Site Sampling Technical Memorandum, Lower Otter Creek and Confluence, Maumee Area of Concern, Toledo, Ohio

Task Order No. 0027, Contract No. EP-R5-11-09

PREPARED FOR:	Brenda Jones and Meaghan Kern/U.S. Environmental Protection Agency - Great Lakes National Program Office
PREPARED BY:	CH2M HILL
DATE:	January 18, 2017
PROJECT NUMBER:	679969

Introduction

This technical memorandum summarizes the objectives, procedures, and results of the predesign investigation conducted at the Lower Otter Creek and Confluence within the Maumee River Area of Concern in Toledo, Ohio (Figure 1). The primary objective of this investigation was to provide remedial design sampling and support for the preferred remedial action alternative (Alternative 3) that was identified in a 2013 focused feasibility study (FFS) (Ramboll Environ Inc. [Ramboll] 2013) to address contaminated sediments at the Lower Otter Creek and Confluence Great Lakes Legacy Act site. As a part of this investigation, CH2M HILL (CH2M) conducted sediment and soil sampling in Otter Creek and the adjacent confluence area in September 2016. The non-federal sponsors (NFS) will prepare the remedial design. The investigation was conducted for the U.S. Environmental Protection Agency (EPA) Great Lakes National Program Office in accordance with Task Order No. 0027, Contract No. EP-R5-11-09.

Otter Creek is approximately 7 miles long and flows from southwest to northeast through portions of Toledo and Oregon, Ohio, discharging into Maumee Bay, which is part of the western basin of Lake Erie. The creek runs through highly industrialized areas, and railroad yards are located on both sides of the lower portion of the creek. This sampling effort focused on an approximate 1.7-mile segment of the creek that was identified in the FFS for the preferred remedial action (Alternative 3), as well as a specific confluence area at the mouth of Otter Creek. Figure 1 shows the project reach within Otter Creek and its confluence area.

The predesign investigation consisted of site access negotiation, a third-party utility locate, drone-assisted photography, bathymetric and topographic surveys, sediment sampling, and a geotechnical bank evaluation. The investigation was conducted in accordance with the following site-specific plans prepared by CH2M and approved by EPA:

- *Quality Assurance Project Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (QAPP; CH2M 2016a)
- *Field Sampling Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (FSP; CH2M 2016b)
- *Health and Safety Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (CH2M 2016c)

Field Objectives

The overall objectives of the predesign investigation in the Otter Creek and its confluence area were to address data gaps for lateral and vertical analytical delineation of soft sediments, define the native clay surface elevation within the creek, characterize native clay, and provide physical and geotechnical data to support the remedial design to be conducted by the NFS. Since the top 4 feet of soft sediment in Otter Creek had been sampled and characterized in previous investigations, the majority of the Otter Creek sampling in this investigation generally was designed to characterize conditions 4 feet or below the soft sediment surface (bss), as well as in the native clay in the creek. There were a few samples collected from the top 4 feet of sediment to gather information for waste profiling or physical parameter characterization. However, the sediment in the confluence area was generally sampled from the top 2 feet of soft sediment in order to address data gaps for lateral delineation, and at certain locations, it was sampled up to 5 feet bss to address gaps for vertical delineation. Overall, sediment samples, soil samples from geotechnical borings, and pore water samples were collected and analyzed to support the remedial design for this project area.

The field activities conducted to achieve the specific objectives for this investigation included:

- A third-party utility locate to identify and locate underground utilities within the project area
- Collection of sediment cores in Otter Creek to define the native clay elevation and chemical analysis (polyaromatic hydrocarbon [PAHs], total petroleum hydrocarbons - diesel range organics [TPH-DRO], and total organic carbon [TOC]) of the soft sediments and native clay to refine an understanding of the nature and extent of contamination in the Otter Creek
- Collection of sediment cores in the Otter Creek confluence area for chemical analysis (PAHs, TPH-DRO, total petroleum hydrocarbons - residual range organics [TPH-RRO], and TOC) to refine an understanding of the nature and extent of contamination.
- Collection of Ponar grab samples (bulk sediment) from the confluence area for pore water PAH analysis to refine an understanding of the nature and extent of contamination
- Collection of sediment cores from Otter Creek and the confluence area to support the remedial design evaluation of pumping and transport of bulk sediments, as well as waste disposal
- Collection of bank geotechnical data for the evaluation of slope stability conditions within Otter Creek
- Bathymetric and topographic surveys in the creek to provide a baseline of sediment surface and bank topography conditions for the remedial design
- Drone-assisted and conventional photography to document the site conditions prior to remedial action and to document the sampling activities
- Characterization and management of investigation-derived waste (IDW)

Field Investigation Activities

The field activities were conducted in three separate mobilizations to the study area. Before conducting intrusive activities, a third-party utility locate was conducted from September 7 through September 8, 2016, with one CH2M staff member in attendance to provide clearance of the proposed sampling locations. The primary field investigation activities were conducted between September 12 and September 17, 2016. Upon receipt of IDW characterization data and completion of related waste profiling paperwork, a third and final field mobilization conducted by one CH2M staff member occurred on October 31, 2016, to coordinate the removal of the staged IDW drums.

Third-Party Utility Locate

Before initiating intrusive subsurface activities, CH2M contacted Ohio's 811 utility locate to identify and locate underground utilities. The field team reviewed utility maps and navigation charts for the study area to determine if planned activities conflict with known utilities. CH2M also requested private utility information for the area of the creek and geotechnical borings from the adjacent property owners, which included CSX Railroad (CSX) and British Petroleum (BP).

Before the sampling event, one CH2M field staff member from Detroit, Michigan, and Blood Hound Underground Utility locators conducted the third-party utility locate between September 7 and September 8, 2016. Underground utilities and subsurface objects were marked as appropriate to the extent possible. The survey identified a BP water discharge line (herein referred as "Permitted Outfall 002") along the western bank of Otter Creek, two fiber optic lines paired with a telephone line (one line near the mouth of the confluence and another line between the road bridge and the railroad bridge), a force main sewer, a water main, a concrete conduit draining into the creek, an electrical conduit, and several outfalls along the creek bank. Figures 2a, 2b, and 2c show the underground utilities identified within the project area. The utility locate conducted for the predesign investigation may be informative for the subsequent remedial implementation, but is not intended to be sufficient for utility clearance prior to actual sediment removal activities.

Photography

The aerial photography team consisting of two CH2M staff (one from Seattle, Washington, and one from Washington, DC) conducted aerial photography of the project area using a drone-assisted high-resolution camera to document pre-remedial conditions and the sampling effort. Drone-assisted videography and photography occurred between September 13 and September 15, 2016, and the CH2M Project Manager (PM) conducted additional land-based photography documenting pre-remedial conditions during the same period. The CH2M drone photography team followed Federal Aviation Administration requirements for this activity and coordinated this effort with CSX and BP as the adjacent property owners.

The drone and field documentation photography were populated to a password protected photo-sharing Web site in accordance with EPA's statement of work and CH2M's technical proposal. The photographs and the drone imagery are intended to be used for site documentation purposes as well as community outreach activities.

Sediment and Soil Sampling

The core field team consisting of seven CH2M staff (five from Milwaukee, Wisconsin; one from Detroit, Michigan; and one from Chicago, Illinois), three staff from Affiliated Researchers (East Tawas, Michigan), and five staff from Coleman Engineering (Iron Mountain, Michigan), which mobilized to the site on September 12, 2016. The CH2M PM and assistant PM were onsite between September 13 and September 14, 2016, to coordinate site access and the overall field event. Two additional CH2M drone operators were onsite between September 13 and September 14, 2016, to take drone photography. Mobilization, sampling activities, survey activities, and demobilization were completed in 6 days from September 12 to September 17, 2016. Under separate contract with EPA, Cetacean Marine collected sediment core and surface grab samples in the confluence area using the R/V Mudpuppy II. One CH2M field staff member was present on the RV Mudpuppy II during sampling, along with the crew and one EPA staff member. Coleman Engineering collected sediment cores in Otter Creek and the geotechnical soil samples from the bank of Otter Creek.

Sediment cores were collected in the creek using direct-push technology aboard a pontoon boat. Sediment cores collected from the confluence area were collected using vibracore methods aboard the R/V Mudpuppy II. Collocated surface (0 to 0.5 foot) sediment grab samples for pore water analysis were collected using a 6-inch petite Ponar aboard the R/V Mudpuppy II. Sediment sample locations were recorded using differential global positioning system (GPS) receivers capable of sub-meter accuracy. Water depth measurements were collected at each location before sediment coring. Sediment cores were then advanced to depth specified in the FSP (CH2M 2016b).

The retrieved cores were taken to the onshore processing area located at the BP Husky boat launch area. The cores were characterized, processed, and placed in appropriate containers for shipment to the designated laboratories according to the QAPP and FSP (CH2M 2016a, 2016b). The surface sediment grab samples collected with a Ponar grab sampler on the R/V Mudpuppy II were placed in a stainless steel pan, (decontaminated between every sample), homogenized, and then transferred to clean sample jars. The jars were then labeled, stored on ice in a cooler at approximately 4 degrees Celsius, and transported to the BP Husky facility for processing. Table 1 presents the physical parameters collected at each location along with the description of the sediment characteristics.

Soil borings for geotechnical evaluation purposes were collected from the banks of Otter Creek using a hollow-stem auger drill rig. Continuous samples were collected from split spoons and Shelby tubes. Soil boring locations were recorded using differential GPS receivers capable of sub-meter accuracy. Soil borings were then advanced to depths specified in the FSP (CH2M 2016b), with field adjustments made in collaboration with EPA and a Ramboll NFS representative who was present in the field during the field-sampling event (see the Deviation Summary Section for details). The collected cores were visually characterized and sampled. Table 2 presents the sample intervals and testing parameters. The Ramboll NFS representative participating in the field geotechnical activities coordinated with the CH2M field geologist to make the final decisions on selecting the geotechnical samples and the geotechnical boring locations, as Ramboll will be the engineer of record on the remedial design and related geotechnical considerations.

The samples were collected and processed according to the procedures and methodologies outlined in the QAPP and FSP (CH2M 2016a, 2016b), with few minor deviations as discussed in the Deviation Summary section below. The field team processed the sediment cores at the temporary processing facility located at the BP Husky boat dock property by placing the cores on a decontaminated table and splitting lengthwise. The CH2M geotechnical engineer processed soil borings at each boring location.

Sediment cores and soil borings were photographed and described with respect to general stratigraphy, sediment type, apparent grain size, color, odor, plasticity, consistency, density, moisture, and any notable characteristics, including visible evidence of staining or nonaqueous phase liquid (NAPL). A photoionization detector (PID) was used to screen the core headspace (the space in the core liner between the top of the sediment and the core liner cap) and in each interval of the core.

For both sediment cores and soil borings, geotechnical field tests (Torvane shear and pocket penetrometer tests) were performed in cohesive material at each location. NAPL, staining, and sheens were observed in some cores. Attachment 1 contains the scanned copies of the field core logs describing the observed features. Attachment 2 contains photograph logs documenting field procedures and visual characteristics of each sediment core. Locations designated for analytical or physical analysis were sampled and processed in accordance with the QAPP and FSP (CH2M 2016a, 2016b). All laboratory analyses were recorded in the Scribe database.

Tables 1 and 2 present the latitude (x), longitude (y), and elevation (z) of the sampled locations, sample identifications, sediment thickness, clay elevations, water depths, core penetration and refusal depths, and the visual observations noted at each location. The material from each sample interval was transferred into disposable aluminum pans and homogenized until uniform texture and color were achieved. The homogenate was then transferred to analyte-specific bottleware, labeled, and bagged for laboratory analysis. Applicable intervals for the selected cores were selected according to the procedures established in the FSP (CH2M 2016b) and submitted for laboratory analysis. Chemical characterization samples, except pore water PAH samples, were shipped to the Pace Analytical laboratory in Green Bay, Wisconsin. Pore water PAH samples were shipped to Energy and Environmental Research Center in Grand Forks, North Dakota, and physical parameter testing samples to support the design were provided onsite to Coleman Engineering and subsequently taken to its laboratory at the completion of field sampling.

Surveys

CH2M's team subcontractor, Affiliated Researchers, performed a topographic survey of the creek banks, as well as a bathymetry survey of Otter Creek and the confluence area. Affiliated Researchers also surveyed the newly identified underground utilities that had been marked by Bloodhound Inc. (third-party utility locator) and the completed final geotechnical boring locations along Otter Creek using real-time kinetic (RTK) methods. The survey activities were performed following the procedures outlined in the QAPP and FSP (CH2M 2016a, 2016b). Attachment 3 contains the detailed survey report provided by Affiliated Researchers. The following summarizes survey activities performed during the sampling event:

- Because of dense leaf cover within certain parts of the project area, the Trimble differential GPS receivers had a limited capability; therefore, the proposed sampling locations along Otter Creek were pre-located and staked using RTK methods.
- The locations of the newly identified underground utilities that were marked during the third-party utility locate were surveyed using RTK methods.
- A topographic bank survey was performed along the bank of Otter Creek and the confluence area. RTK GPS positions were collected along transects beginning at the water's edge up to 100 feet toward the top of the bank, with transect spacing intervals of approximately 150 feet.
- A single-beam bathymetry survey was performed in Otter Creek and the confluence to show the existing sediment conditions. A Knudsen Chirp 3212 dual-frequency single-beam echo-sounder system was used for the survey along transect lines at 50-foot intervals. In shallow areas near the shore and in the narrow areas at the upstream end of the project area, the single-beam survey could not be performed; therefore, static survey shots were used, linked to the RTK unit to directly measure sediment surface elevation along transects to complete the survey coverage. Areas using static survey shots utilized a survey rod fitted with a 6-inch flat disc. Static survey shots were taken along the shore to tie the bathymetric survey into the adjacent shoreline and topographic survey. Top of sediment elevations at each sample location were determined from the bathymetric survey.

Summary of Investigation Results

Sediment cores were collected at 55 locations, of which 33 were from Otter Creek and 22 were from the confluence area. Figures 2a, 2b and 2c show the completed final sample locations. The creek project length is approximately 1.7 miles and its width ranges from approximately 45 feet in the downstream end (northern segment, near the confluence) and middle sections to approximately 15 feet in the upstream reach (southern segment) with the creek tapering at the upstream end.

Although the water levels in the Otter Creek fluctuate due to the seiche effect of Lake Erie, during the sampling event, the water elevation in Otter Creek and the confluence area was generally stable at approximately 572 feet above mean sea level (amsl). The water depths in the creek ranged from 1.3 to 5.8 feet, with an average depth of 3.9 feet. The water depths in the confluence area ranged from 2 to 6 feet, with an average depth of 4.4 feet. Some log debris and dead vegetation were found in the creek, obstructing the creek intermittently. Dense vegetation, including Phragmites were observed on both sides of the creek banks at the southern end and just south of the railroad bridge.

Native Clay Delineation

Thirty-three cores were advanced into the native clay to vertically delineate the thickness of soft sediment and identify the surface of the native clay in Otter Creek. The average depth to native clay in the creek was 6.3 feet bss, with an average clay surface elevation of 562.58 feet amsl. The shallowest elevation of the native clay (at approximately 568 feet amsl at 2.6 feet bss) was observed at the southern portion of the project area near sample location (SD-42. The deepest elevation of the native clay (at approximately 555 feet amsl at 13.9 feet bss) in the creek was observed at location SD-31 in the northern segment north of the CSX road bridge. Figure 4A presents the native clay elevations in Otter Creek and the FFS (Ramboll 2013) proposed dredge cut line of 4 feet bss.

Twenty-two cores in the confluence area were advanced into the native clay. The average depth to native clay in the confluence was 1.4 feet bss, with an average clay surface elevation of 566.92 feet amsl. The shallowest clay surface elevation (570 feet amsl at 0.4 foot bss) was observed near the beach area in the southwestern portion of the confluence area (SD-17 and SD-16), while the deepest clay surface elevation (563.8 feet amsl at 3.8 feet bss) was observed near the northeastern corner of the confluence area (SD-03). Figure 4B presents the native clay elevations in the confluence area.

Sheen and NAPL Observations

Mild to moderate sheen was observed during processing and/or core collection in 6 of the 22 cores collected in the confluence area (SD-01, SD-02, SD-03, SD-04, SD-14, and SD-15), and 14 of the 33 cores collected in Otter Creek (SD-25, SD-27, SD-28, SD-29, SD-30, SD-32, SD-34, SD-37, SD-41, SD-44, SD-47, SD-48, SD-51, and SD-54). Staining and NAPL was observed in one core in the creek (SD-29); no cores collected in the confluence area contained staining or NAPL. However, during anchoring activities of the R/V Mudpuppy vessel in the confluence area, sheen and bubbles of NAPL combined with strong hydrocarbon odor were released onto the water surface from the surficial sediment around locations SD-14, SD-15, SD-01, SD-02, and SD-03. Table 1 presents the visible evidence of sheen, staining, or NAPL observed at the core locations. Attachment 1 contains the sediment logs presenting the visual observations recorded along with the PID readings collected at sample intervals.

Analytical Results

Bulk Sediment Results

During the sampling activities, 105 sediment samples (not including quality assurance [QA]/quality control [QC]) were collected from 55 locations and submitted for chemical analysis. Table 1 summarizes the analysis performed per location. Of the 105 samples, 64 samples from 22 core locations (all locations in the confluence area) were analyzed or archived for PAH, diesel-range organics (DRO), residual-range organics (RRO), and total organic carbon (TOC). Of the 105 samples, 41 samples from 33 locations (all locations designated for chemical analysis in Otter Creek) were analyzed or archived for PAH, DRO, and TOC. The analysis for TPH-RRO was included in the investigation per a request from Ohio EPA, to provide an additional line of evidence that may help to correlate elevated total petroleum hydrocarbon concentrations with the potential for sheen generation. However, there is no remedial cleanup goal for TPH-RRO, and the TPH-RRO data are therefore intended for general informational purposes. Field duplicate and matrix spike/matrix spike duplicate samples were collected at frequencies specified in the QAPP and FSP (10 and 5 percent, respectively) (CH2M 2016a, 2016b).

Sediment sample results from Otter Creek and the confluence area did not exceed the remedial cleanup goal of 3,100 milligrams per kilogram (mg/kg) for DRO (C10-C28). One sediment sample result from the confluence area exceeded the remedial cleanup goal of 22.8 mg/kg for total PAHs (SD-14-1.0/1.4) at 30.5 mg/kg. In the confluence area, RRO concentrations ranged from 0.79 to 2,430 mg/kg; DRO concentrations ranged from 2.5 to 2,010 mg/kg; and total PAH concentrations ranged from 0.13 to

30.5 mg/kg. In Otter Creek, DRO concentrations ranged from 2.2 to 989 mg/kg and total PAH concentrations ranged from 0.13 to 10.84 mg/kg. No creek samples were analyzed for RRO.

Table 3A summarizes the analytical results for the total PAHs (16 target compounds), DRO (C10-C28), RRO (C10-C40), and TOC. Table 3B summarizes sediment samples that had visible sheen and their respective DRO and RRO concentrations. Total PAH concentrations presented in Table 3A were calculated by summing the detected concentration reported for the individual target PAHs in a given sample. If an individual PAH compound was not detected in a sample, one-half the reporting limit for that compound was used. Figures 5a, 5b and 5c show the sample results screened against the remedial cleanup goal criteria. The results that exceeded the remedial cleanup goal criteria are highlighted in red, and the results that were below the criteria are highlighted in green. Attachment 4 contains the Data Usability Report (pending).

Pore Water Results

Twenty-two sediment samples were collected from the surface interval (0 to 0.5 foot bss) using a petite Ponar from 22 locations. Sixteen of the 22 samples were analyzed for 34 PAHs in pore water and pore water sediment. In accordance with the QAPP and FPS (CH2M 2016a, 2016b), no QA/QC pore water samples were collected and submitted for analysis.

Pore water toxicity units (TU) were calculated as the sum of the 34 individual PAH TU. Individual PAH TU were calculated by dividing the pore water concentration of the individual PAH compound by its respective final chronic value (FCV) obtained from Table 3-4 of the *EPA Manual - Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks* (ESBs) *for the Protection of Benthic Organisms* (EPA 2003). Sediment ESB TU were calculated as the sum of the 34 individual PAH TU, normalized for TOC and the FCV values. Although, there is no remedial clean up goal for ESB TU, the research suggests that a toxic effect is likely to occur when levels are greater than 1 TU. Therefore, this ESB TU information is provided for informational purposes.

Pore water results ranged from 0.9 to 15.89 TU, and pore water sediment results ranged from 0.66 to 35.70 ESB TU. Six (SD-01, SD-02, SD-04, SD-08, SD-11, and SD-14) of the 16 pore water samples exceeded the pore water PAH remedial cleanup goal criteria of 5 TU. No remedial cleanup goal was established for sediment ESB TU. Tables 4A and 4B summarize the pore water PAH (34 target compounds) data, along with their respective TU values.

Samples from seven locations (SD-16 through SD-22) of the 22 confluence locations were archived pending analytical results from the 15 primary samples. Based on the results from the 15 primary confluence locations, only one archived sample location (SD-22) was selected and approved by EPA for chemical analysis (pore water PAH, DRO, total PAHs, and RRO). The results of the archived samples for core location SD-22 were below the remedial cleanup goal screening criteria.

Based on the results from the primary samples collected in Otter Creek and the confluence area that were discussed on October 25, 2016, as well as a subsequent review by Ramboll, EPA and the NFS partners agreed that no further analysis of archived samples was necessary.

Geotechnical Laboratory Analyses

Soil borings were collected at seven locations along the banks of Otter Creek. Soil boring processing was performed at each sample location, and physical parameter samples were provided onsite to Coleman Engineering for subsequent transport to its physical testing laboratory. Table 2 summarizes field measurements and physical analysis of the soil borings collected. Seven locations were sampled for geotechnical testing. Each location was sampled continuously in 2-foot intervals using split spoons and Shelby tubes, and recovered samples were analyzed for:

- Moisture content by ASTM D2216 (72 samples)
- Grain size analysis by ASTM D422 (26 samples)
- Atterberg limits by ASTM D4318 (26 samples)
- Density by ASTM D7263 (13 intact samples)
- Specific gravity by ASTM D854 (13 intact samples)
- CU Triaxial by ASTM D4767 (9 intact samples)
- UU Triaxial by ASTM D2850 (4 intact samples)

Table 5 presents the geotechnical bank laboratory test results, including the strength testing results (CU and UU Triaxial). Because of the nature of the sampling, only the cohesive material recovered from the borings was tested in the laboratory, and as such, there is no data for the granular or organic material (peat) encountered. Generally, the cohesive material consisted of lean clay with varying amounts of sand. The lean clay was consistent across the site with an average liquid limit and plastic limit of 32 and 16 percent, respectively; average moisture content of approximately 20 percent; and average sand content of 15 percent. Gravel percentages in the clay were generally less than 3 percent.

In some of the borings, higher plasticity material was encountered that can be classified as fat clay or elastic silt. These zones generally had lower percentages of sand and gravel (usually less than 10 percent) and higher moisture contents (above 60 percent).

Physical Parameter Testing

Bulk sediment samples were collected from 10 core locations (SD-05, SD-07, SD-08, SD-14, SD-25, SD-29, SD-33, SD-37, SD-40, and SD-44) and analyzed for:

- Moisture content by ASTM D2216
- Grain size analysis by ASTM D422
- Porosity by ASTM D7263

Table 6 presents the results of the 10 physical parameter samples collected. Results of the testing indicate the sediments are similar in consistency, generally clayey silt with varying amounts of sand. Most of the samples have low specific gravities and densities, with high porosities and moisture contents, which indicates the sediment might classify as organic silt. The other samples, which contain higher amounts of sand, still have high porosity values and low densities, indicating loose packing and an overall soft nature. These results will be used in the remedial design to evaluate the feasibility of pumping and transportation of the dredged sediment.

Waste Disposal Characterization

Bulk sediment samples for waste disposal characterization were collected from four core locations (SD-07, SD-14, SD-25, and SD-33) and analyzed for:

- Toxicity characteristic leaching procedure (TCLP) volatile organic compounds by EPA SW-846 Methods 1311/8260B
- TCLP semivolatile organic compounds by EPA SW-846 Methods 1311/8270D
- TCLP pesticides by EPA SW-846 Methods 1311/8081B
- TCLP herbicides by EPA SW-846 Methods 1311/8151A
- TCLP metals by EPA SW-846 Methods 1311/6010B/7470
- Polychlorinated biphenyls by EPA SW-846 Method 8082A
- Ignitability (flash point) by EPA SW-846 Method 1030

- Corrosivity (pH) by EPA SW-846 Method 9045D (sediment) and EPA SW-846 Method 9045C (aqueous)
- Paint filter by EPA-846 Method 9095B

Table 7 summarizes the waste disposal characterization data. These results will be used to support the design for the remedial action.

Investigation-Derived Waste Characterization

One composite sample of sediment representing all of the locations was collected and one composite sample of the aqueous waste representing the decontamination water was collected and analyzed for the following:

- TCLP volatile organic compounds by EPA SW-846 Methods 1311/8260B
- TCLP semivolatile organic compounds by EPA SW-846 Methods 1311/8270D
- TCLP pesticides by EPA SW-846 Methods 1311/8081B
- TCLP herbicides by EPA SW-846 Methods 1311/8151A
- TCLP metals by EPA SW-846 Methods 1311/6010B/7470
- Polychlorinated biphenyls by EPA SW-846 Method 8082A
- Ignitability (flash point) by EPA SW-846 Method 1030
- Corrosivity (pH) by EPA SW-846 Method 9045D (sediment) and EPA SW-846 Method 9045C (aqueous)

Table 8 summarizes the IDW characterization data. The solid and liquid waste was determined to be nonhazardous and was removed from the BP Husky staging facility on October 31, 2016, for transportation and disposal. Attachment 5 contains a copy of the signed waste manifest.

Deviation Summary

The following summarizes minor deviations associated with survey transects, sample locations, sample processing, and sample quantity:

Survey

- The topographic survey transects on the western side of Otter Creek were collected from the adjacent Otter Creek road at 150-foot intervals. Because of the increased distance from the creek to the road, as well as the extremely dense Phragmites in the floodplain which limited access, fewer points were surveyed at the bottom of the bank than estimated in the FSP.
- A 1,000-foot-long section of the western bank south of the railroad bridge was inaccessible because of concrete debris. This gap in coverage was addressed by extrapolating the nearby data points and aerial photographs.
- An additional pass (four passes instead of three) with the single-beam echo sounder was added to the bathymetric survey in the creek segment to the south of the railroad overpass because of a wider-than-anticipated creek width.
- The single-beam bathymetric survey was not completed in the southernmost 500 feet of the project area in the creek. Because of shallow water, a manual bathymetric survey was performed using water depth measurements, poling, and static survey shots.

Sediment Sampling

- Additional clay delineation cores (no chemical analysis) were collected in Otter Creek after agreement was obtained from EPA, CH2M, Ramboll, and NFS representatives during a teleconference on September 16, 2016. The additional locations selected for clay surface identification included the following: SD-47, SD-48, SD-50, SD-51, SD-52, SD-54, SD-55, SD-56, SD-58, SD-60, and SD-61. In addition, it was agreed that several of the optional core locations noted above (SD-50, SD-51, SD 52, and SD-54) also would have sediment samples collected for archiving and possible future chemical analysis based on the results of the Otter Creek primary samples. However, as noted above, EPA and the NFS partners agreed that analysis of these archived samples was not necessary.

- SD-44 was moved approximately 5 to 10 feet north of the original proposed location because of the presence of utilities in the area. New coordinates were collected using a Trimble GPS.
- SD-34 was moved north of the original proposed location because of the presence of a fiber optic line crossing the creek. New coordinates were collected using a Trimble GPS.
- SD-32 was moved from the original proposed location that was located 15 feet onto the creek bank. New coordinates were collected using a Trimble GPS.
- SD-26 was moved approximately 20 feet south from the original proposed location because of dense vegetation and trees. New coordinates were collected using a Trimble GPS.
- The Trimble GPS did not have sufficient satellite coverage while collecting a sample at location SD-44; therefore, the GPS had decreased accuracy. For this reason, the proposed coordinates were used as the final coordinates, because the sampled location remained unchanged.
- The core collected at SD-37 had low recovery; therefore, the sampling location was moved approximately 10 feet, and sufficient recovery was obtained using manual coring techniques. New coordinates were collected using a Trimble GPS.

Geotechnical Bank Evaluation

As mentioned above and specified in the FSP (CH2M 2016b), the Ramboll NFS representative participating in the field geotechnical activities coordinated with the CH2M field geologist to make the final decisions on selecting the geotechnical samples and the geotechnical boring locations, since Ramboll will be the engineer of record for the remedial design. Field decisions and deviations were coordinated by Ramboll in consultation with the CH2M field geologist. The geotechnical bank sampling deviations included the following:

- The original proposed location for SO-03 was on a steep, vegetated slope that the drill rig could not access. Several overhead lines were in the immediate area in addition to several underground utilities (gas and water). Because of the topography and presence of utilities, Ramboll determined that a suitable location close to the bridge was not available; therefore, the boring at SO-03 was not performed.
- Proposed locations SO-09, SO-08, SO-07, and SO-06 were planned to be spaced at approximately equal distances along the creek bank adjacent to the railroad. However, the proposed location for SO-06 was relatively close to SO-05, which was deemed an important location. Therefore, Ramboll and CH2M decided to eliminate the boring at SO-06, and move SO-07 north by approximately 600 feet (approximately halfway between the original proposed location for SO-07 and SO-06). This decision was further supported by the similar subsurface geologic conditions encountered in SO-09 and SO-08. Final boring locations were adjusted slightly from the originally proposed locations to allow drill rig access and provide for safe working conditions for the operators. The list below describes the reasoning for each adjustment:
  - SO-01: moved 5 feet south-southeast because of large trees surrounding boring location (drill rig could not fit between trees)
  - SO-02: moved 10feet west because the original proposed location was in dense brush/trees

  - SO-04: moved 3 feet west, as vegetation was in the drill rig's way
  - SO-05: moved 5 feet south, as vegetation was in the drill rig's way
  - SO-07: moved 600 feet north, see detailed explanation above
  - SO-08: moved 5 feet east, as vegetation was in the drill rig's way
  - SO-09: moved 5 feet east, as vegetation was in the drill rig's way

- The proposed sampling included the collection of samples at 1-foot intervals to 25 feet below ground surface (bgs). However, continuous sampling was conducted at 2-foot intervals using split-spoon and Shelby tubes samplers, and borings were advanced to 26 feet bgs, except for SO-02 (25.5 feet bgs) and SO-04 (see below).
- Organic material was encountered at SO-04 at a depth of approximately 21 feet bgs with very little cohesive material above 21 feet bgs. To obtain the planned samples (two Shelby tube intact samples and four index testing samples), Ramboll Environ recommended drilling to 28 feet bgs to collect the required number of samples.
- Deep organic material was also encountered in SO-05 with very little cohesive material. Instead of drilling deeper at this location like at SO-04, Ramboll Environ recommended collecting fewer index-testing samples as the subsurface conditions were similar to SO-04, and thus, only two index testing samples were collected. Additionally, the Shelby tube collected from 20 to 22 feet bgs had limited recovery; therefore, a Triaxial test could not be performed, so an index testing was performed on the recovered material.

Sediment Core Processing

- A composite sample was collected from the soft sediment in the core from SD-08 instead of SD-11 for physical parameter testing because there was no soft sediment at SD-11.
- A 1-foot interval from locations SD-50, SD-51, SD-52, and SD-54 was collected to be archived at the laboratory for chemical analysis. The selection of intervals in these cores were coordinated with Ramboll and CH2M in the field during sediment core processing based visual observations, PID readings, and adjacent sampled locations and intervals. The 5- to 6-foot bss interval was selected for archiving from SD-50. The 6- to 7-foot bss interval was selected for archiving from SD-51. The 5- to 6-foot bss interval was selected for archiving from SD-52. The 6- to 7-foot bss interval was selected for archiving from SD-54.

References

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Tables

Table 1. Summary of Sediment Cores and Pore Water Sample Locations - September 2016
Lower Otter Creek and Confluence, Maumee River AOC

Location ID	Date	Easting[1]	Northing[1]	Core Penetration (ft bss)[5]	Core Recovery (ft bss)[5]	Core Recovery (%)	Water Depth (ft)	Core Refusal Depth (ft)	Native Clay Depth (ft bss)	Water Surface Elevation (ft)[1]	Sediment Surface Elevation (ft)[1]	Core Refusal Elevation (ft)[1]	Native Clay Elevation (ft)[1]	Observations: Sheen	Staining	Odor	PID Max	Geotechnical Field Testing: Torvane (psf) Sed. Avg.	Torvane (psf) Clay Avg.	Penetrometer (psf) Sed. Avg.	Penetrometer (psf) Clay Avg.	Analysis Summary[2]: Clay Delineation Core	Physical Parameter Testing[3]	Waste Char.[4]	Total PAH (16)	DRO	RRO	TOC	Pore Water PAHs[9]
Confluence Area																													
SD-01	9/15/2016	-83.453310	41.699378	4.5	4.7	104%	4.92	4.5	2.5	572.52	567.60	563.10	565.10	X			178		546		2733				X	X	X	X	X
SD-02	9/14/2016	-83.453444	41.699254	4.25	4.9	115%	5.17	4.25	2.7	573.12	567.95	563.70	565.25	X			0.6	102	478	500	467				X	X	X	X	X
SD-03	9/14/2016	-83.453238	41.699154	6	5.5	92%	5.17	6	3.8	572.77	567.60	561.60	563.80	X			51.1		358		1750				X	X	X	X	X
SD-04	9/14/2016	-83.453767	41.699307	4	3.6	90%	5.33	4	2	572.94	567.61	563.61	565.61	X		X	1.5		614		1500				X	X	X	X	X
SD-05	9/14/2016	-83.454173	41.699571	4.25	4.4	104%	5.75	4.25	1.5	573.08	567.33	563.08	565.83				0		287		1000		X		X	X	X	X	X
SD-06	9/14/2016	-83.454952	41.699577	3	2.9	97%	5.42	3	1.9	572.76	567.34	564.34	565.44				0.4		614		1750				X	X	X	X	X
SD-07	9/15/2016	-83.455054	41.699302	4.25	3.6	85%	5.17	4.25	1.5	572.77	567.60	563.35	566.10				7		649		2500		X	X	X	X	X	X	X
SD-08	9/15/2016	-83.454783	41.698996	4	3.9	98%	4.83	4	1.8	572.58	567.75	563.75	565.95			X	1.9		486		1625		X[6]		X	X	X	X	X
SD-09	9/15/2016	-83.455050	41.698785	3.5	3.7	106%	4.97	3.5	0	572.82	567.85	564.35	567.85				0		614		1500				X	X	X	X	X
SD-10	9/15/2016	-83.455053	41.698525	3.75	4.1	109%	4	3.75	0	572.58	568.58	564.83	568.58				0		461		1900				X	X	X	X	X
SD-11	9/14/2016	-83.454416	41.698539	5	4.7	94%	3.83	5	0	572.47	568.64	563.64	568.64				0		947		1750				X	X	X	X	X
SD-12	9/13/2016	-83.454130	41.698134	4	3.9	98%	2.67	4	3.1	572.13	569.46	565.46	566.36				1.1	221	1147	2000	2000				X	X	X	X	X
SD-13	9/13/2016	-83.453711	41.698032	3.5	3.7	106%	2.66	3.5	0	572.03	569.37	565.87	569.37				1		901		2500				X	X	X	X	X
SD-14	9/13/2016	-83.453222	41.698039	3	2.9	97%	3.83	3	1.4	572.56	568.73	565.73	567.33	X		X	42		2074		4250		X	X	X	X	X	X	X
SD-15	9/13/2016	-83.453348	41.697792	3	2	67%	2.83	3	1.4	572.20	569.37	566.37	567.97	X			13.9		1802		3000				X	X	X	X	X
SD-16	9/13/2016	-83.453818	41.697845	4	3.6	90%	2.16	4	0	572.23	570.07	566.07	570.07				0		1444		3000				--	--	--	--	--
SD-17	9/13/2016	-83.454567	41.697968	4	4	100%	2	4	0	572.09	570.09	566.09	570.09				0		765		1833				--	--	--	--	--
SD-18	9/13/2016	-83.455225	41.698315	4	4.1	103%	3	4	0	572.23	569.23	565.23	569.23				0		538		1800				--	--	--	--	--
SD-19	9/15/2016	-83.455354	41.699340	3	2.8	93%	5.08	3	1.9	572.55	567.47	564.47	565.57				0		614		1750				--	--	--	--	--
SD-20	9/15/2016	-83.455327	41.699716	3.25	2.6	80%	6	3.25	0.9	573.10	567.10	563.85	566.20				0		307		1333				--	--	--	--	--
SD-21	9/14/2016	-83.454170	41.699896	2.75	2.7	98%	5.67	2.75	2	572.59	566.92	564.17	564.92				0.3		1075		3500				--	--	--	--	--
SD-22	9/15/2016	-83.453283	41.699543	2.5	1.4	56%	5.33	2.5	--	572.33	567.00	564.50	--				0								X	X	X	X	X
		Confluence Area Average		*3.8*	*3.6*	*95%*	*4.4*	*3.8*	*1.4*	*572.57*	*568.21*	*564.42*	*566.92*																
Otter Creek																													
SD-23	9/15/2016	-83.453349	41.697623	4.8	4.2	88%	3.3	4.8	3.9	573.01	569.71	564.91	565.81				1.5	546	1536	1333	5250	X			X	X		X	
SD-24	9/15/2016	-83.453456	41.696736	10	7.4	74%	2.7	10	7.1	573.82	571.12	561.12	564.02				129	205	942	3000	3750	X							
SD-25	9/15/2016	-83.453396	41.696686	8.2	6	73%	5.8	8.2	5.2	572.57	566.77	558.57	561.57	X		X	244		1357		3750	X	X	X	X	X		X	
SD-26	9/15/2016	-83.453348	41.696623	5	3	60%	2.3	5	2.7	572.58	570.28	565.28	567.58				0	410	614	1375	2000	X							
SD-27	9/15/2016	-83.45358	41.696247	7	4.7	67%	5.1	7	5.6	573.28	568.18	561.18	562.58	X			21		1203		5125	X			X	X		X	
SD-28	9/15/2016	-83.453768	41.695495	8.2	6.1	74%	5.4	8.2	6.2	572.24	566.84	558.64	560.64	X			2.7		1280		3750	X			X	X		X	
SD-29	9/15/2016	-83.45414	41.694148	10	4.9	49%	4.9	10	5	573.87	568.97	558.97	563.97	X	X	X	2.9		1741		3667	X	X		X	X		X	
SD-30	9/15/2016	-83.454658	41.692612	15	11.5	77%	5	15	11.7	572.76	567.76	552.76	556.06	X		X	86	819	2304	2500	4750	X			X	X		X	
SD-31	9/15/2016	-83.454599	41.692588	15	13.4	89%	3.1	15	13.9	572.25	569.15	554.15	555.25				0		956		2833	X							
SD-32	9/14/2016	-83.455305	41.690238	15	13.4	89%	2.7	15	10	574.35	571.65	556.65	561.65	X		X	56	0	2099	1500	2750	X							
SD-33	9/15/2016	-83.455262	41.690205	12	9.1	76%	5.1	12	10	572.92	567.82	555.82	557.82				3.6	205	614	1600	1600	X	X	X	X	X		X	
SD-34	9/14/2016	-83.455616	41.689565	12	8	67%	5	12	10.3	573.52	568.52	556.52	558.22	X			17.4		717		3000	X			X	X		X	
SD-35	9/14/2016	-83.456504	41.687293	8.1	7.7	95%	5.7	8.1	7.3	573.51	567.81	559.71	560.51			X	17.3		205		1000	X			X	X		X	
SD-36	9/14/2016	-83.457491	41.685325	4	1.2	30%	5.6	4	0	573.19	567.59	563.59	567.59				0		1485		6000	X							
SD-37	9/14/2016	-83.457911	41.684437	4.9	4.2	86%	4.4	4.9	3	572.47	568.07	563.17	565.07	X			6.3		1331		9000	X	X		X	X		X	
SD-38	9/14/2016	-83.45923	41.682929	10	3.5	35%	4.6	10	0.7	573.01	568.41	558.41	567.71				1.1		1485		2000	X			X	X		X	
SD-39	9/14/2016	-83.460553	41.681526	10	7.9	79%	3.6	10	7	572.90	569.30	559.30	562.30			X	5.5		410		800	X							
SD-40	9/13/2016	-83.461266	41.680803	10	4.2	42%	3.3	10	6.5	572.27	568.97	558.97	562.47				7.5		717	1000	1750	X	X		X	X		X	
SD-41	9/13/2016	-83.463664	41.678238	10	5.9	59%	3.8	10	4	572.35	568.55	558.55	564.55	X		X	8.4	1024	1707	2500	3700	X			X	X		X	
SD-42	9/13/2016	-83.464871	41.676982	5	3.7	74%	2.9	5	2.6	573.98	571.08	566.08	568.48			X	10.8		123		1000	X							
SD-43	9/13/2016	-83.465597	41.67621	8.5	6.1	72%	2	8.5	6	571.53	569.53	561.03	563.53				0.9	1229	1421		4920	X			X	X		X	
SD-44	9/13/2016	-83.467004	41.674893	11	6.7	61%	2.8	11	6.6	573.67	570.87	559.87	564.27	X		X	27.8	84	1470		5040	X	X		X	X		X	

Table 1. Summary of Sediment Cores and Pore Water Sample Locations - September 2016
Lower Otter Creek and Confluence, Maumee River AOC

Location ID	Date	Easting[1]	Northing[1]	Core Penetration (ft bss)[5]	Core Recovery (ft bss)[5]	Core Recovery (%)	Water Depth (ft)	Core Refusal Depth (ft)	Native Clay Depth (ft bss)	Water Surface Elevation (ft)[1]	Sediment Surface Elevation (ft)[1]	Core Refusal Elevation (ft)[1]	Native Clay Elevation (ft)[1]	Observations: Sheen	Observations: Staining	Observations: Odor	Observations: PID Max	Geotechnical Field Testing: Torvane (psf) Sed. Avg.	Torvane (psf) Clay Avg.	Penetrometer (psf) Sed. Avg.	Penetrometer (psf) Clay Avg.	Analysis Summary[2]: Clay Delineation Core	Physical Parameter Testing[3]	Waste Char.[4]	Total PAH (16)	DRO	RRO	TOC	Pore Water PAHs[9]
Otter Creek																													
SD-47	9/16/2016	-83.453939	41.694886	9	5.1	57%	4.6	9	7.5	572.33	567.73	558.73	560.23	X		X	71		1229		4750	X [8]							
SD-48	9/16/2016	-83.454198	41.694201	10	8.1	81%	2	10	8.7	573.28	571.28	561.28	562.58	X		X	255		2150		4750	X [8]							
SD-50	9/16/2016	-83.454382	41.693281	7.5	6.2	83%	4.8	7.5	7	572.47	567.67	560.17	560.67				18.6		1894		4000	X [8]			-- [7]	-- [7]		-- [7]	
SD-51	9/16/2016	-83.454724	41.692615	15	12	80%	1.3	15	12.6	572.61	571.31	556.31	558.71	X		X	100.8		205		1000	X [8]			-- [7]	-- [7]		-- [7]	
SD-52	9/16/2016	-83.454782	41.691907	12	8	67%	3.7	12	10.7	571.92	568.22	556.22	557.52				1.9		1754		3833	X [8]			-- [7]	-- [7]		-- [7]	
SD-54	9/16/2016	-83.455245	41.690167	12.5	10.4	83%	2.6	12.5	11.5	571.52	568.92	556.42	557.42	X		X	36		768		2550	X [8]			-- [7]	-- [7]		-- [7]	
SD-55	9/16/2016	-83.456081	41.688353	5	2.8	56%	2.6	5	5.5	569.62	567.02	562.02	561.52				8.3		307		1000	X [8]							
SD-56	9/16/2016	-83.456984	41.686373	5	2.6	52%	5.4	5	2.4	573.04	567.64	562.64	565.24				4.8		307		1000	X [8]							
SD-58	9/16/2016	-83.459924	41.682215	5	3.5	70%	3.2	5	2.8	572.45	569.25	564.25	566.45			X	4.2		1024		4000	X [8]							
SD-60	9/16/2016	-83.462883	41.679037	5	2.6	52%	4.5	5	1.8	573.22	568.72	563.72	566.92				6.3		1178		4000	X [8]							
SD-61	9/16/2016	-83.464187	41.677702	5	2.5	50%	4.7	5	1.9	572.81	568.11	563.11	566.21				1.1		205		750	X [8]							
			Creek Average	*8.9*	*6.3*	*68%*	*3.9*	*8.9*	*6.3*	*572.77*	*568.87*	*559.94*	*562.58*																

Notes:

[1]Northing and easting coordinates are in Latitude / Longitude (degrees decimal format) - World Geodetic System 1984 (WGS84). Elevations reported North American Vertical Datum of 1988.

[2]Analytical methods and individual analytes are listed in Table 4 of the QAPP.

[3] Physical parameter testing includes Moisture Content, Grain Size Analysis, and Atterberg Limits.

[4] Waste Characterization includes TCLP VOC, TCLP SVOC, TCLP Pesticides, TCLP Herbicides, TCLP Metals, PCBs, pH, flash point, and paint filter.

[5] For Otter Creek locations (collected using DPT) values reported represent the total sum of interval penetration and recoveries for each sediment core as reported in core logs.

[6] Physical parameter sample collected at SD-08 instead of SD-11 due to limited soft sediment at SD-11.

[7] Samples archived for chemical analysis at one interval per location based on adjacent samples and visual/PID observations. Samples will be released from archive for analysis if the surrounding samples exceed the remedial goal criteria.

[8] Core locations SD-45 through SD-61 were collected only when a variability in clay interface elevation was observed between sample locations and also when the physical characteristics of clay varied between sample locations. Based on field observations, core locations for clay surface delineation were selected by CH2M FTL with consultation from EPA and NFS partners.

[9] Porewater and Porewater Sediment samples analyzed for 34 PAHs compounds as shown in Tables 4a and 4b.

DRO = diesel range organics; RRO = Residual range organics PAH = polycyclic aromatic hydrocarbons; TOC = total organic carbon; TCLP = toxicity characteristic leaching procedure; VOC = volatile organic compound; SVOC = semivolatile organic compound

Table 2. Summary of Geotechnical Analyses and Sample Quantities - September 2016
Lower Otter Creek and Confluence, Maumee River AOC

						Geotechnical and Index Testing Summary						
				Sample Quantity[1] >>>		Split Spoon Intervals[2]			Shelby Tube Samples[2]			
Location ID	Sample Depth Top (ft bss)	Sample Depth Bottom (ft bss)	Easting[3]	Northing[3]	Ground Elevation	Moisture Content (ASTM D2216)	Grain Size Analysis (ASTM D422)	Atterberg Limits (ASTM D4318)	Density (ASTM D7263)	Specific Gravity (ASTM D854)	CU Triaxial (ASTM D4767)[4]	UU Triaxial (ASTM D2850)[4]
SO-01	0	2	-83.453864	41.696309	--	X						
	2	4				X	X	X				
	4	6				X						
	6	8				X						
	8	10				X						
	10	12				X	X	X				
	12	14							X	X	X	
	14	16				X						
	16	18				X	X	X				
	18	20							X	X	X	
	20	22				X						
	22	24				X						
	24	26				X	X	X				
SO-02	0	2	-83.455763	41.690182	575.06	X						
	2	4				X	X	X				
	4	6				X						
	6	8				X						
	8	10				X	X	X				
	10	12				X						
	12	14							X	X	X	
	14	16				X						
	16	18				X	X	X				
	18	20				X						
	20	21.5							X	X	X	
	21.5	23.5				X	X	X				
	23.5	25.5										
SO-045	0	2	-83.456104	41.688871	574.08	X						
	2	4				X						
	4	6				X						
	6	8				X						
	8	10				X						
	8	9					X	X				
	10	12				X						
	12	14				X	X	X				
	14	16				X						
	16	18				X						
	18	20				X						
	20	22				X	X	X				
	22	24							X	X		X
	24	26					X	X				
	26	28							X	X		X
SO-05	0	2	-83.455847	41.688495	--	X						
	2	4				X						
	4	6				X						
	6	8				X						
	8	10				X						
	10	12				X						
	12	14				X						
	14	16				X						
	16	18				X						
	18	20				X	X	X				
	20	22					X[6]	X[6]				
	22	24					X	X				
	24	26							X	X	X	
SO-07	0	2	-83.458538	41.683468	--	X						
	2	4				X	X	X				
	4	6				X						
	6	8				X	X	X				
	8	10							X	X		X
	10	12				X						
	12	14				X	X	X				
	14	16				X						
	16	18				X						
	18	20				X	X	X				
	20	22							X	X		X
	22	24				X						
	24	26										
SO-08	0	2	-83.462655	41.679092	--	X						
	2	4				X	X	X				
	4	6				X						
	6	8				X						
	8	10				X						
	10	12				X	X	X				
	12	14							X	X	X	
	14	16				X						
	16	18				X	X	X				
	18	20				X						
	20	21							X	X	X	
	21	23				X	X	X				
	23	25										
SO-09	0	2	-83.465139	41.676473	581.76	X						
	2	4				X	X	X				
	4	6				X						
	6	8							X	X	X	
	8	10				X						
	10	12				X						
	12	14				X						
	14	16				X	X	X				
	16	18				X						
	18	20				X	X	X				
	20	22							X	X	X	
	22	24				X	X	X				
	24	26										
				Sample Quantity		72	26	26	13	13	9	4

Notes:

[1] Split-spoon samples were collected continuously at each location with index testing samples recommended by the Ramboll NFS representative and collected based on stratigraphy and field conditions with a maximum of 10 moisture content and 4 index testing samples per location. Shelby tube sampling were performed at up to two intervals within each boring, for a maximum of 18 Shelby tube samples.

[2] Intervals to be tested were recommended by the Ramboll Environ NFS representative during the sampling event based on field observations.

[3] Northing and easting coordinates are in Latitude / Longitude (degrees decimal format) - World Geodetic System 1984 (WGS84). Elevations reported North American Vertical Datum of 1988.

[4] CU and UU locations were determined in the field, based on stratigraphy and field observations.

[5] Organic material was encountered in Boring SO-04 to a depth of about 21 feet feet bgs, and little cohesive material was encountered above. In order to obtain the necessary geotech samples (2 Shelby tubes & 4 Atterberg Limits and Grain Sizes), Ramboll approved an additional sample to be taken. Boring SO-04 was terminated at 28 feet bgs.

[6] Deep organic material was encountered in SO-05 with little to no cohesive material above 20 ft bss. Ramboll approved of taking fewer Atterberg and Grain Size samples as the subsurface conditions were very similar to SO-04, and additional samples would be redundant. Only two Atterberg and Grain Size samples were collected. The first Shelby tube collected only had a recovery of about 6 inches, and therefore it could not be used for Triaxial testing due to the sample size. This sample was run for Atterberg Limits and Grain Size testing.

CU = consolidated-undrained; UU = unconsolidated-undrained

Table 3A. Analytical Results Summary - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Sample ID / Analyte	Units	SD-01-0.0/1.0	SD-01-1.0/2.5	SD-01-2.5/3.5	SD-02-0.0/1.0	SD-02-1.0/2.7	SD-02-2.7/3.7	SD-03-0.0/1.0	SD-03-1.0/2.0	SD-03-2.0/3.8	SD-03-3.8/4.8	SD-04-0.0/0.5
TPH - DRO (C10-C28)	**mg/kg**	546	81.6	0.93 J	195	83.4	0.86 J	292	190	808	2.1 J	75.7
TPH - RRO (C10-C40)	**mg/kg**	630	96.6	1.2 J	251	153	0.97 J	360	217	946	2.2	94.3
Total Organic Carbon	**mg/kg**	20000	24000	4100	17600	14000	4070	33700	28800	51600	6070	17300
PAH-16												
Acenaphthene	µg/kg	243	25.2	16.5 U	10.1 J	18 U	16.8 U	14.4 J	31.3	164	16.9 U	10.4 J
Acenaphthylene	µg/kg	92.1	8.8 J	14 U	38.7	12.9 J	14.3 U	6.5 J	16.8 J	38.3	14.4 U	13.4 J
Anthracene	µg/kg	516	25.8 J	24.2 U	72.7	11.9 J	24.7 U	43.2	42.1	101	24.9 U	36.1
Benzo(a)anthracene	µg/kg	1550	81.1	13.5 U	287	36.8	13.8 U	355	105	640	5.6 J	44.5
Benzo(a)pyrene	µg/kg	984	61.4	10.7 U	243	36.6	10.9 U	314	130	464	11 U	51.4
Benzo(b)fluoranthene	µg/kg	781	52.5	12 U	250	37.6	12.2 U	360	134	329	12.3 U	35.6
Benzo(g,h,i)perylene	µg/kg	537	29.3	8.6 U	117	18.1	8.8 U	208	93.3	254	8.9 U	28.6
Benzo(k)fluoranthene	µg/kg	195	15.3	10.7 U	64.3	17.1	10.9 U	60.4	63.1	57.5	10.9 U	33.1
Chrysene	µg/kg	2290	140	14.3 U	459	44.9	14.6 U	1050	251	765	4.8 J	65.8
Dibenzo(a,h)anthracene	µg/kg	441	22.6	9.5 U	78.1	6 J	9.7 U	143	45	244	9.8 U	14.1
Fluoranthene	µg/kg	491	46	22.2 U	183	48.5	22.6 U	164	130	142	22.8 U	60.3
Fluorene	µg/kg	350	26.2	17.6 U	6.6 J	19.3 U	17.9 U	27.9	36.2	209	18.1 U	11.4 J
Indeno(1,2,3-Cd)Pyrene	µg/kg	304	18	9.3 U	85.6	15.5	9.5 U	91.6	58.9	140	9.6 U	23.1
Naphthalene	µg/kg	241	26.1 J	35.8 U	16.4 J	39.2 U	36.5 U	37.4 J	79.9	102	36.8 U	40.2 U
Phenanthrene	µg/kg	1930	127	49.5 U	49.6 J	54.1 U	50.4 U	222	166	243	50.8 U	68.9
Pyrene	µg/kg	1470	110	19.1 U	271	49.8	19.5 U	466	200	517	19.6 U	69.4
Total PAH[1]	**mg/kg**	**12.415**	**0.815**	**0.144**	**2.232**	**0.401**	**0.147**	**3.563**	**1.583**	**4.410**	**0.144**	**0.586**

Sample ID / Analyte	Units	SD-04-0.5/1.0	SD-04-1.0/1.5	SD-04-1.5/2.0	SD-05-0.0/0.5	SD-05-0.5/1.0	SD-05-1.0/1.5	SD-05-1.5/2.5	SD-06-0.0/0.5	SD-06-0.5/1.0	SD-06-1.0/1.5	SD-06-1.5/1.9	SD-07-0.0/0.5	SD-07-0.5/1.0	SD-07-1.0/1.5	SD-07-1.5/2.5	SD-08-0.0/0.5
TPH - DRO (C10-C28)	**mg/kg**	76	7.6	0.98 J	76.5	9.2	15.6	0.69 J	21.9	13	2.2 J	1.1 J	102	41.2	42.1	0.71 J	154
TPH - RRO (C10-C40)	**mg/kg**	99.6	10.1	1.4 J	95.6	11.6	19.3	0.79 J	27.5	16.5	2.7	1.6 J	133	49.8	50.1	0.90 J	189
Total Organic Carbon	**mg/kg**	13800	16400	7720	16400	11700	14500	9800	13600	10600	14500	10000	25900	13000	15000	10100	17000
PAH-16																	
Acenaphthene	µg/kg	9.8 J	17.6 U	17 U	68.8	12.6 J	19.1 U	17.4 U	19.3 U	17.5 U	17.7 U	16.8 U	22.5 U	58.6	74.6	17.5 U	14 J
Acenaphthylene	µg/kg	24.9	15.1	14.5 U	94.2	16.1	16.3 U	14.8 U	16.4 U	6.9 J	15.1 U	7 J	9.2 J	62.1	45.6	14.9 U	10.4 J
Anthracene	µg/kg	31.7	12.6 J	21.1 J	189	38.7	28.2 U	25.6 U	28.4 U	11.4 J	26 U	24.7 U	24.6 J	67.4	78.2	25.8 U	39
Benzo(a)anthracene	µg/kg	63.3	67.4	62.7	249	76.2	9 J	5.9 J	11.6 J	21.7	12.9 J	36.1	133	146	134	14.4 U	117
Benzo(a)pyrene	µg/kg	67.4	82.8	56.2	252	77.9	7.2 J	4.5 J	11.8 J	22.2	11 J	40.5	145	184	134	11.4 U	94.5
Benzo(b)fluoranthene	µg/kg	75.1	77.3	64.1	279	80.6	7.6 J	12.7 U	13.6 J	25.7	11 J	38	135	205	158	12.8 U	72.1
Benzo(g,h,i)perylene	µg/kg	38.2	41.7	26.8	126	32.5	10 U	9.1 U	7.6 J	12	4.3 J	19.2	97.9	106	74.3	9.2 U	49.8
Benzo(k)fluoranthene	µg/kg	36.5	34.6	28.4	141	37.9	3.9 J	4.2 J	6.2 J	11.8	5.6 J	17.2	67.6	96.2	71.8	11.3 U	42.9
Chrysene	µg/kg	76.3	76.8	62.6	283	90.5	7.8 J	5.4 J	14.9 J	27.1	11.2 J	40.8	384	240	158	15.2 U	210
Dibenzo(a,h)anthracene	µg/kg	11.6	10.2	6.5 J	41.3	8.9 J	11.1 U	10 U	11.1 U	3.2 J	10.2 U	5 J	67.6	35.4	20.7	10.1 U	40.8
Fluoranthene	µg/kg	101	78.3	135	473	150	15.9 J	9.7 J	13.1 J	39.2	19.8 J	59	83	156	288	23.6 U	69.8
Fluorene	µg/kg	9.5 J	18.9 U	18.2 U	68.3	6.2 J	20.5 U	18.6 U	20.6 U	18.7 U	18.9 U	18 U	9.2 J	59.3	72.7	18.7 U	16.7 J
Indeno(1,2,3-Cd)Pyrene	µg/kg	33.6	33.2	25.3	123	30.2	10.9 U	9.9 U	6.1 J	10.5	3.4 J	16.6	51.4	94.7	69.4	9.9 U	35.8
Naphthalene	µg/kg	39.9 U	38.4 U	37.1 U	89.4	37.6 U	41.7 U	37.9 U	42 U	38.1 U	38.5 U	36.6 U	41.9 J	36 J	76.9	38.1 U	14.5 J
Phenanthrene	µg/kg	74.9	26 J	55.2	462	83.5	57.6 U	52.3 U	58 U	32.2 J	53.2 U	50.5 U	110	276	346	52.6 U	68.6
Pyrene	µg/kg	87.4	90.4	108	395	145	13.8 J	8.4 J	15.3 J	38.5	18.8 J	74.9	160	170	222	20.3 U	116
Total PAH[1]	**mg/kg**	**0.761**	**0.684**	**0.695**	**3.334**	**0.906**	**0.173**	**0.142**	**0.198**	**0.300**	**0.188**	**0.428**	**1.531**	**1.993**	**2.024**	**0.153**	**1.012**

Abbreviations:

µg/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; -- = not analyzed; J = Estimated; U = Non Detect; PAH = polycyclic aromatic hydrocarbons; TPH = total petroleum hydrocarbons; DRO = diesel range organics; RRO = residual range organics

Notes:

[1] The total PAH concentration was calculated by summing the detected results for 16-PAH compounds and using one-half of the RL for nondetect values. For results with no detectable concentrations, the summation will be qualified "U" for nondetect.

Red shaded results exceed the site specific remedial goal screening value.

Table 3A. Analytical Results Summary - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Sample ID / Analyte	Units	SD-08-0.5/1.0	SD-08-1.0/1.5	SD-08-1.5/1.8	SD-09-0.0/1.0	SD-10-0.0/1.0	SD-11-0.0/1.0	SD-12-0.0/0.5	SD-12-0.5/1.0	SD-12-1.0/1.5	SD-12-1.5/2.0	SD-13-0.0/1.0	SD-14-0.0/0.5	SD-14-0.5/1.0	SD-14-1.0/1.4	SD-14-1.4/2.4	SD-15-0.0/1.4	SD-15-1.4/2.0	SD-22-0.0/0.5	SD-22-0.5/1.0	SD-22-1.0/1.4	SD-23-3.9/4.9	SD-25-4.2/5.2	SD-25-5.2/6.2	SD-27-4.6/5.6	SD-27-5.6/6.6	SD-28-4.0/5.0	SD-28-5.2/6.2
TPH - DRO (C10-C28)	**mg/kg**	10.9	16.8	2.7	3.8	4.6	4.9	2.5	2.8	7.1	30.8	39.5	619	1000	2010	35.7	277	15.8	13.9	22.3	4.2	4.3	52.3	37.1	3.1	14.2	24	7.2
TPH - RRO (C10-C40)	**mg/kg**	13.8	22.9	3.3	4.2	5.1	5.6	3.4	3.5	9.2	39	52.8	737	1200	2430	41.8	370	19	18.2	31.8	5.6	--	--	--	--	--	--	--
Total Organic Carbon	**mg/kg**	8100	12000	8400	7800	11000	11800	9000	9100	12000	15000	7400	29000	40000	28000	3800	15000	5700	13000	28300	9330	4900	27000	12000	10000	6100	16000	15000
PAH-16																												
Acenaphthene	µg/kg	16.8 U	8.2 J	16.8 U	15.3 U	15 U	15.2 U	16.3 U	16.7 U	6.7 J	8.1 J	15.1 U	34.7	196 U	92.6 J	6.6 J	39.9	15.8 U	18.9 J	5.4 J	17.8 U	15.3 U	7.3 J	15.9 U	14.7 U	15.4 U	127 U	15.9 U
Acenaphthylene	µg/kg	14.3 J	20.2	14.4 U	13.1 U	12.8 U	13 U	8.9 J	6.3 J	7 J	14.8 J	12.9 U	21.4	167 U	208 U	13.2 U	9.8 J	13.5 U	51	9.7 J	15.2 U	13.1 U	3.9 J	13.6 U	12.6 U	13.1 U	77.6 J	13.6 U
Anthracene	µg/kg	15 J	19.2 J	24.8 U	22.5 U	22.1 U	22.4 U	13.4 J	24.6 U	12 J	18.2 J	22.2 U	48.3	150 J	289 J	13.3 J	98.7	23.2 U	46.5	13.3 J	8.6 J	22.6 U	24.6	23.5 U	21.7 U	22.7 U	407	23.5 U
Benzo(a)anthracene	µg/kg	28	59.3	6.6 J	12.6 U	12.3 U	12.5 U	32.2	15.9	19.5	36	12.7	126	1550	2810	41.3	247	13 U	102	51.1	23.5	12.6 U	87.6	13.1 U	9.8 J	12.6 U	1050	13.1 U
Benzo(a)pyrene	µg/kg	32	71.3	5.9 J	9.9 U	9.8 U	9.9 U	34.4	18.7	20.1	40.9	10.1	143	1340	2190	28	201	10.2 U	132	63.4	24.5	9.9 U	57.3	10.3 U	5.4 J	10 U	962	3.9 J
Benzo(b)fluoranthene	µg/kg	23.3	71.6	3.8 J	11.2 U	11 U	11.1 U	24.8	12.3	14.6	28.6	9.4 J	142	1490	2450	31.4	191	11.5 U	140	56.6	26	11.2 U	40.5	11.6 U	7.2 J	11.2 U	644	11.6 U
Benzo(g,h,i)perylene	µg/kg	17.2	42.1	8.8 U	8 U	7.9 U	8 U	14.9	8.8	9.5	18.7	5.1 J	121	950	1430	17.2	159	8.3 U	77.4	33.6	12.2	8 U	34.8	8.4 U	3.5 J	8.1 U	427	2.8 J
Benzo(k)fluoranthene	µg/kg	29.5	38	5.9 J	9.9 U	9.7 U	9.9 U	32.7	17.8	19.3	37.4	4 J	47.4	440	613	7.9 J	51.8	10.2 U	73.3	31.6	15.7	9.9 U	19.8	10.3 U	9.5 U	10 U	974	10.3 U
Chrysene	µg/kg	33.3	68.5	6.9 J	13.3 U	4.4 J	13.2 U	37.9	17.4	24.3	40.7	27.7	398	5240	8840	130	552	4.7 J	134	61	29.8	4.6 J	147	7.1 J	20.4	13.4 U	1010	7.5 J
Dibenzo(a,h)anthracene	µg/kg	6.5 J	11	9.7 U	8.8 U	8.7 U	8.8 U	5.6 J	3.1 J	3.6 J	6.9 J	2.9 J	58.8	633	988	10.4	104	9.1 U	21.5	7.7 J	10.3 U	8.8 U	27.2	9.2 U	8.5 U	8.9 U	171	9.2 U
Fluoranthene	µg/kg	41.9	86.7	10.3 J	20.6 U	20.3 U	20.5 U	47.5	16.7 J	38.6	61.4	9.8 J	89.8	656	1380	34.1	154	21.3 U	161	76.8	42.7	20.7 U	25.4	21.5 U	7.7 J	20.7 U	2200	21.5 U
Fluorene	µg/kg	18 U	6.9 J	18 U	16.4 U	16.1 U	16.3 U	17.5 U	17.9 U	18.6 U	6.2 J	16.1 U	42.3	88.7 J	248 J	20.9	49.9	16.9 U	16.1 J	19.2 U	19 U	16.4 U	16.6	17 U	15.7 U	16.5 U	136 U	17 U
Indeno(1,2,3-Cd)Pyrene	µg/kg	17.1	36	9.6 U	8.7 U	8.5 U	8.7 U	15.1	8.3 J	9.2 J	19.2	2.7 J	49.1	382	581	6.5 J	68.8	9 U	70.1	26.2	11.4	8.7 U	18.8	9.1 U	8.4 U	8.7 U	442	9.1 U
Naphthalene	µg/kg	36.6 U	38.3 U	36.7 U	33.3 U	32.7 U	33.2 U	35.6 U	36.4 U	37.8 U	38.1 U	32.9 U	41.5 J	428 U	530 U	33.6 U	33.9	34.4 U	17.3 J	39.1 U	38.7 U	33.4 U	32.3 U	34.7 U	32.1 U	33.5 U	276 U	34.7 U
Phenanthrene	µg/kg	34.7 J	51.3 J	50.6 U	46 U	45.2 U	45.8 U	49.1 U	50.3 U	52.2 U	52.6 U	18.4 J	163	1100	3950	237	190	47.5 U	124	27.7 J	20.7 J	46.1 U	68.2	47.9 U	13.9 J	46.3 U	466	47.9 U
Pyrene	µg/kg	35.1	82.9	9.1 J	17.8 U	17.5 U	17.7 U	40.4	16 J	32.5	50.3	21.3	279	2210	4270	102	441	18.4 U	141	84.3	36.2	17.8 U	71	18.5 U	18.6	17.9 U	1740	6.6 J
Total PAH[1]	**mg/kg**	**0.364**	**0.692**	**0.143**	**0.134**	**0.129**	**0.133**	**0.367**	**0.214**	**0.271**	**0.433**	**0.174**	**1.805**	**16.625**	**30.501**	**0.710**	**2.592**	**0.136**	**1.326**	**0.578**	**0.302**	**0.132**	**0.666**	**0.139**	**0.148**	**0.135**	**10.840**	**0.135**

Abbreviations:

µg/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; -- = not analyzed; J = Estimated; U = Non Detect; PAH = polycyclic aromatic hydrocarbons; TPH = total petroleum hydrocarbons; DRO = diesel range organics; RRO = residual range organics

Notes:

[1] The total PAH concentration was calculated by summing the detected results for 16-PAH compounds and using one-half of the RL for nondetect values. For results with no detectable concentrations, the summation will be qualified "U" for nondetect.

Red shaded results exceed the site specific remedial goal screening value.

Table 3A. Analytical Results Summary - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Sample ID / Analyte	Units	SD-28-6.2/7.2	SD-29-4.0/5.0	SD-29-5.0/6.0	SD-30-10.7/11.7	SD-30-11.7/12.7	SD-30-4.0/5.0	SD-33-10.0/10.8	SD-33-4.0/5.0	SD-33-9.0/10.0	SD-34-10.3/10.7	SD-34-4.0/5.0	SD-34-9.3/10.3
TPH - DRO (C10-C28)	**mg/kg**	8.4	184	19.3	2.2	50.9	11.9	0.73 J	39.7	50.8	353	989	1.9 U
TPH - RRO (C10-C40)	**mg/kg**	--	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	**mg/kg**	8100	13000	7600	8600	7000	100000	8500	51000	130000	7000	65400	6280
PAH-16													
Acenaphthene	µg/kg	14.9 U	15.6 U	15.1 U	15.9 U	15.4 U	33.9 U	17.2 U	24.1 U	33.5 U	15.7 U	33.1 U	15 U
Acenaphthylene	µg/kg	12.7 U	13.3 U	12.9 U	13.5 U	13.1 U	28.9 U	14.7 U	20.6 U	28.5 U	13.3 U	28.2 U	12.8 U
Anthracene	µg/kg	21.9 U	10.2 J	22.3 U	23.4 U	22.7 U	49.9 U	25.4 U	35.5 U	49.3 U	23.1 U	48.8 U	22.1 U
Benzo(a)anthracene	µg/kg	12.2 U	60.6	12.4 U	13 U	12.7 U	27.8 U	14.1 U	7.5 J	27.5 U	12.9 U	16.5 J	12.3 U
Benzo(a)pyrene	µg/kg	9.7 U	41.6	9.8 U	10.3 U	10 U	22 U	11.2 U	15.7 U	21.7 U	10.2 U	11.8 J	9.7 U
Benzo(b)fluoranthene	µg/kg	10.9 U	26.8	11 U	11.6 U	11.2 U	24.7 U	12.6 U	17.6 U	24.4 U	11.4 U	11.6 J	10.9 U
Benzo(g,h,i)perylene	µg/kg	7.8 U	23.6	7.9 U	8.3 U	8.1 U	17.8 U	9 U	12.7 U	17.6 U	8.2 U	8.1 J	7.9 U
Benzo(k)fluoranthene	µg/kg	9.6 U	5.4 J	9.8 U	10.3 U	10 U	21.9 U	11.2 U	15.6 U	21.7 U	10.1 U	21.5 U	9.7 U
Chrysene	µg/kg	12.9 U	89.7	13.1 U	13.8 U	13.4 U	29.4 U	14.9 U	9.9 J	29.1 U	13.6 U	20.4 J	13 U
Dibenzo(a,h)anthracene	µg/kg	8.6 U	9.5	8.7 U	9.2 U	8.9 U	19.6 U	9.9 U	13.9 U	19.3 U	9 U	19.1 U	8.7 U
Fluoranthene	µg/kg	20.1 U	26.6	20.4 U	21.4 U	20.8 U	45.7 U	23.2 U	32.6 U	45.1 U	21.1 U	44.7 U	20.2 U
Fluorene	µg/kg	15.9 U	16.7 U	16.2 U	17 U	16.5 U	36.2 U	18.4 U	25.8 U	35.8 U	16.7 U	35.4 U	16 U
Indeno(1,2,3-Cd)Pyrene	µg/kg	8.5 U	7.4 J	8.6 U	9 U	8.8 U	19.2 U	9.8 U	13.7 U	19 U	8.9 U	18.8 U	8.5 U
Naphthalene	µg/kg	32.4 U	33.9 U	33 U	34.6 U	33.6 U	73.8 U	37.5 U	52.6 U	72.9 U	34.1 U	72.1 U	32.6 U
Phenanthrene	µg/kg	44.8 U	67.1	45.6 U	47.7 U	46.3 U	102 U	51.8 U	72.6 U	101 U	47.1 U	99.6 U	45.1 U
Pyrene	µg/kg	17.3 U	117	17.6 U	18.4 U	17.9 U	39.4 U	20 U	12.5 J	38.9 U	18.2 U	27.9 J	17.4 U
Total PAH[1]	**mg/kg**	**0.130**	**0.525**	**0.132**	**0.139**	**0.135**	**0.296**	**0.150**	**0.206**	**0.293**	**0.137**	**0.307**	**0.131**

Sample ID / Analyte	Units	SD-35-4.0/5.0	SD-35-6.3/7.3	SD-35-7.3/7.7	SD-37-3.0/4.0	SD-38-4.5/5.5	SD-40-4.5/5.5	SD-40-5.5/6.5	SD-40-6.5/7.5	SD-41-2.0/3.0	SD-43-5.0/6.0	SD-43-6.0/7.0	SD-44-5.0/5.6	SD-44-5.6/6.6	SD-44-6.6/7.6
TPH - DRO (C10-C28)	**mg/kg**	226	9.9	0.63 J	11.3	4.1	238	2.9	2.1 U	4.8	290	1.3 J	290	352	32.9
TPH - RRO (C10-C40)	**mg/kg**	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Organic Carbon	**mg/kg**	126000	153000	15200	6670	4690	66000	45800	5550	6300	31000	8400	24000	44000	5100
PAH-16															
Acenaphthene	µg/kg	31.9 J	39.5 U	17.5 U	15.1 U	15.6 U	14 J	19.6 U	16.4 U	16.4 U	6.2 J	15.5 U	32.4 U	32.2	15.9 U
Acenaphthylene	µg/kg	32.8 J	33.7 U	14.9 U	12.9 U	13.3 U	8 J	16.8 U	14 U	14 U	16.9 U	13.2 U	27.6 U	13.3 J	13.5 U
Anthracene	µg/kg	116	58.2 U	25.8 U	22.3 U	22.9 U	21.5 J	28.9 U	24.1 U	24.2 U	13.7 J	22.8 U	47.7 U	49.8	23.4 U
Benzo(a)anthracene	µg/kg	144	32.4 U	14.4 U	5.4 J	6.7 J	10.4 J	16.1 U	13.5 U	13.5 U	12.5 J	12.7 U	12 J	27.7	5.9 J
Benzo(a)pyrene	µg/kg	146	25.6 U	11.3 U	6.2 J	5.3 J	8.5 J	12.7 U	10.6 U	10.6 U	10.7 J	10.1 U	12.7 J	14 J	4.5 J
Benzo(b)fluoranthene	µg/kg	101	28.8 U	12.8 U	6.2 J	4.2 J	8.3 J	14.3 U	11.9 U	12 U	10.1 J	11.3 U	10.4 J	13.5 J	3.5 J
Benzo(g,h,i)perylene	µg/kg	78	20.7 U	9.2 U	5.1 J	2.5 J	6 J	10.3 U	8.6 U	8.6 U	8.1 J	8.1 U	9.5 J	10.6 J	2.5 J
Benzo(k)fluoranthene	µg/kg	101	25.6 U	11.3 U	7.3 J	6.1 J	6.9 J	12.7 U	10.6 U	10.6 U	9.8 J	10 U	12.7 J	11 J	4.7 J
Chrysene	µg/kg	197	34.3 U	15.2 U	9.2 J	7.1 J	26.7 J	17.1 U	14.2 U	14.2 U	26.7	13.5 U	26.2 J	75.6	9.8 J
Dibenzo(a,h)anthracene	µg/kg	43.2	22.8 U	10.1 U	8.7 U	9 U	18 U	11.3 U	9.5 U	9.5 U	11.5 U	9 U	18.7 U	17.4 U	9.2 U
Fluoranthene	µg/kg	220	53.3 U	23.6 U	20.4 U	15.2 J	17.5 J	26.5 U	22.1 U	22.1 U	23.9 J	20.9 U	18.8 J	50.4	9.3 J
Fluorene	µg/kg	36.8 J	42.2 U	18.7 U	16.2 U	16.6 U	23.4 J	21 U	17.5 U	17.6 U	9 J	16.6 U	34.7 U	48.5	17 U
Indeno(1,2,3-Cd)Pyrene	µg/kg	63.4	22.4 U	9.9 U	4.4 J	8.8 U	17.7 U	11.2 U	9.3 U	9.3 U	5.7 J	8.8 U	6.9 J	6.3 J	9 U
Naphthalene	µg/kg	102 U	86 U	38.1 U	32.9 U	33.9 U	34.6 J	42.8 U	35.7 U	35.7 U	14.4 J	33.8 U	28 J	53.1 J	34.6 U
Phenanthrene	µg/kg	228	119 U	52.6 U	45.5 U	46.8 U	48.9 J	59.1 U	49.3 U	49.4 U	30.7 J	46.6 U	97.5 U	169	16.2 J
Pyrene	µg/kg	230	45.9 U	20.3 U	17.6 U	11.4 J	30.1 J	22.8 U	19 U	19.1 U	35.1	18 U	25.2 J	123	12.3 J
Total PAH[1]	**mg/kg**	**1.820**	**0.345**	**0.153**	**0.140**	**0.142**	**0.283**	**0.172**	**0.143**	**0.143**	**0.231**	**0.135**	**0.292**	**0.707**	**0.130**

Abbreviations:

µg/kg = micrograms per kilogram; mg/kg = milligrams per kilogram; -- = not analyzed; J = Estimated; U = Non Detect; PAH = polycyclic aromatic hydrocarbons; TPH = total petroleum hydrocarbons; DRO = diesel range organics; RRO = residual range organics

Notes:

[1] The total PAH concentration was calculated by summing the detected results for 16-PAH compounds and using one-half of the RL for nondetect values. For results with no detectable concentrations, the summation will be qualified "U" for nondetect.

Red shaded results exceed the site specific remedial goal screening value.

Table 3B. Summary of NAPL Observations - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Location ID	Easting[1]	Northing[1]	Water Depth (ft)	Core Refusal Depth (ft)	Native Clay Depth (ft bss)	Observations: Sheen	Observations: Staining	Observations: Odor	Observations: PID Max	Analysis Summary[2]: TPH-DRO (Max) [mg/kg]	Analysis Summary[2]: TPH-RRO (Max) [mg/kg]
Confluence Area											
SD-01	-83.453310	41.699378	4.92	4.5	2.5	X			178	546	630
SD-02	-83.453444	41.699254	5.17	4.25	2.7	X			0.6	195	251
SD-03	-83.453238	41.699154	5.17	6	3.8	X			51.1	808	946
SD-04	-83.453767	41.699307	5.33	4	2	X		X	1.5	107	99.6
SD-05	-83.454173	41.699571	5.75	4.25	1.5				0	76.5	95.6
SD-06	-83.454952	41.699577	5.42	3	1.9				0.4	24	27.5
SD-07	-83.455054	41.699302	5.17	4.25	1.5				7	102	133
SD-08	-83.454783	41.698996	4.83	4	1.8			X	1.9	154	189
SD-09	-83.455050	41.698785	4.97	3.5	0				0	3.8	4.2
SD-10	-83.455053	41.698525	4	3.75	0				0	4.6	5.1
SD-11	-83.454416	41.698539	3.83	5	0				0	4.9	5.6
SD-12	-83.454130	41.698134	2.67	4	3.1				1.1	30.8	39
SD-13	-83.453711	41.698032	2.66	3.5	0				1	39.5	52.8
SD-14	-83.453222	41.698039	3.83	3	1.4	X		X	42	2010	2430
SD-15	-83.453348	41.697792	2.83	3	1.4	X			13.9	277	370
SD-22	-83.453283	41.699543	5.33	2.5	--				0	22.3	31.8
	Confluence Area Average		*4.4*	*3.8*	*1.4*						
Otter Creek											
SD-23	-83.453349	41.697623	3.3	4.8	3.9				1.5	4.3	NA
SD-24	-83.453456	41.696736	2.7	10	7.1				129	NA	NA
SD-25	-83.453396	41.696686	5.8	8.2	5.2	X		X	244	52.3	NA
SD-26	-83.453348	41.696623	2.3	5	2.7				0	NA	NA
SD-27	-83.45358	41.696247	5.1	7	5.6	X			21	14.2	NA
SD-28	-83.453768	41.695495	5.4	8.2	6.2	X			2.7	24	NA
SD-29	-83.45414	41.694148	4.9	10	5	X	X	X	2.9	184	NA
SD-30	-83.454658	41.692612	5	15	11.7	X		X	86	50.9	NA
SD-31	-83.454599	41.692588	3.1	15	13.9				0	NA	NA
SD-32	-83.455305	41.690238	2.7	15	10	X		X	56	NA	NA
SD-33	-83.455262	41.690205	5.1	12	10				3.6	88.4	NA
SD-34	-83.455616	41.689565	5	12	10.3	X			17.4	989	NA
SD-35	-83.456504	41.687293	5.7	8.1	7.3			X	17.3	226	NA
SD-36	-83.457491	41.685325	5.6	4	0				0	NA	NA
SD-37	-83.457911	41.684437	4.4	4.9	3	X			6.3	11.3	NA
SD-38	-83.45923	41.682929	4.6	10	0.7				1.1	4.1	NA
SD-39	-83.460553	41.681526	3.6	10	7			X	5.5	NA	NA
SD-40	-83.461266	41.680803	3.3	10	6.5				7.5	618	NA
SD-41	-83.463664	41.678238	3.8	10	4	X		X	8.4	NA	NA
SD-42	-83.464871	41.676982	2.9	5	2.6			X	10.8	NA	NA
SD-43	-83.465597	41.67621	2	8.5	6				0.9	290	NA
SD-44	-83.467004	41.674893	2.8	11	6.6	X		X	27.8	502	NA

Table 3B. Summary of NAPL Observations - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Location ID	Easting[1]	Northing[1]	Water Depth (ft)	Core Refusal Depth (ft)	Native Clay Depth (ft bss)	Observations: Sheen	Observations: Staining	Observations: Odor	Observations: PID Max	Analysis Summary[2]: TPH-DRO (Max) [mg/kg]	Analysis Summary[2]: TPH-RRO (Max) [mg/kg]
Otter Creek											
SD-47	-83.453939	41.694886	4.6	9	7.5	X		X	71	NA	NA
SD-48	-83.454198	41.694201	2	10	8.7	X		X	255	NA	NA
SD-50	-83.454382	41.693281	4.8	7.5	7				18.6	NA	NA
SD-51	-83.454724	41.692615	1.3	15	12.6	X		X	100.8	NA	NA
SD-52	-83.454782	41.691907	3.7	12	10.7				1.9	NA	NA
SD-54	-83.455245	41.690167	2.6	12.5	11.5	X		X	36	NA	NA
SD-55	-83.456081	41.688353	2.6	5	5.5				8.3	NA	NA
SD-56	-83.456984	41.686373	5.4	5	2.4				4.8	NA	NA
SD-58	-83.459924	41.682215	3.2	5	2.8			X	4.2	NA	NA
SD-60	-83.462883	41.679037	4.5	5	1.8				6.3	NA	NA
SD-61	-83.464187	41.677702	4.7	5	1.9				1.1	NA	NA
		Creek Average	*3.9*	*8.9*	*6.3*						

Notes:

[1]Northing and easting coordinates are in Latitude / Longitude (degrees decimal format) - World Geodetic System 1984 (WGS84). Elevations reported North American Vertical Datum of 1988.

[2]Analytical methods and individual analytes are listed in Table 4 of the QAPP.

DRO = diesel range organics; RRO = Residual range organics

Table 4A - Pore Water Toxicity Unit Calculations - September 2016

Lower Otter Creek and Confluence Area, Ohio

Analyte	FCV	PW-01-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	193.5	0.014728682	2.850		U	5.7
2-Methylnaphthalene	72.16	0.016629712	1.200		U	2.4
1-Methylnaphthalene	75.37	0.015921454	1.200		U	2.4
C2-Naphthalenes	30.24	0.013881429	0.420	0.42	J	0.89
C3-Naphthalenes	11.1	0.139663121	1.550	1.55	J	0.33
C4-Naphthalenes	4.048	0.834725039	3.379	3.38	J	0.12
Acenaphthylene	306.9	0.014662757	4.500		U	9
Acenaphthene	55.85	0.014324082	0.800		U	1.6
Fluorene	39.3	0.015267176	0.600		U	1.2
C1-Fluorenes	13.99	0.033662147	0.471	0.47	J	0.41
C2-Fluorenes	5.305	0.193045907	1.024	1.02	J	0.16
C3-Fluorenes	1.916	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.014636696	0.280		U	0.56
Anthracene	20.73	0.014712976	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.01197408	0.089	0.09	J	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.17066322	0.546	0.55	J	0.09
C3-Phenanthrenes/Anthracenes	1.256	1.372882206	1.724	1.72	J	0.04
C4-Phenanthrenes/Anthracenes	0.5594	3.280180904	1.835	1.83	J	0.02
Fluoranthene	7.109	0.018233172	0.130	0.13	J	0.21
Pyrene	10.11	0.019922485	0.201	0.20	J	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.048907316	0.239	0.24	J	0.14
Benzo(a)anthracene	2.227	0.010138769	0.023	0.02	J	0.07
Chrysene	2.042	0.024702287	0.050	0.05		0.06
C1-Chrysenes	0.8557	0.035821985	0.031	0.03	J	0.03
C2-Chrysenes	0.4827	0.014501761	0.007		U	0.01
C3-Chrysenes	0.1675	0.014925373	0.003		U	0.01
C4-Chrysenes	0.07062	0.014160295	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.015541741	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03
Perylene	0.9008	0.014431616	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.014545455	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.014159292	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.014803006	0.007		U	0.01
Total TUs		6.49				
Duplicate run (per method)						
Naphthalene	193.5	0.014728682	2.850		U	5.7
2-Methylnaphthalene	72.16	0.016629712	1.200		U	2.4
1-Methylnaphthalene	75.37	0.015921454	1.200		U	2.4
C2-Naphthalenes	30.24	0.015049538	0.455	0.46	J	0.89
C3-Naphthalenes	11.1	0.130049796	1.444	1.44	J	0.33
C4-Naphthalenes	4.048	0.837853206	3.392	3.39	J	0.12
Acenaphthylene	306.9	0.014662757	4.500		U	9
Acenaphthene	55.85	0.014324082	0.800		U	1.6
Fluorene	39.3	0.015267176	0.600		U	1.2
C1-Fluorenes	13.99	0.033558237	0.469	0.47	J	0.41
C2-Fluorenes	5.305	0.192749549	1.023	1.02	J	0.16
C3-Fluorenes	1.916	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.014636696	0.280		U	0.56
Anthracene	20.73	0.014712976	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.012582407	0.094	0.09	J	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.185012348	0.592	0.59	J	0.09
C3-Phenanthrenes/Anthracenes	1.256	1.342102155	1.686	1.69	J	0.04
C4-Phenanthrenes/Anthracenes	0.5594	3.264216384	1.826	1.83	J	0.02
Fluoranthene	7.109	0.018188632	0.129	0.13	J	0.21
Pyrene	10.11	0.020415938	0.206	0.21	J	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.052092108	0.255	0.25	J	0.14
Benzo(a)anthracene	2.227	0.011534024	0.026	0.03	J	0.07
Chrysene	2.042	0.026036261	0.053	0.05		0.06
C1-Chrysenes	0.8557	0.041990076	0.036	0.04	J	0.03
C2-Chrysenes	0.4827	0.014501761	0.007		U	0.01
C3-Chrysenes	0.1675	0.014925373	0.003		U	0.01
C4-Chrysenes	0.07062	0.014160295	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.015541741	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03
Perylene	0.9008	0.014431616	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.014545455	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.014159292	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.014803006	0.007		U	0.01
Total TUs		6.46				

Analyte	PW-02-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.0009201	0.178	0.18	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.02091851	0.633	0.63	J	0.89
C3-Naphthalenes	0.4956676	5.502	5.50		0.33
C4-Naphthalenes	3.88809055	15.739	15.74		0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.00133082	0.052	0.05	J	1.2
C1-Fluorenes	0.10401116	1.455	1.46		0.41
C2-Fluorenes	0.68626931	3.641	3.64		0.16
C3-Fluorenes	1.23926077	2.374	2.37		0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.00701759	0.145	0.15	J	0.61
C1-Phenanthrenes/Anthracenes	0.02561967	0.191	0.19	J	0.22
C2-Phenanthrenes/Anthracenes	0.41768544	1.336	1.34	J	0.09
C3-Phenanthrenes/Anthracenes	2.49458706	3.133	3.13	J	0.04
C4-Phenanthrenes/Anthracenes	5.76030343	3.222	3.22	J	0.02
Fluoranthene	0.01732173	0.123	0.12	J	0.21
Pyrene	0.02884999	0.292	0.29	J	0.3
C1-Fluoranthenes/Pyrenes	0.09307185	0.455	0.45	J	0.14
Benzo(a)anthracene	0.025424	0.057	0.06	J	0.07
Chrysene	0.05557983	0.113	0.11		0.06
C1-Chrysenes	0.07831339	0.067	0.07		0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.05291137	0.036	0.04	J	0.02
Benzo(e)pyrene	0.01394762	0.013	0.01	J	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	15.70				
Duplicate run (per method)					
Naphthalene	0.00087244	0.169	0.17	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.02326635	0.704	0.70	J	0.89
C3-Naphthalenes	0.47645638	5.289	5.29		0.33
C4-Naphthalenes	3.86053231	15.627	15.63		0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.00145089	0.057	0.06	J	1.2
C1-Fluorenes	0.0995968	1.393	1.39	J	0.41
C2-Fluorenes	0.66378796	3.521	3.52		0.16
C3-Fluorenes	1.29443057	2.480	2.48		0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.00692787	0.144	0.14	J	0.61
C1-Phenanthrenes/Anthracenes	0.02478623	0.184	0.18	J	0.22
C2-Phenanthrenes/Anthracenes	0.39178608	1.253	1.25	J	0.09
C3-Phenanthrenes/Anthracenes	2.59678623	3.262	3.26	J	0.04
C4-Phenanthrenes/Anthracenes	5.68299644	3.179	3.18	J	0.02
Fluoranthene	0.01691072	0.120	0.12	J	0.21
Pyrene	0.02829414	0.286	0.29	J	0.3
C1-Fluoranthenes/Pyrenes	0.09302865	0.455	0.45	J	0.14
Benzo(a)anthracene	0.02578672	0.057	0.06	J	0.07
Chrysene	0.05852302	0.120	0.12		0.06
C1-Chrysenes	0.09011419	0.077	0.08		0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.05860129	0.040	0.04		0.02
Benzo(e)pyrene	0.01417275	0.013	0.01	J	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	15.70				

Analyte	PW-03-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01354089	0.409	0.41	J	0.89
C3-Naphthalenes	0.20878358	2.317	2.32	J	0.33
C4-Naphthalenes	0.32392883	1.311	1.31	J	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01320617	0.185	0.18	J	0.41
C2-Fluorenes	0.09121497	0.484	0.48	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.01194136	0.089	0.09	J	0.22
C2-Phenanthrenes/Anthracenes	0.08699959	0.278	0.28	J	0.09
C3-Phenanthrenes/Anthracenes	0.54888346	0.689	0.69	J	0.04
C4-Phenanthrenes/Anthracenes	1.84528314	1.032	1.03	J	0.02
Fluoranthene	0.00400015	0.028	0.03	J	0.21
Pyrene	0.00814033	0.082	0.08	J	0.3
C1-Fluoranthenes/Pyrenes	0.02419334	0.118	0.12	J	0.14
Benzo(a)anthracene	0.00497568	0.011	0.01	J	0.07
Chrysene	0.01335095	0.027	0.03	J	0.06
C1-Chrysenes	0.01994579	0.017	0.02	J	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	3.50				
Duplicate run (per method)					
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01485345	0.449	0.45	J	0.89
C3-Naphthalenes	0.21766467	2.416	2.42	J	0.33
C4-Naphthalenes	0.34389057	1.392	1.39	J	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.0159361	0.223	0.22	J	0.41
C2-Fluorenes	0.08349262	0.443	0.44	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.01218474	0.091	0.09	J	0.22
C2-Phenanthrenes/Anthracenes	0.08998225	0.288	0.29	J	0.09
C3-Phenanthrenes/Anthracenes	0.55786204	0.701	0.70	J	0.04
C4-Phenanthrenes/Anthracenes	1.86124176	1.041	1.04	J	0.02
Fluoranthene	0.00389519	0.028	0.03	J	0.21
Pyrene	0.00831392	0.084	0.08	J	0.3
C1-Fluoranthenes/Pyrenes	0.02158754	0.105	0.11	J	0.14
Benzo(a)anthracene	0.00438754	0.010	0.01	J	0.07
Chrysene	0.0118351	0.024	0.02	J	0.06
C1-Chrysenes	0.0204008	0.017	0.02	J	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	3.55				

Analyte	PW-04-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.00122593	0.237	0.24	J	5.7
2-Methylnaphthalene	0.00072056	0.052	0.05	J	2.4
1-Methylnaphthalene	0.000708	0.053	0.05	J	2.4
C2-Naphthalenes	0.06356245	1.922	1.92	J	0.89
C3-Naphthalenes	1.27255744	14.125	14.13		0.33
C4-Naphthalenes	4.23649339	17.149	17.15		0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.1437521	2.011	2.01		0.41
C2-Fluorenes	0.61719994	3.274	3.27		0.16
C3-Fluorenes	1.07183291	2.054	2.05	J	0.06
Phenanthrene	0.00830932	0.159	0.16	J	0.56
Anthracene	0.00675526	0.140	0.14	J	0.61
C1-Phenanthrenes/Anthracenes	0.04104916	0.305	0.31	J	0.22
C2-Phenanthrenes/Anthracenes	0.40900311	1.308	1.31	J	0.09
C3-Phenanthrenes/Anthracenes	1.55877893	1.958	1.96	J	0.04
C4-Phenanthrenes/Anthracenes	2.81868953	1.577	1.58	J	0.02
Fluoranthene	0.02593315	0.184	0.18	J	0.21
Pyrene	0.03921933	0.397	0.40		0.3
C1-Fluoranthenes/Pyrenes	0.08576705	0.419	0.42	J	0.14
Benzo(a)anthracene	0.01910937	0.043	0.04	J	0.07
Chrysene	0.05532351	0.113	0.11		0.06
C1-Chrysenes	0.04824921	0.041	0.04		0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	12.71				
Duplicate run (per method)					
Naphthalene	0.00112381	0.217	0.22	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.00073164	0.055	0.06	J	2.4
C2-Naphthalenes	0.06138999	1.856	1.86	J	0.89
C3-Naphthalenes	1.25288582	13.907	13.91		0.33
C4-Naphthalenes	4.26491391	17.264	17.26		0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.13808121	1.932	1.93		0.41
C2-Fluorenes	0.61312215	3.253	3.25		0.16
C3-Fluorenes	1.05295337	2.017	2.02	J	0.06
Phenanthrene	0.00781219	0.149	0.15	J	0.56
Anthracene	0.0067323	0.140	0.14	J	0.61
C1-Phenanthrenes/Anthracenes	0.04067962	0.302	0.30	J	0.22
C2-Phenanthrenes/Anthracenes	0.40373215	1.292	1.29	J	0.09
C3-Phenanthrenes/Anthracenes	1.59577295	2.004	2.00	J	0.04
C4-Phenanthrenes/Anthracenes	2.80432913	1.569	1.57	J	0.02
Fluoranthene	0.02647708	0.188	0.19	J	0.21
Pyrene	0.03809819	0.385	0.39		0.3
C1-Fluoranthenes/Pyrenes	0.07950021	0.389	0.39	J	0.14
Benzo(a)anthracene	0.02040429	0.045	0.05	J	0.07
Chrysene	0.05785395	0.118	0.12		0.06
C1-Chrysenes	0.04878445	0.042	0.04		0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	12.72				

Analyte	PW-05-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.0006127	0.119	0.12	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.00803609	0.243	0.24	J	0.89
C3-Naphthalenes	0.23558028	2.615	2.61	J	0.33
C4-Naphthalenes	0.59126226	2.393	2.39	J	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01978136	0.277	0.28	J	0.41
C2-Fluorenes	0.10299822	0.546	0.55	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.00627805	0.047	0.05	J	0.22
C2-Phenanthrenes/Anthracenes	0.06182973	0.198	0.20	J	0.09
C3-Phenanthrenes/Anthracenes	0.44247929	0.556	0.56	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.0099251	0.071	0.07	J	0.21
Pyrene	0.01149337	0.116	0.12	J	0.3
C1-Fluoranthenes/Pyrenes	0.03138163	0.153	0.15	J	0.14
Benzo(a)anthracene	0.00881354	0.020	0.02	J	0.07
Chrysene	0.0181376	0.037	0.04	J	0.06
C1-Chrysenes	0.04958966	0.042	0.04		0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	1.88				
Duplicate run (per method)					
Naphthalene	0.00060052	0.116	0.12	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.00816169	0.247	0.25	J	0.89
C3-Naphthalenes	0.24000685	2.664	2.66	J	0.33
C4-Naphthalenes	0.59951861	2.427	2.43	J	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.02123572	0.297	0.30	J	0.41
C2-Fluorenes	0.10515946	0.558	0.56	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.00621734	0.046	0.05	J	0.22
C2-Phenanthrenes/Anthracenes	0.06902851	0.221	0.22	J	0.09
C3-Phenanthrenes/Anthracenes	0.43978984	0.552	0.55	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.01001424	0.071	0.07	J	0.21
Pyrene	0.01137223	0.115	0.11	J	0.3
C1-Fluoranthenes/Pyrenes	0.03029211	0.148	0.15	J	0.14
Benzo(a)anthracene	0.00873988	0.019	0.02	J	0.07
Chrysene	0.01790903	0.037	0.04	J	0.06
C1-Chrysenes	0.04162461	0.036	0.04	J	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	1.89				

Analyte	PW-06-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.00736581	0.223	0.22	J	0.89
C3-Naphthalenes	0.18356185	2.038	2.04	J	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.00254261	0.018	0.02	J	0.21
Pyrene	0.0148368	0.150		U	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14
Benzo(a)anthracene	0.01481814	0.033		U	0.07
Chrysene	0.01469148	0.030		U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	0.66				
Duplicate run (per method)					
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.00720386	0.218	0.22	J	0.89
C3-Naphthalenes	0.19504062	2.165	2.16	J	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.00241603	0.017	0.02	J	0.21
Pyrene	0.0148368	0.150		U	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14
Benzo(a)anthracene	0.01481814	0.033		U	0.07
Chrysene	0.01469148	0.030		U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	0.67				

Analyte	PW-07-0.0/0.5 TU	Result*	Result**	Qual	RDL
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.0027269	0.019	0.02	J	0.21
Pyrene	0.00142365	0.014	0.01	J	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14
Benzo(a)anthracene	0.01481814	0.033		U	0.07
Chrysene	0.01469148	0.030		U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	0.48				
Duplicate run (per method)					
Naphthalene	0.01472868	2.850		U	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12
Acenaphthylene	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6
Fluorene	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02
Fluoranthene	0.00264129	0.019	0.02	J	0.21
Pyrene	0.00140978	0.014	0.01	J	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14
Benzo(a)anthracene	0.01481814	0.033		U	0.07
Chrysene	0.01469148	0.030		U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01
Total TUs	0.48				

* Nondetects replaced with RDL values

** Detected Results only. All PAH results are in µg/L

U = nondetect, J = result is estimated, TU = toxicity unit

1. Power water TUs were calculated as the sum of the individual PAH TUs. Individual PAH TUs were calculated as follows: PWconc in µg/L/FCV µg/L taken from Table 3-4 in EPA 2003 (Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures).

3. Red shading represents results greater than site-specific remedial goal (5

Table 4A - Pore Water Toxicity Unit Calculations - September 2016

Lower Otter Creek and Confluence Area, Ohio

		PW-08-0.0/0.5					PW-09-0.0/0.5				
Analyte	*FCV*	*TU*	*Result**	*Result***	*Qual*	*RDL*	*TU*	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	193.5	0.00065137	0.126	0.13	J	5.7	0.01472868	2.850		U	5.7
2-Methylnaphthalene	72.16	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	75.37	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	30.24	0.02386612	0.722	0.72	J	0.89	0.01471561	0.445		U	0.89
C3-Naphthalenes	11.1	0.51614656	5.729	5.73		0.33	0.01486486	0.165		U	0.33
C4-Naphthalenes	4.048	1.99881161	8.091	8.09		0.12	0.01482213	0.060		U	0.12
Acenaphthylene	306.9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	55.85	0.00218749	0.122	0.12	J	1.6	0.01432408	0.800		U	1.6
Fluorene	39.3	0.00302979	0.119	0.12	J	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	13.99	0.04933372	0.690	0.69	J	0.41	0.01465332	0.205		U	0.41
C2-Fluorenes	5.305	0.29482353	1.564	1.56	J	0.16	0.01508011	0.080		U	0.16
C3-Fluorenes	1.916	0.73060176	1.400	1.40	J	0.06	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	20.73	0.00312178	0.065	0.06	J	0.61	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.02520885	0.187	0.19	J	0.22	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.31748894	1.016	1.02	J	0.09	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	1.256	1.14383533	1.437	1.44	J	0.04	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.5594	2.20294112	1.232	1.23	J	0.02	0.0178763	0.010		U	0.02
Fluoranthene	7.109	0.014615	0.104	0.10	J	0.21	0.0025666	0.018	0.02	J	0.21
Pyrene	10.11	0.02538182	0.257	0.26	J	0.3	0.0148368	0.150		U	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.06900467	0.337	0.34	J	0.14	0.01432372	0.070		U	0.14
Benzo(a)anthracene	2.227	0.01510241	0.034	0.03	J	0.07	0.00129827	0.003	0.00	J	0.07
Chrysene	2.042	0.03508901	0.072	0.07		0.06	0.00183845	0.004	0.00	J	0.06
C1-Chrysenes	0.8557	0.04797471	0.041	0.04		0.03	0.01460792	0.013		U	0.03
C2-Chrysenes	0.4827	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.1675	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.07062	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.9008	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs		7.73					0.47				
Duplicate run (per method)											
Naphthalene	193.5	0.00059927	0.116	0.12	J	5.7	0.01472868	2.850		U	5.7
2-Methylnaphthalene	72.16	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	75.37	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	30.24	0.02162796	0.654	0.65	J	0.89	0.01471561	0.445		U	0.89
C3-Naphthalenes	11.1	0.46730201	5.187	5.19		0.33	0.01486486	0.165		U	0.33
C4-Naphthalenes	4.048	1.87198209	7.578	7.58		0.12	0.01482213	0.060		U	0.12
Acenaphthylene	306.9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	55.85	0.0022514	0.126	0.13	J	1.6	0.01432408	0.800		U	1.6
Fluorene	39.3	0.00285415	0.112	0.11	J	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	13.99	0.04532388	0.634	0.63	J	0.41	0.01465332	0.205		U	0.41
C2-Fluorenes	5.305	0.27274961	1.447	1.45	J	0.16	0.01508011	0.080		U	0.16
C3-Fluorenes	1.916	0.92723988	1.777	1.78	J	0.06	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	20.73	0.00277352	0.057	0.06	J	0.61	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.0258817	0.192	0.19	J	0.22	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.28799393	0.921	0.92	J	0.09	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	1.256	1.11416864	1.399	1.40	J	0.04	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.5594	2.26176208	1.265	1.27	J	0.02	0.0178763	0.010		U	0.02
Fluoranthene	7.109	0.01408166	0.100	0.10	J	0.21	0.00221095	0.016	0.02	J	0.21
Pyrene	10.11	0.02483204	0.251	0.25	J	0.3	0.0148368	0.150		U	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.06746826	0.330	0.33	J	0.14	0.01432372	0.070		U	0.14
Benzo(a)anthracene	2.227	0.01596956	0.036	0.04	J	0.07	0.00141572	0.003	0.00	J	0.07
Chrysene	2.042	0.03785171	0.077	0.08		0.06	0.00168597	0.003	0.00	J	0.06
C1-Chrysenes	0.8557	0.04456983	0.038	0.04	J	0.03	0.01460792	0.013		U	0.03
C2-Chrysenes	0.4827	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.1675	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.07062	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.9008	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs		7.72					0.47				

	PW-10-0.0/0.5					PW-11-0.0/0.5				
Analyte	*TU*	*Result**	*Result***	*Qual*	*RDL*	*TU*	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	0.01472868	2.850		U	5.7	0.00084274	0.163	0.16	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89	0.01585901	0.480	0.48	J	0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33	0.27449271	3.047	3.05	J	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12	4.34336789	17.582	17.58	U	0.12
Acenaphthylene	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6	0.01015359	0.567	0.57	J	1.6
Fluorene	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41	0.13437271	1.880	1.88	U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16	0.9264806	4.915	4.91	U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06	1.47242876	2.821	2.82	U	0.06
Phenanthrene	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61	0.00784643	0.163	0.16	U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22	0.03443329	0.256	0.26	J	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09	0.242612	0.776	0.78	J	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04	2.23644109	2.809	2.81	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02	4.84944758	2.713	2.71	J	0.02
Fluoranthene	0.00207143	0.015	0.01	J	0.21	0.03223935	0.229	0.23	J	0.21
Pyrene	0.00163812	0.017	0.02	J	0.3	0.06682073	0.676	0.68	U	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14	0.15670514	0.766	0.77	U	0.14
Benzo(a)anthracene	0.00152581	0.003	0.00	J	0.07	0.03243301	0.072	0.07	J	0.07
Chrysene	0.0018041	0.004	0.00	J	0.06	0.08294226	0.169	0.17	U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03	0.06890216	0.059	0.06	U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02	0.0276559	0.019	0.02	J	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03	0.01930421	0.017	0.02	J	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03	0.01042168	0.009	0.01	J	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs	0.45					15.22				
Duplicate run (per method)										
Naphthalene	0.01472868	2.850		U	5.7	0.0008636	0.167	0.17	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89	0.01421673	0.430	0.43	J	0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33	0.25746834	2.858	2.86	J	0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12	4.23927527	17.161	17.16	U	0.12
Acenaphthylene	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6	0.00968275	0.541	0.54	J	1.6
Fluorene	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41	0.13958134	1.953	1.95	U	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16	0.90571791	4.805	4.80	U	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06	1.50147549	2.877	2.88	U	0.06
Phenanthrene	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	0.01471298	0.305		U	0.61	0.00736669	0.153	0.15	U	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22	0.03236284	0.241	0.24	J	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09	0.25961019	0.830	0.83	J	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04	2.29754305	2.886	2.89	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02	4.88482058	2.733	2.73	J	0.02
Fluoranthene	0.00202613	0.014	0.01	J	0.21	0.03188739	0.227	0.23	J	0.21
Pyrene	0.00197077	0.020	0.02	J	0.3	0.06769194	0.684	0.68	U	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14	0.15961812	0.780	0.78	U	0.14
Benzo(a)anthracene	0.00167301	0.004	0.00	J	0.07	0.03524169	0.078	0.08	J	0.07
Chrysene	0.00181428	0.004	0.00	J	0.06	0.08411413	0.172	0.17	U	0.06
C1-Chrysenes	0.01460792	0.013		U	0.03	0.07719026	0.066	0.07	U	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02	0.02934472	0.020	0.02	J	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03	0.02057373	0.019	0.02	J	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03	0.01092187	0.010	0.01	J	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs	0.45					15.24				

	PW-12-0.0/0.5					PW-13-0.0/0.5					PW-14-0.0/0.5				
Analyte	*TU*	*Result**	*Result***	*Qual*	*RDL*	*TU*	*Result**	*Result***	*Qual*	*RDL*	*TU*	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	0.01472868	2.850		U	5.7	0.00062688	0.121	0.12	J	5.7	0.00121739	0.236	0.24	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4	0.00077985	0.056	0.06	J	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4	0.00193548	0.146	0.15	J	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89	0.01406126	0.425	0.43	J	0.89	0.14561765	4.403	4.40		0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33	0.07999622	0.888	0.89	J	0.33	1.0762822	11.947	11.95		0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12	0.32540814	1.317	1.32	J	0.12	2.06793561	8.371	8.37		0.12
Acenaphthylene	0.01466276	4.500		U	9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6	0.01432408	0.800		U	1.6	0.00372085	0.208	0.21	J	1.6
Fluorene	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2	0.00584523	0.230	0.23	J	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41	0.01443113	0.202	0.20	J	0.41	0.08435062	1.180	1.18	J	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16	0.0699704	0.371	0.37	J	0.16	0.28251481	1.499	1.50	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56	0.0127884	0.245	0.24	J	0.56
Anthracene	0.01471298	0.305		U	0.61	0.01471298	0.305		U	0.61	0.00247086	0.051	0.05	J	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22	0.00584302	0.043	0.04	J	0.22	0.06664298	0.496	0.50	J	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09	0.03921955	0.125	0.13	J	0.09	0.37462266	1.198	1.20	J	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04	0.29722957	0.373	0.37	J	0.04	0.98744096	1.240	1.24	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02	0.0178763	0.010		U	0.02	2.05145753	1.148	1.15	J	0.02
Fluoranthene	0.00161706	0.011	0.01	J	0.21	0.0044247	0.031	0.03	J	0.21	0.00789864	0.056	0.06	J	0.21
Pyrene	0.0148368	0.150		U	0.3	0.00645751	0.065	0.07	J	0.3	0.01704733	0.172	0.17	J	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14	0.01303361	0.064	0.06	J	0.14	0.04344759	0.212	0.21	J	0.14
Benzo(a)anthracene	0.00138853	0.003	0.00	J	0.07	0.00204525	0.005	0.00	J	0.07	0.00531128	0.012	0.01	J	0.07
Chrysene	0.00301426	0.006	0.01	J	0.06	0.00919436	0.019	0.02	J	0.06	0.02327504	0.048	0.05		0.06
C1-Chrysenes	0.01460792	0.013		U	0.03	0.01460792	0.013		U	0.03	0.02442637	0.021	0.02	J	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs	0.47					1.18					7.46				
Duplicate run (per method)															
Naphthalene	0.01472868	2.850		U	5.7	0.00063448	0.123	0.12	J	5.7	0.00115235	0.223	0.22	J	5.7
2-Methylnaphthalene	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4	0.0007727	0.056	0.06	J	2.4
1-Methylnaphthalene	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4	0.00190335	0.143	0.14	J	2.4
C2-Naphthalenes	0.01471561	0.445		U	0.89	0.0133507	0.404	0.40	J	0.89	0.1412142	4.270	4.27		0.89
C3-Naphthalenes	0.01486486	0.165		U	0.33	0.09113649	1.012	1.01	J	0.33	1.05159437	11.673	11.67		0.33
C4-Naphthalenes	0.01482213	0.060		U	0.12	0.31255849	1.265	1.27	J	0.12	2.33877861	9.467	9.47		0.12
Acenaphthylene	0.01466276	4.500		U	9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	0.01432408	0.800		U	1.6	0.01432408	0.800		U	1.6	0.00372673	0.208	0.21	J	1.6
Fluorene	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2	0.00612004	0.241	0.24	J	1.2
C1-Fluorenes	0.01465332	0.205		U	0.41	0.01420237	0.199	0.20	J	0.41	0.07998947	1.119	1.12	J	0.41
C2-Fluorenes	0.01508011	0.080		U	0.16	0.06585615	0.349	0.35	J	0.16	0.30890279	1.639	1.64	J	0.16
C3-Fluorenes	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06
Phenanthrene	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56	0.01285671	0.246	0.25	J	0.56
Anthracene	0.01471298	0.305		U	0.61	0.01471298	0.305		U	0.61	0.00277645	0.058	0.06	J	0.61
C1-Phenanthrenes/Anthracenes	0.0147929	0.110		U	0.22	0.00539781	0.040	0.04	J	0.22	0.07188195	0.535	0.53	J	0.22
C2-Phenanthrenes/Anthracenes	0.0140669	0.045		U	0.09	0.04263927	0.136	0.14	J	0.09	0.36579328	1.170	1.17	J	0.09
C3-Phenanthrenes/Anthracenes	0.01592357	0.020		U	0.04	0.3046878	0.383	0.38	J	0.04	0.9509609	1.194	1.19	J	0.04
C4-Phenanthrenes/Anthracenes	0.0178763	0.010		U	0.02	0.0178763	0.010		U	0.02	1.83446809	1.026	1.03	J	0.02
Fluoranthene	0.00143068	0.010	0.01	J	0.21	0.00416007	0.030	0.03	J	0.21	0.00843167	0.060	0.06	J	0.21
Pyrene	0.0148368	0.150		U	0.3	0.00612429	0.062	0.06	J	0.3	0.01713947	0.173	0.17	J	0.3
C1-Fluoranthenes/Pyrenes	0.01432372	0.070		U	0.14	0.01197527	0.059	0.06	J	0.14	0.0398317	0.195	0.19	J	0.14
Benzo(a)anthracene	0.00139699	0.003	0.00	J	0.07	0.00223933	0.005	0.00	J	0.07	0.00589398	0.013	0.01	J	0.07
Chrysene	0.00304433	0.006	0.01	J	0.06	0.00811742	0.017	0.02	J	0.06	0.02345826	0.048	0.05		0.06
C1-Chrysenes	0.01460792	0.013		U	0.03	0.01460792	0.013		U	0.03	0.02224005	0.019	0.02	J	0.03
C2-Chrysenes	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.01416029	0.001		U	0	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs	0.47					1.18					7.46				

* Nondetects replaced with RDL values

** Detected Results only. All PAH results are in µg/L

U = nondetect, J = result is estimated, TU = toxicity unit

1. Power water TUs were calculated as the sum of the individual PAH TUs. Individual PAH TUs were calculated as follows: PWconc in µg/L/FCV µg/L taken from Table 3-4 in EPA 2003 (Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures).

3. Red shading represents results greater than site-specific remedial goal (5

Table 4A - Pore Water Toxicity Unit Calculations - September 2016

Lower Otter Creek and Confluence Area, Ohio

		PW-15-0.0/0.5					PW-22-0.0/0.5				
Analyte	*FCV*	*TU*	*Result**	*Result***	*Qual*	*RDL*	*TU*	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	193.5	0.01472868	2.850		U	5.7	0.01472868	2.850		U	5.7
2-Methylnaphthalene	72.16	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	75.37	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	30.24	0.01513047	0.458	0.46	J	0.89	0.01471561	0.445		U	0.89
C3-Naphthalenes	11.1	0.12620242	1.401	1.40	J	0.33	0.01486486	0.165		U	0.33
C4-Naphthalenes	4.048	0.49647802	2.010	2.01	J	0.12	0.01482213	0.060		U	0.12
Acenaphthylene	306.9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	55.85	0.01432408	0.800		U	1.6	0.01432408	0.800		U	1.6
Fluorene	39.3	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	13.99	0.01435922	0.201	0.20	J	0.41	0.01465332	0.205		U	0.41
C2-Fluorenes	5.305	0.10184606	0.540	0.54	J	0.16	0.01508011	0.080		U	0.16
C3-Fluorenes	1.916	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	20.73	0.01471298	0.305		U	0.61	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.01079546	0.080	0.08	J	0.22	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.12948116	0.414	0.41	J	0.09	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	1.256	0.65608704	0.824	0.82	J	0.04	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.5594	1.73505702	0.971	0.97	J	0.02	0.0178763	0.010		U	0.02
Fluoranthene	7.109	0.0055492	0.039	0.04	J	0.21	0.00281334	0.020	0.02	J	0.21
Pyrene	10.11	0.00948888	0.096	0.10	J	0.3	0.00593472	0.060	0.06	J	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.02668874	0.130	0.13	J	0.14	0.01841621	0.090	0.09	J	0.14
Benzo(a)anthracene	2.227	0.00369558	0.008	0.01	J	0.07	0.00369558	0.008	0.01	J	0.07
Chrysene	2.042	0.01653085	0.034	0.03	J	0.06	0.00979432	0.020	0.02	J	0.06
C1-Chrysenes	0.8557	0.01937623	0.017	0.02	J	0.03	0.01460792	0.013		U	0.03
C2-Chrysenes	0.4827	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.1675	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.07062	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.9008	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs		**3.65**					**0.47**				
Duplicate run (per method)											
Naphthalene	193.5	0.01472868	2.850		U	5.7	0.01472868	2.850		U	5.7
2-Methylnaphthalene	72.16	0.01662971	1.200		U	2.4	0.01662971	1.200		U	2.4
1-Methylnaphthalene	75.37	0.01592145	1.200		U	2.4	0.01592145	1.200		U	2.4
C2-Naphthalenes	30.24	0.01413731	0.428	0.43	J	0.89	0.01471561	0.445		U	0.89
C3-Naphthalenes	11.1	0.12740218	1.414	1.41	J	0.33	0.01486486	0.165		U	0.33
C4-Naphthalenes	4.048	0.49006277	1.984	1.98	J	0.12	0.01482213	0.060		U	0.12
Acenaphthylene	306.9	0.01466276	4.500		U	9	0.01466276	4.500		U	9
Acenaphthene	55.85	0.01432408	0.800		U	1.6	0.01432408	0.800		U	1.6
Fluorene	39.3	0.01526718	0.600		U	1.2	0.01526718	0.600		U	1.2
C1-Fluorenes	13.99	0.01522636	0.213	0.21	J	0.41	0.01465332	0.205		U	0.41
C2-Fluorenes	5.305	0.1082475	0.574	0.57	J	0.16	0.01508011	0.080		U	0.16
C3-Fluorenes	1.916	0.01565762	0.030		U	0.06	0.01565762	0.030		U	0.06
Phenanthrene	19.13	0.0146367	0.280		U	0.56	0.0146367	0.280		U	0.56
Anthracene	20.73	0.01471298	0.305		U	0.61	0.01471298	0.305		U	0.61
C1-Phenanthrenes/Anthracenes	7.436	0.00950768	0.071	0.07	J	0.22	0.0147929	0.110		U	0.22
C2-Phenanthrenes/Anthracenes	3.199	0.12604649	0.403	0.40	J	0.09	0.0140669	0.045		U	0.09
C3-Phenanthrenes/Anthracenes	1.256	0.69261417	0.870	0.87	J	0.04	0.01592357	0.020		U	0.04
C4-Phenanthrenes/Anthracenes	0.5594	1.71036105	0.957	0.96	J	0.02	0.0178763	0.010		U	0.02
Fluoranthene	7.109	0.00509936	0.036	0.04	J	0.21	0.00281334	0.020	0.02	J	0.21
Pyrene	10.11	0.00979561	0.099	0.10	J	0.3	0.00593472	0.060	0.06	J	0.3
C1-Fluoranthenes/Pyrenes	4.887	0.02825493	0.138	0.14	J	0.14	0.01636996	0.080	0.08	J	0.14
Benzo(a)anthracene	2.227	0.00363736	0.008	0.01	J	0.07	0.00363736	0.008	0.01	J	0.07
Chrysene	2.042	0.01584943	0.032	0.03	J	0.06	0.00979432	0.020	0.02	J	0.06
C1-Chrysenes	0.8557	0.01843937	0.016	0.02	J	0.03	0.01460792	0.013		U	0.03
C2-Chrysenes	0.4827	0.01450176	0.007		U	0.01	0.01450176	0.007		U	0.01
C3-Chrysenes	0.1675	0.01492537	0.003		U	0.01	0.01492537	0.003		U	0.01
C4-Chrysenes	0.07062	0.01416029	0.001		U	0	0.01416029	0.001		U	0
Benzo(b,k)fluoranthene	0.6774	0.01402421	0.010		U	0.02	0.01402421	0.010		U	0.02
Benzo(e)pyrene	0.9008	0.01554174	0.014		U	0.03	0.01554174	0.014		U	0.03
Benzo(a)pyrene	0.9573	0.01357986	0.013		U	0.03	0.01357986	0.013		U	0.03
Perylene	0.9008	0.01443162	0.013		U	0.03	0.01443162	0.013		U	0.03
Indeno(1,2,3-c,d)pyrene	0.275	0.01454545	0.004		U	0.01	0.01454545	0.004		U	0.01
Dibenzo(a,h)anthracene	0.2825	0.01415929	0.004		U	0.01	0.01415929	0.004		U	0.01
Benzo(g,h,i)perylene	0.4391	0.01480301	0.007		U	0.01	0.01480301	0.007		U	0.01
Total TUs		**3.66**					**0.47**				

* Nondetects replaced with RDL values

** Detected Results only. All PAH results are in µg/L

U = nondetect, J = result is estimated, TU = toxicity unit

1. Power water TUs were calculated as the sum of the individual PAH TUs. Individual PAH TUs were calculated as follows: PWconc in µg/L/FCV µg/L taken from Table 3-4 in EPA 2003 (Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures).

3. Red shading represents results greater than site-specific remedial goal (5

Table 4B - Equilibrium Partitioning Sediment Benchmarks Toxicity Unit Calculations[1,] September 2016

Lower Otter Creek and Confluence Area, Ohio

TOC Fraction (f_{oc})	$C_{OC, PAHi, FCVi}$	$C_{OC, PAHi, Maxi}$	PW-01-0.0/0.5 0.02					
Analyte	**(ug/g$_{OC}$)**	**(ug/g$_{OC}$)**	**ESBTU$_{FCVi}$ [2]**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	385	61700	0.11	42.80983814	0.86	0.86		0.11
2-Methylnaphthalene	446	165700	0.15	67.43389897	1.35	1.35		0.13
1-Methylnaphthalene	447	154800	0.05	22.80977591	0.46	0.46		0.13
C2-Naphthalenes	510	--	0.53	271.2783201	5.43	5.43		0.15
C3-Naphthalenes	581	--	0.83	482.1638585	9.64	9.64		0.17
C4-Naphthalenes	657	--	2.22	1459.963545	29.20	29.20		0.19
Acenaphthylene	452	24000	0.03	14.55448552	0.29	0.29		0.13
Acenaphthene	491	33400	0.01	6.320698888	0.13	0.13		0.14
Fluorene	538	26000	0.01	4	0.08		U	0.16
C1-Fluorenes	611	--	0.22	132.6309906	2.65	2.65		0.18
C2-Fluorenes	686	--	0.83	568.6563711	11.37	11.37		0.20
C3-Fluorenes	769	--	0.77	590.9741802	11.82	11.82		0.23
Phenanthrene	596	34300	0.10	60.73792395	1.21	1.21		0.18
Anthracene	594	1300	0.13	75.08738935	1.50	1.50		0.17
C1-Phenanthrenes/Anthracenes	670	--	0.48	324.2232127	6.48	6.48		0.20
C2-Phenanthrenes/Anthracenes	746	--	3.35	2497.446602	49.95	49.95	E	0.22
C3-Phenanthrenes/Anthracenes	829	--	4.47	3704.920391	74.10	74.10		0.24
C4-Phenanthrenes/Anthracenes	913	--	1.84	1677.548959	33.55	33.55	E	0.27
Fluoranthene	707	23870	0.13	94.38427099	1.89	1.89		0.21
Pyrene	697	9090	0.39	268.8140181	5.38	5.38		0.21
C1-Fluoranthenes/Pyrenes	770	--	1.06	819.0500187	16.38	16.38	E	0.23
Benzo(a)anthracene	841	4153	0.23	193.6243928	3.87	3.87		0.25
Chrysene	844	826	0.35	298.1230991	5.96	5.96		0.25
C1-Chrysenes	929	--	1.72	1597.52512	31.95	31.95		0.27
C2-Chrysenes	1008	--	2.61	2632.929287	52.66	52.66		0.30
C3-Chrysenes	1112	--	1.78	1983.301688	39.67	39.67		0.33
C4-Chrysenes	1214	--	1.05	1279.363373	25.59	25.59		0.36
Benzo(b,k)fluoranthene	979	2169	0.12	117.2300261	2.34	2.34		0.29
Benzo(e)pyrene	967	4300	0.19	180.0177132	3.60	3.60		0.28
Benzo(a)pyrene	965	3840	0.21	204.4032098	4.09	4.09		0.28
Perylene	967	431	0.04	40.96962633	0.82	0.82		0.28
Indeno(1,2,3-c,d)pyrene	1115	--	0.08	92.59260172	1.85	1.85		0.33
Dibenzo(a,h)anthracene	1123	2389	0.05	54.34712757	1.09	1.09		0.33
Benzo(g,h,i)perylene	1095	648	0.10	113.2276266	2.26	2.26		0.32
Sum total of ESBTU$_{FCVi}$			**26.26**					

TOC Fraction (f_{oc})	PW-02-0.0/0.5 0.0176					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.08	29.83	0.53	0.53		0.11
2-Methylnaphthalene	0.11	47.97	0.84	0.84		0.13
1-Methylnaphthalene	0.03	13.28	0.23	0.23		0.13
C2-Naphthalenes	0.42	214.28	3.77	3.77		0.15
C3-Naphthalenes	0.82	475.58	8.37	8.37		0.17
C4-Naphthalenes	3.21	2108.28	37.11	37.11		0.19
Acenaphthylene	0.02	9.08	0.16	0.16		0.13
Acenaphthene	0.02	12.24	0.22	0.22		0.14
Fluorene	0.02	12.51	0.22	0.22		0.16
C1-Fluorenes	0.30	180.54	3.18	3.18		0.18
C2-Fluorenes	1.10	756.22	13.31	13.31		0.20
C3-Fluorenes	0.94	721.30	12.69	12.69		0.23
Phenanthrene	0.08	50.15	0.88	0.88		0.18
Anthracene	0.13	78.48	1.38	1.38		0.17
C1-Phenanthrenes/Anthracenes	0.42	283.08	4.98	4.98		0.20
C2-Phenanthrenes/Anthracenes	2.92	2181.14	38.39	38.39	E	0.22
C3-Phenanthrenes/Anthracenes	4.53	3756.02	66.11	66.11		0.24
C4-Phenanthrenes/Anthracenes	1.99	1815.46	31.95	31.95	E	0.27
Fluoranthene	0.12	87.77	1.54	1.54		0.21
Pyrene	0.30	210.35	3.70	3.70		0.21
C1-Fluoranthenes/Pyrenes	0.90	691.72	12.17	12.17	E	0.23
Benzo(a)anthracene	0.23	195.49	3.44	3.44		0.25
Chrysene	0.44	368.95	6.49	6.49		0.25
C1-Chrysenes	1.85	1718.22	30.24	30.24		0.27
C2-Chrysenes	2.47	2489.37	43.81	43.81		0.30
C3-Chrysenes	1.54	1707.62	30.05	30.05		0.33
C4-Chrysenes	0.91	1104.54	19.44	19.44		0.36
Benzo(b,k)fluoranthene	0.11	112.01	1.97	1.97		0.29
Benzo(e)pyrene	0.13	127.23	2.24	2.24		0.28
Benzo(a)pyrene	0.17	163.19	2.87	2.87		0.28
Perylene	0.04	37.57	0.66	0.66		0.28
Indeno(1,2,3-c,d)pyrene	0.07	83.31	1.47	1.47		0.33
Dibenzo(a,h)anthracene	0.04	45.24	0.80	0.80		0.33
Benzo(g,h,i)perylene	0.08	88.51	1.56	1.56		0.32
Sum total of ESBTU$_{FCVi}$	**26.56**					

TOC Fraction (f_{oc})	PW-03-0.0/0.5 0.0337					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.02	7.79	0.26	0.26		0.11
2-Methylnaphthalene	0.03	15.19	0.51	0.51		0.13
1-Methylnaphthalene	0.01	4.16	0.14	0.14		0.13
C2-Naphthalenes	0.15	76.96	2.59	2.59		0.15
C3-Naphthalenes	0.17	99.06	3.34	3.34		0.17
C4-Naphthalenes	0.28	184.57	6.22	6.22		0.19
Acenaphthylene	0.01	2.45	0.08	0.08	J	0.13
Acenaphthene	0.00	1.71	0.06	0.06	J	0.14
Fluorene	0.01	3.82	0.13	0.13		0.16
C1-Fluorenes	0.04	24.85	0.84	0.84		0.18
C2-Fluorenes	0.11	74.20	2.50	2.50		0.20
C3-Fluorenes	0.09	65.60	2.21	2.21		0.23
Phenanthrene	0.03	17.81	0.60	0.60		0.18
Anthracene	0.02	13.89	0.47	0.47		0.17
C1-Phenanthrenes/Anthracenes	0.11	70.67	2.38	2.38		0.20
C2-Phenanthrenes/Anthracenes	0.47	349.34	11.77	11.77	E	0.22
C3-Phenanthrenes/Anthracenes	0.51	421.90	14.22	14.22		0.24
C4-Phenanthrenes/Anthracenes	0.21	190.66	6.43	6.43		0.27
Fluoranthene	0.03	17.90	0.60	0.60		0.21
Pyrene	0.06	39.34	1.33	1.33		0.21
C1-Fluoranthenes/Pyrenes	0.13	100.85	3.40	3.40		0.23
Benzo(a)anthracene	0.03	24.45	0.82	0.82		0.25
Chrysene	0.06	52.58	1.77	1.77		0.25
C1-Chrysenes	0.20	188.57	6.35	6.35		0.27
C2-Chrysenes	0.29	296.99	10.01	10.01		0.30
C3-Chrysenes	0.22	239.62	8.08	8.08		0.33
C4-Chrysenes	0.13	155.41	5.24	5.24		0.36
Benzo(b,k)fluoranthene	0.02	21.65	0.73	0.73		0.29
Benzo(e)pyrene	0.02	21.84	0.74	0.74		0.28
Benzo(a)pyrene	0.03	27.39	0.92	0.92		0.28
Perylene	0.01	8.15	0.27	0.27		0.28
Indeno(1,2,3-c,d)pyrene	0.02	18.01	0.61	0.61		0.33
Dibenzo(a,h)anthracene	0.01	6.80	0.23	0.23		0.33
Benzo(g,h,i)perylene	0.02	18.84	0.64	0.64		0.32
Sum total of ESBTU$_{FCVi}$	**3.53**					

TOC Fraction (f_{oc})	PW-04-0.0/0.5 0.0173					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.06	23.97	0.41	0.41		0.11
2-Methylnaphthalene	0.03	13.50	0.23	0.23		0.13
1-Methylnaphthalene	0.01	4.06	0.07	0.07		0.13
C2-Naphthalenes	0.20	103.15	1.78	1.78		0.15
C3-Naphthalenes	0.71	413.28	7.15	7.15		0.17
C4-Naphthalenes	2.18	1433.59	24.80	24.80		0.19
Acenaphthylene	0.02	8.70	0.15	0.15		0.13
Acenaphthene	0.01	6.37	0.11	0.11		0.14
Fluorene	0.03	13.95	0.24	0.24		0.16
C1-Fluorenes	0.23	139.20	2.41	2.41		0.18
C2-Fluorenes	0.70	479.42	8.29	8.29		0.20
C3-Fluorenes	0.56	428.26	7.41	7.41		0.23
Phenanthrene	0.04	22.10	0.38	0.38		0.18
Anthracene	0.10	59.85	1.04	1.04		0.17
C1-Phenanthrenes/Anthracenes	0.28	186.04	3.22	3.22		0.20
C2-Phenanthrenes/Anthracenes	2.03	1517.20	26.25	26.25	E	0.22
C3-Phenanthrenes/Anthracenes	2.56	2122.53	36.72	36.72		0.24
C4-Phenanthrenes/Anthracenes	0.94	854.73	14.79	14.79		0.27
Fluoranthene	0.10	69.75	1.21	1.21		0.21
Pyrene	0.24	168.76	2.92	2.92		0.21
C1-Fluoranthenes/Pyrenes	0.65	496.89	8.60	8.60		0.23
Benzo(a)anthracene	0.19	163.65	2.83	2.83		0.25
Chrysene	0.33	276.35	4.78	4.78		0.25
C1-Chrysenes	1.38	1280.17	22.15	22.15		0.27
C2-Chrysenes	1.68	1697.05	29.36	29.36		0.30
C3-Chrysenes	0.95	1059.91	18.34	18.34		0.33
C4-Chrysenes	0.54	654.41	11.32	11.32		0.36
Benzo(b,k)fluoranthene	0.08	81.08	1.40	1.40		0.29
Benzo(e)pyrene	0.10	95.14	1.65	1.65		0.28
Benzo(a)pyrene	0.13	121.26	2.10	2.10		0.28
Perylene	0.03	26.93	0.47	0.47		0.28
Indeno(1,2,3-c,d)pyrene	0.05	55.94	0.97	0.97		0.33
Dibenzo(a,h)anthracene	0.03	32.89	0.57	0.57		0.33
Benzo(g,h,i)perylene	0.05	56.89	0.98	0.98		0.32
Sum total of ESBTU$_{FCVi}$	**17.21**					

Notes:

* Non detects replaced with RDL values

** Detected Results only. All PAH results are in µg/kg

U = non-detect, J = result is estimates, E = exceeded calibration range

1. Sediment ESB toxic units (TUs) were calculated as the sum of the 34-individual PAH TU - normalized for TOC and normalized for the FCV values. Although, there is no remedial clean up goal for ESBTU, the research suggests that a toxic effect is likely to occur when levels are greater than 1. Therefore, this ESB TU information is provided for informational purposes

2. U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460

Table 4B - Equilibrium Partitioning Sediment Benchmarks Toxicity Unit Calcula
Lower Otter Creek and Confluence Area, Ohio

TOC Fraction (f_{oc})	$C_{OC, PAHi, FCVi}$	$C_{OC, PAHi, Maxi}$	PW-05-0.0/0.5						PW-06-0.0/0.5						PW-07-0.0/0.5						PW-08-0.0/0.5					
			0.0222						0.0136						0.0259						0.017					
Analyte	(ug/g_{OC})	(ug/g_{OC})	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	385	61700	0.06	22.67	0.50	0.50		0.11	0.02	7.42	0.10	0.10	J	0.11	0.01	5.12	0.13	0.13		0.11	0.06	21.81	0.37	0.37		0.11
2-Methylnaphthalene	446	165700	0.02	7.72	0.17	0.17		0.13	0.01	5.97	0.08	0.08		0.13	0.01	3.30	0.09	0.09		0.13	0.03	12.16	0.21	0.21		0.13
1-Methylnaphthalene	447	154800	0.00	1.82	0.04	0.04	J	0.13	0.00	1.54	0.02	0.02	J	0.13	0.00	0.99	0.03	0.03	J	0.13	0.01	4.17	0.07	0.07		0.13
C2-Naphthalenes	510	--	0.07	34.61	0.77	0.77		0.15	0.10	52.14	0.71	0.71		0.15	0.05	26.07	0.68	0.68		0.15	0.18	93.47	1.59	1.59		0.15
C3-Naphthalenes	581	--	0.08	49.14	1.09	1.09		0.17	0.04	25.19	0.34	0.34		0.17	0.02	13.75	0.36	0.36		0.17	0.60	346.77	5.90	5.90		0.17
C4-Naphthalenes	657	--	0.22	145.06	3.22	3.22		0.19	0.07	46.58	0.63	0.63		0.19	0.04	25.11	0.65	0.65		0.19	1.54	1010.04	17.17	17.17		0.19
Acenaphthylene	452	24000	0.01	4.17	0.09	0.09	J	0.13	0.01	3.15	0.04	0.04	J	0.13	0.00	1.37	0.04	0.04	J	0.13	0.02	9.83	0.17	0.17		0.13
Acenaphthene	491	33400	0.00	2.11	0.05	0.05	J	0.14	0.00	2.10	0.03	0.03	J	0.14	0.00	1.23	0.03	0.03	J	0.14	0.01	5.29	0.09	0.09		0.14
Fluorene	538	26000	0.01	4.19	0.09	0.09	J	0.16	0.01	3.51	0.05	0.05	J	0.16	0.00	2.16	0.06	0.06	J	0.16	0.03	13.62	0.23	0.23		0.16
C1-Fluorenes	611	--	0.04	22.44	0.50	0.50		0.18	0.02	9.75	0.13	0.13		0.18	0.01	4.93	0.13	0.13		0.18	0.16	98.04	1.67	1.67		0.18
C2-Fluorenes	686	--	0.09	64.14	1.42	1.42		0.20	0.03	18.99	0.26	0.26		0.20	0.01	10.21	0.26	0.26		0.20	0.51	349.66	5.94	5.94		0.20
C3-Fluorenes	769	--	0.07	55.40	1.23	1.23		0.23	0.02	17.46	0.24	0.24	J	0.23	0.01	10.43	0.27	0.27	J	0.23	0.47	362.44	6.16	6.16		0.23
Phenanthrene	596	34300	0.02	14.59	0.32	0.32		0.18	0.02	13.51	0.18	0.18		0.18	0.01	7.73	0.20	0.20		0.18	0.04	25.84	0.44	0.44		0.18
Anthracene	594	1300	0.03	17.08	0.38	0.38		0.17	0.01	6.25	0.09		U	0.17	0.01	3.28	0.09		U	0.17	0.09	53.23	0.90	0.90		0.17
C1-Phenanthrenes/Anthracenes	670	--	0.07	45.27	1.00	1.00		0.20	0.04	26.58	0.36	0.36		0.20	0.02	11.36	0.29	0.29		0.20	0.28	185.36	3.15	3.15		0.20
C2-Phenanthrenes/Anthracenes	746	--	0.28	205.95	4.57	4.57		0.22	0.14	101.97	1.39	1.39		0.22	0.08	57.42	1.49	1.49		0.22	1.97	1472.77	25.04	25.04	E	0.22
C3-Phenanthrenes/Anthracenes	829	--	0.35	288.89	6.41	6.41		0.24	0.14	114.48	1.56	1.56		0.24	0.08	66.90	1.73	1.73		0.24	2.20	1823.65	31.00	31.00		0.24
C4-Phenanthrenes/Anthracenes	913	--	0.13	117.51	2.61	2.61		0.27	0.04	39.77	0.54	0.54		0.27	0.03	23.41	0.61	0.61		0.27	0.81	735.44	12.50	12.50		0.27
Fluoranthene	707	23870	0.04	29.43	0.65	0.65		0.21	0.03	22.62	0.31	0.31		0.21	0.02	15.31	0.40	0.40		0.21	0.10	72.78	1.24	1.24		0.21
Pyrene	697	9090	0.07	48.00	1.07	1.07		0.21	0.04	25.34	0.34	0.34		0.21	0.02	16.01	0.41	0.41		0.21	0.23	162.75	2.77	2.77		0.21
C1-Fluoranthenes/Pyrenes	770	--	0.12	96.05	2.13	2.13		0.23	0.04	29.83	0.41	0.41		0.23	0.02	17.40	0.45	0.45		0.23	0.61	466.62	7.93	7.93		0.23
Benzo(a)anthracene	841	4153	0.04	30.76	0.68	0.68		0.25	0.01	11.70	0.16	0.16		0.25	0.01	6.98	0.18	0.18		0.25	0.18	153.16	2.60	2.60		0.25
Chrysene	844	826	0.06	53.23	1.18	1.18		0.25	0.03	23.04	0.31	0.31		0.25	0.02	15.93	0.41	0.41		0.25	0.29	246.30	4.19	4.19		0.25
C1-Chrysenes	929	--	0.18	169.50	3.76	3.76		0.27	0.05	47.59	0.65	0.65		0.27	0.03	26.42	0.68	0.68		0.27	1.31	1216.57	20.68	20.68		0.27
C2-Chrysenes	1008	--	0.22	219.03	4.86	4.86		0.30	0.07	74.29	1.01	1.01		0.30	0.04	42.58	1.10	1.10		0.30	1.66	1670.73	28.40	28.40		0.30
C3-Chrysenes	1112	--	0.11	121.47	2.70	2.70		0.33	0.02	22.94	0.31	0.31	J	0.33	0.01	11.27	0.29	0.29	J	0.33	0.95	1054.68	17.93	17.93		0.33
C4-Chrysenes	1214	--	0.01	8.11	0.18		U	0.36	0.01	13.24	0.18		U	0.36	0.01	6.95	0.18		U	0.36	0.59	715.46	12.16	12.16		0.36
Benzo(b,k)fluoranthene	979	2169	0.03	24.83	0.55	0.55		0.29	0.02	18.60	0.25	0.25		0.29	0.01	7.19	0.19	0.19		0.29	0.08	81.43	1.38	1.38		0.29
Benzo(e)pyrene	967	4300	0.02	18.42	0.41	0.41		0.28	0.01	10.61	0.14	0.14		0.28	0.01	5.68	0.15	0.15		0.28	0.11	105.95	1.80	1.80		0.28
Benzo(a)pyrene	965	3840	0.03	28.31	0.63	0.63		0.28	0.02	17.90	0.24	0.24		0.28	0.01	8.93	0.23	0.23		0.28	0.13	122.67	2.09	2.09		0.28
Perylene	967	431	0.03	29.67	0.66	0.66		0.28	0.06	60.07	0.82	0.82		0.28	0.03	30.04	0.78	0.78		0.28	0.04	34.25	0.58	0.58		0.28
Indeno(1,2,3-c,d)pyrene	1115	--	0.02	16.81	0.37	0.37		0.33	0.01	13.88	0.19	0.19		0.33	0.01	7.25	0.19	0.19		0.33	0.05	54.52	0.93	0.93		0.33
Dibenzo(a,h)anthracene	1123	2389	0.00	5.22	0.12	0.12		0.33	0.00	2.50	0.03	0.03		0.33	0.00	1.39	0.04	0.04		0.33	0.03	32.57	0.55	0.55		0.33
Benzo(g,h,i)perylene	1095	648	0.01	14.97	0.33	0.33		0.32	0.01	12.51	0.17	0.17		0.32	0.01	6.17	0.16	0.16		0.32	0.05	58.02	0.99	0.99		0.32
Sum total of $ESBTU_{FCVi}$			**2.54**						**1.17**						**0.65**						**15.41**					

Notes:

* Non detects replaced with RDL values

** Detected Results only. All PAH results are in µg/kg

U = non-detect, J = result is estimates, E = exceeded calibration range

1. Sediment ESB toxic units (TUs) were calculated as the sum of the 34-individual PAH TU - normalized for TOC and normalized for the FCV values. Although, there is no remedial clean up goal for ESBTU, the research suggests that a toxic effect is likely to occur when levels are greater than 1. Therefore, this ESB TU information is provided for informational purposes

2. U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460

Table 4B - Equilibrium Partitioning Sediment Benchmarks Toxicity Unit Calcul

Lower Otter Creek and Confluence Area, Ohio

TOC Fraction (f_{oc})	$C_{OC, PAHi, FCVi}$	$C_{OC, PAHi, Maxi}$	PW-09-0.0/0.5						PW-10-0.0/0.5						PW-11-0.0/0.5						PW-12-0.0/0.5					
			0.0078						0.011						0.0118						0.009					
Analyte	(ug/g_{OC})	(ug/g_{OC})	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*	$ESBTU_{FCVi}$	TOC Normalized	*Result**	*Result***	*Qual*	*RDL*
Naphthalene	385	61700	0.04	16.50	0.13	0.13		0.11	0.02	8.22	0.09	0.09	J	0.11	0.07	27.03	0.32	0.32		0.11	0.01	3.54	0.03	0.03	J	0.11
2-Methylnaphthalene	446	165700	0.02	10.60	0.08	0.08		0.13	0.01	5.22	0.06	0.06		0.13	0.08	36.92	0.44	0.44		0.13	0.01	5.01	0.05	0.05	J	0.13
1-Methylnaphthalene	447	154800	0.01	3.67	0.03	0.03	J	0.13	0.00	2.08	0.02	0.02	J	0.13	0.02	8.47	0.10	0.10		0.13	0.00	1.87	0.02	0.02	J	0.13
C2-Naphthalenes	510	--	0.18	90.94	0.71	0.71		0.15	0.15	75.27	0.83	0.83		0.15	0.35	177.66	2.10	2.10		0.15	0.10	52.73	0.47	0.47		0.15
C3-Naphthalenes	581	--	0.12	67.42	0.53	0.53		0.17	0.17	98.39	1.08	1.08		0.17	0.65	376.34	4.44	4.44		0.17	0.11	63.91	0.58	0.58		0.17
C4-Naphthalenes	657	--	0.16	107.66	0.84	0.84		0.19	0.28	187.01	2.06	2.06		0.19	4.22	2772.82	32.72	32.72		0.19	0.23	150.78	1.36	1.36		0.19
Acenaphthylene	452	24000	0.01	5.22	0.04	0.04	J	0.13	0.00	2.11	0.02	0.02	J	0.13	0.02	9.00	0.11	0.11		0.13	0.00	1.37	0.01	0.01	J	0.13
Acenaphthene	491	33400	0.02	8.97	0.07		U	0.14	0.01	2.56	0.03	0.03	J	0.14	0.04	18.96	0.22	0.22		0.14	0.02	7.78	0.07		U	0.14
Fluorene	538	26000	0.02	8.56	0.07	0.07	J	0.16	0.01	7.27	0.08		U	0.16	0.03	15.67	0.18	0.18		0.16	0.01	2.91	0.03	0.03	J	0.16
C1-Fluorenes	611	--	0.04	23.89	0.19	0.19		0.18	0.04	25.72	0.28	0.28		0.18	0.47	288.19	3.40	3.40		0.18	0.03	16.52	0.15	0.15		0.18
C2-Fluorenes	686	--	0.06	39.94	0.31	0.31		0.20	0.09	59.97	0.66	0.66		0.20	1.87	1279.63	15.10	15.10		0.20	0.04	27.13	0.24	0.24		0.20
C3-Fluorenes	769	--	0.03	22.34	0.17	0.17	J	0.23	0.05	37.77	0.42	0.42		0.23	1.44	1105.71	13.05	13.05		0.23	0.03	21.54	0.19	0.19	J	0.23
Phenanthrene	596	34300	0.06	33.75	0.26	0.26		0.18	0.04	23.69	0.26	0.26		0.18	0.14	84.33	1.00	1.00		0.18	0.02	13.56	0.12	0.12	J	0.18
Anthracene	594	1300	0.02	10.90	0.09		U	0.17	0.01	7.73	0.09		U	0.17	0.17	101.10	1.19	1.19		0.17	0.02	9.44	0.09		U	0.17
C1-Phenanthrenes/Anthracenes	670	--	0.08	52.01	0.41	0.41		0.20	0.10	68.86	0.76	0.76		0.20	0.56	378.03	4.46	4.46		0.20	0.06	43.36	0.39	0.39		0.20
C2-Phenanthrenes/Anthracenes	746	--	0.22	167.65	1.31	1.31		0.22	0.34	257.31	2.83	2.83		0.22	2.58	1925.98	22.73	22.73	E	0.22	0.19	144.30	1.30	1.30		0.22
C3-Phenanthrenes/Anthracenes	829	--	0.20	162.70	1.27	1.27		0.24	0.28	229.68	2.53	2.53		0.24	5.04	4176.93	49.29	49.29		0.24	0.24	199.15	1.79	1.79		0.24
C4-Phenanthrenes/Anthracenes	913	--	0.05	43.99	0.34	0.34		0.27	0.07	63.82	0.70	0.70		0.27	2.43	2214.87	26.14	26.14		0.27	0.07	62.34	0.56	0.56		0.27
Fluoranthene	707	23870	0.05	36.01	0.28	0.28		0.21	0.03	21.01	0.23	0.23		0.21	0.18	129.76	1.53	1.53		0.21	0.01	9.99	0.09	0.09	J	0.21
Pyrene	697	9090	0.06	38.65	0.30	0.30		0.21	0.06	39.44	0.43	0.43		0.21	0.65	451.82	5.33	5.33		0.21	0.03	17.50	0.16	0.16		0.21
C1-Fluoranthenes/Pyrenes	770	--	0.05	38.48	0.30	0.30		0.23	0.08	59.34	0.65	0.65		0.23	1.62	1245.56	14.70	14.70	E	0.23	0.03	24.24	0.22	0.22		0.23
Benzo(a)anthracene	841	4153	0.02	16.89	0.13	0.13		0.25	0.02	15.05	0.17	0.17		0.25	0.47	394.01	4.65	4.65		0.25	0.01	5.40	0.05	0.05	J	0.25
Chrysene	844	826	0.04	29.64	0.23	0.23		0.25	0.04	37.72	0.41	0.41		0.25	0.91	766.86	9.05	9.05		0.25	0.02	18.94	0.17	0.17		0.25
C1-Chrysenes	929	--	0.05	49.86	0.39	0.39		0.27	0.08	73.64	0.81	0.81		0.27	3.33	3097.61	36.55	36.55		0.27	0.04	41.16	0.37	0.37		0.27
C2-Chrysenes	1008	--	0.09	91.92	0.72	0.72		0.30	0.09	88.13	0.97	0.97		0.30	3.77	3804.72	44.90	44.90		0.30	0.07	68.36	0.62	0.62		0.30
C3-Chrysenes	1112	--	0.02	21.15	0.17		U	0.33	0.03	31.95	0.35	0.35		0.33	2.36	2625.23	30.98	30.98		0.33	0.02	18.33	0.17		U	0.33
C4-Chrysenes	1214	--	0.02	23.08	0.18		U	0.36	0.01	16.36	0.18		U	0.36	1.16	1413.00	16.67	16.67		0.36	0.02	20.00	0.18		U	0.36
Benzo(b,k)fluoranthene	979	2169	0.02	16.58	0.13	0.13		0.29	0.01	8.81	0.10	0.10		0.29	0.19	189.10	2.23	2.23		0.29	0.01	6.19	0.06	0.06	J	0.29
Benzo(e)pyrene	967	4300	0.01	11.97	0.09	0.09		0.28	0.01	9.63	0.11	0.11		0.28	0.24	234.04	2.76	2.76		0.28	0.01	6.98	0.06	0.06		0.28
Benzo(a)pyrene	965	3840	0.02	21.96	0.17	0.17		0.28	0.01	11.41	0.13	0.13		0.28	0.30	291.96	3.45	3.45		0.28	0.01	6.55	0.06	0.06		0.28
Perylene	967	431	0.04	35.90	0.28	0.28		0.28	0.01	9.79	0.11	0.11		0.28	0.05	51.00	0.60	0.60		0.28	0.00	4.72	0.04	0.04		0.28
Indeno(1,2,3-c,d)pyrene	1115	--	0.02	19.09	0.15	0.15		0.33	0.01	6.92	0.08	0.08		0.33	0.07	75.90	0.90	0.90		0.33	0.00	4.60	0.04	0.04		0.33
Dibenzo(a,h)anthracene	1123	2389	0.00	2.89	0.02	0.02		0.33	0.00	1.85	0.02	0.02		0.33	0.07	82.95	0.98	0.98		0.33	0.02	18.33	0.17		U	0.33
Benzo(g,h,i)perylene	1095	648	0.01	16.05	0.13	0.13		0.32	0.01	7.18	0.08	0.08		0.32	0.13	144.56	1.71	1.71		0.32	0.01	6.08	0.05	0.05		0.32
Sum total of $ESBTU_{FCVi}$			**1.84**						**2.18**						**35.70**						**1.49**					

Notes:

* Non detects replaced with RDL values

** Detected Results only. All PAH results are in µg/kg

U = non-detect, J = result is estimates, E = exceeded calibration range

1. Sediment ESB toxic units (TUs) were calculated as the sum of the 34-individual PAH TU - normalized for TOC and normalized for the FCV values. Although, there is no remedial clean up goal for ESBTU, the research suggests that a toxic effect is likely to occur when levels are greater than 1. Therefore, this ESB TU information is provided for informational purposes

2. U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460

Table 4B - Equilibrium Partitioning Sediment Benchmarks Toxicity Unit Calcul
Lower Otter Creek and Confluence Area, Ohio

TOC Fraction (f_{oc})	$C_{OC, PAHi, FCVi}$	$C_{OC, PAHi, Maxi}$	PW-13-0.0/0.5					
			0.0074					
Analyte	**(ug/g$_{OC}$)**	**(ug/g$_{OC}$)**	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	385	61700	0.04	13.52	0.10	0.10	J	0.11
2-Methylnaphthalene	446	165700	0.07	29.16	0.22	0.22		0.13
1-Methylnaphthalene	447	154800	0.03	12.19	0.09	0.09		0.13
C2-Naphthalenes	510	--	0.64	328.43	2.43	2.43		0.15
C3-Naphthalenes	581	--	0.79	461.08	3.41	3.41		0.17
C4-Naphthalenes	657	--	1.36	894.02	6.62	6.62		0.19
Acenaphthylene	452	24000	0.01	3.71	0.03	0.03	J	0.13
Acenaphthene	491	33400	0.03	13.31	0.10	0.10		0.14
Fluorene	538	26000	0.04	20.56	0.15	0.15		0.16
C1-Fluorenes	611	--	0.24	145.77	1.08	1.08		0.18
C2-Fluorenes	686	--	0.50	339.97	2.52	2.52		0.20
C3-Fluorenes	769	--	0.29	222.62	1.65	1.65		0.23
Phenanthrene	596	34300	0.18	109.90	0.81	0.81		0.18
Anthracene	594	1300	0.02	11.49	0.09		U	0.17
C1-Phenanthrenes/Anthracenes	670	--	0.47	316.33	2.34	2.34		0.20
C2-Phenanthrenes/Anthracenes	746	--	1.42	1058.17	7.83	7.83		0.22
C3-Phenanthrenes/Anthracenes	829	--	1.40	1159.56	8.58	8.58		0.24
C4-Phenanthrenes/Anthracenes	913	--	0.43	393.03	2.91	2.91		0.27
Fluoranthene	707	23870	0.09	65.06	0.48	0.48		0.21
Pyrene	697	9090	0.26	179.35	1.33	1.33		0.21
C1-Fluoranthenes/Pyrenes	770	--	0.47	365.25	2.70	2.70		0.23
Benzo(a)anthracene	841	4153	0.12	99.76	0.74	0.74		0.25
Chrysene	844	826	0.28	234.60	1.74	1.74		0.25
C1-Chrysenes	929	--	0.80	740.84	5.48	5.48		0.27
C2-Chrysenes	1008	--	0.95	961.02	7.11	7.11		0.30
C3-Chrysenes	1112	--	0.48	529.73	3.92	3.92		0.33
C4-Chrysenes	1214	--	0.40	486.58	3.60	3.60		0.36
Benzo(b,k)fluoranthene	979	2169	0.08	76.73	0.57	0.57		0.29
Benzo(e)pyrene	967	4300	0.10	92.43	0.68	0.68		0.28
Benzo(a)pyrene	965	3840	0.10	94.45	0.70	0.70		0.28
Perylene	967	431	0.02	22.26	0.16	0.16		0.28
Indeno(1,2,3-c,d)pyrene	1115	--	0.04	50.17	0.37	0.37		0.33
Dibenzo(a,h)anthracene	1123	2389	0.02	23.28	0.17	0.17		0.33
Benzo(g,h,i)perylene	1095	648	0.06	61.57	0.46	0.46		0.32
Sum total of ESBTU$_{FCVi}$			**12.21**					

TOC Fraction (f_{oc})	PW-14-0.0/0.5					
	0.029					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.07	28.32	0.82	0.82		0.11
2-Methylnaphthalene	0.12	51.91	1.51	1.51		0.13
1-Methylnaphthalene	0.04	16.91	0.49	0.49		0.13
C2-Naphthalenes	0.76	389.20	11.29	11.29		0.15
C3-Naphthalenes	0.85	495.70	14.38	14.38		0.17
C4-Naphthalenes	1.28	841.23	24.40	24.40		0.19
Acenaphthylene	0.01	3.01	0.09	0.09	J	0.13
Acenaphthene	0.01	6.25	0.18	0.18		0.14
Fluorene	0.03	14.99	0.43	0.43		0.16
C1-Fluorenes	0.14	85.64	2.48	2.48		0.18
C2-Fluorenes	0.38	260.11	7.54	7.54		0.20
C3-Fluorenes	0.29	219.37	6.36	6.36		0.23
Phenanthrene	0.10	59.97	1.74	1.74		0.18
Anthracene	0.06	33.15	0.96	0.96		0.17
C1-Phenanthrenes/Anthracenes	0.41	272.22	7.89	7.89		0.20
C2-Phenanthrenes/Anthracenes	1.60	1195.57	34.67	34.67	E	0.22
C3-Phenanthrenes/Anthracenes	1.70	1408.25	40.84	40.84		0.24
C4-Phenanthrenes/Anthracenes	0.52	472.25	13.70	13.70		0.27
Fluoranthene	0.04	27.95	0.81	0.81		0.21
Pyrene	0.12	83.72	2.43	2.43		0.21
C1-Fluoranthenes/Pyrenes	0.30	234.51	6.80	6.80		0.23
Benzo(a)anthracene	0.06	47.47	1.38	1.38		0.25
Chrysene	0.12	103.52	3.00	3.00		0.25
C1-Chrysenes	0.43	396.81	11.51	11.51		0.27
C2-Chrysenes	0.58	588.86	17.08	17.08		0.30
C3-Chrysenes	0.38	425.00	12.32	12.32		0.33
C4-Chrysenes	0.25	305.56	8.86	8.86		0.36
Benzo(b,k)fluoranthene	0.03	33.01	0.96	0.96		0.29
Benzo(e)pyrene	0.04	40.68	1.18	1.18		0.28
Benzo(a)pyrene	0.05	45.54	1.32	1.32		0.28
Perylene	0.01	11.70	0.34	0.34		0.28
Indeno(1,2,3-c,d)pyrene	0.02	25.55	0.74	0.74		0.33
Dibenzo(a,h)anthracene	0.01	10.93	0.32	0.32		0.33
Benzo(g,h,i)perylene	0.03	29.95	0.87	0.87		0.32
Sum total of ESBTU$_{FCVi}$	**10.84**					

TOC Fraction (f_{oc})	PW-15-0.0/0.5					
	0.015					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.07	26.57	0.40	0.40		0.11
2-Methylnaphthalene	0.11	50.12	0.75	0.75		0.13
1-Methylnaphthalene	0.03	13.24	0.20	0.20		0.13
C2-Naphthalenes	0.52	264.83	3.97	3.97		0.15
C3-Naphthalenes	0.49	286.29	4.29	4.29		0.17
C4-Naphthalenes	0.81	534.58	8.02	8.02		0.19
Acenaphthylene	0.01	5.51	0.08	0.08	J	0.13
Acenaphthene	0.01	5.02	0.08	0.08	J	0.14
Fluorene	0.02	11.13	0.17	0.17		0.16
C1-Fluorenes	0.11	68.25	1.02	1.02		0.18
C2-Fluorenes	0.30	207.91	3.12	3.12		0.20
C3-Fluorenes	0.24	184.35	2.77	2.77		0.23
Phenanthrene	0.09	54.83	0.82	0.82		0.18
Anthracene	0.07	39.00	0.58	0.58		0.17
C1-Phenanthrenes/Anthracenes	0.31	208.83	3.13	3.13		0.20
C2-Phenanthrenes/Anthracenes	1.33	989.88	14.85	14.85	E	0.22
C3-Phenanthrenes/Anthracenes	1.67	1388.23	20.82	20.82		0.24
C4-Phenanthrenes/Anthracenes	0.63	579.60	8.69	8.69		0.27
Fluoranthene	0.07	47.52	0.71	0.71		0.21
Pyrene	0.15	106.26	1.59	1.59		0.21
C1-Fluoranthenes/Pyrenes	0.37	286.74	4.30	4.30		0.23
Benzo(a)anthracene	0.08	66.67	1.00	1.00		0.25
Chrysene	0.17	143.45	2.15	2.15		0.25
C1-Chrysenes	0.60	555.23	8.33	8.33		0.27
C2-Chrysenes	0.84	849.39	12.74	12.74		0.30
C3-Chrysenes	0.63	695.35	10.43	10.43		0.33
C4-Chrysenes	0.35	423.25	6.35	6.35		0.36
Benzo(b,k)fluoranthene	0.05	51.38	0.77	0.77		0.29
Benzo(e)pyrene	0.06	56.31	0.84	0.84		0.28
Benzo(a)pyrene	0.07	66.21	0.99	0.99		0.28
Perylene	0.02	16.98	0.25	0.25		0.28
Indeno(1,2,3-c,d)pyrene	0.03	38.70	0.58	0.58		0.33
Dibenzo(a,h)anthracene	0.01	16.69	0.25	0.25		0.33
Benzo(g,h,i)perylene	0.04	42.57	0.64	0.64		0.32
Sum total of ESBTU$_{FCVi}$	**10.38**					

TOC Fraction (f_{oc})	PW-22-0.0/0.5					
	0.013					
Analyte	**ESBTU$_{FCVi}$**	**TOC Normalized**	***Result****	***Result*****	***Qual***	***RDL***
Naphthalene	0.03	12.92	0.17	0.17		0.11
2-Methylnaphthalene	0.04	19.02	0.25	0.25		0.13
1-Methylnaphthalene	0.01	5.46	0.07	0.07		0.13
C2-Naphthalenes	0.23	119.68	1.56	1.56		0.15
C3-Naphthalenes	0.28	162.01	2.11	2.11		0.17
C4-Naphthalenes	0.54	355.86	4.63	4.63		0.19
Acenaphthylene	0.01	2.96	0.04	0.04	J	0.13
Acenaphthene	0.01	3.53	0.05	0.05	J	0.14
Fluorene	0.01	6.69	0.09	0.09	J	0.16
C1-Fluorenes	0.08	50.26	0.65	0.65		0.18
C2-Fluorenes	0.20	140.51	1.83	1.83		0.20
C3-Fluorenes	0.15	113.59	1.48	1.48		0.23
Phenanthrene	0.05	31.93	0.42	0.42		0.18
Anthracene	0.05	27.51	0.36	0.36		0.17
C1-Phenanthrenes/Anthracenes	0.21	138.60	1.80	1.80		0.20
C2-Phenanthrenes/Anthracenes	0.75	561.67	7.30	7.30		0.22
C3-Phenanthrenes/Anthracenes	0.89	738.69	9.60	9.60		0.24
C4-Phenanthrenes/Anthracenes	0.32	288.24	3.75	3.75		0.27
Fluoranthene	0.04	31.37	0.41	0.41		0.21
Pyrene	0.11	79.06	1.03	1.03		0.21
C1-Fluoranthenes/Pyrenes	0.24	187.77	2.44	2.44		0.23
Benzo(a)anthracene	0.05	46.21	0.60	0.60		0.25
Chrysene	0.11	95.69	1.24	1.24		0.25
C1-Chrysenes	0.37	341.27	4.44	4.44		0.27
C2-Chrysenes	0.51	514.96	6.69	6.69		0.30
C3-Chrysenes	0.39	428.96	5.58	5.58		0.33
C4-Chrysenes	0.29	354.30	4.61	4.61		0.36
Benzo(b,k)fluoranthene	0.03	33.61	0.44	0.44		0.29
Benzo(e)pyrene	0.04	39.54	0.51	0.51		0.28
Benzo(a)pyrene	0.04	42.50	0.55	0.55		0.28
Perylene	0.02	14.98	0.19	0.19		0.28
Indeno(1,2,3-c,d)pyrene	0.02	25.52	0.33	0.33		0.33
Dibenzo(a,h)anthracene	0.01	10.61	0.14	0.14		0.33
Benzo(g,h,i)perylene	0.03	29.94	0.39	0.39		0.32
Sum total of ESBTU$_{FCVi}$	**6.19**					

Notes:
* Non detects replaced with RDL values
** Detected Results only. All PAH results are in µg/kg
U = non-detect, J = result is estimates, E = exceeded calibration range

1. Sediment ESB toxic units (TUs) were calculated as the sum of the 34-individual PAH TU - normalized for TOC and normalized for the FCV values. Although, there is no remedial clean up goal for ESBTU, the research suggests that a toxic effect is likely to occur when levels are greater than 1. Therefore, this ESB TU information is provided for informational purposes

2. U.S. EPA. 2003. Procedures for the Derivation of Equilibrium Partitioning Sediment Benchmarks for the Protection of Benthic Organisms: PAH Mixtures. EPA-600-R-02-013. Office of Research and Development. Washington, DC 20460

Table 5. Summary of Geotechnical Testing Results - Bank Soil Borings- September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Core Location	Depth Interval	Moisture Content (%)	Grain Size			Atterberg Limits			UU Triaxial		CU Triaxial		Dry Density (pcf)	Specific Gravity
			% Gravel	% Sand	% Fines	LL	PL	PI	Deviator Stress (psi)	Strain (%)	ϕ'	c' (psf)		
SO-01	0'-2'	14.2	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	2'-4'	20.5	0.3	13.9	85.8	30.0	19.0	11.0	--	--	--	--	--	2.70*
SO-01	4'-6'	16.9	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	6'-8'	21.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	8'-10'	18.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	10'-12'	18.6	1.1	18.6	80.3	28.0	15.0	13.0	--	--	--	--	--	2.70*
SO-01	12'-14'	19.5	--	--	--	--	--	--	--	--	31.5	300	108.0	2.74
SO-01	14'-16'	18.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	16'-18'	18.8	1.8	23.1	75.1	27.0	14.0	13.0	--	--	--	--	--	2.70*
SO-01	18'-20'	18.9	--	--	--	--	--	--	--	--	29.7	100	110.5	2.75
SO-01	20'-22'	18.2	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	22'-24'	17.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-01	24'-26'	17.2	1.2	22.2	76.6	27.0	14.0	13.0	--	--	--	--	--	2.70*
SO-02	0'-2'	11.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	2'-4'	13.5	1.4	25.0	73.6	33.0	15.0	18.0	--	--	--	--	--	2.70*
SO-02	4'-6'	11.9	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	6'-8'	43.5	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	8'-10'	73.4	0.0	8.3	91.7	84.0	46.0	38.0	--	--	--	--	--	2.70*
SO-02	10'-12'	96.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	12'-14'	123.8	--	--	--	--	--	--	--	--	38.4	260	37.9	2.48
SO-02	14'-16'	26.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	16'-18'	106.5	1.0	8.8	90.2	32.0	16.0	16.0	--	--	--	--	--	2.70*
SO-02	18'-20'	16.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-02	20'-21.5'	--	5.0	21.7	73.3	32.5	13.8	18.7	--	--	--	--	--	2.74
SO-02	21.5'-23.5'	14.8	1.5	23.6	74.9	30.0	15.0	15.0	--	--	--	--	--	2.70*
SO-02	23.5'-25.5'	--	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	0'-2'	10.5	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	2'-4'	14.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	4'-6'	12.4	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	6'-8'	15.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	8'-10'	68.0	2.3	9.4	88.3	38.0	19.0	19.0	--	--	--	--	--	2.70*
SO-04	10'-12'	77.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	12'-14'	62.2	0.0	3.7	96.3	67.0	29.0	38.0	--	--	--	--	--	2.70*
SO-04	14'-16'	49.3	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	16'-18'	119.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	18'-20'	130.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-04	20'-22'	43.2	2.3	20.6	77.1	38.0	17.0	21.0	--	--	--	--	--	2.70*
SO-04	22'-24'	18.9	--	--	--	--	--	--	17.34	16.8	--	--	111.3	2.78
SO-04	24'-26'	--	3.7	23.0	73.3	30.0	16.0	14.0	--	--	--	--	--	2.70*
SO-04	26'-28'	17.7	--	--	--	--	--	--	14.28	15.9	--	--	113.8	2.74
SO-05	0'-2'	4.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	2'-4'	5.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	4'-6'	7.2	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	6'-8'	19.2	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	8'-10'	23.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	10'-12'	34.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	12'-14'	115.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	14'-16'	100.7	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	16'-18'	155.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-05	18'-20'	141.0	0.0	8.4	91.6	53.0	29.0	24.0	--	--	--	--	--	2.70*
SO-05	20'-22'	--	7.5	27.5	65	52.0	26.0	26.0	--	--	--	--	--	2.70*
SO-05	22'-24'	--	2.0	21.0	77	30.0	15.0	15.0	--	--	--	--	--	2.70*
SO-05	24'-26'	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 5. Summary of Geotechnical Testing Results - Bank Soil Borings- September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Core Location	Depth Interval	Moisture Content (%)	Grain Size			Atterberg Limits			UU Triaxial		CU Triaxial		Dry Density (pcf)	Specific Gravity
			% Gravel	% Sand	% Fines	LL	PL	PI	Deviator Stress (psi)	Strain (%)	ϕ'	c' (psf)		
SO-07	0'-2'	18.6	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	2'-4'	19.8	0.0	1.7	98.3	38.0	19.0	19.0	--	--	--	--	--	2.70*
SO-07	4'-6'	23.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	6'-8'	21.5	1.1	6.9	92	37.0	18.0	19.0	--	--	--	--	--	2.70*
SO-07	8'-10'	30.7	--	--	--	--	--	--	5.90	20.0	--	--	92.2	2.74
SO-07	10'-12'	28.8	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	12'-14'	133.2	2.2	12.7	85.1	37.0	17.0	20.0	--	--	--	--	--	2.70*
SO-07	14'-16'	137.4	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	16'-18'	133.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	18'-20'	18.2	2.7	21.7	75.6	29.0	15.0	14.0	--	--	--	--	--	2.70*
SO-07	20'-22'	15.7	--	--	--	--	--	--	78.51	11.8	--	--	119.1	2.77
SO-07	22'-24'	18.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-07	24'-26'	--	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	0'-2'	19.9	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	2'-4'	22.1	0.0	4.7	95.3	38.0	17.0	21.0	--	--	--	--	--	2.70*
SO-08	4'-6'	19.0	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	6'-8'	28.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	8'-10'	27.2	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	10'-12'	27.4	0.0	1.1	98.9	34.0	17.0	17.0	--	--	--	--	--	2.70*
SO-08	12'-14'	96.5	--	--	--	--	--	--	--	--	41.20	480	44.4	2.42
SO-08	14'-16'	25.5	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	16'-18'	15.8	2.1	20.4	77.5	30.0	15.0	15.0	--	--	--	--	--	2.70*
SO-08	18'-20'	29.4	--	--	--	--	--	--	--	--	--	--	--	--
SO-08	20'-21'	--	4.0	20.9	75.1	32.5	16.4	16.1	--	--	--	--	--	2.75
SO-08	21'-23'	14.3	1.7	21.9	76.4	32.0	16.0	16.0	--	--	--	--	--	2.70*
SO-08	23'-25'	--	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	0'-2'	19.5	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	2'-4'	18.0	0.2	1.9	97.9	36.0	17.0	19.0	--	--	--	--	--	2.70*
SO-09	4'-6'	19.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	6'-8'	26.4	--	--	--	--	--	--	--	--	32.2	20	96.2	2.75
SO-09	8'-10'	25.6	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	10'-12'	24.4	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	12'-14'	21.1	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	14'-16'	96.9	0.0	36.1	63.9	Non Plastic			--	--	--	--	--	2.70*
SO-09	16'-18'	33.6	--	--	--	--	--	--	--	--	--	--	--	--
SO-09	18'-20'	23.8	1.3	20.5	78.2	38.0	17.0	21.0	--	--	--	--	--	2.70*
SO-09	20'-22'	15.9	--	--	--	--	--	--	--	--	29.4	200	116.2	2.74
SO-09	22'-24'	15.8	1.7	22.7	75.6	30.0	15.0	15.0	--	--	--	--	--	2.70*
SO-09	24'-26'	--	--	--	--	--	--	--	--	--	--	--	--	--

Notes:

*assumed value for hydrometer test

% = percent

ϕ' = Effective Friction Angle

c' = Effective Cohesion

LL = Liquid Limit

PL = Plastic Limit

PI = Plasticity Index

psi = pounds per square inch

psf = pounds per square foot

pcf = pounds per cubic foot

Table 6. Summary of Physical Parameter Results for Sediment Pumping and Transportation Design - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Location ID	Depth Interval	Moisture Content (%)	Grain Size			Dry Density (pcf)	Porosity	Specific Gravity	Sediment Characteristics
			% Gravel	% Sand	% Fines				
SD-05	0'-1.5'	37.7	0.0	32.0	68.0	83.7	50.5	2.72	Very soft silt with very soft clay from 0.1' to 0.4' and fine grained sand from 0.6' to 1.3'
SD-07	0'-1.5'	46.6	1.2	15.4	83.4	74.5	56.3	2.73	Very soft to soft silt with trace fine sand
SD-08	0'-1.8'	31.4	0.0	19.7	80.3	90.4	46.5	2.71	0'-1.0' Very soft silt with fine sand and clay globs; 1.0 -1.8' Silty fine sand with soft clay @ 1.6 to 1.8
SD-14	0'-1.6'	89.0	2.5	11.1	86.4	47.6	70.4	2.58	0' -1.4' Very soft organic silt with trace fine and trace coarse sand
SD-25	0'-2.8'	33.5	9.9	52.2	37.9	85.2	47.3	2.59	0-0.9' Very soft silt with fine sand, trace organics, trace gravel and shells; 0.9' -1.6' Silt with medium to coarse sand and trance organics; 1.6' - 5' Firm well graded sand; 5'-5.2' Soft clay with coarse sand
SD-29	0'-5'	41.7	8.2	39.6	52.2	78.6	53.0	2.68	0-'1.5' Soft organic silt with trace fine sand and organic material; 1.5'-2.5' Firm silty clay with well graded sand, 2.5' - 2.9' firm silty well graded sand; 4.0'-5.0' Firm well graded sand
SD-33	0'-10'	113.9	0.0	9.7	90.3	39.3	74.8	2.50	0'-1.0' Very soft organic clayey silt with trace roots; 1.0' - 10.0' Soft organic silt with broken with a seam of clay @ 1.3'-1.7'
SD-37	0'-3.1'	129.6	1.8	8.4	89.8	36.8	76.9	2.56	0'-3.1' - Very soft silt with trace fine sand and trace soft clay. Trance coarse sand @ 0' -0.2' and @ 3.0'; 3.0'-4.1' - Native Clay material, firm to dense
SD-40	4'-6.5'	78.1	1.1	55.1	43.8	52.5	67.4	2.58	0-0.6' Very soft organic silt with trace fine sand and trace small gravel; 4.0'-5.0' Very soft silt with medium grain sand; 5.0' - 6.5' soft organic silt with fine sand and crushed shells
SD-44	0'-6.6'	115.2	0.5	18.5	81.0	40.6	74.9	2.59	0'-2.5' Very soft organic silt with trace sand; 5.0'-6.6' Soft organic silt with trace sand
Average		**71.7**	**2.5**	**26.2**	**71.3**	**62.9**	**61.8**	**2.62**	

% = percent; pcf = pounds per cubic foot

Table 7. Bulk Sediment Waste Characterization Results - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

	Sample ID					
Method	Analyte	Units	SD-07-0.0/1.5	SD-14-0.0/1.6	SD-25-0.0/5.2	SD-33-0.0/10.0
TCLP Metal						
SW6010	Arsenic	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
SW6010	Barium	mg/L	2.5 U	2.5 U	2.5 U	2.5 U
SW6010	Cadmium	mg/L	0.025 U	0.025 U	0.025 U	0.025 U
SW6010	Chromium	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
SW6010	Copper	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
SW6010	Lead	mg/L	0.060 U	0.060 U	0.060 U	0.060 U
SW6010	Selenium	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
SW6010	Silver	mg/L	0.25 U	0.25 U	0.25 U	0.25 U
SW6010	Zinc	mg/L	0.25 U	0.34	0.25 U	0.25 U
SW7470	Mercury	µg/L	0.42 U	0.42 U	0.42 U	0.42 U
TCLP Pesticide						
SW8081	Alpha-Chlordane	µg/L	0.97 U	0.97 U	0.97 U	0.97 U
SW8081	Chlordane	µg/L	7.3 U	7.3 U	7.3 U	7.3 U
SW8081	Chlorinated Camphene	µg/L	30.0 U	30.0 U	30.0 U	30.0 U
SW8081	Endrin	µg/L	0.52 U	0.52 U	0.52 U	0.52 U
SW8081	gamma-BHC (Lindane)	µg/L	0.21 U	0.21 U	0.21 U	0.21 U
SW8081	Heptachlor	µg/L	0.22 U	0.22 U	0.22 U	0.22 U
SW8081	Heptachlor Epoxide	µg/L	0.43 U	0.43 U	0.43 U	0.43 U
SW8081	Methoxychlor	µg/L	2.7 U	2.7 U	2.7 U	2.7 U
SW8081	trans-Chlordane	µg/L	0.23 U	0.23 U	0.23 U	0.23 U
Polychlorinated Biphenyls						
SW8082	Aroclor 1016	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Aroclor 1221	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Aroclor 1232	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Aroclor 1242	µg/kg	77.6 U	176	683 U	105 U
SW8082	Aroclor 1248	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Aroclor 1254	µg/kg	77.6 U	322	387 J	105 U
SW8082	Aroclor 1260	µg/kg	77.6 U	88.2 J	683 U	105 U
SW8082	Aroclor 1262	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Aroclor 1268	µg/kg	77.6 U	97.4 U	683 U	105 U
SW8082	Total PCBs	mg/kg	0.0776 U	0.587	0.387 J	0.105 U
TCLP Volatile Organic Compounds						
SW8260	1,1-Dichloroethene	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	1,2-Dichloroethane	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	2-Butanone	µg/L	200 U	200 U	200 U	200 U
SW8260	Benzene	µg/L	10.0 U	10.0 U	13.5	10.0 U
SW8260	Carbon tetrachloride	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	Chlorobenzene	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	Chloroform	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8260	Tetrachloroethene	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	Trichloroethylene	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
SW8260	Vinyl Chloride	µg/L	10.0 U	10.0 U	10.0 U	10.0 U
TCLP Semivolatile Organic Compounds						
SW8270	1,4-Dichlorobenzene	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	2,4,5-Trichlorophenol	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	2,4,6-Trichlorophenol	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	2,4-Dinitrotoluene	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	2-Methylphenol	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	3- & 4-Methylphenol	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	Hexachlorobenzene	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	Hexachlorobutadiene	µg/L	100 U	100 U	100 U	100 U
SW8270	Hexachloroethane	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	Nitrobenzene	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
SW8270	Pentachlorophenol	µg/L	100 U	100 U	100 U	100 U
SW8270	Pyridine	µg/L	50.0 U	50.0 U	50.0 U	50.0 U
Wet Chemistry						
SW9040	pH	pH units	7.6	7.0	7.2	7.3
SW9095	Free Liquids	No Unit	Pass	Pass	Pass	Pass
D297487	Moisture, percent	%	35.6	48.6	26.8	52.5
SW1010	Flash Point	deg f	>210	>210	>210	>210

µg/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
TCLP = toxicity characteristic leaching procedure
-- = not analyzed
J = estimated
U = nondetect
> = less than

Table 8. Investigation-Derived Waste Results Summary - September 2016

Lower Otter Creek and Confluence, Maumee River AOC

Analyte	Units	CAS Number	MR-WD-001 (solid) 9/16/2016	MR-WD-002 (liquid) 9/16/2016
pH	pH Units	N/A	7.7	9.2
Flash Point	°F	N/A	>210[a]	>210[a]
Percent Moisture	%	N/A	26	--
Polychlorinated Biphenyls				
PCB-1016	µg/kg (solid) / µg/L (liquid)	12674-11-2	67.6 U	5.0 U
PCB-1221	µg/kg (solid) / µg/L (liquid)	11104-28-2	67.6 U	5.0 U
PCB-1232	µg/kg (solid) / µg/L (liquid)	11141-16-5	67.6 U	5.0 U
PCB-1242	µg/kg (solid) / µg/L (liquid)	53469-21-9	67.6 U	5.0 U
PCB-1248	µg/kg (solid) / µg/L (liquid)	12672-29-6	67.6 U	5.0 U
PCB-1254	µg/kg (solid) / µg/L (liquid)	11097-69-1	67.6 U	5.0 U
PCB-1260	µg/kg (solid) / µg/L (liquid)	11096-82-5	67.6 U	5.0 U
PCB-1262	µg/kg (solid) / µg/L (liquid)	37324-23-5	67.6 U	5.0 U
PCB-1268	µg/kg (solid) / µg/L (liquid)	11100-14-4	67.6 U	5.0 U
Total PCBs	µg/kg (solid) / µg/L (liquid)	N/A	67.6 U	5.0 U
TCLP Metals				
Arsenic	mg/L	7440-38-2	0.25 U	0.243
Barium	mg/L	7440-39-3	2.5 U	1.98
Cadmium	mg/L	7440-43-9	0.025 U	0.0052 J
Chromium	mg/L	7440-47-3	0.25 U	1.48
Copper	mg/L		0.25 U	1.22
Lead	mg/L	7439-92-1	0.060 U	1.05
Selenium	mg/L	7439-97-6	0.25 U	0.005 U
Silver	mg/L	7782-49-2	0.25 U	0.0025 U
Zinc	mg/L		0.25 U	2.5
Mercury	mg/L	7440-22-4	0.42 U	0.002
TCLP Pesticides				
gamma-BHC (Lindane)	µg/L	58-89-9	0.21 U	0.21 U
Alpha Chlordane	µg/L	5103-71-9	0.97 U	0.97 U
Chlordane	µg/L	57-74-9	7.3 U	7.3 U
Chlorinated Camphene	µg/L	8001-35-2	30.0 U	30.0 U
Endrin	µg/L	72-20-8	0.52 U	0.52 U
Heptachlor	µg/L	76-44-8	0.22 U	0.22 U
Heptachlor epoxide	µg/L	1024-57-3	0.43 U	0.43 U
Methoxychlor	µg/L	72-43-5	2.7 U	2.7 U
trans-Chlordane	µg/L	5103-74-2	0.23 U	0.23 U
TCLP VOCs				
Benzene	µg/L	71-43-2	10.0 U	2.5 U
2-Butanone (MEK)	µg/L	78-93-3	200 U	19.3 J
Carbon tetrachloride	µg/L	56-23-5	10.0 U	2.5 U
Chlorobenzene	µg/L	108-90-7	10.0 U	2.5 U
Chloroform	µg/L	67-66-3	50.0 U	12.5 U
1,4-Dichlorobenzene	µg/L	75-35-4	50.0 U	--
1,2-Dichloroethane	µg/L	107-06-2	10.0 U	2.5 U
1,1-Dichloroethene	µg/L	75-35-4	10.0 U	2.5 U
Tetrachloroethene	µg/L	127-18-4	10.0 U	2.5 U
Trichloroethene	µg/L	79-01-6	10.0 U	2.5 U
Vinyl chloride	µg/L	75-01-4	10.0 U	2.5 U
TCLP SVOCs				
2,4-Dinitrotoluene	µg/L	121-14-2	50.0 U	52.8 U
Hexachlorobenzene	µg/L	118-74-1	50.0 U	113 U
Hexachlorobutadiene	µg/L	87-68-3	100 U	164 U
Hexachloroethane	µg/L	67-72-1	50.0 U	177 U
2-Methylphenol	µg/L	95-48-7	50.0 U	57.9 U
4-Methylphenol	µg/L	106-44-5	50.0 U	104 U
3-Methylphenol[b]	µg/L	108-39-4	--	--
Nitrobenzene	µg/L	98-95-3	50.0 U	96.7 U
Pentachlorophenol	µg/L	87-86-5	100 U	95.6 U
Pyridine	µg/L	110-86-1	50.0 U	119 U
2,4,5-Trichlorophenol	µg/L	95-95-4	50.0 U	56.1 U
2,4,6-Trichlorophenol	µg/L	88-06-2	50.0 U	141 U

Notes:

[a] The sample did not spontaneously ignite when exposed to air or water, did not ignite by friction, and sample vapors did not ignite when exposed to a flame using a closed up apparatus.

[b] 3-Methylphenol and 4-methylphenol cannot be resolved under the chromatographic conditions used for sample analysis. The result reported for 4-methylphenol represents the combined total of both compounds.

µg/kg = micrograms per kilogram; µg/L = micrograms per liter; mg/L = milligrams per liter

J = Result is less than the reporting limit but greater than or equal to the method detection limit and

U = Indicates the analyte was analyzed for but not detected.

Figures

Figure 1
Site Map
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG01_SITEMAP.MXD JHANSEN1 12/6/2016 1:45:50 PM

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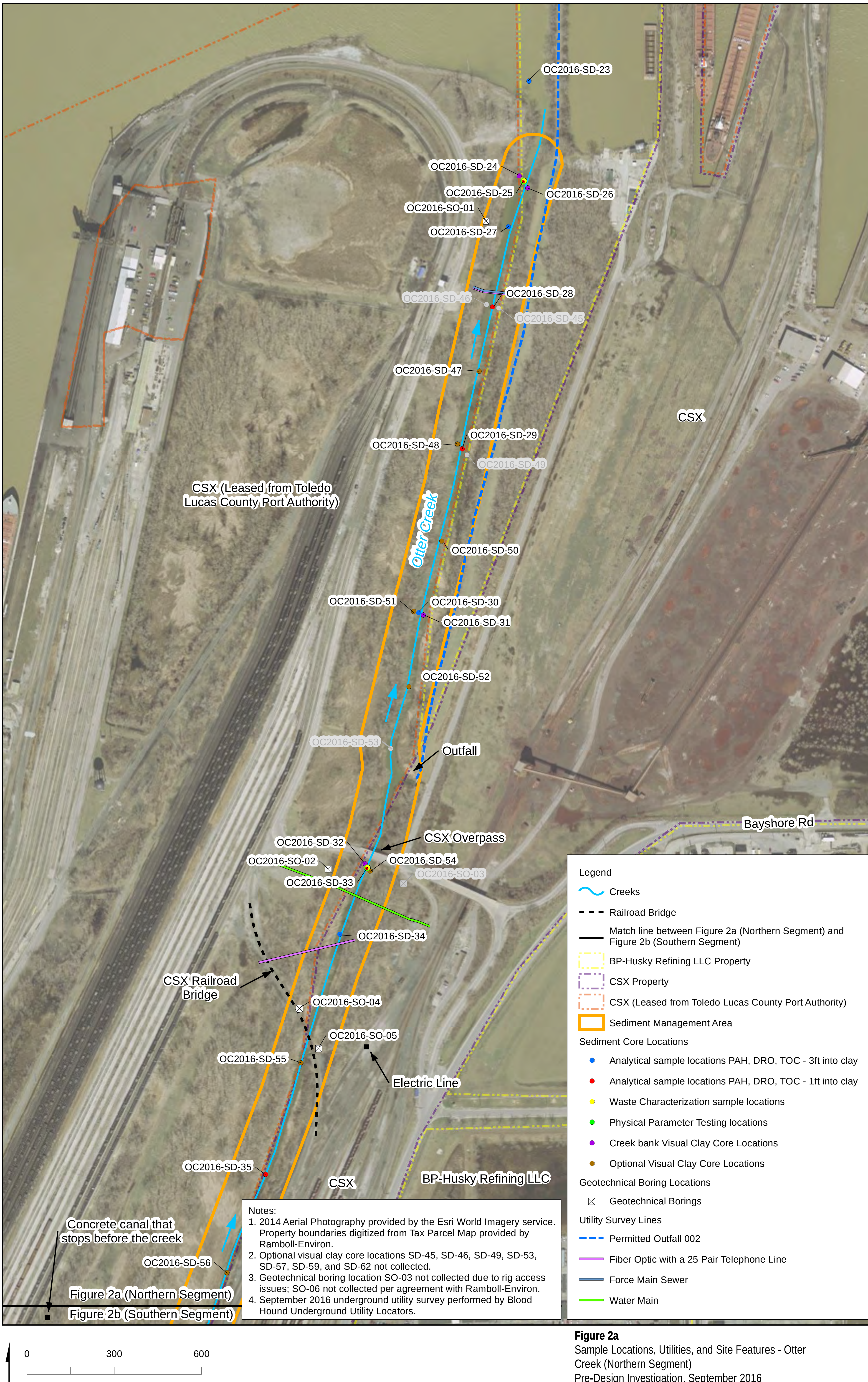

Legend

- Creeks
- Railroad Bridge
- Match line between Figure 2a (Northern Segment) and Figure 2b (Southern Segment)
- BP-Husky Refining LLC Property
- CSX Property
- CSX (Leased from Toledo Lucas County Port Authority)
- Sediment Management Area

Sediment Core Locations

- Analytical sample locations PAH, DRO, TOC - 3ft into clay
- Analytical sample locations PAH, DRO, TOC - 1ft into clay
- Waste Characterization sample locations
- Physical Parameter Testing locations
- Creek bank Visual Clay Core Locations
- Optional Visual Clay Core Locations

Geotechnical Boring Locations

- Geotechnical Borings

Utility Survey Lines

- Permitted Outfall 002
- Fiber Optic with a 25 Pair Telephone Line
- Force Main Sewer
- Water Main

Notes:

1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ.
2. Optional visual clay core locations SD-45, SD-46, SD-49, SD-53, SD-57, SD-59, and SD-62 not collected.
3. Geotechnical boring location SO-03 not collected due to rig access issues; SO-06 not collected per agreement with Ramboll-Environ.
4. September 2016 underground utility survey performed by Blood Hound Underground Utility Locators.

Figure 2a
Sample Locations, Utilities, and Site Features - Otter Creek (Northern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

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\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG02A_SAMPLELOCS_UTILITIES_SITEFEATURESNORTH.MXD JHANSEN1 12/6/2016 1:35:50 PM

Figure 2b
Sample Locations, Utilities, and Site Features - Otter Creek (Southern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG02B_SAMPLELOCS_UTILITIES_SITEFEATURESSOUTH.MXD JHANSEN1 1/16/2017 1:59:21 PM

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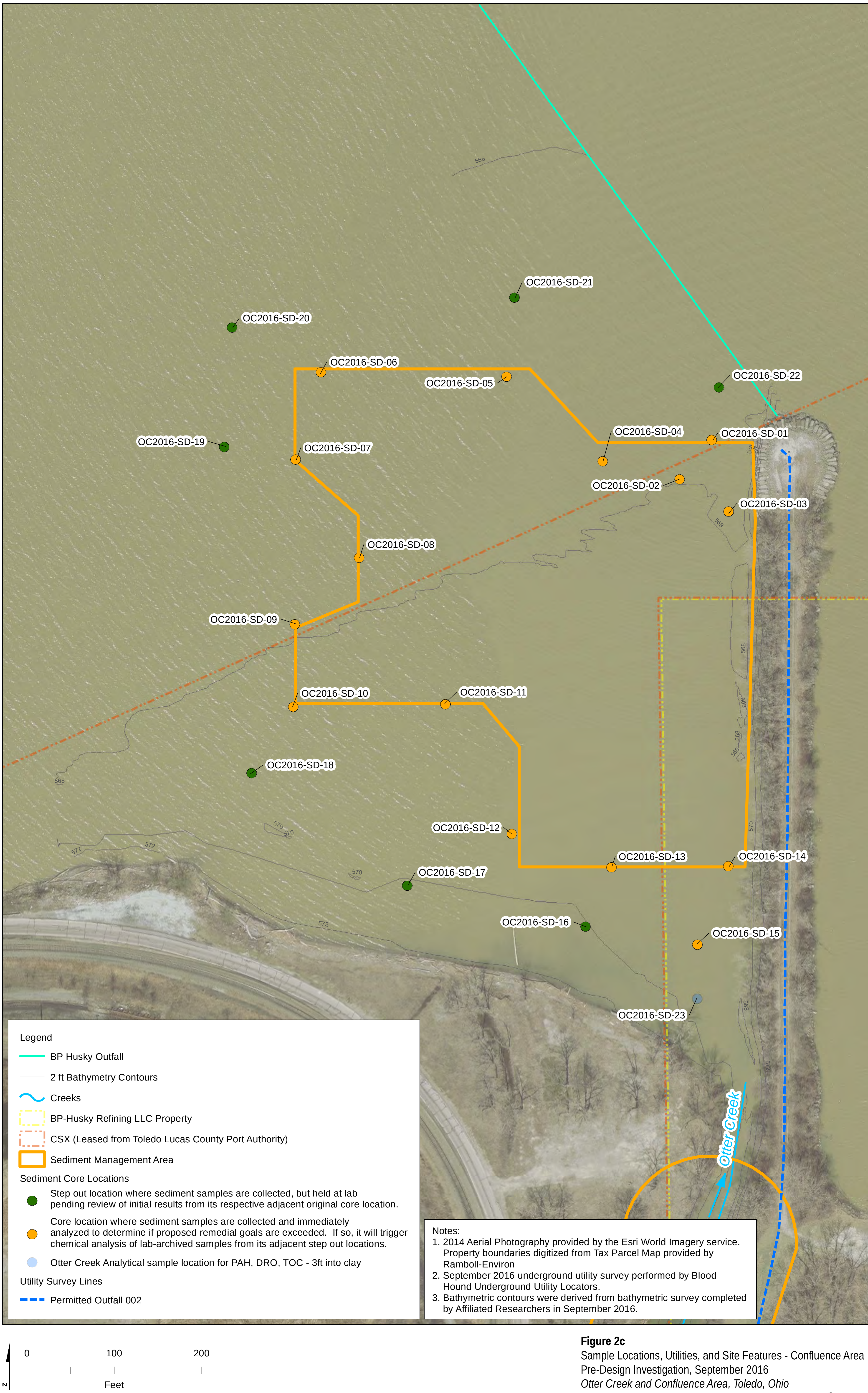

Notes:
1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ
2. September 2016 underground utility survey performed by Blood Hound Underground Utility Locators.
3. Bathymetric contours were derived from bathymetric survey completed by Affiliated Researchers in September 2016.

Figure 2c
Sample Locations, Utilities, and Site Features - Confluence Area
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG02C_SAMPLELOCS_UTILITIES_SITEFEATURESCONFLUENCE.MXD JHANSEN1 12/6/2016 1:39:00 PM

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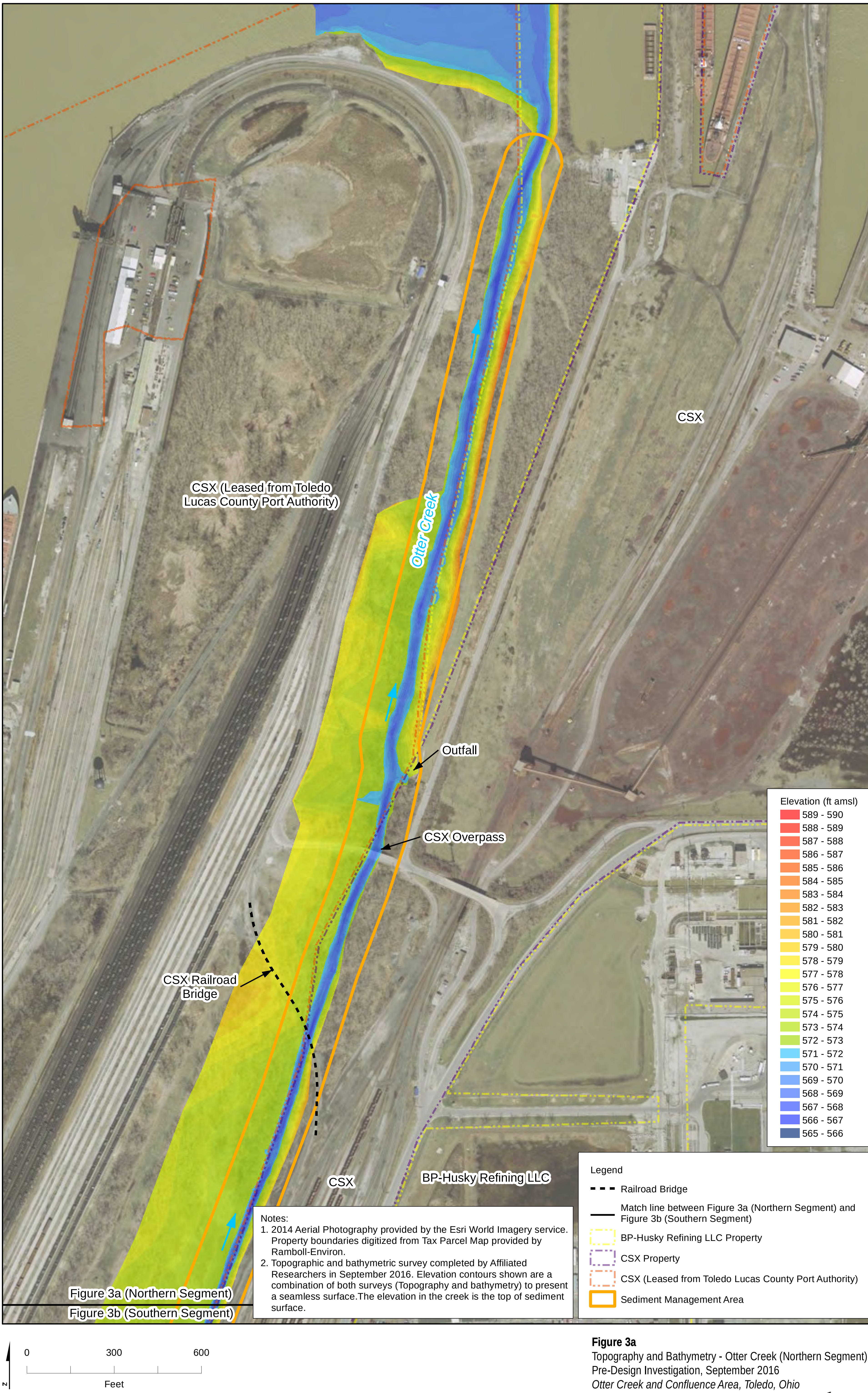
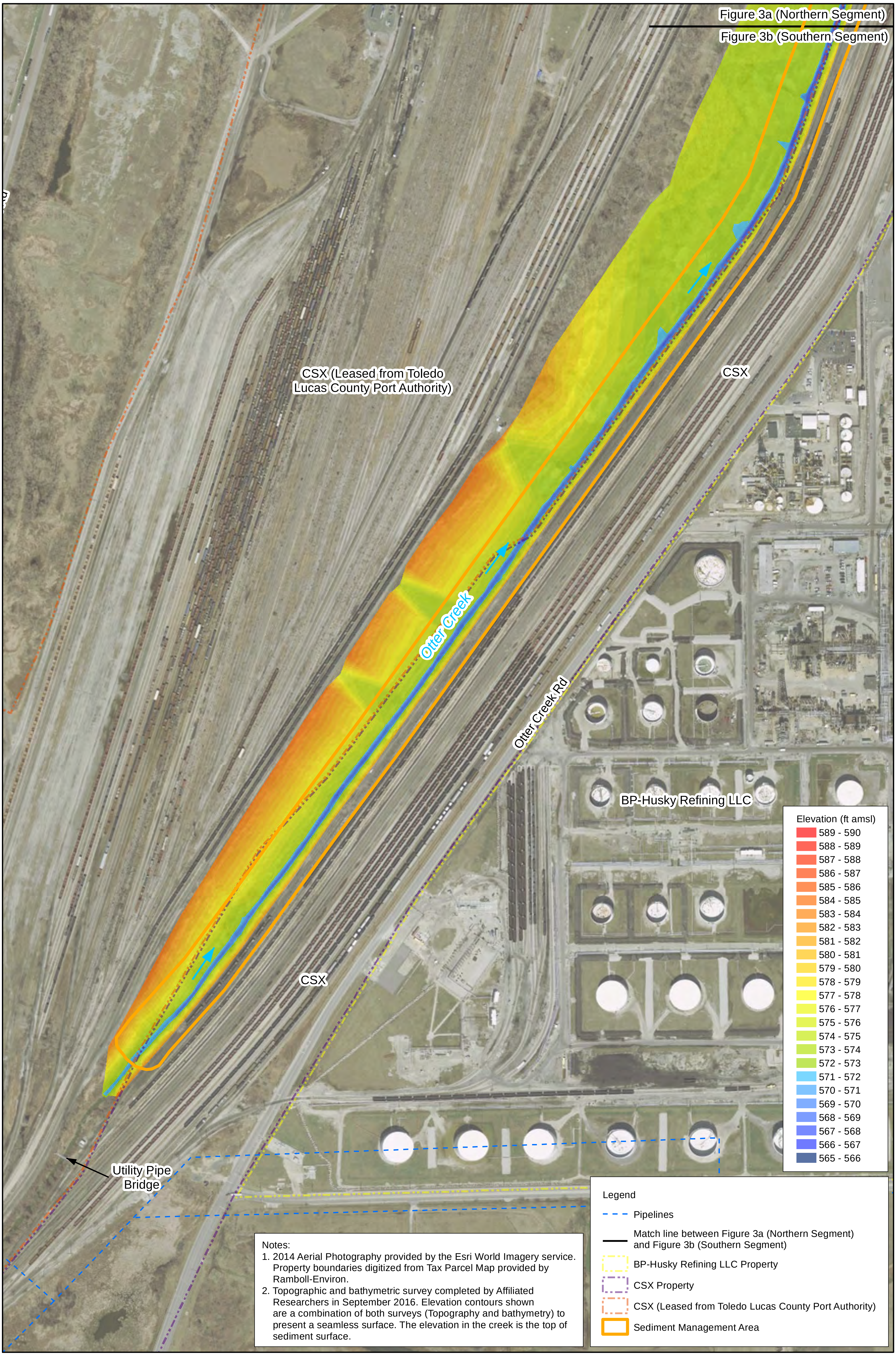


Figure 3a
Topography and Bathymetry - Otter Creek (Northern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

ch2m.

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG03A_TOPOBATHNORTH.MXD JHANSEN1 12/6/2016 1:49:41 PM



Notes:
1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ.
2. Topographic and bathymetric survey completed by Affiliated Researchers in September 2016. Elevation contours shown are a combination of both surveys (Topography and bathymetry) to present a seamless surface. The elevation in the creek is the top of sediment surface.

N 0 350 700 Feet

Figure 3b
Topography and Bathymetry - Otter Creek (Southern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG03B_TOPOBATHSOUTH.MXD JHANSEN1 12/6/2016 1:49:30 PM

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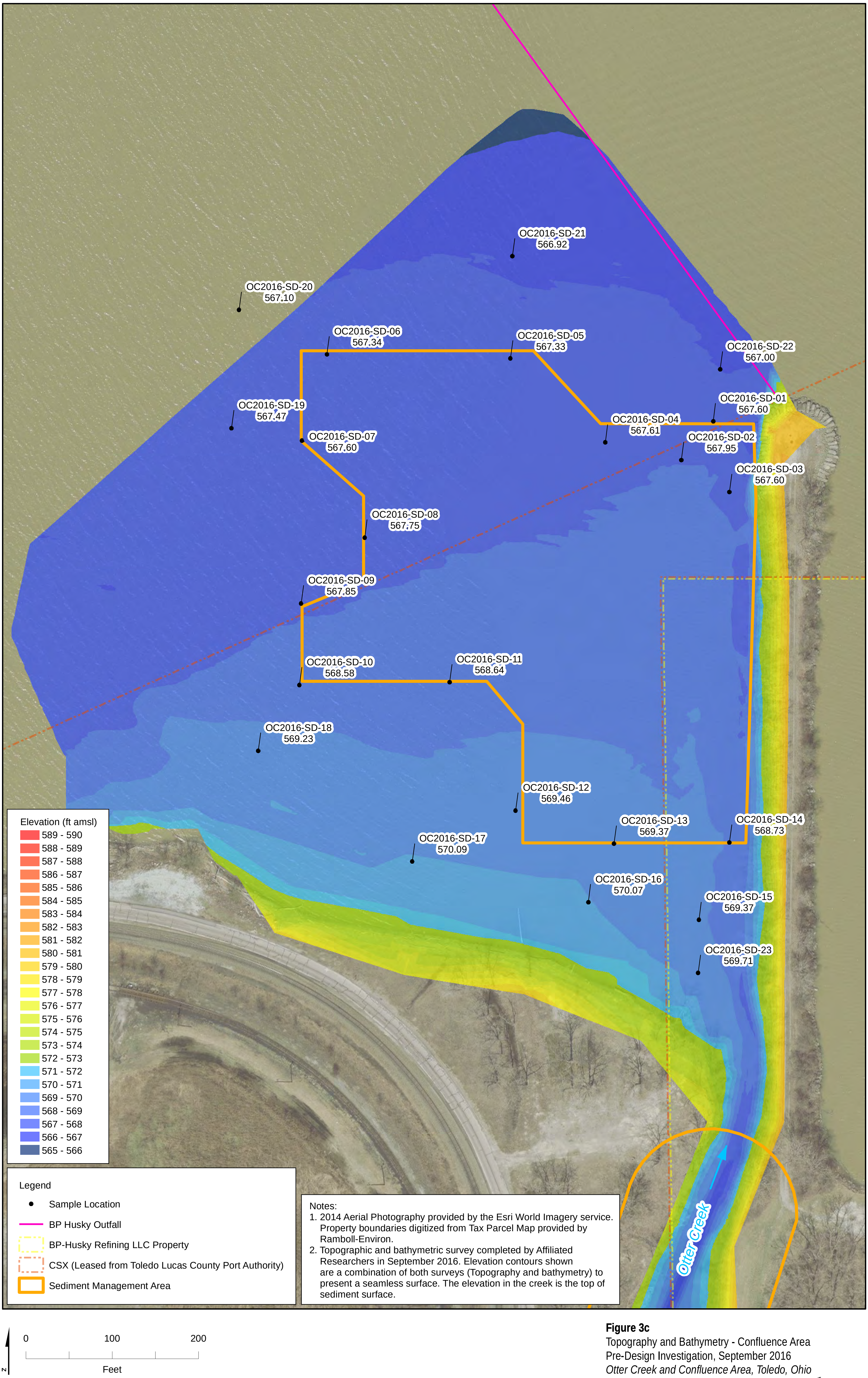

Figure 3c
Topography and Bathymetry - Confluence Area
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG03C_TOPOBATHCONFLUENCEAREA.MXD JHANSEN1 12/6/2016 2:39:05 PM

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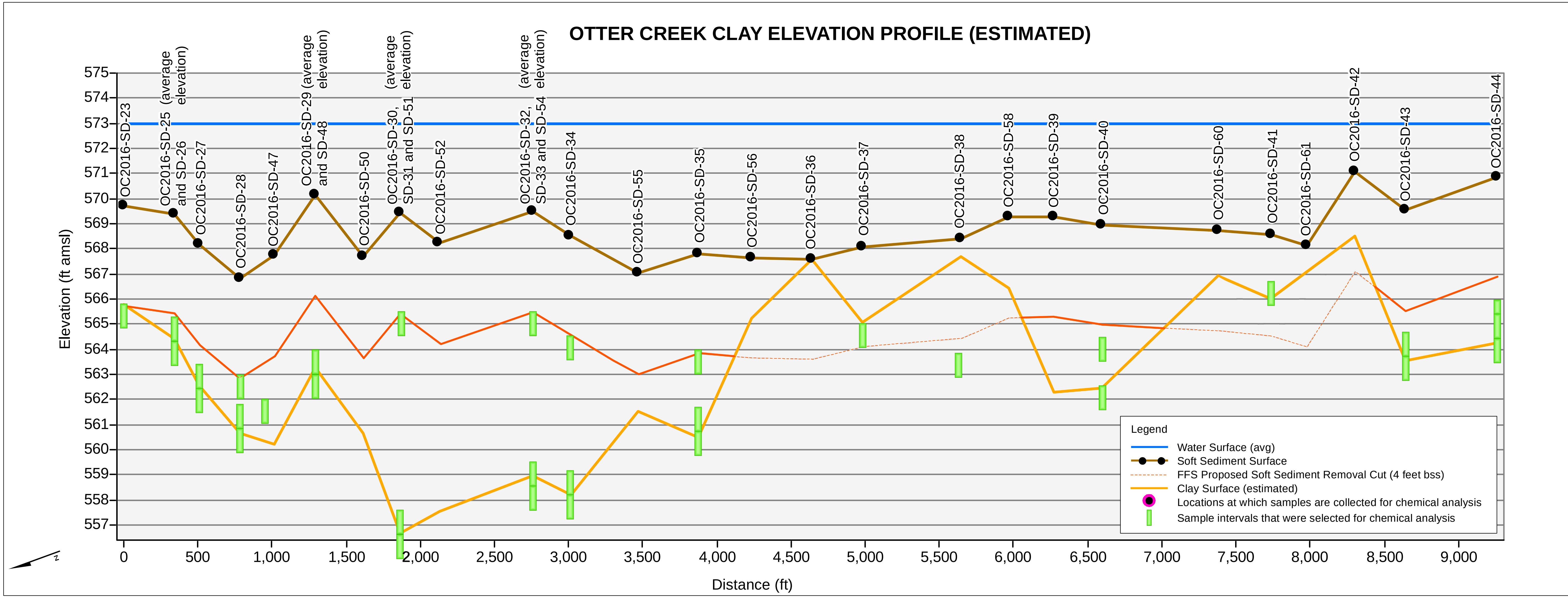
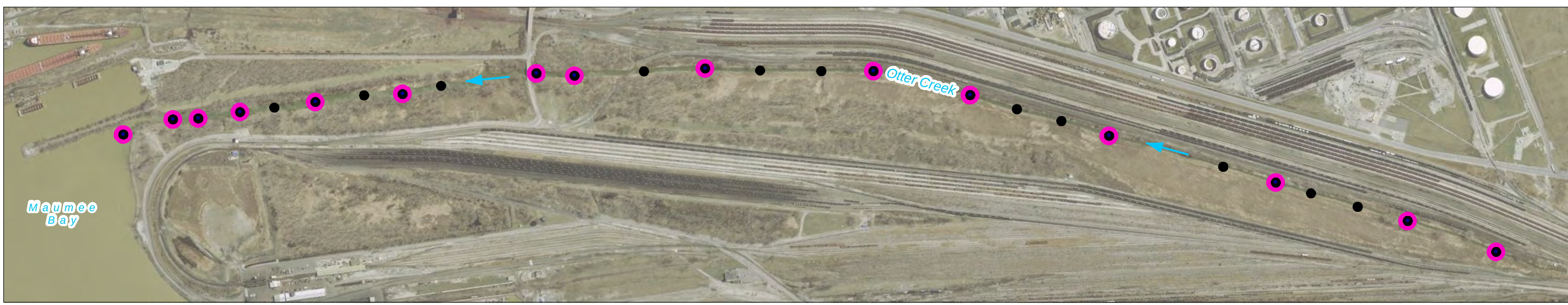


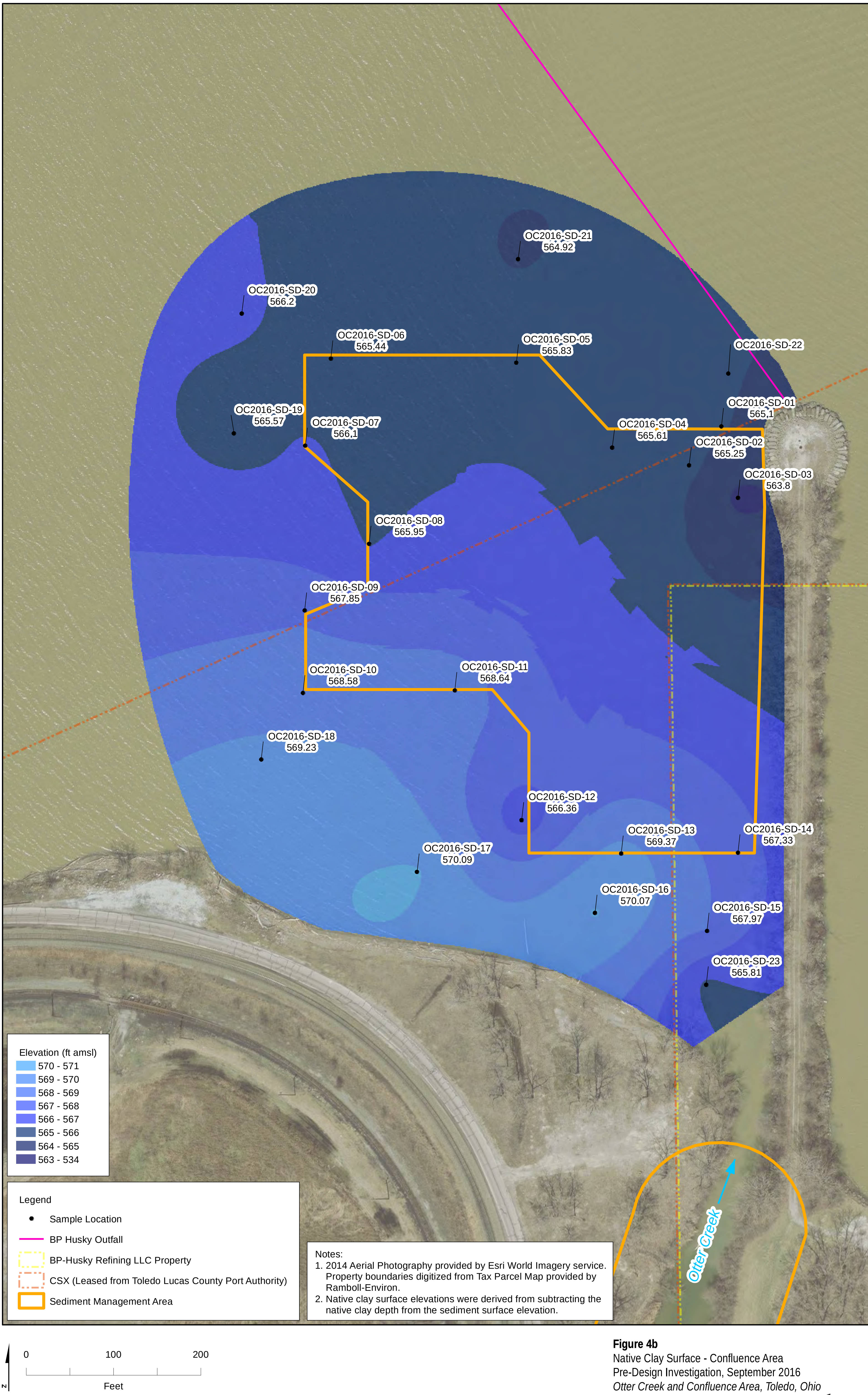


0 650 1,300
Feet

Note:
1. 2014 Aerial Photography provided by the Esri World Imagery service.
2. At transects with more than 1 sample location, the sediment and clay elevations are averaged to a single elevation representing that transect.

Figure 4a
Otter Creek Profile
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

ch2m



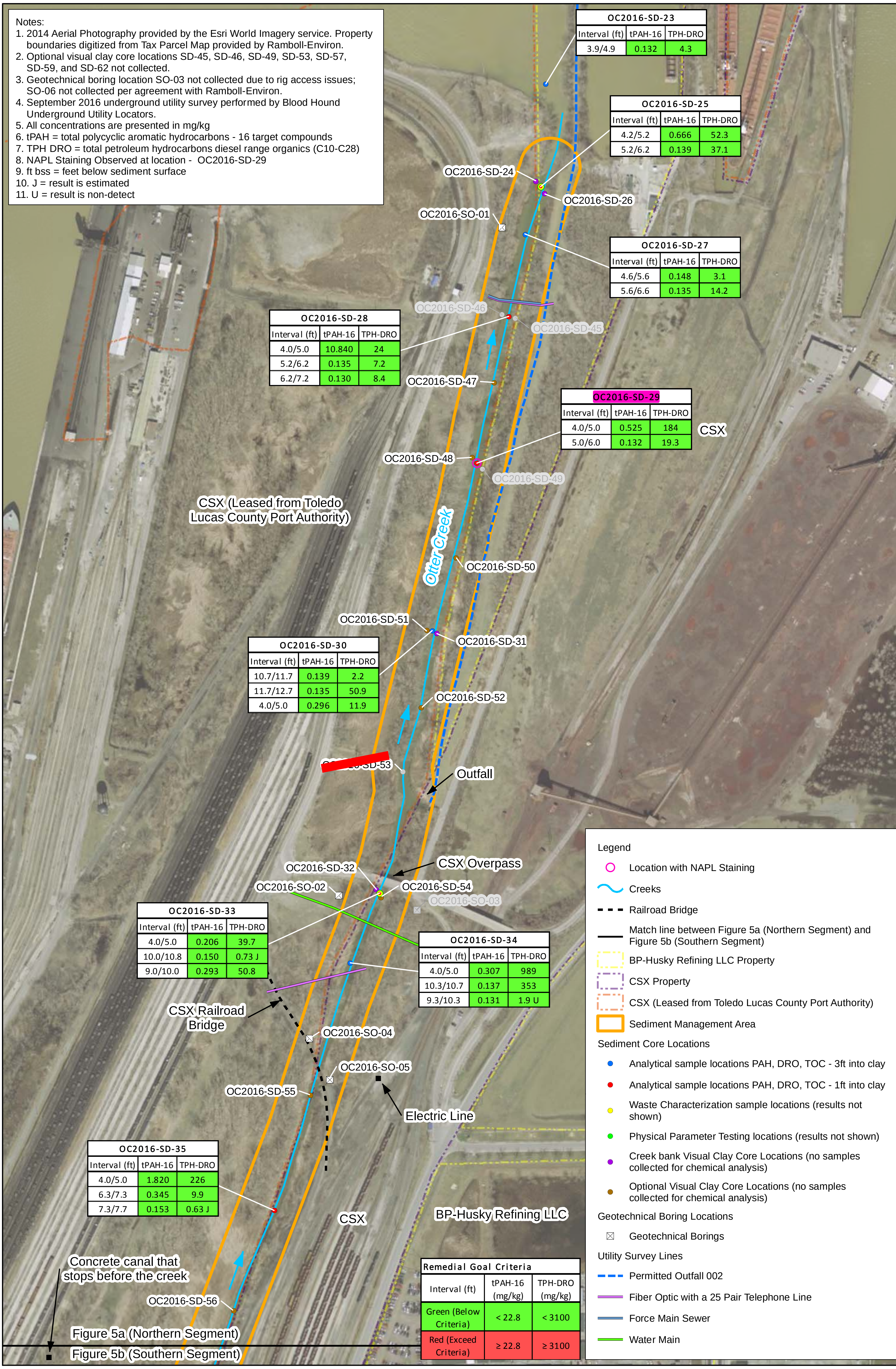
Notes:
1. 2014 Aerial Photography provided by Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ.
2. Native clay surface elevations were derived from subtracting the native clay depth from the sediment surface elevation.

Figure 4b
Native Clay Surface - Confluence Area
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG04B_NATIVECLAYSURFCONFLUENCEAREA.MXD JHANSEN1 12/6/2016 2:05:32 PM

ch2m.

Notes:
1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ.
2. Optional visual clay core locations SD-45, SD-46, SD-49, SD-53, SD-57, SD-59, and SD-62 not collected.
3. Geotechnical boring location SO-03 not collected due to rig access issues; SO-06 not collected per agreement with Ramboll-Environ.
4. September 2016 underground utility survey performed by Blood Hound Underground Utility Locators.
5. All concentrations are presented in mg/kg
6. tPAH = total polycyclic aromatic hydrocarbons - 16 target compounds
7. TPH DRO = total petroleum hydrocarbons diesel range organics (C10-C28)
8. NAPL Staining Observed at location - OC2016-SD-29
9. ft bss = feet below sediment surface
10. J = result is estimated
11. U = result is non-detect



OC2016-SD-23		
Interval (ft)	tPAH-16	TPH-DRO
3.9/4.9	0.132	4.3

OC2016-SD-25		
Interval (ft)	tPAH-16	TPH-DRO
4.2/5.2	0.666	52.3
5.2/6.2	0.139	37.1

OC2016-SD-27		
Interval (ft)	tPAH-16	TPH-DRO
4.6/5.6	0.148	3.1
5.6/6.6	0.135	14.2

OC2016-SD-28		
Interval (ft)	tPAH-16	TPH-DRO
4.0/5.0	10.840	24
5.2/6.2	0.135	7.2
6.2/7.2	0.130	8.4

OC2016-SD-29		
Interval (ft)	tPAH-16	TPH-DRO
4.0/5.0	0.525	184
5.0/6.0	0.132	19.3

OC2016-SD-30		
Interval (ft)	tPAH-16	TPH-DRO
10.7/11.7	0.139	2.2
11.7/12.7	0.135	50.9
4.0/5.0	0.296	11.9

OC2016-SD-33		
Interval (ft)	tPAH-16	TPH-DRO
4.0/5.0	0.206	39.7
10.0/10.8	0.150	0.73 J
9.0/10.0	0.293	50.8

OC2016-SD-34		
Interval (ft)	tPAH-16	TPH-DRO
4.0/5.0	0.307	989
10.3/10.7	0.137	353
9.3/10.3	0.131	1.9 U

OC2016-SD-35		
Interval (ft)	tPAH-16	TPH-DRO
4.0/5.0	1.820	226
6.3/7.3	0.345	9.9
7.3/7.7	0.153	0.63 J

Remedial Goal Criteria		
Interval (ft)	tPAH-16 (mg/kg)	TPH-DRO (mg/kg)
Green (Below Criteria)	< 22.8	< 3100
Red (Exceed Criteria)	≥ 22.8	≥ 3100

Legend
- Location with NAPL Staining
- Creeks
- Railroad Bridge
- Match line between Figure 5a (Northern Segment) and Figure 5b (Southern Segment)
- BP-Husky Refining LLC Property
- CSX Property
- CSX (Leased from Toledo Lucas County Port Authority)
- Sediment Management Area

Sediment Core Locations
- Analytical sample locations PAH, DRO, TOC - 3ft into clay
- Analytical sample locations PAH, DRO, TOC - 1ft into clay
- Waste Characterization sample locations (results not shown)
- Physical Parameter Testing locations (results not shown)
- Creek bank Visual Clay Core Locations (no samples collected for chemical analysis)
- Optional Visual Clay Core Locations (no samples collected for chemical analysis)

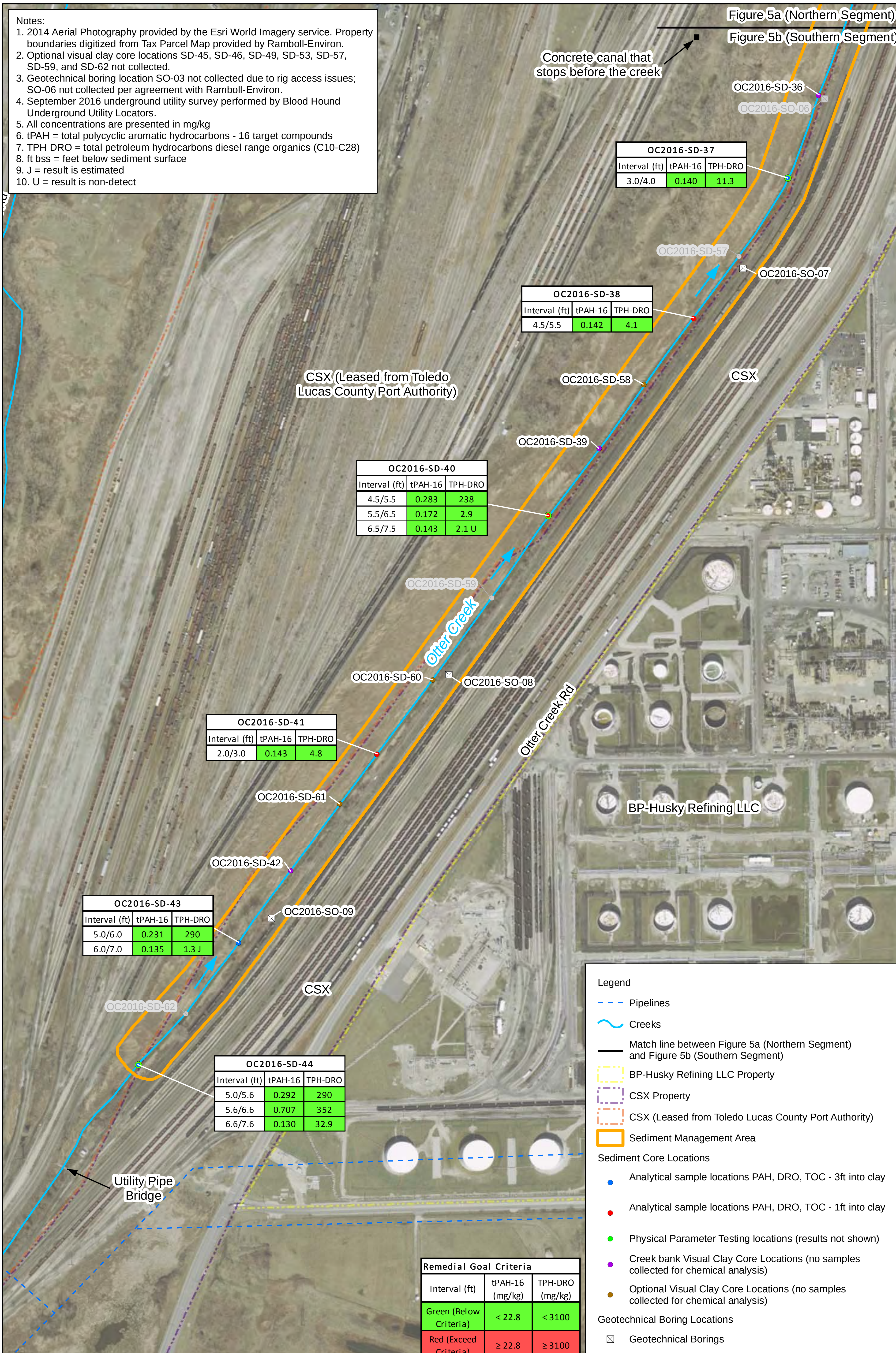
Geotechnical Boring Locations
- Geotechnical Borings

Utility Survey Lines
- Permitted Outfall 002
- Fiber Optic with a 25 Pair Telephone Line
- Force Main Sewer
- Water Main

Figure 5a
Analytical Results - Otter Creek (Northern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

ch2m:

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG05A_ANALYTICALRESULTSNORTH.MXD JHANSEN1 12/6/2016 1:29:36 PM



Notes:
1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ.
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3. Geotechnical boring location SO-03 not collected due to rig access issues; SO-06 not collected per agreement with Ramboll-Environ.
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5. All concentrations are presented in mg/kg
6. tPAH = total polycyclic aromatic hydrocarbons - 16 target compounds
7. TPH DRO = total petroleum hydrocarbons diesel range organics (C10-C28)
8. ft bss = feet below sediment surface
9. J = result is estimated
10. U = result is non-detect

OC2016-SD-37

Interval (ft)	tPAH-16	TPH-DRO
3.0/4.0	0.140	11.3

OC2016-SD-38

Interval (ft)	tPAH-16	TPH-DRO
4.5/5.5	0.142	4.1

OC2016-SD-40

Interval (ft)	tPAH-16	TPH-DRO
4.5/5.5	0.283	238
5.5/6.5	0.172	2.9
6.5/7.5	0.143	2.1 U

OC2016-SD-41

Interval (ft)	tPAH-16	TPH-DRO
2.0/3.0	0.143	4.8

OC2016-SD-43

Interval (ft)	tPAH-16	TPH-DRO
5.0/6.0	0.231	290
6.0/7.0	0.135	1.3 J

OC2016-SD-44

Interval (ft)	tPAH-16	TPH-DRO
5.0/5.6	0.292	290
5.6/6.6	0.707	352
6.6/7.6	0.130	32.9

Remedial Goal Criteria

Interval (ft)	tPAH-16 (mg/kg)	TPH-DRO (mg/kg)
Green (Below Criteria)	< 22.8	< 3100
Red (Exceed Criteria)	≥ 22.8	≥ 3100

Figure 5b
Analytical Results - Otter Creek (Southern Segment)
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

\\MKEFPP01\PROJ\USENVIRONMENTALPROTE\OTTER_CREEK_RD_SUPPORT_GLAES\GIS\MAPFILES\PREDESIGNINVSEPT2016\FIG05B_ANALYTICALRESULTSSOUTH.MXD JHANSEN1 12/6/2016 1:23:26 PM

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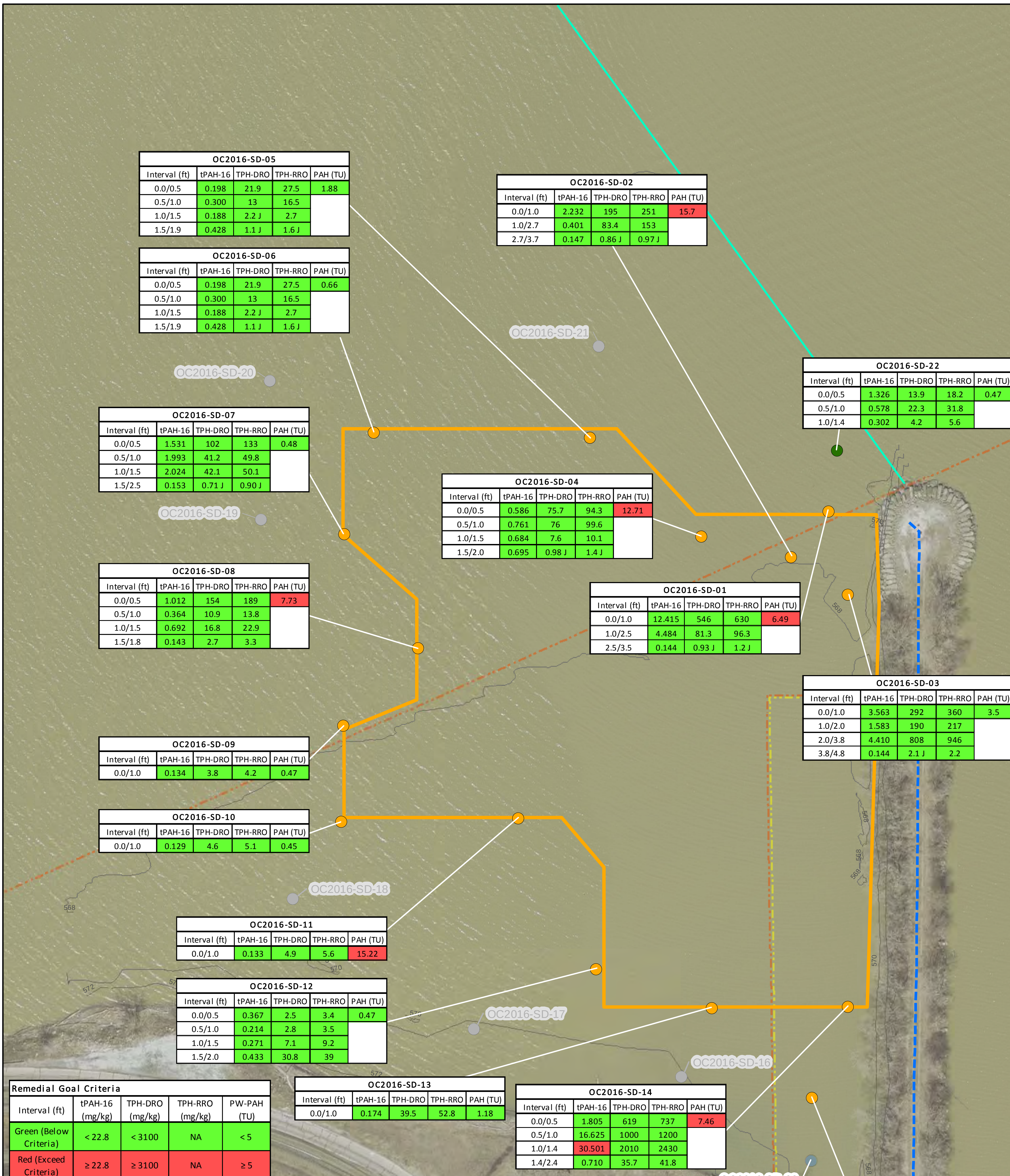

OC2016-SD-05				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	0.198	21.9	27.5	1.88
0.5/1.0	0.300	13	16.5	
1.0/1.5	0.188	2.2 J	2.7	
1.5/1.9	0.428	1.1 J	1.6 J	

OC2016-SD-06				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	0.198	21.9	27.5	0.66
0.5/1.0	0.300	13	16.5	
1.0/1.5	0.188	2.2 J	2.7	
1.5/1.9	0.428	1.1 J	1.6 J	

OC2016-SD-02				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	2.232	195	251	15.7
1.0/2.7	0.401	83.4	153	
2.7/3.7	0.147	0.86 J	0.97 J	

OC2016-SD-22				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	1.326	13.9	18.2	0.47
0.5/1.0	0.578	22.3	31.8	
1.0/1.4	0.302	4.2	5.6	

OC2016-SD-07				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	1.531	102	133	0.48
0.5/1.0	1.993	41.2	49.8	
1.0/1.5	2.024	42.1	50.1	
1.5/2.5	0.153	0.71 J	0.90 J	

OC2016-SD-04				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	0.586	75.7	94.3	12.71
0.5/1.0	0.761	76	99.6	
1.0/1.5	0.684	7.6	10.1	
1.5/2.0	0.695	0.98 J	1.4 J	

OC2016-SD-08				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	1.012	154	189	7.73
0.5/1.0	0.364	10.9	13.8	
1.0/1.5	0.692	16.8	22.9	
1.5/1.8	0.143	2.7	3.3	

OC2016-SD-01				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	12.415	546	630	6.49
1.0/2.5	4.484	81.3	96.3	
2.5/3.5	0.144	0.93 J	1.2 J	

OC2016-SD-03				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	3.563	292	360	3.5
1.0/2.0	1.583	190	217	
2.0/3.8	4.410	808	946	
3.8/4.8	0.144	2.1 J	2.2	

OC2016-SD-09				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	0.134	3.8	4.2	0.47

OC2016-SD-10				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	0.129	4.6	5.1	0.45

OC2016-SD-11				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	0.133	4.9	5.6	15.22

OC2016-SD-12				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	0.367	2.5	3.4	0.47
0.5/1.0	0.214	2.8	3.5	
1.0/1.5	0.271	7.1	9.2	
1.5/2.0	0.433	30.8	39	

OC2016-SD-13				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.0	0.174	39.5	52.8	1.18

OC2016-SD-14				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/0.5	1.805	619	737	7.46
0.5/1.0	16.625	1000	1200	
1.0/1.4	30.501	2010	2430	
1.4/2.4	0.710	35.7	41.8	

OC2016-SD-15				
Interval (ft)	tPAH-16	TPH-DRO	TPH-RRO	PAH (TU)
0.0/1.4	2.592	277	370	3.65
0.0/1.4	2.606	270	345	
1.4/2.0	0.136	15.8	19	

Remedial Goal Criteria				
Interval (ft)	tPAH-16 (mg/kg)	TPH-DRO (mg/kg)	TPH-RRO (mg/kg)	PW-PAH (TU)
Green (Below Criteria)	< 22.8	< 3100	NA	< 5
Red (Exceed Criteria)	≥ 22.8	≥ 3100	NA	≥ 5

Legend

- BP Husky Outfall
- 2 ft Bathymetry Contours
- Creeks
- BP-Husky Refining LLC Property
- CSX (Leased from Toledo Lucas County Port Authority)
- Sediment Management Area

Sediment Core Locations

- Step out location where sediment samples are collected, but held at lab pending review of initial results from its respective adjacent original core location.
- Core location where sediment samples are collected and immediately analyzed to determine if proposed remedial goals are exceeded. If so, it will trigger chemical analysis of lab-archived samples from its adjacent step out locations.
- Otter Creek Analytical sample location for PAH, DRO, TOC - 3ft into clay

Utility Survey Lines

- Permitted Outfall 002

Notes:
1. 2014 Aerial Photography provided by the Esri World Imagery service. Property boundaries digitized from Tax Parcel Map provided by Ramboll-Environ
2. September 2016 underground utility survey performed by Blood Hound Underground Utility Locators.
3. Concentrations for tPAH-16, TPH-DRO, TPH-RRO are presented in milligrams/kilogram (mg/kg); Porewater PAH values are presented in Toxicity Units (TU)
4. All porewater samples are collected from the 0.0-0.5 ft bss interval (surface grab samples)
5. tPAH = total polycyclic aromatic hydrocarbons - 16 target compounds
6. TPH DRO = total petroleum hydrocarbons diesel range organics (C10-C28)
7. TPH RRO = total petroleum hydrocarbons residual range organics (C10-C40)
8. Porewater PAH = polycyclic aromatic hydrocarbons in porewater - 34 target compounds
9. ft bss = feet below sediment surface
10. Based on the results from the primary sample locations, SD-22 (stepout location) was analyzed for pore water, DRO, RRO and tPAH.
10. No specific remedial goal criteria for TPH-RRO.
11. J = result is estimated
12. U = result is non-detect
13. Bathymetric contours were derived from bathymetric survey completed by Affiliated Researchers in September 2016.

N

0 100 200

Feet

Figure 5c
Analytical Results - Confluence Area
Pre-Design Investigation, September 2016
Otter Creek and Confluence Area, Toledo, Ohio

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Attachment 1
Sediment Core Logs

PROJECT NUMBER: 679969	CORE NUMBER: SD-01	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.9 ft | START : 9/15/16 11:34 | END : 9/15/16 11:39 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILTY FINE SAND - soft, with shells			faint sheen from 0.0'-1.3' bss
					CLAYEY ORGANIC SILT - soft, trace fine sand, strong odor			PID: 3.7 ppm
								PID: 178 ppm
								PID: 6.0 ppm
								PID: 4.9 ppm
	4.7	4.7	VC-1					
					NATIVE MATERIAL - LEAN CLAY - trace coarse sand	5200	717	PID: 3.1 ppm
						2000	717	
						1000	205	PID: 1.6 ppm
5					End of Recovery at 4.7' bss (refusal)			
					Samples Collected (9/15/16): OC2016-PW-01-0.0/0.5 (1139) OC2016-SD-01-0.0/1.0 (1315) (MS/MSD) OC2016-SD-01-1.0/2.5 (1320) OC2016-SD-01-1.0/2.5-FD (1322) OC2016-SD-01-2.5/3.5 (1325) (Native)			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER:	CORE NUMBER:
679969	SD-02 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.2 ft | START : 9/14/16 13:48 | END : 9/14/16 13:51 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, very dark grayish green (5GY 3/2), with fine sand, trace organics, slight odor, light sheen			light sheen from 0.0'-0.7' bss
					SILTY CLAY - very soft, dark gray (10YR 4/1), with fine sand, trace shells			PID: 0.6 ppm
						1000		
								PID: 0.0 ppm
	4.3	4.9	VC-1			0	102	
					NATIVE MATERIAL - LEAN CLAY - soft to medium, dark gray (10YR 4/1)			PID: 0.0 ppm
						2000	410	
						2000	512	PID: 0.0 ppm
						2500	512	
5					Lens of rust colored clay with fine sand at 4.8' bss End of Recovery at 4.9' bss (refusal)			
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-02-0.0/0.5 (1351) OC2016-SD-02-0.0/1.0 (1625) (MS/MSD) OC2016-SD-02-1.0/2.7 (1630) OC2016-SD-02-2.7/3.7 (1635) (Native)			
10								

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PROJECT NUMBER:	CORE NUMBER:
679969	SD-03 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.2 ft
START : 9/14/16 10:14
END : 9/14/16 10:52
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	6.0	5.5	VC-1		SILT - very soft, black (5Y 2.5/1), with fine sand, strong odor shells from 0.0-0.2' bss			light sheen from 0.0'-2.3' bss
								PID: 9.5 ppm
					fine gravel at 1.3' bss			PID: 1.5 ppm
					coarse sand from 2.3'-2.5' bss, with strong odor			strong sheen from 2.3'-2.5' bss PID: 51.1 ppm
					coarse sand from 3.0'-3.5' bss			
					clay nodule at 3.3' bss			PID: 7.7 ppm
					NATIVE MATERIAL - LEAN CLAY - soft to medium, very dark greenish gray (10Y 3/1), occasional silt seams, trace coarse sand	2000	410	
								PID: 2.0 ppm
5						1500	307	PID: 4.5 ppm
					WELL GRADED SAND - loose, coarse sand to gravel			
					End of Recovery at 5.5' bss			
					Refusal at 6.0' bss			
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-03-0.0/0.5 (1052) OC2016-SD-03-0.0/1.0 (1300) OC2016-SD-03-0.0/1.0-FD (1305) OC2016-SD-03-1.0/2.0 (1310) OC2016-SD-03-2.0/3.8 (1320) OC2016-SD-03-3.8/4.8 (1325) (Native)			
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-04 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :

WATER DEPTH : 5.3 ft
START : 9/14/16 15:45
END : 9/14/16 15:48
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.0	3.6	VC-1		SILT - very soft to soft, very dark gray (5Y 3/1), with fine sand, trace clay, trace organics			light sheen from 0.0'-0.5' bss
								PID: 1.5 ppm
					fine sand seam from 0.8'-1.1'			PID: 0.5 ppm
								PID: 0.5 ppm
					NATIVE MATERIAL - LEAN CLAY - soft to medium, dark gray (10YR 4/1), trace coarse sand			PID: 0.6 ppm
						1500	614	
						1000	717	PID: 0.4 ppm
						2000	512	
					End of Recovery at 3.6' bss			
					End of Penetration at 4.0' bss			
5								
10								

Samples Collected (9/15/16):

OC2016-PW-04-0.0/0.5 (1548)
OC2016-SD-04-0.0/0.5 (0820)
OC2016-SD-04-0.0/0.5-FD (0825)
OC2016-SD-04-0.5/1.0 (0830)
OC2016-SD-04-1.0/1.5 (0835)
OC2016-SD-04-1.5/2.0 (0840) (MS/MSD)

Abbreviations:
VC - Vibracore
SAA - Same As Above
bss - Below Sediment Surface

PROJECT NUMBER: 679969	CORE NUMBER: SD-05	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.8 ft | START : 9/14/16 14:00 | END : 9/14/16 14:37 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, dark gray (5Y 4/1) very soft clay from 0.1'-0.4' bss fine sand from 0.6'-1.3' bss			PID: 0.0 ppm entire core
	4.3	4.4	VC-1		NATIVE MATERIAL - LEAN CLAY - soft, dark gray (10YR 4/1), trace coarse sand	1000 1000 1000	 246 328	
5					End of Recovery at 4.4' bss			
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-05-0.0/0.5 (1437) OC2016-SD-05-0.0/0.5 (1550) OC2016-SD-05-0.0/0.5-FD (1555) OC2016-SD-05-0.5/1.0 (1600) OC2016-SD-05-1.0/1.5 (1605) OC2016-SD-05-1.5/2.5 (1610) (Native) OC2016-SD-05-0.0/1.5 (1615) (Physical Testing)			
10								

SEDIMENT CORE LOG

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-06	SHEET 1 OF 1

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore — DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 5.4 ft — START : 9/14/16 16:24 — END : 9/14/16 16:28 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.0	2.9	VC-1		SILT - soft, very dark gray (5Y 4/1), with fine sand, with clay shells from 0.0'-0.2' bss soft clay seam at 0.3' bss			PID: 0.4 ppm
					fine sand seam at 0.8' bss			PID: 0.3 ppm
					fine sand seam at 1.2' bss			PID: 0.4 ppm
					SILTY CLAY - soft, dark gray (10YR 4/1), trace organic silt			
					NATIVE MATERIAL - LEAN CLAY - soft to medium, dark gray (10YR 4/1)	1500	512	PID: 0.3 ppm
						2000	717	PID: 0.3 ppm
					End of Recovery at 2.9' bss End of Penetration at 3.0' bss			
5								
					Samples Collected (9/15/16): OC2016-PW-06-0.0/0.5 (1628) OC2016-SD-06-0.0/0.5 (0905) OC2016-SD-06-0.5/1.0 (0910) OC2016-SD-06-0.5/1.0-FD (0915) OC2016-SD-06-1.0/1.5 (0920) OC2016-SD-06-1.5/1.9 (0925)			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10								

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PROJECT NUMBER:	CORE NUMBER:
679969	SD-07 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.2 ft
START : 9/15/16 09:04
END : 9/15/16 09:07
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	44.3	3.6	VC-1		SILT - very soft to soft, very dark gray (5Y 4/1), trace fine sand, trace shells and organics at top			PID: 7.0 ppm PID: 0.0 ppm
					fine sand seam from 1.4'-1.5' bss			PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand consistency increases with depth	1000 1000 1500 2500	 410 512 1024	PID: 0.0 ppm
					End of Recovery at 3.6' bss			
					End of Penetration at 4.25' bss			
5								
					Samples Collected (9/15/16): OC2016-PW-07-0.0/0.5 (0912) OC2016-SD-07-0.0/0.5 (1055) OC2016-SD-07-0.0/0.5-FD (1100) OC2016-SD-07-0.5/1.0 (1105) (MS/MSD) OC2016-SD-07-1.0/1.5 (1110) OC2016-SD-07-1.5/2.5 (1115) (Native) OC2016-SD-07-0.0/1.5 (1120) (Waste Characterization) OC2016-SD-07-0.0/1.5 (1120) (Physical Testing)			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10								

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PROJECT NUMBER:	CORE NUMBER:	
679969	SD-08	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 4.8 ft
START : 9/15/16 15:38
END : 9/15/16 15:40
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, very dark gray (5Y 4/1), with fine sand, occasional clay nodules, shells at top			PID: 0.3 ppm
					SILTY FINE SAND - very dark gray (5Y 4/1)			PID: 1.9 ppm
					soft clay seam from 1.6'-1.8' bss			PID: 0.9 ppm
	4.0	3.9	VC-1		NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand, trace crushed shells	1000	205	PID: 1.8 ppm
						1000	307	
						2000	614	PID: 0.0 ppm
						2500	819	
					End of Recovery at 3.9' bss End of Penetration at 4.0' bss			
5								
					Samples Collected (9/16/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-08-0.0/0.5 (1540) OC2016-SD-08-0.0/0.5 (1100) OC2016-SD-08-0.5/1.0 (1105) OC2016-SD-08-0.5/1.0-FD (1107) OC2016-SD-08-1.0/1.5 (1110) (MS/MSD) OC2016-SD-08-1.5/1.8 (1115) OC2016-SD-08-0.0/1.8 (1120) (Physical Testing)			
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-09

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.0 ft | START : 9/15/16 16:09 | END : 9/15/16 16:11 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.5	3.7	VC-1		NATIVE MATERIAL - LEAN CLAY - soft, dark gray (10YR 4/1), trace coarse sand			PID: 0.0 ppm entire core
						1000	410	
					fine sand seam from 1.2'-1.6' bss			
						1000	0	
						1000	410	
					SAA, medium	3000	1024	
					End of Recovery at 3.7' bss			
5								
					Samples Collected (9/16/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-09-0.0/0.5 (1611) OC2016-SD-09-0.0/1.0 (1145) (Native)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-10	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.0 ft | START : 9/15/16 10:45 | END : 9/15/16 10:48 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.8	4.1	VC-1		NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1) some coarse sand from 0.0'-0.6' bss	2500	1024	PID: 0.0 ppm entire core
					SAA, soft	0	102	
						1400	307	
					some fine sand from 1.5'-2.5' bss			
					SAA, medium	1000	205	
						3500	205	
						1500	717	
						1500	512	
					End of Recovery at 4.1' bss			
5								
					Samples Collected (9/15/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-10-0.0/0.5 (1048) OC2016-SD-10-0.0/1.0 (1400) (Native)			
10								

PROJECT NUMBER:	CORE NUMBER:
679969	SD-11 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 3.8 ft
START : 9/14/16 08:28
END : 9/14/16 08:33
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), some coarse sand, some shells			PID: 0.0 ppm entire core
						3500	2970	
					SAA, soft		102	
						1000		
							205	
	5.0	4.7	VC-1			500		
					SAA, medium	2000	512	
					WELL GRADED SAND - firm to dense, fine to coarse sand			
					End of Recovery at 4.7' bss			
5					End of Penetration at 5.0' bss			
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-11-0.0/0.5 (0833) OC2016-SD-11-0.0/1.0 (1350) (Native)			
10								

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-12	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.7 ft | START : 9/13/16 15:44 | END : 9/13/16 15:48 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILTY FINE SAND - very dark greenish gray (10Y 3/1), trace shells			PID: 0.2 ppm PID: 0.4 ppm
					ORGANIC SILT - very soft, greenish black (10Y 2.5/1)		234	PID: 1.1 ppm PID: 1.1 ppm
	4.0	3.9	VC-1		ORGANIC SILT with SAND - medium, greenish black (10Y 2.5/1), trace fine gravel, trace shells	2000		PID: 0.3 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand, trace shells	2000	1147	
					End of Recovery at 3.9' bss End of Penetration at 4.0' bss			
5								
					Samples Collected (9/13/16): OC2016-PW-12-0.0/0.5 (1548) OC2016-SD-12-0.0/0.5 (1720) OC2016-SD-12-0.5/1.0 (1722) OC2016-SD-12-1.0/1.5 (1724) OC2016-SD-12-1.5/2.0 (1726) OC2016-SD-12-1.5/2.0-FD (1728)			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-13	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 2.7 ft
START : 9/13/16 13:36
END : 9/13/16 13:41
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.5	3.7	VC-1		NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand, trace gravel, trace shells	3500 1500	778	PID: 0.4 ppm
					NATIVE MATERIAL - CLAYEY SAND - dark gray (10YR 4/1), well graded sand with shells			PID: 0.8 ppm PID: 0.8 ppm PID: 10.0 ppm
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand, trace gravel, trace shells		1024	PID: 0.3 ppm
5					End of Recovery at 3.7' bss			
					Samples Collected (9/13/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10					OC2016-PW-13-0.0/0.5 (1341) OC2016-SD-13-0.0/1.0 (1755) (Native)			

PROJECT NUMBER: 679969	CORE NUMBER: SD-14	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 3.8 ft | START : 9/13/16 10:54 | END : 9/13/16 11:10 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					ORGANIC SILT - very soft, very dark grayish green (5GY 3/2), trace fine and coarse sand, trace organics, odor			PID: 42 ppm PID: 25 ppm
	3.0	2.9	VC-1		NATIVE MATERIAL - LEAN CLAY - stiff, dark greenish olive (10Y 4/2), trace gravel consistency increases with depth	3000	717	PID: 6.9 ppm
					SAA, very stiff	5500	3430	PID: 2.4 ppm
					End of Recovery at 2.9' bss End of Penetration at 3.0' bss			
5								
					Samples Collected (9/13/16): OC2016-PW-14-0.0/0.5 (1055) OC2016-SD-14-0.0/0.5 (1315) OC2016-SD-14-0.5/1.0 (1320) OC2016-SD-14-1.0/1.4 (1325) OC2016-SD-14-1.4/2.4 (1330) (Native) OC2016-SD-14-0.0/1.6 (1335) (Waste Characterization) OC2016-SD-14-0.0/1.6 (1335) (Physical Testing)			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER:	CORE NUMBER:
679969	SD-15 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : SEDIMENT ELEVATION : NATIVE CLAY ELEVATION :

WATER DEPTH : 2.8 ft START : 9/13/16 10:05 END : 9/13/16 10:11 LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.0	2.0	VC-1		WELL GRADED SAND with GRAVEL- greenish black (10Y 2.5/1), fine sand to coarse gravel, with shells			PID: 13.9 ppm PID: 1.4 ppm
					NATIVE MATERIAL - LEAN CLAY - stiff, dark greenish gray (10Y 4/1), trace coarse sand, trace gravel	3000	1802	PID: 0.4 ppm
					End of Recovery at 2.0' bss			
					End of Penetration at 3.0' bss			
5								
					Samples Collected (9/13/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-15-0.0/0.5 (1022) OC2016-SD-15-0.0/1.4 (1405) OC2016-SD-15-0.0/1.4-FD (1410) OC2016-SD-15-1.4/2.0 (1415) (Native)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-16	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.2 ft | START : 9/13/16 14:31 | END : 9/13/16 14:38 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.0	3.6	VC-1		NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace gravel, trace sand,	3000	1720	PID: 0.0 ppm entire core
						3000	1167	
					greenish black (10Y 2.5/1) organic silt lens with sand from 2.1'-2.8' bss			
					very dark greenish gray (10Y 3/1) silty sand lens with shells from 2.8'-3.6' bss			
					End of Recovery at 3.6' bss			
					End of Penetration at 4.0' bss			
5								
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-16-0.0/0.5 (1425) OC2016-SD-16-0.0/1.0 (0820) (Native)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-17 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.0 ft | START : 9/13/16 15:03 | END : 9/13/16 15:07 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.0	4.0	VC-1		NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace gravel, trace sand consistency decreases with depth	2000 1500	1229 471	PID: 0.0 ppm entire core
					firm, very dark greenish gray (10Y 3/1) silty sand seam, with trace shells from 1.4'-3.5' bss			
					medium, dark greenish gray (5G 4/1) clay lens with trace roots from 3.5'-4.0' bss	2000	594	
					End of Recovery at 4.0' bss			
5								
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-17-0.0/0.5 (1507) OC2016-SD-17-0.0/1.0 (0840) (Native)			
10								

PROJECT NUMBER: 679969	**CORE NUMBER:** SD-18	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore — DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 3.0 ft — START : 9/13/16 16:34 — END : 9/13/16 16:39 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.0	4.1	VC-1		NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace sand, trace silt, trace shells	2000		PID: 0.0 ppm entire core
						1000	410	
						1000	307	
						2500	717	
						2500	717	
					End of Recovery at 4.1' bss			
5								
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-18-0.0/0.5 (1639) OC2016-SD-18-0.0/1.0 (0855) (Native)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-19	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore — DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 5.1 ft — START : 9/15/16 09:59 — END : 9/15/16 10:02 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - soft, trace organics			PID: 0.0 ppm entire core
					SILTY CLAY - soft, dark gray (5Y 4/1)			
					POORLY GRADED FINE SAND - dark gray (5Y 4/1), trace coarse sand, trace silt, trace shells			
	3.0	2.8	VC-1		SILTY CLAY - soft, dark gray (5Y 4/1)			
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1500	410	
						2000	819	
					End of Recovery at 2.8' bss			
					End of Penetration at 3.0' bss			
5								
					Samples Collected (9/15/16):			Abbreviations: VC - Vibracore; SAA - Same As Above; bss - Below Sediment Surface
					OC2016-PW-19-0.0/0.5 (1002) OC2016-SD-19-0.0/0.5 (1150) OC2016-SD-19-0.5/1.0 (1155) OC2016-SD-19-1.0/1.5 (1200) OC2016-SD-19-1.0/1.5-FD (1202) OC2016-SD-19-1.5/1.9 (1205)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-20 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore
DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :

WATER DEPTH : 6.0 ft
START : 9/15/16 08:23
END : 9/15/16 08:34
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.3	2.6	VC-1		SILT - very soft, dark gray (5Y 2/1), some clay, trace fine sand, trace organics			PID: 0.0 ppm entire core
					SILTY FINE SAND - loose, black (5Y 2.5/1)			
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace sand, trace silt, trace shells	1000	102	
						1500	307	
						1500	512	
					End of Recovery at 2.6' bss			
					End of Penetration at 3.25' bss			
5								
					Samples Collected (9/15/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-20-0.0/0.5 (0829) OC2016-SD-20-0.0/0.5 (1240) OC2016-SD-20-0.5/0.9 (1245) OC2016-SD-20-0.9/1.9 (1250) (Native)			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-21	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore — DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 5.7 ft — START : 9/14/16 10:10 — END : 9/14/16 10:12 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - soft, dark gray (5Y 4/1), with fine sand			light sheen from 0.0'-1.0' bss
								PID: 0.0 ppm
								PID: 0.3 ppm
	2.8	2.7	VC-1					
								PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	2000	1126	PID: 0.0 ppm
						3000	1024	
					End of Recovery at 2.7' bss End of Penetration at 2.75' bss			
5								
					Samples Collected (9/14/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-21-0.0/0.5 (1012) OC2016-SD-21-0.0/0.5 (1140) OC2016-SD-08-0.5/1.0 (1145) (MS/MSD) OC2016-SD-08-1.0/1.5 (1150) OC2016-SD-08-1.5/2.0 (1155) OC2016-SD-08-1.5/2.0-FD (1200)			
10								

ch2m

PROJECT NUMBER: 679969	CORE NUMBER: SD-22 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : Vibracore | DRILLING CONTRACTOR : RV Mudpuppy II

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.3 ft | START : 9/15/16 14:32 | END : 9/15/16 14:36 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, very dark gray (5Y 3/1), with fine sand and shells			PID: 0.0 ppm entire core
	2.5	1.4	VC-1		SILTY FINE SAND - very dark gray (5Y 3/1)			
					End of Recovery at 1.4' bss			
					End of Penetration at 2.5' bss			
5								
					Samples Collected (9/15/16):			Abbreviations: VC - Vibracore SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-22-0.0/0.5 (1436) OC2016-SD-22-0.0/0.5 (1720) OC2016-SD-08-0.5/1.0 (1725) OC2016-SD-08-1.0/1.4 (1730)			
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-23 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :

WATER DEPTH : 3.3 ft
START : 9/15/16 17:00
END : 9/15/16 17:30
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0				POORLY GRADED FINE SAND - medium dense, dark gray (5Y 4/1), trace silt, trace shells, organics at top			PID: 1.1 ppm PID: 1.5 ppm
	3.0	2.3	MC-1	LEAN CLAY - medium, dark greenish gray (10Y 4/1), trace fine sand	1000 1500	614 614	PID: 0.0 ppm
				No Recovery 2.3'-3.0'			
				SILTY FINE SAND - loose, dark gray (5Y 4/1)			PID: 1.4 ppm
	1.8	1.9	MC-2	LEAN CLAY - medium, dark gray (5Y 4/1), with silt and fine sand	1500	410	
				NATIVE MATERIAL - LEAN CLAY - very stiff, brown (10YR 4/3), trace coarse sand	4500 6000	1331 1741	PID: 0.0 ppm
5				End of Sediment Core at 4.9' bss			
				Samples Collected (9/16/16):			
				OC2016-SD-23-3.9/4.9 (1040) (Native)			
10							

Abbreviations:
HC - Hand Core
MC - Macro Core
SAA - Same As Above
bss - Below Sediment Surface

PROJECT NUMBER:	CORE NUMBER:
679969	SD-24 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 2.7 ft
START : 9/15/16 16:20
END : 9/15/16 16:50
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	3.9	MC-1		ORGANIC SILT - very soft, with clay and shells, odor organics from 0.0-0.5' bss black with trace sand and trace wood from 1.0'-1.6' bss soft clay seam with trace silt from 1.6'-3.3' bss trace sand and black material with staining at 2.9' bss	4500		PID: 1.0 ppm PID: 1.5 ppm PID: 2.7 ppm PID: 8.9 ppm PID: 3.0 ppm PID: 65.8 ppm PID: 129 ppm PID: 21.1 ppm
					No Recovery 3.9'-5.0' bss			
5	5.0	3.5	MC-2		WELL GRADED SAND - medium dense, some clay, odor darker color from 5.0'-5.7' bss	3000	205	PID: 14.4 ppm PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1)	3000	553 1331	PID: 0.0 ppm PID: 0.0 ppm
					No Recovery 8.5'-10.0' bss			
10					End of Sediment Core at 10' bss			
15					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
20								

PROJECT NUMBER: 679969

CORE NUMBER: SD-25

SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 5.8 ft — START : 9/15/16 15:20 — END : 9/15/16 15:55 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.8	MC-1		SILT - very soft, with sand, trace gravel, trace organics and shells, strong odor			light sheen and staining from 0.0'-1.3' bss few light brown product spots from 0.0-0.9' bss PID: 187 ppm
					SILTY MEDIUM TO COARSE SAND - medium dense, black (5Y 2.5/1), trace organics, odor			PID: 244 ppm
					WELL GRADED SAND - medium dense, black (5Y 2.5/1), odor			PID: 54 ppm
					No Recovery 2.8'-4.0' bss			
					WELL GRADED SAND - medium dense, dark olive gray (5Y 3/2)			PID: 14.6 ppm
5	3.2	3.2	MC-2		LEAN CLAY - soft, dark gray (10YR 4/1), with coarse sand			
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand	3500 4000 3500 4000	1126 1229 1638 1434	PID: 0.0 ppm PID: 0.0 ppm
					End of Sediment Core at 7.2' bss (refusal)			
10								
					Samples Collected (9/16/16):			
					OC2016-SD-25-4.2/5.2 (0850) OC2016-SD-25-5.2/6.2 (0855) (Native) OC2016-SD-25-0.0/5.2 (0900) (Waste Characterization) OC2016-SD-25-0.0/5.2 (0900) (Physical Testing)			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
15								

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-26	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.3 ft | START : 9/15/16 15:00 | END : 9/15/16 15:20 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILTY SAND - very loose, dark olive gray (5Y 3/2), with organic matter			PID: 0.0 ppm entire core
					SILTY CLAY - soft, dark gray (5Y 4/1), trace gravel	1500	410	
					SILTY CLAY - soft, black (5Y 2.5/1) sand seam from 1.0'-1.2' bss	500	0	
					SAA, medium	2000	512	
	5.0	3.0	MC-1			1500	410	
					NATIVE MATERIAL - LEAN CLAY - dark gray (10YR 4/1)	2000	614	
					No Recovery 3.0'-5.0' bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/15/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-27	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.1 ft | START : 9/15/16 14:00 | END : 9/15/16 14:40 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.5	1.9	MC-1		SILTY MEDIUM SAND - with shells			faint sheen from 0.0'-0.1' bss
					SILTY CLAY - soft, dark gray (10YR 4/1), with fine sand, trace coarse sand			PID: 21 ppm PID: 0.0 ppm
					WELL GRADED SAND - olive (5Y 4/4), medium to coarse sand			PID: 0.0 ppm
					No Recovery 1.9'-4.5' bss			
5	2.5	2.8	MC-2		WELL GRADED SAND - medium dense, olive (5Y 4/4), medium to coarse sand fine sand silt from 4.5'-4.9' bss			PID: 3.7 ppm
					NATIVE MATERIAL - LEAN CLAY - very stiff, dark gray (10YR 4/1), trace coarse sand	4000 5000 6500 5000	922 819 1434 1638	PID: 0.0 ppm PID: 0.0 ppm
					End of Sediment Core at 7.3' bss (refusal)			
10								
					Samples Collected (9/15/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-27-4.6/5.6 (1710) OC2016-SD-27-5.6/6.6 (1715) (Native)			
15								

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-28	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.4 ft | START : 9/15/16 13:05 | END : 9/15/2016 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - soft, dark gray (5Y 4/1), with fine sand			very faint sheen at 0.1' bss
					SILTY CLAY - medium, dark gray (5Y 4/1), trace fine sand			PID: 2.7 ppm PID: 0.8 ppm
					WELL GRADED SAND - dark gray (5Y 4/1), medium to coarse sand, trace silt			PID: 0.0 ppm
	5.0	2.2	MC-1		No Recovery 2.2'-4.0' bss			
5	1.2	1.4	MC-2		WELL GRADED SAND - loose, dark gray (5Y 4/1), medium to coarse sand, trace silt			PID: 0.0 ppm
					LEAN CLAY - soft, dark gray (10YR 4/1), with coarse sand			
					WELL GRADED SAND - medium to coarse sand			
	2.0	2.5	MC-3		NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand	2000	819	PID: 0.0 ppm
					End of Sediment Core at 7.2' bss (refusal)	5500	1741	
10								
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-28-4.0/5.0 (0815) (MS/MSD) OC2016-SD-28-5.2/6.2 (0820) OC2016-SD-28-6.2/7.2 (0825) (Native)			
15								

PROJECT NUMBER:	CORE NUMBER:
679969	SD-29 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.9 ft | START : 9/15/16 10:55 | END : 9/15/16 11:30 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.9	MC-1		ORGANIC SILT - soft, trace fine sand, trace organics (wood chips)			PID: 2.9 ppm, rainbow sheen from 0.5'-1.5' bss, yellow staining on liner from 0.5'-2.5' bss PID: 1.0 ppm
					SILTY CLAY - medium, with well graded sand			PID: 0.8 ppm
					WELL GRADED SAND with SILT - medium dense			
					No Recovery 2.9'-4.0' bss			
5	5.0	2.0	MC-2		WELL GRADED SAND - medium dense			PID: 0.7 ppm, sheen at 4.0' bss, yellow staining on liner from 4.0'-5.0' bss, yellow product floating in core at 4.0' bss
					NATIVE MATERIAL - LEAN CLAY - very stiff, dark gray (10YR 4/1), with coarse sand, trace shells	1500 4500 5000	614 1126 3482	PID: 0.0 ppm
					No Recovery 6.0'-9.0' bss			
10					End of Sediment Core at 9.0' bss			
15								
					Samples Collected (9/15/16): OC2016-SD-29-4.0/5.0 (1625) OC2016-SD-29-4.0/5.0-FD (1630) OC2016-SD-29-5.0/6.0 (1635) (Native) OC2016-SD-29-0.0/5.0 (1640) (Physical Testing)			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
20								

PROJECT NUMBER: 679969	CORE NUMBER: SD-30	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.0 ft
START : 9/15/16 10:45
END : 9/15/16 11:15
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	3.6	MC-1		SILT - very soft, dark olive gray (5Y 3/2), trace fine sand, trace organics, odor			light sheen from 0.0'-1.0' bss PID: 86 ppm
					ORGANIC SILT - soft, dark olive gray (5Y 3/2), with crushed shells			PID: 16.6 ppm PID: 7.3 ppm PID: 0.0 ppm
					No Recovery 3.6'-4.0' bss			
5	5.0	3.8	MC-2		ORGANIC SILT - soft, dark olive gray (5Y 3/2), with crushed shells			PID: 0.0 ppm PID: 0.0 ppm PID: 0.0 ppm PID: 0.0 ppm
					No Recovery 7.8'-9.0' bss			
10	5.0	4.1	MC-3		ORGANIC SILT - soft, dark olive gray (5Y 3/2), with crushed shells			PID: 0.0 ppm PID: 0.0 ppm
					WELL GRADED SAND with SILT - medium dense, dark gray (5Y 4/1)	2500 4000 5500	819 1434 3174	PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - very stiff, dark gray (10YR 4/1), trace coarse sand, trace shells			PID: 0.0 ppm
					No Recovery 13.1'-14.0' bss			
15					End of Sediment Core at 14.0' bss			
					Samples Collected (9/15/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-30-4.0/5.0 (1600) OC2016-SD-30-10.7/11.7 (1605) OC2016-SD-30-11.7/12.7 (1610) (Native)			
20								

PROJECT NUMBER: 679969

CORE NUMBER: SD-31 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : SEDIMENT ELEVATION : NATIVE CLAY ELEVATION :

WATER DEPTH : 3.1 ft START : 9/15/16 10:10 END : 9/15/16 10:40 LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - soft, dark olive gray (5Y 3/2), trace fine sand, trace organics			PID: 0.0 ppm
	5.0	4.6	MC-1		ORGANIC SILT - soft, with crushed shells			
5					No Recovery from 4.6'-5.0' bss			
	5.0	4.0	MC-2		ORGANIC SILT - soft, with crushed shells			
10					No Recovery from 9.0-10.0' bss			
	5.0	4.8	MC-3		ORGANIC SILT - soft, with crushed shells			
					coarse sand seam at 13.3' bss			
					rock at 13.9' bss	2500	1024	
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand, trace shells	3000	819	
15					No Recovery 14.8'-15.0' bss	3000	1024	
					End of Sediment Core at 15.0' bss			
					Samples Collected (9/15/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
20								

PROJECT NUMBER: 679969	CORE NUMBER: SD-32	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 2.7 ft — START : 9/14/16 16:30 — END : 9/14/16 17:15 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	5.0	MC-1	ORGANIC SILT - soft, black (5Y 2.5/1), trace fine sand, trace clay			PID: 19.2 ppm
				SAA, black (5Y 2.5/2)			PID: 3.3 ppm
							PID: 1.4 ppm
				SAA, some shells			PID: 0.7 ppm
							PID: 0.0 ppm
5	5.0	5.0	MC-2	SAA, black (5Y 2.5/1), trace fine sand, trace clay, odor			PID: 56 ppm
							PID: 2.6 ppm
				SAA, medium, black (5Y 2.5/2), with crushed shells			PID: 1.0 ppm
							PID: 0.7 ppm
						0	PID: 0.0 ppm
				SANDY ORGANIC SILT - black (5Y 2.5/2), with crushed shells			
10	5.0	3.4	MC-3	NATIVE MATERIAL - LEAN CLAY - stiff, dark greenish gray (10Y 4/1), with coarse sand, trace shells		717	PID: 0.0 ppm
				SAA, dark gray (10YR 4/1) pebble/gravel seam from 11.2'-11.7' bss		819	PID: 0.0 ppm
						3072	PID: 0.0 ppm
						3789	PID: 0.0 ppm
				No Recovery 13.4'-15.0' bss			
15				End of Sediment Core at 15.0' bss			
				Samples Collected (9/15/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
				None - Visual Core			
20							

PROJECT NUMBER: 679969	CORE NUMBER: SD-33	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.1 ft
START : 9/15/16 08:30
END : 9/15/16 09:45
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					ORGANIC CLAYEY SILT - very soft, black, trace roots			PID: 0.6 ppm
	5.0	4.2	MC-1		ORGANIC SILT - soft, black (5Y 3/2), broken shells throughout clay seam from 1.3'-1.7' bss			PID: 3.6 ppm PID: 0.5 ppm PID: 0.4 ppm PID: 0.4 ppm PID: 0.0 ppm
5	5.0	3.1	MC-2					PID: 0.0 ppm PID: 0.0 ppm PID: 0.0 ppm
					No Recovery 7.1'-9.0' bss			
					ORGANIC SILT - soft, black (5Y 3/2), broken shells throughout	1600	205	PID: 0.0 ppm
10	3.0	1.8	MC-3		NATIVE MATERIAL - LEAN CLAY - medium, dark greenish gray (10Y 4/1), trace coarse sand	1600	614	PID: 0.0 ppm
					No Recovery 10.8'-12.0' bss			
					End of Sediment Core at 12.0' bss			
15								
					Samples Collected (9/15/16): OC2016-SD-33-4.0/5.0 (1500) OC2016-SD-33-4.0/5.0-FD (1505) OC2016-SD-33-9.0/10.0 (1510) OC2016-SD-33-10.0/10.8 (1515) (Native) OC2016-SD-33-0.0/10.0 (1520) (Waste Characterization) OC2016-SD-33-0.0/10.0 (1520) (Physical Testing)			<u>Abbreviations:</u> HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
20								

PROJECT NUMBER: 679969	CORE NUMBER: SD-34 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 5.0 ft — START : 9/14/16 14:10 — END : 9/14/16 15:30 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.3	MC-1		SILT - soft, very dark gray (5Y 3/1), trace fine sand, trace coarse sand, trace shells			PID: 2.1 ppm PID: 9.4 ppm PID: 1.9 ppm
					No Recovery 2.3'-4.0' bss			
5	4.0	3.2	MC-2		SILT - soft, very dark gray (5Y 3/1), trace fine sand, trace coarse sand, trace shells approximately 20% fine sand from 6.3'-7.2' bss			very light sheen from 4.0'-5.0' bss PID: 17.4 ppm PID: 2.4 ppm PID: 1.2 ppm
					No Recovery 7.2'-8.0' bss			
10	3.0	2.7	MC-3		SILT - soft, very dark gray (5Y 3/1), trace fine sand, trace coarse sand, trace shells			PID: 3.8 ppm
					POORLY GRADED SAND with SILT - dark gray (10YR 4/1), with gravel			PID: 1.0 ppm
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand	3000	717	PID: 0.0 ppm
					No Recovery 10.7'-11.0' bss End of Sediment Core at 11.0' bss			
15					Samples Collected (9/14/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-34-4.0/5.0 (1725) OC2016-SD-34-4.0/5.0-FD (1730) OC2016-SD-34-9.3/10.3 (1735) OC2016-SD-34-10.3/10.7 (1740) (Native)			
20								

PROJECT NUMBER: 679969	CORE NUMBER: SD-35	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.7 ft
START : 9/14/16 13:35
END : 9/14/16 14:00
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.1	3.0	HC-1		ORGANIC SILT - very soft. very dark gray (5Y 3/1), trace fine sand, trace organics and shells			PID: 17.3 ppm PID: 5.3 ppm PID: 9.8 ppm PID: 4.2 ppm PID: 3.5 ppm PID: 1.2 ppm
5	5.0	4.7	MC-1		odor from 4.0'-5.0' bss			PID: 0.8 ppm PID: 0.6 ppm PID: 0.7 ppm
					NATIVE MATERIAL - LEAN CLAY - soft, dark gray (10YR 4/1), trace coarse sand	1000	205	PID: 0.6 ppm
					No Recovery 7.7'-8.0' bss			
					End of Sediment Core at 8.0' bss			
10								
15								
					Samples Collected (9/14/16): OC2016-SD-35-4.0/5.0 (1510) OC2016-SD-35-6.3/7.3 (1515) OC2016-SD-35-6.3/7.3-FD (1520) OC2016-SD-35-7.3/7.7 (1525) (Native)			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
20								

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-36	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 5.6 ft | START : 9/14/16 12:50 | END : 9/14/16 13:30 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	4.0	1.2	MC-1		NATIVE MATERIAL - LEAN CLAY - very stiff, dark gray (10YR 4/1), trace coarse sand	5000 7000	1434 1536	PID: 0.0 ppm
					No Recovery 1.2'-4.0' bss			
5					End of Sediment Core at 4.0' bss			
					Samples Collected (9/14/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
10								

ch2m

PROJECT NUMBER:	CORE NUMBER:
679969	SD-37 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.4 ft | START : 9/14/16 10:45 | END : 9/14/2016 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	3.2	3.1	HC-1		SILT - very soft, very dark gray (5Y 3/1), trace fine sand, trace clay, trace organics trace coarse sand from 0.0'-0.2' bss trace coarse sand at 3.0' bss			PID: 6.3 ppm PID: 5.2 ppm PID: 5.2 ppm PID: 1.8 ppm
	1.7	1.1	MC-1		NATIVE MATERIAL - LEAN CLAY - very stiff, dark gray (10YR 4/1), trace coarse sand	9000	1331	PID: 0.8 ppm
					No Recovery 4.1'-4.7' bss			
5					End of Sediment Core at 4.7' bss			
					Samples Collected (9/14/16): OC2016-SD-37-3.0/4.0 (1420) (Native) OC2016-SD-37-0.0/3.1 (1430) (Physical Testing)			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-38 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 4.6 ft
START : 9/14/16 09:15
END : 9/14/16 09:40
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	1.2	MC-1		SILTY SAND - soft, black (5Y 2.5/1), trace gravel, trace coal, some organics			PID: 1.1 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	2000	1741	PID: 0.0 ppm
					No Recovery 1.2'-4.0' bss			
	5.0	2.3	MC-2		NATIVE MATERIAL - LEAN CLAY - soft, dark gray (10YR 4/1), trace coarse sand			
5					SAA, medium	2000	1229	PID: 0.0 ppm
					SAA, stiff	4000		PID: 0.0 ppm
					No Recovery 6.3'-9.0' bss	0		
					End of Sediment Core at 9.0' bss			
10								
					Samples Collected (9/14/16):			
					OC2016-SD-38-0.7/1.2 (1045) (Native)			
15								

Abbreviations:
HC - Hand Core
MC - Macro Core
SAA - Same As Above
bss - Below Sediment Surface

PROJECT NUMBER: 679969	CORE NUMBER: SD-39	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 3.6 ft | START : 9/14/16 08:35 | END : 9/14/16 09:05 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	3.2	MC-1		SILT - very soft, black (5Y 2.5/1), trace fine sand, trace organics, some odor			PID: 0.0 ppm PID: 2.0 ppm
					ORGANIC SILT - soft, dark olive gray (5Y 3/2), some shells			PID: 1.7 ppm
					No Recovery 3.2'-4.0' bss			
5	5.0	4.7	MC-2		SILT - very soft, black (5Y 2.5/1), trace fine sand, trace organics, some odor			PID: 0.3 ppm PID: 4.9 ppm
					ORGANIC SILT - soft, dark olive gray (5Y 3/2), some shells			PID: 0.4 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand, trace silt, trace shells	1000 400 1000	410	PID: 0.0 ppm PID: 0.0 ppm
					No Recovery 8.7'-9.0' bss			
					End of Sediment Core at 9.0' bss			
10								
15								
					Samples Collected (9/14/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
20								

PROJECT NUMBER: 679969	CORE NUMBER: SD-40	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 3.3 ft | START : 9/13/16 17:15 | END : 9/13/16 09:40 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	0.6	MC-1		ORGANIC SILT - very soft, dark greenish gray (5GY 3/2), trace fine gravel, trace fine sand, with organics			PID: 1.6 ppm
					No Recovery 0.6'-4.0' bss			
					SILT - very soft, dark greenish gray (5GY 3/2), some medium sand, trace organics			PID: 7.5 ppm
5	5.0	3.6	MC-2		ORGANIC SILT - soft, black (5Y 2.5/1), with fine sand, with crushed shells	1000		PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark greenish gray (10BG 4/2)	2500	1126	PID: 0.0 ppm
					SAA, dark gray (10YR 4/1), some sand seams and gravel	1000	307	PID: 0.0 ppm
					No Recovery 7.6'-9.0' bss			
					End of Sediment Core at 9.0' bss			
10								
15								
					Samples Collected (9/14/16):			Abbreviations: HC - Hand Core; MC - Macro Core; SAA - Same As Above; bss - Below Sediment Surface
					OC2016-SD-40-4.5/5.5 (0940) OC2016-SD-40-4.5/5.5-FD (0942) OC2016-SD-40-5.5/6.5 (0945) OC2016-SD-40-6.5/7.5 (0950) (Native) OC2016-SD-40-4.0/6.5 (0940) (Physical Testing)			
20								

PROJECT NUMBER: 679969

CORE NUMBER: SD-41 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 3.8 ft
START : 9/13/16 16:10
END : 9/13/2016
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0				ORGANIC SILT - very soft, black (5Y 2.5/1), sith fine sand, slight odor			PID: 8.4 ppm, light sheen from 0.5'-1.0' bss
							PID: 2.1 ppm
	5.0	3.0	MC-1	NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand	2500	1024	PID: 0.0 ppm
				No Recovery 3.0'-4.0' bss			
5				NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand consistency increasing with depth	2000	717	PID: 0.0 ppm
					2000 1000	614	
					4500		
	5.0	2.9	MC-2	SAA, very stiff	9000	3789	PID: 0.0 ppm
				No Recovery 6.9'-9.0' bss			
				End of Sediment Core at 9.0' bss			
10							
15							
				Samples Collected (9/14/16):			Abbreviations: HC - Hand Core; MC - Macro Core; SAA - Same As Above; bss - Below Sediment Surface
				OC2016-SD-41-2.0/3.0 (1015) (Native)			
20							

ch2m

PROJECT NUMBER:	CORE NUMBER:
679969	SD-42 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 2.9 ft — START : 9/13/16 15:30 — END : 9/13/16 15:45 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					ORGANIC SILTY SAND - soft, black (5Y 2.5/1), trace coarse sand			PID: 0.2 ppm
					ORGANIC SILT = very soft, black (N 2.5/1), with fine sand seams, trace organics, slight odor			PID: 1.6 ppm PID: 10.8 ppm
	5.0	3.7	MC-1		NATIVE MATERIAL - LEAN CLAY - medium, dark greenish gray (5G 4/1), trace coarse sand	1000	123	PID: 1.4 ppm PID: 0.6 ppm
					No Recovery 3.7'-5.0' bss			
5					End of Sediemnt Core at 5.0' bss			
					Samples Collected (9/14/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Visual Core			
10								

PROJECT NUMBER:	CORE NUMBER:
679969	SD-43 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :

WATER DEPTH : 2.0 ft
START : 9/13/16 14:15
END : 9/13/16 15:15
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.6	MC-1		ORGANIC SILT - very soft, greenish black (10Y 2.5/1), trace organics (roots and shells) sand content increases with depth trace gravel at 2.5' bss		123	PID: 0.8 ppm
					No Recovery from 2.6'-5.0' bss			
5	2.0	2.0	MC-2		ORGANIC SILT - very soft, greenish black (10Y 2.5/1), trace organics, trace gravel			PID: 0.5 ppm
					POORLY GRADED FINE SAND - greenish black (10Y 2.5/1), trace fine gravel, trace organics			PID: 0.9 ppm
					NATIVE MATERIAL - LEAN CLAY - stiff, dark gray (10YR 4/1), trace coarse sand, trace fine gravel	1500 2500	819 1516	
	1.5	1.5	MC-3		SAA, very stiff	2600 9000 9000	1085 1843 1843	PID: 0.2 ppm
					End of Sediment Core at 8.5' bss (refusal)			
10								
15								
					Samples Collected (9/13/16): OC2016-SD-43-5.0/6.0 (1625) (MS/MSD) OC2016-SD-43-6.0/7.0 (1630) (Native)			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
20								

ch2m

PROJECT NUMBER: 679969	CORE NUMBER: SD-44	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.8 ft | START : 9/13/16 12:30 | END : 9/13/16 13:50 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.5	MC-1		ORGANIC SILT - very soft, very dark greenish gray (10Y 3/1), trace sand, odor		107	trace sheen from 0.0'-2.5' bss PID: 1.2 ppm PID: 27.8 ppm
					No Recovery 2.5'-5.0' bss			
5	5.0	3.3	MC-2		ORGANIC SILT - very soft, very dark greenish gray (10Y 3/1), trace sand, odor		61	PID: 14.4 ppm
					NATIVE MATERAIL - LEAN CLAY - medium, dark gray (10YR 4/1), trace gravel, trace sand	1200 2000	696 922	PID: 12.0 ppm
					SAA, very stiff	4000	1843	PID: 3.0 ppm
					No Recovery 8.3'-10.0' bss			
10	1.0	0.9	MC-3		NATIVE MATERAIL - LEAN CLAY - hard, dark gray (10YR 4/1), trace gravel, trace sand	9000	1843	PID: 1.5 ppm
					No Recovery 10.9'-11.0' bss End of Sediment Core at 11.0' bss	9000	2048	
15								
					Samples Collected (9/13/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-44-5.0/5.6 (1500) OC2016-SD-44-5.6/6.6 (1505) OC2016-SD-44-5.6/6.6-FD (1510) OC2016-SD-44-6.6/7.6 (1515) (Native) OC2016-SD-44-0.0/6.6 (1530) (Physical Testing)			
20								

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-47	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.6 ft | START : 9/16/16 15:00 | END : 9/16/16 15:15 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.1	MC-1		SILT - soft, black (5Y 2.5/1), trace fine sand, odor			sheen from 0.0-1.0' bss PID: 71 ppm PID: 28 ppm PID: 1.1 ppm
					No Recovery 2.1'-5.0' bss			
5	3.0	3.0	MC-2		SILTY FINE SAND - loose, black (5Y 2.5/1)			PID: 0.0 ppm
					SILTY CLAY - medium, black (5Y 2.5/1)			
					WELL GRADED SAND - dark olive gray (5Y 3/2) trace silt 5.7'-6.5' bss			PID: 0.0 ppm PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1) consistency increases with depth	2000	614	
					SAA, very stiff	7500	1843	PID: 0.0 ppm
					End of Sediment Core at 8.0' bss (refusal)			
10								
					Samples Collected (9/16/16):			
					None - Optional Visual Core			
15								

Abbreviations:
HC - Hand Core
MC - Macro Core
SAA - Same As Above
bss - Below Sediment Surface

PROJECT NUMBER:	CORE NUMBER:	
679969	SD-48	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 2.0 ft — START : 9/16/16 14:30 — END : 9/16/16 14:45 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	3.4	MC-1		SILT - very soft, black (5Y 2.5/1), trace fine sand, trace organics, strong odor			light sheen from 0.0'-3.4' bss; PID: 28.5 ppm; PID: 255 ppm; PID: 161 ppm
					No Recovery 3.4'-5.0' bss			PID: 54 ppm
5	5.0	4.7	MC-2		SILT - very soft, black (5Y 2.5/1), trace fine sand, trace organics, strong odor			PID: 35 ppm; PID: 89 ppm
					POORLY GRADED MEDIUM SAND - dark gray (5Y 4/1), trace silt			PID: 168 ppm; PID: 6.9 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1500	1229	PID: 2.5 ppm
					SAA, very stiff	8000	3072	
					No Recovery 9.7'-10.0' bss			
10					End of Sediment Core at 10.0' bss			
					Samples Collected (9/16/16):			
					None - Optional Visual Core			
15								

Abbreviations:
HC - Hand Core
MC - Macro Core
SAA - Same As Above
bss - Below Sediment Surface

PROJECT NUMBER: 679969	CORE NUMBER: SD-50	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 4.8 ft — START : 9/16/16 14:10 — END : 9/16/16 14:25 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILTY CLAY - soft, trace sand			
								PID: 1.1 ppm
					SAA, very stiff			PID: 5.4 ppm
	5.0	3.7	MC-1			6500	2253	
					SILTY FINE SAND - medium dense, dark olive gray (5Y 3/2), trace gravel, trace coarse sand			PID: 18.6 ppm
					No Recovery 3.7'-5.0' bss			
5					SILT - very soft, dark olive gray (5Y 3/2)			PID: 10.8 ppm
					SILT with FINE SAND - medium, dark olive gray (5Y 3/2)			
								PID: 0.0 ppm
	2.5	2.5	MC-2		WELL GRADED SAND - medium to coarse sand, trace gravel			
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1500	1536	PID: 0.0 ppm
					End of Sediment Core at 7.5' bss			
10					Samples Collected (9/15/16):			Abbreviations:
					OC2016-SD-50-5.0/6.0 (1455) (Archive)			HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
15								

PROJECT NUMBER: 679969	CORE NUMBER: SD-51	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 1.3 ft
START : 9/16/16 13:20
END : 9/16/16 13:50
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	4.2	MC-1		SILT - very soft to soft, trace sand, trace organics, odor			light sheen from 0.0'-7.5' bss PID: 2.8 ppm PID: 100.8 ppm PID: 27.7 ppm PID: 45.8 ppm
					No Recovery 4.2'-5.0' bss			
5	5.0	4.8	MC-2		SILT - very soft to soft, trace sand, trace organics, odor			PID: 47.6 ppm PID: 7.6 ppm
					ORGANIC SILT - trace crushed shells			PID: 0.0 ppm PID: 0.0 ppm
					No Recovery 9.8'-10.0' bss			
10	5.0	3.0	MC-3		ORGANIC SILT - trace crushed shells			PID: 0.0 ppm PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace sand	1000	205	
					No Recovery 13.0'-15.0' bss			
15					End of Sediment Core at 15.0' bss			
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-PW-51-6.0/7.0 (1530) (Archive)			
20								

ch2m

PROJECT NUMBER:	CORE NUMBER:
679969	SD-52 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence — LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT — DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : — SEDIMENT ELEVATION : — NATIVE CLAY ELEVATION :

WATER DEPTH : 3.7 ft — START : 9/16/16 12:45 — END : 9/16/16 13:15 — LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	2.1	MC-1		SILT - very soft, dark olive gray (5Y 3/2), trace fine sand, trace organics, trace shells			PID: 1.2 ppm
					No Recovery 2.1'-5.0' bss			PID: 0.6 ppm
5	5.0	4.1	MC-2		SILT - very soft, dark olive gray (5Y 3/2), trace fine sand, trace organics, trace shells			PID: 1.9 ppm PID: 1.2 ppm
					ORGANIC SILT - soft, dark olive gray (5Y 3/2)			PID: 0.6 ppm PID: 0.7 ppm
					LEAN CLAY - medium, with medium sand			PID: 0.0 ppm
					No Recovery 9.1'-10.0' bss			
10	2.0	1.8	MC-3		POORLY GRADED FINE SAND - dark olive gray (5Y 3/2), trace silt			
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1000 3500	410 1229	PID: 0.0 ppm
					SAA, very stiff	7000	3625	PID: 0.0 ppm
					No Recovery 11.8'-12.0 bss			
					End of Sediment Core at 12.0' bss			
15								
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-52-5.0/6.0 (1430) (Archive)			
20								

ch2m

PROJECT NUMBER:	CORE NUMBER:
679969	SD-54 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 2.6 ft | START : 9/16/16 11:55 | END : 9/16/16 12:20 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0	5.0	3.2	MC-1		SILT - very soft, black (5Y 2.5/1), with fine sand, trace organics, light odor			faint sheen from 0.0'-3.2' bss PID: 13.4 ppm PID: 2.4 ppm PID: 36 ppm
					No Recovery 3.2'-5.0' bss			
5	5.0	4.8	MC-2		SILT - very soft, black (5Y 2.5/1), with fine sand, trace organics, light odor			PID: 1.9 ppm PID: 2.4 ppm PID: 3.8 ppm
					ORGANIC SILT - black (5Y 2.5/2), few crushed shells throughout			PID: 2.1 ppm PID: 0.0 ppm
					No Recovery 9.8'-10.0' bss			
10	2.5	2.4	MC-3		SILT - very soft, black (5Y 2.5/1), with fine sand, trace organics			PID: 4.9 ppm
					ORGANIC SILT - black (5Y 2.5/2), few crushed shells throughout		819	PID: 1.9 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (5Y 4/1), trace coarse sand	1600	717	PID: 0.4 ppm
					SAA, stiff	3500		
					No Recovery 12.4'-12.5' bss			
					End of Sediment Core at 12.5' bss			
15								
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					OC2016-SD-6.0/7.0 (1400) (Archive)			
20								

PROJECT NUMBER: 679969

CORE NUMBER: SD-55

SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence

LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT

DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION :

SEDIMENT ELEVATION :

NATIVE CLAY ELEVATION :

WATER DEPTH : 2.6 ft

START : 9/16/16 10:55

END : 9/16/16 11:10

LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILTY FINE SAND - loose			PID: 4.5 ppm
					SILT - soft, black (5Y 2.5/1), trace fine sand			PID: 8.3 ppm
					ORGANIC SILT - soft, black (5Y 2.5/1), trace crushed shells			PID: 4.3 ppm PID: 1.1 ppm
	5.0	2.8	MC-1					PID: 0.0 ppm
					NATIVE MATERIAL - LEAN CLAY - dark greenish gray (10Y 4/1), trace sand	1000	307	PID: 0.0 ppm
					No Recovery 2.8'-5.0' bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/16/16):			
					None - Optional Visual Core			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-56 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 5.4 ft
START : 9/16/16 10:35
END : 9/16/16 10:45
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, greenish black (10Y 2.5/1), with fine sand, trace organics			PID: 4.8 ppm PID: 2.9 ppm PID: 2.9 ppm
					SILTY CLAY - soft, greenish black (10Y 2.5/1), trace fine sand			PID: 0.7 ppm
	5.0	2.9	MC-1		NATIVE MATERIAL - LEAN CLAY - medium, dark greenish gray (10Y 3/1), trace coarse sand	1000 1000	410 205	PID: 0.0 ppm
					No Recovery 2.9'-5.0 bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Optional Visual Core			
10								

PROJECT NUMBER: 679969

CORE NUMBER: SD-58 **SHEET** 1 **OF** 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence
LOCATION : Toledo, OH
DRILLING EQUIPMENT AND METHOD : DPT
DRILLING CONTRACTOR : Coleman Engineering Co.
WATER ELEVATION :
SEDIMENT ELEVATION :
NATIVE CLAY ELEVATION :
WATER DEPTH : 3.2 ft
START : 9/16/16 09:30
END : 9/16/16 09:45
LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					ORGANIC SILT - very soft, black (5Y 2.5/1), with fine sand, trace organics, light odor			PID: 1.0 ppm PID: 3.1 ppm PID: 2.8 ppm PID: 2.5 ppm
	5.0	3.5	MC-1		SILTY MEDIUM SAND - medium dense, black (5Y 2.5/1)			PID: 4.2 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1000	307	PID: 0.0 ppm
					SAA, very stiff	7000	1741	
					No Recovery 3.5'-5.0' bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/16/16):			
					None - Optional Visual Core			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-60 SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.5 ft | START : 9/16/16 08:50 | END : 9/16/16 09:15 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					ORGANIC SILT - very soft, black (5Y 2.5/1), with fine sand, trace organics			
								PID: 5.1 ppm
								PID: 2.4 ppm
								PID: 6.3 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, dark gray (10YR 4/1), trace coarse sand	1600	614	
	5.0	2.6	MC-1		SAA, very stiff	7000	1741	PID: 0.0 ppm
					No Recovery 2.6'-5.0' bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/16/16):			
					None - Optional Visual Core			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
10								

PROJECT NUMBER: 679969	CORE NUMBER: SD-61	SHEET 1 OF 1

SEDIMENT CORE LOG

PROJECT : Lower Otter Creek and Confluence | LOCATION : Toledo, OH

DRILLING EQUIPMENT AND METHOD : DPT | DRILLING CONTRACTOR : Coleman Engineering Co.

WATER ELEVATION : | SEDIMENT ELEVATION : | NATIVE CLAY ELEVATION :

WATER DEPTH : 4.7 ft | START : 9/16/16 10:00 | END : 9/16/16 10:30 | LOGGER : S. Maihofer

DEPTH BELOW TOP OF SEDIMENT (ft)	PENETRATION (ft)	RECOVERY (ft)	CORE TYPE	SYMBOLIC LOG	SOIL DESCRIPTION: SEDIMENT TEXTURE, COLOR, RELATIVE DENSITY OR CONSISTENCY, & SOIL STRUCTURE	POCKET PEN (psf)	TORVANE (psf)	COMMENTS: PID READING, SAMPLE ID, QA/QC, ETC.
0					SILT - very soft, black (N 2.5/1), with fine sand			
					sand seam from 1.0'-1.3' bss			PID: 1.1 ppm
					NATIVE MATERIAL - LEAN CLAY - medium, very dark greenish gray (5GY 3/1), trace coarse sand	500	205	PID: 0.5 ppm
	5.0	2.5	MC-1			1000	205	PID: 0.2 ppm
					No Recovery 2.5'-5.0' bss			
5					End of Sediment Core at 5.0' bss			
					Samples Collected (9/16/16):			Abbreviations: HC - Hand Core MC - Macro Core SAA - Same As Above bss - Below Sediment Surface
					None - Optional Visual Core			
10								

PROJECT NUMBER:	BORING NUMBER:
679969	SO-01 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Lower Otter Creek and Confluence — PROJECT LOCATION: Toledo, OH

ELEVATION: — DRILLING CONTRACTOR : Coleman Engineering Co.

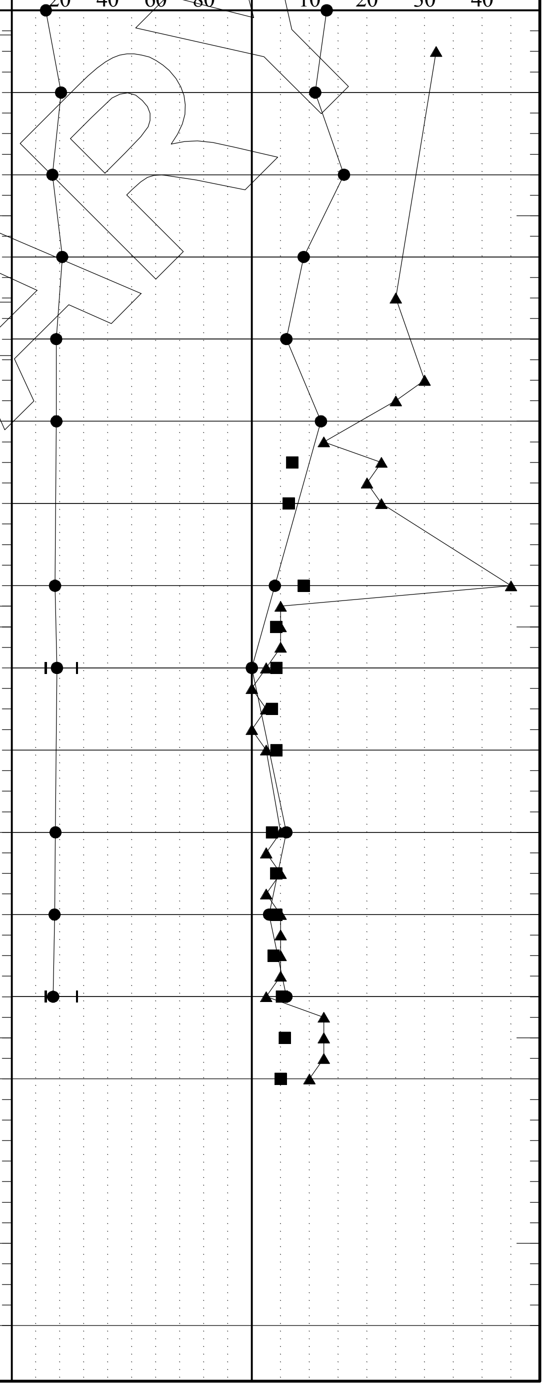
DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : dry — START : 9/14/16 09:50 — END : 9/14/16 11:45 — LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0				TOPSOIL - brown (10YR 4/3)
	0.0–2.0	1.5	SS - 1	4-6-7-9 (13)	SILTY CLAY - damp, stiff, yellowish brown (10YR 5/4), some roots and mottling
	2.0–4.0	1.8	SS - 2	5-6-5-6 (11)	SAA, pale brown (10YR 6/3), interbedded with light yellowish brown (2.5Y 6/4) silt
5	4.0–6.0	1.0	SS - 3	6-7-9-4 (16)	SAA, very stiff, brown (10YR 4/3) SAA, moist, sandy
	6.0–8.0	1.6	SS - 4	4-5-4-2 (9)	SILTY SAND - moist, loose, dark gray (10YR 4/1)
10	8.0–10.0	1.6	SS - 5	6-3-3-6 (6)	LEAN CLAY - moist, stiff, dark yellowish brown (10YR 4/4)
	10.0–12.0	2.0	SS - 6	4-5-7-9 (12)	yellowish brown (10YR 5/8) sand seam at 10.0' bss SAA, trace sand and gravel
	12.0–14.0	2.0	ST - 1		wet on top of Shelby tube at 12.0' bgs
15	14.0–16.0	1.8	SS - 7	1-2-2-4 (4)	LEAN CLAY - moist, medium, dark gray (10YR 4/1), trace gravel
	16.0–18.0	2.0	SS - 8	WR-WH-WH-WH	SAA, very soft
20	18.0–20.0	2.0	ST - 2		
	20.0–22.0	2.0	SS - 9	WH-3-3-3 (6)	SAA, medium
	22.0–24.0	2.0	SS - 10	WH-WH-3-4 (3)	SAA, soft wet at bottom of Shelby tube at 22.0' bgs
25	24.0–26.0	2.0	SS - 11	WH-3-3-5 (6)	SAA, medium
	26.0				wet at bottom of split spoon at 26.0' bgs End of Boring at 26.0' bgs
30					

● MOISTURE CONTENT; ATTERBERG LIMITS PLASTIC — LIQUID (20 40 60 80)

■ TORVANE (tsf) 1.0 2.0 3.0 4.0; ▲ POCKET PEN (tsf) 1.0 2.0 3.0 4.0; ● BLOW COUNT (N) 10 20 30 40



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

PROJECT NUMBER: 679969

BORING NUMBER: SO-02 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Lower Otter Creek and Confluence

PROJECT LOCATION: Toledo, OH

ELEVATION:

DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

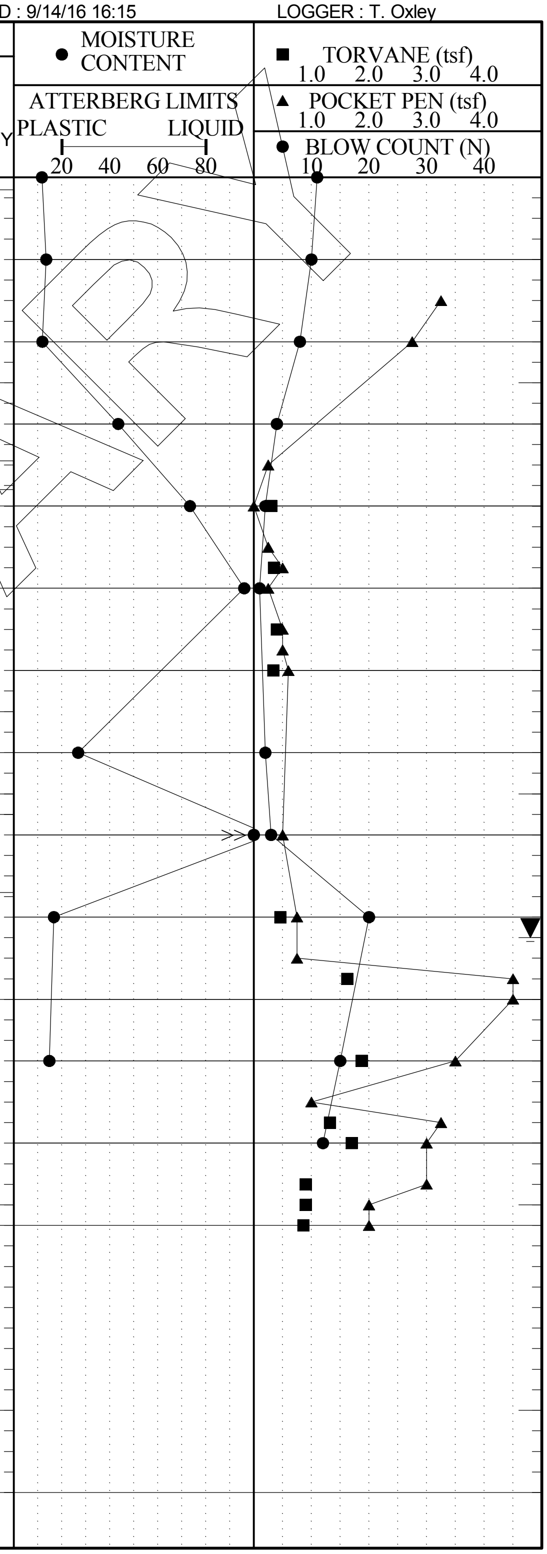
WATER LEVELS : ▽ 18.5

START : 9/14/16 14:15

END : 9/14/16 16:15

LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0 – 2.0	0.8	SS - 1	4-5-6-12 (11)		TOPSOIL - brown (10YR 4/3) LEAN CLAY - moist, stiff, grayish brown (10YR 5/2), gravelly
	2.0 – 4.0	1.9	SS - 2	3-4-6-6 (10)		SAA, gray (10YR 5/1), with large gravel, some roots
5	4.0 – 6.0	0.6	SS - 3	5-5-3-3 (8)		
	6.0 – 8.0	1.6	SS - 4	2-2-2-2 (4)		ORGANIC SILT - moist, medium, black (10YR 2/1)
10	8.0 – 10.0	1.6	SS - 5	1-1-1-1 (2)		LEAN CLAY - moist, medium, dark gray (10YR 4/1) ORGANIC SILT - moist, soft, very dark brown (10YR 2/2), with roots
	10.0 – 12.0	1.8	SS - 6	1-1 (1)		SAA, trace sand, with roots and shells
	12.0 – 14.0	1.5	ST - 1			WELL GRADED SAND - wet, very dark brown (10YR 2/2), some fine gravel
15	14.0 – 16.0	1.0	SS - 7	1-1-1-1 (2)		ORGANIC SILT - moist, soft, very dark brown (10YR 2/2), with roots LEAN CLAY - wet, soft, dark gray (10YR 4/1), silty, with some organics and sand
	16.0 – 18.0	1.3	SS - 8	WH-WH-3-3 (3)		LEAN CLAY - moist, very stiff, dark gray (10YR 4/1), silty, trace gravel
20	18.0 – 20.0	1.7	SS - 9	3-8-12-14 (20)		
	20.0 – 21.5	1.6	ST - 2			SAA, dark brown (10YR 3/3)
	21.5 – 23.5	1.5	SS - 10	4-6-9-12 (15)		SAA. dark grayish brown (10YR 4/2), trace coarse sand
25	23.5 – 25.5	1.4	SS - 11	3-4-8-11 (12)		SAA, stiff, dark gray (10YR 4/1)
						End of Boring at 25.5' bgs
30						



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

PROJECT NUMBER:	BORING NUMBER:
679969	SO-04 SHEET 1 OF 1

SOIL BORING LOG

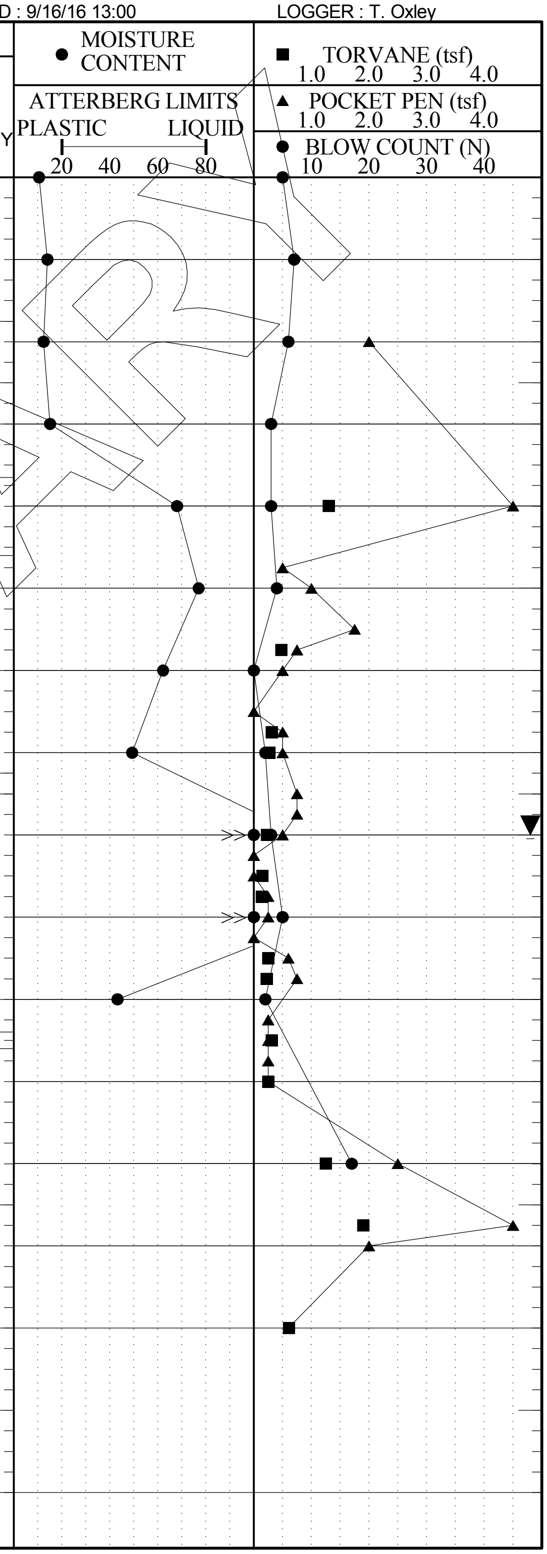
PROJECT : Lower Otter Creek and Confluence — PROJECT LOCATION: Toledo, OH

ELEVATION: — DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : ▼ 16.0 — START : 9/16/16 10:50 — END : 9/16/16 13:00 — LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft) INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION (SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY)
0.0–2.0	1.6	SS - 1	2-2-3-4 (5)	LIGNITE AND COAL DUST - moist, loose, black (10YR 2/1), with gravel
2.0–4.0	1.8	SS - 2	3-4-3-5 (7)	SAA, clayey
4.0–6.0	0.5	SS - 3	4-3-3-2 (6)	CLAYEY GRAVEL - moist, medium dense, dark brown (10YR 3/3), trace coarse sand
6.0–8.0	1.0	SS - 4	1-2-1-4 (3)	LEAN CLAY - moist, soft, dark yellowish brown (10YR 4/4) LEAN CLAY - moist, soft, grenish gray (10Y 5/1), trace sand
8.0–10.0	1.2	SS - 5	3-1-2-1 (3)	SAA, trace gravel FIBROUS PEAT - moist, soft, very dark grayish brown (10YR 3/2), with roots and shells
10.0–12.0	1.3	SS - 6	1-2-2-3 (4)	SAA, medium, dark brown (10YR 3/3)
12.0–14.0	1.5	SS - 7	WH-WH-WH-2	ORGANIC SILT - moist, very soft, black (10YR 2/1), with roots and leaves
14.0–16.0	1.7	SS - 8	WH-1-1-2 (2)	FIBROUS PEAT - moist, soft, very dark grayish brown (10YR 3/2), with roots and shells
16.0–18.0	2.0	SS - 9	1-1-2-2 (3)	SAA, wet
18.0–20.0	2.0	SS - 10	1-2-3-4 (5)	SAA, moist, medium
20.0–22.0	2.0	SS - 11	WH-WH-2-3 (2)	LEAN CLAY - moist, soft, very dark gray (10YR 3/1), trace roots
22.0–24.0	2.0	ST - 1		LEAN CLAY - moist, soft, dark gray (10YR 4/1), trace gravel SAA, dark grayish brown (10YR 4/2)
24.0–26.0	0.9	SS - 12	5-7-10-11 (17)	SAA, very stiff
26.0–28.0	2.0	ST - 2		
				End of Boring at 28.0' bgs



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

PROJECT NUMBER:	BORING NUMBER:
679969	SO-05 SHEET 1 OF 1

SOIL BORING LOG

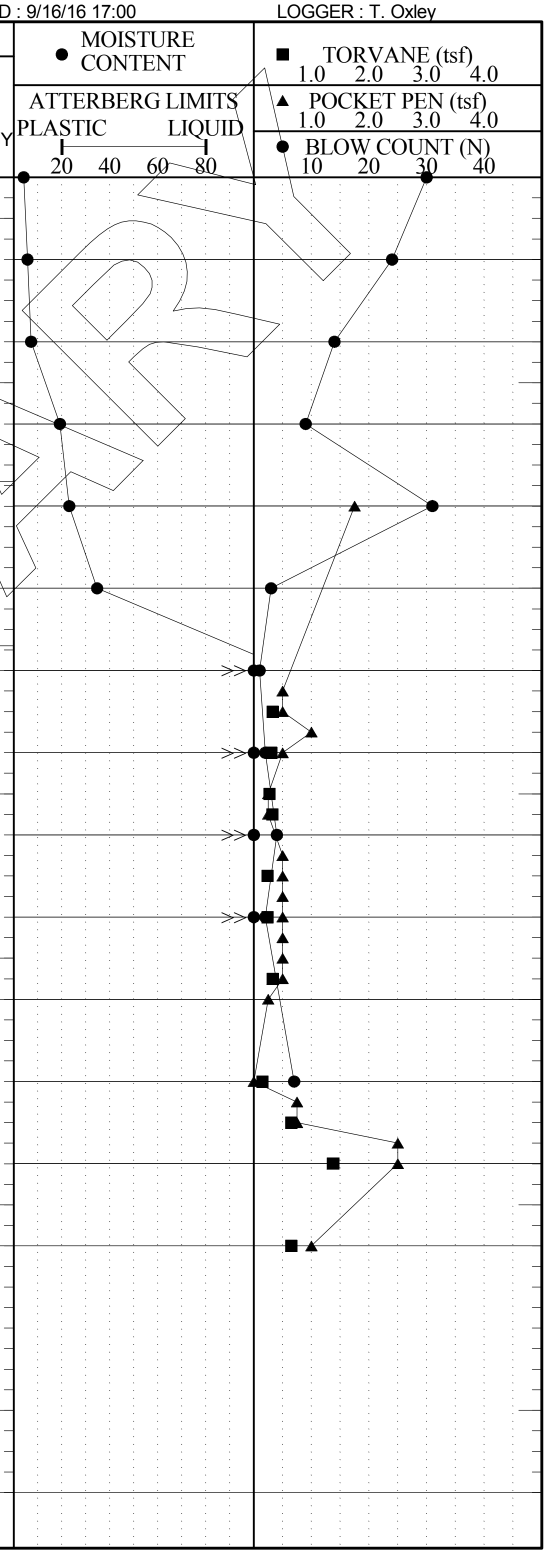
PROJECT : Lower Otter Creek and Confluence PROJECT LOCATION: Toledo, OH

ELEVATION: DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : dry START : 9/16/16 14:50 END : 9/16/16 17:00 LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0 – 2.0	1.3	SS - 1	8-10-20-26 (30)	TOPSOIL - very dark gray (10YR 3/1) LIGNITE AND COAL DUST - moist, loose, black (10YR 2/1), with gravel
	2.0 – 4.0	1.4	SS - 2	13-14-10-7 (24)	SAA, medium dense, black (10YR 2/1)
5	4.0 – 6.0	1.1	SS - 3	8-8-6-5 (14)	
	6.0 – 8.0	0.9	SS - 4	9-4-5-5 (9)	LEAN CLAY - moist, stiff, very dark gray (2.5Y 3/1)
10	8.0 – 10.0	0.6	SS - 5	7-10-21-28 (31)	SAA, hard rock chunk in toe of sampler at 10.0' bgs
	10.0 – 12.0	1.1	SS - 6	3-2-1-1 (3)	ORGANIC SILT - moist, soft, black (10YR 2/1), with roots and leaves, potential diesel staining and odor
	12.0 – 14.0	1.6	SS - 7	2-1-2 (1")	FIBROUS PEAT - moist, very soft, dark brown (10YR 3/3) with roots and shells
15	14.0 – 16.0	1.7	SS - 8	1-1-1-1 (2)	SAA, soft
	16.0 – 18.0	2.0	SS - 9	1-2-2-3 (4)	SAA, medium
20	18.0 – 20.0	2.0	SS - 10	1-1-1-2 (2)	SAA, soft LEAN CLAY - moist, soft, very dark grayish brown (10YR 3/2), trace roots
	20.0 – 22.0	0.4	ST - 1		SAA, very dark gray (10YR 3/1)
	22.0 – 24.0	2.0	SS - 11	WH-3-4-6 (7)	SAA, medium, dark gray (10YR 4/1)
25	24.0 – 26.0	1.0	ST - 2		SAA, dark grayish brown (10YR 4/2)
					End of Boring at 26.0' bgs
30					



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

PROJECT NUMBER:	BORING NUMBER:
679969	SO-07 SHEET 1 OF 1

SOIL BORING LOG

PROJECT : Lower Otter Creek and Confluence

PROJECT LOCATION: Toledo, OH

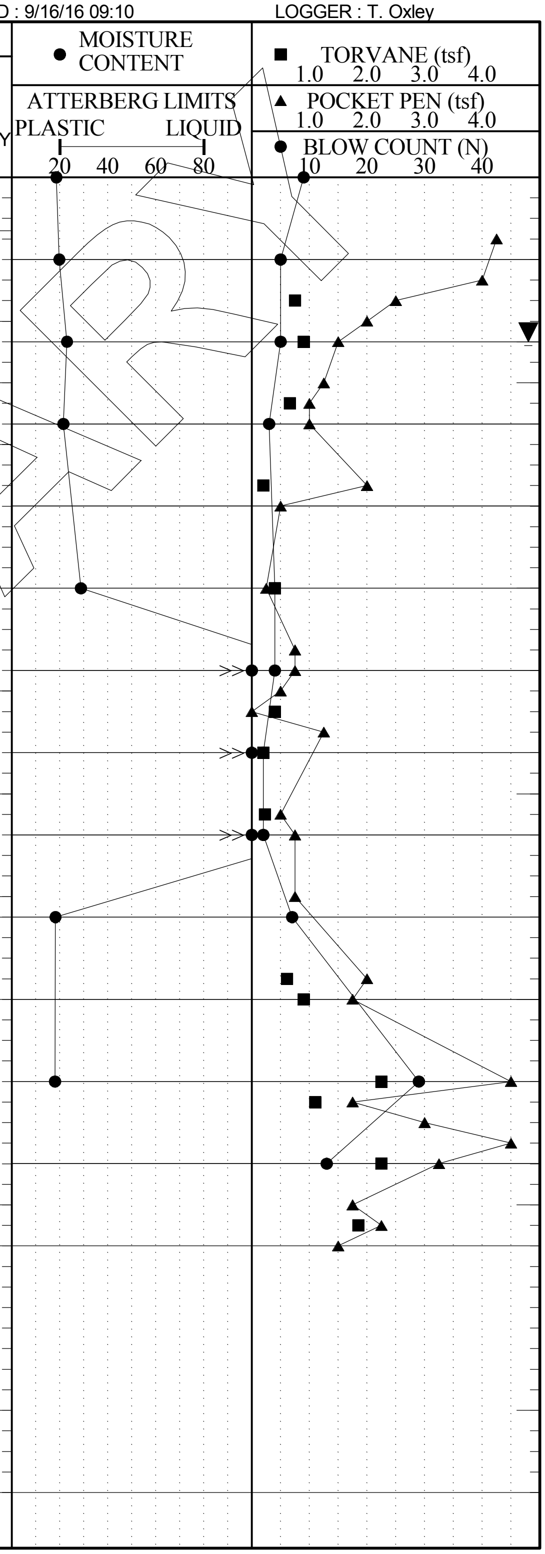
ELEVATION:

DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : ▼ 4.0 | START : 9/15/16 15:45 | END : 9/16/16 09:10 | LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0 – 2.0	1.5	SS - 1	4-4-5-7 (9)		POORLY GRADED GRAVEL - damp, medium dense, black (10YR 2/1), sandy LEAN CLAY - moist, stiff, dark brown (10YR 3/3), silty
	2.0 – 4.0	2.0	SS - 2	3-3-2-4 (5)		SAA, medium LEAN CLAY - moist, medium, dark yellowish brown (10YR 4/4), trace gravel
5	4.0 – 6.0	1.3	SS - 3	3-2-3-3 (5)		
	6.0 – 8.0	1.1	SS - 4	1-2-1-1 (3)		SAA, soft LEAN CLAY - moist, soft, very dark gray (10YR 3/1)
10	8.0 – 10.0	1.4	ST - 1			SAA, dark grayish brown (10YR 4/2) water on top of Shelby tube at 8.0' bgs
	10.0 – 12.0	1.0	SS - 5	2-2-2-2 (4)		SAA, wet, with black silty sand seams
	12.0 – 14.0	2.0	SS - 6	WH-2-2-2 (4)		SAA, medium ORGANIC SILT - moist, medium, black (10YR 2/1), with shells and roots
15	14.0 – 16.0	1.0	SS - 7	WH-WH-2-2 (2)		SAA, soft
	16.0 – 18.0	1.3	SS - 8	WH-1-1-1 (2)		LEAN CLAY with GRAVEL - wet, soft, dark gray (10YR 4/1), sandy
20	18.0 – 20.0	1.0	SS - 9	3-3-4-7 (7)		SAA, medium, trace gravel
	20.0 – 22.0	2.0	ST - 2			SAA, dark grayish brown (10YR 4/2)
	22.0 – 24.0	2.0	SS - 10	12-12-17-20 (29)		SAA, very stiff
25	24.0 – 26.0	1.4	SS - 11	5-5-8-12 (13)		SAA, stiff
						End of Boring at 26.0' bgs
30						



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

ch2m

PROJECT NUMBER:	BORING NUMBER:
679969	SO-08 SHEET 1 OF 1

SOIL BORING LOG

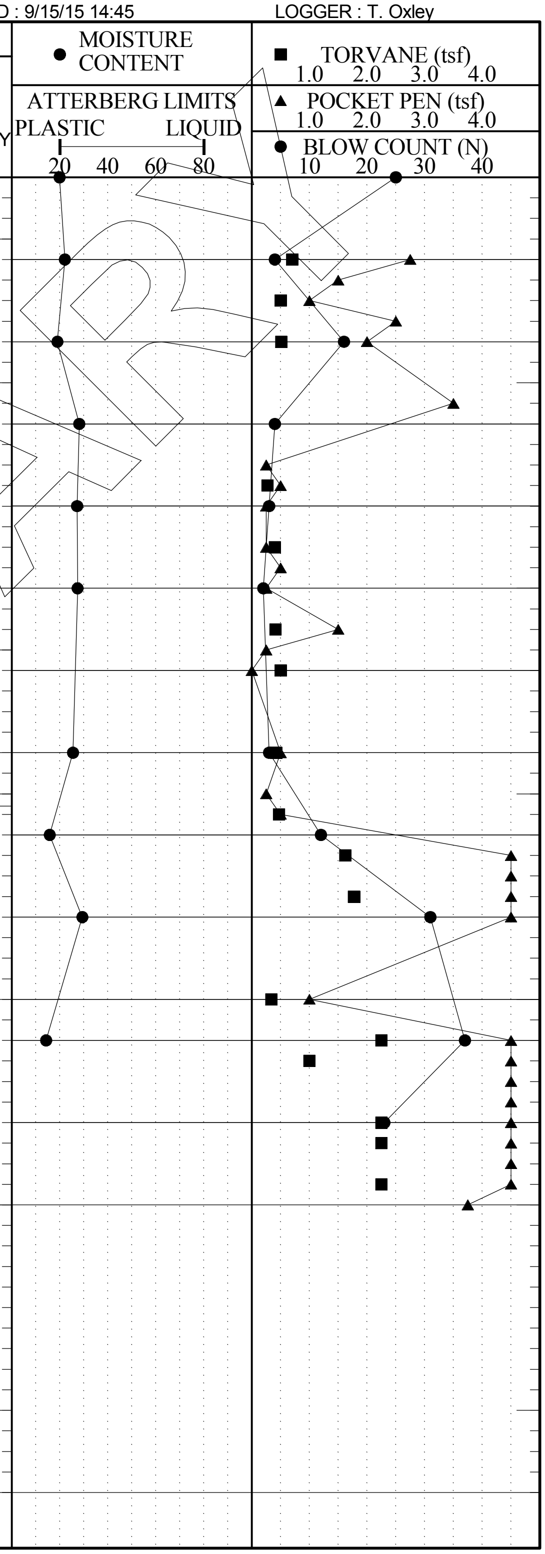
PROJECT : Lower Otter Creek and Confluence | PROJECT LOCATION: Toledo, OH

ELEVATION: | DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : dry | START : 9/15/16 13:00 | END : 9/15/15 14:45 | LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0 – 2.0	1.3	SS - 1	16-17-8-5 (25)	POORLY GRADED GRAVEL - damp, medium dense, gray (10YR 5/1), sandy
	2.0 – 4.0	2.0	SS - 2	2-2-2-4 (4)	LEAN CLAY - moist, very stiff, dark yellowish brown (10YR 4/4) SAA, medium
5	4.0 – 6.0	1.0	SS - 3	4-11-5-6 (16)	SAA, very stiff, some glass and slag pieces, trace gravel
	6.0 – 8.0	1.1	SS - 4	1-2-2-1 (4)	SAA, medium
10	8.0 – 10.0	1.4	SS - 5	1-1-2-2 (3)	SAA, soft
	10.0 – 12.0	1.4	SS - 6	WH-1-1-2 (2)	
	12.0 – 14.0	2.2	ST - 1		LEAN CLAY - moist, soft, dark gray (10YR 4/1), trace gravel
15	14.0 – 16.0	0.9	SS - 7	WH-1-2-2 (3)	ORGANIC SILT - moist, soft, black (10YR 2/1), with roots and organics LEAN CLAY - moist, soft, very dark grayish brown (2.5Y 3/2), trace gravel
	16.0 – 18.0	1.7	SS - 8	WH-4-8-12 (12)	SAA, stiff, dark grayish brown (10YR 4/2) SAA, dark yellowish brown (10YR 4/4)
20	18.0 – 20.0	0.4	SS - 9	5-14-17-20 (31)	SAA, hard, dark grayish brown (10YR 4/2)
	20.0 – 21.0	1.4	ST - 2		SAA, dark yellowish brown (10YR 4/4), trace gravel
	21.0 – 23.0	2.0	SS - 10	7-17-20-27 (37)	SAA, dark grayish brown (10YR 4/2), with dark yellowish brown (10YR 4/6) mottles
25	23.0 – 25.0	2.0	SS - 11	6-16-13-15 (29)	SAA, very stiff
					End of Boring at 25.0' bgs
30					



Abbreviations:
SS - Split Spoon
ST - Shelby Tube
SAA - Same As Above
bgs - Below Ground Surface

SOIL BORING LOG

PROJECT NUMBER:	BORING NUMBER:	
679969	SO-09	SHEET 1 OF 1

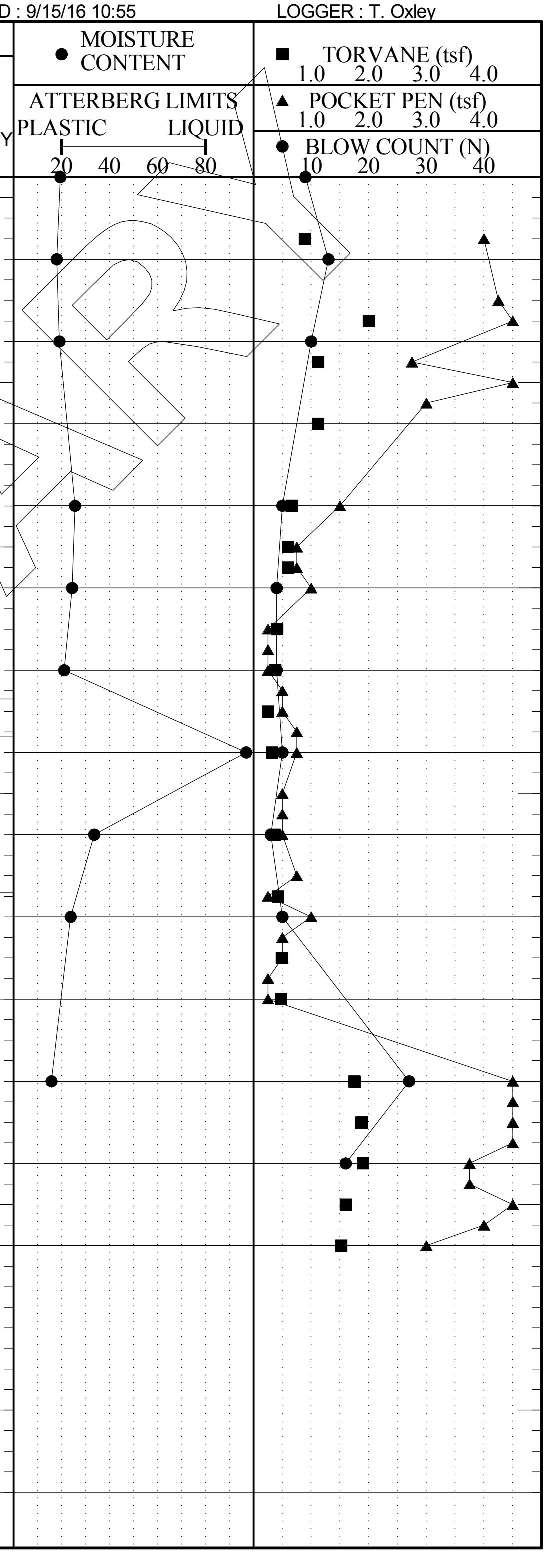
PROJECT : Lower Otter Creek and Confluence PROJECT LOCATION: Toledo, OH

ELEVATION: DRILLING CONTRACTOR : Coleman Engineering Co.

DRILLING EQUIPMENT AND METHOD : D50, #339, HSA

WATER LEVELS : dry START : 9/15/16 08:45 END : 9/15/16 10:55 LOGGER : T. Oxley

DEPTH BELOW EXISTING GRADE (ft)	INTERVAL (ft)	RECOVERY (ft)	#TYPE	STANDARD PENETRATION TEST RESULTS 6"-6"-6"-6" (N)	SYMBOLIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY
	0.0 – 2.0	1.5	SS - 1	5-3-6-7 (9)		TOPSOIL - very dark brown (10YR 2/2), sitly with gravel SILTY CLAY - moist, stiff, dark yellowish brown (10YR 4/4), some mottling
	2.0 – 4.0	1.5	SS - 2	5-5-8-10 (13)		
5	4.0 – 6.0	2.0	SS - 3	4-5-5-6 (10)		
	6.0 – 8.0	1.5	ST - 1			
10	8.0 – 10.0	1.4	SS - 4	2-2-3-3 (5)		SAA, medium, trace gravel LEAN CLAY - moist, medium, very dark gray (10YR 3/1)
	10.0 – 12.0	1.8	SS - 5	1-2-2-2 (4)		SAA, dark yellowish brown (10YR 4/4), some gray (10YR 5/1) mottling
	12.0 – 14.0	1.7	SS - 6	1-2-2-2 (4)		LEAN CLAY - moist, soft, dark gray (10YR 4/1)
15	14.0 – 16.0	1.5	SS - 7	WH-2-3-3 (5)		ORGANIC SILT - moist, medium, black (10YR 2/1), with organics and roots
	16.0 – 18.0	1.4	SS - 8	WH-1-2-2 (3)		LEAN CLAY - moist, soft, very dark gray (2.5Y 3/1), trace gravel
20	18.0 – 20.0	1.8	SS - 9	WH-2-3-2 (5)		SAA, medium, trace roots
	20.0 – 22.0	1.8	ST - 2			SAA, dark grayish brown (10YR 4/2)
	22.0 – 24.0	2.0	SS - 10	6-12-15-16 (27)		SAA, very stiff, trace gravel
25	24.0 – 26.0	2.0	SS - 11	4-6-10-13 (16)		SAA, dark yellowish brown (10YR 4/6) mottling
						End of Boring at 26.0' bgs
30						Abbreviations: SS - Split Spoon ST - Shelby Tube SAA - Same As Above bgs - Below Ground Surface



Attachment 2
Photograph Log

Attachment 2A – Photograph Log
Geotechnical Bank Sampling

SO-01, 0-2'.


SO-01, 12'.

SO-01, 10-12'.


SO-01, 14'.

SO-01, 14-16'.

SO-01, 18-20'.

SO-01, 16-18'.

SO-01, 2-4'.

SO-01, 20-22'.

SO-01, 24-26'.

SO-01, 22-24'.

SO-01, 4-6'.

SO-01, 6-8'.

SO-01, Drilling Activities.

SO-01, 8-10'.

SO-01, Removing Augers.

SO-01, Restored.

SO-01, Setup.

SO-01, Shelby Tube Sample.

SO-02, 0-2'.

SO-02, 14'.

SO-02, 12-14'.

SO-02, 14-16'.

SO-02, 16-18'.

SO-02, 2-4'.

SO-02, 18-20'.

SO-02, 20-21.5'.

SO-02, 21.5'.

SO-02, 23.5-25.5'.

SO-02, 21.5-23.5'.

SO-02, 4-6'.

SO-02, 8-10'.

SO-04, 0-2'.


SO-02, Restored.

SO-04, 10-12'.

SO-04, 12-14'.

SO-04, 16-18'.

SO-04, 14-16'.

SO-04, 18-20'.

SO-04, 22-24'.

SO-04, 26-28'.

SO-04, 24-26'.

SO-04, 6-8'.

SO-04, 8-10'.


SO-04, Restored.


SO-04, Bentonite Cap.


SO-04, Setup.

SO-05 Setup.

SO-05, 10-12'.

SO-05, 0-2'.

SO-05, 12-14'.

SO-05, 14-16'.

SO-05, 18-20'.

SO-05, 16-18'.

SO-05, 2-4'.

SO-05, 20-22'.

SO-05, 24-26'.

SO-05, 22-24'.

SO-05, 4-6'.

SO-05, 8-10'.

SO-07, 0-2'.

SO-05, Restored.

SO-07, 10-12'.

SO-07, 12-14'.

SO-07, 16-18'.

SO-07, 14-16'.

SO-07, 18-20'.

SO-07, 2-4'.

SO-07, 22-24'.

SO-07, 20-22'.

SO-07, 24-26'.

SO-07, 6-8'.

SO-07, Restored.

SO-07, 8-10'.

SO-07, Rig Placement (14' bgs).

SO-07, Setup.

SO-08, 0-2'.

SO-07, Split Spoon Sample.

SO-08, 10-12'.

SO-08, 12-14'.

SO-08, 14-16'.


SO-08, 14'.

SO-08, 16-18'.

SO-08, 18-20'.

SO-08, 2-4'.


SO-08, 20-21'.

SO-08, 21'.

SO-08, 23-25'.

SO-08, 21-23'.

SO-08, 4-6'.

SO-08, 6-8'.


SO-08, After Drilling Activities.

SO-08, 8-10'.

SO-09, 0-2'.

SO-09, 10-12'.

SO-09, 14-16'.

SO-09, 12-14'.

SO-09, 16-18'.

SO-09, 18-20'.

SO-09, 20-22'.

SO-09, 2-4'.

SO-09, 22-24'.

SO-09, 24-26'.

SO-09, 6-8'.

SO-09, 4-6'.

SO-09, 8-10'.

SO-09, After Drilling Activities.

SO-09, Setup.

Attachment 2B – Photograph Log
Otter Creek Confluence Sampling

SD-01 Ponar 01.

SD-02 Ponar 01.

SD-01 Ponar 02.

SD-02 Ponar 02.

SD-03 Ponar 01.

SD-03 Ponar 03.

SD-03 Ponar 02.

SD-04 Ponar 01.

SD-04 Ponar 02.

SD-05 Ponar 02.

SD-05 Ponar 01.

SD-05 Ponar 03.

SD-06 Ponar 01.

SD-07 Ponar 01.

SD-06 Ponar 02.

SD-07 Ponar 02.


SD-08 Ponar 01.


SD-09 Ponar 01.


SD-08 Ponar 02.


SD-09 Ponar 02.

SD-10 Ponar 01.

SD-11 Location.

SD-10 Ponar 02.

SD-11 Ponar 01.

SD-11 Ponar 02.

SD-13 Ponar Grab 01.

SD-12 Ponar Grab 01.

SD-13 Ponar Grab 02.

SD-14 Ponar Grab 01.

SD-15 Ponar Grab 01.

SD-15 Location Sheen.

SD-15 Ponar Grab 02.

SD-16 Ponar Grab 01.

SD-18 Ponar Grab 01.

SD-17 Ponar Grab 01.

SD-18 Ponar Grab 02.

SD-19 Ponar 01.

SD-21 Ponar 01.

SD-20 Ponar 01.

SD-22 Ponar 01.

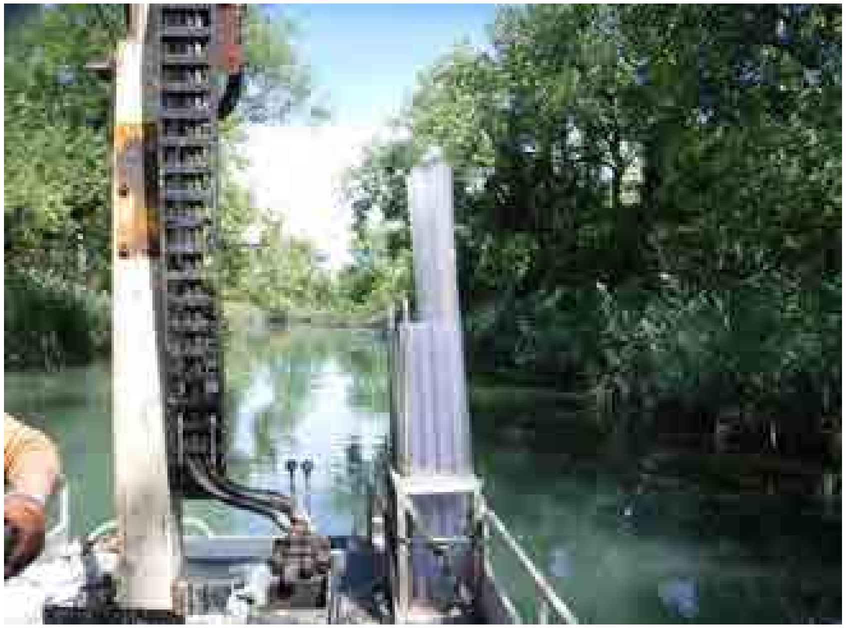
SD-22 Ponar 02.

Attachment 2C – Photograph Log
Otter Creek Sampling


Otter Creek near confluence looking north.


SD26, SD25 and 24 looking south.


SD26, SD25 and 24 looking north.


SD28 looking north.

SD28 looking south.

SD29 looking south.

SD29 looking north.

SD31 and SD30 looking north.

SD31 and SD30 looking toward west bank.

SD32 looking north.

SD31 looking south.

SD32 looking south.

SD35 looking north.

SD36 looking north.

SD35 looking south.

SD36 looking south.

SD37 looking north.

SD38 looking north.

SD37 looking south.

SD38 looking south.

SD39 looking north.

SD41 looking north.

SD39 looking south.

SD41 looking south.

SD42 looking north.

SD43 looking north.

SD42 looking south.

SD43 looking south.

SD44 looking north.

SD44 looking south.

Attachment 2D – Photograph Log
Sediment Core Processing

SD-01, 0-4.7'.

SD-03, 0-5.5'.

SD-02, 0-4.9'.

SD-04, 0-3.6'.

SD-05, 0-4.4'.

SD-07, 0-3.6'.

SD-06, 0-2.9'.

SD-08, 0-3.9'.

SD-09, 0-3.7'.

SD-11, 0-4.7'.

SD-10, 0-4.1'.

SD-12, 0.0-3.9.

SD-13, 0.0-3.7.

SD-14, 0.0-2.95.

SD-14, 0.0-2.8 (#2).

SD-15, 0.0-2.0.

SD-16, 0-3.6'.

SD-18, 0-4.1'.

SD-17, 0-4'.

SD-19, 0-2.8'.

SD-20, 0-2.6'.

SD-22, 0-1.5'.

SD-21, 0-2.7'.

SD-23, 0-2.3'.

SD-23, 3-4.9'.

SD-24, 5-8.5'.

SD-24, 0-3.9'.

SD-25, 0-2.8'.

SD-25, 4-7.2'.

SD-27, 0.0-1.9.

SD-26, 0-3.0'.

SD-27, 4.5-7.3' (2).

SD-28, 0-2.2'.

SD-28, 5.2-7.7'.

SD-28, 4-5.4'.

SD-29, 0-2.9'.

SD-29, 4.0-6.0 staining.

SD-30, 0-3.6'.

SD-29, 4.0-6.0'.

SD-30, 4-7.8'.

SD-30, 9-13.1' #2.

SD-31, 10-14.8'.

SD-31, 0-4.6'.

SD-31, 5-9'.

SD-32, 0-5'.

SD-32, 5-10'.

SD-32, 10-13.4'.

SD-33, 0-4.2'.

SD-33, 4-7.1'.

SD-34, 0-2.3'.

SD-33, 9-10.8'.

SD-34, 4-7'.

SD-34, 8-10.7'.

SD-35, 3-7.7'.

SD-35, 0-3'.

SD-36, 0-1.2'.

SD-37, 0-3.1'.

SD-38, 0-1.2'.

SD-37, 3-4.1'.

SD-38, 4-6.3'.

SD-39, 0-3.2'.

SD-40, 0-0.6'.

SD-39, 4-8.7'.

SD-40, 4-7.6'.

SD-41, 0-3'.

SD-42, 0-3.7'.

SD-41, 4-6.9'.

SD-43, 5.0-7.0.

SD-43, 7.0-8.5.

SD-44, 10.0-10.9.

SD-44, 0.0-2.5.

SD-44, 5.0-8.3.

SD-47, 0-2.1'.

SD-48, 0-3.4'.

SD-47, 5-8.0'.

SD-48, 5-9.7'.

SD-50, 0-3.7'.

SD-51, 0-4.2'.

SD-50, 5-7.5'.

SD-51, 10-13'.

SD-51, 5-9.8'.

SD-52, 10-11.8'.

SD-52, 0-2.1'.

SD-52, 5-9.1'.

SD-54, 0-3.2'.

SD-54, 5-9.8'.

SD-54, 10-12.4'.

SD-55, 0-2.8'.

SD-56, 0-2.9'.

SD-60, 0-2.6'.

SD-58, 0-3.5'.

SD-61, 0-2.5'.

Attachment 2E – Photograph Log Drone

Affiliated Researchers Vessel in Creek.

Coleman Engineering Vessels.

Coleman Engineering Vessels and RV Mudpuppy II.

Drone and Pilot.

Drone and Pilot.

Drone and Ship at Docks.

Drone Controls.

Drone Flying.

Drone Flying.

Drone Flying.

RV Mudpuppy II Crew at Dock.

RV Mudpuppy II Crew at Dock.

RV Mudpuppy II Crew Collecting Sediment Core.

RV Mudpuppy II Crew Collecting Sediment Core.

RV Mudpuppy II Crew Collecting Sediment Core.

RV Mudpuppy II Crew Collecting Sediment Core.

RV Mudpuppy II Crew Collecting Sediment Core and Drone Overhead.

RV Mudpuppy II in Confluence.

RV Mudpuppy II Leaving Dock.

Attachment 3
Survey Report

DATA SUMMARY TECHNICAL MEMORANDUM
BATHYMETRIC AND TOPOGRAPHICAL SURVEYING SERVICES AT
LOWER OTTER CREEK AND CONFLUENCE, TOLEDO, OHIO

Provided to CH2M HILL
7 October 2016
updated 28 October 2016

This Data Summary Technical Memorandum (Tech Memo) summarizes the methods and findings for the bathymetric and topographical surveying services provided by AFFILIATED RESEARCHERS during September of 2016, under sub-contract with CH2M HILL (CH2M) with respect to the referenced project.

PROJECT DESCRIPTION

CH2M, on behalf of USEPA, provided its team subcontractor AFFILIATED RESEARCHERS with a Scope of Work (SOW) for bathymetric and topographical surveying services, as part of a remedial design sampling required to characterize sediments in Otter Creek and its confluence area.

Otter Creek is part of the Maumee River Area of Concern located near the city of Toledo, Lucas County, Ohio (Figure 1). The study area includes 1.7 miles of Otter Creek and a portion of Otter Creek confluence with Lake Erie (project site, Figures 2 and 3).

AFFILIATED RESEARCHERS evaluated the SOW, communicated with CH2M staff regarding certain project details, submitted a project proposal to meet the project objectives and tasking, and conducted its proposed services at the project site during September 2016.

PROJECT TASKING

The project objectives and tasking included:

- Participation in conference calls;
- Mobilization and demobilization;
- Field-locate utilities;
- Establish local survey controls;
- Field-locate and stake proposed sediment sampling locations in the creek;

- Utilizing single-beam bathymetry and manual surveying techniques to obtain survey data of baseline conditions of the creek and the confluence area;
- Obtain topographic survey of the riverbank of Otter Creek and the confluence area;
- Locate and mark proposed DPT drilling locations in Otter Creek and its banks;
- Provide a Data Summary Technical Memorandum summarizing the surveying activities performed, the data obtained, and quality control (QC)/quality assurance (QA) data collected with the surveys; and,
- Provide data and report in usable electronic formats, for the generation of bathymetric surface contour maps and topographical maps of the banks.

AFFILIATED RESEARCHERS provided all of the equipment, personnel, materials, and services necessary to perform the described tasking and meet the described objectives.

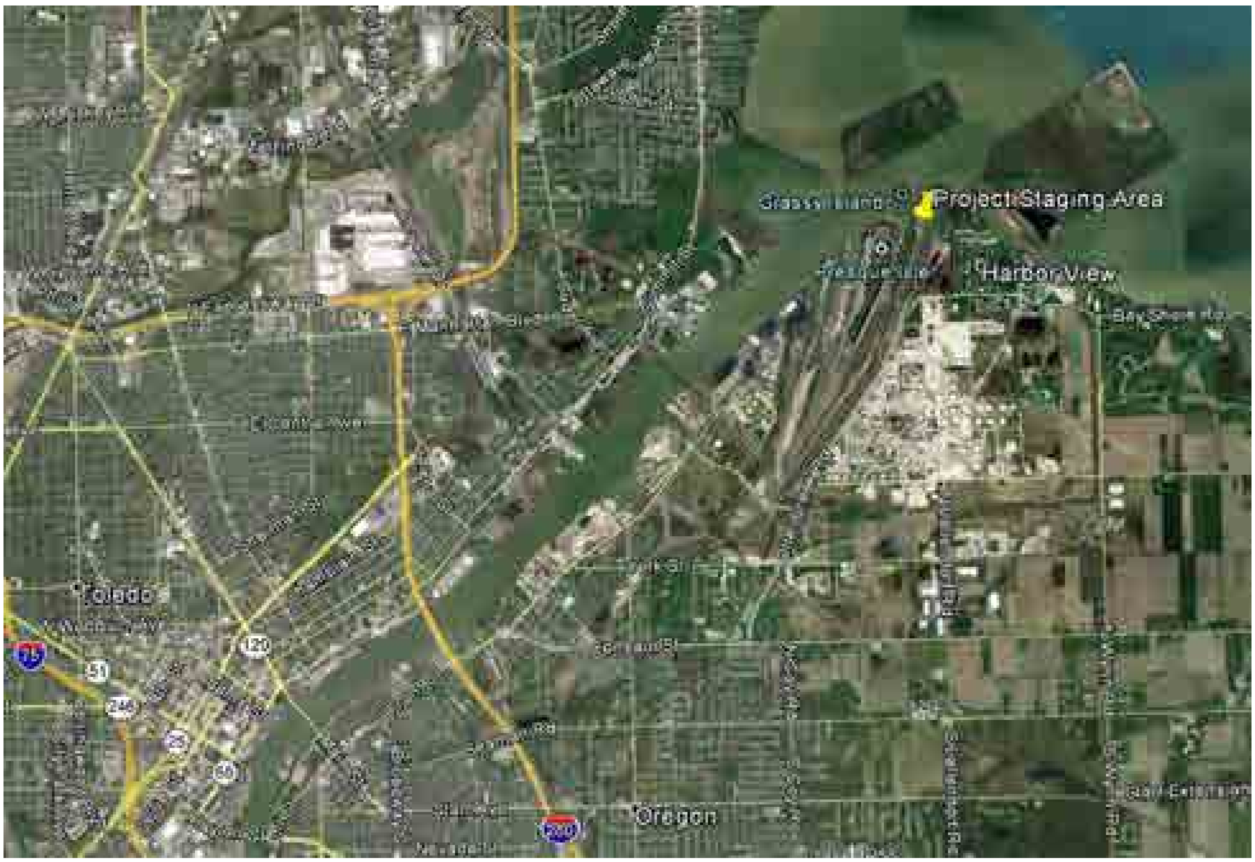


Figure 1. Vicinity (source: *Google Earth*, 2016)**.**

Figure 2. Otter Creek Project Area (taken from CH2M Field Sampling Plan, 7Sep16).

FIELD RECORDS

AFFILIATED RESEARCHERS' field staff maintained daily electronic field records of all survey points and coordinate data to include datum, horizontal positions, and vertical elevations. Electronic data collected on data collectors and field computers were "backed-up" at the end of field day to an onsite external hard drive. AFFILIATED RESEARCHERS' staff also maintained written daily field records in a *Rite-in-the-Rain* journal with *Rite-in-the-Rain* ink, documenting:

- Procedures, equipment, personnel;
- calibrations and QAQC;
- field and weather conditions;
- control points, elevation measurements; and,
- unplanned events, and other important information.

Field records were used to help develop the Tech Memo. Copies of all field records are available to CH2M upon request.

Figure 3. Confluence Project Area (taken from CH2M SOW)**.**

CONFERENCE CALLS

AFFILIATED RESEARCHERS participated in several calls and conference calls to coordinate project plans, objectives, tasking, scheduling, logistics, and concerns.

MOBILIZATION/DEMOBILIZATION

On 1 August 2016, AFFILIATED RESEARCHERS mobilized its Project Manager to assist CH2M in an initial reconnaissance (recon) of the project site. During the initial recon, AFFILIATED RESEARCHERS observed the dense vegetative overstory and determined that the next generation of RTK-GPS survey equipment (*Trimble R-10*) would need to be rented in order to accomplish the project tasking. AFFILIATED RESEARCHERS' Project Manager demobilized on 2 August.

On 12 September 2016, AFFILIATED RESEARCHERS mobilized its crew, its aquatic vessels, supporting equipment, materials, and tools required to conduct the work described. Prior to mobilization, CH2M provided AFFILIATED RESEARCHERS with electronic files containing the coordinates of the sample locations to be uploaded onto its GPS equipment.

Due to site security protocols, AFFILIATED RESEARCHERS was unable to access the site to establish staging areas, complete benchmark establishment, located and mark DPT locations, or field-locate utility locations during the day of its mobilization to the site.

AFFILIATED RESEARCHERS' Hydrographer de-mobilized during the late afternoon of 13 September in order to temporarily attend another, ongoing CH2M project located in Kentucky. AFFILIATED RESEARCHERS' Project Manager and Senior Technician remained onsite. AFFILIATED RESEARCHERS' Hydrographer re-mobilized to the project site on 15 September y.

On 17 September, AFFILIATED RESEARCHERS de-mobilized its crew and equipment from the project site. Upon completion of its work, AFFILIATED RESEARCHERS removed from the site all equipment, unused materials, supplies, temporary facilities, and ancillary items resulting from or used in its operation. The wooden stakes used to mark the location of the survey controls established on site, were left in place for any follow-on work.

No problems occurred during the mobilization or demobilization aspects of the project.

FIELD-LOCATE UTILITIES

On 13 September, AFFILIATED RESEARCHERS assisted CH2M by utilizing its RTK-GPS survey equipment to obtain field locations of marked utilities at the project site. The GPS coordinates of the utilities have been provided to CH2M electronically as an XYZ file.

No problems occurred during this aspects of the project.

(989) 739-5471 • 864 Aulerich Road, East Tawas, Michigan 48730 • www.affiliatedresearchers.com
Service-disabled Veteran-owned Small Business • *Certified HUBZone Business Consideration*

DATUM, SURVEY CONTROLS, AND QAQC

AFFILIATED RESEARCHERS provided RTK-GPS survey equipment (with a documented horizontal and vertical accuracy of <0.05') and a trained operator for same; capable of achieving the positional data accuracy requirements of stated in the SOW (i.e. ±0.5' horizontal and ±0.1' vertical)[1].

DATUM

The units of measurement for this project were US Survey Feet. Coordinates have been provided in the following datums:

- Latitude /Longitude, World Geodetic System 1984 (WGS84); and,
- Vertical Datum: North American Vertical Datum of 1988 (NAVD 88).

ESTABLISHMENT OF LOCAL CONTROL POINTS AND SURVEY CONTROL

AFFILIATED RESEARCHERS established survey control points at the project site utilizing recognized National Geodetic Survey OPUS methods[2]. The survey control points were established in accordance with stated accuracies described in the SOW, confirmed as accurate, and utilized for this project. The OPUS data sheets are provided in Attachment 1 of this Tech Memo.

Figure 4.

The local control points were semi-permanently established using a 2' length of "re-bar" capped and flush with the ground, and identified as CP-100, CP-101, and CP-102 (described in Table 1). AFFILIATED RESEARCHERS also utilized established benchmarks existing in the vicinity of the project site to confirm its survey.

[1] *The relative horizontal control work accuracy shall conform to the 2-centimeter accuracy standard as outlined in the FGDC Geospatial Positioning Accuracy Standards, Part 2: National Standard for Spatial Data Accuracy. Vertical control work shall be Third Order, as outlined in the FGDC Geospatial Positioning Accuracy Standards, Part 4: Standards for Architecture, Engineering, Construction (A/E/C) and Facility Management.*

[2] http://www.ngs.noaa.gov. September 2016.

All survey controls were referenced in the field notes.

The control points were used for a RTK-GPS base station, and to provide a reference point against which the accuracy of its GPS equipment shall be checked and documented (Figure 4).

To assure RTK-GPS real-time accuracy and reliability, AFFILIATED RESEARCHERS utilized one of the local survey controls (CP-100) as a RTK-GPS "base station". The base station transmitted highly accurate real-time RTK-GPS corrections to the RTK-GPS survey "rover" equipment during the bathymetric and topographic surveys. AFFILIATED RESEARCHERS used CP-101 and CP-102 to conduct QAQC accuracy checks of its RTK-GPS survey equipment during the project. AFFILIATED RESEARCHERS conducted QAQC checks of its GPS equipment twice daily, at these established survey controls during the project. The QAQC checks were recorded in the field and are included in Table 2.

Survey Control	Elevation	Latitude	Longitude
CP-100	577.59	41° 41' 44.03185"	83° 27' 6.65808"
CP-101	577.75	41° 41' 43.86670"	83° 27' 6.83153"
CP-102	577.59	41° 41' 43.80405"	83° 27' 6.41864"

Table 1. Locally established survey controls.
Coordinates are WGS84. Elevations are NAVD88 US Survey Feet.

Date	Survey Control	GPS Equipment	Point ID	Description	Time	Horizontal Difference	Vertical Difference
13-Sep-16	CP 101	R-10 (1)	chin 0911	Check In	0911	0.06	0.03
13-Sep-16	CP 102	R-10 (1)	chin 0912	Check In	0912	0.05	0.00
13-Sep-16	CP 101	R-10 (1)	cp101a	Check Out	1823	0.03	0.03
13-Sep-16	CP 102	R-10 (1)	cp102a	Check Out	1824	0.04	-0.02
14-Sep-16	CP 101	R-10 (1)	cp101c	Check In	0802	0.08	0.02
14-Sep-16	CP 102	R-10 (1)	cp102d	Check In	0803	0.03	-0.06
14-Sep-16	CP 101	R-10 (1)	cp101 1826	Check Out	1826	0.01	0.02
14-Sep-16	CP 102	R-10 (1)	cp102 1827	Check Out	1827	0.02	0.01
15-Sep-16	CP 101	R-10 (1)	cp101 915 0757	Check In	0756	0.05	0.05
15-Sep-16	CP 102	R-10 (1)	cp102 915 0758	Check In	0758	0.04	-0.01
15-Sep-16	CP 101	R-10 (1)	cp1011806	Check Out	1806	0.04	0.00
15-Sep-16	CP 102	R-10 (1)	cp1021807	Check Out	1807	0.01	-0.05
16-Sep-16	CP 101	R-10 (2)	chin0744	Check In	0744	0.05	0.03
16-Sep-16	CP 101	R-10 (1)	cp1010749	Check In	0750	0.06	-0.04
16-Sep-16	CP 102	R-10 (2)	chin0745	Check In	0745	0.03	-0.02
16-Sep-16	CP102	R-10 (1)	cp1020750	Check In	0750	0.06	-0.11
16-Sep-16	CP 101	R-10 (1)	cp1019161722	Check Out	1721	0.11	0.07
16-Sep-16	CP 102	R-10 (1)	cp1029161723	Check Out	1723	0.07	0.02
16-Sep-16	CP 101	R-10 (2)	cp1019161724	Check Out	1723	0.05	-0.06
16-Sep-16	CP 102	R-10 (2)	cp1029161725	Check Out	1725	0.02	-0.10
Average						0.04	-0.01
STDEV						0.02	0.05

Table 2. QAQC accuracy checks of RTK-GPS survey equipment. Horizontal and vertical differences are in US Survey Feet.

To account for, and record daily water level changes that occurred at the site, AFFILIATED RESEARCHERS utilized its RTK-GPS survey equipment to accurately measure and record water levels (elevations) during the project activities (Table 3). AFFILIATED RESEARCHERS also collected water levels using its RTK-GPS survey equipment during the bathymetric survey.

PROBLEMS ENCOUNTERED

No problems occurred during the datum, survey controls, and QAQC aspects of the project.

BATHYMETRIC SURVEY

To obtain survey data of baseline conditions of Otter Creek and its confluence area, AFFILIATED RESEARCHERS performed single-beam bathymetry survey at the project site utilizing hydrographic and RTK-GPS survey equipment and methodology capable of achieving equal to or better than the accuracy requirements of the SOW.

AFFILIATED RESEARCHERS conducted the bathymetric survey in accordance with the US Army Corps of Engineers hydrographic survey manual (USACE Manual[3]).

BATHYMETRIC SURVEYING
WITH ECHO-SOUNDER

To provide bathymetric surveying in the project area, AFFILIATED RESEARCHERS' hydrographic surveying team utilized a *Knudsen Chirp 3212* dual-frequency single-beam echo-sounder system, *Trimble* RTK-GPS survey equipment, and *HYPACK* hydrographic software (Figures 5 and 6).

The *Knudsen Chirp 3212* operates at dual frequencies of 200 kHz and 50 kHz; with a vertical resolution of 0.01' (in water depths < 100'); at better-than accuracy standards established by the USACE and International Hydrographic Organization (IHO).

Figure 5

[3] Dept. of the Army. 2013. EM 1110-2-1003: *Engineering and Design – Hydrographic Surveying. Engineer Manual* (30 November 2013). CECW-CE *I* CECW-OD. Washington, DC.

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AFFILIATED RESEARCHERS conducted and documented QAQC checks of bathymetric sonar instruments equipment in accordance with the USACE Manual protocol. For additional QAQC, AFFILIATED RESEARCHERS also collected manual water depth measurements to provide direct comparison to measurements collected with the echo-sounder. Prior to commencing the survey utilizing the echo-sounder, all bar checks and water depth measurements were presented to CH2M for review.

AFFILIATED RESEARCHERS utilized its 16' *Alumaweld* survey vessel to collect bathymetric survey data along cross-channel survey transects arranged at 50' intervals. Within the upper reaches of the project site where Otter Creek became too narrow to effectively accomplish cross-channel transects, bathymetric survey data were collected along longitudinal transects.

Figure 6.

The survey transect lines were developed using HYPACK and AutoCAD software and provided to CH2M for review. Prior to conducting the bathymetric survey, the survey transect lines were uploaded onto the onboard *Toughbook* hydrographic computer for real-time navigation.

Bathymetry data was continuously collected during the bathymetric survey at a rate of 10 positions/second. During the survey, water level elevations, geodetic positions, and time-of-data were also continuously collected by means of the onboard *Trimble* RTK-GPS survey equipment, at a rate of 1 position/second. The data were recorded to the onboard computer during the survey.

BATHYMETRIC SURVEYING WITH CONVENTIONAL RTK-GPS METHODS

In areas of extremely shallow water (approximately 3') as well as areas of excessive debris and vegetation where echo-sounder technology was not usable, AFFILIATED RESEARCHERS conducted the bathymetric surveying from its smaller, 14' *Lund* survey vessel, using RTK-GPS conventional methods and a survey rod fitted with a 6" flat disc.

Along the survey transects, survey data were collected at increments to include the toe of the creek bank, and at the water line of the creek in order to provide sufficient data to complete the bathymetric survey (Figure 7).

WATER ELEVATIONS AND QAQC

Due to the potential for water levels in Otter Creek and its Lake Erie confluence area to fluctuate throughout the day, AFFILIATED RESEARCHERS conducted static RTK-GPS survey shots to measure the water surface elevation during the bathymetric survey.

AFFILIATED RESEARCHERS conducted QAQC checks of the RTK-GPS survey equipment twice daily (prior to commencing and after the completion of daily field sampling activities) at the established survey controls. QAQC checks were recorded in the field and included in this Tech Memo.

Figure 7.

DATA COMPILING

AFFILIATED RESEARCHERS compiled the bathymetric data using *HYPACK* hydrographic software and developed XYZ files of the bathymetry (at 3' x 3' grids) of the project site; and provided electronically to CH2M.

PROBLEMS ENCOUNTERED

No problems occurred during the bathymetric surveying aspects of the project, except for the following:

- The cross-channel transects established on 50' intervals were spaced too far apart relative to the width of creek channel, in order to provide adequate coverage and readily facilitate a bathymetric contour map of the project site. This had been discussed with CH2M during pre-project coordination. This issue was resolved, but required additional hours of data compiling and interpolation. Adequate bathymetric coverage was established in the creek in areas where longitudinal transects were utilized.

TOPOGRAPHIC SURVEY

AFFILIATED RESEARCHERS utilized its RTK-GPS survey equipment and conventional RTK-GPS methods to conduct a topography survey along designated transects along the banks of 1.7 river miles of Otter Creek, designated transects in areas adjacent its confluence with Lake Erie. The transect interval spacing was 150'.

AFFILIATED RESEARCHERS collected horizontal and vertical survey data along transects beginning at the water's edge up towards the top of the bank. Data collection along the transects was increased or decreased depending upon variability of the bank topography.

AFFILIATED RESEARCHERS utilized its 16' *Alumaweld* and 14' *Lund* survey vessels to provide logistical support for certain portions of the topographic survey.

The topographic data were compiled into XYZ tabular formats and provided electronically to CH2M.

No problems occurred during the topographic surveying aspects of the project with the exception of some planned transects were found to be in areas that were determined by the AFFILIATED RESEARCHERS field staff and CH2M safety coordinator to be unsafe and inaccessible.

Date	Time	Point ID	Elevation	Latitude	Longitude
9/13/2016	15:32	wtr1	572.01	41.69645731	83.45364010
9/13/2016	15:42	wtr2	572.00	41.69615720	83.45367427
9/13/2016	15:42	wtr3	571.89	41.69615711	83.45367408
9/13/2016	16:53	wtr25	572.25	41.68766135	83.45637713
9/13/2016	17:06	wtr60	572.20	41.68623148	83.45706075
9/14/2016	17:24	wtr1725	572.66	41.68074294	83.46126232
9/14/2016	17:35	wtr1735	572.55	41.67617198	83.46557306
9/14/2016	17:54	wtr1755	572.57	41.68736707	83.45641850
9/15/2016	14:16	wtr89	572.40	41.67848290	83.46345551
9/15/2016	16:49	wtr1650	572.99	41.69084182	83.45513520
9/15/2016	16:52	wtr1652	572.91	41.69119031	83.45508955
9/15/2016	18:00	wtr1801	573.22	41.69698779	83.45236155
9/15/2016	16:31	wtr1632	572.84	41.68976281	83.45558620
9/16/2016	08:26	wtr0727	572.71	41.69700187	83.45236526
9/16/2016	11:25	wtr1000	572.80	41.69638355	83.45337409
9/16/2016	10:42	wtr1043	572.67	41.69699964	83.45234600
9/16/2016	13:46	wtr1346	573.91	41.67493965	83.46691930
9/16/2016	15:32	wtr1531	572.47	41.67974449	83.46218130
9/16/2016	17:05	wtr1703	572.52	41.69699917	83.45231251
9/16/2016	17:05	wtr1706	572.54	41.69920372	83.45313073

Table 3.
Water elevations obtained with RTK-GPS survey equipment.
Coordinates are WGS84. Elevations are NAVD88 US Survey Feet.

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LOCATE AND MARK DRILLING LOCATIONS

CH2M requested AFFILIATED RESEARCHERS to utilize RTK-GPS methods to "mark out" the proposed DPT drilling locations in Otter Creek and its banks. CH2M provided AFFILIATED RESEARCHERS with an Excel file containing the proposed sample location coordinates prior to surveying activities, and requested AFFILIATED RESEARCHERS to stake the drilling locations on the creek bank, as well as in the creek bed (or on the adjacent creek bank).

AFFILIATED RESEARCHERS utilized its trained Technician, RTK-GPS survey equipment, and conventional RTK-GPS methods to locate and stake in the field the locations for the proposed DPT driller. CH2M provided the coordinates of the sample locations, which were uploaded onto AFFILIATED RESEARCHERS' RTK-GPS equipment. A total of 70 drilling locations were located and marked in the field at the project site, to include 9 locations on the terrain and 61 locations in the creek. All locations were marked by AFFILIATED RESEARCHERS using 6' plastic stakes and orange flagging.

Due to restrictive field conditions at some of the terrain locations, CH2M determined which locations were to be relocated a small distance in order to provide for more effective DPT drilling. The coordinates of the DPT terrain locations which were relocated in the field are provided in Table 4.

All of the drilling locations in the creek were staked by AFFILIATED RESEARCHERS at, or as close to the respective coordinates proposed by CH2M[4].

No problems occurred during the locating and marking of the DPT drilling locations.

Location ID	Latitude	Longitude	Elevation
OC2016-SO-04	41.68885091	83.45608253	579.71
OC2016-SO-06	41.68530663	83.45733279	580.28
OC2016-SO-07	41.68216278	83.45975373	581.00
OC2016-SO-08	41.67909540	83.46266729	581.14
OC2016-SO-09	41.67647414	83.46515896	582.04

Table 4.
Coordinates and elevations of the relocated DPT terrain locations.
Coordinates are WGS84. Elevations are NAVD88 US Survey Feet.

[4] Some of the DPT locations within the creek could not be marked exactly at the designated coordinates, due to water depth, dense vegetation, or coordinates being outside of creek channel. The marking of the DPT locations in the creek, that were not exactly at the designated coordinates, were communicated to CH2M staff as location offsets.

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DATA SUMMARY
TECHNICAL MEMORANDUM

The data summary technical memorandum describes the tasking activities conducted, and provides discussion of survey coverage, reliability and accuracy of the data, problems encountered during the project, interpretation and post-processing of the data, and deliverables.

Deliverables provided electronically under separate cover, included:

- Scaled, color drawings (*AutoCAD* DXF file) showing results of the bathymetric data;
- Processed bathymetric survey data provided in XYZ format, at a minimum grid spacing of 3-feet by 3-feet;
- Topographic data in an Excel format of survey points; and,
- Utility data in an Excel format of survey points.

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ATTACHMENT 1.

From:	opus
To:	mike@affiliatedresearchers.com
Subject:	OPUS solution : CP100_01132570.16o OP1474375754195
Date:	Tuesday, September 20, 2016 8:53:02 AM

FILE: CP100_01132570.16o OP1474375754195

NGS OPUS SOLUTION REPORT
========================

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

```
     USER: mike@affiliatedresearchers.com         DATE: September 20, 2016
RINEX FILE: cp10257n.16o                          TIME: 12:50:52 UTC


  SOFTWARE: page5  1209.04 master52.pl 160321      START: 2016/09/13  13:03:00
 EPHEMERIS: igr19142.eph [rapid]                    STOP: 2016/09/13  22:25:00
  NAV FILE: brdc2570.16n                       OBS USED: 22748 / 23777   :  96%
  ANT NAME: TRM57970.00     NONE            # FIXED AMB:   104 /   112   :  93%
ARP HEIGHT: 2.0                            OVERALL RMS: 0.015(m)


 REF FRAME: NAD_83(2011)(EPOCH:2010.0000)           IGS08 (EPOCH:2016.7015)

        X:      543923.570(m)   0.007(m)          543922.704(m)   0.007(m)
        Y:    -4738547.420(m)   0.006(m)        -4738546.032(m)   0.006(m)
        Z:     4220508.866(m)   0.008(m)         4220508.801(m)   0.008(m)

      LAT:   41 41 44.03185      0.003(m)       41 41 44.06214      0.003(m)
    E LON:  276 32 53.34192      0.006(m)      276 32 53.31155      0.006(m)
    W LON:   83 27  6.65808      0.006(m)       83 27  6.68845      0.006(m)
   EL HGT:         140.630(m)   0.009(m)             139.484(m)   0.009(m)
 ORTHO HGT:         176.049(m)   0.027(m) [NAVD88 (Computed using GEOID12B)]

                   UTM COORDINATES    STATE PLANE COORDINATES
                    UTM (Zone 17)         SPC (3401 OH N)
Northing (Y) [meters]     4618880.731          225739.990
Easting (X)  [meters]      295971.402          520765.417
Convergence  [degrees]    -1.63146442         -0.62531781
Point Scale                1.00011229          0.99999915
Combined Factor            1.00009023          0.99997709

US NATIONAL GRID DESIGNATOR: 17TKG9597118880(NAD 83)


                         BASE STATIONS USED
PID       DESIGNATION                        LATITUDE    LONGITUDE DISTANCE(m)
DN5844 OHSB SOUTH BASS ISLAND CORS ARP      N413811.216 W0824947.180   52223.5
DH3473 BGOH BOWLINGGREEN COOP CORS ARP      N412248.595 W0833833.456   38478.5
DI0214 MIMO MONROE MI CORS ARP              N415529.549 W0832753.436   25492.9

              NEAREST NGS PUBLISHED CONTROL POINT
MC0277      906 3085 WHSE                  N414137.5   W0832820.2       1712.5
```

From:	opus
To:	mike@affiliatedresearchers.com
Subject:	OPUS solution : CP101_ OP1474375856588
Date:	Tuesday, September 20, 2016 8:55:11 AM

FILE: CP101_ OP1474375856588

NGS OPUS SOLUTION REPORT
========================

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

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      USER: mike@affiliatedresearchers.com          DATE: September 20, 2016
RINEX FILE: cp10260v.16o                            TIME: 12:51:36 UTC


  SOFTWARE: page5  1209.04 master51.pl 160321      START: 2016/09/16  21:39:00
 EPHEMERIS: igr19145.eph [rapid]                    STOP: 2016/09/16  23:42:00
  NAV FILE: brdc2600.16n                       OBS USED:  4717 /  5155   :  92%
  ANT NAME: TRM57970.00     NONE            # FIXED AMB:    30 /    30   : 100%
ARP HEIGHT: 2.0                             OVERALL RMS: 0.014(m)


 REF FRAME: NAD_83(2011)(EPOCH:2010.0000)              IGS08 (EPOCH:2016.7102)

         X:      543919.976(m)   0.007(m)           543919.110(m)   0.007(m)
         Y:    -4738551.280(m)   0.009(m)         -4738549.892(m)   0.009(m)
         Z:     4220505.093(m)   0.007(m)          4220505.028(m)   0.007(m)

       LAT:   41 41 43.86670      0.009(m)       41 41 43.89698      0.009(m)
     E LON:  276 32 53.16847      0.008(m)      276 32 53.13811      0.008(m)
     W LON:   83 27  6.83153      0.008(m)       83 27  6.86189      0.008(m)
    EL HGT:          140.678(m)   0.006(m)              139.531(m)   0.006(m)
 ORTHO HGT:          176.097(m)   0.024(m) [NAVD88 (Computed using GEOID12B)]

                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 17)         SPC (3401 OH N)
Northing (Y) [meters]     4618875.752           225734.939
Easting (X)  [meters]      295967.247           520761.351
Convergence  [degrees]    -1.63149504          -0.62534946
Point Scale                1.00011231           0.99999914
Combined Factor            1.00009024           0.99997708

US NATIONAL GRID DESIGNATOR: 17TKG9596718875(NAD 83)


                             BASE STATIONS USED
PID       DESIGNATION                        LATITUDE    LONGITUDE DISTANCE(m)
DN5844 OHSB SOUTH BASS ISLAND CORS ARP      N413811.216 W0824947.180   52226.9
DH3473 BGOH BOWLINGGREEN COOP CORS ARP      N412248.595 W0833833.456   38472.2
DO4957 OHLC LUCAS COUNTY 2 CORS ARP         N414316.405 W0833134.586    6817.0

                  NEAREST NGS PUBLISHED CONTROL POINT
MC0277      906 3085 WHSE                   N414137.5   W0832820.2      1707.9
```

From:	opus
To:	mike@affiliatedresearchers.com
Subject:	OPUS solution : CP102_ OP1474398150618
Date:	Tuesday, September 20, 2016 3:04:41 PM

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 FILE: CP102_ OP1474398150618

                    NGS OPUS SOLUTION REPORT
                    ========================

All computed coordinate accuracies are listed as peak-to-peak values.
For additional information: http://www.ngs.noaa.gov/OPUS/about.jsp#accuracy

      USER: mike@affiliatedresearchers.com         DATE: September 20, 2016
RINEX FILE: cp10260v.16o                           TIME: 19:03:16 UTC


  SOFTWARE: page5  1209.04 master52.pl 160321      START: 2016/09/16  21:51:00
 EPHEMERIS: igr19145.eph [rapid]                    STOP: 2016/09/16  23:54:00
  NAV FILE: brdc2600.16n                       OBS USED:  4778 /  5235   :  91%
  ANT NAME: TRMR10          NONE            # FIXED AMB:    34 /    35   :  97%
ARP HEIGHT: 2.0                            OVERALL RMS: 0.013(m)


 REF FRAME: NAD_83(2011)(EPOCH:2010.0000)              IGS08 (EPOCH:2016.7103)

         X:      543929.604(m)   0.009(m)           543928.738(m)   0.009(m)
         Y:    -4738551.434(m)   0.013(m)         -4738550.046(m)   0.013(m)
         Z:     4220503.619(m)   0.013(m)          4220503.554(m)   0.013(m)

       LAT:   41 41 43.80405      0.005(m)       41 41 43.83434      0.005(m)
     E LON:  276 32 53.58136      0.009(m)      276 32 53.55100      0.009(m)
     W LON:   83 27  6.41864      0.009(m)       83 27  6.44900      0.009(m)
    EL HGT:          140.632(m)   0.016(m)              139.485(m)   0.016(m)
 ORTHO HGT:          176.051(m)   0.035(m) [NAVD88 (Computed using GEOID12B)]

                        UTM COORDINATES    STATE PLANE COORDINATES
                         UTM (Zone 17)         SPC (3401 OH N)
Northing (Y) [meters]     4618873.548           225732.902
Easting (X)  [meters]      295976.737           520770.877
Convergence  [degrees]    -1.63141811          -0.62527411
Point Scale                1.00011226           0.99999914
Combined Factor            1.00009020           0.99997708

US NATIONAL GRID DESIGNATOR: 17TKG9597618873(NAD 83)


                         BASE STATIONS USED
PID       DESIGNATION                        LATITUDE    LONGITUDE DISTANCE(m)
DN5844 OHSB SOUTH BASS ISLAND CORS ARP    N413811.216 W0824947.180   52217.1
DO4957 OHLC LUCAS COUNTY 2 CORS ARP       N414316.405 W0833134.586    6826.5
DI0214 MIMO MONROE MI CORS ARP            N415529.549 W0832753.436   25500.1

               NEAREST NGS PUBLISHED CONTROL POINT
MC0277      906 3085 WHSE                N414137.5   W0832820.2      1717.2
```

Attachment 4
Data Usability Report

Data Usability Report Lower Otter Creek and Confluence, Maumee Area of Concern, Toledo, Ohio

Task Order No. 0027, Contract No. EP-R5-11-09

PREPARED FOR:	Brenda Jones and Meaghan Kern/U.S. Environmental Protection Agency - Great Lakes National Program Office
PREPARED BY:	CH2M HILL, Inc.
DATE:	January 16, 2017
PROJECT NUMBER:	679969

This data usability report presents the quality assessment of the data collected during sediment investigations conducted within the Lower Otter Creek and Confluence within the Maumee River Area of Concern in Toledo, Ohio. The primary objective of this investigation was to provide the data for designing the preferred remedial alternative (Alternative 3) identified in the 2013 focused feasibility study (Ramboll Environ 2013) to address the contaminated sediments at the Lower Otter Creek and Confluence Great Lakes Legacy Act site. CH2M HILL, Inc. (CH2M) conducted sediment and soil sampling in Otter Creek and the adjacent confluence area in September 2016. The work was conducted in accordance with the following site-specific plans prepared by CH2M and approved by the U.S. Environmental Protection Agency (EPA):

- *Quality Assurance Project Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (QAPP; CH2M 2016a)
- *Field Sampling Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (FSP; CH2M 2016b)
- *Health and Safety Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio* (CH2M 2016c)

Field and analytical results were evaluated using the criteria of precision, accuracy, representativeness, comparability, and completeness. Sample collection methods, processing and analytical methods, general field observations, and the analytical data are summarized in the site sampling technical memorandum (SSTM), the primary document.

Field Data

The SSTM (primary document) presents the field investigation objectives and the activities conducted. The following subsections summarize field data collected during the predesign investigation activities. Deviations from the sampling program and potential impacts on the usability of the data and decision making are also presented.

Surveys

CH2M's team subcontractor, Affiliated Researchers, performed a topographic survey of the creek banks, as well as a bathymetry survey of Otter Creek and the confluence area. The survey activities were performed following the procedures outlined in the QAPP and FSP (CH2M 2016a, 2016b). The survey equipment quality assurance (QA)/quality control (QC) checks were performed twice daily (prior to commencing and after the completion of daily field surveying activities) by checking the accuracy of the global positioning system (GPS) equipment. As part of initial QA/QC of the single-beam echo-sounder, manual water depth soundings was performed prior to performing bathymetry surveying in order to verify the single-beam echo-sounder readings. The QA/QC checks, benchmark coordinates, GPS calibration information, etc., were included in field forms, along with the Geographic Information System Metadata Forms (Attachment 3). Attachment 3 of the SSTM contains the detailed survey report provided by Affiliated Researchers. The following bullets summarize survey activities performed during the sampling event:

- Because of dense leaf cover within certain parts of the project area, the Trimble differential GPS receivers had a limited capability; therefore, the proposed sampling locations along Otter Creek were pre-located and staked using real-time kinematic (RTK) methods.
- Affiliated Researchers also surveyed the newly identified underground utilities that had been marked by Bloodhound Inc. (third-party utility locator) and the completed final geotechnical boring locations along Otter Creek using RTK methods.
- A topographic bank survey was performed along the bank of Otter Creek and the confluence area. The horizontal and elevational data were collected along transects beginning at the water's edge up to 100 feet toward the top of the bank, with transect spacing intervals of approximately 150 feet.
- A single-beam bathymetry survey was performed in Otter Creek and the confluence to provide the elevation of the sediment surface. A Knudsen Chirp 3212 dual-frequency single-beam echo-sounder system was used for the survey along transect lines at 50-foot intervals. In shallow areas near the shore and in the narrow areas at the upstream end of the project area, the single-beam survey could not be performed; therefore, the sediment surface elevation in such shallow areas was measured using static survey shots linked to the RTK unit. Areas using static survey shots used a survey rod fitted with a 6-inch flat disc. Static survey shots were also taken along the shore to tie the bathymetric survey into the adjacent shoreline and topographic survey. The top of sediment elevation at each sample location was based on the bathymetric survey.

Site Characteristics

The creek's project length is approximately 1.7 miles, and its width ranges from approximately 45 feet in the downstream end (northern segment, near the confluence) and middle sections to approximately 15 feet in the upstream reach (southern segment) with the creek tapering at the upstream end.

During the sampling event, the water elevation in Otter Creek and the confluence area was generally stable at approximately 572 feet above mean sea level (amsl). The SSTM presents details on the water depth, sediment thickness, and clay depth measurement methods. The water depths in the creek ranged from 1.3 to 5.8 feet, with an average depth of 3.9 feet. The water depths in the confluence area ranged from 2 to 6 feet, with an average depth of 4.4 feet. Some log debris and dead vegetation were found in the creek, obstructing the creek intermittently. Dense vegetation, including Phragmites, were observed on both sides of the creek banks at the southern end and just south of the railroad bridge.

The average depth to native clay in the creek was 6.3 feet below sediment surface (bss), with an average clay surface elevation of 562.58 feet amsl. The shallowest depth to the native clay (at approximately 568 feet amsl at 2.6 feet bss) was observed at the southern portion of the project area near sample location SD-42. The deepest depth to the native clay (at approximately 555 feet amsl at 13.9 feet bss) in the creek was observed at location SD-31 in the northern segment north of the CSX railroad bridge.

The average depth to native clay in the confluence was 1.4 feet bss, with an average clay surface elevation of 566.92 feet amsl. The shallowest depth to clay surface (570 feet amsl at 0.4 foo bss) was observed near the beach area in the southwestern portion of the confluence area (SD-17 and SD-16), while the deepest clay surface (563.8 feet amsl at 3.8 feet bss) was observed near the northeastern corner of the confluence area (SD-03). The SSTM document presents the sheen and nonaqueous phase liquid (NAPL) observations documented during this predesign investigation. Staining and NAPL were observed in one core in the creek (SD-29); no cores collected in the confluence area contained staining or NAPL. However, during anchoring activities of the R/V Mudpuppy II vessel in the confluence area around locations SD-14, SD-15, SD-01, SD-02, and SD-03, sheen and bubbles of NAPL combined with strong hydrocarbon odor were released onto the water surface from the surficial sediment

Deviation Summary

The following subsections summarize minor deviations associated with survey transects, sample locations, sample processing, and sample quantity:

Survey

- The topographic survey transects on the western side of Otter Creek were collected from the adjacent Otter Creek Road at 150-foot intervals. Because of the increased distance from the creek to the road, as well as the extremely dense Phragmites in the floodplain limiting access, fewer points were surveyed at the bottom of the bank than estimated in the FSP.
- A 1,000-foot-long section of the western bank south of the railroad bridge was inaccessible because of concrete debris. This gap in coverage was addressed by extrapolating the nearby data points and aerial photographs.
- An additional pass (four passes instead of three) with the single-beam echo sounder was added to the bathymetric survey in the creek segment to the south of the railroad overpass because of a wider-than-anticipated creek width.
- The single-beam bathymetric survey was not completed in the southernmost 500 feet of the project area in the creek. Because of shallow water, a manual bathymetric survey was performed using water depth measurements, poling, and static survey shots.

Sediment Sampling

- Additional clay delineation cores (no chemical analysis) were collected in Otter Creek after agreement was obtained from EPA, CH2M, Ramboll Environ, and Non-Federal Sponsors (NFS) representatives during a teleconference on September 16, 2016. The additional locations selected for clay surface identification included the following: SD-47, SD-48, SD-50, SD-51, SD-52, SD-54, SD-55, SD-56, SD-58, SD-60, and SD-61. In addition, it was agreed that several of the optional core locations noted above (SD-50, SD-51, SD 52, and SD-54) also would have sediment samples collected for archiving and possible future chemical analysis based on the results of the Otter Creek primary samples. However, EPA and the NFS partners agreed that analysis of these archived samples was not necessary.
- SD-44 was moved approximately 5 to 10 feet north of the original proposed location because of the presence of utilities in the area. New coordinates were collected using a Trimble GPS.
- SD-34 was moved north of the original proposed location because of the presence of a fiber optic line crossing the creek. New coordinates were collected using a Trimble GPS.

- SD-32 was moved from the original proposed location that was located 15 feet onto the creek bank. New coordinates were collected using a Trimble GPS.
- SD-26 was moved approximately 20 feet south from the original proposed location because of dense vegetation and trees. New coordinates were collected using a Trimble GPS.
- The core collected at SD-37 had low recovery; therefore, the sampling location was moved approximately 10 feet, and sufficient recovery was obtained using manual coring techniques. New coordinates were collected using a Trimble GPS.

Geotechnical Bank Evaluation

As specified in the FSP (CH2M 2016b) and in the SSTM, the Ramboll Environ NFS representative made the final decisions on the geotechnical boring locations and selected the sampling intervals for the geotechnical analysis, since Ramboll Environ will be the engineer of record for the remedial design. The CH2M field geotechnical engineer coordinated the decision making with Ramboll Environ's NFS representative. The geotechnical bank sampling deviations included the following:

- The original proposed location for SO-03 was on a steep, vegetated slope that the drill rig could not access. Several overhead lines were in the immediate area in addition to several underground utilities (gas and water). Because of the topography and presence of utilities, Ramboll Environ determined that a suitable location close to the bridge was not available; therefore, the boring at SO-03 was not performed.
- Proposed locations SO-09, SO-08, SO-07, and SO-06 were spaced equally along the railroad south of the CSX vehicle bridge, with SO-06 relatively close to SO-05 (deemed a critical location). Since the subsurface conditions encountered in SO-09 and SO-08 were similar, Ramboll Environ decided to eliminate the boring at SO-06 and move SO-07 north by approximately 600 feet (approximately halfway between the original proposed location for SO-07 and SO-06) to consolidate the number of borings.
- To obtain the most pertinent information about the slopes leading down to the creek, the borings were placed as close as possible to the edge; however, dense vegetation lining the creek made accessing the original proposed locations difficult. Therefore, final locations were adjusted to allow drill rig access and provide for safe working conditions for the operators. The list below describes the reasoning for each adjustment:
  - SO-01: moved 5 feet south-southeast because of large trees surrounding the boring location (drill rig could not fit between trees)
  - SO-02: moved 10 feet west because the original proposed location was in dense brush/trees
  - SO-04: moved 3 feet west because vegetation was in the drill rig's way
  - SO-05: moved 5 feet south because vegetation was in the drill rig's way
  - SO-07: moved 600 feet north, see detailed explanation above
  - SO-08: moved 5 feet east because vegetation was in the drill rig's way
  - SO-09: moved 5 feet east because vegetation was in the drill rig's way
- The proposed sampling included the collection of samples at 1-foot intervals to 25 feet below ground surface (bgs). However, continuous sampling was conducted at 2-foot intervals using split-spoon and Shelby tubes samplers, and borings were advanced to 26 feet bgs, except for SO-02 (25.5 feet bgs) and SO-04 (see below).

- Organic material was encountered at SO-04 at a depth of approximately 21 feet bgs with very little cohesive material above 21 feet bgs. To obtain the planned samples (two Shelby tube intact samples and four index testing samples), Ramboll Environ recommended drilling to 28 feet bgs to collect the required number of samples.
- Deep organic material was also encountered in SO-05 with very little cohesive material. Instead of drilling deeper at this location like at SO-04, Ramboll Environ recommended collecting fewer index-testing samples as the subsurface conditions were similar to SO-04, and thus, only two index testing samples were collected. Additionally, the Shelby tube collected from 20 to 22 feet bgs had limited recovery; therefore, a Triaxial test could not be performed, so an index testing was performed on the recovered material.

Sediment Core Processing

- A composite sample was collected from the soft sediment in the core from SD-08 instead of SD-11 for physical parameter testing because there was no soft sediment at SD-11.
- A field decision (not in the proposed plan) was made in collecting 1-foot interval samples from locations SD-50, SD-51, SD-52, and SD-54 to be archived at the laboratory for possible chemical analysis in the future. The selection of intervals in these cores were coordinated with Ramboll Environ and CH2M in the field during sediment core processing based on visual observations, photoionization detector readings, and adjacent sampled locations and intervals. The 5- to 6-foot bss interval was selected for archiving from SD-50. The 6- to 7-foot bss interval was selected for archiving from SD-51. The 5- to 6-foot bss interval was selected for archiving from SD-52. The 6- to 7-foot bss interval was selected for archiving from SD-54.

Analytical Laboratory Data

Samples were collected and shipped to Pace Analytical Services, Inc., in Green Bay, Wisconsin, for analysis of and polyaromatic hydrocarbon (PAH), total organic carbon (TOC), diesel range organics (DRO), and residual range organics (RRO). QA/QC samples were collected as described in the FSP and QAPP (CH2M 2016a and 2016b). QA/QC samples included field duplicates, matrix spikes (MSs)/matrix spike duplicates (MSDs), and one equipment blank sample. Pore water samples were collected and shipped to Energy and Environmental Research Center at the University of North Dakota. Samples for geotechnical analysis, as discussed in the SSTM, were collected and analyzed by Coleman Engineering and are not discussed in this data usability report. A summary of the samples collected and the analyses are as follows:

- A total of 83 sediment samples, 15 field duplicate samples, and 13 aliquots for laboratory MS/MSDs were analyzed for PAHs, RROs, DROs, and/or TOC.
- A total of 16 pore water and sediment samples was analyzed for PAHs (34).
- Two investigation-derived waste samples were collected and analyzed for waste characterization parameters. The results of these sample were used to characterize waste for disposal. The waste data were not validated and are not included in this memorandum.

Analytical method information is presented in Exhibit 1 below. Sample delivery groups (SDGs) and sample identifications (IDs) are presented in Table 1.

Exhibit 1. Analytical Method Information
Lower Otter Creek and Confluence, Maumee Area of Concern

Analyte Class	Matrix	Method Citations	Laboratory Assignment
PAH-16	Sediment	SW-846 8270D SIM	Pace Analytical Services

Exhibit 1. Analytical Method Information
Lower Otter Creek and Confluence, Maumee Area of Concern

Analyte Class	Matrix	Method Citations	Laboratory Assignment
DRO (C10-C28)	Sediment	SW-846 8015B	Pace Analytical Services
RRO (C10-C40)	Sediment	SW-846 8015B	Pace Analytical Services
TOC	Sediment	SW-846 9060	Pace Analytical Services
PAH-34	Porewater/Sediment	ASTM D7363-13	Energy & Environmental Research Center

Excluding geotechnical samples sent to Coleman, 100 percent of the predesign sediment and pore water investigation data were reviewed, verified, and validated by CH2M following the Stage 2a validation level (Great Lakes National Program Office [GLNPO] Tier 1), and at least 20 percent of the sediment data at Stage 4 (GLNPO Tier 2), according to the *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use* (EPA 2009).

Stage 2a includes verification that samples were analyzed for the methods requested, review of the laboratory case narrative, and the accuracy, precision, completeness, and compliance of sample-related QC. Stage 4 includes all of the items in Stage 2a validation, plus completeness and compliance of instrument QC, recalculations, and review of instrument outputs (raw data). Samples were selected for Stage 4 validation by randomly selecting samples that contained concentrations high enough for recalculation.

Validation was performed manually in accordance with the QAPP and patterned after the EPA National Functional Guidelines flagging protocol (EPA 2014a and 2014b). The QC requirements specified in the QAPP, individual analytical method requirements, and laboratory standard operating procedures were referenced during the review of the data set. Data were qualified according to the measurement quality objectives specified in the QAPP for each parameter.

Data qualifiers were applied to sample results when the QC statistics indicated a possible bias to specific compounds or analytes associated with a particular method and sample batch. Multiple qualifiers are routinely applied to specific sample method/matrix/analyte combinations, but there will only be one final qualifier. A final qualifier is applied to the data and is the most conservative of the applied validation qualifiers. Standard data qualifiers were used as a means of classifying the data with regard to their conformance to QC requirements. The applied data qualifiers are defined in Exhibit 2.

Exhibit 2. Summary of Data Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Qualifier	Definition
U	The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J	The analyte was positively identified; the associated numerical value is an approximate concentration of the analyte in the sample.
UJ	The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the action limit of quantitation necessary to accurately and precisely measure the analyte in the sample.
R	The sample result was rejected because of serious deficiencies in the ability to analyze the sample and meet the QC criteria. The presence of absence of the analyte could not be verified.

In some cases, multiple runs were reported for PAHs due to dilutions and/or re-extractions. Validation protocol and professional judgment were used by the validator to determine the most representative result for final reporting.

Samples that contained analytes exceeding the calibration range were diluted and reanalyzed by the laboratory. The result from the lowest dilution not exceeding the calibration range should be used for making project decisions.

Findings

The QA/QC results were within project control limits, except where noted in the following subsections. Table 2 lists changes in data qualifiers based upon the validation process, not including those that were excluded due to dilutions or reanalysis.

Hold Time

All hold times were met, with the following exceptions: samples OC2016-SD-22-0.0/0.5, OC2016-SD-22-0.5/1.0, and OC2016-SD-22-1.0/1.4 were taken off hold after the holding time had been exceeded, and associated compounds were qualified as estimated "J" or "UJ".

Surrogate Recovery

Surrogates were added as required and, generally, all acceptable criteria were met. When surrogate recoveries were low, the associated compounds were qualified as estimated "J" or "UJ". When recoveries were high, associated detected compounds were qualified as estimated "J", and nondetects were not qualified.

Matrix Spike and Matrix Spike Duplicates

MS/MSD samples were performed as required. The majority of recoveries were within established control limits. When recoveries were low, the MS/MSD parent sample result was qualified as estimated "J" or "UJ". When recoveries or relative percent differences (RPDs) were high, MS/MSD parent sample detected results were qualified as estimated "J", and nondetects were not qualified. In cases where the recoveries or RPD were outside of criteria, but the parent sample concentration was greater than 4 times the spiking level, the results were not qualified.

Equipment Blank

In accordance with the FSP and QAPP, equipment blank samples were collected for nondisposable sampling equipment. One equipment blank sample (EB-001) was collected by pouring deionized water over the decontaminated stainless-steel spoons used for processing the sediment cores and homogenizing the sediment prior to containerizing in sample jars. The equipment blank was generally free from contamination, with the exception of phenanthrene, benzo(b)fluoranthene, fluoranthene, and chrysene. Sample results for the compounds less than the reporting limit (RL) were qualified as not detected "U", and the numeric value raised to the value of the RL.

Pyrene was reported in the equipment blank, but also detected in the associated method blank, was qualified as not detected "U", and the numeric value raised to the value of the RL. Therefore, the result for pyrene was not used to qualify other field samples.

Method Blank

The laboratory method blanks were generally free from contamination, with the exception of DRO, RRO, and pyrene. Sample results for these compounds less than the RL were qualified as not detected "U", and the numeric value was raised to the value of the RL.

Continuing Calibration Blank

Calibration blanks were analyzed at the required frequency and, generally, all acceptable criteria were met.

Laboratory Duplicate Samples

Laboratory duplicate samples were performed by the laboratory to determine instrument and method precision and, generally, all acceptable criteria were met.

Field Duplicate Samples

Field duplicate samples were collected to measure heterogeneity of the sample matrix, analytical precision, and representativeness. Field duplicate pairs were collected at the same time as the parent sample and analyzed for the same parameters. In accordance with the FSP and data quality objectives, when the RPD between the parent sample and the field duplicate sample exceeded 100 percent, and the sample values were greater than or equal to 5 times the reporting limit, the results were qualified as estimated “J” in the field duplicate pair. Nondetected results were qualified as estimated “UJ” if one sample result in the field duplicate pair was reported above the reporting limit.

Continuing Calibration Verification

Continuing calibration verifications were analyzed at the required frequency and, generally, all acceptable criteria were met.

Independent Validation

The sediment data set was submitted on January 10, 2017, to EPA’s Quality Assurance Technical Support contractor, CB&I Federal Services LLC (CB&I), for an independent review of completeness and to verify that the data validation had been conducted in accordance with the National Functional Guidelines and QAPP. The objective of the independent review is to assess the accuracy and precision of the method and the matrix using the appropriate criteria. Upon receipt from CB&I, the results of the CB&I validation will be provided in Attachment 1 of this DUR.

Conclusions

The goal of the data assessment is to determine if deviations from the FSP and QAPP affect the usability of the field data and the analytical results, meet the data quality objectives, and whether the field and laboratory data can be used to support the decision making process. The following summary highlights the data evaluation findings:

1. The gaps in the topographic survey coverage were addressed by extrapolating the nearby data points and aerial photographs; therefore, the deviation will not adversely affect the data usability.
2. At the southern end of the Otter Creek reach, where the survey was not accessible due to shallow water, the use of a manual bathymetric survey to supplement the single-beam survey does not affect the data usability.
3. Some proposed sampling locations in the project area were adjusted (to meet the data quality objectives) in the field due to site conditions. The adjusted locations will not adversely affect the data usability.
4. The relocation of sample SD-37 approximately 10 feet from the original location because of low recovery will not adversely affect the data usability.
5. Some of the proposed geotechnical sampling locations in the Otter Creek banks were adjusted in the field under the direction of the Ramboll Environ NFS representative. The final decisions on selecting

the geotechnical samples were also made by the Ramboll Environ NFS representative. Because Ramboll Environ will be the engineer on record for the remedial design, these modifications will not adversely affect the data usability.

6. At few locations, multiple sampling attempts were required. Sampling attempts were followed per the procedures outlined in the FSP (CH2M 2016b) and QAPP (CH2M 2016a), meeting the data quality objectives.
7. Samples were collected as indicated in the FSP and QAPP and meet the accuracy and precision criteria for good data quality.
8. Due to the laboratory reporting issues identified by CH2M validators, the amount and level of data validation was increased to determine if the precision and accuracy of the data would meet the data quality objectives. As a result of the increased validation recommended by CH2M and performed by CB&I, CH2M validators and chemists determined the data quality objectives were met as measured by field and laboratory QC indicators.
9. The completeness objective of 90 percent was met for all method/analyte combinations.

References

CH2M HILL, Inc. (CH2M). 2016a. *Quality Assurance Project Plan, Lower Otter Creek and Confluence, Maumee River Area of Concern, Toledo, Ohio*.

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U.S. Environmental Protection Agency (EPA). 2014a. *Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review*. EPA-540-R-14-002. August.

U.S. Environmental Protection Agency (EPA). 2014b. *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Data Review*. OSWER 9240.1-51. EPA 540-R-13-01. August.

Tables

Table 1. Sample Delivery Group and Sample Identification Summary
Lower Otter Creek and Confluence, Maumee Area of Concern

SDG	Sample ID
40138448	OC2016-SD-02-0.0/1.0
40138448	OC2016-SD-02-1.0/2.7
40138448	OC2016-SD-02-2.7/3.7
40138448	OC2016-SD-03-0.0/1.0
40138448	OC2016-SD-03-0.0/1.0-FD
40138448	OC2016-SD-03-1.0/2.0
40138448	OC2016-SD-03-2.0/3.8
40138448	OC2016-SD-03-3.8/4.8
40138448	OC2016-SD-04-0.0/0.5
40138448	OC2016-SD-04-0.0/0.5-FD
40138448	OC2016-SD-04-0.5/1.0
40138448	OC2016-SD-04-1.0/1.5
40138448	OC2016-SD-04-1.5/2.0
40138448	OC2016-SD-05-0.0/0.5
40138448	OC2016-SD-05-0.0/0.5-FD
40138448	OC2016-SD-05-0.5/1.0
40138448	OC2016-SD-05-1.0/1.5
40138448	OC2016-SD-05-1.5/2.5
40138448	OC2016-SD-06-0.0/0.5
40138448	OC2016-SD-06-0.5/1.0
40138448	OC2016-SD-06-0.5/1.0-FD
40138448	OC2016-SD-06-1.0/1.5
40138448	OC2016-SD-06-1.5/1.9
40138448	OC2016-SD-07-0.0/0.5
40138448	OC2016-SD-07-0.0/0.5-FD
40138448	OC2016-SD-07-0.0/1.5
40138448	OC2016-SD-07-1.5/2.5
40138448	OC2016-SD-34-10.3/10.7
40138448	OC2016-SD-34-4.0/5.0
40138448	OC2016-SD-34-4.0/5.0-FD
40138448	OC2016-SD-34-9.3/10.3
40138448	OC2016-SD-35-4.0/5.0
40138448	OC2016-SD-35-6.3/7.3
40138448	OC2016-SD-35-6.3/7.3-FD
40138448	OC2016-SD-35-7.3/7.7
40138448	OC2016-SD-37-3.0/4.0
40138451	OC2016-SD-11-0.0/1.0
40138451	OC2016-SD-12-0.0/0.5
40138451	OC2016-SD-12-0.5/1.0
40138451	OC2016-SD-12-1.0/1.5
40138451	OC2016-SD-12-1.5/2.0
40138451	OC2016-SD-12-1.5/2.0-FD
40138451	OC2016-SD-13-0.0/1.0
40138451	OC2016-SD-14-0.0/0.5
40138451	OC2016-SD-14-0.0/1.6
40138451	OC2016-SD-14-0.5/1.0
40138451	OC2016-SD-14-1.0/1.4
40138451	OC2016-SD-14-1.4/2.4
40138451	OC2016-SD-15-0.0/1.4
40138451	OC2016-SD-15-0.0/1.4-FD
40138451	OC2016-SD-15-1.4/2.0
40138451	OC2016-SD-38-4.5/5.5
40138451	OC2016-SD-40-4.5/5.5
40138451	OC2016-SD-40-4.5/5.5-FD
40138451	OC2016-SD-40-5.5/6.5
40138451	OC2016-SD-40-6.5/7.5
40138451	OC2016-SD-41-2.0/3.0
40138451	OC2016-SD-43-5.0/6.0
40138451	OC2016-SD-43-6.0/7.0
40138451	OC2016-SD-44-5.0/5.6
40138451	OC2016-SD-44-5.6/6.6
40138451	OC2016-SD-44-5.6/6.6-FD
40138451	OC2016-SD-44-6.6/7.6
40138487	OC2016-SD-08-0.0/0.5
40138487	OC2016-SD-08-0.5/1.0
40138487	OC2016-SD-08-0.5/1.0-FD
40138487	OC2016-SD-08-1.0/1.5
40138487	OC2016-SD-08-1.5/1.8
40138487	OC2016-SD-09-0.0/1.0
40138487	OC2016-SD-22-0.0/0.5
40138487	OC2016-SD-22-0.5/1.0
40138487	OC2016-SD-22-1.0/1.4
40138487	OC2016-SD-23-3.9/4.9
40138487	OC2016-SD-25-0.0/5.2
40138487	OC2016-SD-25-4.2/5.2
40138487	OC2016-SD-25-5.2/6.2
40138487	OC2016-SD-27-4.6/5.6
40138487	OC2016-SD-27-5.6/6.6
40138487	OC2016-SD-28-4.0/5.0
40138487	OC2016-SD-28-5.2/6.2

Table 1. Sample Delivery Group and Sample Identification Summary
Lower Otter Creek and Confluence, Maumee Area of Concern

SDG	Sample ID
40138487	OC2016-SD-28-6.2/7.2
40138487	OC2016-SD-29-4.0/5.0-FD
40138489	OC2016-SD-01-0.0/1.0
40138489	OC2016-SD-01-1.0/2.5
40138489	OC2016-SD-01-1.0/2.5-FD
40138489	OC2016-SD-01-2.5/3.5
40138489	OC2016-SD-07-0.5/1.0
40138489	OC2016-SD-07-1.0/1.5
40138489	OC2016-SD-10-0.0/1.0
40138489	OC2016-SD-29-4.0/5.0
40138489	OC2016-SD-29-5.0/6.0
40138489	OC2016-SD-30-10.7/11.7
40138489	OC2016-SD-30-11.7/12.7
40138489	OC2016-SD-30-4.0/5.0
40138489	OC2016-SD-33-0.0/10.0
40138489	OC2016-SD-33-10.0/10.8
40138489	OC2016-SD-33-4.0/5.0
40138489	OC2016-SD-33-4.0/5.0-FD
40138489	OC2016-SD-33-9.0/10.0
40138505	OC2016-EB-001
EERC201609	OC2016-PW-01-0.0/0.5
EERC201609	OC2016-PW-02-0.0/0.5
EERC201609	OC2016-PW-03-0.0/0.5
EERC201609	OC2016-PW-04-0.0/0.5
EERC201609	OC2016-PW-05-0.0/0.5
EERC201609	OC2016-PW-06-0.0/0.5
EERC201609	OC2016-PW-07-0.0/0.5
EERC201609	OC2016-PW-08-0.0/0.5
EERC201609	OC2016-PW-09-0.0/0.5
EERC201609	OC2016-PW-10-0.0/0.5
EERC201609	OC2016-PW-11-0.0/0.5
EERC201609	OC2016-PW-12-0.0/0.5
EERC201609	OC2016-PW-13-0.0/0.5
EERC201609	OC2016-PW-14-0.0/0.5
EERC201609	OC2016-PW-15-0.0/0.5
EERC201609	OC2016-PW-22-0.0/0.5

Table 2. Applied Data Validation Qualifiers

Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
C2016-EB-001	40138505	SW8270	INITIAL	Pyrene	0.035	µg/l	U	Original lab result 0.025 DV code=MBL
OC2016-SD-01-0.0/1.0	40138489	BNASIM	INITIAL	Pyrene	1470	µg/kg	J	MSDH
OC2016-SD-01-0.0/1.0	40138489	BNASIM	INITIAL	Benzo(k)fluoranthene	195	µg/kg	J	MSDH
OC2016-SD-01-0.0/1.0	40138489	BNASIM	INITIAL	Benzo(a)pyrene	984	µg/kg	J	MSDH
OC2016-SD-01-0.0/1.0	40138489	BNASIM	INITIAL	Benzo(a)anthracene	1550	µg/kg	J	MSDH
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Pyrene	110	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Benzo(g,h,i)perylene	29.3	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Benzo(b)fluoranthene	52.5	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Chrysene	140	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Benzo(a)pyrene	61.4	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Dibenzo(a,h)anthracene	22.6	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Benzo(a)anthracene	81.1	µg/kg	J	FD
OC2016-SD-01-1.0/2.5	40138489	BNASIM	INITIAL	Phenanthrene	127	µg/kg	J	FD
OC2016-SD-01-2.5/3.5	40138489	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	2.1	mg/kg	U	Original lab result 0.93, DV code=EBL
OC2016-SD-01-2.5/3.5	40138489	SW8015B	INITIAL	TPH (C10-C40)	2.1	mg/kg	U	Original lab result 1.20, DV code=EBL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Pyrene	271	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	250	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Fluoranthene	183	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Acenaphthylene	38.7	µg/kg	J	MSL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Chrysene	459	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Benzo(a)pyrene	243	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Benzo(a)anthracene	287	µg/kg	J	MSDL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Acenaphthene	10.1	µg/kg	J	MSL
OC2016-SD-02-0.0/1.0	40138448	BNASIM	INITIAL	Phenanthrene	56.7	µg/kg	U	Original lab result 49.6 DV code= EBL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Anthracene	42.1	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Fluoranthene	130	µg/kg	J	MSL

Table 2. Applied Data Validation Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Benzo(k)fluoranthene	63.1	µg/kg	J	2SL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Acenaphthylene	16.8	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Chrysene	251	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Acenaphthene	31.3	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Phenanthrene	166	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Fluorene	36.2	µg/kg	J	MSL
OC2016-SD-03-1.0/2.0	40138448	BNASIM	INITIAL	Naphthalene	79.9	µg/kg	J	MSL
OC2016-SD-04-0.0/0.5	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	35.6	µg/kg	J	FD
OC2016-SD-04-0.0/0.5	40138448	BNASIM	INITIAL	Benzo(k)fluoranthene	33.1	µg/kg	J	2SL
OC2016-SD-04-1.0/1.5	40138448	BNASIM	INITIAL	Phenanthrene	53.1	µg/kg	U	Original lab result 26.0 DV code=EBL
OC2016-SD-04-1.5/2.0	40138448	BNASIM	INITIAL	Fluoranthene	135	µg/kg	J	MSDL
OC2016-SD-05-0.0/0.5	40138448	BNASIM	INITIAL	Anthracene	189	µg/kg	J	FD
OC2016-SD-05-0.0/0.5	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	279	µg/kg	J	FD
OC2016-SD-05-0.0/0.5	40138448	BNASIM	INITIAL	Fluoranthene	473	µg/kg	J	FD
OC2016-SD-05-0.0/0.5	40138448	BNASIM	INITIAL	Phenanthrene	462	µg/kg	J	FD
OC2016-SD-05-1.0/1.5	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	14	µg/kg	U	Original lab result 7.6 DV code=EBL
OC2016-SD-05-1.0/1.5	40138448	BNASIM	INITIAL	Fluoranthene	25.8	µg/kg	U	Original lab result 15.9 DV code=EBL
OC2016-SD-05-1.0/1.5	40138448	BNASIM	INITIAL	Chrysene	16.6	µg/kg	U	Original lab result 7.8 DV code=EBL
OC2016-SD-05-1.5/2.5	40138448	BNASIM	INITIAL	Fluoranthene	23.4	µg/kg	U	Original lab result 9.7 DV code=EBL
OC2016-SD-05-1.5/2.5	40138448	BNASIM	INITIAL	Benzo(k)fluoranthene	4.2	µg/kg	J	2SL
OC2016-SD-05-1.5/2.5	40138448	BNASIM	INITIAL	Chrysene	15.1	µg/kg	U	Original lab result 5.4 DV code=EBL
OC2016-SD-05-1.5/2.5	40138448	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	2.3	mg/kg	U	Original lab result 0.69 DV code=MBL
OC2016-SD-05-1.5/2.5	40138448	SW8015B	INITIAL	TPH (C10-C40)	2.3	mg/kg	U	Original lab result 0.79 DV code=MBL
OC2016-SD-06-0.0/0.5	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	14.1	µg/kg	U	Original lab result 13.6 DV code=EBL
OC2016-SD-06-0.0/0.5	40138448	BNASIM	INITIAL	Fluoranthene	26	µg/kg	U	Original lab result 13.1 DV code=EBL
OC2016-SD-06-0.0/0.5	40138448	BNASIM	INITIAL	Chrysene	16.7	µg/kg	U	Original lab result 14.9 DV code=EBL
OC2016-SD-06-0.5/1.0	40138448	BNASIM	INITIAL	Phenanthrene	52.6	µg/kg	U	Original lab result 32.2 DV code=EBL
OC2016-SD-06-1.0/1.5	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	12.9	µg/kg	U	Original lab result 11.0 DV code EBL

Table 2. Applied Data Validation Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-06-1.0/1.5	40138448	BNASIM	INITIAL	Fluoranthene	23.9	µg/kg	U	Original lab result 19.8 DV code EBL
OC2016-SD-06-1.0/1.5	40138448	BNASIM	INITIAL	Chrysene	15.4	µg/kg	U	Original lab result 11.2 DV code EBL
OC2016-SD-07-0.0/0.5	40138448	BNASIM	INITIAL	Benzo(k)fluoranthene	67.6	µg/kg	J	2SL
OC2016-SD-07-0.0/0.5	40138448	BNASIM	INITIAL	Acenaphthylene	9.2	µg/kg	J	SSL
OC2016-SD-07-0.0/0.5	40138448	BNASIM	INITIAL	Acenaphthene	22.5	µg/kg	UJ	SSL
OC2016-SD-07-0.0/0.5	40138448	BNASIM	INITIAL	Fluorene	9.2	µg/kg	J	SSL
OC2016-SD-07-0.0/0.5	40138448	BNASIM	INITIAL	Naphthalene	41.9	µg/kg	J	SSL
OC2016-SD-07-0.5/1.0	40138489	BNASIM	INITIAL	Chrysene	240	µg/kg	J	MSDL
OC2016-SD-07-0.5/1.0	40138489	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	41.2	mg/kg	J	MSDH
OC2016-SD-07-0.5/1.0	40138489	SW8015B	INITIAL	TPH (C10-C40)	49.8	mg/kg	J	MSH
OC2016-SD-08-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	42.9	µg/kg	J	2SL
OC2016-SD-08-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	29.5	µg/kg	J	2SL
OC2016-SD-08-0.5/1.0	40138487	BNASIM	INITIAL	Phenanthrene	50.6	µg/kg	U	Original lab result 34.7 DV code=EBL
OC2016-SD-08-1.0/1.5	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	38	µg/kg	J	2SL
OC2016-SD-08-1.0/1.5	40138487	BNASIM	INITIAL	Phenanthrene	52.9	µg/kg	U	Original lab result 51.3 DV code=EBL
OC2016-SD-08-1.5/1.8	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	12.3	µg/kg	U	Original lab result 3.8 DV code=EBL
OC2016-SD-08-1.5/1.8	40138487	BNASIM	INITIAL	Fluoranthene	22.7	µg/kg	U	Original lab result 10.3 DV code=EBL
OC2016-SD-08-1.5/1.8	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	5.9	µg/kg	J	2SL
OC2016-SD-08-1.5/1.8	40138487	BNASIM	INITIAL	Chrysene	14.6	µg/kg	U	Original lab result 6.9 DV code=EBL
OC2016-SD-09-0.0/1.0	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	9.9	µg/kg	UJ	2SL
OC2016-SD-11-0.0/1.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	9.9	µg/kg	UJ	2SL
OC2016-SD-12-0.0/0.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	32.7	µg/kg	J	2SL
OC2016-SD-12-0.5/1.0	40138451	BNASIM	INITIAL	Fluoranthene	22.5	µg/kg	U	Original lab result 16.7 DV code=EBL
OC2016-SD-12-0.5/1.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	17.8	µg/kg	J	2SL
OC2016-SD-12-1.0/1.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	19.3	µg/kg	J	2SL
OC2016-SD-12-1.5/2.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	37.4	µg/kg	J	2SL
OC2016-SD-12-1.5/2.0	40138451	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	30.8	mg/kg	J	FD
OC2016-SD-12-1.5/2.0	40138451	SW8015B	INITIAL	TPH (C10-C40)	39	mg/kg	J	FD

Table 2. Applied Data Validation Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-13-0.0/1.0	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	11	µg/kg	U	Original lab result 9.4 DV code=EBL
OC2016-SD-13-0.0/1.0	40138451	BNASIM	INITIAL	Fluoranthene	20.4	µg/kg	U	Original lab result 9.8 DV code=EBL
OC2016-SD-13-0.0/1.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	4	µg/kg	J	2SL
OC2016-SD-13-0.0/1.0	40138451	BNASIM	INITIAL	Phenanthrene	45.4	µg/kg	U	Original lab result 18.4 DV code=EBL
OC2016-SD-14-0.0/0.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	47.4	µg/kg	J	2SL
OC2016-SD-14-0.5/1.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	440	µg/kg	J	2SL
OC2016-SD-14-1.0/1.4	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	613	µg/kg	J	2SL
OC2016-SD-14-1.4/2.4	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	7.9	µg/kg	J	2SL
OC2016-SD-15-0.0/1.4	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	51.8	µg/kg	J	2SL
OC2016-SD-15-1.4/2.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	10.2	µg/kg	UJ	2SL
OC2016-SD-15-1.4/2.0	40138451	BNASIM	INITIAL	Chrysene	13.7	µg/kg	U	Original lab result 4.7 DV code=EBL
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Anthracene	46.5	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Pyrene	141	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(g,h,i)perylene	77.4	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Indeno(1,2,3-Cd)Pyrene	70.1	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	140	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Fluoranthene	161	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	73.3	µg/kg	J	2SL
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Acenaphthylene	51	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Chrysene	134	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(a)pyrene	132	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Dibenzo(a,h)anthracene	21.5	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Benzo(a)anthracene	102	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Acenaphthene	18.9	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Phenanthrene	124	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Fluorene	16.1	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	BNASIM	INITIAL	Naphthalene	17.3	µg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	Lloyd Kahn	INITIAL	Total Organic Carbon	13000	mg/kg	J	HTP

Table 2. Applied Data Validation Qualifiers

Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-22-0.0/0.5	40138487	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	13.9	mg/kg	J	HTP
OC2016-SD-22-0.0/0.5	40138487	SW8015B	INITIAL	TPH (C10-C40)	18.2	mg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Anthracene	13.3	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Pyrene	84.3	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(g,h,i)perylene	33.6	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Indeno(1,2,3-Cd)Pyrene	26.2	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	56.6	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Fluoranthene	76.8	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	31.6	µg/kg	J	2SL
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Acenaphthylene	9.7	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Chrysene	61	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(a)pyrene	63.4	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Dibenzo(a,h)anthracene	7.7	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Benzo(a)anthracene	51.1	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Acenaphthene	5.4	µg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Phenanthrene	54	µg/kg	U	Original lab result 27.7 DV code=EBL
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Fluorene	19.2	µg/kg	UJ	HTP
OC2016-SD-22-0.5/1.0	40138487	BNASIM	INITIAL	Naphthalene	39.1	µg/kg	UJ	HTP
OC2016-SD-22-0.5/1.0	40138487	Lloyd Kahn	INITIAL	Total Organic Carbon	28300	mg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	22.3	mg/kg	J	HTP
OC2016-SD-22-0.5/1.0	40138487	SW8015B	INITIAL	TPH (C10-C40)	31.8	mg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Anthracene	8.6	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Pyrene	36.2	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Benzo(g,h,i)perylene	12.2	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Indeno(1,2,3-Cd)Pyrene	11.4	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	26	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Fluoranthene	42.7	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	15.7	µg/kg	J	2SL

Table 2. Applied Data Validation Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Acenaphthylene	15.2	µg/kg	UJ	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Chrysene	29.8	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Benzo(a)pyrene	24.5	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Dibenzo(a,h)anthracene	10.3	µg/kg	UJ	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Benzo(a)anthracene	23.5	µg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Acenaphthene	17.8	µg/kg	UJ	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Phenanthrene	53.5	µg/kg	U	Original lab result 20.7 DV code=EBL
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Fluorene	19	µg/kg	UJ	HTP
OC2016-SD-22-1.0/1.4	40138487	BNASIM	INITIAL	Naphthalene	38.7	µg/kg	UJ	HTP
OC2016-SD-22-1.0/1.4	40138487	Lloyd Kahn	INITIAL	Total Organic Carbon	9330	mg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	4.2	mg/kg	J	HTP
OC2016-SD-22-1.0/1.4	40138487	SW8015B	INITIAL	TPH (C10-C40)	5.6	mg/kg	J	HTP
OC2016-SD-23-3.9/4.9	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	9.9	µg/kg	UJ	2SL
OC2016-SD-25-4.2/5.2	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	19.8	µg/kg	J	2SL
OC2016-SD-25-5.2/6.2	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	10.3	µg/kg	UJ	2SL
OC2016-SD-25-5.2/6.2	40138487	BNASIM	INITIAL	Chrysene	13.8	µg/kg	U	Original lab result 7.1 DV code=EBL
OC2016-SD-27-4.6/5.6	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	10.7	µg/kg	U	Original lab result 7.2 DV code=EBL
OC2016-SD-27-4.6/5.6	40138487	BNASIM	INITIAL	Fluoranthene	19.9	µg/kg	U	Original lab result 7.7 DV code=EBL
OC2016-SD-27-4.6/5.6	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	9.5	µg/kg	UJ	2SL
OC2016-SD-27-4.6/5.6	40138487	BNASIM	INITIAL	Phenanthrene	44.3	µg/kg	U	Original lab result 13.9 DV code=EBL
OC2016-SD-27-5.6/6.6	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	10	µg/kg	UJ	2SL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Anthracene	407	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Benzo(g,h,i)perylene	427	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Indeno(1,2,3-Cd)Pyrene	442	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Benzo(b)fluoranthene	644	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	974	µg/kg	J	2SL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Acenaphthylene	77.6	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Chrysene	1010	µg/kg	J	MSL

Table 2. Applied Data Validation Qualifiers
Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Benzo(a)pyrene	962	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Dibenzo(a,h)anthracene	171	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Benzo(a)anthracene	1050	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Acenaphthene	127	µg/kg	UJ	MSDL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Phenanthrene	466	µg/kg	J	MSL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Fluorene	136	µg/kg	UJ	MSDL
OC2016-SD-28-4.0/5.0	40138487	BNASIM	INITIAL	Naphthalene	276	µg/kg	UJ	MSDL
OC2016-SD-28-4.0/5.0	40138487	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	24	mg/kg	J	MSH
OC2016-SD-28-5.2/6.2	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	10.3	µg/kg	UJ	2SL
OC2016-SD-28-5.2/6.2	40138487	BNASIM	INITIAL	Chrysene	13.8	µg/kg	U	Original lab result 7.5 DV code=EBL
OC2016-SD-28-6.2/7.2	40138487	BNASIM	INITIAL	Benzo(k)fluoranthene	9.6	µg/kg	UJ	2SL
OC2016-SD-29-4.0/5.0	40138489	BNASIM	INITIAL	Benzo(k)fluoranthene	5.4	µg/kg	J	2SL
OC2016-SD-33-4.0/5.0	40138489	BNASIM	INITIAL	Chrysene	21	µg/kg	U	Original lab value 9.9 Dvcode= EBL
OC2016-SD-34-10.3/10.7	40138448	BNASIM	INITIAL	Benzo(k)fluoranthene	10.1	µg/kg	UJ	2SL
OC2016-SD-34-4.0/5.0	40138448	BNASIM	INITIAL	Benzo(b)fluoranthene	24.1	µg/kg	U	Original lab value 11.6 DVcode= EBL
OC2016-SD-34-4.0/5.0	40138448	BNASIM	INITIAL	Chrysene	28.7	µg/kg	U	Original lab value 20.4 DVcode= EBL
OC2016-SD-38-4.5/5.5	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	11.4	µg/kg	U	Original lab value 4.2 DV code= EBL
OC2016-SD-38-4.5/5.5	40138451	BNASIM	INITIAL	Fluoranthene	21	µg/kg	U	Original lab value 15.2 DV code= EBL
OC2016-SD-38-4.5/5.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	6.1	µg/kg	J	2SL
OC2016-SD-38-4.5/5.5	40138451	BNASIM	INITIAL	Chrysene	13.5	µg/kg	U	Original lab value 7.1 DV code= EBL
OC2016-SD-40-4.5/5.5	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	22.8	µg/kg	U	Original lab result 8.3 DV code=EBL
OC2016-SD-40-4.5/5.5	40138451	BNASIM	INITIAL	Fluoranthene	42.1	µg/kg	U	Original lab result 17.5 DV code=EBL
OC2016-SD-40-4.5/5.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	6.9	µg/kg	J	2SL
OC2016-SD-40-4.5/5.5	40138451	BNASIM	INITIAL	Chrysene	27.1	µg/kg	U	Original lab result 26.7 DV code=EBL
OC2016-SD-40-4.5/5.5	40138451	BNASIM	INITIAL	Phenanthrene	93.9	µg/kg	U	Original lab result 48.9 DV code=EBL
OC2016-SD-40-5.5/6.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	12.7	µg/kg	UJ	2SL
OC2016-SD-40-6.5/7.5	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	10.6	µg/kg	UJ	2SL
OC2016-SD-41-2.0/3.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	10.6	µg/kg	UJ	2SL

Table 2. Applied Data Validation Qualifiers

Lower Otter Creek and Confluence, Maumee Area of Concern

Sample ID	SDG	Analytical Method	Analytical Run	Analyte	Result	Unit	CH2M Final Qualifier	Reason Code/Comment
OC2016-SD-43-5.0/6.0	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	14.5	µg/kg	U	Original lab result 10.1 DV code EBL
OC2016-SD-43-5.0/6.0	40138451	BNASIM	INITIAL	Fluoranthene	26.8	µg/kg	U	Original lab result 23.9 DV code EBL
OC2016-SD-43-5.0/6.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	9.8	µg/kg	J	2SL
OC2016-SD-43-5.0/6.0	40138451	BNASIM	INITIAL	Phenanthrene	59.7	µg/kg	U	Original lab result 30.7 DV code EBL
OC2016-SD-43-6.0/7.0	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	10	µg/kg	UJ	2SL
OC2016-SD-43-6.0/7.0	40138451	SW8015B	INITIAL	Diesel Range Organics (C10 - C28)	2	mg/kg	U	Original lab result 1.3 DV code=MBL
OC2016-SD-44-5.0/5.6	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	23.6	µg/kg	U	Original lab result 10.4 DV code=EBL
OC2016-SD-44-5.0/5.6	40138451	BNASIM	INITIAL	Fluoranthene	43.7	µg/kg	U	Original lab result 18.8 DV code=EBL
OC2016-SD-44-5.0/5.6	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	12.7	µg/kg	J	2SL
OC2016-SD-44-5.0/5.6	40138451	BNASIM	INITIAL	Chrysene	28.1	µg/kg	U	Original lab result 26.6 DV code=EBL
OC2016-SD-44-5.6/6.6	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	21.9	µg/kg	U	Original lab result 13.5 DV code=EBL
OC2016-SD-44-5.6/6.6	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	11	µg/kg	J	2SL
OC2016-SD-44-6.6/7.6	40138451	BNASIM	INITIAL	Benzo(b)fluoranthene	11.6	µg/kg	U	Original lab result 3.5 DV code=EBL
OC2016-SD-44-6.6/7.6	40138451	BNASIM	INITIAL	Fluoranthene	21.4	µg/kg	U	Original lab result 9.3 DV code=EBL
OC2016-SD-44-6.6/7.6	40138451	BNASIM	INITIAL	Benzo(k)fluoranthene	4.7	µg/kg	J	2SL
OC2016-SD-44-6.6/7.6	40138451	BNASIM	INITIAL	Chrysene	13.8	µg/kg	U	Original lab result 9.8 DV code=EBL
OC2016-SD-44-6.6/7.6	40138451	BNASIM	INITIAL	Phenanthrene	47.8	µg/kg	U	Original lab result 16.2 DV code=EBL

mg/kg = milligram per kilogram; µg/kg = microgram per kilogram

Reason Code Definitions:

2SL	Second source standard recovery low
FD	Field duplicate exceeds RPD criteria
HTP	Hold time exceedance
EBL	Equipment blank concentration exceeded criteria
MBL	Method blank concentration exceeded criteria
MSDH	Matrix spike duplicate recovery criteria greater than the upper limit
MSDH	Matrix spike duplicate recovery criteria greater than the upper limit
MSDL	Matrix spike duplicate recovery criteria less than the lower limit
MSH	Matrix spike recovery criteria greater than the upper limit
MSL	Matrix spike recovery criteria less than the lower limit
SSL	Surrogate recovery less than lower limit

Attachment 1
CB&I validation (pending)

Attachment 5
Waste Manifest

Please print or type. (Form designed for use on elite (12-pitch) typewriter.) Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST	1. Generator ID Number: CESQG	2. Page 1 of 1	3. Emergency Response Phone	4. Manifest Tracking Number: 016583468 JJK

GENERATOR

5. Generator's Name and Mailing Address
USEPA
77 W. Jackson Blvd. G-17J, Chicago, IL 60604-3590
Generator's Phone: 312 886-7188 Attn: Brenda Jones

Generator's Site Address (if different than mailing address)
USEPA - BP Husky Facility's Boat Launch Area
1951 Otter Creek Road
Oregon, OH 43616

6. Transporter 1 Company Name: EQ Industrial Services, Inc. — U.S. EPA ID Number: MIK 435 642 742

7. Transporter 2 Company Name — U.S. EPA ID Number

8. Designated Facility Name and Site Address: EQ Detroit, Inc.
1923 Frederick Street
Detroit, MI 48211
Facility's Phone: 313-347-1300 — U.S. EPA ID Number: MID 980 991 566

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes
	1. Non RCRA, Non DOT Regulated Liquid (IDW water)	1	DM	500	P	029L
	2. Non RCRA, Non DOT Regulated Solid (IDW soil/sediment)	2	DM	1000	P	None
	3. Non RCRA, Non DOT Regulated Solid (PPE)	3	DM	600	P	None
	4.					

14. Special Handling Instructions and Additional Information
1. J165169DET NH IDW water
2. J165171DET NH IDW soil/sediment
3. J165172DET NH PPE / sediment core liners
CESI: ROAN-TFORT-5462-26208-27623

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name: ALISON SKWARSKI/CH2M on behalf of USEPA — Signature: Alison Skwarski — Month 10 Day 31 Year 16

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:
Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials
Transporter 1 Printed/Typed Name: Shellin Edwards — Signature — Month Day Year
Transporter 2 Printed/Typed Name — Signature — Month Day Year

DESIGNATED FACILITY

18. Discrepancy
18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection
Manifest Reference Number:
18b. Alternate Facility (or Generator) — U.S. EPA ID Number
Facility's Phone:
18c. Signature of Alternate Facility (or Generator) — Month Day Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)
1. 2. 3. 4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a
Printed/Typed Name — Signature — Month Day Year

EPA Form 8700-22 (Rev. 3-05) Previous editions are obsolete.

GENERATOR'S INITIAL COPY