperature); however, the sample receipt checklist documented that the client approved the temperature; therefore, this slight temperature excursion is considered acceptable and no qualifiers were added on this basis.

Aluminum, arsenic, barium, calcium, copper, iron, magnesium, manganese, sodium, and zinc were detected in the method blank for sediment samples (MB-30675). The concentrations of those metals in the associated samples were greater than 10x the blank result; therefore, no qualifiers were added based on blank contamination.

MS/MSD and/or PSD recoveries for sediment sample OLC-2 for the metals aluminum, calcium, cobalt, magnesium, manganese, potassium, selenium, and zinc were outside control limits for the MS/MSD and/or post digestion spike (PDS); however, for various reasons, no qualification was required.

For surrogate decachlorobiphenyl, recoveries were above laboratory control limits and within the control limits stated in USEPA Region II Data Validation SOP HW-36A; therefore, no qualification was needed on the basis of surrogate recovery.

COMMENTS: *The sample bottles were delivered without custody seals on them. Three Sample bottles were received with cracked lids, which the laboratory replaced upon receipt: OLC-1 (two bottles) and OLCR-2 (one bottle). The organochlorine pesticide compounds chlordane and toxaphene were not included in the LCS* *spiking solution; however, the ICV and CCV results for those compounds were acceptable; therefore, no data qualification was required on the basis of the LCS.*

Reviewer Name(s): Joanna Christopher

Date: 8/4/2016

Approver Name: Marcia M. Galloway

Affiliation: Ecology and Environment, Inc.

Data Qualifier Definitions (National Functional Guidelines)			
Qualifier Symbol	Explanation		
	INORGANICS	ORGANICS	CHLORINATED DIOXIN/FURAN
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted CRQL for sample and method	The analyte was analyzed for but not detected. The value preceding the "U" may represent the adjusted Contract Required Quantitation Limit (see DLM02.X, Exhibit D, Section 1.2 and Table 2), or the sample specific estimated detection limit (EDL, see Method 8290A, Section 11.9.5).
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to an issue with the quality of the data generated because certain QC criteria were not met, or the concentration of the analyte was below the adjusted CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	-	
J−	The result is an estimated quantity, but the result may be biased low.		
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.	The analyte was not detected (see definition of "U" flag, above). The reported value should be considered approximate.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
N		*The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".*	
NJ		The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	
C		This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).	
X		This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.	

ANALYSIS: METALS

Metals 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Metals 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the metals on the Inorganic TAL. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of continuing calibration verifications.

Metals 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

The associated preparation blank analyte results are greater than or equal to MDLs but less than reporting limits for: Aluminum, Arsenic, Barium, Calcium, Copper, Iron, Magnesium, Manganese, Sodium, and Zinc in method blank for sediment samples (MB-30675).

- Aluminum, barium, calcium, copper, iron, magnesium, manganese, sodium, and zinc results were greater than 10x the blank result; therefore, no qualifiers were added.
- Arsenic results greater than 10x the blank result were not qualified; results below the reporting limit (samples OLC-2 and OLC-3) were qualified with U as non-detect and the detection limit was elevated to the result value; result above the reporting limit was qualified with U as non-detect and the reporting limit was elevated to the sample result (sample OLC-1).

Metals 4. INTERFERENCE CHECK SAMPLE

The Interference Check Sample (ICS) verifies the analytical instrument's ability to overcome interferences typical of those found in samples. The laboratory should have analyzed and reported ICS results for all elements being reported from the analytical run and for all interferents (target and non-target) for these reported elements. The ICS consists of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents. Results for the analysis of ICS Solution must fall within the control limits of ± 20% or ±CRQL (whichever is greater) of the true value for the analytes and interferents included in the solution. If results that are ≥ MDL are observed for analytes that are not present in the ICS solution, the possibility of false positives exists. If negative results are observed for analytes that are not present in the ICS solution, and their absolute value is ≥ MDL, the possibility of false negatives in the samples exists. In general, ICP sample data can be accepted if the concentrations of Al, Ca, Fe, and Mg in the sample are found to be less than or equal to their respective concentrations in the ICS. Qualifications were applied to the samples and analytes as shown below.

ICS recoveries were acceptable. No qualification was needed on the basis of ICS recoveries.

Metals 5. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed for sediment sample OLC-2.

- Aluminum, calcium, magnesium, manganese recoveries were outside control limits for the MS/MSD and post digestion spike (PDS); however, the parent sample concentration was greater than 4x the spike amount added; therefore, no qualification was required.
- Zinc recovery was outside laboratory control limits for the MS/MSD, within USEPA Region II Data Validation SOP limits and within laboratory control limits for the PDS; therefore, the parent sample results were not qualified.
- Iron recovery was above control limits for the MS and PDS; therefore, the parent sample result was qualified with J as estimated.
- Potassium recovery was above control limits for the MS/MSD and PDS; however, the parent sample concentration was greater than 4x the spike amount added; therefore, no qualification was required.
- Cadmium and thallium recoveries were below control limits for the MS/MSD and within limits for the PDS; therefore, the parent sample results were qualified with J as estimated.
- Cobalt and selenium recoveries were below laboratory control limits for the MS/MSD but within USEPA Region II Data Validation SOP limits and within limits for the PDS; therefore, the parent sample results were not qualified.

Metals 6. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

A laboratory control sample duplicate analysis was not performed; however, serial dilution recoveries were acceptable and precision was acceptable for MS/MSD analyses; therefore, no qualification was required on the basis of duplicate sample analysis.

Metals 7. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Metals 8. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%, except for Sb and Ag which must fall within the control limits of 50-150%. Qualifications were applied to the samples and analytes as shown below.

LCS recoveries were acceptable. No qualification was needed on the basis of LCS recoveries.

Metals 9. ICP SERIAL DILUTION

The serial dilution of samples quantitated by Inductively Coupled Plasma determines whether or not significant physical or chemical interferences exist due to sample matrix. If the analyte concentration is sufficiently high [concentration in the original sample is > 50 times (50x) the MDL, the %D between the original determination and the serial dilution analysis (a five-fold dilution) after correction for dilution shall be less than 10 (15-120% for soils/sediments). For a serial dilution analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the serial dilution sample.

Serial dilution was performed for sample OLC-2 with acceptable %Ds. No qualification was needed on the basis of serial dilution recovery.

Metals 10. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

ANALYSIS: MERCURY

Mercury 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time, pH (aqueous samples), or cooler temperature are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (28 days) and pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects (sample quantitation limits) will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Mercury 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for mercury. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be employed to establish the analytical curve. At least one of the calibration standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The calibration curves for mercury shall possess a correlation coefficient of ≥ 0.995 to ensure the linearity over the calibrated range. The percent differences calculated for all of the non-zero standards must fall within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. All sample results shall be reported from an analysis within the calibrated range. Qualifications were applied to the samples and analytes as shown below.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for mercury by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every hour during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 85 – 115%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of continuing calibration verifications.

Mercury 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

Mercury 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed on sediment sample OLC-2 with acceptable accuracy and precision. No qualification was needed on the basis of MS/MSD results.

Mercury 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Laboratory duplicate analysis precision was acceptable for the MS/MSD. No qualification was needed on the basis of MS/MSD results.

Mercury 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Mercury 7. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

ANALYSIS: SVOCs

SVOCS 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

SVOCS 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

For base/neutral surrogate compound terphenyl-d14, recoveries were above control limits for samples OLC-1, OLC-2, OLC-3, OLCR-1, OLCD-1, and OLCD-2. Associated compound results for the affected samples were qualified with J+ as estimated with a high bias and non-detects were not qualified.

SVOCS 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for sediment sample OLC-1. MS/MSD recoveries were above control limits for compounds Anthracene, Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, and pyrene. Parent sample results for those compounds were qualified with J+ as estimated with a high bias and non-detects were not qualified.

SVOCS 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS recoveries were above control limits for compounds Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo (a,h) anthracene, and Indeno(1,2,3-cd)pyrene. Associated sample results for those compounds were qualified with J+ as estimated with a high bias and non-detects were not qualified.

SVOCS 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No target analytes were detected in method blanks. No data qualifications were needed based upon blank evaluations.

Field blank contamination:

No field blank was collected.

SVOCS 6. MASS SPECTROMETER TUNING:

Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds and to some degree, sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, these criteria should be met in all circumstances. The tuning standard for semi-volatiles Decafluorotriphenyl-phosphine (DFTPP). If the mass calibration is in error, all associated data will be classified as unusable "R".

MS tuning parameters were within the acceptable ranges. No qualifications were needed based on MS tuning.

SVOCS 7. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Response Factor GC/MS:

The response factor measures the instrument's response to specific chemical compounds. The response factor for the most TCL and for SPCC compounds must be ≥ 0.05, in both the initial and continuing calibrations. The exception being the twenty-five (25) poor performing compounds which require a value < 0.01. A low RRF value indicates a serious detection and quantitation problem (poor sensitivity). Analytes detected in the sample will be qualified as estimated, "J". All non-detects for that compound will be rejected "R".

Response factors were within acceptance limits. No qualification was necessary based on RRFs.

Calibration Checks %RSD and %D:

Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. Percent RSD must be < 20% for target analytes, <30% for CCC compounds. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R". The following analytes in the sample shown were qualified for %RSD and %D:

%Ds were above control limits for CCVs S5 090413 and S5 090513 for compounds 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, and Pyrene; associated sample results for those compounds were qualified with J as estimated and non-detects were qualified with UJ as estimated non-detect.

SVOCS 8. INTERNAL STANDARDS PERFORMANCE GC/MS

Internal standards performance criteria ensure that the GC/MS sensitivity and response are stable during every experimental run. The internal standard area count must not vary by more than a factor of

2 (-50% to +100%) from the associated continuing calibration standard. The retention time of the internal standard must not vary more than 30 seconds from the associated continuing calibration standard. If the area count is outside the (-50% to +100%) range of the associated standard, all of the positive results for compounds quantitated using that IS are qualified as estimated, "J", and all non-detects as "UJ", or "R" if there is a severe loss of sensitivity. If an internal standard retention time varies by more than 30 seconds, the reviewer will use professional judgment to determine either partial or total rejection of the data for that sample fraction.

Internal standards were within acceptance limits. No qualification was necessary based on internal standard performance.

SVOCS 9. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

SVOCS 10. FIELD DOCUMENTATION: No problems.

SVOCS 11. OTHER PROBLEMS:

Percent Solids: Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

SVOCS 12. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: ORGANOCHLORINE PESTICIDES

Pest 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Pest 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

For surrogate decachlorobiphenyl, recoveries were above laboratory control limits for samples OLCR-COMP and OLCD-2. However, recoveries were within the control limits stated in USEPA Region II Data Validation SOP HW-36A; therefore, no qualification was needed on the basis of surrogate recovery.

Pest 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for sediment sample OLC-3. MS/MSD accuracy and precision were within control limits; therefore, no qualification was required on the basis of MS/MSD.

Pest 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS/LCSD accuracy and precision were within laboratory control limits. The compounds chlordane and toxaphene were not included in the LCS spiking solution; however, the ICV and CCV results for those compounds were acceptable; therefore, no data qualification was required on the basis of the LCS.

Pest 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No analytes were detected in the method blank. No data qualification was required based on blank contamination. .

Field blank contamination:

No field blank was collected.

Pest 6. CALIBRATION:
Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Initial Calibration and %RSD:
Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent RSD must be:

< 20.0% for single component target compounds except alpha-BHC and delta-BHC.
< 25.0% for alpha-BHC and delta-BHC.
< 30.0% for Toxaphene peaks.
< 30.0% for surrogates (tetrachloro-m-xylene and decachlorobiphenyl).

A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Initial calibration and %RSD were acceptable. No data qualification was needed on the basis of initial calibration.

Continuing Calibration and %D:
Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Calibration results for RRF and %D were within control limits. No data qualification was needed on the basis of continuing calibration.

Pest 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

Pest 8. FIELD DOCUMENTATION:
No problems were identified.

Pest 9. OTHER PROBLEMS:
Percent Solids: Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

Pest 10. REANALYSIS
This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: PCB

PCB 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

PCB 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Surrogate recoveries were within control limits. No data qualification was needed on the basis of surrogates.

PCB 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were performed for sediment sample OLCD-COMP. MS/MSD accuracy and precision were within control limits; therefore, no qualification was required on the basis of MS/MSD.

PCB 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS accuracy was within laboratory control limits; therefore, no data qualification was required on the basis of the LCS.

PCB 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No Aroclors were detected in method backs. No data qualifications were needed on the basis of blank contamination.

Field blank contamination:

No field blank was collected.

PCB 6. CALIBRATION:
Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. 2nd Order Non Linear calibration model is used. The Calibration Verification checks document that the instrument is giving satisfactory daily performance.

Correlation coefficient R^2 and Percent RSD:
For the initial calibration, if the value of the correlation coefficient R^2 is below 0.99 for any PCB or any surrogate or if the %RSD of the CFs for the three to five major peaks of each of the Aroclor compounds and the two surrogates must be less than or equal to 20.0% If not, qualify all associated positive results "J" and non-detects "UJ". Qualifiers are applied based on primary column calibration only.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

Percent Drift (%Drift):

For the Calibration Verification checks, if Percent Drift exceeds 15% for any PCB or any surrogate, qualify all associated positive results “J” and non-detects “UJ”. Qualifiers are applied based on primary column calibration only.

Continuing calibrations were acceptable. No qualification was needed on the basis of continuing calibration.

PCB 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

PCB 8. FIELD DOCUMENTATION:
No problems were identified.

PCB 9. OTHER PROBLEMS:
Percent Solids: Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ).

PCB 10. REANALYSIS
This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: GENERAL CHEMISTRY

General Chemistry 1. HOLDING TIME AND PRESERVATION
The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

General Chemistry 2. CALIBRATION
Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the target analytes. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION
A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Initial calibrations were acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of initial or continuing calibration verifications.

General Chemistry 3. BLANK CONTAMINATION
QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

No target analytes were detected in method blanks except total phosphorus was detected below the PQL. Associated sample results were greater than 10x the blank concentration; therefore, no data qualification was needed based on blank contamination.

General Chemistry 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed for sediment sample OLC-1 for Method 4500-P-F (Total Phosphorus). Total phosphorus recoveries were below control limits for the MS/MSD and within limits for the LCS; therefore, the parent sample results were qualified with J as estimated. MS/MSD analyses were performed for sediment sample OLCD-COMP for Method 9012B (Total Cyanide) and OLC-1 for Method 9060 (TOC), with acceptable accuracy; therefore, no qualification was required on the basis of MS/MSD. MS/MSDs were performed for Method 9071B (Hexane Extractable Materials -- Oil and Grease); for sediment sample OLC-1. The case narrative states that the MS/MSD were not reported due to an error in the spiking procedure; however, they were reported in the EDD with acceptable accuracy; therefore, no qualification was required on the basis of MS/MSD.

General Chemistry 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

A laboratory sample duplicate analysis was performed for Methods 350.1 (Ammonia-Nitrogen), ASTM D22 (Percent Moisture), ASTM D422 (Particle Size), and Method 351.2 (Total Kjeldahl Nitrogen) with acceptable precision except the RPD for Method ASTM D422 (Particle Size) was outside control limits for sample OLC-1 for the analyte “clay”; therefore, the sample result was qualified with J as estimated. A matrix spike duplicate sample analysis was performed for Methods 9012B (Total Cyanide), 4500-P-F (Total Phosphorus), 9060 (TOC), and Method 351.2 (Total Kjeldahl Nitrogen) with acceptable precision. MS/MSDs were performed for Method 9071B (Hexane Extractable Materials -- Oil and Grease). The case narrative states that they were not reported due to an error in the spiking procedure; however, they are reported in the EDD with acceptable precision; therefore, no qualification was required on the basis of MS/MSD precision.

General Chemistry 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it’s duplicate.

Field duplicate samples were not submitted.

General Chemistry 7. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as

employed for the samples. All LCS %R must fall within the control limits of 70-130%. Qualifications were applied to the samples and analytes as shown below.

All LCS analytes were within control limits.

General Chemistry 8. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Samples OLCR-1, OLCR-2, OLCR-COMP, OLCD-1, OLCD-2, and OLCD-COMP had percent solids less than 50%. Reported results in those samples that were above the MDL were qualified as estimated (J) and the non-detects were qualified as estimated non-detect (UJ) except Percent Moisture and Particle Size (with Hydrometer).

ACROYMNS

TCL – Target Compound List
RPD – Relative Percent Difference
%D – Percent Difference
LCS – Laboratory Control Sample
%R – Percent Recovery
CCC – calibration check compound
CCV – Continuing Calibration Verification
CRQL Contract Required Quantitation Limit
DQO – data quality objective
EDD – electronic data deliverable
EPA – (United States) Environmental Protection Agency
EQM – Environmental Quality Management, Inc.
FSP – Field Sampling Plan
GLLA – Great Lakes Legacy Act
GLSED – Great Lakes Sediment Database
GPS – global positioning system
ICS Interference Check Sample
ICV Initial Calibration Verification
ID – Inner Diameter
MDL – Method detection limit
mm – millimeters
NELAC National Environmental Laboratory Accreditation Conference
PCB – polychlorinated biphenyl
ppm – parts per million
PQL – project quantitation limit
QA/QC – Quality assurance/quality control
QAPP – Quality Assurance Project Plan
RRF Relative response factor
SOP – standard operating procedure
TAL Target Analyte List
TCLP – toxicity characteristic leaching procedure
TOC – Total organic carbon
TSCA – Toxic Substances Control Act

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EXECUTIVE NARRATIVE

Project ID: USACE 2013
Site: Eighteenmile Creek Superfund Site OU3

Laboratory SDG No.: ***1308881***
Laboratory: *RTI Laboratories, Inc.*

Number of Samples	Matrix	Sampling dates	Analysis
4	Elutriate	8/20/13	Metals – EPA Method 3020A/6020A Mercury – EPA Method 7470A Semi-Volatile Organic Compounds (PNAs) – EPA Methods 3510C/8270D Organochlorine Pesticides - EPA Method 3510C/8081B Polychlorinated Biphenyls – EPA Methods 3510C/8082A Total Cyanide – EPA Method 9012B Hexane Extractable Materials (Oil and Grease) – EPA Method 1664 Total Phosphorus – Standard Methods 4500-P-F Total Kjeldahl Nitrogen – EPA Method 351.2 Ammonia-Nitrogen – Standard Method 4500-NH3-D
0	QA	N/A	No field duplicates or splits. Laboratory QC samples were analyzed.

QAPP: No QAPP was provided.
HWSS #: Not applicable.
Contractor Document : Olcott Harbor, Niagara County, New York – 4- CFR 230.11 (d) Contaminant Determinations, 21 November 2013

SUMMARY:

The most current version of the USEPA Region II Data Validation SOPs were used for guidance. The data were evaluated against the analytical method requirements.

Critical: Results have an unacceptable level of uncertainty and should not be used for making decisions. Data has been qualified "R" rejected.

Major: A level of uncertainty exists that may not meet the data quality objectives for the project. A bias is likely to be present in the results. Data has been qualified "J" estimated.

Minor: The level of uncertainty is acceptable. No significant bias in the data was observed.

Critical Findings: No critical findings.

EXECUTIVE NARRATIVE (continued)

Major Findings:

Two arsenic results (samples OLCD and OLC-3) were qualified with U as non-detect and the detection limit was elevated to the sample result value due to method blank contamination.

Four TKN results (samples OLCD, OLC-1, OLC-2, and OLC-3) were qualified with U as non-detect and the reporting limit was elevated to the sample result value due to method blank contamination.

Several semivolatile compounds were qualified with UJ as estimated non-detect for associated samples due to high %Ds for ICV/CCVs.

Minor Findings: The cooler containing the samples was received at a temperature of 6.2 °C (0.2 °C above the required temperature); however, the sample receipt checklist documented that the client approved the temperature; therefore, this slight temperature excursion is considered acceptable and no qualifiers were added on this basis.

Magnesium, sodium, and calcium recoveries were outside control limits for the MS and/or MSD; however, the parent sample concentration was greater than 4x the spike amount added; therefore, no qualification was required based on spike recovery.

LCS and/or LCSD recoveries were above control limits for LCS/LCSD 30679 for several SVOC compounds. Associated sample results for those compounds were non-detects and were not qualified. Samples were not re-extracted due to limited sample volume.

LCS/LCSD accuracy and precision were within laboratory control limits except for pesticides Aldrin, alpha-BHC, gamma-BHC, and heptachlor in the LCSD only (all LCS results were within control limits). No data qualification was required on the basis of the LCS/LCSD.

COMMENTS: *The sample bottles were delivered without custody seals on them. Three Sample bottles were received with cracks, which the laboratory replaced upon receipt: OLC-3 (two bottles) and OLC-2 (one bottle). The organochlorine pesticide compounds chlordane and toxaphene were not included in the LCS spiking solution; however, the ICV and CCV results for those compounds were acceptable; therefore, no data qualification was required on the basis of the LCS.*

Reviewer Name(s): Joanna Christopher

Date: 8/17/2016

Approver Name: Marcia M. Galloway

Affiliation: Ecology and Environment, Inc.

Data Qualifier Definitions (National Functional Guidelines)

Qualifier Symbol	Explanation		
	INORGANICS	**ORGANICS**	**CHLORINATED DIOXIN/FURAN**
U	The analyte was analyzed for, but was not detected above the level of the reported quantitation limit.	The analyte was analyzed for, but was not detected at a level greater than or equal to the level of the adjusted CRQL for sample and method	The analyte was analyzed for but not detected. The value preceding the "U" may represent the adjusted Contract Required Quantitation Limit (see DLM02.X, Exhibit D, Section 1.2 and Table 2), or the sample specific estimated detection limit (EDL, see Method 8290A, Section 11.9.5).
J	The result is an estimated quantity. The associated numerical value is the approximate concentration of the analyte in the sample.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to the quality of the data generated because certain quality control criteria were not met, or the concentration of the analyte was below the CRQL.	The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample (due either to an issue with the quality of the data generated because certain QC criteria were not met, or the concentration of the analyte was below the adjusted CRQL).
J+	The result is an estimated quantity, but the result may be biased high.	-	
J−	The result is an estimated quantity, but the result may be biased low.		
UJ	The analyte was analyzed for, but was not detected. The reported quantitation limit is approximate and may be inaccurate or imprecise.	The analyte was not detected at a level greater than or equal to the adjusted CRQL. However, the reported adjusted CRQL is approximate and may be inaccurate or imprecise.	The analyte was not detected (see definition of "U" flag, above). The reported value should be considered approximate.
R	The data are unusable. The sample results are rejected due to serious deficiencies in meeting Quality Control (QC) criteria. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.	The sample results are unusable due to the quality of the data generated because certain criteria were not met. The analyte may or may not be present in the sample.
N		*The analysis indicates the presence of an analyte for which there is presumptive evidence to make a "tentative identification".*	
NJ		The analysis indicates the presence of an analyte that has been "tentatively identified" and the associated numerical value represents its approximate concentration.	
C		This qualifier applies to pesticide and Aroclor results when the identification has been confirmed by Gas Chromatograph/Mass Spectrometer (GC/MS).	
X		This qualifier applies to pesticide and Aroclor results when GC/MS analysis was attempted but was unsuccessful.	

ANALYSIS: METALS

Metals 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Metals 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the metals on the Inorganic TAL. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of continuing calibration verifications.

Metals 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

The associated preparation blank analyte results are greater than or equal to MDLs but less than reporting limits for: Arsenic in method blank (0.14 µg/L) for elutriate samples (MB-30724).

- Arsenic results greater than 10x the blank result were not qualified; results less than 10x the blank result (samples OLCD and OLC-3) were qualified with U as non-detect and the detection limit was elevated to the result value.

Metals 4. INTERFERENCE CHECK SAMPLE

The Interference Check Sample (ICS) verifies the analytical instrument's ability to overcome interferences typical of those found in samples. The laboratory should have analyzed and reported ICS results for all elements being reported from the analytical run and for all interferents (target and non-target) for these reported elements. The ICS consists of two solutions: Solution A and Solution AB. Solution A consists of the interferents, and Solution AB consists of the analytes mixed with the interferents. Results for the analysis of ICS Solution must fall within the control limits of ± 20% or ±CRQL (whichever is greater) of the true value for the analytes and interferents included in the solution. If results that are ≥ MDL are observed for analytes that are not present in the ICS solution, the possibility of false positives exists. If negative results are observed for analytes that are not present in the ICS solution, and their absolute value is ≥ MDL, the possibility of false negatives in the samples exists. In general, ICP sample data can be accepted if the concentrations of Al, Ca, Fe, and Mg in the sample are found to be less than or equal to their respective concentrations in the ICS. Qualifications were applied to the samples and analytes as shown below.

ICS recoveries were acceptable. No qualification was needed on the basis of ICS recoveries.

Metals 5. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD and PDS analyses were performed for elutriate sample OLC-1.

- Magnesium, sodium, and calcium recoveries were outside control limits for the MS and/or MSD; however, the parent sample concentration was greater than 4x the spike amount added; therefore, no qualification was required based on spike recovery.

Metals 6. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

A laboratory control sample duplicate analysis was not performed; however, serial dilution recoveries were acceptable and precision was acceptable for MS/MSD analyses; therefore, no qualification was required on the basis of duplicate precision.

Metals 7. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field

duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Metals 8. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%, except for Sb and Ag which must fall within the control limits of 50-150%. Qualifications were applied to the samples and analytes as shown below.

LCS recoveries were acceptable. No qualification was needed on the basis of LCS recoveries.

Metals 9. ICP SERIAL DILUTION

The serial dilution of samples quantitated by Inductively Coupled Plasma determines whether or not significant physical or chemical interferences exist due to sample matrix. If the analyte concentration is sufficiently high [concentration in the original sample is > 50 times (50x) the MDL, the %D between the original determination and the serial dilution analysis (a five-fold dilution) after correction for dilution shall be less than 10 (15-120% for soils/sediments). For a serial dilution analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the serial dilution sample.

Serial dilution was performed for elutriate sample OLC-1. Serial dilution %Ds were acceptable. No qualification was needed on the basis of serial dilution recovery.

Metals 10. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, "J". Qualifications were applied to the samples and analytes as shown below.

Not applicable to elutriate matrix samples.

ANALYSIS: MERCURY

Mercury 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time, pH (aqueous samples), or cooler temperature are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (28 days) and pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects (sample quantitation limits) will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Mercury 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for mercury. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be employed to establish the analytical curve. At least one of the calibration standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The calibration curves for mercury shall possess a correlation coefficient of ≥ 0.995 to ensure the linearity over the calibrated range. The percent differences calculated for all of the non-zero standards must fall within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. All sample results shall be reported from an analysis within the calibrated range. Qualifications were applied to the samples and analytes as shown below.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for mercury by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every hour during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 85 – 115%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of continuing calibration verifications.

Mercury 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

No target analytes were detected in method blanks. No qualification was needed on the basis of blank contamination.

Mercury 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD and PDS analyses were performed on elutriate sample OLC-1 with acceptable accuracy and precision. No qualification was needed on the basis of sample spike results.

Mercury 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

Laboratory duplicate analysis precision was acceptable for the MS/MSD. No qualification was needed on the basis of MS/MSD results.

Mercury 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted. No qualification was required on the basis of field duplicate sample analysis.

Mercury 7. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. Qualifications were applied to the samples and analytes as shown below.

Not applicable to elutriate matrix samples.

ANALYSIS: SVOCs

SVOCS 1. HOLDING TIME :

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

SVOCS 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

For surrogate compounds 2-Fluorobiphenyl, Nitrobenzene-d5, and Terphenyl-d14, recoveries were above control limits for LCS-30679 and for surrogate compound Nitrobenzene-d5 for method blank MB-30679; no qualification was required for associated sample results due to surrogate recovery.

SVOCS 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were not performed for this SDG. LCS and/or LCSD recoveries were above control limits for several compounds (see Section SVOCS 4, below). LCS/LCSD precision was acceptable; therefore, no qualification was required due to duplicate precision.

SVOCS 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS and/or LCSD recoveries were above control limits for LCS/LCSD 30679 for compounds 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Naphthalene, Phenanthrene, and Pyrene; and for LCS/LCSD 30730 for compounds Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, and Chrysene. Associated sample results for those compounds were non-detects and were not qualified. Samples were not re-extracted due to limited sample volume.

SVOCS 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No target analytes were detected in method blanks. No data qualifications were needed based upon blank evaluations.

Field blank contamination:

No field blank was collected.

SVOCS 6. MASS SPECTROMETER TUNING:

Tuning and performance criteria are established to ensure adequate mass resolution, proper identification of compounds and to some degree, sufficient instrument sensitivity. These criteria are not sample specific. Instrument performance is determined using standard materials. Therefore, these criteria should be met in all circumstances. The tuning standard for semi-volatiles Decafluorotriphenyl-phosphine (DFTPP). If the mass calibration is in error, all associated data will be classified as unusable "R".

MS tuning parameters were within the acceptable ranges. No qualifications were needed based on MS tuning.

SVOCS 7. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Response Factor GC/MS:

The response factor measures the instrument's response to specific chemical compounds. The response factor for the most TCL and for SPCC compounds must be ≥ 0.05, in both the initial and continuing calibrations. The exception being the twenty-five (25) poor performing compounds which require a value < 0.01. A low RRF value indicates a serious detection and quantitation problem (poor sensitivity). Analytes detected in the sample will be qualified as estimated, "J". All non-detects for that compound will be rejected "R".

Response factors were within acceptance limits. No qualification was necessary based on RRFs.

Calibration Checks %RSD and %D:

Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. Percent RSD must be < 20% for target analytes, <30% for CCC compounds. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R". The following analytes in the sample shown were qualified for %RSD and %D:

%Ds were above control limits for ICV S8 082813 and CCVs S8 082913 and S5 090413 for compounds 2-Methylnaphthalene, Acenaphthene, Acenaphthylene, Anthracene, Benz(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(g,h,i)perylene, Benzo(k)fluoranthene, Chrysene, Dibenz(a,h)anthracene, Fluoranthene, Fluorene, Indeno(1,2,3-cd)pyrene, Naphthalene, Phenanthrene, and Pyrene; associated sample results for those compounds non-detects and were qualified with UJ as estimated non-detect.

SVOCS 8. INTERNAL STANDARDS PERFORMANCE GC/MS

Internal standards performance criteria ensure that the GC/MS sensitivity and response are stable during every experimental run. The internal standard area count must not vary by more than a factor of 2 (-50% to +100%) from the associated continuing calibration standard. The retention time of the internal standard must not vary more than 30 seconds from the associated continuing calibration standard. If the area count is outside the (-50% to +100%) range of the associated standard, all of the positive results for compounds quantitated using that IS are qualified as estimated, "J", and all non-detects as "UJ", or "R" if there is a severe loss of sensitivity. If an internal standard retention time varies by more than 30 seconds, the reviewer will use professional judgment to determine either partial or total rejection of the data for that sample fraction.

Internal standards were within acceptance limits. No qualification was necessary based on internal standard performance.

SVOCS 9. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

SVOCS 10. FIELD DOCUMENTATION: No problems.

SVOCS 11. OTHER PROBLEMS: None.

SVOCS 12. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: ORGANOCHLORINE PESTICIDES

Pest 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

Pest 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Surrogate recoveries were within control limits; therefore, no qualification was needed on the basis of surrogate recovery.

Pest 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were not performed for this SDG. LCS and/or LCSD accuracy and/or precision were outside control limits for several compounds (see Section Pest 4, below).

Pest 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS/LCSD accuracy and precision were within laboratory control limits except for Aldrin, alpha-BHC, gamma-BHC, and Heptachlor in the LCSD only (all LCS results were within control limits). The compounds chlordane and toxaphene were not included in the LCS spiking solution; however, the ICV and CCV results for those compounds were acceptable. No data qualification was required on the basis of the LCS/LCSD.

Pest 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No analytes were detected in the method blank. No data qualification was required based on blank contamination. .

Field blank contamination:

No field blank was collected.

Pest 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. The continuing calibration checks document that the instrument is giving satisfactory daily performance.

Initial Calibration and %RSD:

Percent RSD is calculated from the initial calibration and is used to indicate the stability of the specific compound response factor over increasing concentration. Percent RSD must be:

< 20.0% for single component target compounds except alpha-BHC and delta-BHC.
< 25.0% for alpha-BHC and delta-BHC.
< 30.0% for Toxaphene peaks.
< 30.0% for surrogates (tetrachloro-m-xylene and decachlorobiphenyl).

A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Initial calibration and %RSD were acceptable. No data qualification was needed on the basis of initial calibration.

Continuing Calibration and %D:

Percent D compares the response factor of the continuing calibration check to the mean RRF from the initial calibration. Percent D is a measure of the instrument's daily performance. %D must be < 20% for target analytes and for CCC compounds. A value outside of these limits indicates potential detection and quantitation errors. For these reasons, all positive results are flagged as estimated, "J" and non-detects are flagged "UJ". If %RSD and %D grossly exceed QC criteria (>90%), non-detects data may be qualified "R".

Calibration results for RRF and %D were within control limits. No data qualification was needed on the basis of continuing calibration.

Pest 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

Pest 8. FIELD DOCUMENTATION:

No problems were identified.

Pest 9. OTHER PROBLEMS:

None.

Pest 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: PCB

PCB 1. HOLDING TIME:

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time is exceeded, the data may not be valid. Those analytes detected in the samples whose holding time has been exceeded will be qualified as estimated, "J". The non-detects (sample quantitation limits) will be flagged as estimated, "J", or unusable, "R", if the holding times are grossly exceeded. The following action was taken in the samples and analytes shown due to excessive holding time.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

PCB 2. SURROGATES

All samples are spiked with surrogate compounds prior to sample preparation to evaluate overall laboratory performance and efficiency of the analytical technique. If the measured surrogate concentrations were outside contract specifications, qualifications were applied to the samples and analytes as shown below.

Surrogate recoveries were within control limits. No data qualification was needed on the basis of surrogates.

PCB 3. MATRIX SPIKE/SPIKE DUPLICATE, MS/MSD:

The MS/MSD data are generated to determine the long-term precision and accuracy of the analytical method in various matrices. The MS/MSD may be used in conjunction with other QC criteria for additional qualification of data.

MS/MSD analyses were not performed for this SDG. LCS and/or LCSD accuracy and/or precision were within control limits; therefore, no qualification was required on the basis of LCS/LCSD.

PCB 4. Laboratory Control Samples (LCS):

The LCSs data provides information on the accuracy of the analytical method and laboratory performance. If LCS recoveries fell outside of the acceptable limits, qualifications were applied to the associated samples and compounds as shown below.

LCS accuracy was within laboratory control limits; therefore, no data qualification was required on the basis of the LCS.

PCB 5. BLANK CONTAMINATION:

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Method blanks measure laboratory contamination. Field and rinse blanks measure cross-contamination of samples during field operations. Depending on the concentration of the analyte in the blank, the analytes are qualified as non-detects U. The following analytes in the sample shown were qualified with "U" for these reasons:

Method blank contamination:

No Aroclors were detected in method backs. No data qualifications were needed on the basis of blank contamination.

Field blank contamination:

No field blank was collected.

PCB 6. CALIBRATION:

Satisfactory instrument calibration is established to ensure that the instrument is capable of producing acceptable quantitative data. An initial calibration demonstrates that the instrument is capable of giving acceptable performance at the beginning of an experimental sequence. 2nd Order Non Linear calibration model is used. The Calibration Verification checks document that the instrument is giving satisfactory daily performance.

Correlation coefficient R^2 and Percent RSD:

For the initial calibration, if the value of the correlation coefficient R^2 is below 0.99 for any PCB or any surrogate or if the %RSD of the CFs for the three to five major peaks of each of the Aroclor compounds and the two surrogates must be less than or equal to 20.0% If not, qualify all associated positive results "J" and non-detects "UJ". Qualifiers are applied based on primary column calibration only.

Initial calibration was acceptable. No qualification was needed on the basis of initial calibration.

Percent Drift (%Drift):

For the Calibration Verification checks, if Percent Drift exceeds 15% for any PCB or any surrogate, qualify all associated positive results “J” and non-detects “UJ”. Qualifiers are applied based on primary column calibration only.

Continuing calibrations were acceptable. No qualification was needed on the basis of continuing calibration.

PCB 7. CONTRACT PROBLEMS NON-COMPLIANCE: Not applicable.

PCB 8. FIELD DOCUMENTATION:

No problems were identified.

PCB 9. OTHER PROBLEMS: None.

PCB 10. REANALYSIS

This package may contain re-extracted, re-analyzed or dilution runs. Upon reviewing the QA results, the following Form 1(s) are identified NOT to be used.

None.

ANALYSIS: GENERAL CHEMISTRY

General Chemistry 1. HOLDING TIME AND PRESERVATION

The amount of an analyte in a sample can change with time due to chemical instability, degradation, volatilization, etc. If the specified holding time or pH (aqueous samples are not within the acceptable range, the data may not be valid. Those analytes detected in the samples whose holding time (180 days) or pH (≤2) have not been met, will be qualified as estimated, "J"; the non-detects will be flagged as unusable, "R". Qualifications were applied to the samples and analytes as shown below.

Sample preservation was acceptable and the analyses were performed within specified holding times. No qualification was needed on the basis of holding time or preservation.

General Chemistry 2. CALIBRATION

Method requirements for satisfactory instrument calibration are established to ensure that the instrument is capable of producing acceptable quantitative data for the target analytes. ICV demonstrates that the instrument is capable of acceptable performance at the beginning of the analytical run. CCV demonstrates that the initial calibration is still valid by checking the performance of the instrument on a continuing basis.

INITIAL CALIBRATION

A blank and at least five calibration standards shall be used to establish each analytical curve. At least one of these standards shall be at or below the CRQL. The calibration curve shall be fitted using linear regression or weighted linear regression. The curve may be forced through zero. The curve must have a correlation coefficient ≥ 0.995. The percent differences calculated for all of the non-zero standards must be within ±30% of the true value of the standard. The y-intercept of the curve must be less than the CRQL. Qualifications were applied to the samples and analytes as shown below.

Initial calibrations were acceptable. No qualification was needed on the basis of initial calibration.

INITIAL AND CONTINUING CALIBRATION VERIFICATION

Immediately after each system has been calibrated, the accuracy of the initial calibration must be verified and documented for each target analyte by the analysis of an ICV solution(s). The CCV standard shall be analyzed at a frequency of every two hours during an analytical run. The CCV standard shall also be analyzed at the beginning of the run, and again after the last analytical sample. The percent recovery acceptable limits for ICV/CCV are 90 – 110%. Qualifications were applied to the samples and analytes as shown below.

Initial and continuing calibration verifications were acceptable. No qualification was needed on the basis of initial or continuing calibration verifications.

General Chemistry 3. BLANK CONTAMINATION

QA blanks, i.e., method, field, or rinse blanks are prepared to identify any contamination, which may have been introduced into the samples during sample preparation or field activity. Calibration blanks (ICB and CCB) are used to ensure a stable instrument baseline before and during the analysis of analytical samples. The preparation blank is used to assess the level of contamination introduced to the analytical samples throughout the sample preparation process. Field and rinse blanks measure cross-contamination of samples during field operations. Qualifications were applied to the samples and analytes as shown below.

No target analytes were detected in method blanks except TKN was detected below the reporting limit. Associated sample results were above the reporting limit and less than 10x the blank concentration;

therefore, the sample results were qualified with U as non-detect and the reporting limit was elevated to the sample result.

General Chemistry 4. SPIKE SAMPLE ANALYSIS

The spiked sample analysis is designed to provide information about the effect of each sample matrix on the sample preparation procedures and the measurement methodology. The spike %R shall be within the established acceptance limits of 75 – 125%. However, spike recovery limits do not apply when the sample concentration is ≥ 4x the spike added. For a matrix spike analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the matrix spike sample.

MS/MSD analyses were performed for a non-project sample for Method SM_4500-NH3-D (Ammonia as N), and for elutriate sample OLCD for Method 4500-P-F (Total Phosphorus) and Method 9012B (Total Cyanide),with acceptable accuracy. MS/MSDs were not performed for Method 9071B (Hexane Extractable Materials -- Oil and Grease); however, LCS/LCSD accuracy was acceptable. No qualification was required on the basis of spike samples.

General Chemistry 5. DUPLICATE SAMPLE ANALYSIS

The objective of duplicate sample analysis is to demonstrate acceptable method precision by the laboratory at the time of analysis. A control limit of 20% (35% for soil/sediment samples) for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For a duplicate sample analysis that does not meet the technical criteria, the action was applied to only the field sample used to prepare the duplicate sample.

MS/MSD analyses were performed for a non-project sample for Method SM_4500-NH3-D (Ammonia as N), with acceptable precision. MS/MSD analyses were performed for a non-project sample for Method SM_4500-NH3-D (Ammonia as N), and for elutriate sample OLCD for Method 4500-P-F (Total Phosphorus) and Method 9012B (Total Cyanide),with acceptable precision. A laboratory sample duplicate analysis was performed for elutriate sample OLC-3 for Method 351.2 (Total Kjeldahl Nitrogen) with acceptable precision. MS/MSDs were not performed for Method 9071B (Hexane Extractable Materials -- Oil and Grease) however, LCS/LCSD precision was acceptable. No qualification was required on the basis of duplicate precision.

General Chemistry 6. FIELD DUPLICATE

Field duplicates may be taken and analyzed as an indication of overall precision. These analyses measure both field and laboratory precision. A control limit of 20% for the RPD shall be used for original and duplicate sample values ≥ five times (5x) the CRQL. A control limit of the CRQL shall be used if either the sample or duplicate value is < 5x the CRQL. For field duplicates analysis that does not meet the technical criteria, the action was applied to only the field sample and it's duplicate.

Field duplicate samples were not submitted.

General Chemistry 7. LABORATORY CONTROL SAMPLE

The LCS serves as a monitor of the overall performance of each step during the analysis, including the sample preparation. Aqueous/water, soil/sediment, wipe, and filter LCSs shall be analyzed for each analyte utilizing the same sample preparations, analytical methods, and QA/QC procedures as employed for the samples. All LCS %R must fall within the control limits of 70-130%. Qualifications were applied to the samples and analytes as shown below.

All LCS analytes were within control limits.

General Chemistry 8. PERCENT SOLIDS

The laboratory is required to perform the percent solids determination prior to sample preparation and analysis. All results of a sample with percent solids less than 50% are qualified estimated, “J”. Qualifications were applied to the samples and analytes as shown below.

Not applicable to elutriate matrix samples.

ACROYMN LIST

ACROYMNS

TCL	–	Target Compound List
RPD	–	Relative Percent Difference
%D	–	Percent Difference
LCS	–	Laboratory Control Sample
%R	–	Percent Recovery
CCC	–	calibration check compound
CCV	–	Continuing Calibration Verification
CRQL		Contract Required Quantitation Limit
DQO	–	data quality objective
EDD	–	electronic data deliverable
EPA	–	(United States) Environmental Protection Agency
EQM	–	Environmental Quality Management, Inc.
FSP	–	Field Sampling Plan
GLLA	–	Great Lakes Legacy Act
GLSED	–	Great Lakes Sediment Database
GPS	–	global positioning system
ICS		Interference Check Sample
ICV		Initial Calibration Verification
ID	–	Inner Diameter
MDL	–	Method detection limit
mm	–	millimeters
NELAC		National Environmental Laboratory Accreditation Conference
PCB	–	polychlorinated biphenyl
ppm	–	parts per million
PQL	–	project quantitation limit
QA/QC	–	Quality assurance/quality control
QAPP	–	Quality Assurance Project Plan
RRF		Relative response factor
SOP	–	standard operating procedure
TAL		Target Analyte List
TCLP	–	toxicity characteristic leaching procedure
TOC	–	Total organic carbon
TSCA	–	Toxic Substances Control Act

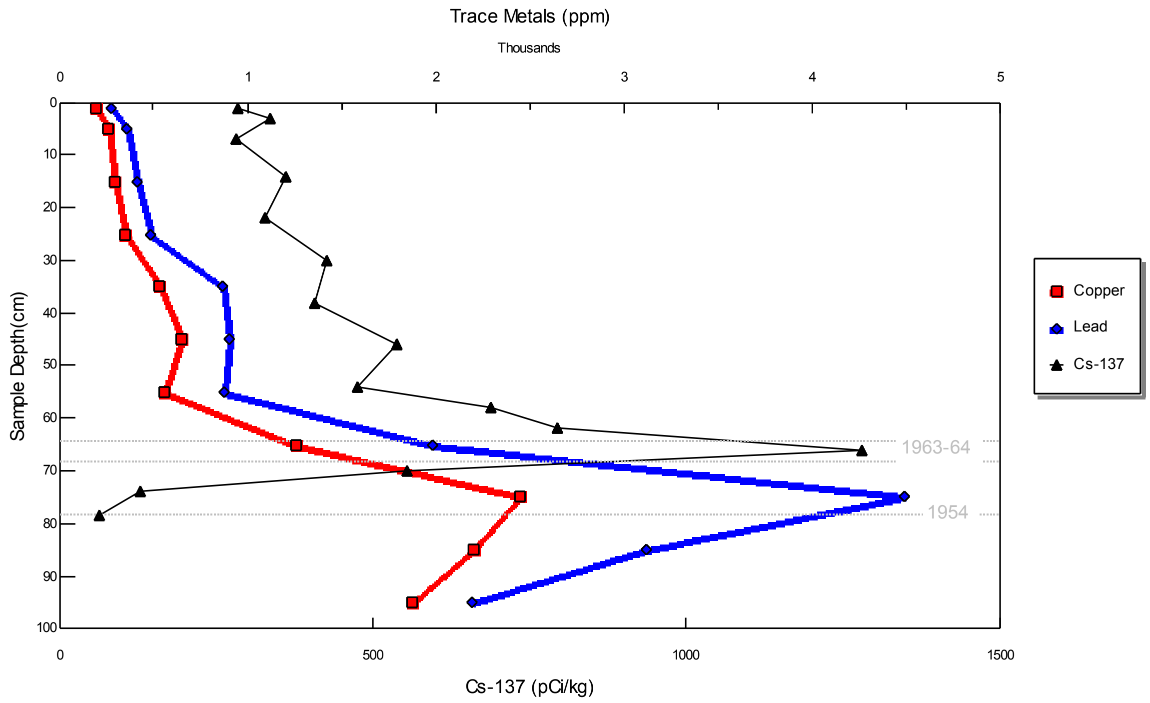
C

Radio-Dating Results

from the core collected there. Maximum cadmium (16.2 ppm), chromium (12,400 ppm), iron (32,900 ppm) and nickel (478 ppm) concentrations were observed in the 60- 70 cm subsample. Peak aluminum (17,400 ppm), arsenic (12.3 ppm), copper (2,450 ppm), lead (4,490 ppm) and zinc (10, 800 ppm) were seen in the 70- 80 cm subsample and the highest mercury (3.31 ppm) and silver (8.0 ppm) concentrations were found in the 80- 90 cm sample depth.

In an effort to better understand the historic distribution of contaminants at this site radionuclide dating techniques were employed. These results are presented in Figure 2-2.

Figure 2-2. Chronology of Trace Metals Deposition in Sediments Upstream of The Burt Dam
Station No. 6C



The cesium dating results presented in Figure 2-2 show the maximum copper and lead concentrations at Station No. 6C occur in sediments deposited sometime between the middle 1950's and early 1960's (70- 80 cm subsample). Recent trace metal concentrations, as measured in the surface sediments, are considerably lower than the buried, peak concentrations.

Maximum trace metals concentrations at Station No. 6E (with the exception of nickel) were found in the deepest subsample (56- 74 cm) collected there. The highest concentrations observed at this site were similar to the maximum concentrations reported at Station No. 6C.

Peak trace metals concentrations observed further upstream in the Burt Dam depositional pool (Station No. 6F) were generally found closer to the surface (28- 52 cm). The nickel (997 ppm) and zinc (15,100 ppm) concentrations observed at this site were the highest measured during this study. The source of these metals is unknown.

It is unknown why the maximum concentrations observed at Station No. 6F were found closer to the surface (28-52 cm subsample). One hypothesis is that the net depositional rate at this site is lower, due to its location in the shallower, faster moving waters at the upstream end of the depositional pool created by the Burt Dam.

Station Nos.7ABC, 7A, 7B and 7C were located within the depositional pool upstream of the Newfane Dam. Although the highest concentrations of several metals were found further downstream, in the Burt Dam pool, very high concentrations of several trace metals were encountered at these sites. Trace metals of particular concern include cadmium (9.5 ppm), chromium (798 ppm), copper (1,330), lead (2,840 ppm), mercury (10.1 ppm), nickel (178 ppm), silver (4.6 ppm[1]) and zinc (8,640 ppm). All of these metals exceeded their respective SEL concentrations (see Figure 2-1 for SEL values).

Radiodating of a sediment core from the Newfane Dam pool (Station No. 7C) was also performed ***(complete radiodating results are presented in Appendix H).*** Peak cesium-137 concentrations occurred in the 20-24 cm section and correspond to the middle 1960s. As discussed previously, peak metals concentrations in the core collected further downstream, in the Burt Dam pool (Station No. 6C) generally correspond with the period from the middle 1950s to the middle 1960s (see Figure 2-2). It is hypothesized that, if the source of these metals is upstream of both dams, peak metals in the Station No. 7C core (Newfane Dam) would correspond to the same period (middle 1950s to middle 1960s). If this hypothesis is correct, peak cadmium, chromium, copper, lead, nickel, silver and zinc at Station No. 7C would be expected to occur in the 20-32 cm depth and not in the 0-20 cm depth as shown in Figures 2-1C, D, E, G, J, K and L, respectively. Unfortunately, sediments from the 20-32 cm depth at Station No. 7C were not evaluated separately but included in the 20-70 cm core sample. Collection and finer subsectioning of a core from Station No.7C would be necessary to determine the depth of peak metals concentrations.

High-resolution total and monomethyl mercury was evaluated during this study by the Brooks Rand Ltd. laboratory. These results are shown in figures 2-1H and 2-1I, respectively. Monomethyl mercury was evaluated due to its high bioaccumulative potential in fish. The highest mercury concentration observed during this study (10.1 ppm) was measured at Station No. 7A (Newfane Dam pool). It should be noted, however, this concentration occurred in the deepest subsample (90- 104 cm) at that site. The maximum concentration of monomethyl mercury (10.1 ppb) was observed at Station No. 6E (Burt Dam pool, 56- 74 cm.).

The highest concentrations of several metals in the Newfane Dam pool occurred at the upstream end of the pool. This observation was made for the following metals, cadmium, chromium, copper, lead, mercury, nickel, silver and zinc. With the exception of mercury, peak concentrations were found in the near-surface subsample (0-20 cm) at Station No. 7A.

Trace metals concentrations were generally lower at sampling sites located upstream of the Burt and Newfane Dam depositional pools. Although lower, trace metals exceeding their respective SEL concentrations included copper (Station No. 12), lead (Station Nos. 8A, 11 and 12), silver (Station No. 12) and zinc (Station Nos. 8A, 11 and 12).

[1] -Parameter was between IDL and contract required detection limit.

Appendix H.-Summary of Radionuclide Counting Data

Sediment Core 6C

This is an excellent core that appears to contain a continuous record of sediment accumulated from ca. 1954 to the date of coring (98230).

- Be-7, a short-lived (half-life = 53.4 days) natural radionuclide produced in the atmosphere by cosmic ray spallation of N_2 and O_2, was detected in the 0-2 cm section. This indicates that this sample contains a significant component of particles deposited within a year of sample collection.
- A peak in Cs-137 activity is seen in the 64-68 cm section. We assign this peak activity to the 1963-64 global fallout maximum and calculate an average net sedimentation rate of about 1.9 cm/y between 1963 and 1997.
- The deepest detection of Cs-137 occurs at about 78 cm. We associate this horizon with the onset of large-scale atmospheric testing of nuclear weapons in about 1954. We calculate an average net sedimentation rate of about 1.8 cm/y between 1954 and 1997.
- The fairly high particle accumulation rate produces a fairly low surface Pb-210 activity (6.71 ± 0.84 dpm/g). As expected, total Pb-210 levels show a general decrease with depth, however, because of the low surface activity, quantitative dating information cannot be obtained.

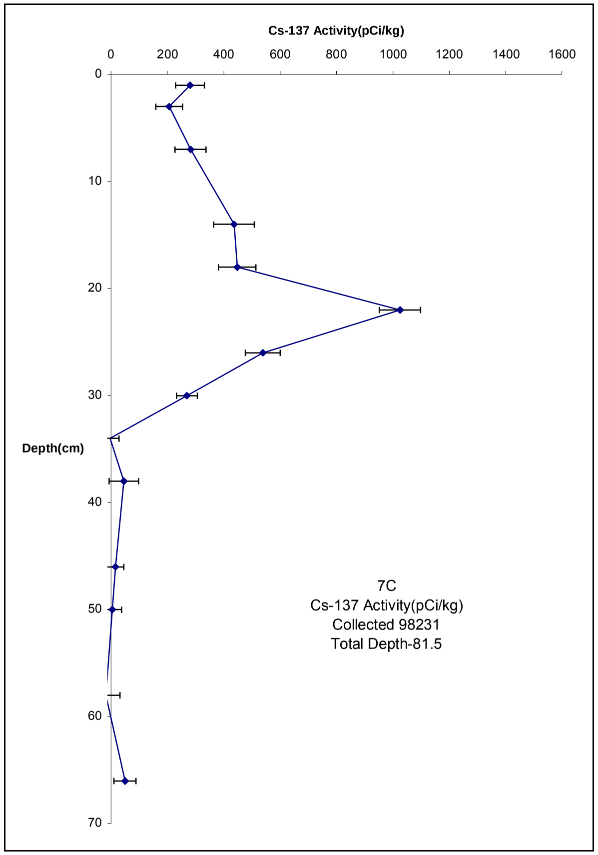
Sediment Core 7C

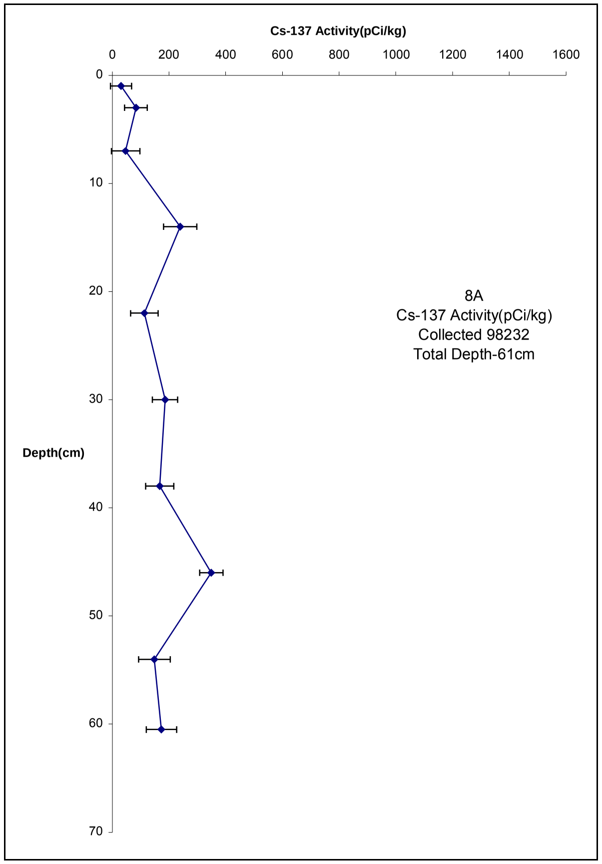
A very good core, containing sediment deposited between about 100 years ago and the date of collection (98231). Key features include:

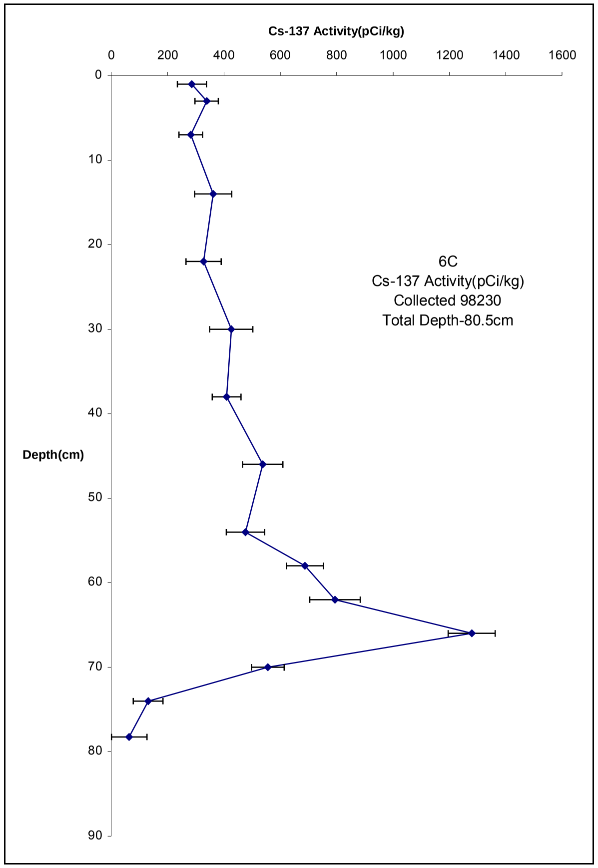
- Detectable Be-7 activity in the 0-2 cm section.
- A peak Cs-137 activity (1963-64) in the 20-24 cm section and the deepest detectable activity (ca. 1954) in the 28-32 cm section. Both of these time indicators are consistent with a net sediment accumulation rate of about 0.65 cm/y.
- Fairly low surface Pb-210 activity (6.46 ± 0.81 dpm/g) that generally decreases with depth (as expected), but cannot provide quantitative dating information.
- Extrapolation of the Cs-137 derived sedimentation rate suggests that the bottom section of the core (64-68 cm) contains sediment deposited around 1900.

Sediment Core 8A

This 61 cm long core was collected on 98232. It is a rather poor core from a dating perspective. The Be-7 content of the 0-2 cm section was positive, but less than 2σ greater than zero. Total Pb-210 activities were low and variable, 4.15 ± 0.66 dpm/g in the 0-2 cm section. Cs-137 activity was detected to the bottom section of the core, but the levels were low and the profile was not readily interpretable. Detectable Cs-137 activity in most sections indicates that much of the core contains a significant component of particles deposited since 1954.


Cs-137 Activity(pCi/kg)
0
200
400
600
800
1000
1200
1400
1600
Depth(cm)
0
10
20
30
40
50
60
70
7C
Cs-137 Activity(pCi/kg)
Collected 98231
Total Depth-81.5


Cs-137 Activity(pCi/kg)
0
200
400
600
800
1000
1200
1400
1600
Depth(cm)
0
10
20
30
40
50
60
70
8A
Cs-137 Activity(pCi/kg)
Collected 98232
Total Depth-61cm


Cs-137 Activity(pCi/kg)
0
200
400
600
800
1000
1200
1400
1600
Depth(cm)
0
10
20
30
40
50
60
70
80
90
6C
Cs-137 Activity(pCi/kg)
Collected 98230
Total Depth-80.5cm

Radiodating Results

Core 6C

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	286	52	1203	552	6.71	0.84	17446.6	1392.8
2-4	338	41	369	413	6.57	0.65	18079.9	1191.5
6-8	282	42					18343.2	1300.5
12-16	362	66					19256.9	1735.0
20-24	328	62			5.92	0.91	19231.3	1641.1
28-32	426	77			6.48	1.37	16352.8	1765.8
36-40	409	51			6.06	0.75	16783.8	1276.6
44-48	537	72					19204.6	1703.9
52-56	476	68			4.45	0.85	18300.3	1589.0
56-60	688	66			4.40	0.71	15506.9	1274.6
60-64	794	89			5.25	1.04	12462.5	1512.8
64-68	1279	84			3.50	0.57	15837.1	1152.9
68-72	556	58			3.00	0.65	15451.3	1245.4
72-76	130	53			3.15	0.85	15466.3	1501.0
76-80.5	63	63			4.13	1.04	18041.1	1883.9

Core 7C

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	280	51	1543	557	6.46	0.81	15019.3	1256.8
2-4	206	47	542	525	6.33	0.77	15298.5	1247.0
6-8	282	55			5.97	0.82	16130.5	1389.6
12-16	436	72			3.95	0.96	14205.8	1537.1
16-20	448	66			5.22	0.88	16151.0	1465.0
20-24	1025	74					12415.4	986.6
24-28	538	62			4.14	0.69	12807.4	1154.9
28-32	269	37			2.39	0.50	13845.6	998.7
32-36	-4	32			2.02	0.52	14397.9	1069.3
36-40	45	52			2.51	0.86	17250.4	1624.0
44-48	15	30			3.87	0.57	17074.3	1196.7
48-52	4	34			2.59	0.55	17504.6	1246.0
56-60	-19	50			3.44	0.88	15806.5	1552.9
64-68	49	39			2.02	0.65	18253.0	1417.6

Core 8A

Depth Interval(cm)	Cs-137(pCi/kg)	1s	Be-7(pCi/kg)	1s	Pb-210(dpm/g)	1s	K-40(pCi/kg)	1s
0-2	31	37	576	432	4.15	0.66	16027.2	1228.5
2-4	84	40	518	467	4.62	0.68	18083.5	1338.6
6-8	47	50			4.73	0.95	16347.4	1515.7
12-16	240	59			5.84	1.01	16936.2	1624.5
20-24	114	49			5.54	0.92	15676.1	1429.2
28-32	186	44			5.14	0.76	14657.2	1236.8
36-40	168	50			4.12	0.93	16309.7	1473.4
44-48	349	41			4.18	0.58	20106.3	1306.0
52-56	149	55			2.95	0.90	15552.1	1507.5
60-61	174	53			5.10	0.87	16726.3	1455.5