REMEDIAL ACTION REPORT

FINAL DRAFT

LINCOLN PARK/MILWAUKEE RIVER CHANNEL
SEDIMENTS SITE PHASE 2

Great Lakes National Program Office Cleanup Services
(GLNPOCS)
Contract No. EP-R5-11-04
Task Order No. 0004

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<td>Triangulated Irregular Network</td>
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<td>VSP</td>
<td>Visual Sample Plan®</td>
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EXECUTIVE SUMMARY

The Environmental Quality Management, Inc. (EQM) Team mobilized to the Lincoln Park Phase 2 site on October 6, 2014 and demobilized on November 16, 2015. During this period, the Team:

- Installed temporary infrastructures and provided facilities to investigate the extent of contaminated sediment at the site.
- Remediated and removed contaminated sediments.
- Sampled and analyzed contaminated sediments.
- Provided confirmation sampling and analyses.
- Transported and disposed of solid and Toxic Substances Control Act (TSCA) waste generated from the contaminated sediments and infrastructure-impacted construction materials.
- Constructed natural habit features.
- Revegetated disturbed areas with native plantings in wetland areas and turf grass in upland areas as part of the site remediation restoration.

These activities resulted in the removal of 52,456 cubic yards of contaminated sediment and the transportation and disposal of 92,358.41 tons of solid waste and 4,972.42 tons of TSCA waste. Remediation efforts resulted in the removal of 2,330 pounds of polychlorinated biphenyls (PCBs) and 12,683 pounds of polynuclear aromatic hydrocarbon (PAH) contamination from 11.18 acres of the Milwaukee River stream bed.

A total of 1.62 acres of wetland habitat was restored with native seedings, trees, shrubs, and herbaceous plants. A total of 11 log/root wads and 10 boulder clusters were installed to improve wildlife habitat.
1. INTRODUCTION

1.1 Contract Information

Contractor Name: Environmental Quality Management, Inc.
Contract No.: EP-R5-11-04
Task Order No./Title: 0004/Lincoln Park, Milwaukee River Channel Sediment Site, Phase 2
Task Options Exercised: CLIN 0001 and CLIN 0002
Task Order Type: Lump Sum & Fixed Unit Rate
Period of Performance: 09/05/2014 – 12/31/2017

1.2 Project Background

This project is part of a Great Lakes Legacy Act (GLLA) contaminated sediment cleanup and habitat restoration project planned by U.S. Environmental Protection Agency (USEPA) and its project partners Milwaukee County Department of Parks, Recreation and Culture (MCDPRC) and the Wisconsin Department of Natural Resources (WDNR). The USEPA Great Lakes National Program Office (GLNPO) and its partners, the WDNR and the MCDPRC, sponsored a GLLA sediment cleanup project along the lower Milwaukee River within the City limits of Milwaukee and Glendale, Wisconsin. The site location is depicted in Figure 1-1. (Note: All figures are located in Appendix A.) The selected remedy was developed based on the Final Basis of Design Report, Lincoln Park/Milwaukee River Channel Sediments Site Phase 2 (LPP2) Feasibility Study/Remedial Design, Milwaukee Estuary Area of Concern, Milwaukee, Wisconsin (BODR), prepared for USEPA by EA Engineering, Science, and Technology, Inc. (EA), (EA, 2014a). Sediments contaminated with Polychlorinated Biphenyls (PCBs), Polynuclear Aromatic Hydrocarbons (PAHs), and Non-Aqueous Phase Liquid (NAPL) were discovered at the LPP2 site with concentrations exceeding standards that protect human health and the environment. This remedial action (RA) began in the middle of October 2014 and field work was completed in November 2015.

This Remedial Action Report (RAR) is one of the required submittals under the USEPA LPP2 task order (TO), which was awarded to Environmental Quality Management, Inc. (EQM) on September 5, 2014. TO 0004 was awarded under EQM’s Great Lakes National Program Of-
fice Cleanup Services (GLNPOCS) Contract (EP-R5-11-04). The RAR provides USEPA with an overview of the investigative, remedial, and restoration activities completed for this task order.

1.3 Site Characteristics

The 318-acre Lincoln Park property is located within the cities of Glendale and Milwaukee, Wisconsin, near the confluence of Lincoln Creek and the Milwaukee River. The Lincoln Park/Milwaukee River Site is part of the 103-acre Estabrook Impoundment within the Milwaukee Estuary Area of Concern (AOC) and includes Lincoln Creek downstream of Green Bay Avenue and the Milwaukee River from 1/4 mile north of the western and eastern oxbows to the Estabrook Park Dam. The LPP2 AOC includes the area along the Milwaukee River east of North Milwaukee River Parkway, from the railroad bridge north of the oxbows downstream to the Estabrook Park Dam.

The following project background information includes excerpts from the BODR (EA, 2014a). The Lincoln Park area was originally occupied by an oxbow of the Milwaukee River. The area was excavated in the 1930s to create a new, straighter main channel for the Milwaukee River, leaving the former main channel as the East and West Oxbows. The site contains sediments that were transported from Lincoln Creek and the Milwaukee River [STN Environmental JV (STN), 2009]. The Estabrook Dam located at the southern extent of the site was built on a limestone outcrop in the late 1930s to aid navigation and to maintain a pool of water above the dam for boating, swimming, and fishing. The dam is currently owned and operated by Milwaukee County. The bottom draw design of the dam and its periodic opening and closing has allowed the sediment to dewater, resulting in compaction of the sediment upstream within the impoundment (WDNR, 2005).

Inspections by WDNR have identified the need for significant repair work on the Estabrook Park Dam and fixed crest spillway. WDNR issued a Repair or Abandon Order to Milwaukee County on July 28, 2009. The order establishes deadlines for Milwaukee County to meet the needs that are related to outstanding maintenance and repair requirements. The order also gives Milwaukee County the option to decide whether to abandon the dam. The decision for repair or abandonment is the responsibility of Milwaukee County, the owner of the dam. The dam will remain open until it is repaired or abandoned.
PCB contamination was initially identified in the Milwaukee River through fish tissue sampling in 1981. Contaminated sediment has been recognized to be the major contributor to use impairments within the Milwaukee Estuary AOC [Technical and Citizens Advisory Committee (TCAC), 1994]. Beneficial Use Impairments (BUIs) in the AOC include fish consumption advisories, such as those in effect from Grafton to the mouth of the Milwaukee River resulting from PCB contaminations. The contaminated sediment management strategy of the Milwaukee Remedial Action Plan (RAP) identified remediation of upstream sources of contaminated sediments as a top priority.

The zones for the LPP2 Site consist of the following contaminated sediment deposits:

- **Zone 7**: Deposits 7-1, 7-2, 7-3, and 7-4.
- **Sub-Zone 3**: Deposit 3B-1.
- **Zone 4**: Deposits 4-1, 4-2, and 4-3.
- **Zone 5**: Deposit 5-1.

As part of the remedy selection process, USEPA and its partners developed remedial action objectives (RAOs) and remedial goals (RGs) to provide the framework for selecting and designing remedial alternatives that are protective of human health and the environment. The RAOs define the basis for evaluating different sediment remedy options and describe, in general terms, what the selected sediment remedial action is intended to accomplish. The RGs establish the targets necessary to achieve the RAOs.

The RAOs for the LPP2 remediation project are:

- **RAO 1**: Remove/manage sediments contributing to the following BUIs within the Milwaukee Estuary AOC:
  - Restriction on fish and wildlife consumption
  - Degradation of fish and wildlife populations
  - Degradation of benthos
  - Restrictions on dredging activities
- **RAO 2**: Minimize potential risks to human health and the environment during remedial activities.
- **RAO 3**: Upon completion of remedial activities, restore habitat in the remediated areas.

Based on these RAOs and the site-specific physical, hydraulic, and chemical nature of the sediments and the site, the project team developed the RGs for the LPP2 sediment remediation project shown in Table 1-1. All Tables are presented in Appendix B. These RAOs and RGs guided the design of the remedial action that was implemented during this project.
1.4 Scope of Work

The Statement of Work (USEPA, 2014a) included the following:

- Prepare and/or submit plans and product information to address and provide guidance for the various aspects of the Statement of Work (SOW).
- Obtain contractor required permits and comply with permit requirements to remediate contaminated sediments and restore natural habitat per project design.
- Mobilize resources, construct temporary infrastructure, and provide facilities that included a mobile laboratory to support SOW.
- Conduct a pre-removal sediment investigation in 9 sediment deposits in 4 separate work zones to define the extent of PCB, PAH, and NAPL sediment contamination laterally and vertically; determine the extent of contaminated sediment removal using the on-site mobile laboratory to expedite sediment sampling analyses and contaminated sediment removal.
- Isolate and dewater isolation areas and sediments to facilitate contaminated sediment removal in dry excavation conditions and install natural habitat construction features.
- Treat surface waters extracted from the isolation area with mechanical filtration units to remove suspended particulates to permit required conditions prior to discharge back to the Milwaukee River at permit designated outfall locations.
- Treat contaminated sediment contact water with the mobile waste water treatment plant (WWTP) to permit required conditions prior to discharge of extracted contact water back to Milwaukee River and eliminate the need for off-site disposal of sediment contact water.
- Excavate contaminated sediments vertically and laterally to meet project RGs.
- Secure proper disposal acceptance to load, transport, and dispose of TSCA and solid waste contaminated sediments at appropriate disposal facilities.
- Restore designated wetland areas in 3 zones with sand backfill, topsoil backfill, and native plants.
- Install natural habitat construction features in 3 work zones.
- Remove temporary infrastructure and restore disturbed areas.
- Demobilize site resources.

Table 1-2 provides the line item scope of work from the task order schedule of supplies and services with start and completion dates obtained from the construction schedule in Appendix C. The table includes two columns: one showing sequential order for starting and one showing sequential order for completion. Table 1-3 quantifies work completed per Task Order Line Item. Table 3-3 quantifies work by construction zone.
1.5 Summary of Scope of Work Execution

The EQM team planned to address the scope of work for field activities by addressing each zone in the following sequential order: Zone 7, Zone 5, Zone 3, and Zone 4. This sequence was revised to Zone 3, Zone 7, Zone 4, and Zone 5 as a result of complications with Cofferdam 2 installation and delays obtaining access agreements from a property owner in Zone 5.

The remediation and restoration process that was completed for each zone is summarized below along with a brief description of any variations. A more detailed explanation of the remediation and restoration process is provided in Sections 2, 3, and 4 of the report.

1.5.1 Site Preparation

Each work zone was prepared to facilitate remediation and restoration activities. Work was initiated with pre-condition survey documentation and utility location and staking. Temporary infrastructure improvement locations were surveyed and staked to enable collection of pre-construction soil samples to further document pre-construction conditions. Clearing and grubbing of vegetation was performed to facilitate temporary infrastructure improvements. Topsoil was stripped and stockpiled for subsequent reuse from locations where temporary haul roads, dewatering pads, WWTP pads, and decontamination pads were being constructed. Temporary infrastructure improvements were made as needed, including temporary security fencing, haul roads, decontamination pads, river access ramps, and cofferdam isolation areas. In Zone 7 a sediment dewatering pad, waste water treatment plant pad, and waste water treatment plant were also constructed. Office facilities, field laboratory, sanitation facilities, and utilities were provided to facilitate site operations. Water conveyance pipelines were constructed from each zone’s cofferdam isolation area to the waste water treatment plant in Zone 7. Additional water conveyance lines were constructed to the outfall locations permitted for discharging treated water removed during dewatering operations back to the Milwaukee River. Pumping stations were installed in the excavation areas to allow for surface dewatering and contaminated sediment de-watering.

1.5.2 Pre-removal Contaminated Sediment Investigation

Pre-removal investigation was required to determine the extent of contaminated sediment removal for each deposit. A grid sampling program was developed in the Sampling and Analysis
Plan to evaluate the lateral and vertical extent of contaminated sediments that required removal. This program also facilitated the segregation of PCB-contaminated sediments that required disposal at a permitted TSCA facility from contaminated sediments that were disposed of at a Subtitle D solid waste landfill. A grid network was developed for each deposit to obtain one sample core from each grid that was subsequently subdivided vertically into individual soil samples based on field screening parameters for analysis of PCBs and PAHs in the on-site field laboratory. The excavation grids were initially sized based on the suspected extent of contamination according to the information provided in the BODR and Request for Task order Proposal (RFTOP) design drawings. The grid network was expanded as needed based on step-out sampling results to define the lateral extent of contamination for each deposit. Investigation results were used to develop Excavation Plans for the contaminated sediment deposits.

1.5.3 Excavation Area Isolation and Dewatering

Contaminated sediment deposits were isolated from river flow conditions by constructing cofferdams to facilitate dewatering of the areas within each zone so that contaminated sediment removal could be completed in relatively dry conditions with conventional excavation and material handling equipment. Dredging-in-the-dry was the more feasible approach because the shallow water depths did not provide adequate draft for utilization of barges. Dry excavation was advantageous for conducting more precise removal due to the ability to adjust excavation activities using visual observations during removal of the contaminated sediments. Isolation area dewatering was performed to prepare the area for excavation by removing surface waters from the isolated areas followed by removal of contact water from the sediment targeted for excavation. A total of five sets of one or more cofferdams within each excavation were constructed to isolate individual or multiple deposits to facilitate dewatering for excavation and stream habitat restoration. Zone 7 required two phases of cofferdam implementation during which five individual cofferdam segments were constructed to isolate four deposits. The 1st Phase utilized three cofferdams to isolate the western portion of Deposit 7-2, then the 2nd Phase utilized four cofferdams to isolate Deposits 7-1, 7-3, and 7-4 and the eastern portion of Deposit 7-2. Deposits in Zones 3, 4, and 5 were each isolated with the implementation of a single segment of cofferdam. Pumping stations were established for each isolated area to initially dewater the area and then maintain dewatered conditions until excavation, confirmatory sampling, and stream habitat restoration
construction activities were completed (as applicable). Initial dewatering was conducted with high-volume pumps processing water through particulate filtration before discharging the treated water back to the river at the corresponding outfall location designated in the Wisconsin Pollutant Discharge Elimination System (WPDES) permit. This permit is discussed further in Section 2. Initial dewatering was performed until surface water levels approached approximately 1 foot above the sediment surface. Sediment and maintenance dewatering started once initial dewatering was completed and continued through conclusion of work activities associated with the respective isolation area. Sediment and maintenance dewatering differed from initial/surface dewatering in that initial dewatering proceeded only until the water depth within the cofferdam isolation area was less than 1 foot above sediment. Water extracted below the 1-foot average depth, including depressions and/or sumps below the sediment surface elevation, was considered to have a high likelihood of coming into contact with contaminated sediments and thus required more extensive treatment. Contact water was processed through the on-site WWTP prior to discharge back to the river in accordance with the WPDES permit. This process is referred to as in-situ sediment dewatering and is discussed in more detail later in this report. Ex-situ sediment dewatering and treatment through the WWTP is also discussed later in this report. Ex-situ sediment dewatering is the process of allowing latent water to drain from excavated sediment by placing it on the dewatering pad until the sediment moisture content met the requirements of the receiving disposal facility.

1.5.4 Contaminated Sediment Excavation

Sediment excavation was performed in Deposits 3B-1, 7-1, 7-2, 7-3, 7-4, 4-1, 4-2, and 5-1 to the limits of removal determined by Pre-removal Contaminated Sediment Investigation results. Deposit 4-3 was found to have no recoverable volume of sediments present during pre-removal characterization and was eliminated from the scope of work. Each Excavation Plan included a reference figure that identified contaminated sediment removal grids within the deposit area, provided reference elevation data for vertical control, and distinguished the location of contaminated sediments requiring TSCA disposal from sediments requiring solid waste disposal. The excavation process began with pre-removal survey. The survey documented the pre-removal sediment surface and staking of the removal grid locations which provided benchmarks for maintaining vertical control. Timber mats were used to provide access ways and work platforms.
Some or all mats were redeployed as needed during the excavation process to adjust access to the excavation areas. Sediment excavation was performed in the targeted grids with a long reach excavator. The grade foreman utilized the Excavation Plan to monitor and direct the excavator operator on removal of contaminated sediment. A laser level was also used by the grade foreman to monitor excavation depth so as to maintain vertical control during removal. Sediments were typically loaded into off-road dump trucks (ORDT) for transfer to the dewatering pad. In Zones 4 and 5, disposal transport trucks were live-loaded in the work zone for direct shipment to the appropriate landfill. The grade foreman was responsible for identifying when TSCA sediments were to be sent to the TSCA portion of the dewatering pad and when non-TSCA sediments were to be sent to the solid waste portion of the dewatering pad. Once sediment removal was completed to the lateral and vertical extent of a grid, post-removal soil samples were collected to confirm sediment removal met RAOs. In some cases additional excavation was required to meet RAOs. Additional excavation is discussed further in Section 3.4 of this report.

1.5.5 Solidification

Solidification was performed subsequent to sediment excavation. Solidification of sediments was performed to ensure matrix water would not be released from removed sediments and to prevent leaks from the transportation vehicles as a result of the transportation process. EQM utilized the dewatering pad as the primary means of solidifying sediment waste. Excavated material was transferred from the excavation area and deposited on the dewatering pad. Once on the pad, material was handled in various ways to decrease the moisture content in the excavated sediments. Sediments were turned over, wind rowed, and stacked to increase exposure to air and sunshine as well as to promote gravity drainage. Sediments were allowed to remain on the dewatering pad for 0.5 to 3 days to dewater before shipment. EQM utilized solidification agents to bind with matrix water present in the sediments. The solidification agent was applied both at the excavation site and on the dewatering pad. When excavating sediments, the operator often scraped sediments into a loadout pile adjacent to the excavation site to allow sediments to gravity drain as much as possible before live-loading them into the transfer trucks. EQM utilized Calci-ment™ and corn cob grit for solidification agents. Further details are presented in Section 3.5 of this report.
1.5.6 Transportation and Disposal

The contaminated sediments contained PCBs, PAHs, and NAPLs; it was the PCB concentration, however, that determined whether sediments would be disposed of at a TSCA-permitted facility or a Subtitle D solid waste disposal facility. PCB contamination was not allowed to be disposed of at a Subtitle D solid waste facility regardless of the concentration, but the PAH and NAPL contaminated sediments could be disposed of at a TSCA facility if cross-contamination with TSCA sediments occurred. Therefore, EQM managed disposal of two waste streams which were PCB contaminated: sediments that possessed PCB concentrations equal to or greater than 50 ppm and contaminated sediments that possessed PCB concentrations less than 50 ppm. PCB sediments with concentrations equal to or greater than 50 ppm were segregated in their own section of the dewatering pad. These sediments were shipped to a permitted TSCA disposal facility. TSCA waste disposal required shipping in trucks licensed to transport hazardous waste and required shipment with a uniform hazardous waste manifest. TSCA waste was disposed of at Heritage Environmental Services, Inc. (HES), a TSCA-permitted Landfill in Roachdale, Indiana. Sediments with PCB concentrations less than 50 ppm were transported with solid waste manifests to Waste Management, Inc. (WM) solid waste Landfill in Menomonee Falls Wisconsin. Details concerning contaminated sediment waste transportation and disposal are provided in Section 3.6 of this report.

1.5.7 Work Zone Area Restoration

Restoration of the excavation areas began once contaminated sediment removal was deemed complete by the Project Coordination Team (PCT). Restoration requirements of an excavation area varied within each zone. Some areas required stone placement as well as sand and topsoil backfilling in order to restore wetland habitat and stabilize stream banks. These areas included Deposits 7-2, 7-3, 4-1, 4-2, and 5-1. Other areas required installation of stream habitat features such as log-root wads and boulder clusters. Usually this required isolation cofferdams to remain in place and maintenance dewatering to continue until these features were installed. Once the results of post-removal sampling confirmed that contaminated sediments had been removed to the satisfaction of RAOs, the pumping operations switched from the in-situ dewatering system back to high-volume dewatering. High-volume dewatering continued until backfilling and construction of habitat features were complete. Pumping system equipment was then removed, fol-
ollowed by removal of the isolation cofferdams. This was followed by removal of temporary infrastructure features, such as conveyance water pipelines, decontamination pads, haul roads, and construction equipment.

Perimeter security fencing was left in place until vegetation was established on disturbed areas. The footprint of the fencing was reduced to only restrict access to areas requiring revegetation in Zones 4 and 5. The fencing in Zone 3 was removed entirely before demobilization in late fall of 2015 because revegetation was established. Once all temporary infrastructures were removed, restoration began of topsoil to areas disturbed by construction activities such as haul roads, dewatering pads, and the WWTP pad.

Topsoil stripped and stockpiled during site preparation was reused as appropriate and additional topsoil was imported to supplement site needs. These areas were seeded and planted with appropriate vegetation as required to the specific areas being restored. Upland areas typically received a turf grass and cover crop seed admixture, and upland trees were planted in Zones 3 and 7. Other areas received a no-mow/low grow seed mixture where upland areas transitioned to stream banks and wetlands. Stream banks and designated wetland restoration areas were planted with native seed mixtures, herbaceous plants, shrubs, and trees. Repairs were made to damage of permanent constructed features that included the asphalt bike path in the Zone 7 Support area and concrete and asphalt curbs in Zones 7 and 3, where access roads junction with North Milwaukee River Parkway.

### 1.6 Project Team

The project team consisted of USEPA-GLNPO, WDNR, MCDPRC, EA, and EQM and its subcontractors. The project team consisted of three groups based on roles and responsibilities. The project coordination team (PCT) was composed of USEPA-GLNPO, WDNR, and MCDPRC that consisted of representatives of the funding agencies. The PCT technically reviewed construction planning documents, provided construction work, and advised USEPA on technical decision making. EA was USEPA’s project oversight consultant that assisted the PCT with review of construction planning documents, monitored construction work, and provided advice on technical decision making. The EQM Team was responsible for performing the scope of work described herein. During major construction work periods, the project team would meet
weekly or as necessary to review work progress, plan and coordinate future work, monitor project schedule, and permit compliance.

EQM as prime contractor under our USEPA GLNPOCS contract was supported on this project by two GLNPOCS Team subcontractors: Sevenson Environmental Services (SES) and AECOM. Other project team role players included Environmental Chemistry Consulting Services, Inc. (ECCS), a Madison, Wisconsin based mobile lab; Pace Analytical Services, Inc. (Pace), in Green Bay, Wisconsin; and ALS Environmental Laboratory (ALS) in Holland, Michigan. A local firm, Limb Walkers, Incorporated (Inc.) provided support during clearing and grubbing. Applied Ecological Services (AES) supported the habitat restoration and plant maintenance work efforts.

1.6.1 Contractor Team Description

As the prime contractor, EQM was responsible for project and on-site management, reporting, Construction Quality Control (CQC), health & safety, site preparation, sediment sampling and analysis, data review and reporting, sediment solidification, off-site transportation and disposal of waste materials, and cost and schedule control. SES was responsible for selective clearing and grubbing, constructing temporary infrastructure improvements, dewatering the excavation, excavating the sediments, solidification of all sediment, and water treatment. AECOM provided the Quality Control Officer (QCO) and support in the areas of surveying, sediment sampling, environmental controls, and oversight of habitat restoration.

ECCS provided the required on-site soil, sediment, and wastewater treatment analyses. Pace provided specialty analyses (Oil and Grease and waste characterization). ALS was procured after a Technical Systems audit noted that the methods associated with waste water analysis required to be changed (USEPA, 2015). Limb Walkers, Inc. performed the clearing and grubbing necessary to complete infrastructure construction and provide access to deposits for remediation in areas where specialized equipment and personnel were required due to vegetation size and removal volume. AES, the local Wisconsin vendor, supported the habitat restoration and plant maintenance work. All four firms were subcontracted to EQM and under the appropriate direction. AECOM provided oversight of AES during plant maintenance activities.

As the prime contractor, EQM was responsible for project and on-site management, reporting, CQC, health & safety, procurement of required materials, and schedule control. With the
exception of the drilling subcontractor Verizon, which contracted with AECOM, all project sub-
contractors were contracted directly with EQM.

1.6.2 Key Roles and Responsibilities

As the Task Order Contracting Officer Representative (TOCOR), Brenda Jones (or Diana Mally as the Secondary TOCOR) was responsible for ensuring the Contractor (EQM) performed the work in compliance with submitted plans. As such, Ms. Jones and/or Ms. Mally provided technical direction on the scope of the TO that assisted the EQM Team in accomplishing the Statement of Work (SOW). Ms. Jones and/or Ms. Mally provided comments on and approved all plans, reports, and other deliverables.

As the Quality Assurance (QA) Lead, Mark Loomis reviewed the project quality documentation and compared the components to the requirements. Mr. Loomis evaluated project planning quality documentation to ensure that it was scientifically sound and complete, ensured that all comments were documented to effectively communicate issues noted to the project participants, and provided recommendations to improve documentation. In addition, Mr. Loomis led the Technical Systems Audit of the Remedial Action Activities at Lincoln Park.

Jack Greber was the authorized EQM Team representative who certified payment requests and submittals, and executed modifications on behalf of the EQM Team. Mr. Greber was the primary programmatic point-of-contact for the USEPA and provided supervision and guidance for all contractor personnel assigned to the TO. He was ultimately responsible for the quality and efficiency of the support effort, to include both technical and business issues. Mr. Greber was responsible for the execution and compliance of all procurements and subcontracting. He negotiated and approved TO modifications. Mr. Greber is a Senior Vice President and an authorized agent for EQM, prime contractor under contract EP-R5-11-04, Task Order 0004 (USEPA, 2014a).

As the EQM Project Manager (PM), Eric Bowman had the responsibility to ensure project personnel complied with the criteria presented in the Project Plans. Mr. Bowman was responsible for integrating work plans, staffing plans, and schedules to accomplish all task objectives. He was responsible for ensuring effective communication between the Site Superintendent (SS), Quality Control (QC) Manager, QCO, and Team Members. Mr. Bowman tracked cost and delivery schedules.
The EQM QC Manager (QCM) for this project was Jackie Doan. Ms. Doan was responsible for ensuring the QCO enforced the QC measurements identified in the EQM Contractor Construction Quality Assurance Plan (CCQAP), May 2015 (EQM, 2015b). She was responsible for working with the QCO to ensure the quality and timeliness of submittals. Ms. Doan reported to EQM’s Chief Executive Officer, and was the line of communication between the GLLA QA Lead Mark Loomis and the QCO.

As the QCO, Mark Kromis (AECOM) was responsible for implementing the CCQAP (EQM, 2015b) and ensuring the SS inspected the materials and equipment received on site were compliant with data sheets submitted and approved by TOCOR. Mr. Kromis worked with the Site Safety and Health Officer (SSHO) who inspected safety and health equipment to ensure proper operation and accuracy.

As the EQM SS, Chris Hartford was responsible for ensuring site activities and work product complied with site-specific criteria defined in the Project Plans. He was the primary on-site point of contact to the TOCOR in the field. Whenever work was in progress, he maintained and enforced safety regulations and emergency procedures required by the EQM Site Safety and Health Plan (SSHP) (EQM, 2014a).

The Project Geologist, Staci Goetz (AECOM), directed the drill rig geologist and Environmental Sampler on the collection of pre- and post- removal characterization sediment cores, pre- and post-construction surface soil samples, and waste characterization samples. She was responsible for ensuring these activities were conducted in accordance with the Sampling and Analysis Plan (SAP) (EQM, 2014b) and project specifications (Chemical Data Quality Control, 01 35 45.00), (EA, 2014b). Ms. Goetz also directed the preparation of map and summary table presentations summarizing the analytical results obtained for each zone. Under the guidance of Mr. Dave Henderson, P.E. (AECOM), Ms. Goetz and other scientific support staff developed Excavation Plans, which included SWAC predictive models and existing conditions and SWAC calculations. Randomly-generated post-removal confirmation sampling points were generated by the scientists under the direction of the Project Geologist and independent of the excavation team (EQM and SES). Ms. Goetz assisted the SS with strategies when unanticipated conditions were encountered during excavation.
2. PROJECT PLANNING AND COORDINATION

2.1 Permitting

The Contracting Team was diligent about complying with federal, state, and local regulations while implementing the scope of work for GLNPOCS Lincoln Park Phase II. A comprehensive list of pertinent regulations and permits is provided in the Table of Contents of the Permit Book presented in Appendix D.

2.1.1 Discharge Monitoring Reports

Daily logs and reports were maintained for contact water treatment activities that included volumes treated and discharged amounts of wastes staged and treated, post-treatment analytical results, and any process upsets or releases of known PCB materials or potentially PCB-impacted materials. Releases were reported to WDNR spill hotline, cleaned up by the Contracting Team and documented in Daily Monitoring Reports (DMRs). Copies of the DMRs are presented in Appendix H.

2.2 Planning Documents

EQM and its team members began preparation of planning documents starting on September 5, 2014. Priority was placed on preparing planning documents with specified submittal deadlines, as well as documentation required to mobilize, obtain required permits, and to establish the basis for project billing. Table 2-2 summarizes information for the initial planning documents, and further details regarding required submittals are provided in the submittal register in Appendix E.

2.3 Communication and Coordination of Work Activities

Clear and frequent communication and coordination with the PCT and other key contributors was essential to ensuring all parties were aware of, and in agreement with, all planned work
activities, progress, problems, and corrective actions associated with the Lincoln Park task order. Common forms of communication and coordination with the PCT included the construction schedule, daily progress reports, weekly progress meetings, and as-needed verbal or written communications.

2.3.1 Construction Schedule

The construction schedule for GLNPOCS Lincoln Park Phase II was updated monthly to track work progress, material quantities utilized, and project task completion dates. This exercise not only provided an accounting of project implementation, but also served as a valuable tool for identifying alternative approaches and innovative methods to increase operational efficiency, improve remediation effectiveness, manage work site logistics, and identify potential cost-savings opportunities. The final construction schedule prepared for this project is provided in Appendix C.

2.3.2 Daily Progress Reports

Reports were prepared each day to summarize work progress and document important decisions. Primary topics discussed in Daily Progress Reports included: work completed and ongoing; the schedule for the upcoming work week and related planned work activities; material, personnel, and equipment resources required; maintenance of quality and work standards; quality control actions; health and safety; issues that affect the schedule and corrective measures needed to regain project schedule; and other business relating to project work. Quality control issues were also addressed and documented in the daily reports, or sooner if the issues were time critical. The Daily Progress Reports were submitted to the PCT by uploading them to the ShareFile FTP site established by EQM.

2.3.3 Weekly Progress Meetings

Weekly Progress Meetings were typically held at 9 am each Thursday, depending on urgency and availability, and attended by the PCT, EPA on-site representatives, and the Contractor Team. These Weekly Progress Meetings were used to summarize work progress since the previous meeting. They also provided an opportunity to discuss concerns and document critical decisions regarding corrective measures to restore or improve remedial effectiveness, operational ef-
ficiency, worker health and safety, and project schedule. The Weekly Progress Meetings could be attended remotely via multi-media teleconferencing applications, such as GoToMeeting.™ An agenda was distributed to all attendees prior to each meeting, and meeting minutes were recorded and uploaded to the ShareFile site.

2.3.4 Field Decision Protocols (Corrective Actions, PCT, Field Concurrence, RFIs, etc.)

Specifications and planning documents were used to detail decisions made by the Contracting Team during remedial activities. These documents were reviewed and approved by the PCT, and intended to provide latitude for the Contracting Team to implement many of the field decisions at the discretion of the site superintendent. The excavation approach was frequently adjusted to accommodate unanticipated field conditions such as fluctuating water level in the channel, ability of sediment to meet the required moisture content prior to disposal, and need for solidification. Other unanticipated circumstances, such as the presence of potential NAPL or dramatic elevation change across a grid, required approval by the PCT before the Contracting Team could move forward with implementation. Consulting with the PCT each time such field variations were encountered was not feasible because they were typically not present on site, and remote communications for each occurrence would have stilled work progress. Thus, decision protocols were occasionally established with the approval of the PCT to allow real-time adjustments to the excavation approach in the field by the Contracting Team. Such decisions were typically carried out only after the EPA oversight contractor concurred with the proposed adjustment.

Although every effort was made to minimize additional excavation within a grid, the variability of pre-removal topography and vertical patterns of contaminant deposition required some flexibility for making timely and effective field decisions. During remedial excavation of Deposit 7-4, concerns arose with the PCT about excavating sediment within grids in addition to the maximum removal limits defined by the Chapter 30 permit. This was discussed during the weekly progress meeting held on June 3, 2015. The PCT and Contracting Team discussed the decision-making process that should be employed under such circumstances during subsequent remedial excavation. This resulted in a document submitted on June 2015 entitled *Maintaining Vertical Control During Excavation Activities*, which included a decision matrix for field operators. The decision matrix provided guidance for field operators as the excavation progressed toward the riverbanks. This was necessary to avoid removal of terrestrial soil contamination, which
was not in the scope of this remedial action. This document described three scenarios commonly encountered during remedial excavation work, including: sloping topography, river bank conditions, and encountering black sediment. Field decisions were implemented once the EPA field representative, QCO, and Contracting Team all concurred with an acceptable approach to the issue identified.

2.3.4.1 **Maintaining Vertical Control During Excavation Activities**

Maintenance of lateral and vertical control during the excavation process was necessary to ensure excavation efforts were performed properly to meet RAOs. The pre-removal sampling data was used to create Excavation Plan drawings depicting the limits of removal for each grid prior to excavation. These figures identified removal grid layouts within each work zone and the pre-removal core sampling location within each grid. The corners of grids scheduled for remedial excavation were located by the AECOM survey team and identified with wood lathes to guide equipment operators during removal activities. Excavation sequencing was typically prioritized for TSCA over non-TSCA removal, but was often adjusted based on the availability of waste disposal trucks. A laser level was used to check the grade during removal activities.

The vertical control – or the depth to which the initial excavation was performed for each grid – was initially based on the analytical results from pre-removal sampling. The pre-removal sediment surface elevation was surveyed for each core sample location and used as the reference elevation for determining the cut line elevation corresponding to the target excavation depth. The cut line elevation was determined by subtracting the target removal thickness (which was based on core sampling analytical data identifying contaminated sediments above the RGs) from the sediment surface elevation. The SES grade foreman was responsible for maintaining vertical control during excavation. The SES grade foreman utilized the survey control points established by the AECOM survey team as a benchmark for making elevation measurements. The grade foreman was provided a copy of the Excavation Plan so that he could determine the target cut line elevation for the active excavation grid that was based on the results of pre-removal sampling. The grade foreman utilized a laser level with the instrument height determined by reference control points to monitor vertical progress of excavation down to the cut line elevation depth.
The project team worked together to establish the 617-foot mean sea level elevation on river banks as the lateral and vertical limit of excavation activities that progressed into river banks. The 617-foot elevation was determined to be the base water surface elevation corresponding to the predominately ponded conditions assumed to be present during the period contemporaneous to the introduction of contaminants to the Milwaukee River. The ponded conditions were created when the slats of the Estabrook Dam were closed, which impounded water upstream as far north as Zone 7. The decision to use the 617-foot elevation was documented in the following communications between the project team and the PCT:

- Deposit 3B-1 and Zone 7 deposits in response to RFI 17 on January 22, 2015
- Deposit 4-1 and 4-2 in an e-mail from Brenda Jones on May 28, 2015
- Deposit 5-1 in an e-mail from Brenda Jones on March 30, 2015.

### 2.3.4.2 Decision Protocol for Visual Excavation of Sediments

When digging visually, it becomes difficult to verify the dig is proceeding in accordance with pre-defined lateral and vertical tolerances established to maintain quality control. The field decision matrix was referenced by on-site staff when the excavation approach came into question. As excavation progressed toward river banks or if entrenched channels were encountered, adjustments were made to the cut line elevation to remove approximate target removal thickness within the limits of the excavation and to ensure the vertical accuracy of measuring equipment. Bench cutting was performed parallel to the slope to the approximate removal thickness where gradational changes of greater than 2 foot were encountered.

This protocol was developed after a deposit of black sediment was observed during excavation in Deposit 7-3 that was not detected by pre-removal sampling. The black sediment was observed at a depth between 3 foot and 4 foot along the western portion of Grids 15, 20, 26, 32, 33, 36, and 37 during remedial excavation in Deposit 7-3 on May 14, 2015. Members of the Project Team on site at the time noted the black sediment had a petroleum odor, and they recommended this material be removed outside the scope of the Excavation Plan. The proposed excavation depth for Grids 15, 20, and 26 was 2 to 3 feet. Grids 33, 36, and 37 were partially excavated to remove deposits of black sediment. Deposits were excavated based on a combination of designed cut-line elevations, visual observation of topography to account for sloping deposit surfaces, and the visual presence of NAPL-containing sediments.
Grab samples were collected from sediments containing suspected NAPL (black in color) for analytical evaluation to determine if the material exceeded project remedial goals prior to additional excavation beyond the plan’s horizontal boundaries. If sediment was excavated to bed-rock, additional sampling was performed per Addendum 4 of the approved SAP (EQM, 2015e). If necessary, the approach for residuals management was discussed and approved by the PCT before proceeding.

2.3.5 Map and Survey Quality Control

Result maps underwent QC to verify that all sample exceedances were presented accurately and consistently. Each surveyed sample position was checked to ensure it was located in the correct grid. Any discrepancy between the survey ID and the grid ID within the map was discussed with the field team before being resurveyed. Survey data was then uploaded into GIS to generate a map depicting the geospatial location of the sample and corresponding analytical results. Each sampling location was coded to convey if there were any RG exceedances based on analytical data or field indications of NAPL. The depth of the lowermost exceedance and ground surface elevation were also shown. As additional sample results were received, the map was updated and checked to ensure sample points were correctly identified and exceedances and observations were depicted accurately. After any additional updates, the figures underwent one final QC prior to being uploaded to the project FTP site or prior to being sent to the field for use by the surveyor or sampling crew. The Professional Land Surveyor (PLS) used multiple checkpoints throughout the site to ensure data quality during the survey, as discussed further in Sections 3.4.2.1 and 3.4.2.2.
3. SUMMARY OF GENERAL CONSTRUCTION ACTIVITIES AND SEQUENCING

3.1 Site Preparation Tasks

Site preparation tasks were often specific to each work zone, but shared common elements. The following subsections describe the general efforts required to prepare each work zone for investigation, remediation, and restoration activities. Zone-specific preparation efforts will be described with more detail in Section 4 of this report.

3.1.1 Mobilization

Mobilization of site resources and temporary facilities began the week of October 6, 2014. The majority of mobilization activities were completed during October and November of 2014. Mobilization was deemed complete on December 4, 2014 when electrical service was provided. Mobilization activities in October 2014 consisted of mobilizing site management staff, laborers, equipment, and construction resources needed for site preparation and survey crews to document pre-construction conditions. EQM mobilized its General Foreman on October 6, 2014 to oversee SES mobilization operations and to coordinate utility location and marking activities with Wisconsin One Call and Milwaukee County Parks utility location personnel. During this initial week, a laydown area was established in the Zone 7 support area for equipment, timber mat, and sheet pile deliveries. AECOM mobilized a survey crew to begin pre-construction documentation and to begin surveying limits of disturbance for Zones 7 and 3 and the office trailer area. It also began photographic documentation of the pre-construction condition of work areas prior to initiating construction activities. The following list highlights the mobilization and other site activities that occurred during the week of October 13, 2014:

- Pre-construction meetings were held for clearing and grubbing on October 13 and 16 for Zones 7, 3, and 4.
- A video recording of the Oak Leaf Trail Bike Path was completed October 14, 2014 to document the condition of the trail prior to initiation of construction activities. This paved trail was closed to local traffic with barricades and signage.
Surveying continued on the “Limits of Disturbance” (EA, 2014b) and locations of site infrastructure improvements such as site haul roads, security fence alignment, dewatering pad, and waste water treatment pad.

A gravel pad with 8-ounce non-woven geotextile underlayment was installed on October 14, 2014 for the office trailer area, and gravel was placed on October 15, 2014 to complete construction of the office trailer pad. The EPA office trailer was delivered and situated on the gravel office trailer pad on October 16, 2014, and three more office trailers were installed on October 17. A generator was installed to provide temporary electrical power to the EPA trailer until electrical service was established. The remaining two office trailers were delivered early in the week of October 20, 2014. EQM also mobilized a 70-kilowatt (kW) generator that week to provide electric power to the SES break trailer and office trailer for more suitable amenities for site operations. A second larger generator was mobilized early in November 2014, when it was determined that WE Energy would be delayed in installing electrical service for the site. In the meantime, WE Energy installed a temporary electrical service power distribution panel on November 7 to power work trailers.

EQM had traffic signs delivered and installed along N. Milwaukee River Parkway north of the office trailer area along the west side of the road and south zone near the southern bridge crossing the West Oxbow on the east side of the roadway. The signs informed motorists: “Trucks Entering Roadway” and “Flagman Ahead.” This precautionary measure provided little effect on influencing local motorist speed and caution when utilizing N. Milwaukee River Parkway in the work area, and the road was subsequently closed early in November to maximize safety for the crew and community.

Construction of a lubricant/fuel containment station near the staging area was completed on November 5, 2014.

Construction of an emergency response station between the WWTP and the dewatering pads with first aid kits, evacuation instructions, air horn, etc., was also completed on November 5, 2014.

On November 24, 2014, project Identification signs were installed on N. Milwaukee River Parkway north of the work site and on Hampton Blvd south of the site.

The majority of the mobilization of site resources was completed by November 2014, but various personnel, equipment, and material resources were mobilized subsequent to December 2015 as necessary to support ongoing work activities. Table 3-1 summarizes equipment mobilized to the site and Table 3-2 summarizes materials mobilized to the site.

### 3.1.2 Pre-Construction Meetings

#### 3.1.2.1 Kick-off Pre-Construction Meeting

On September 2, 2014 a pre-construction meeting was held with EQM’s project management team, EPA GLNPO, WDNR, MCDPRC, and EA Engineering, Science and Technolo-
gy, Inc. PBC (EA) design and oversight engineer team members. The following representatives participated in the meeting:

- EPA GLNPO: Brenda Jones TOCOR, Sheila Dolan CO, Kendra Kozak CS, Diana Mally TOCOR Secondary
- WDNR: Marsha Burzynski, Bill Fitzpatrick
- MCDPRC: Kevin Haley
- EA: Jon Trombino, Mike Ciarlo
- EQM Team: Jack Greber EQM Program Manager, Eric Bowman EQM PM, Betsy Kuhlenberg EQM, Brenda Reid EQM, Alan Elia SES, Pat Faessler SES, Mike Lock SES, Staci Geotz AECOM, Kim Elias AECOM, Dave Henderson AECOM.

EQM prepared the meeting agenda and meeting minutes as required by project specifications (see Appendix F for key select minutes). Meeting topics included:

- Roles and Responsibilities
- Access Agreements
- Permits
- Pre-construction submittals and schedule
- Construction schedule and sequencing
- Construction support, reporting, and communications
- Contractual and administrative requirements
- Introduction of Project Coordination Team (PCT) members and EQM site management team members.

3.1.2.2 Pre-Construction Clearing and Grubbing Meeting

The pre-construction clearing and grubbing meeting was held on October 13, 2014 with representatives from the EQM site management team, GLNPOs, MCDPRC, EA and WDNR. The following representatives participated in the meeting:

- EPA GLNPO: Brenda Jones TOCOR
- WDNR: Marsha Burzynski, Bill Fitzpatrick
- MCDPRC: Kevin Haley
- EA EST: Jon Trombino, Mike Ciarlo, Duane Thomas
- EQM Team: Eric Bowman EQM PM, Chris Hartford EQM SS, Andrew Stoeckinger EQM, Glenn Miller EQM, Pat Faessler SES, Kim Elias AECOM, Dave Henderson AECOM, Mark Kromis AECOM.

The purpose of this meeting was to review plans for temporary site infrastructure improvements and related clearing and grubbing activities required to facilitate installation improvements. The following topics were discussed:

- Vegetation suitable for removal and vegetation that needed to be preserved in Zones 7 and 3.
• Limits of disturbance for Zone 5 to convey information to property owners.
• Changes for office pad location due to design documents that require positioning in an area that would require 3 feet of fill material to make a safe level pad area.
• Installation of an additional access road to facilitate installation of the west segment of Cofferdam 2.
• Elimination of the northern access ramp to Deposit 7-2.
• Installation of an additional access road segment in the office trailer area to provide better access to construct the northwest segment of Cofferdam 2.
• Installation of an additional access road to facilitate installation of the south segment of Cofferdam 2.
• Relocating the waste water treatment pad and reducing the footprint of the topsoil staging area to accommodate an additional haul road segment for improved truck access in and out of the dewatering pad area.
• Minimal re-alignment of the access road to Deposit 3B-1 to traverse around an existing art work sculpture.

3.1.3 Pre-Construction Surveys

Surveys of the site were completed prior to the start of clearing and construction work. The surveys included topographic surveys and stakeout of site features by a Professional Land Surveyor (PLS), as well as video and photographic surveys. The surveys are discussed in the following subsections.

3.1.3.1 Topographic and Stakeout Surveys

Prior to clearing and construction of infrastructure (i.e., staging areas, access roads, and temporary facilities, etc.), site features were staked out based on designed extents by a PLS following SOP 010 – Survey Staking Procedure included in the Field Sampling Plan (FSP) (AECOM, 2014), which is in Appendix D of the Sampling and Analysis Plan (SAP) (EQM, 2014b). Field adjustments were made as necessary to avoid removal of large trees identified during the site walks with the MCDPRC Representative discussed in Section 3.1.6.2. In addition, pre-construction ground surveys were conducted in areas where clearing and construction of infrastructure was planned. The pre-construction topographic surveys were conducted to identify the locations of access roads and ramps, decontamination pads, and other infrastructure (i.e., trailer pad area, dewatering pad, wastewater treatment pads, topsoil stockpile areas, etc.). The survey of pre-construction topography was later used for restoring areas to pre-construction
grades once construction work was completed. The pre-construction survey was also used for calculating and tracking quantities of restoration materials.

The topographic surveys of remedial excavation areas were conducted via the field survey grid method as specified in the Final Remedial Design Technical Specifications (Technical Specifications) 01 70 00 (EA, 2014b) and SOP 011 – Survey Topography Procedures in the FSP (AECOM, 2014). In accordance with the Technical Specification, the topographic surveys were conducted at a maximum grid spacing of 25-feet × 25-feet and a tolerance of 0.1 foot or less (i.e., within 0.1 foot of the true location). Slope features (i.e., top and bottom of slopes) and perimeters of the work area were also surveyed.

The PLS used multiple checkpoints throughout the site to ensure data quality during survey activities. SOPs 010 and 011 (AECOM, 2014) indicated site control would be established using Section Corner monuments published by the Southeastern Wisconsin Regional Planning Commission (SEWRPC); however, site control was established using published control stations maintained by the National Geodetic Survey (NGS) instead. The NGS stations were used because their coordinates are in the North American Datum of 1983 (NAD83), which is the datum required by Technical Specifications 01 70 00 (EA, 2014b). The NGS stations used for establishing control are shown in Figure 2-1 and included the Milwaukee N Global Positioning System (GPS), the Brown Deer S GPS, and the Brookfield S GPS. Nearby section corner monuments published by SEWRPC were used for checking the accuracy of the GPS. Horizontal control was then transferred to the Site by establishing site control points using a combination of survey-grade GPSs and Robotic Total Stations. Control points were placed on the site using 5/8-inch rebar, at least 18 inches long, with a plastic cap, or PK nails in pavement and marked with the location’s elevation. A PK nail is a thick shanked nail with an indentation in the middle of its head driven into the ground to mark a position precisely. Twelve control points were established at the site, as shown in Figure 2-1.

Vertical control was established at each on-site control point using an automatic level and following differential leveling techniques. The elevation was measured at the northernmost site control point (Point ID 20009) using a GPS to establish a site benchmark with a known elevation. Then a bench loop was run on all control points using the automatic level to establish the elevation of each control point (i.e., the relative elevation difference between each control point was measured with the automatic level). The bench loop started and ended at control point 20009.
(Figure 2-1) and elevations were accepted for each control point when the ending elevation at 20009 was within 0.02 foot of the initial elevation measurement.

The control points were used to check the accuracy of the instrument being used in the survey prior to any survey being conducted following procedures specified in SOPs 010 and 011 of the FSP (AECOM, 2014). A survey-grade GPS system was generally used when there was no tree coverage to block the GPS satellite signal, and a Robotic Total Station was used when there was too much tree coverage to obtain accurate readings with the GPS. Both the survey-grade GPS system and Robotic Total Station have sub-centimeter accuracy. Any difference between the measured coordinates and established control point coordinates were noted in the surveyor’s field book, and adjustments were made to the measured readings if the measured reading on the control point was more than 0.02 foot different than the coordinate/elevation established for the control point being used.

Horizontal coordinates were referenced to the 1983 Wisconsin State Plane Coordinate System, South Zone (NAD83), and vertical coordinates were referenced to the National Geodetic Vertical Datum 1929 (NGVD 29) for all surveys as required by Technical Specification 01 70 00 (EA, 2014b).

Survey data, field forms, and other field documentation were downloaded to the project file by the survey crew on a daily basis, and the project team was provided a summary of the surveyed data. The field-generated data was then plotted and reviewed by the project team in a Geographic Information System (GIS) as part of the Quality Assurance/Quality Control (QA/QC) process and cataloged into a master database. Any questions regarding the survey data were reviewed and generally resolved within a day or two of the data being collected. Once surveyed surfaces were complete, they were exported from the database into comma-separated values (.csv) and uploaded to the EQM Project ShareFile (FTP) site.

3.1.3.2 Pre-construction Video and Photographic Documentation

Video and photographic documentation of the Site was completed prior to construction activities as required by Technical Specifications 01 70 00 (EA, 2014b). The purpose was to document conditions prior to construction so any damage that may have been incurred during construction could be repaired to pre-construction conditions. Photographs were taken on site of all areas planned for construction according to the Technical Specifications (EA, 2014b). In ad-
dition, a video log of local roads planned for use as haul routes to and from the Site was performed to record pavement conditions before construction began. The video log included West Hampton Avenue from Port Washington Road west to Green Bay Road; North Milwaukee River Parkway from West Hampton Avenue north to Silver Spring Drive; North Estabrook Lane from West River Woods Parkway north to the dead-end private parking lot; West River Woods Parkway both east and west bound lanes from Port Washington Road east to the dead-end roundabout; and Port Washington Road both north and south bound lanes from West River Woods Parkway to West Hampton Avenue.

3.1.4 Floodplain Contingency Plan Implementation

EQM implemented a Flood Contingency Plan, prior to beginning the construction of Cofferdams, by installing a protective dike constructed to a height of 624.1-ft National Geodetic Vertical Datum (NGVD) around the housing structures at 5200 N. Milwaukee River Parkway to protect the structures from a resultant flood event associated with installation of the work zone isolation cofferdams. A total of approximately 415 LF of sand bag dike was installed around the property. The installed location of the sand bag dike is depicted in Figure 3-1 at the northern end of Zone 7. The sand bag dike was constructed in 2 segments to the specified elevation that tied into topographic features of the same elevation to create a barrier protective of a 100-year flood event. The legend in Figure 3-1 notes the protective dike as “sandbag.” The dike construction was completed on October 13, 2014 and removed on September 30, 2015 after all cofferdams were removed from the river.

3.1.5 Pre-Construction Soil Sampling

Pre-construction soil sampling was performed prior to constructing temporary infrastructure. This was an intermittent activity and was not tracked on the constructions schedule. Pre-construction soil sampling was performed to provide the means for evaluating the impact to Milwaukee County property upon which waste handling activities were performed. The pre-construction analytical results were also used to confirm the impacted areas of the site were restored to pre-construction conditions upon project completion. Soils beneath construction laydown areas were sampled during mobilization and site setup, prior to the start of construction. Construction laydown areas included access roads, construction entrances, dewatering pads,
wastewater treatment pad, and decontamination pads as outlined in Technical Specification 01 35 45 (EA, 2014b) and described in the CCQAP (EQM, 2015a). Pre-construction samples, additional to those required by the Technical Specifications (EA, 2014b), were collected from mobile equipment storage areas and turnaround areas, and along the length of the conveyance pipe in case confirmation of restoration was needed. All project-related waste handling (i.e., sediment or wastewater) was managed on lay-down surfaces where pre-construction sampling was performed.

Pre-construction soil samples were composite samples comprised of five aliquots. Composite samples were collected at a frequency of 1 per 10,000 square feet (SF)\(^1\) for the mobile equipment storage areas (ME), the dewatering pad (DW), the topsoil stockpile areas (TP),\(^2\) and the wastewater treatment pad (TP);\(^2\) one sample per decontamination pad (DP)\(^3\) location and turnaround area (TA); and one sample per 500 linear ft (LF) for conveyance piping (CP), access roads (AR), and construction entrances. An estimated 43 five-point composite samples (plus QC) were to be collected to achieve the sampling frequency specified in Technical Specifications 01 35 45.00 (EA, 2014b), but a total of 89 five-point composite samples (plus QC) were collected due to layout changes made to protect and preserve trees and facilitate access, as well as the additional samples not specified in the Technical Specification that were taken under conveyance piping.

Soil aliquots obtained for pre-construction documentation were collected at 0 to 6 inches sub-grade using stainless steel spoons or equivalent. The aliquots were combined and homogenized in decontaminated stainless steel bowls (or equivalent) following the procedures described in *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* (AECOM, 2014). Each sample location was surveyed by a PLS. Sample descriptions were documented and managed following procedures contained in the FSP standard operating procedures (SOPs) (AECOM, 2014), which were included in the SAP (EQM 2014b). The five-point composite samples were analyzed for oil and grease, PAHs, and PCBs.

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\(^1\) Topsoil stockpile samples were collected on the Wheaton property at a frequency of 4:10,000 square feet (sq ft) instead of 1:10,000 sq ft required by specifications.

\(^2\) "TP" was used in the pre/post-construction sample IDs for both the wastewater treatment pad located in Zone 7 and the topsoil stockpile areas located in Zone 5. Topsoil stockpile areas were only sampled in Zone 5.

\(^3\) Decontamination pad samples on the Wheaton property were collected at a frequency of four per decontamination pad as required by specifications.
Information regarding preconstruction sampling is summarized in Table 3-4. The table provides feature location, type of feature sampled, sampling performance period, size of the feature sampled and unit of measures, total number of aliquots, and number of composite samples. The table also references the appropriate figure in Appendix A where pre- and post-sampling locations (Figures 3-2 through 3-5) are depicted in relation to the feature described in Table 3-4. Additionally Table 3-4 provides reference to pre- and post-construction sample detections (Tables 3-5 through 3-8).

3.1.6 Construction of Temporary Infrastructure and Facilities

The following subsections of this report describe work elements completed to construct temporary infrastructure and provide facilities utilized for remediation and restoration activities.

3.1.6.1 Utilities Location and Staking

Utility location and staking were performed in advance of making infrastructure improvements. EQM’s General Foreman contacted utility companies through the Wisconsin One Call System and also contacted the MCDPRC maintenance staff to locate park-owned utilities. Updated staking requests were made as needed to comply with the Wisconsin One Call System.

3.1.6.2 Clearing and Grubbing

Clearing and grubbing was performed in advance of installation of temporary infrastructure. Clearing and grubbing typically preceded installation of storm water and sedimentation controls such as silt fence installation. When minimal clearing was required, however, silt fence installation preceded clearing and grubbing in some locations. Clearing and grubbing was performed by EQM’s team subcontractor SES, EQM’s local subcontractor Limb Walkers, and EQM personnel.

Clearing and grubbing were performed in each work zone. The process EQM followed consisted of:

- Utility location and staking.
- Pre-construction survey to stake the limits of removal and proposed locations for site-specific temporary infrastructure improvements.
- Pre-construction meeting to:
– Review location(s) of temporary infrastructure improvements
– Identify removable vegetation
– Identify legacy vegetation requiring preservation.

- Implementation of legacy vegetation preservation measures consisted of marking with flagging or spray paint and/or installing perimeter barriers such as construction fencing.
- Removal of vegetation and processing of vegetation material with chippers and grinders.
- Stripping of 6 inches of topsoil and stockpiling in an area surrounded by silt fence and covered with tarps to preserve for reuse in areas that receive temporary infrastructure improvements such as haul road, staging pads, etc.

The pre-construction meeting for Zone 4 varied from the other zones as it was the only work zone that possessed the potential of encountering historic artifacts within the support area. Several meetings were held with WDNR Archeologist Mark Dudzik in attendance to ensure grubbing activities did not disturb potential historical burial sites. The first meeting was held October 16, 2014 with Brenda Jones GLNPO, Marsha Burzynski WDNR, Mark Dudzik WDNR (Archeologist), Kevin Haley MCDPRC, Duane Thomas EA, Eric Bowman EQM, Christ Hartford EQM, and Pat Faessler SES in attendance. A review of the Zone 4 work elements was presented to Mark Dudzik WDNR that included construction of the haul road and where contaminated soil excavation was to take place. Mr. Dudzik explained the constraints that the team would need to follow in order to clear, grub, and excavate in this area. These included:

- Any work within the area of disturbance that breaks ground surface required Mr. Dudzik’s attendance at the job site so he could observe and inspect disturbed ground for artifacts.
- Timely coordination needed to be performed with an advance notice greater than 2 weeks prior to commencement of activities.
- Continued communication and schedule updates were needed throughout the work execution.

Additional topics of this meeting included identifying removable vegetation and legacy vegetation requiring preservation. Kevin Haley as the property owner’s representative identified what vegetation was removable and what required preservation. This resulted in modification to the haul road footprint from the contract design drawings. The original haul road segment coming from Hampton Avenue to Deposit 4-1 was eliminated to preserve large oak trees present in footprint location. A road extended into the central portion of the site in place of the segment from Hampton to Deposit 4-1. Minutes documenting discussions held during key meetings are presented in Appendix F.
3.1.6.3 Security Fence

Security fencing was installed to control access to the four work zones. Security fences were provided and installed by EQM’s subcontractor National Construction Rental, Inc. of Chicago, Illinois. Fencing installation techniques varied to adapt to installation needs at the respective installation location. Fencing installation consisted of either pre-fabricated fence panels connected together and placed on support stantions anchored with sand bags or steel posts driven into the ground at 10-foot intervals with 6-foot-tall chain-link fabric affixed to the posts. In some fencing runs, a combination of techniques was used. Prior to installation, EQM provided the utility location and staking through the Wisconsin One Call System and/or coordination with Milwaukee County Park District personnel as appropriate. EQM had AECOM surveyors stake the installation footprint to delineate the installation’s location. Subsequent to fence installation, AECOM surveyors surveyed the installation footprint for as-built documentation and billing purposes. The installation locations are depicted in Figures 2-1 and 3-1. More detailed installation locations for each zone are depicted in Figures 3-6 through 3-9. Additional fencing was installed for safety purposes to isolate conveyance pipeline at the bridge crossing on the Port Washington Bridge. Table 3-9 summarizes security fence installation information for each work zone.

3.1.6.4 Construction Access Routes

Access routes were constructed to provide ingress and egress for heavy equipment in all four work zones. The top 6 inches of topsoil was stripped off of the access road alignments and stockpiled for reuse as restoration backfill upon project completion. Ramps were built off of the access roads to gain access to the deposits with standard excavation equipment. The planned access roads and ramps were to be approximately 20 feet wide and use 12 inches of WDOT No. 2 coarse aggregate placed over an 8-ounce woven geotextile fabric. Timber mats were also deployed where the access ramps were located in unstable areas or needed to be extended into the river channel to access deposits. The actual layout of access routes was adjusted to some degree in each zone to accommodate field conditions and obstructions observed in the field. Such field decisions were made at the discretion of the EQM Site Superintendent and coordinated with the EPA On-site Representative. The access roads and ramps were constructed as depicted in Figure 3-1.
3.1.6.5  Wastewater Treatment Plant and Pad

A water treatment system was required according to the Chapter 30 permit for processing water evacuated from the excavation zones to allow remedial excavations to be conducted in relatively dry conditions. The system provided addressed two types of dewatering conditions. Initial surface water removal from the cofferdam isolation area was performed using a mobile high-volume pumping with a bag filtration system. When water levels within the cofferdam isolation area were reduced to an approximate average depth of 1 foot or less, pumping was redirected to a temporary WWTP located in the Zone 7 support area. The WWTP was also used to process contact water accumulated in the dewatering pad sump from ex-situ dewatering of sediments. Water captured in decontamination pads after washing transport vehicles and remediation equipment was also collected and transferred to the WWTP for treatment. The WWTP was equipped to process water at a rate of 250 gallons per minute (gpm), but was subsequently upgraded to a 600-gpm system for increased pumping capacity. The WWTP system entailed construction of three key components: the WWTP Pad, WWTP System, and Conveyance Piping. The following subsections describe these components and processes.

**WWTP Pad Construction**

The WWTP pad was constructed in accordance with Design Specification 02 56 13 (EA, 2014b) and EQM’s Zone 7 Dewatering System Plan dated December 2014 (EQM, 2014c). SES performed the earthwork to prepare the ground surface for a secondary containment basin constructed with 18-inch earthen berms made impermeable by installing an HDPE liner. EQM’s specialty subcontractor Clean Air and Water Systems (CAWS) constructed the 40-mil HDPE liner for the WWTP and the Dewatering Pad. EQM’s QCO provided by AECOM oversaw pad construction and was responsible for quality control testing and coordinating off-site quality control analysis. The WWTP Pad was constructed between October 10, 2014 and November 9, 2014. The construction process possessed common elements with other constructed features such as surveying and pre-construction sampling, but also required additional construction steps that were as follows:

1. Grading of the subbase and excavation collection sump. The subbase was graded with a 2% to 4% slope to direct water drainage to the collection sump.
2. Containment berms were installed around the outside perimeter of the pad.
3. An anchor trench was excavated around the outer perimeter of the containment berm to bury the outer edge of the 40 MIL HDPE liner to anchor it in place.

4. The HDPE liner installer CAWS constructed the 40-mil HDPE liner:
   a. A spreader bar used to deploy the geomembrane.
   b. Trial seam testing for shear strength and peel adhesion prior to production seaming.
   c. Liner panel seams were fusion welded by a hot wedge welder. The liner was overlapped perpendicular to the seam direction.
   d. Extrusion welding was only utilized for patching and seaming torn sections of HDPE where fusion welding was not practical due to seam overlaps with the ground surface.
   e. Field seams were non-destructive tested for continuity by pressurizing them to 30 pounds per square inch (psi) for 5 minutes. Failed seams were repaired and documented in accordance with the CAWS QC Manual.
   f. The QCO officer submitted 1 sample per 750 LF of field seaming submitted for destructive field seam testing. Samples were subdivided into three equal pieces. One sample was tested by the QC laboratory, one sample retained by CAWS, and the remaining sample was provided to the EA.
   g. Failed seams were retraced to the failed location and repaired at a minimum of 10 ft in each failed location, and steps b. d. and e. were repeated to document repairs.

5. Sand and aggregate were placed on top of the WWTP liner, which consisted of a 12-inch layer of WISDOT No. 2 coarse aggregate covered by a 6-inch layer of WISDOT No. 1 coarse aggregate.

The purpose of the WWTP was to process water that had been removed from work zones to accommodate excavation activities. The WWTP was operated to meet discharge requirements established by the WDNR Dredging Operations Wastewater Discharges General WPDES Permit No. WI-0046558-05, which is presented with the other project permits in Appendix F. The WWTP system consisted of a fixed plant for treating contaminated sediment contact water and mobile filtration unit(s) for processing surface water at depths greater than 1 foot above sediment surface during initial high-volume dewatering of the cofferdam isolated areas. Sources of contact water removed and processed through the WWTP during remedial excavation activities included:

- Standing water in an isolation area < 1 foot above the sediment surface.
- In-situ sediment matrix water pumped from sumps or depressions in contaminated sediment excavation areas to dewater sediments to the greatest extent possible prior to removal and transfer to the dewatering pad.
- Ex-situ sediment matrix water and storm event contact water collected from the sump/reservoir of the dewatering pad where excavated sediments were permitted to gravity drain matrix water prior to final solidification and disposal shipment.
- Decontamination water collected from decontamination pads utilized for truck tire wash and equipment cleaning.
The WWTP was designed to treat contact water contaminated with PCBs, NAPL, PAHs, and total suspended solids (TSS) in accordance with the requirements of the WPDES permit. The initial WWTP system had an operational treatment capacity of 250 gpm to dewater work areas and maintain relatively dry work areas. The system was upgraded during the interim operation period between completing dewatering for Cofferdam 1 and starting dewatering of 1st Phase Cofferdam 2. A parallel 250-gpm system was mobilized consisting of a bag filter, sand filter, zeolite vessel, and carbon vessel. An additional 2,000 pounds of carbon and zeolite were added to the original respective vessels in both 250-gpm systems. Pumps and piping were reconfigured from 4-inch to 6-inch, thus increasing the overall WWTP capacity to 600 gpm. Figure 3-10 provides the process flow diagram and Figure 3-11 provides the treatment system component layout for construction on the WWTP. The fixed plant water treatment process is summarized as follows:

1. Influent sediment contact water enters the system through conveyance piping.
2. A polymer injection port introduced either Aquamark 200 polymer or Solve 163 to the influent water stream at the discretion of the WWTP operator where water would then pass through an inline static mixer. Typical operation did not require the use of polymer to promote the settling of sediments in the following equalization tanks, but was utilized after installing new sumps, excavation near sumps, or after precipitation events when there was a potential for a high amount of suspended sediments. Approximately 80 gallons of polymer were used over the entire WWTP operating period.
3. Influent water then introduced water into two separate but parallel oil-water separators/weir tanks to promote separation of floating organic contaminants and begin settling of suspended solids.
4. Effluent water exiting the oil-water separator/weir tanks was then directed into four separate but parallel equalization tanks to further promote settling of suspended solids and provide a sufficient volume of water to provide a consistent flow of water through the remaining treatment vessels.
5. Water was then directed through a series of filtration units that consisted of a 2-stage back-washable sand filter, 5-stage bag filter with 50-micron bag filters, zeolite filter, carbon filter, and another 5-stage bag filter with 0.5-micron sock filters. During this filtration process, liquid-phase organic compounds and remaining suspended solids greater than 0.5 micron in size were removed.
6. Effluent water was transferred to treated water holding tanks to allow for water quality testing prior discharging to Outfall 005.

SES began mobilizing and assembling WWTP system components on November 10, 2014 and completed assembly on December 11, 2014. The components consisted of 7 Frac
tanks, 2 weir tanks, and a Granular Activated Carbon (GAC) Unit and water treatment trailer with multiple smaller components. Once the units were in place, work began on plumbing the system together and making electrical connections to the generator that powers various components. Potable water was delivered to the site between December 3, 2014 and December 9, 2014 to activate the carbon and backwash media vessels in preparation for system startup. The WWTP was enclosed in a tent and propane heaters were provided to warm the enclosure for winter condition operations.

The WWTP was in operating condition on December 10, 2014 and ready for a trial operation to evaluate system performance and make adjustments to optimize system operation. Water was pumped from Zone 3 to the WWTP on December 11, 2014 to test and optimize the treatment system. A batch of water was treated and held in a frac tank for analytical testing prior to discharge to gauge the effectiveness of the treatment system. Analytical results received the following afternoon on December 12, 2014 confirmed that Wisconsin Pollutant Discharge Elimination System (WPDES) discharge parameters were being achieved, allowing for water discharge to Outfall 005. Additional details pertaining to the analysis of discharge water from the WWTP is provided in Section 3.3, High-Volume and In-Situ Dewatering.

**Conveyance Piping**

Water conveyance pipelines were constructed to transfer water from active excavation areas to the WWTP in Zone 7. These pipelines consisted of HDPE pipe, hard- and soft-walled flexible hose assemblies to convey water from the pumping source through either mobile filtration units or the WWTP to its respective discharge permitted outfall location. Flexible hoses were utilized for the pump intake suction line and initial discharge up to the mobile filtration units. The use of hoses provided flexibility for relocating pumping stations to optimize dewatering operations in a timely manner without having to modify HDPE pipelines. HDPE pipelines were constructed from 4-inch, 6-inch, and 8-inch piping diameters. The 4-inch pipelines were constructed from SDR 11-grade HDPE piping, and the 6-inch and 8-inch pipelines were constructed from SDR 17 HDPE piping. Pipe segments were welded together using heat butt fusion and then pressure tested per specifications prior to being put into service.
Figure 3-1 depicts the HDPE pipeline locations constructed. The conveyance pipeline extending from Zone 3 to the WWTP was constructed from 4-inch HDPE piping. The pipelines constructed in Zone 7 were constructed from 6-inch HDPE pipe. A common pipeline constructed from 8-inch HDPE was used to convey water from Zones 4 and 5 to the WWTP. Tee junction valves were installed to switch pumping between Zones 4 and 5.

Construction of this pipeline required additional planning, coordination, and protective measures with land owners and government agencies. Permission was obtained from the hotel property owner to construct the pipeline beyond the original limit of disturbance for Zone 5 and extend up to Port Washington Road. The pipeline then was installed on the Port Washington Road Bridge, which required a right-of-way permit from the county and protective fencing to be installed along the sidewalk to isolate the pipeline from pedestrian traffic. After crossing the bridge, the pipeline was directed under the bridge and extended west beneath Interstate 43. This required obtaining a right-of-way permit from WISDOT to cross the property under the interstate. The pipeline then entered Milwaukee County Park Property, extended through the Zone 4 support area, then continued across the sidewalk of the Hampton Avenue Bridge. Protective fencing was installed along the pipeline crossing the Hampton Avenue Bridge to isolate the pipeline from pedestrian traffic. The pipeline was directed beneath the western side of the Hampton Avenue Bridge and extended through Zone 3 to reach the WWTP.

**Winterization Contingency Plan Implementation**

Upon receipt of Contract Modification 3 on November 20, 2014, work began on implementation of the Winter Contingency Plan to provide a protective shelter and heating for the WWTP during winter operations. Work began with assembling the aluminum framing for the tent enclosure over the WWTP on December 1, 2014. A local crane subcontractor was brought on site to lift structural components in place for assembly. The tent assembly was completed on December 2, 2014, followed by installation of a propane tank and propane space heaters to heat the enclosure. The heating system was operational on December 3, 2014. The system was operated through April 2015 and completely demobilized in May 2015.
3.1.6.6 Dewatering Pad

The EQM team constructed a sediment dewatering pad in the Zone 7 support area between the Milwaukee River and North Milwaukee River Parkway between October 10, 2014 and December 4, 2014 as depicted in Figure 3-1. The dewatering pad was utilized for the ex-situ dewatering of excavated sediments in preparation for the disposal shipment and to minimize the use of solidification agent. The dewatering pad facilitated gravity drainage of interstitial water bound with sediments and subsequent collection for treatment through the WWTP by use of the 40-mil HDPE liner and collection reservoir in the bottom of the pad. EQM prepared the Zone 7 Dewatering Plan System, December 2014 (EQM, 2014c) in order to construct the dewatering pad in accordance with Design Specification Sections 31 23 19, 01 70 00, 02 56 13 and 02 61 00 (EA, 2014b).

Construction began on October 10, 2014 and was completed on November 21, 2014. The construction process for the WWTP pad described in Section 3.1.6.5 was followed up to Step 4. The remaining construction steps varied from the WWTP pad construction and were done to facilitate the operational needs of the dewatering pad. A layer of 8-ounce nonwoven geotextile fabric was placed over the HDPE liner and then backfilled with 12 inches of aggregate. A layer of 8-inch Envirogrid geocell was installed over the first aggregate lift and filled with WISDOT No. 2 coarse aggregate to create the working surface of the dewatering pad. The geocell product locks the aggregate in place and makes digging into the aggregate material difficult during sediment handling operations due to the rigid vertical cell walls, thus minimizing aggregate replacement and providing protection to the liner. Concrete bin blocks were installed on top of the containment berm and used to divide the surface area for the pad for segregation of TSCA sediments from solid-waste sediments. The TSCA area was elevated an additional eight inches above the remainder of the pad to ensure that TSCA sediments would not be inundated by a 25-year/24-hour precipitation event. Earthen ramps were installed on the east side of the pad. The earthen ramps facilitated the off-loading of dump trucks used to transfer sediment from the Zone 7 and Zone 3 deposits to the pad without having to enter the confines of the pad- minimizing truck tire decontamination and the potential for mechanical cross-contamination sediments.

The completed dewatering pad provided a surface area of 1.45 acres, of which, 2,176 SF were devoted to TSCA sediment storage or approximately 3.5% of the pad’s working surface.
area. The pad was operated from January 22, 2015 through September 22, 2015 to store and ship waste.

On April 23, 2015 three tears were observed in the HDPE liner within the confines of the TSCA sediment handling area on the dewatering pad. These tears appeared to be the result of trying to clear residual sediments from the outer edge of the TSCA sediment handling area against the berm and outer perimeter bin blocks. The Region 5 TSCA permit coordinator was notified of the damage to the HDPE liner in the TSCA sediment handling area and was consulted to formulate the corrective action measures to be implemented. The agreed upon corrective action consisted of scheduling the repair of the tears with EQM’s subcontractor CAWS, preparing the area for patching, surveying the location of the tears, sampling the sediment beneath the liner to determine the impact on sub-liner soils, and completing repairs to the liner. The damaged areas were surveyed and sampled on April 29, 2015 for documentation purposes and the areas were repaired on Friday, May 1, 2015. A sample was sent off site for the seam test. Peel and shear destructive tests performed on site were within the acceptance criteria specified in the Technical Specifications. A portion of the geomembrane liner that was patched was sent to an off-site laboratory for QC analysis, and another portion was provided to the EA project personnel for archiving. On May 5, 2015, the bin blocks for the TSCA stockpiling area on the dewatering pad were rearranged for added protection of the liner.

The dewatering pad was removed in order to restore the site after it was no longer needed to stage and ex-situ dewater excavated sediments. The pad was removed between September 24, 2015 and October 6, 2015.

3.1.6.7 Decontamination Pad(s)

Six decontamination pads were constructed to control contaminated sediment from migrating outside of the work zones. Table 3-11 summarizes installation and removal information concerning the decontamination pads constructed. EQM constructed the decontamination pads in the following manner:

1. A location was selected usually within or in close proximity to the haul road used to send loaded trucks from the excavation zone to the dewatering pad. The trucks would traverse over the decontamination pad to have their tires cleaned of loose sediment before entering public roadways.
2. The soil in areas where the decontamination pad(s) were to be installed were sampled prior to construction to document pre-existing soil conditions for subsequent comparison to post-construction samples. Pre- and post-construction samples were collected to determine the need for excavation in the event that the decontamination pad operation impacted local soils with contaminants. Detected results for pre and post construction sampling are provided in Tables 3-5 to 3-8.

3. Approximately six inches of topsoil were stripped from the decontamination pad footprint and hauled to the local topsoil staging area in the respective construction zone.

4. The footprint was covered with a layer of 8-ounce nonwoven geotextile which was covered with a layer of the RUFCO 4010B liner to serve as a secondary containment measure. The RUFCO 4010B liner was then covered with a layer of 8-ounce nonwoven geotextile fabric.

5. The composited geo-synthetic layers were then covered with a 6-inch layer of sand covered by a 4-inch layer of aggregate.

6. A total of six 31-foot-long by 8-foot-wide by 1.5-foot-tall prefabricated steel decontamination pans were installed in the approximate center of the lined footprint. The parallel pans possess an elevated track for trucks to traverse over while their tires are being cleaned, thus allowing sediment particles and decontamination liquids to dislodge and fall in the bottom of the pan. Accumulated wash water could then be pumped as needed and conveyed to the WWTP, and sediments captured in the bottom of the pans could be periodically cleaned out and sent to the dewatering pad for landfill disposal load-out.

7. Once construction was completed, the four corners of the decontamination pads were surveyed by a PLS to note if their locations were changed from the staked-out design location.

8. After remediation and equipment decontamination work in the respective installed work zone was completed, the pads were disassembled and post-construction soil samples were collected to evaluate the need for contaminated soil removal after the decontamination pad operation.

The packing list for the geomembrane liner received on October 28, 2014, listed the manufacturer’s name, product identification number, roll number, and roll dimensions for the seven rolls of geomembrane liner delivered to the site, the dewatering pad, and the WWTP. EPA granted approval of RFI# 030301-0004-013 on December 12, 2014, allowing for the use of RUFCO 4010B geomembrane liner for construction of decontamination pads in lieu of SOLMAX 440. See Appendix G for RFIs. Photographs were taken during site preparation and decontamination pad installation. Photo documentation was provided in the QCO daily reports and uploaded to the FTP site.
3.1.6.8  **Cofferdams**

Temporary dams, or cofferdams, were constructed to allow remedial activities to be performed within the active river corridor using standard earthmoving equipment. This method of remedial excavation is referred to as “dredging-in-the-dry.” Cofferdams were first constructed around the perimeter of identified contaminated deposits in order to isolate the target area from the hydraulic influence of the river. Water was then pumped from the cofferdam isolation area to allow heavy equipment to access the channel deposits and conduct remedial excavation activities under relatively dry conditions. This method improved the precision of the remedial excavation and prevented disturbed sediments from being carried away by the river current and potentially impacting areas downstream.

The steel sheet pile was conjoined with tongue-and-groove joints, and then driven into the channel sediment using an excavator with a vibratory hammer attachment. The endpoints of the wall layout extended from one bank to the other to isolate the work area from the influence of the river. When driven to the calculated target depth, the force of water against the sheet piling is counteracted by the opposing force of earth pressure below the sediment surface, thus allowing the cofferdam wall to resist overturning. The sheet pile was driven to a target depth ranging from 6 to 12 feet, depending on the subsurface density and cohesion of the sediment.

The remedial design prepared for this project required the installation of cofferdam systems to isolate each of the four work zones to facilitate “dredging in the dry.” The sequence outlined in the original remedial design entailed constructing Cofferdam 2 (Zone 7) first, then followed by Cofferdam 4 (Zone 5), Cofferdam 3 (Zone 4), and lastly Cofferdam 1 (Zone 3). Cofferdams 1 and 2 were constructed using steel sheet piling mechanically driven into the channel using heavy equipment with vibratory hammer attachments, while Cofferdams 3 and 4 were constructed using barrier wall components placed on the channel bed surface. The steel sheet piling used for Cofferdam 2 was originally intended to be reused to construct Cofferdam 1 in order to increase project efficiency while minimizing material and logistical costs associated with obtaining additional sheet piling. Thus, the original planned sequence allowed construction of Cofferdam 4 to proceed while Cofferdam 2 was being removed. Sheet pile removed from Cofferdam 2 could then be reused for constructing Cofferdam 1 (Zone 3). Cofferdam 3 was to be constructed once Cofferdam 1 was removed.
Shortly after completing construction of the west and northwest segments of Cofferdam 2, a rain event occurred on October 29, 2014 that resulted in a minor rise in the river level. Although the cofferdam was designed to resist overtopping up to the 100-year flood event, the water level for this relatively minor event flowed through the pick holes of the sheet pile and came very close to spilling over the top of the cofferdam. As a result, the Project Team decided the original layout of the Cofferdam 2 system needed to be revised to mitigate overtopping, which would require additional time for analysis, modeling, and design. The preferred alternative would have been to refocus remedial efforts in Zone 5 while awaiting the revised Cofferdam 2 layout. However, this alternative was not feasible because signed access agreements had not been received for all the private property owners adjacent to Zone 5. The best option was to initiate remedial activities in Zone 3. The revised layout and sequencing for Cofferdam 2 is detailed further in Section 4.2.2.3.

In an effort to preserve the overall project schedule, EQM requested a change to the sequencing of cofferdam installation and removal for Cofferdam 2. The change was expected to minimize the impact delayed access agreements had on the overall construction schedule. EQM submitted Request for Information (RFI) 7 on November 6, 2014 requesting revising the sequence for cofferdam installation, thus moving completion of Cofferdam 1 ahead of Cofferdam 2. EQM was granted permission by EPA on November 7, 2014 to move work on Cofferdam 1/Zone 3 ahead of Cofferdam 2/Zone 7 while a remedy to Cofferdam 2 was developed through additional surveying and modeling. See Appendix G for copies of the project RFIs. Table 3-12 summarizes information concerning the remaining cofferdam installations.

Work elements to construct the cofferdams were similar for each cofferdam constructed but varied subject to the construction material method (Steel Sheet Pile, Muscle Wall,™ Concrete Barrier Block) and site conditions. Below is the general procedure used in construction of the cofferdams, followed by specific details regarding each cofferdam installation, as well as variances from “as planned” to “as constructed” and lessons learned.

1. **Alignment Survey and Staking**—AECOM surveyors staked the alignment of the cofferdam segment locations in advance of construction to locate the segment alignment for SES to construct.

2. **Access Way and Work Platform Preparation**—Access ways were extended out into river channel to serve as a roadway for movement of construction materials to the installation location and a work platform for heavy equipment to install the cofferdam construction materials. Access ways and work platforms were primarily built from timber mats placed on the river
bottom. In some instances mainly at river access points, large stone was placed to stabilize slopes when transitioning from land surface to river bottom. Timber mat placement was configured to best adapt site conditions. In most areas, a single layer of mats was placed perpendicular to the direction of the access way. In areas of deeper water or softer sediments, a multiple layer configuration was required. The multi-layer configuration was usually done in a manner similar to train-track construction, with rails and cross ties inverted. Two sets of mats were laid out lengthwise parallel to each other in the same direction as the access way. A second layer of mats were laid crosswise on top of the two parallel lines of mats. This configuration created a wide uniform road bed from which heavy equipment could operate.

3. **Cofferdam Installation**—Each cofferdam system was installed according to the layout provided in design drawings approved for each work zone. Surveys were conducted periodically during installation to check actual top elevations against the elevations required by Technical Specification 31 23 19 (EA, 2014b). Once the cofferdam was installed to the required elevation, the top of the cofferdam was surveyed at a minimum of every 5 feet along the cofferdam crest as required by Technical Specification 01 70 00 (EA, 2014b). Check points were used to ensure data quality during the survey as discussed in Section 3.1.3.1. The final surveyed elevations were reviewed and uploaded to the FTP site. Installation methods and equipment varied by the construction material.

a. **Steel Sheet Piling**—Steel sheet piling was utilized when adequate sediment thickness was available for safe installation and operation. Although steel sheet piling was the preferred method of cofferdam construction, shallow bed rock conditions in Zones 4 and 5 were not conducive to installation and alternate construction methods were selected. When steel sheet piling is installed, SWELLEAL™ WA sealant caulking was applied inside the connection joints prior to installation. Steel sheet pile was shuttled to the installation area with various pieces of heavy equipment. A Komatsu PC 300 excavator equipped with a Movac pile driver was used to drive steel sheet pile into alignment. Piles would be driven vertically into the ground until either refusal was encountered or the targeted completion elevation was achieved. When steel piling could not be driven to the desired elevation, additional attempts were made with a larger pile driver. In instances when the desired elevation could still not be achieved, the sheet(s) were either hot cut to the desired completion grade or an RFI was submitted requesting a variance meeting concerning the desired completion elevation. (See RFIs 6 and 16 in Appendix G.) Additional sealing of the connecting joints was performed during initial dewatering.

b. **Muscle Wall™**—Muscle Wall™ consists of prefabricated reusable hollow low-density polyethylene blocks used primarily for containment and flood control. Muscle Wall™ is available in various sizes, and the 4-foot-tall by 6-foot-wide model was utilized for this project. Each unit has interlocking tongue-and-groove joints allowing them to be interconnected to form a continuous wall when slid into place. Each section was placed according to the layout depicted in the plan drawings prepared for each work zone. Each Muscle Wall unit was filled with river water using a 2-inch centrifugal pump to increase their mass and anchor them in place. The wall was then covered with plastic sheeting and anchored with small sand bags to seal off water flow between the connecting joints.

c. **Concrete Jersey Barriers and Sand Bags**—The 20-foot-long by 3.5-foot-tall concrete barrier block (jersey barriers) were installed along the proposed cofferdam alignment using heavy equipment. Large sand bags measuring 3-feet-tall by 3-feet-wide by 3-feet-long, commonly referred to as super sacks, were placed between each jersey barrier to
form a continuous wall. Once the wall was assembled, it was covered with plastic sheeting anchored with small sand bags.

4. **Keying Wall Ends**—In order to complete the confining cofferdam structure, the wall ends were keyed into earthen features of like elevation to wall finish grade elevation. In the case of steel sheet pile, the wall was installed into the earthen river bank. In the case of the Muscle Wall™ and Concrete Barrier Block, the bank was excavated appropriately to extend the structure into the river bank. Earth fill, stone, and sand bags were used to further seal the ends and armor the areas for protection from flood erosion.

5. **Cofferdam Removal**—Each cofferdam was removed after remediation and restoration activities were completed to the satisfaction of RGs and approval of the PCT. Dewatering pumps were shut down and a small portion of the wall was removed to allow the water level within the isolation area to equilibrate with the water level in the river. Then the removal process could essentially proceed in reverse order to the installation process. Steel sheet piling used for Cofferdams 1 and 2 was driven deep into the channel bottom and tended to have a thicker coating of sediment when removed. Thus, sheet piling was transported to the Dewatering Pad for cleaning using a pressure washer prior to reuse or demobilization. Because the jersey barrier and Muscle Wall used for Cofferdams 3 and 4 was placed on top of the channel surface and covered with plastic sheeting, it was considered sufficiently protected from exposure to sediments. These materials were cleaned in the channel prior to removal from the isolation zone.

**Lessons Learned**

A number of lessons were learned with the construction and operation of the various types of cofferdams installed in this removal action. The key lessons are as follows:

1. River flow patterns are dynamic and impacted by a number of factors including, but not limited to, man-made changes to local drainage patterns, greater than normal storm events, and seasonal variations of temperature and precipitation. Although HEC-RAS modeling software is an effective tool for predicting river flow conditions resulting from installation of in-stream structures, its accuracy is improved with use of the most recent topographic survey data available.

2. The use of sealants in the interlocking sections of steel pile is a sound practice to aid in sealing of sheet pile walls. Making adjustments to sheet piling to achieve required cofferdam top elevations after sealant application, however, may lessen the effectiveness of the sealants. Other traditional measures of sealing the sheet wall are still necessary.

3. The Muscle Wall™ product used for cofferdam construction when shallow bedrock conditions exist had limited applications and was not well suited for use in a river environment where hydrodynamic forces from fluctuating river levels can dislodge the product from its installed location. Pre-fabricated concrete barriers have greater density than water-filled Muscle Wall™ units, which make them better suited for withstanding the force of river currents during elevated water conditions.
3.1.6.9 **Mobile High Volume Pumping and Filtration System**

This system consisted of a high-volume pump, mobile filtration unit(s), and energy dissipation pads constructed at the permitted outfall location for the respective remediation zone. Diesel centrifugal pumps in 4-inch, 6-inch, and 8-inch sizes were used with mobile filtration units installed in-line of the discharge piping that directed water to the appropriate permitted outfall location. Pumps were mounted on single-axel trailers for relocation mobility as needed. An operator was provided to continuously monitor pumping when dewatering operations were ongoing. The mobile filtration unit(s) used 6-element filter housings with six 50-µm filter bags to capture suspended sediment to meet the 40-mg/L TSS limit for discharge. Discharge water turbidity and operating pressures on the filter housing were monitored to determine the frequency of filter bag replacement. Energy dissipation pads were constructed at each outfall location to mitigate erosion and disturbance to sediments. The energy dissipation pads were constructed of 6-inch minus riprap placed with heavy equipment that typically amounted to placement of approximately 5 CYs. The number and size of pumps, filter units, and energy dissipation pads varied to meet the needs of each cofferdam isolation area. The outfall discharge locations are depicted in Figure 3-1 for the high-volume systems. Dewatering operations in Zones 3 and 7 both utilized 4-inch and 6-inch pumps. Zone 3 dewatering pumps discharged to Outfall 002, and Zone 7 high-volume pumping systems discharged to Outfalls 001, 008, and 009. Zone 4 did not require high-volume pumping, and all water pumped was directed to the WWTP and discharge to Outfall 005. Zone 5 utilized an 8-inch pump system and discharge to Outfall 004.

3.2 **Pre-removal Sediment Characterization Sampling**

In order to determine the actual excavation limits, pre-removal sediment samples were collected to refine the designed extent of contamination presented in the BODR (EA, 2014a). The sampling design was based on one sample core location per grid. Grid size requirements were presented in the Chemical Data Quality Control Plan 01 35 45.00 10 1.7 (C) of the Technical Specifications (EA, 2014b). The maximum grid sizes were either 25-foot by 25-foot or 50-foot by 50-foot and were dictated by the size of the deposit. The occurrence of TSCA-level PCBs required a maximum grid size of 12.5-foot by 12.5-foot. Contamination was required to be
bound by a sample meeting RGs, thus necessitating successive ‘step-out’ samples to define the extent of the compounds of concern at levels greater than the RGs shown in Table 1-1.

The initial number of grids/sample locations was estimated based on the extent of deposits presented in the BODR (EA, 2014a). The number of samples that were anticipated per deposit is presented in Table 3-13 and is based on deposit size, specified grid sizes, and target depths with sample collection over 1-foot intervals. The actual number of samples that was collected for each deposit is presented in Table 3-13 and represents the total from both anticipated grids and step-out grids. These numbers reflect the transient nature of contamination distribution in this urban riverine environment that is susceptible to flashy flow.

3.2.1 Methods

The sampling points defined for each grid were surveyed by a PLS before the field crew proceeded with collecting core samples. Some sample location coordinates were collected by samplers using a handheld GPS unit with sub-meter accuracy calibrated to the nearest survey checkpoint (discussed in Section 2.2.3). This was specified by SAP Addendum 2 (EQM, 2015d), and was deemed necessary due to the limited space on the sampling boat for the PLS during sediment sampling. The PLS later resurveyed these locations using a survey-grade GPS when possible; however, less than 1% of the core locations had their final locations recorded by the sub-meter GPS. These locations were located primarily in Deposits 4-1, 4-2, and 5-1.

The analytical results from pre-removal sampling were used for planning remedial excavation activities in each work zone; therefore, the sequence of pre-removal sampling generally followed the sequence of remedial action for each zone. EQM revised the sequence of pre-removal sampling according to the revised construction schedule resulting from initial complications with Cofferdam 2, as previously discussed in Section 3.1.6.9. The original plan to initiate pre-removal sampling in Zone 7 was modified to focus on Zone 3, which was chosen as the alternative for the first remedial action. Pre-removal sampling was performed under variable and challenging conditions that included: muddy cofferdam isolation areas after dewatering; sampling through ice cover up to 2-foot thick plus underlying water column; and sampling from a boat deck through standing water.

In general, one core was collected from each grid cell and divided into multiple discrete samples in order to correlate analytical results with in-situ depths of contaminated sediments.
The sample location was biased toward fine-grained organic-rich sediment and topographically low areas within the cell to the extent possible. When sediment and topography were not distinctly visible due to river ice or through the water column from a boat, the sampling location was positioned as close to the center of the grid cell as possible (EQM, 2015c; 2015d).

Cores were stored and transported in a vertical position to the on-site laboratory trailer for core processing. During processing, the core was vertically split, photographed for a photographic log of sediment cores, and described on sediment sampling forms following the standard procedures for sediment characterization presented in Appendix B of the FSP, SOPs 003 (Logging of Borings) and 004 (Glacial Soils Classification). A field log book was used to generate a daily record of the cores that were processed and the time of their processing, and to identify the sampler/logger. Once cores were split, photographed, and described, they were screened for the presence or absence of NAPL. Generally, the core segmentation process followed a visual and olfactory screening process to identify potential NAPL. Intervals with visual or olfactory indicators were noted on the Chain-of-Custody (CoC) when the samples are submitted to the on-site laboratory. Each sample submitted to the laboratory was screened for NAPL by a laboratory chemist using Sudan IV test procedures. Depending on the results of the initial Sudan IV screening, further analytical analysis was conducted for each sample in accordance with procedures presented in the approved SAP (EQM, 2014b). If the initial Sudan IV test was negative, then the sample was analyzed for PAHs and PCBs. If the initial Sudan IV test was positive, then a duplicate Sudan IV analysis was conducted on the sample by the lab. If the duplicate test was positive, then the sample interval and all samples above were analyzed for PCBs only, regardless of the Sudan IV test results. If the initial Sudan IV test was positive and the duplicate was negative, then a triplicate Sudan IV test was conducted on the sample by the lab and the sample interval and all samples above were analyzed for both PAHs and PCBs regardless of their Sudan IV test results. Detailed core segmentation process, homogenization, and sample jarring procedures are presented in Inset 3 of the FSP and described in Section 3.3.2 of the FSP (EQM, 2014b).

The number of samples collected and analyzed was based on an anticipated target drill depth and sample collection over 1-foot intervals. The number of samples for a grid often varied and were dependent on the actual drill depth or refusal found during the investigation and the results of boundary grid cells. Smaller grids were used at grid cell boundaries to refine the excavation extent, as needed. The process for refining grid cell boundaries, if necessary, followed a
procedure similar to the TSCA grid “step out” procedures, which are described in detail in Section 3.3.2 of the FSP.

Sediment was collected using direct-push technology (DPT) [e.g., Geoprobe® as outlined in SOPs 012 and 014 of the FSP] (AECOM, 2014). The core barrel was advanced using 4-foot pushes with a target core recovery of 75% of the attempted depth or better as specified in the SAP (EQM, 2014). In each case that 75% recovery was not achieved, multiple attempts were made and alternative approaches (e.g., type of catcher or method of push such as by hand or rig) to improve recovery were used. When 75% recovery was not achieved, the core with the best recovery was segmented for analysis. A core in which 75% recovery was not achieved was primarily due to refusal on bedrock or debris or a sandy unit at the bottom of the core that fell out the bottom of the core tube upon retrieval.

After cores were collected, they were packaged and transferred in a vertical position to the on-site core processing facility for processing (see Appendix I, Sediment Sampling Boring Logs and Appendix J, Sample Core Photographs) and analytical sampling following guidelines in the FSP and SOPs 002, 003, 004, and 013 (AECOM, 2014). The core was segmented into 1-foot intervals starting from the top of the native soils at the bottom of the core, if encountered. Native soils were only present in Zone 3. In other zones where native soils were not visible, the core was segmented into 1-foot intervals starting from the top of the core to guarantee enough sediment was available for samples collected at the top of the core.

During sampling, any interval with visual or olfactory evidence of hydrocarbons was noted on the field form. A flame ionization detector (FID) with a linear detection range of 1.0 to 10,000 parts per million (ppm) methane (AECOM, 2015) and a photoionization detector (PID) with a linear detection range of 0.5 to 500 ppm isobutylene (EQM, 2014b) were used to monitor for hydrocarbons in each interval. Readings were recorded on the core log forms. Samples were submitted to the lab and screened for NAPL using the Sudan IV test procedure and analyzed for PAHs using Method 8270 and for PCBs using Method 8082.

### 3.2.2 Excavation Grid Identification

To maximize efficiency, identification numbering for excavation grids was chosen to correspond with the sampling sequence conducted prior to field work. The grid identification meth-
odology was outlined in the Field Sampling Plan (FSP) for Lincoln Park/Milwaukee River Channel Phase II Remedial Action prepared by AECOM and accepted by the PCT.

TSCA grid locations within a deposit were sampled first to determine if additional step-out locations were necessary to define the extent of contaminated sediment and to minimize equipment mobilization. Samples were analyzed in the on-site laboratory with 24-hour turnaround time, which allowed sample grid modifications to occur without delays. TSCA grids required additional step-out locations if a pre-excavation TSCA grid sample location had PCBs ≥ 50 mg/kg. Additional 12.5-foot by 12.5-foot grid cells were added in adjacent cells with TSCA-level PCBs.

A similar step-out approach was used around the outermost non-TSCA grid cells for each deposit. Additional step-out locations were added adjacent to or within grid cells if the analytical results exceeded the Remedial Goals (RGs). The size of the step-out grid cells was chosen based on the size of the original non-TSCA grid cell (i.e., 50 x 50 ft, 25 x 25 ft), the levels above the RGs that are detected, and the proximity of the grid to the 617-foot elevation delineating upland and riverine conditions. The step-out grid size was selected to ensure the horizontal extent of contamination was adequately characterized such that step-out grids were smaller than the specified grid size but not larger.

3.2.3 Results

Table 3-14 summarizes the sampling dates, number of non-TSCA and TSCA grids sampled, and number of grids with non-TSCA and TSCA exceedances. Analytical results (Tables 3-14 to 3-21) were compared to project RGs. Observations of odor and sheen recorded on the Sediment Sampling Boring Logs (Appendix I) and field notes were also reviewed to assess sediment quality within each zone. Results for each zone (Zones 3, 4, 5, and 7) and deposit are summarized below in order of sediment removal completion sequence.

Throughout pre-characterization sampling, several QA/QC procedures were used to ensure data quality and accuracy. To ensure each sample core was correctly identified and results were linked to the correct grid, each core was labeled prior to transport to the on-site core processing facility. The cores were labeled with the grid cell it was collected from, the top and bottom, the attempted depth, the length recovered, and any pertinent information for the core processor. Once the core arrived at the on-site core processing facility, the label and sediment core
were photographed. During sample processing, each sample jar was labeled with the sample ID, sample time, sample date, analysis requested, and site-specific information. The lid of each jar was also labeled with the sample ID and was checked prior to submittal to the on-site laboratory for analysis.

3.3 **High-Volume and In-Situ Dewatering**

In-situ and ex-situ sediment dewatering in support of remediation and restoration activities were performed utilizing various pumps, conveyance pipelines and hoses, the WWTP, mobile bag filtration units, and the dewatering pad discussed in Section 3.1.6.5. These components collectively comprised the dewatering system to remove surface water within the cofferdam isolated work zones and from the sediment in-situ and ex-situ. The dewatering system followed the progressive steps presented below with adaptive modifications to adjust for site conditions in each remediation work zone:

1. Water was pumped from cofferdam isolation areas to their respective permitted outfall locations utilizing high-volume pumps equipped with a mobile bag filtration unit to remove suspended solids. Water was pumped down to approximately one foot above the sediment surface.

2. High-volume pumping was terminated in a cofferdam isolation area as water levels approached approximately one foot above the sediment surface. Variances to this approach are noted later in this RAR as appropriate by work zone (i.e., high-volume pumping was required to continue in Zone 7-2 throughout excavation).

3. In-situ dewatering of sediment began when water was pumped from depressions and/or sumps in the work zone and was then directed to the WWTP for processing and subsequent discharge following WPDES permit requirements to Outfall 005 located near the confluence of the West Oxbow and the main Milwaukee River channel (Figure 3-1). Pumping to WWTP continued through completion and verification of contaminated sediment removal.

4. Ex-situ dewatering of sediment was performed post-removal, after sediment was transferred to the dewatering pad. Latent water trapped in the interstitial pore spaces within the sediment was allowed to gravity drain onto the dewatering pad where it could drain to the collection sump reservoir and be pumped to the WWTP. Sediment contact water was pumped from the dewatering pad sump as needed to maintain the required 6-inch freeboard and storage volume, which continued until the pad was taken out of service and demolished.

5. Pumping with the high-volume system equipment was utilized as needed to maintain suitable water levels for streambed and stream bank restoration.

During the processing of in-situ and ex-situ sediment contact water, WWTP discharge samples were tested and reported in accordance with the requirements outlined in the WDNR
Dredging Operations Wastewater Discharges General WPDES Permit No. WI-0046558-05, which is included in Appendix D with other project permits.

Daily turbidity samples were collected from Outfalls 001, 002, 004, 008, 009, and 010 (shown in Figure 3-1) when effluent was discharged from bag filters directly to the Milwaukee River during high-volume dewatering pumping. Samples were collected at a frequency of three times per week for total suspended solids (TSS) analysis. TSS results are presented in the respective DMR in Appendix H.

Daily turbidity samples were collected from Outfall 005 when effluent was discharged from the WWTP; additionally, samples for PCBs, PAHs, and TSS were collected and analyzed at a frequency of three times per week.

A Technical Systems Audit by EPA conducted during March 2015 (USEPA, 2015) determined that the original analytical methods for PAHs and PCBs associated with WWTP effluent discharge were not compliant with methods required by the Clean Water Act. Therefore, the analytical methods were updated beginning May 4, 2015, as indicated in Table 3-10.

Per Wisconsin Statute 283.55, a Discharge Monitoring Report Form (Appendix H) was completed monthly for each outfall and emailed to WDNR no later than the 15th of the following month. Copies of the Discharge Monitoring Form were provided to the TOCOR as well. Correlation curves were developed between turbidity and TSS to allow field turbidity to be used as a proxy for TSS. The correlation curve facilitated the WWTP operation to respond to higher-than-expected effluent solids content rather than waiting for TSS analytical results. Noncompliance notifications were reported to the State within 24 hours after the noncompliance was detected, followed by a written report describing the noncompliance and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. All non-conformance events are detailed in the Non-Conformance Log presented in Appendix K.

3.4 Remedial Excavation of Contaminated Sediments

The contaminated sediment excavation process that EQM followed for this task order consisted of in-situ sediment dewatering, contaminated sediment excavation, ex-situ sediment dewatering, and/or solidification for over-the-road transport and sediment disposal at either a TSCA or solid waste landfill. The following subsections describe the means and measures fol-
allowed to remove contaminated sediments from the river basin and properly dispose of sediments off site.

### 3.4.1 Excavation Plans

EQM prepared a Limit of Removal Map for Deposit 3B-1 and Zone 7 Turbidity Barrier and Excavation Plans for Deposit 7-2 1st Phase; Deposit 7-1 and Deposit 7-2 2nd Phase; Deposits 7-3 and 7-4; Deposits 4-1 and 4-2; and Deposit 5-1. Details regarding submittal dates are presented in Table 2-2. These removal maps and Excavation Plans were utilized to guide excavation efforts and provided a decision process for deviating from the plans when unanticipated conditions were encountered. Each Excavation Plan included an existing condition SWAC calculation based on pre-characterization results for PAHs. Four additional SWACs were also calculated using potential post-excavation PAH results (40, 20, 5, and 0.32 mg/kg) for excavated grids to provide high, mid, and low estimates of post-excavation SWAC values. These model SWACs were used to determine the potential need for excavation in grids or intervals with only PAH exceedances for grids with PAHs point goal exceedances between 20 and 40 mg/kg. If the SWAC was less than or equal to 20 mg/kg, the RG was considered met. The method for calculating the SWAC was:

\[
SWAC = \frac{\sum_{i=1}^{n} A_i \times C_i}{A_{deposit}}
\]

Where:
- \(C\) = PAH concentration
- \(A\) = grid cell area
- \(i\) = number of PAH samples
- \(A_{deposit}\) = deposit area

### 3.4.2 Contaminated Sediment Removal

Contaminated sediment was removed between January 22, 2015 and September 12, 2015 in Deposits 7-1, 7-2, 7-3, 7-4, 3B-1, 4-1, 4-2, and 5-1. Deposit 4-3 was not excavated because pre-removal sampling determined that no removal quantities of sediment were present.

Excavation operations were performed by EQM’s team subcontractor SES. SES utilized a CAT 349 Excavator for contaminated sediment removal and multiple off-road dump trucks to transfer excavated sediments to the dewatering pad. Excavation was performed either from the river bank or from the timber mat access way/work platform installed out into the river bed subject to the location of the deposit.
The excavation process was ordinarily completed in the following steps for each deposit once surface waters were evacuated for the deposit’s respective isolation area and in-situ sediment dewatering was underway:

1. SES extended the timber mat work platform/access way to initial grid within a deposit to be excavated as needed. The access way/work platform was relocated as needed to facilitate further removal and transfer of sediments out of the deposit area.

2. AECOM performed a pre-removal survey, staked the extent of the contaminated sediment removal grid, and established bench marks for the SES Grade Foreman to monitor vertical control within the removal grid.

3. Deposit-specific final excavation preparation activities were performed such as removal of ice or additional clearing and grubbing.

4. The SES Grade Foreman directed the excavator operator to remove contaminated sediment in grid(s) to the extent required in the Excavation Plan and coordinated with ORDT drivers on where to dump their loads on the dewatering pad in order to segregate sediments based on the final disposition requirements (TSCA or solid waste landfill disposal).

5. The excavator operator excavated contaminated sediments from each grid into a load-out pile to allow for additional gravity drainage of interstitial sediment matrix water prior to loading into ORDT or over-the-road disposal trucks.

6. Excavation continued in the respective grid until the target cut line elevation was reached. AECOM samplers were notified and collected post-removal samples for analyses to verify that sediment removal met RGs.

7. Excavation proceeded in the grids following Steps 3 through 5 until analyses confirmed RGs were met or if additional excavation was needed. A decision tree flow chart was developed by the entire project team and incorporated into the Excavation Plan(s) that establishes how unexpected excavation conditions were to be addressed. When additional excavation was required in order to meet RGs, the entire grid was excavated vertically at 6-inch intervals following Steps 3 through 5. When black sediment was encountered, sediment would be removed vertically and laterally until black sediment was no longer visually apparent. “Black sediment” was accepted by the PCT as a surrogate for the RGs based on past chemistry results for visually impacted oil associated sediment.

3.4.2.1 Pre-Removal Survey and Documentation

The topography for each grid requiring excavation was surveyed prior to and after excavation as required by Technical Specification 02 61 00. The surveys were conducted at a minimum 25-foot by 25-foot grid spacing over each grid, similar to the pre-construction topography surveys, and multiple checkpoints were used throughout the site to ensure data quality during the survey as discussed in Section 3.1.3.1. The pre-removal topographic survey was used to calculate excavation quantities. If re-excavation was required in a grid, the topography was again surveyed.
prior to and after the additional excavation was completed in the grid cell. Once surveyed surfaces were reviewed and cataloged into a database as discussed in Section 3.1.3.1, they were exported from the database into comma-separated values (csv) files and filed on the server for use in calculating excavated volumes.

3.4.2.2 Post-Removal Survey, Documentation, and Volume Calculation

Volumes of excavated sediment were calculated for each deposit on a monthly basis using the pre- and post-removal sediment topography surveyed by the PLS. The calculations were made using AutoCAD Civil3d 2013 (C3D) by creating triangulated irregular network (TIN) surfaces with the survey data points collected for the pre- and post-removal surfaces and generating a differential volume surface. The outputs included a cut volume and a figure showing excavation depths with color gradations. The differential volume surfaces created for each deposit are shown in Figures 3-12 through 3-19.

Several steps were included in the QA/QC of the volumes generated. Prior to creating the TIN surfaces in C3D, the points compiled for building the surfaces were reviewed by the PLS to confirm all available points were included and that the excavation boundaries used for generating the volumes were accurate. Once the PLS checked for accuracy, the volume was calculated and the outputs were reviewed for accuracy. The excavation depth maps were reviewed to make sure interpolations were limited to only the areas excavated. The volume estimates were also checked for accuracy by comparing with Excavation Plans and incorporating deviations from the Excavation Plan. The volume and excavation map were then reviewed by the PLS and the QCO for final QC. A ‘volume package’ was assembled including the csv files of the surfaces used in the calculation, an excavation depth map, and brief summary of the excavation results. Data used in the calculation were uploaded to the FTP site once the final total volume for each deposit was calculated and checked for QC.

3.5 Ex-Situ Dewatering and Solidification

To prepare sediments for landfill disposal, in-situ and ex-situ dewatering was performed. Excavated sediments were brought to the dewatering pad to allow for gravity drainage of water over several days prior to loadout for disposal. When in-situ and ex-situ dewatering was not suf-
ficient to achieve landfill disposal conditions, solidification agent was utilized to finalize preparation. Calciment and corn cob grit solidification agent materials were utilized for solidification. EQM received Calciment in bulk and super-sack shipments. Solidification was performed under the following circumstances:

- During the excavation and loading of sediments into the ORDTs to ensure loaded material was of a solid enough consistency that it would remain in the truck and not slough out of the vehicle with changes in travel direction, gradient, or operating speed, and to prevent cross contamination while transporting sediments to the dewatering pad in Zone 7.
- Prior to direct loading into a licensed over-the-road transportation vehicle for shipment to the appropriate disposal facility landfill or the dewatering pad in Zone 7.
- Prior to disposal shipment from the dewatering pad when material would not pass paint filter testing and was not suitable for landfill disposal conditions.

The Calciment™ solidification agent was shipped to the site in bulk dump trucks and in 1-CY super sacks. Bulk deliveries were made to the dewatering pad for mixing with sediments on the pad after several days of gravity drainage. Material brought in super sacks was primarily brought on site to mix with sediments at the excavation location as a dust minimization measure. However, this material was also used at the staging pad location as well. Calciment™ was mechanically mixed into the sediment by the excavator bucket to solidify sediments.

The corn cob grit was delivered to the site in 1-CY super sacks as well. It was used both as a primary solidification agent as well as a secondary control measure to prevent the release of sediment during transport of the disposal transport trucks. When used as a primary solidification agent, it is mixed in the same manner as the Calciment™. When used as a moisture release control measure, it is placed on the bottom disposal truck dump beds, around the tail gates prior to loading, and on top of the sediment after loading to absorb any water or liquid resulting during transport. This was primarily done for the TSCA disposal trucks that required several hours of transport time to reach the landfill.

3.6 Transportation and Disposal Contaminated Sediments

The disposal process for contaminated sediments began with obtaining waste characterization samples in accordance with EQM’s SAP. EQM’s subcontractor AECOM collected two composite samples for waste characterization analyses of the solid waste and TSCA sediments. Sampling procedures and waste characterization analyses are detailed in the SAP. Waste charac-
terization samples were collected from deposits in all four zones. Waste characterization analytical data was used to complete waste profiles for Waste Management, Inc. (WM) to determine the acceptability of the solid waste prior to landfill disposal, and similarly for TSCA waste transported to Heritage Environmental Services, Inc. (HES) for landfill disposal. Waste Management’s waste profile forms were completed by EQM’s transportation and disposal (T&D) coordinator and forwarded to EPA TOCOR, Brenda Jones, for signature on November 26, 2014. The signed form was submitted to WM on December 3, 2014. EQM’s T&D coordinator forwarded the completed waste profile for TSCA sediments on November 21, 2014 for signature by TOCOR Jones. The signed profile was forwarded to HES on November 21, 2014. Waste approval for solid waste sediments from WM was received on December 4, 2014 and for TSCA sediments from HES on January 14, 2015.

All wastes were shipped to their respective landfills under manifest documentation. Solid waste was transported with WM’s solid waste manifest. TSCA waste was transported with uniform hazardous waste manifests. Pre-completed manifests were forwarded to TOCOR Jones for signature and sent to the site for final completion by EQM representatives and signature of the respective truck driver hauling the waste load. EQM tracked disposal shipments daily, matching weight tickets from the landfill(s) to the respective manifest number. Completed manifests with generators, transporters, and disposal facility signatures were returned to USEPA’s oversight engineer. Waste Manifests are presented in Appendix L.

3.7 Residual Management

Residual management was required when RGs could not be met for PCBs in a practical manner. Specification 31 2323 3.5 B permitted placement of 6 inches of sand cover with owner approval when residual management was necessary. These measures will be described in Section 4 of the report respective to the deposits.

3.8 Post-removal Confirmation Sampling

Post-removal confirmation samples were collected to verify that the RGs were met according to Technical Specification 01 10 00 (EA, 2014b). Random sampling locations were gen-
Samples were collected using DPT following the methods discussed in Section 3.2.1. When excavation within a grid was performed to refusal (less than 0.5 foot of sediment remaining), samples were collected by hand in dry sediment, or by petite ponar in wet sediment (EQM, 2015d). Each core had a target depth of 2 feet below the bottom of the excavation and analytical samples were collected every 6 inches along the core. Cores were handled and sediment characterized using the same general procedures as those used for the pre-characterization samples.

When RGs were not met at the surface (0 to 6 inches), additional removal occurred over the entire grid to the depth at which confirmatory analytical results indicate RGS should be met. After re-excavation, a new confirmation core was collected and submitted for laboratory analysis. This process was repeated until RGS were met. QA/QC procedures followed those discussed in Section 3.1.3.1.

The SWAC Models were updated as post-removal confirmation results were received to assess if the excavation would meet the RGS (Tables 3-22 through 3-33). For PAHs with point goal exceedances between 20 and 40 mg/kg, a SWAC was calculated using the method discussed in Section 3.4.1. The SWACs were then used to determine if additional excavation was required.

Additionally, in areas where achieving less than 1 mg/kg PCBs was impractical (e.g., bedrock), a PCB SWAC was calculated using the method presented in Section 3.4.1 as allowed by the Technical Specifications (EA, 2014b). In deposits where there was excavation to impractical surfaces (i.e., bedrock or debris-covered surfaces), the PCBs RG was a SWAC of ≤1 mg/kg.

### 3.9 Habitat Restoration

Habitat restoration consisted of offsetting impacts to, and in some cases improving the quality of, wetland and riverine habitat impaired during the remediation process. This entailed restoring wetlands along the predetermined segments of the river channel and constructing refuge features to benefit native wildlife. Habitat restoration included implementation of the following:

- Backfilling delineated wetland areas impacted with sand to restore grade elevation
- Backfilling with topsoil to provide suitable growth media for reestablishing vegetation
- Restoring vegetation with native seeding, plants, shrubs, and trees
• Installing boulder clusters and log/root wad structures to improve fish and wildlife habitat.

 Restoration work was primarily performed subsequent to remediation activities in a given zone/deposit; however, certain activities such as riprap placement, boulder cluster and log/root wad installation, and topsoil and sand backfilling were performed while cofferdams were in place and dewatering was ongoing so to complete specific work in the river channel in dry conditions. Restoration work was completed intermittently following the progression of remediation in order to maximize the revegetation schedule.

 Some of the restoration work to restore remediation impacted areas was similar in scope of work as residual management and was often performed concurrently. Restoration work for disturbed areas and wetland shared similar work activities. Restoration work also shared similar pre- and post-survey documentation requirements with temporary infrastructure construction and remediation. Post-construction sampling was performed subsequent to removal of temporary infrastructure features and prior to installing restoration features to verify that cross contamination did not occur as a result of remediation work.

3.9.1 Wetland Restoration

 Approximately 1.62 acres of wetland were restored in Zones 4, 5, and 7. Work elements for wetland restoration included sand backfill and imported topsoil backfill, followed by native grass seeding with hydromulch, tree planting, shrub planting, herbaceous planting, and maintenance through the establishment period.

3.9.1.1 Sand Backfill

 Sand placement was performed for restoring the jurisdictional wetland areas that occupied portions of Deposits 4-1, 4-2, 5-1, 7-2 and 7-3. Sand placement was performed to re-establish the pre-excavation elevations and provide a subbase for imported topsoil backfill in the restoration of the wetlands.

3.9.1.2 Imported Topsoil Backfill

 Topsoil was placed over the disturbed areas where the topsoil stockpile, haul road, and decontamination pads were removed in all four zones. Imported topsoil was also used in Deposits 4-1, 4-2, 5-1, and 7-3 to cover the areas backfilled with sand. This provided the growth medi-
um for turf grass and no-mow/low-grow grass mixes for upland areas and native grass mixes for streambank and wetland restoration areas. Grass seed mixes were applied with hydroseeding mulch.

3.9.1.3 Imported Clay Backfill

Imported clay backfill was not implemented due to revision of the Restoration Plan for Zone 5.

3.9.1.4 Wetland Planting

Wetland areas in Deposits 4-1, 4-2, 5-1, and 7-3 were revegetated after imported topsoil backfill operations were completed. Wetland areas were planted with herbaceous plants, trees, and shrubs suitable for wetland habitat, then these areas were seeded with a native grass seed mix.

3.9.2 Streambank Restoration

In Deposits 3B-1, 4-1, 4-2 and 5-1, topsoil backfill was used to restore the streambank which had eroded when contaminated soil was removed on the river bank. This entailed placement and compaction of topsoil to restore the original surface of the bank, which was then hydroseeded with a native grass seed mixture.

3.9.2.1 Log/Root Wad Structures

Log/root wad structures were constructed as part of the habitat restoration performed in Deposits 3B-1, 4-1, 4-2, and 7-3. Trees identified during clearing and grubbing operations that met the specifications for log/root wad structures were removed and stockpiled in Zone 5. These structures were constructed by placing the log on predetermined locations along the bank with the root wad protruding into the river channel and partially submerged to provide habitat for aquatic species. Each log was placed on top of footer stone structures embedded just below the surface of the bank. Additional boulders were placed on top of the log to serve as anchor stones.
3.9.2.2 **Boulder Clusters**  

Boulder clusters were constructed as part of the habitat restoration performed in Deposits 3B-1, 4-1, 4-2, and 7-2. Each cluster consisted of six pairs of boulders with diameters ranging from 1 foot to 4 ft. A footer stone was embedded into the channel surface and another boulder was placed on top to protrude 2 ft from the design water surface elevation. Boulder clusters were placed in areas of active flow to produce minor eddy currents that provide beneficial habitat for fish and other aquatic species.

3.9.2.3 **Substrate Restoration**  

No substrate restoration was performed due to the revised restoration requirements for Zone 4.

3.10 **Work Site Restoration**  

Work site restoration varied in scope subject to each work zone but possessed common work elements. Restoration required removal of temporary infrastructure improvements, restoration of topsoil and vegetation cover, and repairs to permanent constructed features resultant of site operational impact. As with other work, these activities shared ancillary work tasks such as sampling, surveying, and photo documentation.

3.10.1 **Haul Road and Gravel Pad Removal**  

Haul roads, staging areas, turnaround points, and ramps were constructed in all four zones to enable heavy equipment to perform construction activities and access deposits during remedial excavations in all four zones. The gravel and underlying geotextile fabric removed from haul roads and pads were transported to WM’s landfill for disposal as non-TSCA solid waste and for beneficial re-use in the case of clean aggregate from the WWTP. The dewatering pad and WWTP pad in Zone 7 were constructed using substantial amounts of gravel. The portions of the dewatering pad used for solidifying non-TSCA sediments were required to be disposed of as non-TSCA waste, and similarly the gravel underlying the TSCA bin was disposed of as TSCA waste. The gravel used to construct the WWTP pad, on the other hand, was not exposed to more than trace amounts of non-TSCA and TSCA materials. The post-construction sampling of the
gravel material WWTP pad did not indicate the presence of contamination; thus, the PCT approved the beneficial reuse of this material on another construction site in Milwaukee.

3.10.2 Topsoil Backfill and Grading Operations

Areas in all four zones were impacted by the construction of temporary infrastructure, and required replacement of stripped topsoil to restore growth media for vegetative cover replacement. The native topsoil backfill stockpiled during site preparation was re-installed in the disturbed area and supplemented with imported topsoil in each zone to ensure these areas were restored to their original grade.

3.10.3 Restoration of Upland Vegetation

After topsoil backfill and grading was completed, turf grass and no-mow/low-grow grass mixtures were applied to upland areas using hydroseeding mulch as part of the restoration in all four zones. Seed preparation, mulching, and fertilizing were performed by EQM’s landscaping subcontractor AES in the upland areas depicted in Figure 3-6. AES planted upland areas in Zones 4 and 7 with trees species that included Bitternut Hickory’s, Kentucky Coffee trees, American Elms, and American Basswoods.

3.10.4 Pavement Restoration

Restoration of paved surfaces was required where damage occurred as a result of construction activities. Concrete curb and apron repair in Zones 3 and 7 was performed concurrently between November 2 and 5, 2015 by EQM’s subcontractor Munson Paving, Inc. of Glendale, Wisconsin. A concrete curb and apron repair was made where the access road joined North Milwaukee River Parkway. Concrete apron and curb repair amounted to 22 LF of restoration.

3.10.5 Demobilization

Demobilization was completed on October 16, 2015 with the last piece of equipment removed from Zone 7.
3.11 Maintenance Period

The maintenance period for the re-vegetated areas has not begun at the time of this report preparation. In order for the maintenance period to begin, acceptance of cover crop establishment per RFTOP specifications is a prerequisite. A cover crop establishment meeting is scheduled for mid to late July 2016 since much of the vegetative planting took place late in the fall in 2015 when establishment was not under optimum conditions. Once cover crop is establishment is accepted, EQM’s subcontractor AECOM will monitor the establishment of the various plantings and AES will maintain and replace plantings as needed for a period of 2 years subsequent to establishment acceptance. EQM will provide documentation during this period in the form inspection and maintenance logs and reports. Periodic meetings and site visits will be performed with EPA, the EQM team, and land owners to monitor the re-vegetation process.
4. REMEDIAL ACTION ZONES AND PROJECT EXECUTION

Each work zone shared the similar process steps of site preparation, investigation, remediation and restoration that were described in Section 3. This section will provide zone and/or deposit specific details of the processes described in Section 3.

4.1 Zone 3 Remedial Action: Deposit 3B-1

4.1.1 Zone 3 Scope of Work

Zone 3 is located within the confines of Lincoln Park below the confluence of the West Oxbow and Milwaukee River Channel as depicted in Figure 2-1. Remediation and restoration was only required for Deposit 3B-1. The site preparation, remediation, and restoration scope of work included:

- Installation of construction entrance at the junction of the access haul road to North Milwaukee River Parkway.
- Installation of one 20-foot-wide by 363-foot-long access haul road with a footprint of 6,900 SF constructed of geotextile and road aggregate.
- Clearing and grubbing of vegetation along the riverbank for deposit access.
- Construction of a topsoil stockpile storage area that required installation of a 108-LF silt fence around the perimeter of stockpile footprint.
- Installation of 1,153-LF temporary chain-link fence to restrict site access.
- Installation of one decontamination pad.
- Installation of a 630-LF steel sheet pile cofferdam to isolate Deposit 3B-1 from the main river channel.
- Installation of pumping systems to dewater Deposit 3B-1 with pumps, Outfall 002 energy dissipation pad, and conveyance pipeline network to distribute water to Outfall 002 or WWTP.
- Dewatering of the 50,075-SF surface area confined by the Cofferdam along with stream restoration and habitat construction.
- Collection and analysis of 15 grid core samples based on the 16,847-SF limit of the removal area in the RFTOP Design Drawings.
- Removal and disposal as solid waste of 1,108 CY of non-TSCA regulated material/sediment.
• Restoration of 2,585 SF of wetland, which included revegetation with native plantings, placement of 48 CY of sand backfill for grade restoration and 48 CY of topsoil backfill for native plantings growth media.
• Restoration of 5,953 SF of disturbed area with topsoil replacement, turf grass, and native seeding.
• Construction of six log/root wads and four boulder cluster habitat features.

4.1.2 Zone 3 Preparation

4.1.2.1 Zone 3 Clearing and Grubbing

Clearing and grubbing began in Zone 3 on October 6, 2014 and was completed on November 12, 2014. Underbrush and trees were cleared over an area of approximately 13,000 SF to create access to Deposit 3B-1. A total of 20,460 SF of topsoil was stripped from the haul road footprint between November 6, 2014 and November 7, 2014.

4.1.2.2 Zone 3 Haul Road Construction

Haul Road construction in Zone 3 began on October 11, 2014 and was completed on November 17, 2014. The haul road to Deposit 3B-1, including the three access legs, was approximately 1,310 ft in total length and covered a surface area of approximately 20,460 SF. The original layout of the haul roads required a minor adjustment to accommodate the red artistic sculpture located near the construction entrance, which conflicted with the original layout. The haul road layout was shifted approximately three ft north for the segment between the sculpture and North Milwaukee River Parkway. This haul road adjustment was approved by the PCT after submission of RFI No. 001-007 on October 15, 2014.

The Remedial Design Drawings proposed a single haul road to access a ramp located near the center point of Deposit 3B-1. Two additional access ramps were constructed at the northern and southern terminuses of Cofferdam 3 to provide better access for heavy equipment during cofferdam installation. The middle and southern access ramps were both used to load ORDTs during the remedial action. The gravel surface proximal to the middle access ramp was also expanded slightly to provide an equipment staging area and a turnaround point for ORDTs during the remedial action.
4.1.2.3 Zone 3 Cofferdam Isolation Area

Cofferdam 1 consisted of installing one segment of steel sheet pile to isolate Deposit 3B-1. A total of 12 additional linear ft of sheet piling was installed to complete the alignment configuration as depicted in Figure 3-7. Although installation required 4 more days than planned, removal was completed 1 day ahead of schedule. The cofferdam installation required 56 more days than planned due to a number of contributing factors. The cofferdam was installed out of the planned sequence, and thus additional installed duration days included the period for the scheduled holiday break in late December 2014 and early January 2015. Complications were encountered with initial dewatering related to sealing the steel sheet pile joints. The sealant applied to the joints prior to installation was not always effective at sealing the joints. Additional sealing measures were implemented to correct the situation that included applying oakum rosin and installing wooden shims between joints to fill voids. Delays were encountered due to freezing conditions that affected the WWTP and dewatering operations. Contaminated sediment removal exceeded the planned volumes for Deposit 3B-1 as well as pre- and post-sediment sampling requirements.

4.1.2.4 Zone 3 Dewatering Activities

Dewatering of the Cofferdam 1 isolation area occurred in two distinct phases to accommodate the holiday break that occurred in late December 2014 and early January 2015. Dewatering was performed during the first phase to facilitate pre-removal sediment sampling to characterize the contaminated deposits. The first phase of dewatering began December 8, 2014 and continued through December 19, 2014. The system was then emptied of water and conveyance pipelines blown out while the system was shut down for the crew’s holiday break. Water conditions recharged the isolation area over the holiday break. The second phase of dewatering was performed to facilitate contaminated sediment removal and area-specific restoration activities. Dewatering resumed on January 10, 2015 and continued through January 31, 2015.

Table 4-1 summarizes Zone 3 dewatering and water treatment information. A total of 9,414,000 gallons of water were processed through the high-volume pumping and filtration system discharged to Outfall 002 between December 8, 2014 and February 5, 2015. A total of 5,643,129 gallons were processed through the WWTP in support of in-situ and ex-situ sediment dewatering between December 13, 2014 and January 31, 2015.
4.1.3 Zone 3 Investigation Remediation and Restoration

4.1.3.1 Zone 3 Pre-Removal Sampling

Pre-removal sampling in Deposit 3B-1 began on December 15, 2015 and was completed December 18, 2015. A total of thirty 50-foot by 50-foot grids (note that some grid areas overlapped in order to obtain a step-out grid core below the 617-ft elevation) and four 12.5-foot by 12.5-foot grids were sampled; fourteen 50-foot by 50-foot and four 12.5-foot by 12.5-foot grids exceeded RGs. The extent of contamination is depicted in Figure 4-1. Cores were pushed to four ft via a direct-push rig on dewatered sediment. Sample recovery was 75% or greater. Both an NAPL sheen and odor were observed within the deposit.

PCBs at concentrations greater than the RG and less than 50 mg/kg were confirmed (Table 3-14). PCBs at concentrations greater than 50 mg/kg (i.e., TSCA levels) were found in a previously unidentified area. PAHs were detected at concentrations above the remedial goals (20 mg/kg) and generally co-located to PCB exceedances (Figure 4-1 and Table 3-14). The greatest depth of RG exceedance was 2.0 to 3.0 feet.

4.1.3.2 Zone 3 Remedial Excavation

EQM performed sediment removal in Deposit 3B-1 based on the limit-of-removal quantities (Figure 4-1) submitted to the PCT on January 16, 2015. Figure 4-1 depicts the planned excavation work for the deposit that resulted in approximately 33 CY of sediment requiring removal and TSCA disposal and 1,513 CY requiring solid waste disposal. This was an additional 438 CY variance from the RFTOP BODR estimated volume and included 33 CY of sediment requiring TSCA disposal.

Ice accumulations in Deposit 3B-1 were removed in preparation for sediment excavation starting on January 17, 2015; removal was substantially completed on January 20, 2015. Ice was removed by excavation equipment and transferred to the dewatering pad to thaw out over time; embedded sediment accumulated on the pad and was disposed of. Melt waters from the ice were collected in the pad’s reservoir and transferred to the WWTP for processing and discharge.

Excavation in Deposit 3B-1 began on January 22, 2015 and was completed on January 30, 2015. AECOM surveyors staked the limits of excavation on January 13, 2015 in accordance Figure 4-1. Excavated sediments were either direct loaded into off-road dump trucks for transfer
to the dewatering pad or were further solidified in-place with Calciment™ prior to load-out. Loaded trucks followed tire wash procedures before transferring sediments to the dewatering pad and prior to leaving the Zone 7 support area. Trucks delivering material to the dewatering pad backed up the ramp and dumped their loads onto the dewatering pad into the respective handling area for TSCA or solid waste sediments. Table 4-2 summarizes sediment removal activities including which grids were excavated and on what dates, and how many trucks were moved to the dewatering pad and on what date.

Grids 2, 3, 4, 7, 10, 31, 32, 20, 25, 26, and 29 were excavated to remove contaminated sediment laterally out to the next clean pre-removal grid core location. Post-removal sampling and analyses were performed subsequent to exhuming sediments laterally to the grid extent and vertically to the grid target depth to confirm RGs were being achieved. Grids failing to meet RGs were re-excavated at 6-inch-depth intervals until RGs were achieved. Post-removal sampling results for Deposit 3B-1 are reported in Table 4-3 and are depicted in Figure 3-10. Figure 3-11 in Appendix A depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation performed based on pre- and post-removal surveying data determined that 2,586.48 CY of contaminated sediment had been removed from Deposit 3B-1 over a surface area of 37,392.77 SF.

4.1.3.3 Zone 3 Ex-Situ Dewatering and Solidification

A total of 77 tons of solidification agent was used to solidify 2,586.48 CY of contaminated sediment removed from Deposit 3B-1. A combined 4,236 tons of TSCA and solid waste was disposed of. Therefore, 1.8% of the total tons disposed of consisted of solidification agent. The sediment waste disposed averaged approximately 1.7 tons/CY.

4.1.3.4 Zone 3 Disposal of Solid Waste and TSCA Waste Sediments

Disposal of Zone 3 solid waste began on February 5, 2015 and was completed on February 12, 2015. Solid waste was loaded and shipped from the dewatering pad. A total of 173 truck-loads were shipped and 4,096.11 tons disposed of over 7 days. Table 4-4 summarizes solid waste transportation and disposal activity.
Disposal of Zone 3 TSCA waste began on February 3, 2015 and was completed on February 4, 2015. A total of six loads were shipped and 140.60 tons disposed of over 2 days. Table 4-5 summarizes TSCA waste transportation and disposal activity.

4.1.3.5 Zone 3 Post Removal Confirmation Sampling

PCBs and PAHs met RGs throughout the deposit in the excavated grids (Table 4-3 and Figure 23). The highest PCBs result was 0.11 mg/kg and the highest PAHs result was 2.5 mg/kg. Both met their respective RGs of 1 mg/kg for PCBs and 20 mg/kg for PAHs (Table 4-3).

4.1.3.6 Zone 3 Restoration

Restoration in Zone 3 included temporary infrastructure removal, stream bank restoration in the Deposit 3B-1 excavation area, topsoil replacement and hydroseeding, and pavement restoration. Restoration activities began with streambank restoration and cofferdam removal. The haul roads and decontamination pad were removed, once utilization was no longer required. The restoration features are depicted in Figure 9.

Zone 3 Streambank Restoration

Streambank restoration was required for Deposit 3B-1 due to the extent of contaminated soil removal up onto the river bank. EQM submitted RFI -19 on January 10, 2015 requesting clarification on restoration and backfilling (see Appendix G). EPA responded on January 29, 2015 with revised restoration requirements and a cross-section detail figure depicting the revised requirements. The revised requirements included re-grading and placing topsoil on the bank to achieve a 2:1 slope. Once the bank was reconstructed, the wetland portion of the restoration received the sand backfill covered with 6 inches of topsoil backfill, which resulted in 175.11 CY of topsoil backfill. Streambank restoration was completed between January 31, 2015 and February 2, 2015. Topsoil from the Zone 7 stockpile was utilized to establish a 2:1 slope on the bank and to provide a 6-inch cover over the sand backfill in the channel. Zone 7 topsoil was used because imported topsoil was unavailable during the period of performance. The surface area of streambank restoration was 4,599.48 SF and was reseeded with a native grass seed mixture at an application rate of 16.76 pounds (lbs)/acre.
Zone 3 Sand Placement

Sand placement was performed for restoring the wetland area that occupied a portion of the Deposit 3B-1 surface area. Sand placement in the river channel began February 2, 2015 and was completed February 3, 2015. Sand placement was completed over the surface area shaded in yellow beneath the red crosshatching depicted in Figure 3-7. This area was 3,644 SF in size and 283.89 CY of sand fill was placed.

Zone 3 Topsoil Restoration

Topsoil was placed over the disturbed area where the topsoil stockpile, haul road, and de-contamination pad were removed and in the stream channel over the area backfilled with sand in addition to the streambank topsoil placement. Topsoil backfilling of the in-channel area was completed on February 2, 2015 and February 3, 2015. Topsoil for backfilling the in-channel area was obtained from the Zone 7 stockpile. Topsoil backfilling of the upland areas was completed between May 7, 2015 and May 18, 2015 in the upland areas where site infrastructure was removed. The topsoil used for restoration of this area was from the Zone 3 topsoil stockpile that was stripped in fall of 2014. The in-channel topsoil fill area covered approximately 3,469 SF and the upland restoration area covered approximately 38,993 SF. The upland topsoil restoration area was prepared for seeding between May 7, 2015 and May 18, 2015. The 38,993-SF upland area was seeded with a turf grass seed mixture on May 19, 2015 at a rate of 200 lbs/acre. A 2,700-SF area at the top of the streambank was seeded with a no-mow/low-grow seed mixture at a rate of 200 lbs/acre.

4.1.3.7 Zone 3 Infrastructure Removal

Infrastructure in Zone 3 included the cofferdam segments, haul roads, and security fencing. Cofferdam removal information is summarized in Table 4-6. Infrastructure removal began February 17, 2015 and was completed March 24, 2015 with the exception of the security fencing. The security fencing was removed on September 25, 2015.

4.1.3.8 Zone 3 Pavement Restoration

Concrete curb and apron repair in Zone 3 was completed concurrently with repairs made in Zone 7 between November 2, 2015 and November 5, 2015. A concrete curb and apron repair
was made where the access road joined North Milwaukee River Parkway. Concrete apron and curb repair amounted to 22 LF of restoration. Curb and apron repair work was completed by EQM’s subcontractor Munson Paving, Inc. of Glendale, Wisconsin.

4.2 Zone 7 Remedial Actions: Deposits 7-1, 7-2, 7-3, and 7-4

4.2.1 Zone 7 Scope of Work

Zone 7 required more extensive site preparation than the other zones because this area contained four deposits and also served as the project support area. Remediation was required for Deposits 7-1, 7-2, 7-3, and 7-4. Restoration work included construction of habitat improvement features, wetland restoration in the Deposit 7-3 area, and site operations impact restoration. Zone 7 is located within the confines of Lincoln Park above the confluences of the East and West Oxbow and Milwaukee River Channel and extended below both of the confluences back into the river channels depicted in Figure 2-1. The site preparation, remediation, and restoration scope of work included:

- Installation of one construction entrance at junction of access haul road to North Milwaukee River Parkway.
- Installation of a 20-foot-wide by 1,175-foot-long access haul road with a footprint of 33,600 SF constructed of geotextile and road aggregate.
- Clearing and grubbing of vegetation for WWTP pad, and topsoil staging pad construction along riverbank for deposit access.
- Construction of 33,413-SF topsoil stockpile storage area.
- Construction of 81,906-SF dewatering pad and 28,521pSF WWTP pads with 40-MIL HDPE Liner, aggregate fill, and containment berms.
- Installation of office trailers, facilities, and utilities to support site operations.
- Installation of on-site laboratory for analysis of pre- and post-removal sediment samples.
- Installation of WTTP system capable of processing 600-gpm surface waters in isolation areas and 100-gpm sediment contact during maintenance in-situ and ex-situ dewatering operations.
- Installation of 1,832 LF of silt fence around topsoil staging area and areas disturbed by infrastructure construction to prevent migration of soil sediments.
- Installation of a 1,479-LF temporary chain-link fence to restrict site access.
- Installation of four decontamination pads.
- Installation of four steel sheet pile cofferdam segments to create Cofferdam 2 to isolate the four Zone 7 deposits.
- Installation of pumping systems to dewater the Zone 7 deposit area with pumps, Outfall 001 and 005 energy dissipation pad, and conveyance pipeline network to distribute water to Outfall 001 or WWTP.
- Dewatering of 581,549-SF surface area confined by Cofferdam 2 with remediation in stream restoration and habitat construction.
- Collection and analysis of 60 grid core samples based on the combined 146,145-SF limit of removal area for the four deposits in the RFTOP Design Drawings.
- Removal and disposal as solid waste of 20,068 CY of non-TSCA-regulated material/sediment and 85 CY of contaminated sediments requiring TSCA disposal.
- Restoration of 40,638 SF of wetland in the Deposit 7-3 area, which included revegetation with native plantings, placement of 2,338 CY of sand backfill for grade restoration, and 753 CY of topsoil backfill for native plantings growth media.
- Restoration of 29,096 SF of disturbed area with topsoil replacement, turf grass, and native seeding.
- Construction of three Log/root wads in the Deposit 7-3 area and two boulder cluster habitat features in the Deposit 7-2 area.

4.2.2 Zone 7 Preparation

4.2.2.1 Clearing and Grubbing

Primary clearing and grubbing began in Zone 7 on October 6, 2014 to prepare the site for temporary infrastructure improvements and clear the Deposit 7-3 removal area. These areas were substantially completed on November 6, 2014. Additional clearing/grubbing was performed to facilitate pre-removal sediment sampling in Deposit 7-4. Approximately 190,252 SF of vegetation was cleared in Zone 7.

Stripping of topsoil in Zone 7 began on October 20, 2014 and was completed on October 25, 2014. Topsoil was stripped from approximately 65,300 SF of haul roads, 65,217 SF of de-watering pad surface area, and 25,630 SF of the WWTP pad area. Topsoil was staged in the top-soil stockpile area and covered with plastic tarps. The topsoil staging area was surrounded on three sides with a silt fence. A protective sediment intercepting barrier was placed between the stockpile and the river.

4.2.2.2 Zone 7 Haul Road Construction

Haul road construction began in Zone 7 on October 6, 2014 and was completed on November 6, 2014. The entire haul road footprint for Zone 7 is depicted in Figure 2-2. The three
separate haul road segments installed to facilitate Zone 7 work activities included the main support area haul road, access ramp to the northwest segment of Cofferdam 2, and the north bridge access ramp and haul road. The main haul road was installed in the Zone 7 support area with two construction entrances off North Milwaukee Parkway providing access to the dewatering pad, the WWTP, Deposit 7-3, and the south segment of Cofferdam 2. The Zone 7 support area haul road was approximately 2,836 ft in length and covered a surface of approximately 60,960 SF. The segment installed for access to the northwest segment of Cofferdam 2 extended from north of the northern North Milwaukee River Parkway bridge just south of the office trailer, but was not used for handling or transportation of contaminated sediment loads. This segment was approximately 153 ft in length and covered a surface area of 1,963 SF. The third haul road constructed extended from south of the North Milwaukee River bridge to the northwest to provide construction access to install the west segment of Cofferdam 2. This segment was approximately 131 ft in length and covered a surface area of 2,410 SF.

4.2.2.3 Zone 7 Cofferdam Isolation

Cofferdam 2 was originally designed to isolate Deposits 7-1, 7-2, and 7-3 and the majority of 7-4 using four independent segments constructed with steel sheet piling. The segments were referenced according to the geographical orientation to Zone 7; thus, they were identified as the northeastern, northwestern, western, and southern segments. EQM began construction of Cofferdam 2 in October 2014 and suspended construction on October 31, 2014. After the west, northwest, and northeast segments were installed upstream of Zone 7, a relatively minor rain event led to a rise in the river level that caused water to spill over the northwest and northeast segments. River water began to overtop the cofferdam at an approximate flow rate of 820 cfs, which was much lower than the 1,060 cfs predicted by hydraulic modelling as the minimum flowrate to cause overtopping. The Project Team was concerned that the original cofferdam configuration would not effectively prevent the frequency and severity of overtopping events during the remedial action. Overtopping inundates the isolation area with water and requires suspension of remedial excavation activities until the river level subsides. As mentioned in Section 3.1.6.8, these unanticipated hydraulic conditions prompted the Project Team to investigate the hydraulic conditions leading to overtopping and consider an alternative configuration for Cofferdam 2.
After reviewing available data and inspecting areas immediate to the cofferdam layout, the Project Team hypothesized that physical channel conditions in the East Oxbow were likely causing the unanticipated overtopping at the northwest segment of Cofferdam 2. It appeared that significant sediment deposition had occurred in the East Oxbow since the last cross-sectional survey was conducted. The Project Team believed this sedimentation may have raised the surface elevation in areas of the channel bed, creating a potential impediment to flow through the East Oxbow. This channel morphology may not have been accurately represented in the older survey data used for the most recent HEC-RAS modelling effort. This caused the original hydraulic analysis to overestimate the efficiency of flow through the East Oxbow and in turn underestimate the backwater effect in the main channel. With the approval of the PCT, the Project Team proceeded to collect new cross-sectional survey data for the East Oxbow in order to revise the HEC-RAS model and use the updated results to devise a more effective Cofferdam 2 configuration.

By early December 2014, the PLS surveyed the new channel cross sections in the East Oxbow, West Oxbow, and main channel locations upstream and downstream of Zone 7 [Contract Modification 4 (USEPA, 2014b)]. This data was used to revise the HEC-RAS model and analyze the alternative Cofferdam 2 configurations that would alleviate potential overtopping events. The alternative configuration approved by the PCT prescribed installing Cofferdam 2 in two phases. Figure 3-6 depicts the original layout planned for the Cofferdam 2 segments and Figures 3-6a, 3-6b, 3-6c and 3-6d show the as-built layout that was implemented.

The 1st Phase of Cofferdam 2 was configured to isolate only the western portion of Deposit 7-2 by retaining the western and northwestern segments already installed for Cofferdam 2 and allowing the Milwaukee River to flow through the main channel and East Oxbow. This required construction of a fifth cofferdam wall that bisected the eastern portion of Deposit 7-2 between the small island and the northern access ramp from Zone 7. This configuration required the installed portion of the northeastern segment to be removed to allow the river to flow freely through the main channel until the 1st Phase of remedial excavation was completed for the western portion of Deposit 7-2.

The 2nd Phase of Cofferdam 2 isolated the eastern portion of Deposit 7-2, as well as the entirety of Deposits 7-1, 7-3, and 7-4. The segment bisecting Deposit 7-2 would be left in place for use during the 2nd Phase. The western and northwestern segments used for the 1st Phase of
Cofferdam 2 were removed and the sheet piling was reused to construct the revised layout of the northeastern segment. The revised northeast segment of Cofferdam 2 required an additional 231 LF of sheet pile to cross the main channel from the small island to the bank adjacent to the Lincoln Park Golf Course. The eastern terminus of the northeastern segment was situated immediately upstream of the East Oxbow, which cut off flow through the main channel and the East Oxbow and redirected it down the West Oxbow.

The layout for the original southern segment of Cofferdam 2 entailed bisecting the southern tip of Deposit 7-4, such that the majority of the deposit would be contained within the cofferdam isolation area. The small portion of Deposit 7-4 outside of the cofferdam isolation area was originally scheduled to be hydraulically dredged. The 2nd Phase of the revised Cofferdam 2 configuration entailed adjusting the southern segment further downstream, thereby allowing it to encompass the entirety of Deposit 7-4 and eliminate the need for hydraulic dredging for the portion outside of the original cofferdam.

Deposit 7-4 was located near the confluence of the main Milwaukee River Channel and the East Oxbow in the southern extent of the Cofferdam 2 isolation area. Although the revised northeastern segment cut off river flow through the East Oxbow, a municipal stormwater outfall was identified near the midpoint of the East Oxbow. Stormwater discharge from this outfall during a rain event could hinder dewatering efforts for Deposit 7-4. The PCT approved a proposal to install an additional segment of Muscle Wall cofferdam across the East Oxbow downstream of the outfall to intercept stormwater discharge and prevent it from entering the Deposit 7-4 excavation area. A bypass system was installed to pump stormwater intercepted upstream of the Muscle Wall and transfer it to a discharge location downstream of the southern cofferdam segment. Because the discharge from this stormwater outfall occurred intermittently in response to rainfall, the bypass pumps were only activated when water impounded upstream of the Muscle Wall to an approximate depth of 1.5 ft.

Table 4-7 summarizes information concerning the construction of Cofferdam 2, as well as the variances that resulted from the re-designed configuration. The revised construction approach for Cofferdam 2 led to the following changes:

- The northeast cofferdam segment required partial removal and re-installation in a new alignment in order to include the East Oxbow in the isolation area and decrease the installation footprint of the southern cofferdam.
- An additional 320 LF of cofferdam installation was required.
The revised approach only increased the construction and removal schedule by 3.25 days. A total of 6.25 additional days were required for installation; however, removal was completed 3 days sooner than anticipated.

The revised approach required the construction of a 65-LF- long cofferdam, with one wall constructed from Muscle Wall™ and a by-pass pumping system to manage storm water from the East Oxbow.

Installation of cofferdam segments averaged 22.5 days longer than planned; however, the increase in installed duration is attributable to the increased contaminated sediment removal volume in Zone 7, flood events during the 1st Phase, and revised restoration requirements.

Two Force Majeure flood events occurred while the 1st Phase cofferdam segments were in place and as the 2nd Phase re-alignment was beginning; these events impacted the duration of cofferdam installation. The first flood event, occurring from March 11 to 18, 2015, impacted the sediment excavation schedule, dewatering operations, and the Deposit 7-2 restoration schedule. Dewatering continued through March 20, 2015 to restore suitable work conditions. The second flood event occurred from April 9 to 15, 2015 and impacted operations to install the northeastern segment of Cofferdam 2. The second flood event threatened to wash away the timber mats used to access the northeastern cofferdam segment; these timber mats were later used to access Deposit 7-1 and the eastern portion of Deposit 7-2. Concrete barrier blocks used to anchor the timber mats in place were removed after the river level receded.

Another storm event occurred on Friday June 12, 2015, while Deposit 7-4 was being excavated. This storm event resulted in a surge of runoff water into the East Oxbow. Activation of both by-pass pumps prevented overtopping of the Muscle Wall™ cofferdam. However, the hydrodynamic force of the water surge dislodged approximately one half of the barrier from its installed location and partially rotated the dislodged wall from its vertical alignment. The surge waters from the June 12, 2015 storm did not impact the work schedule because no remedial excavation was scheduled for Deposit 7-4 and there was no additional rain forecasted throughout the weekend. The wall was restored to its operating position on Monday June 15, 2015.

Knowledge gained during the construction and operation of Cofferdam 2 helped the crew in performing subsequent cofferdam work on this project. The East Oxbow bypass pumping system was the first time Muscle Wall™ was utilized for this project, and the June 12 storm event provided a valuable lesson on the limitations of this product for cofferdam construction. The Muscle Wall™ cofferdam performance was acceptable for holding back water under static conditions, but it does not seem to provide sufficient mass and stability to resist overturning when
directly impacted by the forces of flowing water. This lesson was taken into consideration when Muscle Wall™ was used to construct Cofferdam 3. Although the length of Cofferdam 3 was installed parallel to the bank and away from the direct force of the main channel, the lateral influence of hydrodynamic forces during a flood event was enough to cause the Muscle Wall™ to overturn. This event is detailed further in Section 4.3.2.2.

Another important lesson learned from Cofferdam 2 work was to make sure the pick holes on the steel sheet piling are properly sealed. Each sheet of steel piling had a hole located a few inches from the top of each sheet pile with an approximate diameter of 2 inches. Pick holes allow the vibratory hammer attachment of the excavator to maintain a tight grip while the sheet pile is driven into place. As the river level increased during flood events, the pick holes were the initial point where water started entering the cofferdam isolation area, and the last point of entry as the river level recedes. At first glance, it does not seem 2-inch holes would present a challenge to dewatering operations; however, the cumulative flow through individual holes across the length of the cofferdam can be significant. For example, the cumulative flow through 2-inch diameter pick holes submerged beneath 3 inches of water across 50 sheets of steel piling equates to approximately 4.3 cfs, which is enough to fill a standard bathtub in less than 3 seconds. After the first overtopping event, the pick holes in upstream segments of Cofferdam 2 were subsequently plugged using small pieces of plywood screwed together on opposing sides of the pick holes and applied with sealant.

4.2.3 Zone 7 Investigation Remediation and Restoration

4.2.3.1 Zone 7 Pre-Removal Sediment Sampling

Deposit 7-2, 1st Phase

The 1st phase of pre-removal sampling in Deposit 7-2 began on January 31, 2015 and was completed on February 27, 2015. This 1st phase included Deposit 7-2 areas north of Cofferdam 2A; however, Grids 57, 32, 33, 34, 56, 67, and 70 were split by Cofferdam 2A and were considered part of both the 1st and 2nd phase of Deposit 7-2. The portions of these grids north and west of Cofferdam 2A were considered part of the 1st phase, and the portions south and east of Cofferdam 2A were considered part of the 2nd phase. Thirty-eight 50-foot by 50-foot grids were sampled, eight of which were split by Cofferdam 2A, and eighteen 12.5-foot by 12.5-foot grids
were sampled. Twenty 50-foot by 50-foot grids and eighteen 12.5-foot by 12.5-foot grids exceeded RGs. The extent of contamination is depicted in Figure 4-3. Cores were pushed to 6 feet via a direct-push rig on dewatered sediment and through ice. Sample recovery was typically 75%. West of the bridge, grid depths with RG exceedances were found to be greater than 6 feet. Cores were attempted to 8 feet, but due to existing riprap throughout the channel, the water column, and ice thickness, 75% recovery could not be achieved. Visible NAPL and odor were present throughout the deposit within the cores and core holes.

PCBs at concentrations greater than 50 mg/kg (i.e., TSCA levels) were confirmed at two previously known sampling locations and one previously unidentified TSCA hot spot (Figure 4-3). NAPL was confirmed within the deposit with Sudan IV results (Table 3-16) and occurred in the organic-rich sediment within the top 1 to 2 feet of the core. PAHs were detected at concentrations above the RG (20 mg/kg), and exceedances were generally co-located to TSCA hot spots and commonly at the same depths as PCB exceedances (Figure 4-3 and Table 3-16). The greatest depth of RG exceedance was typically 3.0 to 4.0 feet in the eastern portion of the zone, and in some areas west of the bridge it was greater than 6.0 feet. The maximum vertical extent west of the bridge was not fully defined due to issues with recovery, NAPL migration within the core, and personnel health and safety concerns.

**Deposit 7-1**

Pre-removal sampling in Deposit 7-1 began on February 2, 2015 and was completed on March 3, 2015 after sampling of 21 grids determined that 10 grids exceeded RGs. Subsequent to a Force Majeure event, additional sampling was performed south of Deposit 7-1 due to scouring within the deposit. Seven additional scour samples were collected between April 30, 2015 and May 8, 2015; one of the scour samples exceeded RGs. The extent of contamination is depicted in Figure 4-4. Cores were pushed to 8 feet via a direct-push rig on dewatered sediment and through ice. Sample recovery was generally 75% or greater, but sand layers found throughout the deposit limited recovery of the 3.0- to 4.0-foot and 7.0- to 8.0-foot intervals. In the scour area south of Deposit 7-1, 75% recovery was not achieved due to a sandy layer. No sheen was observed and odors were limited within the deposit.

PCBs at concentrations greater than the RG and less than 50 mg/kg (i.e., TSCA levels) were confirmed (Table 3-15). In general, grids with PCB exceedances deeper than 4.0 ft below
ground surface had overlying sediment that met the RGs. Most PAHs detected above the RG (20 mg/kg) were co-located with PCB exceedances (Figure 4-4). All PAHs were detected between 20 and 40 mg/kg (Table 3-15). The greatest depth of RG exceedance was 6.0 to 7.0 ft.

**Deposit 7-2, 2nd Phase**

Pre-removal sampling in the 2nd phase of Deposit 7-1 began on February 5, 2015 and was completed on February 25, 2015. Twenty three 50-foot by 50-foot grids were sampled. Eight of these grids were split by Cofferdam 2A and considered part of both the 1st and 2nd phase of Deposit 7-2 as discussed in Section 3.2.1. Sampling determined that 12 grids exceeded RGs, six of which were split by Cofferdam 2A. The extent of contamination is depicted in Figure 4-4. Cores were pushed to 6 feet via a direct-push rig on dewatered sediment and through ice. Sample recovery was typically 75%. Sheen and odor were observed in the southern portion of the deposit, and NAPL was observed at five locations in the central portion of the 2nd phase area of Deposit 7-2.

PCBs at concentrations greater than the RG of 1 mg/kg and less than 50 mg/kg were confirmed (Table 3-16). PAHs were detected at concentrations above the RG (20 mg/kg), and exceedances were generally co-located with the PCB exceedances (Figure 4-4 and Table 3-16). NAPL was confirmed by Sudan IV results and occurred in the organic-rich sediment within the top 1 to 2 feet of the core. The greatest depth of remedial goal exceedance was 3.0 to 4.0 feet.

**Deposit 7-3**

Pre-removal sampling in Deposit 7-3 began on January 27, 2015 and was completed on April 24, 2015. Fifty-three 50-foot by 50-foot grids and twelve 12.5-foot by 12.5-foot grids were sampled; twenty-four 50-foot by 50-foot grids and twelve 12.5-foot by 12.5-foot grids exceeded RGs. An additional two grab samples were collected on May 9 and 13, 2015 during excavation to further delineate the extent of contamination due to the presence of black organic sediment. The extent of contamination is depicted in Figure 4-5. Cores were pushed to 4 feet via a direct-push rig on dewatered sediment and through ice. Sample recovery was 75% or greater.

PCBs at concentrations greater than the RG and less than 50 mg/kg were confirmed (Table 3-17). PCBs at concentrations greater than 50 mg/kg (i.e., TSCA levels) were found in three locations at a depth of 2.0 to 3.0 feet. PAHs were also detected at concentrations above the RGs,
and exceedances were co-located with PCB exceedances (Figure 4-5 and Table 3-17). The greatest depth of RG exceedances was 3.0 to 4.0 feet.

**Deposit 7-4**

Pre-removal sampling in Deposit 7-4 began on February 9, 2015 and was completed on June 20, 2015. A total of 174 grids with dimensions of 50-foot by 50-foot and four 12.5-foot by 12.5-foot grids were sampled; 95 of the 50-foot by 50-foot grids and four of the 12.5-foot by 12.5-foot grids exceeded RGs. In addition, 13 samples from around the turbidity barrier south of Zone 7 were collected to determine if additional excavation was required. Four of the samples were above the PAHs RG. During excavation to further delineate the extent of contamination due to the presence of black organic sediment, an additional eight grab samples were collected between May 23 and June 9, 2015. The extent of contamination is depicted in Figures 4-6 and 4-7. Cores were pushed to 4 to 6 feet via a direct-push rig on dewatered sediment, through ice, from a boat, and with a hand DPT. Sample recovery was typically 75% or greater; however, sample recovery through the ice, water, and with the hand DPT was limited by the power of the unit and the depth of several sand layers throughout the deposit. NAPL sheen was not observed in the deposit, but odor was observed throughout the deposit.

PCBs at concentrations greater than the RG and less than 50 mg/kg were confirmed (Table 3-18). PAHs were detected at concentrations above the RGs (20 mg/kg) at locations co-located to PCB exceedances (Figure 4-6, Figure 4-7, and Table 3-18). Additionally, TSCA level exceedances were discovered at one location during confirmation sampling (after excavation had occurred). The TSCA location is not identified on Figure 4-6 because it was collected as a confirmation sample. However, TSCA grids were added around the sample location and additional pre-characterization samples were collected in the TSCA grids to further refine the extent of the TSCA exceedance. The TSCA exceedance occurred in the 0.0- to 0.5-foot interval. The greatest depth of RG exceedances in Deposit 7-4 was 3.0 to 4.0 feet.

**4.2.3.2 Zone 7 High Volume and In-Situ Dewatering**

Zone 7 dewatering was also completed in two phases. The 1st phase isolated the western portion of Deposit 7-2 and 2nd phase isolated Deposits 7-1, 7-3, 7-4 and the eastern portion of Deposit 7-2. The 1st phase isolated surface area was approximately 2.02 acres and the 2nd phase
isolated area was approximately 15.9 acres. Information concerning Zone 7 discharge outfall utilization, surface and sediment dewatering completion periods, and discharge quantification by outfall is summarized in Table 4-8.

Phase 1 surface dewatering began on February 23, 2015 and was completed on March 26, 2015. A total of 27,837,000 gallons of surface water was processed through the high-volume pumping and filtration system during the 1st phase. A total of 9,094,500 gallons of sediment contact water was processed by the WWTP.

Dewatering practices during the 1st Phase of Zone 7 dewatering varied from the five steps described in Section 3.3. Difficulties were encountered in sealing the northwest segment wall. To minimize the impact to the schedule, an adaptive management approach was developed. This consisted of installing a secondary concrete bin block barrier wall downgradient of the steel sheet pile wall to intercept and mitigate seepage water from impacting the excavation area. During maintenance dewatering operations at the interception location, a high-volume pump and filtration unit was dedicated to capturing seepage water.

The March 11-18, 2015 Force Majeure flood event impacted the extent and duration of dewatering, resulted in additional water being processed, and suspended ongoing remediation and restoration activities. The flood event impacted site operations in the following ways:

- Ongoing remediation and restoration work activities were suspended until flood waters receded and dewatering restored suitable excavation conditions.
- High-volume pumping and filtration was resumed for the isolated area once the inflow of water through the Northwest and Deposit 7-2 Bisecting Cofferdam pick holes located approximately 6 inches below the top of the sheet pile wall outpaced in-situ dewatering to WWTP to prevent flood waters from overtopping the West Cofferdam and flowing out of the confined area. This was done with three 6-inch high-volume pumps, one 4-inch high-volume pump, and four bag filter units through March 14, 2015 when overtopping out of the isolation area could no longer be averted.
- Four additional high-volume pumps and bag filtration units were mobilized on March 14, 2015, but they did not arrive in time to prevent the overtopping event.
- A sorbent boom was deployed on March 14, 2015 around an exposed cut of NAPL-contaminated sediments that had been excavated to the sediment terrestrial soil interface on the south bank of the West Oxbow scheduled for soil/sand cover placement in anticipation of the overtopping event.
- The EQM PM, EA inspector, and the PCT monitored rapidly rising conditions on March 14, 2015. The EPA TOCOR, EQM PM, and EA’s project oversight personnel collectively decided to suspend the high-volume pumping operations and let overtopping occur that evening. High-volume pumping operations were suspended because there was no visible sheen from
the NAPL sediments and additional absorbent boom was deployed downstream of the West Cofferdam. In addition, adding further pumping capacity would increase erosion on the river bottom from discharging water to the energy dissipation pad, which was not designed to accommodate the additional pumping capacity.

- A 4-inch pump continued drawing water from the exposed NAPL sediments and conveyed water to WWTP to minimize potential for NAPL release.
- High-volume pumping with three 6-inch pumps and bag filtration units resumed the evening of March 18, 2015 after the flood crest occurred and then continued through March 20, 2015.
- The steel sheet pile pick holes were sealed on March 19, 2015 with plywood blanks, and additional sand bags were deployed around the western terminus of the northwest segment to mitigate erosion and bypass flow.
- Two 6-inch pump discharge lines were reconfigured to send water to WWTP on March 20, 2014, once water levels in the isolation area receded below 1.5 feet in depth.
- Dewatering of the Zone 7 1st Phase isolation area was terminated on March 27, 2015 in the early afternoon.

The flood event during Phase 1 dewatering resulted in 9,081,000 gallons of surface dewatering requiring high-volume pumping through bag filtration units and 3,152,000 gallons of in-situ and ex-situ dewatering requiring processing through the WWTP. The practice of sealing the pick holes for the steel sheet pile cofferdam installation was incorporated for the remaining steel sheet pile cofferdam installation to minimize the impact of the flood event on the schedule. Sealing of the pick holes would not have prevented the overtopping event, but may have delayed it and thus decreased the duration of suspended work activity.

The 2nd phase of surface dewatering and in-situ and ex-situ dewatering in Zone 7 occurred between April 23, 2015 and June 30, 2015; a total of 53,573,000 gallons of surface dewatering was performed and 20,482,100 gallons of sediment contact water was processed through the WWTP to facilitate pre-removal sampling, contaminated sediment removal, and post-removal sampling. Details regarding pumping events are provided in Table 4-8. During the 2nd phase, EQM utilized Outfalls 001, 008, and 010 for surface dewatering and continued to utilize Outfall 005 for discharge from the WWTP. Outfall locations are depicted in Figure 3-1. During this period, Outfall 008 was relocated to the west side of the cofferdam segment that bisected Deposit 7-2, and a new geotextile and aggregate energy dissipation pad was installed for the outfall.

The Zone 7 2nd Phase isolation area covered approximately 15.9 acres. Groundwater recharge, localized channeling, and surface gradient change facilitated the need for high-volume
pumping and processing of water throughout the remediation and restoration activities in the execution of work in the second phase of Zone 7. Active removal areas were isolated for in-situ dewatering. Small jack pumps were moved as appropriate to dewater confined areas not hydraulically connected to the primary dewatering pump stations. In active excavation areas, jack pumps were used to transfer water via hoses to sump locations within the isolation area, and larger pumps transferred water from the sump to the WWTP. The large area isolated for Zone 7 2nd Phase allowed in-situ and high-volume pumping systems to be operated simultaneously to increase the effectiveness of the dewatering effort. Areas within the isolation area that were neither disturbed nor influenced by excavation activities were allowed to be dewatered using high-volume pumping system with bag filtration while in-situ dewatering was conducted simultaneously in active excavation areas. Jack pumps were used to transfer water to sumps designated for high-volume pumping, where the water would be pumped through bag filtration units prior to discharge back to the river.

The configuration of the 2nd phase cofferdam segment isolated the 2nd phase excavation area within the east oxbow. Although the East Oxbow was not being remediated, it contained storm water outlets that could impact the excavation area from a rain event. To mitigate storm water impact, the Muscle Wall™ cofferdam was installed with a by-pass pumping system to transfer storm water from the East Oxbow to the Milwaukee River Channel downstream of the 2nd Phase isolation cofferdam system. Quantitative monitoring of the discharge volume was not required or performed for processing of East Oxbow storm water. Multiple rain events required periodic use of the bypass pumping system.

4.2.3.3 Zone 7 Excavation Plans

EQM and AECOM prepared the Excavation Plan for Deposits 7-1 through 7-4 to guide removal efforts. The plan included a narrative summary of pre-removal sampling data used to develop the extent of excavation, a narrative describing and a figure depicting the extent of excavation, existing conditions, SWAC of PAHs, predicted SWAC scenarios, and a narrative describing the sequence and methodology for excavation. EQM worked from a draft version of the plan and incorporated modifications to address unforeseen conditions prior to the finalization of the plan.
Deposit 7-2, 1st Phase

Figures 1 and 2 from the Deposit 7-2 1st Phase Excavation Plan depict the planned removal work for the deposit which results in approximately 324 CY of sediment removal requiring TSCA disposal and 2,263 CY requiring solid waste disposal. Total planned sediment removal was 2,587 CY.

Deposit 7-1 and 7-2, 2nd Phase

EQM and AECOM prepared the Deposit 7-1 and 7-2 2nd Phase Excavation Plan to guide removal efforts. The plan included a summary of pre-removal sampling data used to develop the extent of excavation, a figure depicting the extent of excavation, existing SWAC of PAHs for Deposits 7-1 and 7-2 2nd Phase, predicted SWAC scenarios, and a narrative describing the sequence and methodology for excavation. EQM worked from a draft version of the plan and incorporated modifications to address unforeseen conditions prior to the finalization of the plan.

Figures 1 and 2 from the Deposit 7-1 and 7-2 2nd Phase Excavation Plan depict the planned removal work for each deposit, respectively. This resulted in approximately 2,593 CY being removed from Deposit 7-1 and 2,340 CY removed from Deposit 7-2 that required solid waste disposal.

Deposits 7-3 and 7-4

EQM and AECOM prepared the Deposit 7-3 and 7-4 Excavation Plan to guide removal efforts. The plan was written in the same format as the Deposit 7-1 and 7-2 2nd Phase Excavation Plan. The plan included Figures 1 and 2 from the Deposit 7-3 and 7-4 Excavation Plan which depicted the planned removal work for the deposit that resulted in the approximate removal of 60 CY of sediment requiring TSCA disposal and 5,147 CY requiring solid waste disposal, for a total planned removal of 5,234 CY from Deposit 7-3. The planned removal for Deposit 7-4 included 4 CY of sediment requiring TSCA disposal and 16,919 CY of sediment requiring solid waste disposal. The Deposit 7-3 and 7-4 Excavation Plan also included Figures 1 and 2 which depicted the turbidity curtain area. The turbidity curtain area required removal in 2 grids to a depth of 1 foot, which resulted in removal of 185 CY of solid waste sediments.
4.2.3.4 Zone 7 Excavation

Deposit 7-2, 1st Phase

Work began on the 1st phase of contaminated sediment removal in Deposit 7-4 on February 24, 2015 and was completed on March 22, 2015. Work began with removal of surface ice accumulations over the excavation area. Ice was transferred to the dewatering pad to melt over time as was done in Deposit 3B-1. Ice was removed on February 24 and 25, 2015. An additional 25 loads of ice were removed on March 3, 2015. Excavation of contaminated sediments began on February 27, 2015 and was completed on March 22, 2015.

Actual excavation resulted in seventeen 50-foot by 50-foot solid waste grids and twenty-two 12.5-foot by 12.5-foot TSCA grids being targeted for removal based on the Deposit 7-2, 1st Phase Excavation Plan. Additional excavation was required because contaminated sediments were identified between the cofferdam left in place from the Lincoln Creek 1st Phase project performed previously by others and the west segment of the Lincoln Park 2nd Phase Cofferdam 2. A number of 50-foot by 50-foot grids were partially excavated across the expanse of the surface area for various reasons. These grids included Grids 6 and 19, which were excavated to the south up to the 617-foot elevation deemed the sediment/terrestrial soil interface; Grid 8, which was excavated south up to the riprap used to protect the North Milwaukee River Parkway bridge and to the west up to the North Milwaukee River Parkway bridge; and Grids 32, 33, 31, 56, and 67, which were excavated up to the cofferdam segment that divided Deposit 7-2 into the Zone 7 1st Phase and 2nd Phase areas.

Contaminated sediments west of the North Milwaukee River Parkway Bridge were excavated primarily from the south bank of the West Oxbow at the southeast end of the deposit. This was necessary due to the limited surface of the deposit west of the bridge, bank protective riprap present, and the steepness of river banks. Excavating from this location limited the safe working radius of the excavator affecting both lateral reach and excavation depth from this position. This resulted in using residual management measures when sediments could not be removed to a sufficient depth to meet RGs. The resulting residual management measures implemented are described in Section 4.2.37. Contaminated sediments east of the North Milwaukee River Parkway Bridge were excavated from the south bank of the West Oxbow and from timber mat roadways.
extended out into the excavation area. Table 4-9 summarizes excavation progress over the sediment removal period.

Post-removal sampling results for Deposit 7-2, 1st Phase are included in Table 4-10 and depicted on Figure 4-8. Figure 3-13 depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation was performed based on pre- and post-removal surveying data. The cut/fill calculation determined that 517.53 CY of contaminated sediment was removed west of the N. Milwaukee River Parkway Bridge over a surface area of 3,757.65 SF, and 2,324.40 CY of contaminated sediment were removed east of the bridge over a surface area of 23,151.73 SF. This resulted in a total of 2,841.93 CY of contaminated sediment removed from the Deposit 7-2 1st Phase excavation area over a total surface area of 26,909.38 SF. This was approximately 255 CY more removal than planned. The additional volume removal is attributed to re-excavation of grids not meeting RGs and excavation of sediment between the Phase 1 Lincoln Creek and the West Cofferdam.

Deposit 7-1

Contaminated sediment removal work began in Deposit 7-1 on April 28, 2015 and was completed on May 1, 2015. A total of six 50-foot by 50-foot solid waste grids were targeted for removal based on the Deposit 7-1 and 7-2 2nd Phase Excavation Plan. Table 4-11 summarizes excavation activities.

Post-removal sampling results for Deposit 7-1 are included in Table 4-12 in Appendix B and are depicted in Figure 4-9 in Appendix A. Figure 3-14 depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation based on pre- and post-removal surveying data determined that 2,292.54 CY of contaminated sediment was removed from Deposit 7-1 over a surface area of 17,665.94 SF. The removal volume was 301 CY less than planned and is primarily attributable to scour resulting from relocating the Northeast Cofferdam.

Deposit 7-2, 2nd Phase

Contaminated sediment removal work began in the Deposit 7-2, 2nd Phase on May 1, 2015 and was completed on May 7, 2015. Ten 50-foot by 50-foot solid waste grids were targeted for removal based on the Deposit 7-1 and 7-2 2nd Phase Excavation Plan. Only targeted grids along the cofferdam wall segment that divided Deposit 7-2 into the east and west sections re-
quired removal in the eastern portion of the grid. Targeted removal depths ranged from 1 foot to 4 ft.

Post-removal sampling results for Deposit 7-2, 2nd Phase are included in Table 4-14 and are depicted in Figure 4-9. Figure 3-14 depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation based on pre- and post-removal surveying data determined that 2,606.98 CY of contaminated sediment was removed from Deposit 7-2, 2nd Phase over a surface area of 21,142.12 SF. This was 267 CY more volume than planned and is attributable to re-excavation of grids that did not meet RGs.

**Deposit 7-3**

Contaminated sediment removal work began in Deposit 7-3 on May 6, 2015 and was completed on May 16, 2015. Twenty-two 50-foot by 50-foot solid waste grids and twelve 12.5-foot by 12.5-foot TSCA grids were targeted for removal based on the *Deposit 7-3 and 7-4 Excavation Plan*. Targeted removal depths ranged from 1 foot to 5 ft. Table 4-15 summarizes excavation activities.

On May 14, 2015 a deposit of black sediment was observed at a depth of 3 to 4 ft along the western portion of Grids 15, 20, 26, 32, 33, 36, and 37. The black layer was initially assumed to be a deposit of organic substrate associated with the emergent wetlands identified in the design drawings. A strong petroleum odor was observed, however, indicating the possible presence of contaminated material. A trace quantity of NAPL was also observed seeping from the bottom of the partially excavated Grid 37, which produced a visible sheen on the minor volume of water pooled at the bottom of the excavation. Grab samples were collected and analyzed, and the results confirmed that the black sediment exceeded RAOs for PCB and PAH. This information was presented to the PCT and approval was granted to continue excavating the black sediment by “chasing” it into the adjacent grids that did not initially exceed RAOs based on pre-removal sampling results.

Black sediment was encountered in multiple grids along the eastern boundary of Deposit 7-3. The PCT granted permission to use the presence of black sediment as a surrogate for RAOs based on the chemistry results of the previous grab samples. When black sediment was encountered during remedial excavation in Deposit 7-3 and subsequent deposits, the Project Team gathered to inspect and discuss the nature of the sediment. The decision to chase the black material
deeper into the grid or pursue it into an adjoining grid meeting RAOs ultimately depended on the concurrence of the EPA oversight consultant that the sediment had sufficient indicators of contamination. Additional grab samples of the black sediment were collected and analyzed to verify the presence of contaminants of concern above RGs, as discussed in Section 3.2.2. The black sediment was excavated following the decision flow chart included in Attachment A in the Deposit 7-3 and 7-4 Excavation Plan.

Post-removal sampling results for Deposit 7-3 are included in Table 4-16 and are depicted in Figure 4-10. Figure 3-15 depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation was performed based on pre- and post-removal surveying data and it was determined that 7,542.94 CY of contaminated sediment was removed from Deposit 7-3 over a surface area of 58,669.78 SF. This was 2,308 CY more volume than planned and is attributable to re-excavation of grids that did not meet RGs and removing black sediment outside of planned removal areas.

Deposit 7-4

Contaminated sediment removal work began in Deposit 7-4 on May 19, 2015 and was completed on June 25, 2015. Eighty-four 50-foot by 50-foot solid waste grids and four 12.5-foot by 12.5-foot TSCA grids were targeted for removal based on the Deposit 7-3 and 7-4 Excavation Plan. Targeted removal depths ranged from 1 foot to 4 foot. Table 4-17 summarizes excavation activities.

Black sediment encountered in Grids 16, 20, 23, 33, 34, 35, 37, 45, 47, 97, 120, 121, 122, 124, 128, 129, 131, 132, 133, 137, 140, 141, 158, and 176 required additional removal beyond the planned extent following the decision flow chart included in Attachment A in the Deposit 7-3 and 7-4 Excavation Plan. Additional excavation in Zone 7 included excavating grids near the downstream turbidity barrier placed in the main channel below the confluence of the East Oxbow and the main channel of the Milwaukee River prior to the sheet pile installation for the upstream segments of Cofferdam 2, and the scour area downstream of Deposit 7-1. The sediment curtain area was included in the isolation of Zone 7 when the downstream or southern segment was installed. Investigative sampling was performed and confirmed contaminated sediments in this area were the result of re-deposition of Deposit 7-4 sediments when the river flow was directed down the East Oxbow during installation of the upstream cofferdam segments. Excavation was per-
formed in a portion of turbidity barrier Grids 4, 5, 6, and 12. When a portion of the Northeast Cofferdam segment was removed to realign it and close off the East Oxbow, the initial flow of water through the area was believed to scour a portion of Deposit 7-1 and re-deposit sediments downstream of Deposit 7-1. Additional investigation sampling was performed and resulted in excavation of Scour Grids 23, 24, 27, and 28.

Post-removal results for the scour area south of Deposit 7-1 are depicted in Figure 4-9. Post-removal sampling results for Deposit 7-4 and the turbidity barrier area are included in Table 4-18 and are depicted in Figures 4-11 and 4-12. Figures 3-16 and 3-17 depict the lateral and vertical contaminated sediment removal extent in Deposit 7-4 and the Turbidity Barrier removal area. A cut/fill calculation of the scour area determined that 167.06 CY of contaminated sediment was removed over a surface area of 4,208.80 SF. A cut/fill calculation based on pre- and post-removal surveying data determined that 24,423.35 CY of contaminated sediment was removed from Deposit 7-4 and the Turbidity Barrier removal area over a surface area of 225,697.25 SF. This was 7,500 CY more volume than planned and is attributable to re-excavation of grids that did not meet RGs, and removing black sediment outside of the planned removal areas.

4.2.3.5 Zone 7 Solidification

During the Zone 7 contaminated sediment removal period, 272 tons of solidification agents were utilized to prepare the 37,708 CY of sediment removed from Zone 7 for disposal. A total of 58,340 tons of solid waste and TSCA sediments were disposed of from Zone 7. Therefore, the 272 tons of solidification agent accounted for 0.46% by weight of the disposal tonnage. Sediment disposal averaged 1.55 tons per CY.

4.2.3.6 Zone 7 Disposal of Solid Waste and TSCA Sediments

In Zone 7, solid waste was disposed of from all deposits and TSCA waste was disposed of from Deposits 7-2, 7-3, and 7-4. All wastes were loaded and shipped from the dewatering pad. Disposal of Zone 7 solid waste began on March 6, 2015 and was completed on July 15, 2015. Table 4-19 summarizes solid waste transportation and disposal activity. Disposal of Zone 7 TSCA waste began on March 3, 2015 and was completed on August 6, 2015. Table 4-20 summarizes TSCA solid waste transportation and disposal activity.
On March 11, 2015 two overweight vehicles carrying TSCA waste were detained by Wisconsin State Police for trying to bypass state scales while in route to the HES disposal facility in Roachdale, Indiana. While the vehicles were detained, they apparently began leaking liquid from the sediment contained within the dump beds onto the asphalt lot of the weigh station. The transporter U.S. Bulk, a subcontractor for HES, notified EQM of the problem. EQM coordinated and oversaw corrective actions that involved sealing one truck and returning the load to the site to be dumped on the dewatering pad; transferring the contents of the second vehicle into roll-off containers at the scale facility and transporting them to HES; recovering released liquids; and decontaminating the asphalt lot followed by swab sample verification sampling. EQM investigated the cause of the incident and submitted a corrective action report on March 22, 2015. EQM implemented vehicle inspection measures prior to waste sediment loading, and equipment operators were instructed not to overload transport vehicles regardless of the TSCA transport driver’s request. EQM also suspended the use of U.S. Bulk for TSCA waste transportation. See CAR 004 in Appendix K for details.

4.2.3.7 Zone 7 Residual Management

EQM implemented residual management measures to address contaminants in the stream channel that could not be removed safely due to equipment access limitations and to address contaminants at the terrestrial soil and sediment interface. EQM obtained two (2,325 SF each) rolls of geo-synthetic clay liner (GCL) to create a barrier between contaminated terrestrial soils and streambank restoration cover materials. Product information on the GCL was submitted to EPA’s oversight engineer to obtain product approval prior to installation. On March 25, 2015, the excavation crew removed riprap along the bank to prepare the area for GCL installation. Riprap removal continued into March 26, 2015. A total of 323.03 CY of topsoil was backfilled into the portion of the excavation on both sides of the Lincoln Creek 1st Phase cofferdam once riprap was placed over the GCL installation area. The GCL was installed on top of this backfilled portion of the excavation and the soil bank was exposed by riprap removal. A 1.5-foot layer of topsoil obtained from the Zone 7 topsoil stockpile was placed over the GCL. This area was covered with 8-ounce non-woven geotextile fabric prior to restoration of the riprap surface to existing grade. Twelve truckloads containing 262.77 tons of riprap were delivered to the site and placed on the south bank to restore this area. On March 27, 2015 filter fabric was extended along the eastern
edge of Grid 2, placed between Grid 2 and the North Milwaukee River Parkway Bridge, and covered with riprap. The call-out figure embedded in Figure 3-6 i depicts the surface area of riprap installation. The surface area of riprap installation was 210 square yards (SY) based on pre- and post-construction surveys.

Grid 2 and its associated TSCA grids could not be safely excavated to depth to meet RGs to equipment access limitations. Therefore, a protective cover of sand was placed in accordance with specified residual management procedures. The specified approach of placing a 6-inch layer of sand was modified to include additional sand backfilled to pre-existing grade to enhance the protective cover and mitigate erosion due to the location being a narrow stream channel with high current flow. The excavation cavity that was deeper than 3 ft from the pre-removal surface in Grid 2, which included TSCA Grids 1T1, 2T1, 3T1, 4T1, 52, 53, and 54, was filled with 75.18 CY of sand backfill to 3 ft below the top of the Lincoln Creek 1st Phase cofferdam elevation and then covered with 1 foot of topsoil. The extent of sand and topsoil cover placement is depicted in Figure 3-6.

4.2.3.8 Zone 7 Post-removal Confirmation Sampling

Deposit 7-2, 1st Phase

PCB and PAH post removal analytical results met RGs east of the bridge in excavated grids (Table 4-10 and Figure 4-8). West of the bridge, the depth of the excavation was limited due to slope stability and the proximity to the bridge. During an initial round of post-removal confirmation sampling, there were RG exceedances of both PAHs and PCBs (Table 4-10). No additional post-removal confirmation sampling was completed west of the bridge following additional excavation due to health and safety concerns. Once additional excavation was completed, a GCL liner and sand were placed to mitigate residual exceedances (EQM, 2015f).

Deposit 7-1

PCB and PAH post removal analytical results met RGs throughout the deposit in excavated grids (Table 4-12and Figure 4-9). The highest PCB result was 0.41 mg/kg and the highest PAH result was 10 mg/kg, each achieving their RGs of 1 mg/kg PCBs and 20 mg/kg PAHs, respectively (Table 4-12).
Deposit 7-2, 2nd Phase

PCB post removal analytical results met RGs throughout the deposit in the excavated grids (Table 4-14 and Figure 4-9). The highest PCB result was 0.70 mg/kg, which met the RG of 1 mg/kg for PCBs (Table 4-14). One grid had a PAH point goal exceedance of 31 mg/kg, but meets the SWAC calculation RG of 20 mg/kg, as discussed in Section 3.4.1.

Deposit 7-3

PCB and PAH post removal analytical results met RGs throughout the deposit in the excavated grids (Table 4-16 and Figure 4-10). The highest PCB result was 0.050 mg/kg and the highest PAH result was 1.5 mg/kg, each achieving their RGs of 1 mg/kg PCBs and 20 mg/kg PAHs, respectively (Table 4-16).

Deposit 7-4

PCB post removal analytical results met RGs throughout the deposit in the excavated grids (Table 4-18 and Figures 4-11 and 4-12). The highest PCB result was 0.63 mg/kg, which meets the remedial goal of 1 mg/kg PCBs (Table 4-18). Ten grids had a PAH point goal exceedance, with the highest of these being 32 mg/kg. These PAH point goal exceedances met the SWAC calculation RG of 20 mg/kg (discussed in Section 3.4.1).

4.2.3.9 Zone 7 Restoration

Restoration in Zone 7 included temporary infrastructure removal, stream bank restoration in the Deposit 7-2 excavation area, topsoil replacement and seeding, and pavement restoration. Restoration activities began with streambank restoration and cofferdam removal. Haul roads were removed intermittently once they were no longer required. Post-construction soil samples were collected and analyzed to document soil conditions after pad removal prior to restoring topsoil and revegetating the area with turf grass. Detected results for the post construction sampling are provided in Table 3-5.

4.2.3.10 Zone 7 Streambank Restoration

Riprap was restored at the base of the slope of the south bank of the river east of the North Milwaukee River Bridge near the confluence of the river channel and the West Oxbow as
depicted in Figure 3-6. This work was not included in the original scope and was performed under Contract Modification 6. On March 7, 2015 riprap was installed along the shoreline of Grids 8, 14, and 19 to stabilize the toe of the slope disturbed as a result of contaminated sediment removal. A total of 109 SY of riprap was installed east of the bridge based on pre- and post-construction surveys. The length of riprap toe replacement was approximately 160 feet and approximately 4 to 6 feet wide.

4.2.3.11 Zone 7 Infrastructure Removal

Infrastructure in Zone 7 included the cofferdam segments, haul roads, security fencing, dewatering pad, WWTP and pad, office trailers, and gravel pad. Cofferdam dam removal information is summarized in Table 4-7. Haul road removal began April 1, 2015, with removal of the haul road segment extended to install the west segment of Cofferdam 2. The remaining segments were removed between July 15, 2015 and October 14, 2015. The WWTP was removed between September 17, 2015 and October 1, 2015. The WWTP pad was removed between October 1 and 14, 2015. The 1,560.09 tons of aggregate from the WWTP pad were sent to Waste Management for beneficial re-use. The dewatering pad was removed between September 24, 2015 and October 6, 2015. The office trailers, utility service, and gravel lot were removed between October 12 and 15, 2015. Segments removed were backfilled with topsoil and reseeded with the approved turf grass seed mixture. Security fencing will remain in place until acceptance of revegetation, which is anticipated in mid-July 2016.

4.2.3.12 Zone 7 Sand Placement

Sand placement in Zone 7 was performed at two locations. The first location was in the Deposit 7-2 excavation area west of the North Milwaukee River Parkway Bridge. Sand backfilling of this area was described in Section 4.2.3.7. Sand was placed over a 973.81-SF surface area that amounted to 75.18 CY of sand backfill. The second area of sand placement was performed in Deposit 7-3 in order to re-establish the pre-excavation elevation to assist in the restoration of the wetlands. Sand placement began on May 19, 2015 and was completed on June 3, 2015. The sand placement surface area is depicted in the yellow-shaded area beneath the green cross-hatched wetland area in Figure 3-6. A total of 10,155 tons of sand were placed over a surface area of 52,406.82 SF. This resulted in 5,698.49 CY of sand placed in this area.
4.2.3.13 Zone 7 Topsoil Restoration

Zone 7 topsoil restoration was completed in the area depicted in Figure 3-6. The key in Figure 3-17 points out that topsoil was restored in four types of areas. Topsoil was placed in the channel and the streambank in Deposit 7-2 west of the North Milwaukee River Parkway Bridge. This consisted of placing 323.03 CY of topsoil backfill over a surface area of 2,878.82 SF on March 26, 2015 as part of the specialized restoration requirements related to the residual contamination in the channel and along the south bank of the West Oxbow. The source of the topsoil backfill was from the Zone 7 stockpile.

Topsoil was placed in the wetland restoration area where contaminated sediments in Deposit 7-3 had been removed. The topsoil backfill was placed between June 26 and 27, 2015. Topsoil backfill was placed over a 54,110.17 SF (1.24 acres) surface area. A total of 1,202.97 CY of topsoil was imported and placed. Topsoil was provided from EQM’s vendor Liesener Soils, Inc. and transported to the site by Elder Brothers Transportation. Imported topsoil data was submitted to the PCT on May 28, 2015.

Topsoil was placed in upland areas that had been disturbed as a result of temporary infrastructure improvements such as the haul roads, dewatering pad, and WWTP. The haul road segment installed west of North Milwaukee River Parkway was backfilled April 6, 2015 with topsoil from the Zone 7 stockpile. A 3,276-SF area west of the bridge was seeded with a no-mow/low-grow seed mixture at an application rate of 200 lbs/acre. The disturbed area west of the bridge (approximately 3,500 SF) was seeded with a turf grass seed mixture at an application rate of 200 lbs/acre. The remaining disturbed areas were backfilled with imported topsoil intermittently from July 15, 2015 to October 15, 2015, following the removal of the haul road segments, dewatering pad, WWTP pad, and office trailer pad. Additional topsoil fill was placed in the former equipment laydown area to remedy low spots where rain water accumulated. This was completed on November 15, 2015. The surface area of topsoil restoration for the upland areas east of North Milwaukee River Parkway and west of the Milwaukee River channel amounted to 294,507.29 SF (6.76 acres), which required importing and placement of 4,711.87 CY of topsoil backfill.

4.2.3.14 Zone 7 Pavement Restoration

Pavement restoration in Zone 7 consisted of replacing a portion of the Oak Leaf Bike Trail and repairing asphalt and concrete curbs along North Milwaukee River Parkway. Restora-
tion of the Oak Leaf Trail began on August 11, 2015 with the removal of impacted asphalt. EQM submitted RFI 36 to request a variance in Specification 32 12 16 requiring asphalt installation in 2-inch lifts when difficulties were encountered in obtaining subcontractors to bid on restoration work due to concerns of delivery trucks damaging the lifts over the sinuous pathway. The variance was approved on September 3, 2015, and bike path restoration work was completed on September 24, 2015. Approximately 1,207 LF of bike path pavement was replaced. The bike path replacement area is depicted in Figure 3-6.

Asphalt and curb repair in Zone 7 was completed between November 2 and 5, 2015. Four locations were repaired where access roads were extended from the North Milwaukee River Parkway. Asphalt curb and apron repair was completed in two locations, which amounted to 82 LF of restoration. Concrete apron and curb repair was completed in three locations, which amounted to 84 LF of restoration. Curb and apron repair work was completed by EQM’s subcontractor Munson Paving, Inc. of Glendale, Wisconsin.

4.2.3.15 Zone 7 Upland Tree Planting and Turf Grass Restoration

Turf grass seeding of 6.76 acres of upland area topsoil replacement was performed at a rate of 200 lbs/acre to re-establish a vegetative cover crop. Turf grass seeding preparation, seeding, mulching, and fertilizing were performed in the upland areas depicted in Figure 3-6 by EQM’s landscaping subcontractor AES. No-mow/low-grow seeding preparation, seeding, mulching, and fertilizing were performed in the streambank areas depicted in Figure 3-6 by AES. AES provided and planted 60 trees for upland restoration in Zones 7 and 3. The majority of the trees were planted in Zone 7. AES planted 12 Bitternut Hickory’s, 12 Kentucky Coffee trees, 12 American Elms, and 12 American Basswoods on November 5, 2015.

4.3 Zone 4 Remedial Action: Deposits 4-1 and 4-2

4.3.1 Zone 4 Scope of Work

Remediation and restoration was planned in Zone 4 for Deposits 4-1, 4-2, and 4-3. Zone 4 is depicted in Figure 2-1. Deposits 4-1 and 4-2 were located downstream of the West Hampton Avenue Bridge on along the northern river bank, and Deposit 4-3 was located downstream of
Deposit 4-2 along the southern river bank. The site preparation, remediation, and restoration scope of work for Zone 4 included:

- Installation of two construction entrances at the junction of the access haul road to West Hampton Avenue.
- Installation of one 20-foot-wide by 1,032-foot-long access haul road with a footprint of 26,287 SF constructed of geotextile and road aggregate.
- Clearing and grubbing of vegetation along the riverbank for deposit access.
- Construction of a topsoil stockpile storage area that required installation of a 180-LF silt fence around the stockpile footprint perimeter.
- Installation of 1,042-LF temporary chain-link fence to restrict site access.
- Installation of one decontamination pad.
- Installation of 1,045-LF steel sheet pile cofferdam to isolate Deposits 4-1 and 4-2 from the main river channel.
- Installation of pumping systems to dewater Deposits 4-1 and 4-2 with pumps, the energy dissipation pad, and the conveyance pipeline network to convey water to the WWTP.
- Installation of 600-LF sediment curtain in the main river channel along the south bank to confine Deposit 4-3 during hydraulic dredging.
- Dewatering of 60,244-SF surface area confined by the cofferdam with remediation of stream restoration and habitat construction.
- Collection and analysis of 29 grid core samples based on the combined 17,076-SF limit of the removal area in the RFTOP Design Drawings.
- Excavation of Deposit 4-1 and 4-2 in the dry and hydraulic dredging of Deposit 4-3 to remove and dispose of 2,111 CY of non-TSCA-regulated material/sediment as solid waste.
- Restoration of 11,427 SF of substrate and 2,614 SF of wetland, which included revegetation with native plantings.
- Restoration of disturbed upland areas with 6,370 SF of native seedings and 22,570 SF of no-mow-low-grow seeding.
- Construction of three log/root wads and six boulder cluster habitat features.

### 4.3.2 Zone 4 Preparation

Temporary infrastructure constructed to support the remedial action in Deposits 4-1 and 4-2 of Zone 4 included the following:

- Mobilization of equipment and materials
- Vegetation clearing and grubbing
- Topsoil stripping
- Haul road and access ramp construction
- Decontamination pad
- Cofferdam isolation area construction.

As pre-removal sampling progressed in Zone 4, the original boundaries defining Deposits 4-1 and 4-2 as two distinct deposits of contaminated sediment expanded and ultimately overlapped to form a single contiguous deposit. In order to remain consistent with the preliminary design, it was necessary to retain the nomenclature of two separate deposits of contaminated sediment in Zone 4 as an independent Deposit 4-1 and Deposit 4-2.

A total of 1,024 LF of security fencing was installed in Zone 4 on October 16, 2014 and is expected to remain in place throughout the maintenance period anticipated to end mid-July of 2016.

4.3.2.1 Zone 4 Clearing and Grubbing

Clearing and grubbing in Zone 4 began on October 13, 2014 and was completed on December 6, 2014. Trees identified for removal were flagged and Mr. Kevin Haley of Milwaukee County was invited on site to obtain his approval prior to the start of work. Vegetation consisting of trees and underbrush was removed by Limb Walkers, Inc. over an approximate surface area of 57,380 SF between December 3 and 5, 2015. Approximately 25,720 SF of topsoil was stripped to a depth of six inches from the haul road footprint and stockpiled in an area within Zone 4. The topsoil stockpile was surrounded by 156 LF of silt fence and covered with plastic tarps to be reused for haul road restoration after the remedial action was completed.

4.3.2.2 Zone 4 Haul Road Construction

Haul road construction in Zone 4 began on December 1, 2014 and was completed on December 13, 2014. The haul road extended south from Hampton Avenue and branched off to the east and west to allow the excavator access to Deposits 4-1 and 4-2 from the haul road. The entire haul road length was approximately 977 LF and covered a surface area of approximately 25,722 SF. One decontamination pad was constructed to capture contaminants washed from equipment prior to leaving the Zone 4 exclusion area.

The constructed haul road layout in Zone 4 differed from that depicted in the Remedial Design Drawings. The original design proposed two construction entrances to access the eastern and western ends of adjoining Deposits 4-1 and 4-2. After the proposed haul roads were staked, it became apparent that this layout traversed more heavily wooded areas that would require re-
moving an additional number of trees. An alternate haul road layout was requested and approved through submission of RFI No. 12, which proposed a single construction entrance extending to a centrally-located point between Deposits 4-1 and 4-2. This revised layout provided access through an area more predominantly covered by grass, thus requiring fewer trees to be removed. The revised haul road layout also avoided disturbing an area along the original Western Haul Road identified by WDNR Archeologist Mark Dudzik as a potential location of archaeological significance.

**Cofferdam 3 Isolation Area**

Cofferdam 3 was installed as a single continuous barrier to isolate and dewater an approximate 0.42-acre area of the adjoining Deposits 4-1 and 4-2, as depicted in Figure 3-8. Installation of Cofferdam 3 began on June 29, 2015 and was completed on July 2, 2015 in accordance with the planned schedule. Cofferdam 3 was constructed using modular Muscle Wall™ components installed with an overall length of 655 LF, which was 283 LF less than the length proposed in the Remedial Design Drawings.

Unlike steel sheet piling that can be mechanically driven into sediment to more closely match the target top elevation, Muscle Wall™ components have a fixed height of 4 ft and must be placed directly on the surface of the riverbed. The depth to bedrock in the channel adjacent to Zone 4 precluded the use of steel sheet piling for Cofferdam 3. Achieving the target elevation using Muscle Wall™ placed on the shallow side slope adjacent to Deposits 4-1 and 4-2 would have required placing the units far into the channel where the force of river flow is much stronger.

As-built survey data revealed that Cofferdam 3 exceeded the target top elevation of 613.8 feet (NGVD) for much of its length, except for approximately 200 LF near the eastern end of Deposit 4-2. The top elevation of the remaining length of the cofferdam within the channel varied between 614 and 615 feet. The PCT approved installation of Cofferdam 3 with elevations exceeding 613.8 ft after using hydraulic modeling to verify the higher top elevations would not drastically increase backwatering effects during a 100-year flood event.

Concrete barrier blocks were installed between Deposits 4-1 and 4-2 to bisect Zone 4 into two smaller areas. This approach was intended to improve the effectiveness of dewatering and reduce the volume of water sent to the WWTP at any one time. Water removed from the half
where active excavation was occurring was pumped to the WWTP via conveyance pipeline, while the inactive half was dewatered simultaneously using the high-volume dewatering system. This approach was approved by the PCT under the assumption that the inactive half would experience minimal work activity that could disturb and mobilize potentially contaminated sediments. The bag filtration system used in concert with high-volume pumping could then more efficiently capture sediments prior to discharging the treated water back to the river. These simultaneous dewatering operations were switched to complete excavation in the opposing half of Zone 4. The approach had very limited effectiveness in Zone 4 due to the persistent leakage and undermining beneath the Muscle Wall cofferdam. Workers were constantly moving or adding more sand bags and plastic sheeting to mitigate undermining. This was due in large part to the sandy and silty substrate underlying the Muscle Wall,™ which was highly erodible. Fortunately, only the grids farthest into the channel required intensive dewatering to facilitate remedial excavation.

The Muscle Wall™ also had very limited capability of resisting overturning from the hydrodynamic forces of a flowing river, which was previously exemplified in Zone 7 during a high-water event on June 12, 2015. These limitations were repeated during a high-water event that occurred on July 13, 2015 during excavation operations in Zone 4. A rain event led to a rapid rise in river levels of approximately 1 foot, forcing approximately 80 linear feet of Muscle Wall™ to overturn and allow water to inundate Deposits 4-1 and 4-2. Absorbent boom and silt curtain were deployed between the Muscle Wall™ and the excavation area to prevent visible sheen from escaping the isolation area. The wall was restored to its vertical operating position the following day after the high water levels receded. A secondary interior wall of concrete bin blocks was installed to stabilize Cofferdam 3 for the remaining grids to be excavated. Additional plastic sheeting and sand bags were also installed as a sealing measure.

Muscle Wall™ was not only observed to be prone to overturning during high-water events, there were also significant challenges to maintaining water levels during normal dewatering operations. The channel substrate underlying the Cofferdam 3 alignment had a high concentration of sand and silt, which was highly susceptible to persistent undermining and water leakage beneath the barrier wall. The flow of water entering the isolation via undermining increased with rising river levels due to the increased force of hydrostatic pressure. Inflow was exacerbated as the water continued carving and enlarging the conduit beneath the cofferdam. Undermining was mitigated by placing additional sandbags and/or concrete bin blocks on top of the poly
sheeting at the base of the Muscle Wall™ units on the interior and exterior side of the cofferdam. This provided weight to help counteract the pressure of water inflow. Another approach considered was extending the poly sheeting at least 15 feet farther into the channel and securing it to the channel bottom with weight; however, the river current made this task extremely difficult and created a safety hazard for the work crew. Although these measures helped reduce undermining, maintaining low-water levels within the excavation was a persistent challenge, especially for grids located farther into the channel.

Another approach to counteract undermining was constructing an interior wall of bin blocks parallel to the cofferdam and covering the wall with poly sheeting secured with sandbags, similar to an interception trench. High-volume pumping was used to remove the water between the interior wall and cofferdam. This approach could only be employed when the in-situ pumping rate could maintain a lower water level within the excavation grid than that intercepted between the cofferdam and interior wall. This water level difference created a hydrostatic pressure gradient that forced water into the excavation rather than allowing potentially contaminated water to exit the excavation. Interior barrier walls were approved by the PCT as an acceptable method for simultaneously operating the high-volume and in-situ dewatering systems while reducing the potential for contamination escaping active excavation grids. This approach was employed during remedial excavation for Zone 5.

Our experience using Muscle Wall™ for cofferdam construction in Zones 7 and 4 led us to reconsider using this approach for Cofferdam 4. Although Muscle Wall™ is a lightweight and flexible system that could be employed effectively for cofferdam construction under ideal circumstances, it did not prove effective for the dynamic river conditions associated with this project. More ideal circumstances for considering the use of Muscle Wall™ for cofferdam construction might include utilization in water levels less than half the height of the units, use in locations that will not expose units to hydrodynamic forces, and implementation of a pumping system that can match or exceed the cumulative inflow rate of leakage.

Removal of Cofferdam 3 started on August 6, 2015 and was completed on August 13, 2015. The Muscle Wall™ and concrete bin blocks used for cofferdam construction were transported to the Dewatering Pad in Zone 7 for decontamination. Cofferdam removal exceeded the planned schedule by 5 days, but ultimately this additional time did not impact the overall schedule. The additional time was due, in part, to our staff performing a number of concurrent tasks,
for which resource utilization was prioritized on preparing Zone 5 for excavation over Cofferdam 3 removal. The installed duration was exceeded by 14 days, which can be largely attributed to the complications experienced during excavation, sampling, transportation, and disposal activities for Deposits 4-1 and 4-2.

4.3.3 Zone 4 Investigation Remediation and Restoration

4.3.3.1 Zone 4 Pre-Removal Sediment Sampling

Sampling for pre-removal sediment characterization in Deposit 4-1 began on February 26, 2015 and was completed May 13, 2015. A total of 139 pre-removal core samples were collected to define the lateral extent of contaminated sediments in Deposits 4-1 and 4-2, including step-out samples. This resulted in a total of 450 pre-removal samples analyzed after the cores were segmented into discrete segments, as detailed in Section 3.2.1.

Twelve pre-removal core samples were attempted in Deposit 4-3 by using a geoprobe through thick ice cover, but all attempts encountered refusal due to shallow bedrock at approximately 8 inches. Because none of the sampling attempts collected sufficient material required for validity in accordance with the SAP, the remedial action for Deposit 4-3 was cancelled.

Pre-removal sampling was conducted successfully to define the lateral extent of contamination in Deposits 4-1 and 4-2. Analytical results for pre-removal samples, including step-out samples, were collected from Deposits 4-1 and 4-2 with non-TSCA grids measuring 25 by 25 feet and TSCA grids measuring 12.5 by 12.5 feet. Pre-removal core samples were collected on dry land accessible prior to and after dewatering by using hand-driven coring equipment or a direct-push technology (DPT) rig with dual-track mobility. Pre-removal core samples were collected in standing water conditions prior to initiation of Zone 4 dewatering operations by using a DPT rig mounted on the bow of an airboat.

Pre-removal sampling results indicated the presence of contamination levels exceeding RGs for non-TSCA were detected in 31 of the 53 total grids sampled for Deposit 4-1 and 15 of the 44 total grids sampled for Deposit 4-2. The presence of sediments with contamination levels exceeding RGs for TSCA were identified in 27 of the 30 grids sampled for Deposit 4-1 and 10 of the 12 grids sampled for Deposit 4-2. The extent of contamination for Deposits 4-1 and 4-2 are depicted on Figure 4-13. The greatest depth of RG exceedance was 2 to 3 ft. Both NAPL sheen and odor were observed within the deposit during pre-removal sampling.
As pre-removal sampling progressed for Deposits 4-1 and 4-2, in accordance with the approved SAP, the decision-making process for delineating the TSCA extent became more complex than encountered to date. The complexity arose from step-out sampling performed to delineate the extent of TSCA material within the sediment deposits; this sampling was generating TSCA grids that overlapped with ‘regular’ grids that were determined by sampling results to meet the RGs. This was further complicated by efforts to collect step-out core samples without extending beyond the 617-foot elevation. The EQM Team analyzed two different approaches for delineating TSCA extents: the point-to-point approach and the grid-by-grid approach. The point-to-point basis of drawing the lateral extent of TSCA contamination reduced the potential for excavating portions of ‘clean’ grids where step-out sampling is limited. The grid-by-grid basis of drawing the lateral TSCA extents was considered where additional step-out grids successfully sampled and overlapping grid boundaries were considered to optimize the excavation boundaries. Maps were generated to explore these options for delineating deposits to be excavated in Deposits 4-1 and 4-2 to illustrate these potential approaches to delineating the extent of TSCA contamination, and to present to the PCT the excavation strategy. The volumes were estimated under each of the two scenarios being considered by using a common excavation thickness for all grids within a TSCA area (i.e., not computer-generated, three-dimensional volumes). The EQM Team recommended using the point-to-point basis because it resulted in smaller disposal volumes, was consistent with the approved SAP and previous remedial excavation completed to date, and offered potential cost savings associated with additional sampling. The point-to-point basis of delineating the TSCA area for excavation was approved by the PCT as the preferred approach, and was applied for delineating the extent of TSCA levels for remedial excavation that remained for Deposit 5-1.

4.3.3.2 Zone 4 High-Volume and In-Situ Dewatering

The high-volume pumping system with bag filtration was not employed for initial dewatering of Cofferdam 3. The EQM Team decided the water volume within the 0.42-acre area isolated by Cofferdam 3 was minor enough to perform initial dewatering using the in-situ dewatering system. Thus, both the initial and in-situ phases of dewatering for the adjoining Deposits 4-1 and 4-2 were used to pump the excavation water to the WWTP for treatment, rather than employing the high-volume pumping system with bag filtration used for initial dewatering in the
other remedial action zones. Dewatering operations for the Deposits 4-1 and 4-2 was initiated on June 30, 2015 and was shut down on July 29, 2015 after remedial and restoration activities were completed. Details regarding surface sediment dewatering and in-situ and ex-situ dewatering are provided in Table 4-21.

The challenges with managing the water leaking through the Muscle Wall in Cofferdam 3 limited the ability to remove standing water from Deposits 4-1 and 4-2 during excavation. The free water surface increased the risk of cross-contamination between excavation grids and contamination escaping the cofferdam isolation area. Muscle Wall™ and concrete bin blocks were installed in the interior of Cofferdam 3 to isolate individual and small groupings of excavation grids in order to facilitate dewatering by reducing the volume of water to be removed. Smaller 4-inch (jack) pumps and 2-inch (trash) pumps were utilized to transfer water from excavation grids to the sump in Grid 4 of Deposit 4-1; the water was then pumped to the WWTP for treatment. Approximately 3,233,200 gallons of water were processed through the WWTP system for initial, in-situ, and ex-situ dewatering.

4.3.3.3 Zone 4 Remedial Excavation

EQM and AECOM prepared the Deposit 4-1 and 4-2 Excavation Plan to guide removal efforts. The plan was similar in format and content as plans prepared for Zone 7. Figure 1 from the Deposit 4-1 and 4-2 Excavation Plan depicts the planned removal grids and their associated target depths. Planned removal in Deposit 4-1 consisted of 185 CY of sediments requiring TSCA disposal and 859 CY of sediments requiring solid waste disposal. Planned removal in Deposit 4-2 consisted of 64 CY of sediments requiring TSCA disposal and 636 CY of sediments requiring solid waste disposal.

Contaminated sediment removal was more challenging in this zone due to a number of circumstances that included:

- Complications with Cofferdam 3 and associated dewatering.
- Logistics associated with remoteness of the zone from the dewatering pad
  - Excavated waste could not be left stockpiled in the excavation area overnight
  - Direct loading of disposal vehicles provided little flexibility in planned daily excavation activities.
- Merging of deposits into one continuous deposit while trying to maintain the separate nomenclature for the original two deposits complicated sampling and associated documentation.
Shallow bedrock conditions complicated mechanical removal operations.

These complicating circumstances were addressed collectively by frequent communication between the EQM team and PCT, and coordination between the EQM Team and supporting subcontractors.

The remedial action for Zone 4 started with Deposit 4-1 on July 6, 2015, and excavation in Deposit 4-2 started on July 8, 2015. The proximity of Deposits 4-1 and 4-2 allowed for readily alternating excavation activities between deposits, which prevented excavation from being suspended while waiting for analytical results to be released. The initial priority was focused on completing the excavation in the TSCA grids before moving to the non-TSCA grids in both deposits.

Excavated sediment was direct loaded into disposal facility transport vehicles and transferred in licensed hazardous waste transport vehicles to the dewatering pad. Although the intent was to direct load the disposal vehicles on three of the removal days, material was transferred to the dewatering pad for subsequent disposal shipment in order to maintain excavation productivity and not stockpile material in the excavation zones. Table 4-22 summarizes grid excavation activity by date and when material was transferred to the dewatering pad. On dates when no material was transferred to the dewatering pad, waste was direct loaded and shipped to the disposal facility. Shipment information is provided in Tables 4-23 and 4-24.

During the excavation of TSCA sediments from Grids 61 and 75 of Deposit 4-1, bedrock was encountered that could not be effectively removed to meet RGs using an excavator. The specifications permitted residual sediments to exceed RGs, but required implementation of a residual management program that specified placing a 6-inch cover of sand over the areas of remaining concentrations that exceeded RGs. However, the specifications did not anticipate that residuals would exceed TSCA levels as in the case of Grid 75, where post-removal sampling analyses reported 150 mg/kg after excavation to refusal. The project team re-evaluated the placement of a 6-inch sand cover as a way to manage residual sediments that exceeded TSCA levels, and the Excavation Plan was amended to include a decision tree for encountering residual sediments that exceeded TSCA-level concentrations that incorporated the use of hydro-excavation to remove these sediments when encountered. On July 28, 2016 EQM agreed with the PCT to further excavate Grid 75 using the hydro-excavation technique to remove residual PCB
sediment and then cover these grids with a 6-inch layer of sand backfill to address the remaining residual contaminants (this is further discussed in Section 4.3.3.5).

Remedial excavation was completed in Deposit 4-2 on July 20, 2015, and Deposit 4-1 was completed on July 29, 2015. The total volume of contaminated sediment removed during the Zone 4 remedial action was approximately 1,849 CY over a total surface area of 0.56 acres. The resultant removal quantity exceeded the planned removal quantity by 169 CY.

4.3.3.4 Zone 4 Post-Removal Confirmation Sampling

Post-removal sampling was typically conducted shortly after excavation in a particular grid was completed to the prescribed depth. A total of 93 post-removal core samples were collected. On July 20, 2015, excavation was initiated to remove 0.5 foot of TSCA material left on top of the bedrock encountered in Grid 15, which was the last grid to be excavated to complete remedial action in Deposit 4-2. The approximate 3-foot-high southern sidewall of Grid 15 suddenly collapsed from the pressure of water retained in the adjacent grid, thereby allowing water to flood the excavation. A makeshift sand bag dike was constructed along the collapsed portion of Grid 15 and in-situ dewatering was resumed in order to complete the excavation. Shortly after the excavation was completed, the southern bank failed for the second time and flooded Grid 15 once again. Due to the water inundation and minimal sediment thickness observed, the post removal sample for grid 15 was collected using Ponar sampling techniques at the predetermined random location to confirm RAOs were met.

Deposit 4-1

PCB and PAH post removal analytical results met RGs throughout the deposit in the excavated grids (Table 4-23 and Figure 4-15). Residual contamination of both PCBs and PAHs still occurs within the central TSCA area between Deposits 4-1 and 4-2. Sediment in that area was excavated to bedrock and covered with 6 inches of clean sand. All remaining PAH and PCB exceedances met the PAHs and PCBs SWAC calculation RG of 20 mg/kg and 1 mg/kg, respectively.
Deposit 4-2

PCB and PAH post removal analytical results met RGs throughout the deposit in the excavated grids (Table 4-24 and Figure 4-16). All remaining PAH and PCB point goal exceedances met the PAHs and PCBs SWAC calculation RG of 20 mg/kg and 1 mg/kg, respectively.

4.3.3.5 Zone 4 Residual Management

Some grids could not be excavated sufficiently to pass post-removal sampling analysis to meet RGs. Grids 75 and 61 in Deposit 4-1 were excavated to bedrock, but post-excavation samples of the residual materials did not meet RGs. Grid 61 in Deposit 4-1 was suitable for residual management with a 6-inch sand cover to meet RGs. RGs could not be met even with the placement of a 6-inch sand cover over residual sediments in Grid 75 of Deposit 4-1 (which contained TSCA Grids 105 and 106). This was due to the residual PCB concentrations of the post-removal sample at 150 mg/kg. Vacuum excavation of the residual sediments in Grid 75 was selected as the approach to conduct further removal of residual material to meet RGs due to complications encountered that prevented complete dewatering of Grid 75 to facilitate further mechanical residual removal.

Vacuum excavation was performed on July 29, 2015 by local subcontractor Northshore Contracting, Inc. (NCI). SES working with NCI vacuum excavated 2.92 CY of residual sediment as determined by pre- and post-removal surveying performed by AECOM surveyors to complete cut/fill calculations. Residual materials were taken to the TSCA portion of the dewatering pad for ex-situ dewatering, and the vacuum truck collection vessel was decontaminated prior to leaving the site. A 6-inch sand cover was placed over Grids 61 and 75 in early August 2015 concurrently with other sand backfilling activities to restore the area. The sand cover area is depicted in Figure 3-8. The surface area of sand cover was approximately 1,281 SF.

4.3.3.6 Zone 4 Ex-Situ Dewatering and Solidification

During the remedial excavation performed in Zone 4, 272 tons of solidification agents were utilized to prepare the 1,849 CY of sediment removed for off-site disposal. A total of 3,907 tons of solid waste and TSCA sediments were disposed of from Zone 4. Therefore, the 272 tons of solidification agent accounted for 0.46% of the disposal tonnage. Sediment disposal averaged 2.11 tons per CY.
**4.3.3.7 Zone 4 Disposal of Solid Waste and TSCA Sediments**

Disposal of Zone 4 solid waste began on July 7, 2015 and was completed on July 21, 2015. During the course of remedial action for Zone 4, a total of 104 truckloads transported 3,018 tons of Non-TSCA sediment and 39 truckloads transported 890 tons of TSCA sediment for offsite landfill disposal. Table 4-25 summarizes solid waste transportation and disposal activity. Disposal of Zone 4 TSCA waste began on July 6, 2015 and was completed on July 23, 2015 and is summarized in Table 4-26.

**4.3.3.8 Zone 4 Restoration**

Restoration in Zone 4 included temporary infrastructure removal, sand placement in Deposit 4-1 and 4-2 excavation areas, topsoil replacement, and seeding. Restoration activities began with sand placement and cofferdam removal. The haul roads and decontamination pad were removed once utilization was no longer required. The restoration features are depicted in Figure 3-8. A total of 27 pre-construction samples were collected from the proposed haul road areas, five samples were selected from the proposed conveyance pipeline alignment, and five samples were collected from the decontamination pad location. The analytical results of pre-construction sampling were compared with post-construction sampling results collected from the same locations to confirm contaminants were not introduced to native soils during construction activities.

EQM submitted RFI 33 on July 1, 2015 requesting clarification of restoration work in Zone 4 as a result of a variance of actual contaminated sediment removal work from the designed removal extent. USEPA replied on July 15, 2015 with a revised restoration design that realigned sand, topsoil, wetland planting, log/root wads, and boulder cluster placement. EQM performed restorative construction work in accordance with the restoration design provided with the response to RFI 33. Restoration features are depicted in Figure 3-8. Pavement replacement was unnecessary in Zone 4. The only paved surface that could be damaged during construction operations were the curbs along West Hampton Boulevard, but use of 4-inch by 4-inch boards, gravel, and plywood prevented significant damage requiring repairs.

**Zone 4 Sand Placement**

Sand backfilling work in Deposits 4-1 and 4-2 began on August 4, 2015 and was completed on August 6, 2015. The area of sand placement is depicted by the yellow shading beneath
green wetland cross-hatching in Figure 3-8. A total of 644.68 CY of sand was placed over a surface area of 16,275.30 SF (0.37 acre). A total of 1,228.65 tons were imported for placement.

**Zone 4 Topsoil Restoration**

Topsoil placement began on August 6, 2015 and was completed on August 8, 2015 in the wetland and streambank areas. The area of topsoil placement is depicted by the green wetland cross-hatching and brown streambank cross hatching in Figure 3-8. A total of 620 CY of topsoil was placed over a surface area of 24,207.46 SF (0.37 acre) for wetland restoration. Zone 4 wetland restoration areas were planted with 770 herbaceous plants, 109 trees, and 47 shrubs suitable for wetland habitat; then the area was seeded with a native grass seed mix. Replacement of the topsoil removed from areas used for constructing temporary infrastructure in Zone 4 was completed on September 24, 2015. The infrastructure removal area of topsoil placement is depicted by the red upland cross-hatching in Figure 3-8. A total of 532.16 CY of upland topsoil was placed over a surface area of 39,016.68 SF.

**Zone 4 Infrastructure Removal**

Infrastructure removal in Zone 4 included the cofferdam segments, haul roads, Zone 4 and 5 conveyance pipelines to the WWTP, and security fencing. Cofferdam removal information is summarized in Table 4-6. Infrastructure removal began on August 13, 2015 and was completed on September 22, 2015 with the exception of the security fencing. The security fencing footprint was reduced but not totally removed on September 25, 2015. The remaining security fence will stay in place until vegetation establishment/acceptance, which is anticipated in mid-July 2016. Removal of a temporary infrastructure from Zone 4 resulted in 37 truckloads transporting 950 tons of solid waste, which was handled as Non-TSCA waste for off-site landfill disposal. The area was prepared for seeding between May 7 and 18, 2015. The area was seeded with the no-mow/low-grow seed mixture on May 19, 2015.

**Zone 4 Streambank and Upland Revegetation**

Revegetation and hydro-seeding began in Zone 4 on September 15, 2016 and was completed on September 16, 2015. The 0.9-acre upland topsoil area was seeded at a rate of 200 lbs/acre with the no-mow/low-grow grass mixture, and the 0.2-acre streambank restoration area
was seeded with a native seed mixture as depicted in Figure 3-8. The seed mixture was applied at a rate of 16.76 lbs/acre. AES planted upland areas in Zones 4 with trees species that included Bitternut Hickory’s, Kentucky Coffee trees, American Elms, and American Basswoods.

4.4 Zone 5 Remedial Action: Deposit 5-1

4.4.1 Zone 5 Scope of Work

Zone 5 required site preparation similar in scope to Zones 3 and 4. Remediation and restoration was planned for Deposit 5-1. Deposit 5-1 is located downstream of the Port Washington Road Bridge and upstream from the Estabrook Dam as depicted in Figure 2-1. The site preparation, remediation, and restoration scope of work included:

- Installation of one construction entrance at the junction of the access haul road to N Estabrook Lane.
- Installation of one 20-foot-wide by 1,840-foot-long access haul road with a footprint of 36,800 SF constructed of geotextile and road aggregate.
- Clearing and grubbing of vegetation along the haul road route and riverbank for deposit access.
- Construction of the topsoil stockpile storage area that required installation of a 180-LF silt fence around the stockpile footprint perimeter.
- Installation of a 3,240-LF temporary chain-link fence to restrict site access.
- Installation of one decontamination pad.
- Installation of a 952-LF Muscle Wall™ cofferdam to isolate Deposit 5-1 from the main river channel.
- Installation of pumping systems to dewater Deposit 5-1 with pumps, an energy dissipation pad, and conveyance pipeline network to distribute water to WWTP.
- Dewatering of a 168,080-SF surface area confined by a cofferdam with in-stream restoration and habitat construction.
- Collection and analyses of 28 grid core samples based on the 68,687-SF limits of removal area in the RFTOP Design Drawings.
- Excavation of Deposit 5-1 to remove and dispose of 9,488 CY of non-TSCA regulated material/sediment as solid waste and 242 CY of contaminated sediment requiring disposal as TSCA waste.
- Restoration of 8,942 SF of wetland along the west shore and on the center channel island, which included revegetation with native plantings.
- Restoration of the disturbed streambank and upland areas with 11,331 SF of native seeding and 37,411 SF of no-mow/low-grow seeding.
4.4.2 Zone 5 Preparation

4.4.2.1 Zone 5 Clearing and Grubbing

Clearing and grubbing began in Zone 5 on October 2, 2014 and were completed on April 8, 2015. The extensive period for performing clearing and grubbing activities is attributed to the slow receipt of access agreements from the property stakeholders that delayed work completion. EQM’s local specialty subcontractor Limb Walkers, Inc. was mobilized to begin clearing and grubbing once initial access agreements were received; however, one of the property owners took much longer to consent to property access than anticipated. This resulted in multiple mobilizations of Limb Walkers, Inc., and extended the performance far beyond the original construction schedule. Tree candidates for harvesting and reuse as log/rootwads were identified during the initial pre-construction meeting held on October 13, 2014. The trees harvested for reuse were carefully removed to preserve a portion of the rootwad and then stockpiled on site until they were needed for restoration activities.

Clearing and grubbing of trees and underbrush over an approximate area of 62,050 SF took place intermittently between November 14, 2014 and April 2, 2015. SES stripped and stockpiled soil from infrastructure improvements that mainly consisted of the access haul road over a surface area of approximately 42,090 SF. Some of the topsoil was stockpiled in an area surrounded by silt fence and covered with tarps for subsequent reuse. Pre-construction sampling identified that some of the topsoil being stripped exceeded RGs for the site and could not be used as topsoil backfill. Therefore, 515.15 tons of native topsoil was stripped in preparation for haul road construction and was disposed of as solid waste on April 16-17, 2015. The remaining 527 CY of topsoil removed possessed numerous roots and woody debris and was not suitable for use as topsoil backfill for restoration. EQM requested in RFI 38 to dispose of the remaining topsoil at WM. This request was denied; however, EPA’s engineer EA reviewed different alternatives for reuse in lieu of disposal. It was agreed that the material was not suitable for restoration of upland areas but could be used as core fill material for wetland area restoration. EQM was required to remove rocks, concrete, and other foreign debris from the stockpiled topsoil material prior to utilization as wetland backfill material. EQM utilized the material to supplement wetland sand backfill.
4.4.2.2 Zone 5 Haul Road Construction

Haul road construction in Zone 5 began on November 21, 2014 and was completed on April 15, 2015. Pre-installation surveying and staking was performed between November 21 and 22, 2014 to aid in obtaining access agreements by delineating the haul road footprint so that property owners could envision disturbed areas. The haul road was constructed between April 13 and 15, 2015. The haul road extended northeast from the gravel lot used as mobile equipment storage area and turned to the northwest and then split into legs to the northwest and to the southeast running parallel along the river shoreline. The entire haul road length was approximately 1,637 LF over a surface area of approximately 42,088 SF.

4.4.2.3 Zone 5 Cofferdam Isolation Area

Cofferdam 4 was constructed in one segment to isolate Deposit 5-1, as depicted in Figure 3-9. This cofferdam was constructed from concrete “Jersey” barriers and super sack sand bags as described earlier in this section. The same materials were used to construct an additional wall segment perpendicular to the primary cofferdam wall to bisect Deposit 5-1 into two smaller areas, similar to the approach used in Zone 4. This approach facilitated more effective dewatering and reduced the volume of water sent to the WWTP at any one time. Water removed from the half where active excavation was occurring was pumped to the WWTP via conveyance pipeline, while the inactive half was dewatered simultaneously using the high-volume dewatering system. This dewatering approach was first applied during remedial excavation of the southern half of Deposit 5-1, and then these simultaneous dewatering operations were switched to complete excavation in the northern half of Deposit 5-1.

This approach of bisecting the isolation area and then simultaneously operating the high-volume and in-situ dewatering systems proved to be more effective in Zone 5 than it was for Zone 4. This was due in large part to the improved impermeability provided by the jersey barrier and sand super sack materials used to construct the primary cofferdam wall in Zone 5. As previously discussed, the Muscle Wall used to construct the Zone 4 cofferdam was prone to persistent leakage that challenged the effectiveness of dewatering grids farther into the channel and otherwise below the water surface.
4.4.3 Zone 5 Investigation Remediation and Restoration

4.4.3.1 Zone 5 Pre-Removal Sediment Sampling

Deposit 5-1 pre-removal sampling began on March 4, 2015 and was completed on June 25, 2015. Sixty-two 50-foot by 50-foot grids and forty-one 12.5-foot by 12.5-foot grids were sampled; forty-three 50-foot by 50-foot grids and thirty-nine 12.5-foot by 12.5-foot grids exceeded RGs. The extent of contamination is depicted in Figure 4-17. Cores were pushed to 4 ft or refusal via a direct-push rig on dewatered sediment, through ice, from a boat, and with a hand DPT. Sample recovery, which was typically 75% or greater, was affected by sampling to refusal and sand or debris at the bottom of the core. A sheen was not observed in the deposit, but odor was noted throughout the deposit.

PCBs at concentrations greater than the RG and less than 50 mg/kg were confirmed (Table 3-21). PCBs at concentrations greater than 50 mg/kg (i.e., TSCA levels) were confirmed near the spillway. Previously unidentified TSCA hot spots also occurred in grids in the northwestern portion of the deposit (Figure 4-17. The greatest depth of TSCA level remedial goal exceedances was typically 0.0 to 1.0 foot with a maximum exceedance depth interval of 1.0 to 2.0 ft. PAHs were detected at concentrations above remedial goals (20 mg/kg) throughout the deposit (Figure 4-17 and Table 3-21). The depth of PAH RG exceedances was typically less than 2.0 ft.

4.4.3.2 Zone 5 High-Volume and In-Situ Dewatering

Approximately 3.7 acres of the Zone 5 excavation area in Deposit 5-1 were isolated by Cofferdam 4 from the main stream of the Milwaukee River Channel. An internal barrier wall was installed to allow for segregated surface and sediment dewatering in the east and west sections of Deposit 5-1 to best manage overall dewatering activities. Details regarding pumping periods and quantification of water handling for surface and sediment dewatering are presented in Table 4-27. Surface dewatering with high-volume pumps and bag filtration units was discharged through Outfall 004 located downstream of the Estabrook Spillway Dam near the southeast end as shown in Figure 3-1. In-situ and decontamination pad water were pumped through the 6,357-foot-long pipeline to the WWTP. Surface dewatering of the entire excavation area took place between August 6, 2015 and August 7, 2015 to prepare the deposit for excavation. High-volume pumping of the western portion of Zone 5 was performed between August 8, 2015 and September 1, 2015.
Pumping was regulated to keep water levels above 1 foot of the sediment surface during this period. During this period, in-situ sediment dewatering of the eastern portion with discharge to the WWTP was ongoing to facilitate excavation in the dry. On September 3, 2015, pumping systems were reconfigured to perform high-volume pumping from the eastern portion and in-situ dewatering from the western portion. This continued through September 15, 2015, when remediation activities were deemed complete. High-volume pumping of the western portion of the excavation area resumed on September 16, 2015 and continued to September 17, 2015 to facilitate wetland and streambank restoration work. Surface dewatering and discharge through Outfall 004 totaled 31,764,000 gallons, and sediment dewatering through the WWTP processed 12,179,600 gallons of water.

4.4.3.3 Zone 5 Remedial Excavation

EQM and AECOM prepared the Deposit 5 Excavation Plan to guide removal efforts with similar subject content and format as previous plans. Figure 1 from the Deposit 5-1 Excavation Plan depicts the grids targeted for removal and their associated removal depths. Planned removal in Deposit 5-1 consisted of removing 567 CY of sediment requiring TSCA disposal and 5,801 CY of sediment requiring solid waste disposal for total sediment removal of 6,368 CY.

Contaminated sediment removal work began in Deposit 5-1 on August 12, 2015 and was completed on September 12, 2015. Thirty-eight 50-foot by 50-foot solid waste grids and forty-six 12.5-foot by 12.5-foot TSCA grids were targeted for removal based on the Deposit 5-1 Excavation Plan. Targeted removal depths ranged from <1 foot to 4 ft. Table 4-28 summarizes excavation activities with respect to which grids were excavated on a given date and when material was transferred to the Dewatering Pad in Zone 7.

The remote location of Zone 5 from the Zone 7 dewatering pad and the permit requirements of not stockpiling waste overnight in the excavation area affected the handling of excavated sediment as was the case in Zone 4. The work approach incorporated the adaptive management practice of both direct loading into disposal facility transport vehicles and/or transferring material in licensed hazardous waste transport vehicles to the dewatering pad when disposal trucking capacity was not available to keep excavation progressing. As a further measure, roll-off boxes were provided and staged in the Zone 5 support area to contain excavated waste if it could not be directly shipped to the disposal facility or transferred to the dewatering pad in Zone
7. However, circumstances did not arise that required the use of the roll-off boxes as temporary storage to mitigate overnight stockpiling in the excavation zone. All excavated sediment was either liveloaded and shipped directly to the disposal facility in the same day it was excavated or transferred to the dewatering in Zone for subsequent shipment. Table 4-28 demonstrates the dates and number of trucks sent to the dewatering on those days when disposal truck capacity varied from daily excavation volume.

All grids in Deposit 5-1 were excavated to refusal when bedrock was encountered. Grids T6-03, T6-04, T4-04, 43, and 44 confirmatory samples from the residual sediment exceeded RGs, and the grids received 6 inches of residual sand cover. Additional details concerning the residual sand covered are provided in Section 4.4.3.5 of this report.

Post-removal sampling results for Deposit 5-1 are included in Table 4-29 in Appendix B and are depicted in Figure 4-18. Figure 3-19 depicts the lateral and vertical contaminated sediment removal extent. A cut/fill calculation based on pre- and post-removal surveying data determined that 8,146.22 CY of contaminated sediment were removed from Deposit 7-4 over a surface area of 76,453.77 SF. This removal volume varied from the planned amount by 1,778 CY. This volume increase was greatly attributable to removing sediments to greater depths in grids adjacent to the center of the spillway dam to meet RGs as well as re-excavation of grids when RGs were not within planned removal depths.

4.4.3.4 Zone 5 Post-Removal Sampling

Although PCB and PAH point goal exceedances occurred in Deposit 5-1, the PCB and PAH SWAC RGs were met (Table 4-29 and Figure 4-18). All grids in Zone 5 were excavated to bedrock. Residual cover was placed in the TSCA area located in the central spillway of the Estabrook Dam. The residual cover consisted of 6 inches of clean sand. All remaining PAH and PCB exceedances meet the PAH and PCB SWAC calculation RG of 20 mg/kg and 1 mg/kg, respectively.

4.4.3.5 Zone 5 Residual Management

Grids T6-03, 33, T6-04, 44, T4-04, 53, 43, and 52 were excavated to bedrock but did not meet RGs. Residual contaminant levels were managed with a 6-inch sand cover. On September 1, 2015, 499.63 tons of sand were placed in a 6-inch-thick lift over the surface area of 6,119 SF.
Residual sand cover was placed over these grids that were located in the central area of the channel adjacent to the Estabrook Dam Spillway. The location of the residual cover placement area is depicted in Figure 3-9 i.

4.4.3.6 Zone 5 Ex-Situ Dewatering and Solidification

Sediments excavated from Deposit 5-1 were primarily live-loaded for direct shipment from Zone 5 to off-site landfills for disposal. Sediments that were not sufficiently consolidated for live-loading were placed in adjacent grids not meeting RGs that had similar levels of contamination. The excavated sediment was amended with solidification agent before live-loading the material for transportation to the landfill. Approximately 117 tons of solidification agent was used to solidify sediments excavated from Zone 5. A total of 8,146 CYs of sediment were removed from Deposit 5-1, which resulted in 15,895 tons of TSCA and solid waste disposal. Solidification agent accounted for 0.73% of the disposal tonnage. Sediment disposal averaged 1.95 tons per CY, which the increase is attributable to direct loading the majority of the sediments from the excavation area without the benefit of ex-situ dewatering on the Zone 7 pad.

4.4.3.7 Zone 5 Disposal of Solid Waste and TSCA Sediments

Zone 5 required solid waste disposal and TSCA disposal from Deposit 5-1. Some waste was direct loaded and shipped to the respective landfill, and some wastes were sent to the dewatering pad in the Zone 7 support area and subsequently shipped for disposal from there. Disposal of Zone 5 solid waste began on August 13, 2015 and was completed on September 12, 2015. Table 4-30 summarizes solid waste transportation and disposal activity.

Disposal of Zone 5 TSCA waste began on August 12, 2015 and was completed on September 4, 2015. Table 4-31 summarizes solid waste transportation and disposal activity.

4.4.3.8 Zone 5 Restoration

Restoration in Zone 5 included temporary infrastructure removal; sand placement in the Deposit 5-1 wetland replacement area; topsoil replacement and seeding for the streambank, wetland, and upland infrastructure removal areas, and the island; and out-of-scope erosion control measures. Restoration activities began with sand placement and cofferdam removal. The haul roads and decontamination pads were removed once they were no longer required. At the request
of the property owner, the gravel staging area near the construction entrance to Zone 5 was left in place. The restoration features are depicted in Figure 3-9.

**Zone 5 Sand Placement**

Sand backfilling work in Deposit 5-1 began on September 14, 2015 and was completed on September 15, 2015. The area of sand placement is depicted by the yellow shading beneath the green wetland cross-hatching in Figure 3-9. A total 721.07 CY of sand was placed over a surface area of 5,023.54 SF (0.12 acre). A total of 497.87 tons were imported for placement.

**Zone 5 Topsoil Restoration**

Topsoil placement began on September 15, 2015 and was completed on October 16, 2015 in the island, wetland, streambank, and upland areas where temporary infrastructure improvements were removed. The areas of topsoil placement are depicted by the green wetland cross-hatching, brown streambank cross-hatching, blue island cross-hatching, violet in-channel cross-hatching, and red upland cross-hatching in Figure 3-9. Table 4-32 summarizes topsoil placement activities.

**Zone 5 Infrastructure Removal**

Infrastructure removal in Zone 5 included the cofferdam segments, haul roads, Zone 4 and 5 conveyance pipeline to the WWTP, and security fencing. Cofferdam dam removal information is summarized in Table 3-12. Infrastructure removal began on September 15, 2015 and was completed October 5, 2015 with the exception of the security fencing. The security fencing footprint was reduced, but not totally removed on November 12, 2015. The remaining security fence will stay in place until vegetation establishment/acceptance, which is anticipated middle of July 2016.

**Zone 5 Island, Streambank, Wetland, In-Channel and Upland Revegetation**

Revegetation began in Zone 5 with hydro-seeding and installation of an erosion-control blanket on the portion of the island backfilled with topsoil. These activities were completed on September 16, 2016. The native seed mixture was applied over the backfilled area at a rate of 16.76 lbs/acre. The streambank, wetland, in-channel, and upland areas were seeded between Oc-
October 5 and 8, 2015. The native seed mixture was applied at a rate of 16/76 lbs/acre to the 0.29-acre area of the in-channel, streambank, and wetland areas, and the no-mow/low-grow seed mixture was applied to the 1.33-acre upland areas at a rate of 200 lbs/acre. Seeding was performed by AES.

Zone 5 Erosion-Control Features

EQM installed four erosion-control features that were out of scope for Zone 5 restoration work. These erosion-control features are depicted in Figure 3-9 as restoration riprap. The erosion feature depicted at the southeast end of the excavation area required riprap placement around the end of a concrete storm drain pipe that extended into the excavation area. The three remaining features were required to mitigate the impact to restoration planting from future storm events. The need for these erosion repair features was identified as a result of a rain event that occurred on September 19, 2015 during infrastructure removal, which created erosion rills and gullies in the streambank at the west end of the excavation area and the central portion of the haul road area. The erosion damage was attributed to storm water runoff from parking lots on two of the neighboring properties. Neither of these properties possessed storm water catch basins or other storm water controls. Heavy precipitation events result in a heavy stream of water that flows onto the site and down the riverbank. EQM worked with the PCT and oversight personnel to develop a remedy to mitigate further erosion. On September 25, 2015 EQM submitted a cost estimate for constructing the erosion repair features and notified EPA that features would be constructed at risk to correct the problem but that a Request for Equitable Adjustment (REA) would be submitted.

The erosion repair features were constructed between September 28, 2015 and October 6, 2015. The repair features were constructed by grading out the rills and gullies with the excavator bucket creating a depressed pathway for storm water flow, placing geotextile over the footprint of the repair area, and covering geotextile with a 6-inch to 10-inch layer of 4-inch to 8-inch riprap.
5. CONCLUSION

5.1 Summary of High-Volume, In-Situ Dewatering, and Water Treatment

Tables 4-1, 4-8, 4-21, and 4-27 summarize water volumes removed from work zone isolation areas during high-volume and in-situ dewatering operations for each zone as well as water volumes treated using the WWTP. Table 5-1 presents a summary of the water treatment activities.

5.2 Construction Soil Sampling

Pre- and post-construction sampling resulted in the collection of 638 pre-construction samples and 388 post-construction samples. This data was evaluated to determine if remedial action activities impacted areas disturbed to install temporary infrastructure improvements. Contaminants of concern were detected in both pre- and post-constructions samples. Upon evaluation, it was determined that post-construction results (while individual results varied somewhat) were consistent with historical levels of contamination prior to conducting the remedial action. Therefore, no excavation and associated disposal was required of EQM resulting from site practices associated with the remedial action.

Post-Construction soil samples were collected and analyzed for PCBs, PAHs, and Oil and Grease following the procedures and specifications for pre-construction sampling discussed in Section 3.1.5. Surveyed pre-construction sampling locations were used to locate post-construction soil sample locations for direct comparison as shown in Figures 3-2 through 3-5 by zone. A total of 54 post-construction five-point composite samples (plus QC) were collected. The number of post-construction samples differs from the number of pre-construction samples because laydown areas were adjusted based on field conditions and contractor approach. Results from post-construction soil sample results above the method detection limit (MDL) were compared to the corresponding pre-construction soil sample results at or above the MDL at the same location. Any results between the MDL and laboratory reporting limit were qualified as estimated and ‘J’ flagged.
The SAP indicates that additional soil management/removal actions may be required for pre- and post-construction sampling results under one of the two following conditions:

1. If a post-construction sampling result for any detected compound of concern (COC) greater than the laboratory reporting limit (RL) exceeds the corresponding pre-construction sampling result for that detected COC by more than 20 percent, or
2. If a post-construction sampling result for any detected COC greater than the RL exceeds the corresponding pre-construction non-detect (less than RL) by more than 30 percent.

In the event the post-construction sampling result or both sampling results are below the laboratory reporting limit, or the post-construction sampling result or both sampling results are between the MDL and laboratory reporting limit, no action will be taken unless directed by the PCT.

Tables 3-5 through 3-8 summarize the results of post-construction soil samples in comparison to pre-construction samples collected in each zone. Across the site, a total of 16 total PAH exceedances (either 20% or 30% SAP rule exceedances) and 4 total PCB exceedances (either 20% or 30% SAP rule exceedances) were detected in three of the four zones. Each of these location’s sample IDs are presented below from upstream to downstream:

**Zone 3:**

PAH Exceedances: SS03-DP-01  
PCB Exceedances: SS03-CP-02

**Zone 7:**

PAH Exceedances:  
SS07-AR-04    SS07-CP-01    SS07-CP-03    SS07-DW-02    SS07-DW-07  
SS07-AR-07    SS07-CP-02    SS07-DW-01    SS07-DW-05    SS07-ME-01  
SS07-ME-02

PCB Exceedances:  
SS07-AR-08, SS07-CP-01, and SS07-CP-02

**Zone 5:**

PAH Exceedances:  
SS05-AR-02, SS05-TP02A-W, SS05-TP02B-W and SS05-TP02D-W

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4 “W” in sample ID indicates a Wheaton property sample, which was collected at a frequency of 4:10,000 square feet (sq ft) instead of 1:10,000 sq ft required by specifications.
To evaluate the exceedance of the SAP criteria (>20% increase in post-construction concentration above pre-construction for detected constituents or 30% increase for non-detections) at these locations, multiple lines of evidence were evaluated:

- There were no spills or leaks observed at each location.
- The suite of PAHs detected is the same as detected at other pre- and post-construction sampling locations. The suite is consistent with an ambient urban environment.
- Reported total PCBs concentrations are less than the reporting limit and well below the 20 CFR 761.61(a) high-occupancy standard of ≤1 mg/kg.

Reports summarizing the post-construction soil sampling results and recommendations were submitted to the PCT (EQM, 2015f; 2015g). Approval for no remedial action was received from the PCT for the reasons discussed above. The disturbed areas were covered with topsoil and seeded to control potential exposure pathways.

5.3 Summary of Pre-Removal and Post-Removal Sediment Sampling and Analyses

5.3.1 Pre-Removal Sampling

Pre-removal sampling efforts exceeded the work planned in the RFTOP in the following areas: number of sampling days required, geographic surface area investigated, and number of samples collected and analyzed to characterize deposits for removal. Planned pre-and post-removal sediment sampling was to be completed in 15 working days but was actually completed in 87.5 days. This was a variance of 483%. Associated sample analyses were expected to be completed in 26 working days; however, they were completed in 161 working days, for a variance of 519%. The combined RFTOP investigation area for all deposits was originally 5.4 acres and the resulting investigation area expanded to 11.3 acres, for a variance of 209%. The planned minimum number of core samples based on the RFTOP was 246 and the actual number of core samples was 638, for a variance of 259%.

5.3.2 Post-Removal Sampling

Tables 4-3, 4-10, 4-12, 4-14, 4-16, 4-18, 4-25, 4-26, and 4-29 summarize post-removal sampling conducted to confirm remedial actions in Zones 3, 4, 5, and 7 met RGs for GLNPOCS Lincoln Park Phase II.
5.4 Post-Construction Surveys

Restoration backfill materials described in Section 3.9 were surveyed as restoration was completed in each zone as required by Technical Specification 31 23 23 (EA, 2014b). This included the top of sand and topsoil placed in the wetland area, and top of topsoil on the banks. Once restoration was completed and the staging area, access roads, and temporary facilities in the upland area were removed, the post-construction topography was surveyed prior to placement of restoration topsoil. The post-construction topography was surveyed for use in calculating quantities of topsoil placed for restoration in those areas and for calculating the area of seed needed for planting those areas. Figures 3-6 through 3-9 provide an as-built of the areas restored. The topsoil topography was surveyed once it was placed over those areas. The topography was surveyed following procedures described in Section 3.4.2.2.

5.5 Summary of Sediment Removed and Disposal

5.5.1 Summary of Sediment Removed

Table 5-2 summarizes the sediment removed for the entire project.

5.5.2 Summary of Solid Waste Disposal

Table 5-3 summarizes solid waste transportation and disposal for the entire project. Additional solid wastes were disposed of that were not sediment in origin. These waste included construction materials not suitable for beneficial reuse, and contaminated topsoil removed from the haul road footprint that contained contaminants of concern that exceeded RGs. Table 5-4 summarizes construction material solid waste transportation and disposal activity. Table 5-5 summarizes Zone 5 topsoil solid waste transportation and disposal activity.

5.5.3 Summary of TSCA Disposal

Table 5-2 summarizes solid waste Transportation and disposal for the entire project. Additional TSCA waste disposed of included construction materials from the TSCA portion of the dewatering pad, which included sand, aggregate, geotextile, and HDPE liner. Table 5-6 summarizes total construction material TSCA waste transportation and disposal activity.
5.6 Summary of Restoration

5.6.1 Wetland Restoration

Wetland restoration was initiated upon completion of remedial activities in each of Zones 4, 5, and 7. Zone 3 required only streambank and upland site restoration and not wetland planting. Wetland areas were restored in accordance with permit conditions and Technical Specifications Section 32 90 00 – Planting. The following activities were documented and photographed by the QCO.

SES prepared the streambank and wetland areas to be restored by backfilling with sand to 6 inches below grade; the top of the sand was surveyed by a PLS. Topsoil removed during construction activities was staged on site or imported topsoil was placed from the top of sand to finish grade. The graded topsoil was surveyed by a PLS.

AES employees removed rocks greater than 3/4 of an inch, limbs, and branches from the topsoil in preparation for seeding and planting. The area was raked either mechanically by dragging a gill behind a tractor or all-terrain vehicle or by using a hand rake to prepare the topsoil for seeding.

During the wetland planting in Zone 7, the QCO observed trees and shrubs randomly planted with sufficient spacing between them. Herbaceous plants were intermittently planted between the trees and shrubs. Native grass was also planted in the restored wetland areas. Grass seed was applied via broadcast spreader and/or by hydromulcher broadcasting a mixture of Flexterra® HP-FGM and seed.

The frequency of seed application and plantings for each zone was evaluated and determined to be consistent with the requirements listed in the Technical Specifications Section 32 90 00 – Planting (EA, 2014b).

Wetland revegetation seeding and planting was performed over a surface of 1.12 acres in Zone 7 (Deposit 7-3 area), 0.36 acre in Zone 4, and 0.14 acre in Zone 5. This resulted in a total of 1.62 acres of wetland restoration. Native grass seeding in the wetland restoration areas was performed at an application rate of 16.76 lbs/acre. Native grass seeding was performed over the 1.12-acres wetland area that was formerly known as Deposit 7-3. Native grass seeding was performed over the 0.36-acre wetland restoration area in Zone 4. Zone 5 wetland native grass seed-
ing covered an area of 0.14 acre. The inventory of trees, shrubs, and herbaceous plants is provided in Table 4-33. This table summarizes the type and quantity of plants that were installed in the 3 wetland restoration areas. Trees were planted at a rate of 305 trees per acre. Shrubbs were planted at a rate of 131 shrubs per acre. Herbaceous plants were planted at a rate of 2,376 plants per acre.

5.6.2 Log/Root Wad and Boulder Clusters

Log/root wads and boulder clusters were installed in Zones 3, 7, and 4. Log/root wads were obtained from Zones 4 and 5 within the limits of clearing and grubbing. Boulders for the boulder clusters and log/root wad pinning stones were supplied by Lannon Stone Products, Inc. The installation locations for the Zone 3, Zone 7, and Zone 4 boulder clusters and log/root wads are depicted in Figures 3-6 through 3-8. Installation location adjustments from the designed locations were made with the concurrence of the oversight engineer’s designated representative. Table 4-34 summarizes the installation of log/root wad and boulder features.

5.7 EQM Data Validation

Validation and verification of the data generated during field and laboratory activities was essential to obtaining defensible data of acceptable quality. Verification methods performed for the field and laboratory activities are discussed below.

5.7.1 Field Data Verification

EQM Team personnel reviewed field data to verify or identify inconsistencies or anomalous values. The QCO, Environmental Sampler, and technical project staff reviewed field data and provide feedback to the team with recommendations for corrective measures. Any inconsistencies discovered were resolved as soon as possible by seeking clarification from field personnel responsible for data acquisition. All field personnel were responsible for following the sampling and documentation procedures described in this SAP so that defensible and justifiable data were obtained. The QCO, along with the Project Manager, distributed the SAP to field personnel and held kick-off meetings for each task prior to task initiation.
5.7.2 Laboratory Data Verification

Laboratory personnel verified analytical data (1) at the time of analysis and prior to reporting Level I data packages to the ShareFile site and (2) through subsequent reviews of the raw data for any non-conformances with the requirements of analytical methods. Laboratory personnel made a systematic effort to identify any outliers or errors before the data were reported. Outliers identified during data verification were investigated and corrected; outliers not attributed to errors in analysis, transcription, or calculation were clearly identified in the case narrative section of the analytical data package.

Despite the laboratory’s review efforts, an error was noted by WDNR personnel following posting of the Level 1 data to the ShareFile site for a pre-removal sample in Deposit 7-2. The error consisted of a discrepancy between the reported total PCB concentration and the summation of the individual aroclors. Once alerted by WDNR, the EQM team initiated a CAR (CAR# LP-003) and the ECCS Project Chemist was contacted. Upon review it was noted that the error was associated with the reporting of the dilution of individual aroclors and that the total aroclor result was correct and did not require modification. The subsequent investigation initiated by the CAR determined this issue was a single isolated event and that a heightened level of scrutiny would be provided at the analyst peer level review for all samples which require analysis at a dilution. In addition, EQM personnel agreed to review and verify data as quickly as possible once ECCS laboratory personnel had posted Level I data packages to the Project Share site. The intent of posting Level I data packages, accessible for all Project Control Team Members, was to provide ‘real time’ access of sample results. When this approach was originally discussed, it was understood that the possibility for data to be viewed by Project Control Team Members, prior to an independent verification by EQM personnel, was considerable. However, the benefit of ‘real time’ access for all Project Control Team Members outweighed any potential risks, as future decisions would only be made on data verified. After discussion, it was determined that the ‘real time’ access approach would be continued, as this particular instance represented an error of less than 1% of the entire data population for the project to that point. It was also reiterated that EQM personnel communicate any data quality issues, with potential to impact reported results, to AECOM immediately. Because AECOM was using the data reported in the Level I report to evaluate and make decisions for excavation and/or further delineation, it was important they were made aware of potential data quality issues.
5.7.3 Verification and Validation Methods

Data packages (Level II and higher) generated by the EQM Team’s subcontracted laboratory were initially reviewed by the EQM Team’s Analytical Coordinator or Data Validator, before data packages were forwarded to EPA. 100% of post-construction and post-removal data for this project underwent a Tier 1 validation, and 20% of post-construction and post-removal data underwent a Tier 2 validation, as specified in the GLLA QA Considerations. The Tier 1 validation ensured that the data package contained all requested analyses and analytical QC results. Qualifiers were applied to the data as a result of this validation process. Along with the qualified data, a brief description of the data quality was submitted to EPA. Laboratory raw data was validated for 20% of post-construction and post-removal samples as specified and Part 1.4A of Specification 01 35 45.00 10.

The EQM Team included the validated results in the final reports submitted to EPA. The National Function Guidelines were used for validation; however, data were qualified based on the criteria specified in this SAP. Standard EPA data qualifiers and GLNPO data qualifiers were applied as necessary to only the data that is validated. Following the completion of validation, a summary report was generated. Summary reports are provided in Appendix M of this RAR.

As applicable, requests for missing data or required corrections to the data by the laboratory as a result of the data review or validation were made in writing by EQM QA personnel to the laboratory. The requests were in the form of email and contained information in sufficient detail for the laboratory to reply in a timely manner. In the event the missing data or corrections impacted the results previously reported to EPA, a Corrective Action Report (CAR) was submitted indicating the error identified impact of the change, and any subsequent corrective action taken by the laboratory. Immediate notification to the EPA was made if the resulting error indicates previously reported data may not be below its respective action level. The revised laboratory data reports were submitted to the EPA along with the completed CAR.

During the Tier 2 validation of the PAH results from select samples from Area 5-1 (see Table 5-6), it was noted by the validator that the quantitation method date and time used to process the PAH ICV was different than the quantitation method used to process the samples and corresponding continuing calibration verification (CCV). The laboratory was emailed by the EQM validator to begin further investigation. It was determined that the error was a result of the laboratory not using the current calibration to quantitate the PAH sequence from Y5I1402. After
further investigation, a list of impacted samples were compiled by the laboratory, re-quantitated with the updated calibration, and re-reported. The sample results for individual PAH changed slightly; however, the total PAH concentration for the samples did not change by more than 1 mg/kg on any sample and did not change the total PAH result from being either below or above the RG of 20 mg/kg as reported in the initial analysis. Below is a summary of the changes. None of the original data presented in Table 5-6 have been included in the reports found in Appendix M of this RAR; only reprocessed data have been included.

5.8 Punch List and Final Inspection and Documentation

EQM submitted a letter request for certification of substantial completion on October 5, 2015. The letter request was accompanied by an “Initial Substantial Completion Punch List” and a request for substantial completion inspection to be held on October 13, 2015. The substantial completion inspection was held on October 13, 2015 with a debrief meeting held on the morning of October 14, 2015. The meeting was attended by Brenda Jones USEPA TOCOR, Marsha Burzynski WDNR, Bill Fitzpatrick WDNR, Jon Trombino EAEST, Mike Ciarlo EAEST, Duane Thomas EAEST, Pat Faessler SES, Chris Hartford EQM, and Eric Bowman EQM. An updated copy of the punch list was provided to the attendees. The inspection started in Zone 5 and progressed to Zone 4, Zone 3, and Zone 7. Punch list items were reviewed at the debrief meeting the following morning and a tentative completion schedule was discussed for outstanding items. The final completion inspection will be held in late June 2016 once revegetation is ready for establishment inspection. All remaining punch-list items with the exception of vegetation establishment were addressed by November 16, 2015.

5.9 Accomplishments

The following list highlights some of the significant accomplishments achieved during the GLNPOCS Lincoln Park/Milwaukee River Channel Phase II Remedial Action:

- Excavated 52,462 CY of overall sediment from 8 deposits covering 11.31 acres.
- Transported 77,881 tons of non-TSCA solid waste for off-site landfill disposal.
- Transported 4,972 tons of TSCA waste for off-site landfill disposal.
• Remediation efforts removed 2,330 pounds of PCB and 12,683 pounds of PAH contamination.
• Restored 1.62 acres of wetland habitat with native grasses, shrubs, herbaceous plants, and trees.
• Installed 11 log/root wad structures and 10 boulder clusters for aquatic habitat improvement.
• Transported 1,560 tons of used aggregate for beneficial reuse on a nearby work site.
6. REFERENCES


EQM 2015c. Sampling and Analysis Plan Addendum 1, Lincoln Park/Milwaukee River Channel Phase II Remedial Action, Milwaukee, Milwaukee, Wisconsin. August 2015.


EQM 2015e. Sampling and Analysis Plan Addendum 4, Lincoln Park/Milwaukee River Channel Phase II Remedial Action, Milwaukee, Milwaukee, Wisconsin. August 2015.


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