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ENVIRONMENT

Ms. Carolyn Bury
United States Environmental Protection Agency, Region 5
77 West Jackson Boulevard
Mail Code LR-16J
Chicago, IL  60604-3590

Date:
September 29, 2020

Contact:
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Our ref:
30054483

Subject:
Final Sediment Monitored Natural Recovery Work Plan
Former Koppers Wood-Treating Site – Carbondale, Illinois

Dear Ms. Bury:

On behalf of Beazer East, Inc. (Beazer), attached for USEPA's final approval, please find a final *Sediment Monitored Natural Recovery Work Plan* (MNR Work Plan) for the Former Koppers Wood-Treating Site in Carbondale, Illinois (the Site). This version of the MNR Work Plan supersedes prior versions submitted to USEPA on September 29, 2017; July 13, 2018; October 9, 2018; and September 9, 2020.

Please feel free to contact me at 218.208.3427, or Mr. Michael Slenska of Beazer at 412.208.8867, if you have any questions or comments regarding this submittal.

Sincerely,

Arcadis U.S., Inc.

David Bessingpas

David Bessingpas
Project Manager

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Tom Williams, USEPA
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Beazer East, Inc.

# SEDIMENT MONITORED NATURAL RECOVERY WORK PLAN

Former Koppers Wood-Treating Site

Carbondale, Illinois

September 29, 2020

# SEDIMENT MONITORED NATURAL RECOVERY WORK PLAN

Former Koppers Wood-Treating Site
Carbondale, Illinois

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Our Ref.:

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Date:

September 29, 2020

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# ATTACHMENTS

# ACRONYMS AND ABBREVIATIONS

| | |
|---|---|
| Arcadis | Arcadis U.S., Inc. |
| Beazer | Beazer East, Inc. |
| COPC | constituent of potential concern |
| IDNR | Illinois Department of Natural Resources |
| MNA | monitored natural attenuation |
| MNR | monitored natural recovery |
| NAPL | non-aqueous phase liquid |
| PAH | polycyclic aromatic hydrocarbon |
| Site | Former Koppers Wood-Treating Site in Carbondale, Illinois |
| SOP | Standard Operating Procedure |
| USEPA | United States Environmental Protection Agency |

# 1 INTRODUCTION

On behalf of Beazer East, Inc. (Beazer), Arcadis U.S., Inc. (Arcadis) has prepared this *Sediment Monitored Natural Recovery Work Plan* (MNR Work Plan) to present the monitoring scope of work and procedures associated with the Monitored Natural Recovery (MNR) program for sediments in Piles Fork and Crab Orchard Creek, located downstream of the Former Koppers Wood-Treating Site in Carbondale, Illinois (the Site). As further discussed in Section 2, this MNR Work Plan is the culmination of various investigations and evaluations that have been completed over the years to assess the nature and extent of sediment impacts in waterways at and downstream of the Site, as well as any associated potential risks to human and ecological receptors.

The scope of work presented in this MNR Work Plan is based on the following documents previously submitted to the United States Environmental Protection Agency (USEPA):

- *Baseline Characterization Work Plan* (Arcadis BBL 2007);
- *Baseline Characterization Report* (Arcadis 2012);
- *Proposed Elements of Sediment Monitored Natural Recovery Program* (Arcadis 2015a); and
- *Supplemental Information Related to Sediment Monitored Natural Recovery Program* (Arcadis 2016).

This MNR Work Plan also addresses USEPA's comments discussed during an August 1, 2017 conference call, written comments from USEPA dated June 1, 2018, comments contained in an e-mail from USEPA dated September 17, 2018, and written comments from USEPA dated April 20 and August 21, 2020.

The remainder of this MNR Work Plan is organized into the sections listed below.

**Section 2 – Background:** Summarizes pertinent background information related to the sediment MNR program.

**Section 3 – Monitoring Scope of Work and Procedures:** Presents the scope of work and procedures to be used to assess the recovery of sediments in Piles Fork and Crab Orchard Creek.

**Section 4 – Quality Assurance/Quality Control (QA/QC):** Discusses the QA/QC procedures for the sampling and analysis activities presented in this MNR Work Plan.

**Section 5 – Property Access:** Discusses the proposed process for obtaining access approvals to non-Beazer-owned properties, as necessary to implement the MNR monitoring program.

**Section 6 – Data Evaluation:** Discusses how the MNR investigation data will be evaluated to assess the ongoing natural recovery of sediments.

**Section 7 – Monitoring Frequency and Reporting:** Outlines the frequency of the monitoring activities, as well as the reporting approach.

**Section 8 – Contingency Plan:** Outlines contingency actions to be implemented, if necessary, based on the findings of the monitoring activities.

**Section 9 – References:** Provides a bibliography of the documents referenced throughout this MNR Work Plan.

# 2 BACKGROUND

In May 2004, the USEPA issued the *RCRA Corrective Action Final Decision and Response to Comments on the Selection of Remedies to Address Contamination at Beazer East, Inc., Carbondale, Illinois* (Final Decision Document; USEPA 2004). The Final Decision Document specified the following remedies for impacted sediments at the Site:

- Relocation of a portion of the Glade Creek channel in the eastern portion of the Site;
- Construction of a trench-based DNAPL barrier system to mitigate the discharge of DNAPL into the relocated Glade Creek channel;
- Removal of sediments from the portion of Glade Creek downstream of the channel relocation area; and
- MNR[1] of remaining impacted sediments.

The Glade Creek channel relocation and trench-based DNAPL barrier construction (which addressed DNAPL discharges to Glade Creek), and the downstream sediment removal activities, were completed between 2004 and 2006[2]. In December 2007, Beazer submitted a *Baseline Characterization Work Plan* (BCWP; Arcadis 2007) to USEPA, which identified the scope of work and procedures for additional characterization of waterways at and downstream of the Site. The BCWP was an initial step in the proposed approach for developing and implementing an MNR program for residual sediment impacts at the Site. In accordance with the USEPA-approved BCWP, the investigation data were to be used to complete human health and ecological risk assessments for the Site, as well as provide baseline data for comparison to future MNR monitoring data, if necessary. If the human health and/or ecological risk assessments identified waterways (or portions of waterways) that posed unacceptable risks, an MNR program would then be developed for those specific waterways (or portions of waterways) with unacceptable risks.

The BCWP investigations were completed from 2008-2010, and the associated data were presented in the *Baseline Characterization Report* (BCR; Arcadis 2012). Following submittal of the BCR, Beazer initiated preparation of human health and ecological risk assessments, in coordination with USEPA. A final *Human Health Risk Assessment for the Former Koppers Wood-Treating Site* (HHRA; Arcadis 2015) was submitted to USEPA on November 6, 2015. USEPA approved the HHRA on November 24, 2015 (USEPA 2015c)[3]. While a formal Ecological Risk Assessment Report has not been submitted to date, the following submittals summarize the findings of ecological risk assessment evaluations that have been completed:

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[1] In some prior Site-related documents, including the Final Decision Document, MNR has been referred to as Monitored Natural Attenuation (MNA).

[2] Refer to the *Final Documentation Report* (Arcadis 2011) for additional details regarding the previously completed corrective actions.

[3] On June 1, 2018, Beazer submitted a *Human Health Risk Assessment Addendum: Evaluation of the Commercial/Industrial Worker Scenario* (HHRA Addendum) to document that potential risks associated with a potential future generic commercial/industrial worker receptor at the Site are acceptable. The HHRA Addendum was revised to address USEPA comments and resubmitted on August 17, 2018 and June 18, 2019. USEPA provided additional comments on May 15, 2020, which Beazer responded to on July 12, 2020. Final USEPA approval of the HHRA Addendum is pending.

- September 9, 2013 memorandum from Arcadis to USEPA – *Summary of Ecological Risk Assessment Findings and Path Forward – Carbondale, IL* (Arcadis 2013a);
- March 18, 2014 memorandum from Arcadis to USEPA – *Ecological Risk Evaluation Follow-Up Action Items: January 22, 2014 Meeting* (Arcadis 2014a);
- October 10, 2014 *Draft Proposed Scope and Rationale for Ecological-Based Remediation at the Former Koppers Wood-Treating Site in Carbondale, Illinois* (Arcadis 2014b); and
- May 11, 2016 *Revised Draft Proposed Conceptual Approach for Additional Ecological Based Remediation* (Beazer 2016).

The conclusions of the HHRA and ecological risk assessment evaluations indicate no unacceptable risks to potential human or ecological receptors in waterways at and downstream of the Site (including Smith Ditch, Glade Creek, Piles Fork, and Crab Orchard Creek). Therefore, following the process outlined in the USEPA-approved BCWP, monitoring the ongoing natural recovery of sediments would not be required. However, Beazer recognizes USEPA's concern regarding the presence of residual creosote non-aqueous phase liquid (NAPL) impacts in portions of Piles Fork and Crab Orchard Creek that were documented during the BCWP implementation and a follow-up investigation conducted in 2012. While these investigations demonstrated the extent of impacts was substantially reduced relative to prior events[4], Beazer acknowledges the USEPA's desire for continued monitoring of this condition to confirm continued improvements regarding the NAPL-impacted sediment area. Accordingly, this MNR Work Plan presents a monitoring program aimed at assessing the continued natural recovery of sediment in the portions of Piles Fork and Crab Orchard Creek where NAPL impacts were observed, as well as sediments immediately downstream of the NAPL-impacted areas. In addition, per USEPA's request, fish sampling has been included in this MNR Work Plan to provide data to confirm the conclusions of the previously completed human health and ecological risk assessments.

As defined in USEPA's *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (USEPA 2005), MNR is "a remedy for contaminated sediment that typically uses ongoing, naturally occurring processes to contain, destroy, or reduce the bioavailability or toxicity of contaminants in sediment" and "[m]ay include physical, biological, and chemical mechanisms." Natural sediment recovery mechanisms anticipated to be occurring at the Site include biodegradation, biotransformation, bioturbation, diffusion, dilution, adsorption, volatilization, chemical reaction or destruction, resuspension, burial by clean sediment, and dispersion (more detailed descriptions of these sediment recovery mechanisms can be found in USEPA 2005). The table below summarizes the Site-specific sediment recovery processes relevant to each of the four main constituent of potential concern (COPC) groups[5]:

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[4] The *August 2012 Sediment Investigation Findings* (Arcadis 2013b) documented substantial improvements in both the extent of visibly impacted surficial sediments and COPC concentrations between the 2012 investigations and prior investigations conducted in 1987, 1996, and 2001. In addition, a natural attenuation/forensic evaluation conducted in 2001 provided strong evidence of ongoing natural attenuation of polycyclic aromatic hydrocarbons (PAHs) in sediments (BBL 2002).
[5] Degradation mechanisms of dioxins/furans in aquatic system may include: photolysis (both in surface water following partitioning from sediments (Kim and O'Keefe 1998) and in exposed sediment/soil during low water conditions (Tysklind et al 1992)); biotransformation and biodegradation (Barkovskii et al. 1994); and volatilization (Podoll et al. 1986).

| COPC Group | Biological | | Physical | | | | | | | Chemical | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | Biodegradation | Biotransformation | Bioturbation | Diffusion | Dilution | Volatilization | Resuspension | Burial | Dispersion | Adsorption | Chemical Reaction/ Destruction |
| PAHs | + | + | ● | ● | + | ● | + | + | + | + | + |
| Pentachlorophenol | + | + | ● | ● | + | ● | + | + | + | ● | + |
| Metals | | ● | ● | ● | + | | + | + | + | ● | |
| Dioxins/Furans | ● | ● | ● | ● | + | ● | + | + | + | + | ● |

**+** = likely sediment recovery process for specified COPC

● = possible sediment recovery process for specified COPC

blank = unlikely sediment recovery process for specified COPC

As indicted in the table above, all types of sediment recovery mechanisms (biological, physical, and chemical) are anticipated to be applicable to PAHs, pentachlorophenol, and dioxins/furans, though PAHs and pentachlorophenol are more amenable to the biological processes than dioxins and furans. For metals, applicable sediment recovery mechanisms are primarily physical processes and adsorption, though some biotransformation may also occur. Regardless, the dominant mechanisms of recovery for all COPCs in near-Site sediments in Crab Orchard Creek and Piles Fork are expected to be physical. Those mechanisms of recovery include resuspension of sediments and subsequent downstream transport that leads to dispersion, dilution and burial of COPCs associated with near-Site sediments. All of these recovery mechanisms can occur during typical flow regimes in Crab Orchard Creek and Piles Fork, but may be most prevalent during periods of high flow. Of these natural recovery mechanisms, dispersion is the least preferred, but it is an accepted and allowed recovery mechanism as long as it is not transferring unacceptable risk to another area (USEPA 2005).

# 3 MONITORING SCOPE OF WORK AND PROCEDURES

This section presents the scope of work and procedures to be used to monitor the natural recovery of sediments in Piles Fork and Crab Orchard Creek. The monitoring program will consist of the following three components:

- Sediment coring and visual characterization within portions of Piles Fork and Crab Orchard Creek to assess continued natural recovery of a limited area of sediments where creosote NAPL was observed during the BCWP and a follow-up investigation in 2012;
- Sediment sampling and analysis for Site-related COPCs to assess COPC concentration trends in surficial sediments within and downstream of the NAPL-impacted areas in Piles Fork and Crab Orchard Creek; and
- Fish sampling and analysis for Site-related COPCs to assess COPC concentration trends in both edible-size and forage fish. The data will also be used to confirm the conclusions of the previously completed human health and ecological risk assessments.

The scope of work and procedures for each of these components is detailed in the following subsections.

## 3.1 Sediment Coring/Visual Characterization

The scope of work for sediment coring/visual characterization to be implemented as part of the MNR program is consistent with that used during the 2012 investigation, including conducting sediment coring at 27 transects – 15 in Piles Fork and 12 in Crab Orchard Creek (Figure 1). Transect locations will be established in the field using a GPS and the location coordinates recorded during the 2012 investigation. At each transect, coring will be conducted at the center of the channel; at the midpoints between the center of the channel and the creek banks; and along the creek banks (five locations per transect). At all five locations along each transect, probing will be conducted to determine the approximate thicknesses of the loose depositional material and then a sediment core will be collected for visual characterization.

Sediment coring procedures will be consistent with those used during the 2012 investigation, and the Standard Operating Procedure (SOP) in Attachment 1. First, a metal rod will be manually pushed into the sediments at a given location to estimate the depth at which loose, depositional material transitions to stiffer underlying soils. Following probing with the metal rod, a Lexan® tube will be manually driven as deep as possible into the creek bottom at each location to retrieve sediment for visual characterization. The entire thickness of loose, depositional material will be targeted for sediment coring.

Sediment recovered during the coring will be visually inspected and classified with respect to potential impacts using the following descriptions:

- Type A – the sediment is visibly impacted by creosote NAPL;
- Type B – the sediment exhibits odor, staining and/or sheens, but is not visibly impacted by creosote NAPL; and
- Type C – the sediment is not visibly impacted by creosote NAPL, and does not exhibit odor, staining and/or sheens.

This visual classification approach was used during the 2012 investigation, as well as prior investigations in 1996 and 2001[6]. In addition, the sediment color, grain size, presence of organics, and any other notable characteristics will be recorded. Photographs of the recovered sediments from each core will also be taken.

## 3.2 Sediment Sampling/Analysis

### 3.2.1 Sample Locations

Sediment samples will be collected at four locations in Piles Fork and six locations in Crab Orchard Creek (Figure 2). These 10 sample locations were selected to correspond to prior sample locations from 1987 (Remedial Investigation [RI]), 2001, and/or 2008/2010 (BCWP), such that concentration trends can be evaluated. The table below summarizes the proposed sediment sample locations by water body.

| Waterway | Proposed MNR Sample ID | General Location Description | Corresponding Sample IDs from Prior Investigations | | |
|---|---|---|---|---|---|
| | | | 1987 (RI) | 2001 | 2008/2010 (BCWP) |
| Piles Fork | PF-MNR-SED-01 (Background location) | Upstream of confluence with Glade Creek | -- | -- | PF-BC-01 |
| | PF-MNR-SED-02 (Background location) | Upstream of confluence with Glade Creek | -- | PF-SED-01 | PF-BC-02 |
| | PF-MNR-SED-03 | Between Glade Creek and Crab Orchard Creek | -- | PF-SED-03 | PF-BC-03 |
| | PF-MNR-SED-04 | Between Glade Creek and Crab Orchard Creek | -- | PF-SED-04 | PF-BC-04 |
| Crab Orchard Creek | COC-MNR-SED-02 (Background location) | Upstream of confluence with Piles Fork (~1,100') | #9A | -- | COC-BC-02 |
| | COC-MNR-SED-03 (Background location) | Upstream of confluence with Piles Fork (~300') | #9 | COC-SED-01 | COC-BC-03 |
| | COC-MNR-SED-04 | Downstream of confluence with Piles Fork (~200') | -- | -- | COC-BC-04 |
| | COC-MNR-SED-05 | Downstream of confluence with Piles Fork (~400') | #10 | COC-SED-02 | COC-BC-05 |
| | COC-MNR-SED-06 | Downstream of confluence with Piles Fork (~1,200') | #10A | -- | COC-BC-06 |
| | COC-MNR-SED-07 | Downstream of confluence with Piles Fork (~1,500') | #10B | -- | COC-BC-07 |

[6] Refer to *Summary of Field Investigations and Modifications to the IGMP Monitoring Well Network* (BBL 2002) for a more detailed description of the visual classification approach, including correlations between visual classifications and polycyclic aromatic hydrocarbon (PAH) concentrations.

Sample locations will be established in the field using a GPS and the location coordinates recorded during the 2008/2010 BCWP investigation.

### 3.2.2 Sampling Procedures

Sediment samples will be collected in a manner consistent with the sediment sampling approach outlined in the BCWP (Arcadis 2007), and the SOP in Attachment 2. Specifically, at each of the proposed sample locations, a composite sample will be collected consisting of approximately five to eight discrete surficial (0- to 0.5-foot depth interval) samples collected from across the width of the creek. The number of discrete samples per composite will depend on the width of the creek at each sample location, and will not be less than five (resulting in a minimum distance of about 3 feet between samples in the narrowest transects) and not more than eight (resulting in a maximum distance of about 10 feet between samples in the widest transects). Discrete samples at a given location will be combined and mixed to create a single, homogeneous composite sample. Sediment samples will be collected using Lexan® tubes. Characteristics (e.g., color; grain size; presence of organic matter; presence/absence of creosote, staining, sheens and odors; and any other notable characteristics) of recovered sediments from each sample location will be recorded in a field book. In addition, photographs of the recovered sediments from each sample location will be taken.

### 3.2.3 Analytical Scope/Procedures

Sediment samples will be analyzed for the following parameters (note this is the same analytical suite as used during the BCWP investigation in 2008/2010):

- Polycyclic aromatic hydrocarbons (PAHs) and pentachlorophenol (Method 8270);
- Arsenic, chromium, and copper (Method 6010B);
- Dioxins/furans (Method 8290); and
- TOC (Walkley-Black).

## 3.3 Fish Sampling/Analysis

### 3.3.1 Sample Locations

Fish samples will be collected at five locations in Crab Orchard Creek (Figure 3). Four of the five sample locations were selected to correspond to prior sample locations from the 2008 BCWP sampling event, such that concentration trends can be evaluated. The fifth sample location, at the Dillinger Road Bridge, was added per USEPA’s request. The table below summarizes the proposed fish sample locations.

| Proposed MNR Sample ID | General Location Description | Corresponding Sample IDs from 2008 BCWP Investigation |
|---|---|---|
| COC-MNR-FISH-01 (Background location) | Upstream of confluence with Piles Fork (~2,100') | COC-BC-01-EDCAT COC-BC-01-FFCAT |
| COC-MNR-FISH-04 | Downstream of confluence with Piles Fork (~200') | COC-BC-04-EDCAT COC-BC-04-FFCAT |
| COC-MNR-FISH-07 | Downstream of confluence with Piles Fork (~1,500') | COC-BC-07-EDCAT COC-BC-07-FFCAT |
| COC-MNR-FISH-09 | Downstream of confluence with Piles Fork (~4,700') | COC-BC-09-EDCAT COC-BC-09-FFCAT |
| COC-MNR-FISH-DRB | At the Dillinger Road Bridge | Not sampled in 2008 |

Note: 2008 BCWP sample IDs with an "EDCAT" extension were edible-sized channel catfish samples; samples with an "FFCAT" extension were forage-sized channel catfish samples. MNR sample IDs will also distinguish between edible fish samples and forage fish samples (see Section 3.3.2).

Sample locations will be established in the field using a GPS and the location coordinates recorded during the 2008 BCWP investigation.

### 3.3.2 Targeted Fish Sizes and Species

Both edible and forage fish samples will be collected at sample locations COC-MNR-FISH-01, COC-MNR-FISH-04, COC-MNR-FISH-07, and COC-MNR-FISH-09. At COC-MNR-FISH-DRB, only edible fish samples will be collected.

Edible fish samples will be composed of channel catfish. Targeting only channel catfish will provide the greatest level of comparability to the fish sample data collected during the 2008 BCWP investigation, as channel catfish were the only fish species consistently caught at all of the 2008 sample locations. Edible-sized channel catfish targeted for sampling will be approximately 10 inches or greater in length. As necessary, channel catfish will be composited to achieve the sample mass requirements at each sampling location. Consistent with USEPA guidance (USEPA 2000), the smallest fish in a composite sample will be no less than 75% of the size of the largest individual.

Forage fish will be defined as those fish that are two to eight inches in length. The number of forage fish per sample will vary depending on sampling yield. Based on observations made in Crab Orchard Creek during the RI and 2008 BCWP sampling event, sunfish species (such as bluegill) or channel catfish are expected to be the most abundant fish collected for forage fish samples. Channel catfish will be the targeted forage fish species at all sample locations. If after reasonable effort that does not lead to the collection of sufficient mass for the laboratory analyses, multiple species may be composited to form a forage fish sample at a given location.

### 3.3.3 Sampling Procedures

Fish sampling methodologies are provided in the SOP in Attachment 3 and are described below. Prior to sampling, a scientific permit will be obtained from the Illinois Department of Natural Resources (IDNR). It is anticipated that electrofishing will be the primary sampling method used. Either boat-mounted or backpack electrofishing units will be used depending on water levels and accessibility. As necessary, electrofishing would be supplemented with other active methods (e.g., angling, seining, or cast netting) and/or passive methods (e.g., trotlining, gillnetting, minnow traps).

Consistent with the 2008 BCWP investigation, fish sampling will be conducted on a reach basis. Sampling reaches will be approximately 400 feet in length, extending approximately 200 feet upstream and 200 feet downstream of the targeted sample location. It may be necessary to expand the length of the reaches, depending on sampling yield.

Initially, up to 8 hours of sampling will be spent at each fish sample location by a team of at least two individuals, to obtain sufficient fish of the targeted size and species (see Section 3.3.2) to meet the minimum laboratory mass requirements. As discussed above, it is anticipated that a combination of electroshocking and, as necessary, other active or passive sampling methodologies will be utilized throughout the 8-hour collection period per location.

At the Dillinger Road Bridge sample location (COC-MNR-FISH-DRB), if necessary, additional efforts will be expended (beyond the initial 8 hours) to collect enough channel catfish to meet the minimum laboratory mass requirements. However, if after three days of sampling at this location, the minimum laboratory mass requirements still haven't been achieved, Beazer will contact USEPA to discuss a path forward.

At the sample locations upstream of the Dillinger Road Bridge, if less than one-half of the sample mass requirements have been achieved during the initial 8-hour sampling effort at a given location, then additional efforts will not be expended at that location. If one-half or more of the sample mass requirements have been achieved during the initial 8-hour sampling effort, then up to an additional 8 hours of effort will be expended to collect enough channel catfish and forage fish to meet the minimum laboratory mass requirements. If after this additional 8 hours of effort, the minimum laboratory mass requirements still haven't been achieved, Beazer will contact USEPA to discuss a path forward (e.g., abandoning efforts at a given location, continuing to fish for an additional period of time).

After collection, fish samples will be processed following the procedures outlined in the SOP in Attachment 3. Fish will be identified, counted, weighed, measured, and photographed. Fish retained for lab analyses will be gently rinsed with deionized or distilled analyte-free water to remove the sediments that may have accumulated during the collection process (e.g., dragging a seine net through the sediments). Fish will then be wrapped in foil, labeled as to whether they are to be composited for fillet analyses (edible fish) or composited for whole-body analyses (forage fish), and put on ice until shipment to the laboratory. Fish samples will be filleted and homogenized at the laboratory prior to analysis. Fish not retained for laboratory analysis will be released in the reach from which they were collected.

### 3.3.4 Analytical Scope/Procedures

Fish samples will be analyzed for the following parameters:

- Dioxins/furans (Method 8290); and
- Percent lipids (Method 3541, gravimetric).

For edible fish samples, the lab will prepare fillets from the submitted fish samples, composite as necessary, and analyze for the parameters listed above. For forage fish samples, the lab will analyze whole body composites for the parameters listed above.

# 4 QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

QA/QC procedures for the sampling and analysis activities presented in this MNR Work Plan are covered under the Site-specific *Quality Assurance Project Plan* (QAPP; Arcadis 2008).

# 5 PROPERTY ACCESS

While it is anticipated that some of the sediment coring, sediment sampling, and fish sampling activities associated with this MNR Work Plan can be done by boat, access will be required to certain non-Beazer-owned properties to facilitate the field work (e.g., boat launching, sediment core processing, sediment/fish sample processing). In addition, if water levels are too low for boat access, fishing from the shorelines may be required. Prior to initiating the field investigation activities, Beazer will contact the applicable property owners to request permission to access their properties to facilitate implementation of the field work. If necessary, access agreements will be prepared and executed with the appropriate property owners.

# 6 DATA EVALUATION

This section discusses how the MNR investigation data will be evaluated to assess the ongoing natural recovery of sediments in Piles Fork and Crab Orchard Creek. For each of the three datasets (sediment coring/visual characterization, sediment sampling/analysis, and fish sampling/analysis), graphs will be prepared to assess whether data trends are increasing, decreasing, or stable. More quantitative trend evaluations (e.g., linear regression, Mann-Kendall) may also be performed. Contingency actions to be implemented based on the data evaluations are further discussed in Section 8.

## 6.1 Sediment Coring/Visual Characterization

As described in Section 3, sediment coring and visual characterization are being conducted to assess the continued natural recovery of a limited area of sediments in Piles Fork and Crab Orchard Creek where creosote NAPL was observed during the BCWP field work and a follow-up investigation in 2012.

The sediment coring and visual characterization data will be evaluated in two ways, consistent with the evaluations performed on the 2012 investigation data set (Arcadis 2013). First, the percentage of the recovered sediment cores (based on the total core length) that are composed of Type A, Type B, and Type C sediment (see descriptions in Section 3.1) will be calculated. For example:

$$\%\,Type\ A\ Sediment = \frac{Cumulative\ Length\ of\ Core\ Sediments\ Characterized\ as\ Type\ A}{Total\ Length\ of\ Recovered\ Core\ Segments}$$

In addition, a 3D model will be developed to represent the sediment coring visual characterization dataset. Consistent with the 3D model created with the 2012 sediment coring dataset, two computer-based data integration and interpretation methods – kriging and nearest neighbor – will be used in the 3D model to interpret the data and translate the boring-specific data into a representative 3D depiction of the sediment conditions between the individual data points. The 3D model will also be used to calculate percentages and volumes of Type A, Type B, and Type C sediment within the investigation limits.

Because the proposed sediment coring scope of work for the sediment MNR program is identical to the scope of work implemented during the 2012 supplemental investigation (same number and location of sediment coring points), comparisons between the 2012 and MNR datasets can be made to assess trends. Specifically, the percentages/volumes of Type A, Type B and Type C sediments (determined based on the length of recovered sediment cores and the 3D model, for both the 0- to 0.5-foot depth interval and the 0-foot to bottom of core depth interval) will be compared from event to event to see if those percentages/volumes are increasing, decreasing, or stable.

## 6.2 Sediment Sampling/Analysis

As described in Section 3, sediment sampling/analysis is being conducted to assess COPC concentration trends in surficial sediments within and downstream of the NAPL-impacted areas in Piles Fork and Crab Orchard Creek. To quantitatively assess trends, COPC concentrations in the MNR sediment samples will be compared to the 2008/2010 baseline data. In addition, a qualitative comparison to COPC concentrations in sediment samples collected in 2008/2010 (BCWP), 2001, and 1987 (RI) will be conducted to provide an overall perspective of the long-term change in sediment COPC concentrations. Tables 1 through 5 summarize the baseline and historical sediment sample results that will be used in quantitative and qualitative MNR sediment sample data comparisons.

## 6.3 Fish Sampling/Analysis

As described in Section 3, fish sampling/analysis is being conducted to assess COPC concentration trends in both edible-size and forage fish and to confirm the conclusions of the previously completed human health and ecological risk assessments. To assess trends, COPC concentrations in the MNR fish samples will be compared to COPC concentrations in fish samples collected in 2008 as part of the BCWP investigation. Table 6 summarizes the 2008 fish sample results that the MNR fish sample data will be compared to. Note that COPC concentrations in the edible catfish samples to be collected at the Dillinger Road Bridge (COC-MNR-FISH-DRB) will be compared to the maximum concentration detected in the 2008 BCWP samples located upstream of the bridge, which was the exposure point concentration used in the previously completed HHRA, because this location was not sampled in 2008.

Because the conclusions of the previously completed HHRA and ecological risk assessment evaluations indicated no unacceptable risks to potential human or ecological receptors in waterways at and downstream of the Site, if stable or decreasing COPC concentrations in fish samples are observed, then no additional risk evaluations would be warranted. However, if increasing COPC concentrations in fish samples are observed, or if the toxicity reference values used to calculate hazard quotients or cancer risk become more conservative, then Beazer will engage in discussions with USEPA regarding the need for and scope of additional risk evaluations. For reference, Table 7 summarizes the exposure point concentrations for fish used in the HHRA and ecological risk evaluations.

# 7 MONITORING FREQUENCY AND REPORTING

Two rounds of sediment coring, sediment sampling/analysis, and fish sampling/analysis will be conducted, five years apart (e.g., 2020/2021 and 2025/2026), after which time the need for and scope of additional monitoring will be assessed. It is anticipated that monitoring events will be conducted during the late spring to early fall timeframe, when the creeks are most likely to be at baseflow conditions (monitoring event schedules will be selected/modified as necessary to avoid conducting field work during or immediately following flooding events). This will also allow for the most direct comparisons to the 2008 fish sample data, which were collected in June and July.

MNR Monitoring Reports will be submitted after each sampling event, and will include a summary of the sediment coring and visual characterization results (including photographs of the recovered sediment cores), sediment and fish sample analytical data summary tables and laboratory reports, and discussion of data trends and conditions relative to prior events. The MNR Monitoring Report submitted after the first monitoring event will propose adjustments to the monitoring scope for the second event, if necessary and appropriate. The MNR Monitoring Report submitted after the second monitoring event will include Beazer's assessment of the need for and proposed scope of any additional monitoring. Contingency actions to be implemented based on the data evaluations are further discussed in Section 8.

# 8 CONTINGENCY PLAN

If the sediment coring and sediment/fish sampling data continue to demonstrate stable or improving conditions (in terms of the extent of NAPL-impacted sediments and COPC concentrations), Beazer will propose to discontinue or reduce the scope/frequency of the MNR monitoring program. However, if the sediment coring and/or sediment/fish sampling data indicate increases in the extent of NAPL-impacted sediments and/or COPC concentrations, Beazer will propose contingency actions commensurate with the observed trends. The exact contingency actions that would be proposed will depend on the nature and magnitude of the trends, and whether one, two, or all three of the data sets (i.e., sediment coring, sediment sampling, fish sampling) indicate consistent trends. Accordingly, this section is meant to provide a range of possible contingency actions. If increasing trends are observed, Beazer will engage in discussions with USEPA to discuss and agree upon the most appropriate contingency actions to undertake.

Possible contingency actions that may be implemented if the MNR monitoring data indicate increasing trends include:

- Additional/more frequent sediment coring, sediment sampling, and/or fish sampling at the established locations and/or additional locations; and/or
- Updated human health and ecological risk assessment calculations to determine whether conditions pose potentially unacceptable risks to human or ecological receptors.

In the unexpected event that the MNR data indicate consistently worsening conditions, and human health and/or ecological risks become unacceptable, then additional corrective actions (e.g., enhanced sediment MNR, sediment capping, sediment removal) may be warranted. In such a case, Beazer would engage in discussions with USEPA regarding the scope and schedule for determining and implementing an appropriate corrective action approach.

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# TABLES

**Table 1**
**Sediment Sample Data Summary (Total PAHs)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

| Proposed MNR Sample ID | Corresponding Sample IDs from Prior Investigations | | | Total PAHs (mg/kg) | | | |
|---|---|---|---|---|---|---|---|
| | 1987 Historical | 2001 Historical | 2008/2010 Baseline | 1987 Historical | 2001 Historical | 2008 Baseline | 2010 Baseline |
| **Piles Fork** | | | | | | | |
| PF-MNR-SED-01 | -- | -- | PF-BC-01 | -- | -- | 0.051 | NA |
| PF-MNR-SED-02 | -- | PF-SED-01 | PF-BC-02 | -- | 2.6 | 3.9 | 0.85 |
| PF-MNR-SED-03 | -- | PF-SED-03 | PF-BC-03 | -- | 457 | 30 | NA |
| PF-MNR-SED-04 | -- | PF-SED-04 | PF-BC-04 | -- | 56 | 7.6 | 12 |
| **Crab Orchard Creek** | | | | | | | |
| COC-MNR-SED-02 | #9A | -- | COC-BC-02 | 4.8 | -- | ND | 0.52 |
| COC-MNR-SED-03 | #9 | COC-SED-01 | COC-BC-03 | 1027 | 6.3 | 0.55 | NS |
| COC-MNR-SED-04 | -- | -- | COC-BC-04 | -- | -- | 94 | NA |
| COC-MNR-SED-05 | #10 | COC-SED-02 | COC-BC-05 | 530 | 45 | 22 | NA |
| COC-MNR-SED-06 | #10A | -- | COC-BC-06 | 257 | -- | 0.40 | NS |
| COC-MNR-SED-07 | #10B | -- | COC-BC-07 | 143 | -- | 8.5 | 12 |

**Notes:**
NA = not analyzed
ND = not detected
NS = not sampled
1. Results for the following samples represent an average of parent and duplicate sample results:

| Sample ID (Year) | Parent | Duplicate |
|---|---|---|
| #10 (1987) | 239 | 821 |
| COC-BC-02 (2010) | 0.331 | 0.703 |
| COC-BC-04 (2008) | 115 | 72.7 |

2. Quantitative trend evaluations will be conducted using the 2008/2010 baseline data.

**Table 2**
**Sediment Sample Data Summary (Arsenic)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

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| Proposed MNR Sample ID | Corresponding Sample IDs from Prior Investigations | | | Arsenic (mg/kg) | | | |
|---|---|---|---|---|---|---|---|
| | 1987 Historical | 2001 Historical | 2008/2010 Baseline | 1987 Historical | 2001 Historical | 2008 Baseline | 2010 Baseline |
| **Piles Fork** | | | | | | | |
| PF-MNR-SED-01 | -- | -- | PF-BC-01 | -- | -- | 7.1 | 9.5 |
| PF-MNR-SED-02 | -- | PF-SED-01 | PF-BC-02 | -- | NA | 13.0 | 7.0 |
| PF-MNR-SED-03 | -- | PF-SED-03 | PF-BC-03 | -- | NA | 6.0 | 10.2 |
| PF-MNR-SED-04 | -- | PF-SED-04 | PF-BC-04 | -- | NA | 8.1 | 12.8 |
| **Crab Orchard Creek** | | | | | | | |
| COC-MNR-SED-02 | #9A | -- | COC-BC-02 | 4.5 | -- | 7.7 | 6.5 |
| COC-MNR-SED-03 | #9 | COC-SED-01 | COC-BC-03 | 7.2 | NA | 6.2 | NS |
| COC-MNR-SED-04 | -- | -- | COC-BC-04 | -- | -- | 7.2 | 9.4 |
| COC-MNR-SED-05 | #10 | COC-SED-02 | COC-BC-05 | 8.4 | NA | 7.1 | 10.8 |
| COC-MNR-SED-06 | #10A | -- | COC-BC-06 | 0.5 | -- | 6.5 | NS |
| COC-MNR-SED-07 | #10B | -- | COC-BC-07 | 5 | -- | 6.1 | 16.6 |

**Notes:**
NA = not analyzed
NS = not sampled
1. Results for the following samples represent an average of parent and duplicate sample results:

| Sample ID (Year) | Parent | Duplicate |
|---|---|---|
| #10 (1987) | 6.8 | 10 |
| COC-BC-04 (2008) | 8.0 | 6.3 |
| COC-BC-04 (2010) | 10.3 | 8.4 |

2. Quantitative trend evaluations will be conducted using the 2008/2010 baseline data.

**Table 3**
**Sediment Sample Data Summary (Chromium)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

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| Proposed MNR Sample ID | Corresponding Sample IDs from Prior Investigations | | | Chromium (mg/kg) | | | |
|---|---|---|---|---|---|---|---|
| | 1987 Historical | 2001 Historical | 2008/2010 Baseline | 1987 Historical | 2001 Historical | 2008 Baseline | 2010 Baseline |
| **Piles Fork** | | | | | | | |
| PF-MNR-SED-01 | -- | -- | PF-BC-01 | -- | -- | 11.5 | 12.4 |
| PF-MNR-SED-02 | -- | PF-SED-01 | PF-BC-02 | -- | NA | 18.9 | 9.8 |
| PF-MNR-SED-03 | -- | PF-SED-03 | PF-BC-03 | -- | NA | 13.9 | 14.8 |
| PF-MNR-SED-04 | -- | PF-SED-04 | PF-BC-04 | -- | NA | 16.1 | 15.0 |
| **Crab Orchard Creek** | | | | | | | |
| COC-MNR-SED-02 | #9A | -- | COC-BC-02 | 6.8 | -- | 15.6 | 9.6 |
| COC-MNR-SED-03 | #9 | COC-SED-01 | COC-BC-03 | 19.9 | NA | 12.7 | NS |
| COC-MNR-SED-04 | -- | -- | COC-BC-04 | -- | -- | 16.3 | 13.6 |
| COC-MNR-SED-05 | #10 | COC-SED-02 | COC-BC-05 | 20.1 | NA | 13.9 | 18.9 |
| COC-MNR-SED-06 | #10A | -- | COC-BC-06 | 13.4 | -- | 16.3 | NS |
| COC-MNR-SED-07 | #10B | -- | COC-BC-07 | 13.8 | -- | 13.9 | 18.6 |

**Notes:**
NA = not analyzed
NS = not sampled
1. Results for the following samples represent an average of parent and duplicate sample results:

| Sample ID (Year) | Parent | Duplicate |
|---|---|---|
| #10 (1987) | 20.4 | 19.8 |
| COC-BC-04 (2008) | 13.5 | 19.0 |
| COC-BC-04 (2010) | 12.8 | 14.3 |

2. Quantitative trend evaluations will be conducted using the 2008/2010 baseline data.

**Table 4**
**Sediment Sample Data Summary (Copper)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

| Proposed MNR Sample ID | Corresponding Sample IDs from Prior Investigations | | | Copper (mg/kg) | | | |
|---|---|---|---|---|---|---|---|
| | 1987 Historical | 2001 Historical | 2008/2010 Baseline | 1987 Historical | 2001 Historical | 2008 Baseline | 2010 Baseline |
| **Piles Fork** | | | | | | | |
| PF-MNR-SED-01 | -- | -- | PF-BC-01 | -- | -- | 11.0 | 13.5 |
| PF-MNR-SED-02 | -- | PF-SED-01 | PF-BC-02 | -- | NA | 23.8 | 11.4 |
| PF-MNR-SED-03 | -- | PF-SED-03 | PF-BC-03 | -- | NA | 14.0 | 15.8 |
| PF-MNR-SED-04 | -- | PF-SED-04 | PF-BC-04 | -- | NA | 17.4 | 15.6 |
| **Crab Orchard Creek** | | | | | | | |
| COC-MNR-SED-02 | #9A | -- | COC-BC-02 | 8.3 | -- | 17.1 | 9.8 |
| COC-MNR-SED-03 | #9 | COC-SED-01 | COC-BC-03 | 14.6 | NA | 11.1 | NS |
| COC-MNR-SED-04 | -- | -- | COC-BC-04 | -- | -- | 15.8 | 20.2 |
| COC-MNR-SED-05 | #10 | COC-SED-02 | COC-BC-05 | 15.3 | NA | 13.1 | 19.9 |
| COC-MNR-SED-06 | #10A | -- | COC-BC-06 | 10.1 | -- | 13.9 | NS |
| COC-MNR-SED-07 | #10B | -- | COC-BC-07 | 11.6 | -- | 14.1 | 15.7 |

**Notes:**
NA = not analyzed
NS = not sampled
1. Results for the following samples represent an average of parent and duplicate sample results:

| Sample ID (Year) | Parent | Duplicate |
|---|---|---|
| #10 (1987) | 15.8 | 14.8 |
| COC-BC-04 (2008) | 14.4 | 17.2 |
| COC-BC-04 (2010) | 22.5 | 17.9 |

2. Quantitative trend evaluations will be conducted using the 2008/2010 baseline data.

**Table 5**
**Sediment Sample Data Summary (TCDD-TEQ)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

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| Proposed MNR Sample ID | Corresponding Sample IDs from Prior Investigations | | | TCDD-TEQ (ng/kg) | | | |
|---|---|---|---|---|---|---|---|
| | 1987 Historical | 2001 Historical | 2008/2010 Baseline | 1987 Historical | 2001 Historical | 2008 Baseline | 2010 Baseline |
| **Piles Fork** | | | | | | | |
| PF-MNR-SED-01 | -- | -- | PF-BC-01 | -- | -- | 0.51 | 1.1 |
| PF-MNR-SED-02 | -- | PF-SED-01 | PF-BC-02 | -- | NA | NA | 0.49 |
| PF-MNR-SED-03 | -- | PF-SED-03 | PF-BC-03 | -- | NA | 8.2 | 9.8 |
| PF-MNR-SED-04 | -- | PF-SED-04 | PF-BC-04 | -- | NA | 45 | 30 |
| **Crab Orchard Creek** | | | | | | | |
| COC-MNR-SED-02 | #9A | -- | COC-BC-02 | NA (Note 2) | -- | NA | 2.8 |
| COC-MNR-SED-03 | #9 | COC-SED-01 | COC-BC-03 | NA (Note 2) | NA | NA | NS |
| COC-MNR-SED-04 | -- | -- | COC-BC-04 | -- | -- | 9.8 | 3.7 |
| COC-MNR-SED-05 | #10 | COC-SED-02 | COC-BC-05 | NA (Note 2) | NA | 2.4 | 3.6 |
| COC-MNR-SED-06 | #10A | -- | COC-BC-06 | NA (Note 2) | -- | NA | NS |
| COC-MNR-SED-07 | #10B | -- | COC-BC-07 | NA (Note 2) | -- | 14 | 31 |

**Notes:**
NA = not analyzed
NS = not sampled
1. Results for the following samples represent an average of parent and duplicate sample results:

| Sample ID (Year) | Parent | Duplicate |
|---|---|---|
| COC-BC-02 (2010) | 3.7 | 2.0 |
| COC-BC-04 (2008) | 6.2 | 13.4 |
| COC-BC-04 (2010) | 3.5 | 3.9 |

2. Note that the 1987 samples were analyzed for hexachlorodibenzodioxins and hexachlorodibenzofurans, but not the full list of dioxins/furans.
3. Quantitative trend evaluations will be conducted using the 2008/2010 baseline data.

**Table 6**
**Baseline Fish Tissue Data Summary (TCDD-TEQ)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

| Proposed MNR Sample ID | Corresponding Sample ID from 2008 BCWP Investigation | TCDD-TEQ (ng/kg wet weight) | TCDD-TEQ (Mammal) (ng/kg wet weight) | TCDD-TEQ (Bird) (ng/kg wet weight) |
|---|---|---|---|---|
| **Edible Fish (Fillet Composites)** | | | | |
| COC-MNR-FISH-01-ED | COC-BC-01-EDCAT | 0.033 | N/A | N/A |
| COC-MNR-FISH-04-ED | COC-BC-04-EDCAT | 0.16 | N/A | N/A |
| COC-MNR-FISH-07-ED | COC-BC-07-EDCAT | 0.31 | N/A | N/A |
| COC-MNR-FISH-09-ED | COC-BC-09-EDCAT | 0.16 | N/A | N/A |
| COC-MNR-FISH-DRB-ED | N/A - See Note 1 | | N/A | N/A |
| **Forage Fish (Whole Body Composites)** | | | | |
| COC-MNR-FISH-01-FF | COC-BC-01-FFCAT | N/A | 0.050 | 0.045 |
| COC-MNR-FISH-04-FF | COC-BC-04-FFCAT | N/A | 0.093 | 0.11 |
| COC-MNR-FISH-07-FF | COC-BC-07-FFCAT | N/A | 0.37 | 0.34 |
| COC-MNR-FISH-09-FF | COC-BC-09-FFCAT | N/A | 0.48 | 0.51 |

**Notes:**
1. COC-MNR-FISH-DRB-ED TCDD-TEQ concentrations will be compared to 0.31 ng/kg, which is the maximum detected TCDD-TEQ concentration in edible fish samples collected during the 2008 BCWP investigation (at location COC-BC-07-EDCAT).
ng/kg = nanograms per kilogram
N/A = not applicable
TCDD-TEQ = tetrachlorodibenzo-p-dioxin toxic equivalency (calculated assuming non-detect = 1/2 detection limit)

**Table 7**
**Fish Exposure Point Concentrations (TCDD-TEQ)**
**Sediment Monitored Natural Recovery Work Plan**
**Former Koppers Wood-Treating Site**
**Carbondale, Illinois**

Design & Consultancy for natural and built assets

| Parameter | HHRA Edible Fish EPC (ng/kg wet weight) | ERA Forage Fish EPC (ng/kg wet weight) |
|---|---|---|
| TCDD-TEQ | 0.31 | N/A |
| TCDD-TEQ (Mammal) | N/A | 0.48 |
| TCDD-TEQ (Bird) | N/A | 0.51 |

**Notes:**
EPC = exposure point concentration
ERA = ecological risk assessment
HHRA = human health risk assessment
ng/kg = nanograms per kilogram
N/A = not applicable
TCDD-TEQ = tetrachlorodibenzo-p-dioxin toxic equivalency (calculated assuming non-detect = 1/2 detection limit)

# FIGURES

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: R. ANDERSON PM: J. HOLDEN TM: D. BESSINGPAS LYR:(Opt)ON=*;OFF=*REF*
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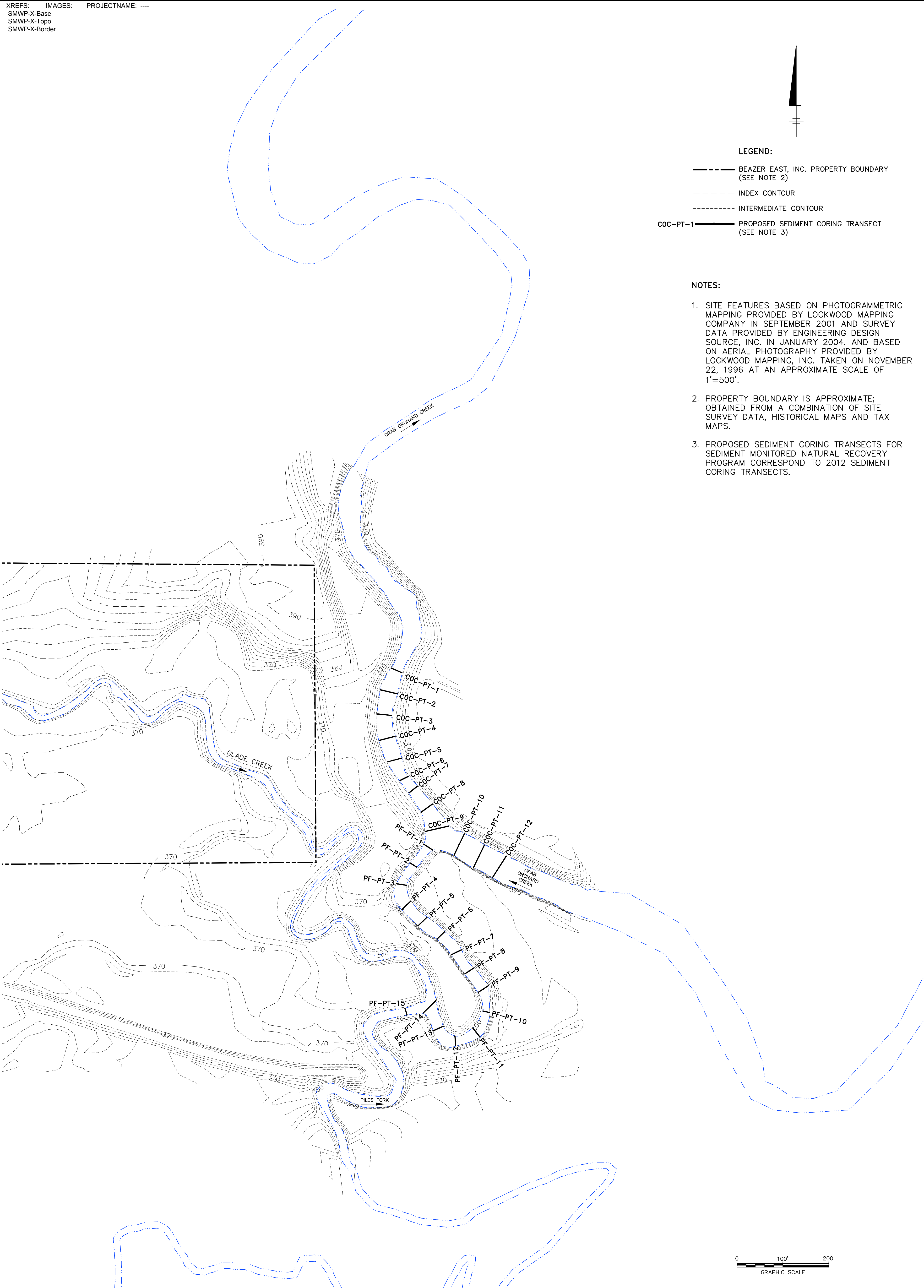


**LEGEND:**

BEAZER EAST, INC. PROPERTY BOUNDARY (SEE NOTE 2)

INDEX CONTOUR

INTERMEDIATE CONTOUR

COC-PT-1 PROPOSED SEDIMENT CORING TRANSECT (SEE NOTE 3)

**NOTES:**

1. SITE FEATURES BASED ON PHOTOGRAMMETRIC MAPPING PROVIDED BY LOCKWOOD MAPPING COMPANY IN SEPTEMBER 2001 AND SURVEY DATA PROVIDED BY ENGINEERING DESIGN SOURCE, INC. IN JANUARY 2004. AND BASED ON AERIAL PHOTOGRAPHY PROVIDED BY LOCKWOOD MAPPING, INC. TAKEN ON NOVEMBER 22, 1996 AT AN APPROXIMATE SCALE OF 1"=500'.
2. PROPERTY BOUNDARY IS APPROXIMATE; OBTAINED FROM A COMBINATION OF SITE SURVEY DATA, HISTORICAL MAPS AND TAX MAPS.
3. PROPOSED SEDIMENT CORING TRANSECTS FOR SEDIMENT MONITORED NATURAL RECOVERY PROGRAM CORRESPOND TO 2012 SEDIMENT CORING TRANSECTS.

BEAZER EAST, INC.
FORMER KOPPERS WOOD-TREATING SITE
CARBONDALE, ILLINOIS
**SEDIMENT MNR WORK PLAN**

**MNR PROGRAM SEDIMENT CORING LOCATIONS**

ARCADIS Design & Consultancy for natural and built assets

FIGURE
**1**

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: R. ANDERSON PM: J. HOLDEN TM: D. BESSINGPAS LYR:(Opt)ON=*;OFF=*REF*
C:\Users\roberlander\OneDrive - ARCADIS\BIM 360 Docs\BEAZER EAST, INC\Cdale Sediment MNR WP\2018\B0039330.0000\01-DWG\SMWP-Fig 2-MNR Sed Samp Loc.DWG LAYOUT: 2 SAVED: 7/13/2018 12:13 PM ACADVER: 21.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/13/2018 12:18 PM BY: OBERLANDER, ROSEANNE

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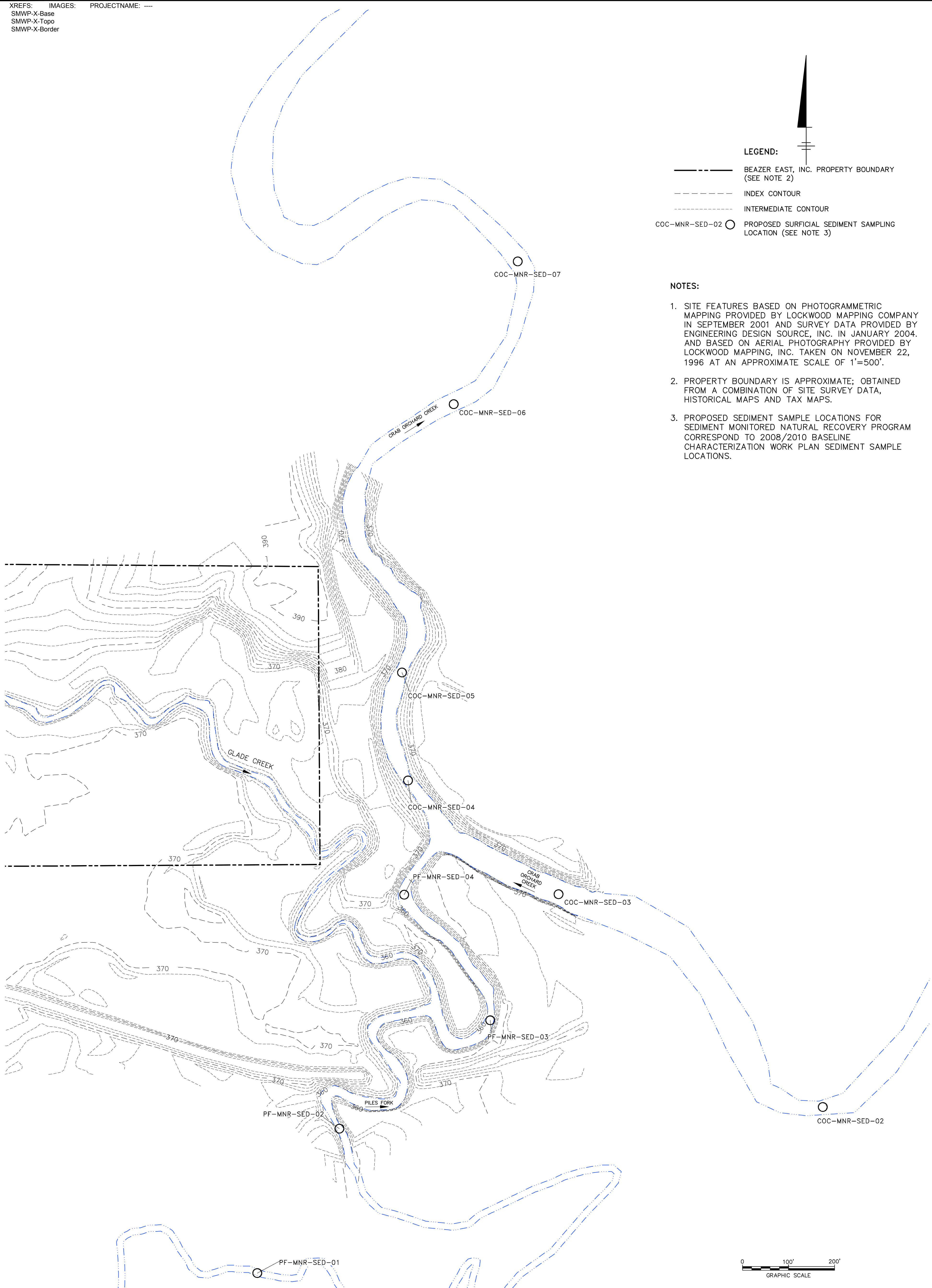


**LEGEND:**

- BEAZER EAST, INC. PROPERTY BOUNDARY (SEE NOTE 2)
- INDEX CONTOUR
- INTERMEDIATE CONTOUR
- COC-MNR-SED-02 ○ PROPOSED SURFICIAL SEDIMENT SAMPLING LOCATION (SEE NOTE 3)

**NOTES:**

1. SITE FEATURES BASED ON PHOTOGRAMMETRIC MAPPING PROVIDED BY LOCKWOOD MAPPING COMPANY IN SEPTEMBER 2001 AND SURVEY DATA PROVIDED BY ENGINEERING DESIGN SOURCE, INC. IN JANUARY 2004. AND BASED ON AERIAL PHOTOGRAPHY PROVIDED BY LOCKWOOD MAPPING, INC. TAKEN ON NOVEMBER 22, 1996 AT AN APPROXIMATE SCALE OF 1"=500'.
2. PROPERTY BOUNDARY IS APPROXIMATE; OBTAINED FROM A COMBINATION OF SITE SURVEY DATA, HISTORICAL MAPS AND TAX MAPS.
3. PROPOSED SEDIMENT SAMPLE LOCATIONS FOR SEDIMENT MONITORED NATURAL RECOVERY PROGRAM CORRESPOND TO 2008/2010 BASELINE CHARACTERIZATION WORK PLAN SEDIMENT SAMPLE LOCATIONS.

BEAZER EAST, INC.
FORMER KOPPERS WOOD-TREATING SITE
CARBONDALE, ILLINOIS
**SEDIMENT MNR WORK PLAN**

**MNR PROGRAM SEDIMENT SAMPLING LOCATIONS**

ARCADIS Design & Consultancy for natural and built assets

FIGURE
**2**

CITY: MINNEAPOLIS, MN DIV/GROUP: ENV/CAD DB: R. OBERLANDER LD: R. OBERLANDER PIC: R. ANDERSON PM: J. HOLDEN TM: D. BESSINGPAS LYR:(Opt)ON=*;OFF=*REF*
C:\Users\roberlander\OneDrive - ARCADIS\BIM 360 Docs\BEAZER EAST, INC\Cdale Sediment MNR WP\2018\B0039330.0000\01-DWG\SMWP-Fig 3-MNR Prog Fish Samp Loc.DWG LAYOUT: 3 SAVED: 7/13/2018 12:17 PM ACADVER: 21.0S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: ---- PLOTTED: 7/13/2018 12:19 PM BY: OBERLANDER, ROSEANNE
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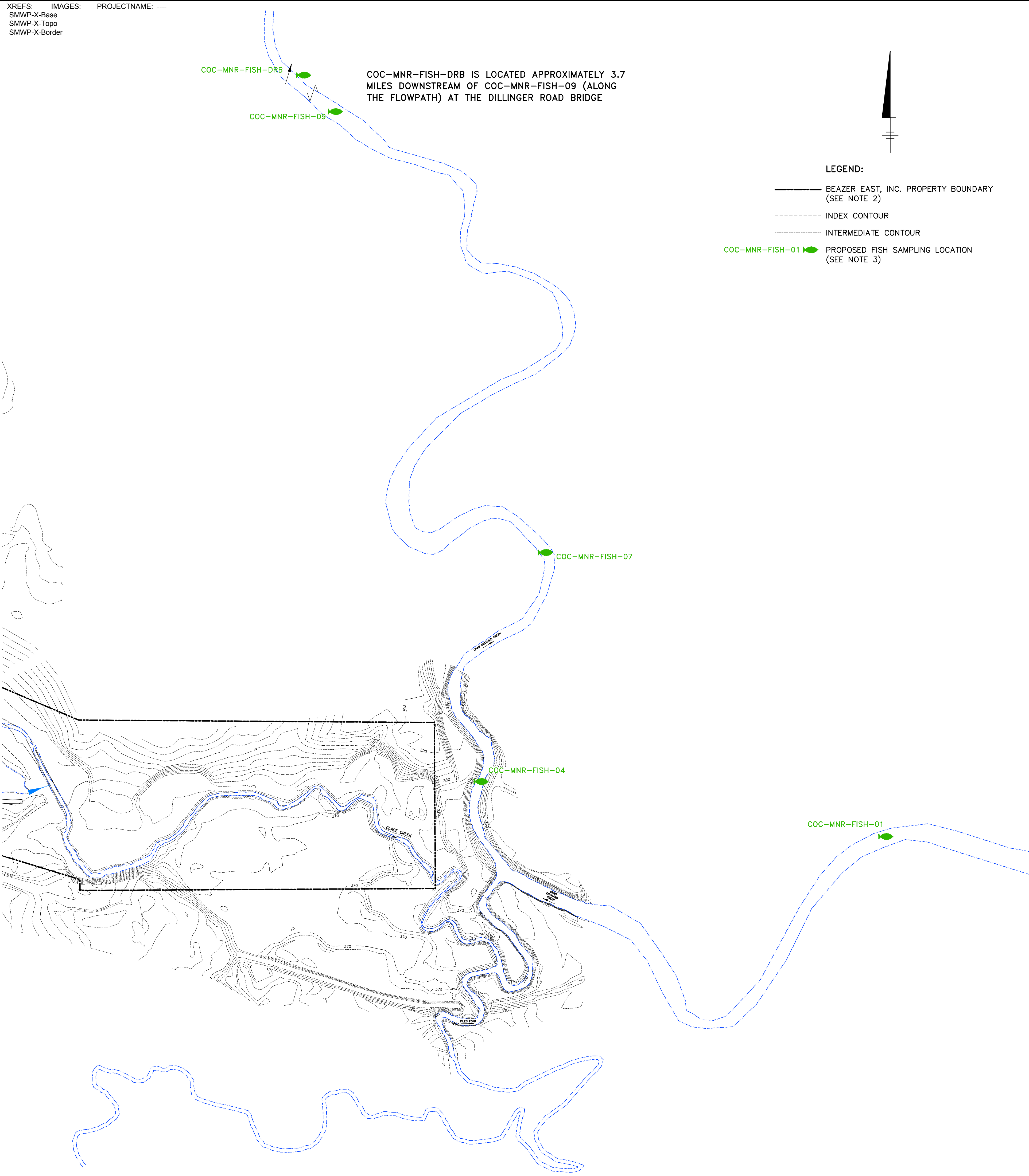
SMWP-X-Topo
SMWP-X-Border




**NOTES:**

1. SITE FEATURES BASED ON PHOTOGRAMMETRIC MAPPING PROVIDED BY LOCKWOOD MAPPING COMPANY IN SEPTEMBER 2001 AND SURVEY DATA PROVIDED BY ENGINEERING DESIGN SOURCE, INC. IN JANUARY 2004. AND BASED ON AERIAL PHOTOGRAPHY PROVIDED BY LOCKWOOD MAPPING, INC. TAKEN ON NOVEMBER 22, 1996 AT AN APPROXIMATE SCALE OF 1'=500'.
2. PROPERTY BOUNDARY IS APPROXIMATE; OBTAINED FROM A COMBINATION OF SITE SURVEY DATA, HISTORICAL MAPS AND TAX MAPS.
3. PROPOSED FISH SAMPLE LOCATIONS FOR SEDIMENT MONITORED NATURAL RECOVERY PROGRAM CORRESPOND TO 2008 BASELINE CHARACTERIZATION WORK PLAN FISH SAMPLE LOCATIONS (WITH THE EXCEPTION OF COC-MNR-FISH-DRB, WHICH WAS NOT SAMPLED IN 2008).

BEAZER EAST, INC.
FORMER KOPPERS WOOD-TREATING SITE
CARBONDALE, ILLINOIS
**SEDIMENT MNR WORK PLAN**

**MNR PROGRAM FISH SAMPLING LOCATIONS**

ARCADIS Design & Consultancy for natural and built assets

FIGURE
**3**

# ATTACHMENT 1

## Standard Operating Procedure:  Sediment Coring for Visual Characterization

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built assets

# ATTACHMENT 1

# STANDARD OPERATING PROCEDURE: SEDIMENT CORING FOR VISUAL CHARACTERIZATION

Rev Date: September 29, 2017

# 1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures that will be followed to collect sediment cores for visual characterization at the Former Koppers Wood-Treating Site in Carbondale, Illinois.

# 2 PERSONNEL QUALIFICATIONS

Arcadis field personnel will have current health and safety training, including 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) training, as well as first aid and cardiopulmonary resuscitation (CPR) training, as needed. Arcadis field personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to complete the work.

# 3 EQUIPMENT LIST

The following materials will be needed during the sediment coring activities:

- Copy of Work Plan;
- Copy of Site-specific Health and Safety Plan (HASP);
- Health and safety equipment as required by the HASP;
- Aluminum boat with outboard motor (if needed, depending on water depths);
- Chest and/or hip waders;
- Hand-held global positioning (GPS) unit;
- Metal push rod;
- 6-foot rule or survey rod;
- Lexan® tubing with end caps for each coring location;
- Generator and extension cords;
- Electrical shears for cutting open cores;
- Core driver;
- Hacksaw;
- Duct tape;
- Disposable aluminum pans;
- Plastic sheeting;
- Digital camera;
- Field notebook;
- Garbage bags.

# 4 CAUTIONS

Care must be taken to ensure that all equipment, including waders and personal protective equipment are clean and free of sediment or oily residue between investigation locations. Conduct work in a downstream to upstream manner to minimize the potential for cross-contamination.

# 5 HEALTH AND SAFETY CONSIDERATIONS

Sampling personnel should be cautious of working in and around water during sampling and sample processing activities. Sampling personnel must be aware of weather conditions at all times as creek water levels rise quickly during storm events.

Uneven/slippery terrain and obstacles (e.g., brush, fallen tree, etc.) exist in the uplands area (which will need to be traversed to reach the creeks), on the creek banks, and in the creeks themselves; sampling personnel should exercise caution to avoid slips, trips, and falls.

Refer to the Site-specific HASP for additional details and considerations.

# 6 PROCEDURE

1. Locate targeted coring transect in the field. Record GPS coordinates in field notebook.
2. Measure width of creek at transect location, and record general observations of surrounding area in the field notebook (e.g., nearby creek bends, nearby snags, bank conditions).
3. Don PPE as required by the HASP.
4. Measure water depth using ruler or survey rod and record in field notebook.
5. Push metal rod into sediments by hand until refusal; record sediment thickness (depth rod penetrated below sediment surface) in field notebook.
6. Sediment Core Collection:
    a. Lower a section of Lexan® tube until it reaches the top of sediment.
    b. Push Lexan® tube into the sediment by hand (or use core driver if needed) until refusal.
    c. Create a vacuum by filling the Lexan® tube completely with water and place a cap on top of the tube.
    d. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).
    e. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged.
    f. Keeping tube upright, seal the cap with duct tape and label. Measure length of sediment recovered and record in field notebook.
    g. While keeping the core upright, use a hacksaw to make are horizontal cut in the tube approximately 1 inch above the sediment, then re-cap the cut end of the tube, sealing with duct tape. Mark as "top."
7. Place the recovered core on top of plastic sheeting on the ground surface or a portable table. Use an electric shears to cut open the core along its length (two cuts, 180 degrees apart). Open the core to expose the recovered sediments. Photograph sediments and record general sediment descriptions as a function of depth, including color, grain size, texture, presence of organics, visual impacts, and odor.

# 7 WASTE MANAGEMENT

Lexan® tubes, other disposable equipment, used personal protective equipment (e.g., nitrile gloves), and recovered sediments generating during the field work will be containerized in 55-gallon drums for appropriate disposal by Beazer.

# 8 DATA RECORDING AND MANAGEMENT

Field personnel will maintain a field notebook as a record of the field work and will provide a copy to the project manager. The following details will be recorded (in addition to the information discussed above):

- Project name and location;
- Daily log of activities;
- Personnel present;
- Weather conditions;
- Rationale for field decisions, as appropriate;
- Deviations from SOP or Work Plan; and
- Any health and safety incidents or "near-misses."

# ATTACHMENT 2

## Standard Operating Procedure: Sediment Sample Collection

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## ATTACHMENT 2

# STANDARD OPERATING PROCEDURE: SEDIMENT SAMPLE COLLECTION

Rev Date: September 29, 2017

# 1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures that will be followed to collect sediment samples at the Former Koppers Wood-Treating Site in Carbondale, Illinois.

# 2 PERSONNEL QUALIFICATIONS

Arcadis field personnel will have current health and safety training, including 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) training, as well as first aid and cardiopulmonary resuscitation (CPR) training, as needed. Arcadis field personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to complete the work.

# 3 EQUIPMENT LIST

The following materials will be needed during the sediment sampling activities:

- Copy of Work Plan;
- Copy of Site-specific Health and Safety Plan (HASP);
- Health and safety equipment, as required by the HASP;
- Aluminum boat with outboard motor (if needed, depending on water depths);
- Chest and/or hip waders;
- Hand-held global positioning (GPS) unit;
- Metal push rod;
- 6-foot rule or survey rod;
- Lexan® tubing with end caps and/or dredge sampler;
- Core driver;
- Vacuum pump;
- Hacksaw;
- Duct tape;
- Paper towels;
- Generator and extension cords;
- Electrical shears for cutting open cores;
- Aluminum or stainless-steel trays/bowls and spoons/spatulas;
- Sample transport coolers with ice;

- Appropriate sample containers and forms;
- Digital camera
- Field notebook; and
- Garbage bags.

The following materials will be needed for equipment cleaning:

- Health and safety equipment, as required in the HASP;
- Deionized or distilled analyte free water;
- Non-phosphate soap (Alconox or equivalent);
- Appropriate cleaning solvent (e.g., hexane);
- Buckets for cleaning equipment in and containing cleaning fluids;
- Brushes;
- Aluminum foil; and
- Spray bottles for cleaning fluids.

# 4 CAUTIONS

Sampling personnel should be cautious of working in and around water during sampling and sample processing activities. Sampling personnel must be aware of weather conditions at all times as creek water levels rise quickly during storm events.

Uneven/slippery terrain and obstacles (e.g., brush, fallen tree, etc.) exist in the uplands area (which will need to be traversed to reach the creeks), on the creek banks, and in the creeks themselves; sampling personnel should exercise caution to avoid slips, trips, and falls.

Care must be taken to ensure that all equipment, including waders and personal protective equipment are clean and free of sediment or oily residue between investigation locations. Conduct work in a downstream to upstream manner to minimize the potential for cross-contamination.

# 5 HEALTH AND SAFETY CONSIDERATIONS

Sampling personnel should be cautious of working in and around water during sampling and sample processing activities. Sampling personnel must be aware of weather conditions at all times as creek water levels rise quickly during storm events.

Uneven/slippery terrain and obstacles (e.g., brush, fallen tree, etc.) exist in the uplands area (which will need to be traversed to reach the creeks), on the creek banks, and in the creeks themselves; sampling personnel should exercise caution to avoid slips, trips, and falls.

Refer to the Site-specific HASP for additional details and considerations.

# 6 PROCEDURE

**Surficial Sediment Sampling Procedures (Using Dredge Sampler)**

1. Locate the targeted sampling location in the field and review the Work Plan to confirm sampling scope.

2. Identify the sample location in the field notebook along with a general description of the creek conditions at the sampling location.

3. Don personal protective equipment (PPE), as required by the HASP.

4. At each sample location, lower the dredge sampler (attached to a rope) until it just reaches the top of sediment. Measure and record the depth of water.

5. Once the dredge has been allowed to settle into the sediment, pull hard on the rope to collect the sediment inside the dredge.

6. Retrieve the dredge and empty sediments into an aluminum or stainless-steel tray or bowl and record general sediment descriptions, including color, texture, visual impacts, and odors.

7. Repeat Steps 4 through 6 at various locations across the creek, in accordance with the Work Plan, until sufficient sample volume is obtained for the required analyses.

8. Homogenize the sediments with a stainless-steel spoon or spatula and record general sediment descriptions, including color, texture, visual impacts, and odors.

9. Place each sediment sample into the appropriate laboratory-supplied sample containers.

10. Label all sample containers with sample ID and depth interval, sample date/time, samplers' names, and requested analytical methods.

11. Handle, pack, and ship samples using standard chain-of-custody procedures.

**Surficial Sediment Sampling Procedures (Using Lexan® Tubes)**

1. Locate the targeted sampling location in the field and review Work Plan to confirm sampling scope.

2. Identify the sample location in the field notebook along with a general description of the creek conditions at the sampling location.

3. Don PPE, as required by the HASP.

4. At each sample location, lower a section of Lexan® tube until it reaches the top of sediment. Measure and record the depth of water.

5. Push the Lexan® tube into the sediment by hand (or use a core driver if needed) to the targeted surficial sediment sample depth.

6. Pump the water out from inside the Lexan® tube and place a vacuum pump on the top end of the Lexan® tube and create a vacuum to prevent the sediments from escaping; or create a vacuum by filling the Lexan® tube completely with water and place a cap on the top of the tube.

7. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).

8. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged.

9. Empty sediments from Lexan® tube into an aluminum or stainless-steel tray or bowl and record general sediment descriptions, including color, texture, visual impacts, and odors. If necessary, use electric shears to cut open Lexan® tube.

10. Repeat Steps 4 through 9 at various locations across the creek, in accordance with the Work Plan, until sufficient sample volume is obtained for the required analyses.

11. Homogenize the sediments with a stainless-steel spoon or spatula and record the sediment sample color, texture, visual impacts, and odors.

12. Place each sediment sample into the appropriate laboratory-supplied sample containers.

13. Label all sample containers with sample ID and depth interval, sample date/time, samplers' names, and requested analytical methods.

14. Handle, pack, and ship samples using standard chain-of-custody procedures.

**Deep Sediment Sampling Procedures (Using Lexan® Tubes)**

1. Locate the targeted sampling location in the field and review Work Plan to confirm sampling scope.

2. Identify the sample location in the field notebook along with a general description of the creek conditions at the sampling location.

3. Don personal protective equipment (PPE), as required by the HASP.

4. At each sample location, lower a section of Lexan® tube until it just reaches the top of sediment. Measure the depth of water.

5. Push the Lexan® tube into the sediment by hand (use a core driver if needed) to approximately three inches past the targeted sample depth, or until refusal. Measure the depth of sediment.

6. Pump the water out from inside the Lexan® tube and place a vacuum pump on the top end of the Lexan® tube and create a vacuum to prevent the sediments/plug from escaping; or create a vacuum by filling the Lexan® tube completely with water and place a cap on the top of the tube.

7. Slowly pull the tube from the sediment, twisting it slightly as it is removed (if necessary).

8. Before the tube is fully removed from the water, place a cap on the bottom end of the tube while it is still submerged.

9. Keeping the tube upright, wipe the bottom end dry and seal the cap with duct tape and label. Measure the length of sediment recovered and evaluate the integrity of the core. If the core is not suitably intact, repeat coring procedure within 5 to 10 feet of the first location attempted.

10. While still keeping the core upright, use a hacksaw to make a horizontal cut in the tube approximately 1 inch above the sediment.

11. Re-cap the cut end of the tube, seal the cap with duct tape, and mark this end as “top.”

12. Wipe the tube dry.

13. Place a completed sample label on the tube.

14. Record the following information on both the tube and on the cap: 1) sample ID; 2) sampling date; and 3) sampling time.

15. Extrude the sediment core from the Lexan® tube onto an aluminum or stainless-steel tray. If necessary, use electric shears to cut open Lexan® tube.

16. Characterize the entire sediment core for color, texture, visual impacts, and odors as a function of depth.

17. Homogenize the sediments from the targeted sample interval(s) with a stainless-steel spoon or spatula.

18. Place each sediment sample into the appropriate laboratory-supplied sample containers.

19. Label all sample containers with sample ID and depth interval, sample date/time, samplers’ names, and requested analytical methods.

20. Handle, pack, and ship samples using standard chain-of-custody procedures.

**Equipment Cleaning Procedures**

Non-dedicated and non-disposable sampling equipment will be cleaned prior to use at each sampling location. Equipment cleaning procedures will be as follows:

1. Wash with non-phosphate detergent and distilled/deionized water to remove visible particulate matter and oils;
2. Rinse with distilled/deionized water;
3. Triple rinse sequence of solvent (e.g. hexane, methanol, nitric acid) followed by distilled/deionized water; and
4. Air dry and wrap in aluminum foil.

All cleaning fluids will be collected and appropriately containerized for subsequent disposal.

# 7 WASTE MANAGEMENT

Lexan® tubes, other disposable equipment, used personal protective equipment (e.g., nitrile gloves), equipment cleaning fluids, and recovered sediments generating during the field work will be containerized in 55-gallon drums for appropriate disposal by Beazer.

# 8 DATA RECORDING AND MANAGEMENT

Field personnel will maintain a field notebook as a record of the field work and will provide a copy to the project manager. The following details will be recorded (in addition to the information discussed above):

- Project name and location;
- Daily log of activities;
- Personnel present;
- Weather conditions;
- Rationale for field decisions, as appropriate;
- Deviations from SOP or Work Plan; and
- Any health and safety incidents or “near-misses.”

# 9 QUALITY ASSURANCE

Refer to the Site-specific Quality Assurance Project Plan.

# ATTACHMENT 3

## Standard Operating Procedure: Fish Sample Collection and Processing

# ATTACHMENT 3

# STANDARD OPERATING PROCEDURE: FISH SAMPLE COLLECTION AND PROCESSING

Rev Date: September 29, 2017

# 1 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures that will be followed to collect and process fish samples at the Former Koppers Wood-Treating Site in Carbondale, Illinois.

**Note: Either boat-mounted or backpack electrofishing units will be used for fish sample collection, depending on water levels and accessibility. As necessary, electrofishing will be supplemented with other active methods (e.g., angling, seining, cast netting) and/or passive methods (e.g., trotlining, gillnetting, minnow traps).**

# 2 PERSONNEL QUALIFICATIONS

Arcadis field personnel will have current health and safety training, including 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response Standard (HAZWOPER) training, as well as first aid and cardiopulmonary resuscitation (CPR) training, as needed. Arcadis field personnel will be well versed in the relevant SOPs and possess the required skills and experience necessary to complete the work.

# 3 EQUIPMENT LIST

The following materials and supplies, as appropriate, are necessary for collection and processing of freshwater fish:

- Copy of Work Plan;
- Copy of Site-specific Health and Safety Plan (HASP);
- Health and safety equipment as required by the HASP;
- Field log book;
- Field sampling personnel business cards;
- Sampling permits and licenses;
- Chain-of-custody and security seals;
- Cooler;
- Aluminum foil;
- Plastic bags for ice and sample sets;
- Ice;
- Paper towels;
- Aluminum boat with outboard motor (if needed, depending on water depths);
- Electrofishing equipment;
- Dip nets with non-conductive handles;

- Live well or 5-gallon bucket;
- Measuring board and ruler;
- Top-loading electronic and suspended-weight spring balances;
- Camera;
- Global positioning system (GPS); and
- Fishing rods/reels and bait/tackle, casting net, trot lines, gill nets, and minnow traps (to be used, as needed, as a supplement to electrofishing).

# 4 PROCEDURE

The following procedures will be used to collect and process fish samples for laboratory analysis:

1. Electrofishing

    A. Boat-Mounted Electrofishing

        1) The field crew will don health and safety equipment (e.g., life jackets, non-conductive shoes and gloves, etc.), set up the electrofishing equipment, and test it upon arrival at the sampling site.

        2) If conditions permit, set up block nets at the downstream and upstream end of the sampling reach.

        3) The boat operator will be responsible for control of the boat, and operation of the control equipment and generator. The remaining field crew will operate from the front of the boat and will be responsible for control of the on-off floorboard switch and capturing the fish.

        4) Electricity will be applied to the water by actively maintaining the on-off switch in the closed position while the generator and control equipment are operative.

        5) The electrical current will be set to stun the fish but should not cause mortality.

        6) Sampling will be conducted from downstream to upstream.

        7) Fish will be collected using non-conductive dip-nets and will be placed in a live-well with fresh water.

B. Backpack Electrofishing

1) The field crew will don health and safety equipment (e.g., life jackets, non-conductive gloves, waders, etc.), set up the electrofishing equipment, and test it upon arrival at the sampling site.

2) If conditions permit, set up block nets at the downstream and upstream end of the sampling reach.

3) The field crew leader will be responsible for operation of the backpack unit. The remaining field crew will be responsible for capturing the fish.

4) Electricity will be applied to the water by actively maintaining the on-off switch on the anode pole.

5) The electrical current will be set to stun the fish but should not cause mortality.

6) Sampling will be conducted from downstream to upstream.

7) Fish will be collected using non-conductive dip-nets and will be placed in a 5-gallon bucket with fresh water until they can be transferred to a cooler with ice.

2. Fish Processing, Handling, Packaging, and Shipping

A. Temporary Storage

1) Measure and/or weigh each fish after collection, as necessary, to ensure that appropriate sized fish are taken and that minimum mass requirements are satisfied.

2) Transfer fish to sealable plastic bags (if not done previously) and label with sampling date and capture location, and place in coolers with ice until field processing can occur. Large fish or large numbers of fish that do not fit into plastic bags may be placed on ice in clean coolers that are clearly labeled.

3) Count the number of fish to ensure that the correct numbers are collected.

B. Processing

1) All samples will be given a unique sample identification number that will be recorded on the field sampling form, and that corresponds to the fish species, sampling date, and collection location.

2) To begin processing, sediments, soil, and other debris will be removed from the fish, as needed, by handpicking or by rinsing with potable water.

3) Each sample will be assigned a unique sample identification number which will be recorded in the field notebook or data sheet along with the species, number of individuals in the sample, collection date, and collection location.

4) Each sample will be measured and weighed including total length (length range for composite samples) and weight and measurements will be recorded in the field notebook or data sheet.

5) External abnormalities or visible parasites will be noted in the field notebook or data sheets along with the sample preparation method (i.e. standard fillet, whole-body composite or head and viscera removed) depending on species and size.

6) Composite samples will be formed of fish of the same species and of similar size (e.g. if possible, the smallest individual in a composite will be no less than 75% of the length of the largest individual).

7) Individual and composite fish samples will have sufficient sample mass, as possible, to meet the minimum sample mass requirements for chemical analysis.

8) Fish samples will be wrapped in aluminum foil and placed into large sealable plastic bags on ice in preparation for packing. The sample identification number will be written on each bag with a waterproof marker.

9) All equipment will be cleaned with detergent and a potable water rinse as required or immediately following processing.

10) Chain-of-custody forms, custody seals, address labels, and air-bill forms will be initiated. Chain-of-custody forms will identify the tissue sample preparation procedure and chemical analysis. A copy of the completed chain-of-custody form and air-bill form will be retained by the sampler.

C. Handling

1) Specify on the field sample form and on the chain-of-custody form the tissue sample preparation procedure (e.g., skin-on/scales-off fillets, whole body grinding) and chemical analysis (e.g., dioxins/furans and percent lipids) the laboratory will follow.

2) Designate sampling personnel responsible for sample custody. Note: If the designated sampling person relinquishes the samples to other sampling or field personnel for packing or other purposes, the sampler will complete the chain-of-custody form to document the sample custody transfer.

D. Packing

1) Coolers used for transport will be duct-taped at the drain plug on the outside and inside of the cooler.

2) Ice will be packaged in sealable plastic bags (double-bagged with the outer seal duct-taped) and placed in the bottom of the cooler. The sealed fish samples will be placed inside the cooler with enough room for additional ice bags to be placed on top.

3) The completed chain-of-custody form will be placed into a plastic bag and duct-taped to the inside of the cooler lid.

4) The cooler will be closed and fastened with duct tape around the seam of the lid to prevent water leakage and with strapping or duct tape around the entire cooler to prevent it from opening during transport.

5) A completed custody seal will be placed across the seam of the cooler lid. A completed address label will be placed on top of the cooler. Both will be taped-over using clear packing tape.

E. Shipping

1) Samples will be shipped to the laboratory via hand delivery or by express carrier. The signed and dated chain-of-custody forms should be included in the cooler. The express carrier will not be required to sign the chain- of-custody forms. The sampler should retain the express carrier receipt or bill of lading.

2) The laboratory will be notified of the shipment and will be contacted following the arrival date to ensure that delivery has occurred. When the samples are received by the laboratory, the laboratory personnel should complete the chain-of- custody forms by recording receipt of samples, and then check the sample identification numbers on the containers against the chain-of-custody forms.

# 5 WASTE MANAGEMENT

Disposable equipment, used personal protective equipment (e.g., nitrile gloves), and other wastes generated during the field work will be containerized in 55-gallon drums for appropriate disposal by Beazer.

# 6 DATA RECORDING AND MANAGEMENT

Field personnel will maintain a field notebook as a record of the field work and will provide a copy to the project manager. The following details will be recorded (in addition to the information discussed above):

- Project name and location;
- Daily log of activities;
- Personnel present;
- Weather conditions;
- Rationale for field decisions, as appropriate;
- Deviations from SOP or Work Plan; and
- Any health and safety incidents or “near-misses.”

# 7 QUALITY ASSURANCE

Refer to the Site-specific Quality Assurance Project Plan.

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