

# Sediment Sampling Plan

BASF (Former Ciba-Geigy Facility)  
180 Mill Street, Cranston, Rhode Island

RCRA Corrective Action Program  
EPA ID No. RID001194323

BASF Corporation

June 13, 2023, Revised August 2024

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# 1. Introduction

On behalf of BASF Corporation (BASF), AECOM prepared a Draft Sediment Sampling Plan (SSP) for work on the Pawtuxet River adjacent to the former Ciba-Geigy Facility located at 180 Mill Street in Cranston, Rhode Island (Facility or Site). The Draft SSP was delivered to United States Environmental Protection Agency (USEPA) on October 13, 2023, who provided comments on March 7, 2024. AECOM has provided a comment response document, and has prepared this Final Sediment Sampling Plan (SSP) in response to the March 7, 2024 comments.

## 1.1 Site Description

The former Ciba-Geigy Facility was a chemical manufacturing facility operated by Alrose Chemical Company beginning in 1939. Geigy Chemical Corporation began operating at the Site in 1954 and continued operations until May 1986. Following closure, the facility was decommissioned, and former production area buildings were demolished to grade.

The Site is bounded to the south by the Pawtuxet River, to the north and east by residential properties, and to the west by industrial properties and undeveloped land (Figure 1). In 2009, BASF acquired Ciba Corporation which acquisition included the Site. Investigation and remediation activities at the Site have been conducted under regulatory oversight of the United States Environmental Protection Agency (USEPA) since 1989 as part of the USEPA Resource Conservation and Recovery Act (RCRA) Corrective Action program.

## 1.2 Environmental History

An Administrative Order of Consent (AOC) was issued to Ciba-Geigy June 16, 1989, which required a RCRA Corrective Action Study. The RCRA Facility Assessment (RFA) was conducted by the USEPA, and the report was issued in January 1988. The report determined that known and/or suspected releases had occurred on the Site.

A RCRA Facility Investigation (RFI) was undertaken by Ciba-Geigy as the next step in the RCRA Correction Action process (CIBA Corporation, 1995). Remedial investigation activities were performed between 1990 and 2014.

Several interim corrective measures were completed during the RFI, and after the May 2016 Statement of Basis (USEPA, 2016) in which the USEPA issued the Remedy Determination for the Facility, comprehensive corrective actions were implemented. The following remedial activities have been completed at the Site under the RCRA program.

**Table 1 Summary of Remedial Activities Completed**

Year(s)	Remedial Activity
1995 – 1996	Shallow soil excavation and capping to address polychlorinated biphenyls (PCBs)
	Soil vapor extraction (SVE) system installation to address a toluene spill
	Groundwater extraction and treatment system installation to address constituents of concern discharging to the Pawtuxet River
1995 – 1997	Sediment excavation and capping to address PCBs in the vicinity of the of the cofferdam treatment area
1997 – 2005	SVE system operation
1996 – 2006	Groundwater extraction and treatment system operation
2012	Focused sediment excavation and capping to address PCBs identified during a 2010-2011 sampling program
2018	Soil excavation and capping to address PCB impacted soil
2018	Introduction of sodium persulfate to address residual volatile organic compound (VOC) impacts in the toluene spill area
2019 – 2023	Installation and operation of permeable reactive barrier utilizing alkaline-activated potassium persulfate in the jet sump area

An original draft of this Sediment Sampling Plan was provided to the United States Environmental Protection Agency (USEPA) on October 13, 2023. The USEPA provided comments on this SSP on March 7, 2024, and the SSP has been revised to reflect responses to these EPA comments.

### 1.2.1 Selection of Constituents for Inclusion in Sediment Sampling Plan

There are multiple lines of evidence suggesting that both VOCs and PCBs are present in the Pawtuxet River adjacent to the Site. Previous investigations (AECOM, 2016a,b, AEI Consultants, 2020, CIBA Corporation, 1995, 1996a,b) indicate that VOCs and PCBs are site-related COCs. Additional sampling and analysis activities are required to better understand the nature, extent, fate, and transport properties of these COCs in riverine sediment.

To evaluate whether or not additional COCs should be included in this proposed sampling effort, BASF conducted an evaluation of historical reports and data to better understand the Site conceptual site model (CSM) and the potential for other COCs to be present in Pawtuxet River sediments.

As discussed below, the CSM for this site supports the focus on PCBs and VOCs in the river.

### 1.2.2 Summary of 1996 Ecological Risk Assessment

The 1996 Baseline Ecological Risk Assessment (BERA) for the Pawtuxet River (CIBA Corporation, 1996a) was conducted using data collected in 1990. The results of the BERA included risk to receptors from Upstream (i.e., background) and adjacent to the Production Area (Upper Facility in the BERA) and in the river near the Wastewater Treatment Area (Lower Facility in the BERA). Constituents were evaluated for risk to the great blue heron on a “river wide” basis. The BERA included assumptions that tended to the conservative, “tending to overestimate ecological risk” (CIBA Corporation, 1996a).

Adjacent to the Site, the BERA indicated there may be risks from PCBs/dioxins/furans, polycyclic aromatic hydrocarbons (PAHs), metals, and pesticides in sediment prior to the 1995 sediment excavation and capping in the cofferdam area. The calculated potential risks from PCBs in sediment were grouped with dioxins and furans in the BERA; however, dioxins and furans were not detected in the Upper Facility Reach, adjacent to the facility. The risks in this reach were driven by PCBs, which were reduced following the 1995 sediment removal (CIBA Corporation, 1996b).

The BERA also concluded that the Pawtuxet River is ecologically stressed in all reaches of the river studied in the BERA, including upstream, and that the river is impacted by upstream sources. Given the conclusion, a review of data from the historic sampling was conducted to identify potential upland sources from facility operations for the constituents listed in the BERA, and upstream sources are being researched.

### 1.2.3 Evaluation of Upland Constituents

Data collected and reported in the RCRA RFI (CIBA Corporation, 1995), the Corrective Measures Implementation Closure Report: Soil Remedy for Former Production Area (Lot 1102) (AEI Consultants, 2020), the 2016 Supplemental Remedial Investigation Report (AECOM 2016a), and the 2016 Final Corrective Measures Study (AECOM, 2016b) were used to inform the selection of constituents for this study and to ensure that the focus on VOCs and PCBs is warranted.

Data analysis from the RCRA RFI (CIBA Corporation, 1995), Supplemental RFI (AECOM, 2016a), and Statement of Basis (USEPA, 2016) identified PAHs, PCBs, and VOCs as constituents requiring remediation in the former production area (FPA). Sources of releases included documented chemical spills, a failure of the Boiler Plant Jet Sump, the Hot Sump, and the Building #21 Tank Farm.

- The Boiler Plant Jet Sump was formerly located in the southeastern corner of the property, approximately 20 feet from the river. The Boiler Plant Jet Sump failed in the mid-1970s, and solvents were observed in the structure at the time prior to filling the sump in approximately 1978. High concentrations of VOCs were identified in this area during the Supplemental RCRA Field Investigation (AECOM, 2016a).
- The Hot Sump was located in the northeastern corner of the former production area, adjacent to the river. The Hot Sump was connected via an outfall to a cofferdam treatment area in the river. The cofferdam treatment

area received facility wastewater from this outfall. This cofferdam was approximately 8 feet wide adjacent to the Facility along a 50-foot length of river. Sediment excavation to remove visually impacted sediments and construction of a sediment cover system was performed in the area of the cofferdam in 1995.

Sampling during the RFI (CIBA Corporation, 1995) included groundwater and soil from a Background Area, the Production Area, and the Wastewater Treatment Area for constituents including metals, PAHs, pesticides, and dioxin/furans. Data collected from the Warwick Area were reviewed, but since this area is not adjacent to the Pawtuxet River, no migration pathway was identified.

#### **1.2.3.1 Production Area**

In shallow and deep soil, pesticides were detected at concentrations less than 1 part per million (ppm). Single part per billion (ppb) and sub-ppb concentrations of pesticides were detected in some groundwater wells. Since the pesticides were detected in groundwater at very low concentrations, a migration pathway to the river is unlikely.

In shallow and deep soil, PAHs were detected at concentrations less than 10 ppm. In some groundwater wells, PAHs were detected at concentrations <10 ppb. Naphthalene was detected at concentrations up to 240 ppb from one shallow well in SWMU 11 (approximately 200 feet from the river) and was <26 ppb in other wells. A statistical comparison of Production Area PAH concentrations to background concluded that PAHs are consistent with background. Since the PAHs were detected in soils and groundwater at very low concentrations, a migration pathway to the river is unlikely.

Some chlorinated dioxin and furan congeners were detected at trace levels in shallow and deep soil in the background area and the Production Area. Given the binding affinity of dioxins and furans, a migration pathway to the river is unlikely.

Nickel was the only metal not screened out using background soil data. The highest concentration detected in soil was 26.6 ppm. Nickel was detected in groundwater from approximately half of the wells in the Production Area. Detected concentrations ranged from 20.2 to 549 ppb. Since the nickel was detected in groundwater and soil at very low concentrations, a migration pathway to the river is unlikely.

#### **1.2.3.2 Wastewater Treatment Area**

Gamma chlordane was detected in 8 of the 21 shallow soil samples at concentrations up to 19 ppm. Other pesticides were detected at <1 ppm. Single ppb concentrations of pesticides were detected in some groundwater wells. Since the pesticides were detected in groundwater at very low concentrations, a migration pathway to the river is unlikely.

In shallow and deep soil, PAHs were detected at concentrations less than 7 ppm. PAHs were detected in some groundwater wells at concentrations <5 ppb. A statistical comparison of Wastewater Treatment Area PAH concentrations to background concluded that PAHs are consistent with background. Since the PAHs were detected in groundwater at very low concentrations, a migration pathway to the river is unlikely.

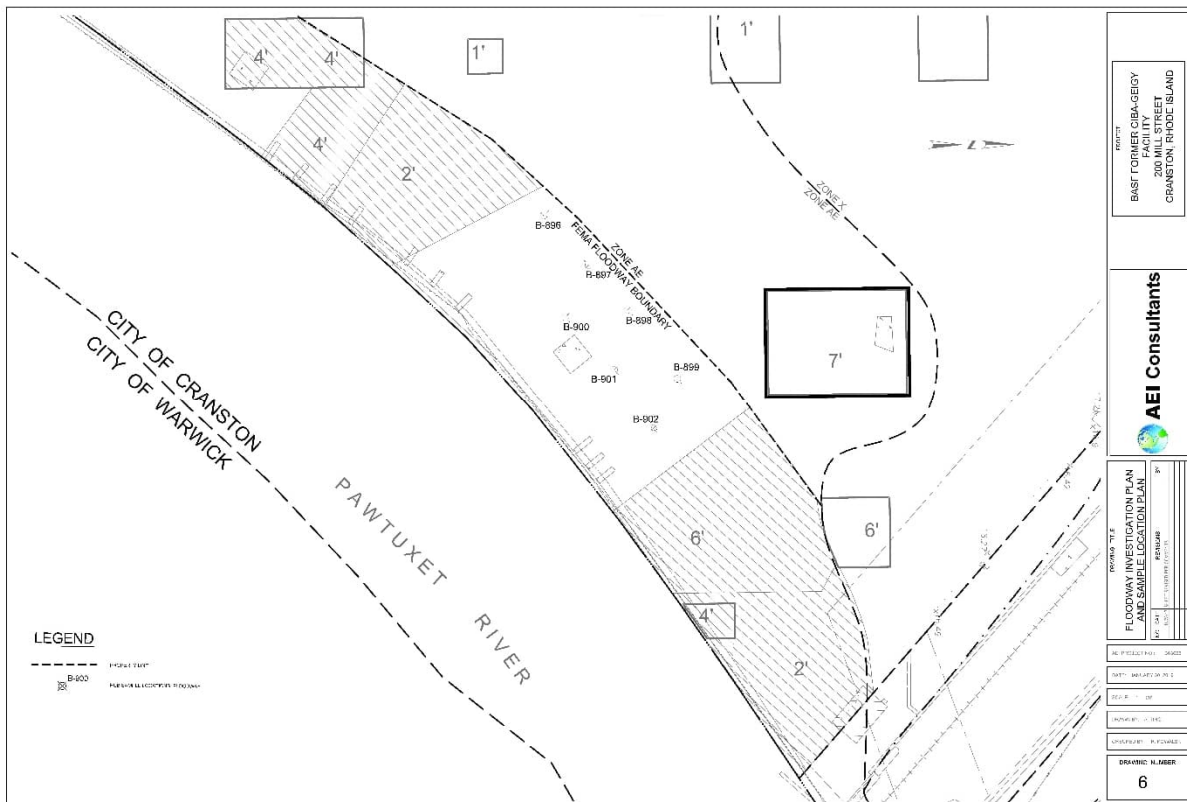
In soil, tetrachlorodibenzofuran isomers were detected. Given the binding affinity of these furan compounds and general lack of constituents in groundwater, a migration pathway to the river is unlikely.

Metals were not detected in soil at concentrations of concern based on comparison to background data. Therefore, any metals detected in the Wastewater Treatment Area were determined consistent with background and not related to the Site.

#### **1.2.3.3 Floodway Sampling**

As part of the Corrective Measures Implementation (AEI Consultants, 2020), USEPA requested soil sampling in the Federal Emergency Management Agency (FEMA) floodway between the Production Area and the Wastewater Treatment Area. Seven soil borings (to 4 feet) were collected (Exhibit 1). Seven samples were analyzed for VOCs from discrete depths. Seven soil samples composited from 0 to 4 feet below surface were analyzed for RCRA 8 metals, PAHs, pesticides, PCBs and total cyanide. Six samples were also analyzed for PAHs from 0 to 2 feet and 2 to 4 feet horizons. Three borings were located adjacent to the river and four were on the edge of the FEMA floodway toward the upland. PAHs were detected in samples at locations B-896, B-897, B-898, and B-900 at concentrations exceeding residential soil screening value. BASF removed these soils. Pesticides at concentrations below residential

screening values were detected in the same samples as the PAHs and were removed during the PAH soil removal. Given the binding affinity of pesticides and PAHs, a migration pathway to the river is unlikely.



**Exhibit 1 Locations of Floodway Samples (source: Corrective Measures Implementation [AEI Consultants, 2020])**

### 1.2.4 Constituents of Concern

Based on the data review and consensus from the reports developed for the Site, PCBs and VOCs are the two constituents identified for action in the upland area. No significant migration pathway of other constituents to the river were identified. Concentrations were generally low and primarily in soils, not groundwater.

PCBs and VOCs have been retained for evaluation in the Pawtuxet River sediments.

## 1.3 Pawtuxet River Sediment Sampling

Under the RCRA program, sediment sampling has occurred in the Pawtuxet River since the early 1990s. A review of data collected from multiple rounds of sampling (see Section 1.3) indicate that:

- PCBs are present in the sediments adjacent to the Facility; and
- VOCs such as chlorinated benzenes have been detected at high concentrations adjacent to the bulkhead in the upstream portion of the Site, near the former tank storage area.

### 1.3.1 Historical PCB Sampling and Analysis

Figure 2 depicts the results of PCB sediment sampling conducted between 1990 to 2022. Concentrations of PCBs (analyzed as Aroclors) above 0.4 milligram per kilogram (mg/kg or ppm)<sup>1</sup> were found in nearshore environments, in

<sup>1</sup> The concentration 0.4 mg/kg has been used for qualitative delineation based on the historic data and is not a cleanup goal or risk-based level.



the vicinity of the three historic sediment removal areas (SD2R, SD-34, and SD-42) and adjacent to the bulkhead separating the river from upland portions of the Site.

The highest concentrations of PCBs were detected at sampling location PZ-01D2, adjacent to the bulkhead, in August 2022. Concentrations ranged from 840 to 1,200 mg/kg in the upper 5.5 feet of the sediment profile, and concentrations rapidly decreased with depth of the sediment column. Concentrations were less than 1 mg/kg or not detected from 9 feet to the bottom of the core (23.3 feet). PCB concentrations up to 32 mg/kg were detected in the top 2 feet of sediment in samples collected in 2022 near the SD2R and SD-34 removal areas, just downstream of the PZ-01D2 location. Near the SD-42 excavation area and the downstream Facility Railroad Bridge, PCBs were largely found at concentrations less than 0.4 mg/kg. However, in 1994, at two locations in the vicinity of the railroad bridge (SD-TUF2B and SD-TUF2C), PCBs were detected at 2.1 and 75 mg/kg in the 1 to 2-foot (ft) sampling horizon.

In the immediate vicinity of the Site, PCB impacts to the Pawtuxet River have largely been bounded by historic sampling activities (Figure 2).

- Upstream Extent: Approximately 100 feet upstream of sampling location PZ-01D2, in the transect of samples labeled SD-TUF10A through C, PCB concentrations ranged from ND to 0.021 mg/kg, indicating that the upstream extent of PCB impacts to the river has been defined.
- Cross-River Extent. Multiple sediment samples were collected from across the river from the Site. PCB concentrations in these samples ranged ND to 0.3 mg/kg, indicating that PCB impacts do not extend laterally to the southeasterly far-shore side of the river.
- Downstream Extent: Approximately 50 feet downstream of the Facility Railroad Bridge, PCB concentrations in a cross-river transect (SD-TUFA through C) ranged from 0.038 to 0.176 mg/kg, indicating that the downstream end of near-Site PCB impacts is well delineated.

A second smaller area of PCB-impacted sediment is located approximately 200 feet downstream of the Facility Railroad Bridge. This area was sampled in 1992, 1994, 1995, and 2002. PCBs were detected in two sample locations (SD-TLF-12B and SD-04R) abutting the northern side of the river at concentrations ranging from ND to 17.5 mg/kg. It is not known if the PCBs in sediment in this other area are related to operations at the Facility or related to urban river background conditions.

### 1.3.2 Historical VOC Sampling and Analysis

Figure 3 depicts the results of sediment sampling for nine selected VOCs<sup>2</sup> conducted between 1992 to 2022. Historic sampling locations were situated adjacent to the bulkhead in an area of presumed former discharges of groundwater to the river and near the old tank storage area. VOCs were not sampled in the middle of or on the far shore of the river.

The highest concentrations of VOCs were detected at sampling location PZ-01D2 in August 2022. This station was sampled in the mudflat adjacent to the open water using mechanical drilling equipment (e.g., an auger or casing rig); as such, deeper samples were obtained than would be with a sediment coring device. Except for 1,2-dichlorobenzene; concentrations of the selected VOCs were highest in the upper 5.5 feet of sediment. Concentrations decreased with depth.

VOC concentrations in the three samples adjacent to the bulkhead ranged from:

- ND to 410 mg/kg for chlorobenzene (maximum in 0.25 to 0.75 ft horizon at PZ-01D2),
- ND to 3,200 mg/kg for trichloroethylene (maximum in 0.25 to 0.75 ft horizon at PZ-01D2),
- ND to 20,000 mg/kg for tetrachloroethylene (maximum in 4 to 5.5 ft horizon at PZ-01D2),
- ND to 3,400 mg/kg for cis-1,2-dichloroethene (maximum in 4 to 5.5 ft horizon at PZ-01D2),
- ND to 130 mg/kg for 1,2-dichlorobenzene (maximum in 9 to 10.4 ft horizon at PZ-01D2),

<sup>2</sup> Chlorobenzene, trichloroethylene, tetrachloroethylene, cis-1,2-dichlorobenzene, 1,2-dichlorobenzene, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, toluene and xylene were selected to present on Figure 3 as indicative VOCs detected in sediment.

- ND to 300 mg/kg for 1,2,4-trimethylbenzene (maximum in 4 to 5.5 ft horizon at PZ-01D2),
- ND to 200 mg/kg for 1,3,5-trimethylbenzene (maximum in 4 to 5.5 ft horizon at PZ-01D2),
- ND to 95 mg/kg for toluene (maximum in 4 to 5.5 ft horizon at PZ-01D2),
- ND to 233 mg/kg for xylene (maximum in 4 to 5.5 ft horizon at PZ-01D2),

Available data suggests that sediments impacted with VOCs are limited to the northwesterly side of the river, immediately adjacent to the Facility bulkhead. While no upstream samples were collected, sediment collected from across the river at sampling location SD-02L contained ND to very low (0.063 mg/kg for chlorobenzene and 0.076 mg/kg for toluene) concentrations of VOCs. A second across river sample (SD-03L) is located upstream of the railroad bridge; VOC concentrations at this location were also very low (0.078 mg/kg for chlorobenzene and ND to 0.1 mg/kg for toluene). Approximately 200 linear feet downstream of the Facility Railroad Bridge, at sampling location SD-04R where PCBs were previously detected (Section 1.3.1), concentrations of chlorobenzene and toluene were detected at concentrations ranging from 0.17 to 0.66 and ND to 0.58 mg/kg, respectively.

## 2. Scope of Work

PCBs and VOCs are present in Pawtuxet River sediments at elevated concentrations, particularly near the bulkhead and adjacent to the Facility. Although the upstream and downstream sediment impacts are well delineated, given the age and limitations of the existing data set, developing a better understanding of the distribution of these constituents in the river adjacent to the Facility is necessary.

For the purposes of this SSP, four distinct areas of the river requiring additional investigation have been operationally defined:

- **Study Area 1:** The reach of the Pawtuxet River adjacent to the Facility
- **Study Area 2:** The portion of the river approximately 200 ft downstream of the Facility Railroad Bridge where PCBs were detected in some samples.
- **Background Area 1:** Clean boundary transects (Figures 4 and 5) have been identified approximately 50 ft upstream of Study Area 1. Background samples have been located upstream of the boundary.
- **Background Area 2:** Additional background samples will be identified during the field investigation. The cores collected in Study Areas 1 and 2 will be logged for sediment type and other characteristics. Attempts will be made to identify similar sediments upstream of the Site and to collect background samples from these locations. Potential locations of deposition are shown in Figure 6.

The sediment sampling procedures are provided in Appendix A.

Three data quality objectives (DQOs) have been established for this program:

- DQO 1: Supplement existing sediment data to characterize the extent of site-related constituents in the Pawtuxet River and to support further evaluation of sediment management strategies at the Site.
- DQO 2: Evaluate Site sediment constituent concentrations relative to upgradient constituent concentrations in the Pawtuxet River.
- DQO 3: Develop correlation of total PCB congener concentrations and total PCB Aroclor concentrations.

These DQOs are provided in Appendix B. The data being generated from this field program can also be used to evaluate the upland CSM and may be used in the design of additional programs including those linked to the upland.

The work being conducted to support this SSP includes: (1) sediment sampling and analysis and (2) physical characterization of the Pawtuxet River adjacent to the Facility. These tasks are described below.

## 2.1 Sediment Sampling and Analysis

### 2.1.1 PCB Aroclor and Congener Sampling

Regarding PCB sampling, and in response to USEPA comments, this SSP has been updated to include both PCB Aroclor sampling (USEPA Method 8082A) and high-resolution PCB congener sampling (USEPA Method 1668C).

- BASF will conduct the extensive PCB grid sampling program using Method 8082A (Aroclors) (e.g., up to 420 sediment samples will be collected and analyzed for PCB Aroclors).
- A sub-set of these 420 samples will be being analyzed for congeners via high resolution GC/MS Method 1668C, providing paired Aroclor and congener data at each of these sub-set sampling stations.

DQOs have been developed and refined to support this approach.

At every sediment sampling location, sufficient sediment will be collected for both Aroclor and congener analyses. The baseline program will include analysis of 240 of the approximately 420 collected samples for PCB Aroclors. The remaining samples will be archived. When the baseline program PCB Aroclor data are received from the laboratories, they will be reviewed relative to the DQOs. Should additional PCB Aroclor data be needed to meet the DQOs, additional PCB Aroclor samples (e.g., some or all the archived samples) will be analyzed for PCB Aroclors. Additional analysis of PCB Aroclors may be conducted in archive samples pending an evaluation of the data from samples analyzed. Archive samples selected for Aroclor analysis will also be analyzed for TOC and grain size. The selection of these samples will be documented in a memorandum and provided to USEPA for their records.

Once all Aroclor data have been analyzed, a subset of samples (approximately 20%) will be analyzed for PCB congeners. The selection of these samples will be documented in a memorandum and provided to USEPA. The selection of the subset of samples to be analyzed for PCB congeners will depend on the concentration of Aroclors, the general lithology of the sample horizons, and the locations of the samples (horizontally and vertically). The objectives, further defined in the DQOs, include evaluating the data to determine whether or not a ratio (total PCB congeners to total PCB Aroclors) could be developed and could potentially be used to estimate total PCB congeners in sediments using Aroclor data. Depending on the sediment lithology and the observed statistical relationships, more than one ratio may be calculated, or an algorithm (rather than a ratio) may be developed to best explain relationships.

While the absolute number of paired samples will be determined based on the above-described data reviews, it is envisioned that approximately 20% of the Aroclor samples (48 to 84 samples) will be analyzed for congeners, providing a robust paired dataset for statistical analysis.

Additional detail regarding this sampling program in each of the study reaches is summarized below.

### 2.1.2 Study Area 1

The Study Area 1 sediment sampling program has been designed using gridded nodes on 50-foot centers in the river (Figure 4 and Figure 5). The longitudinal spacing is 50 feet for all samples; the latitudinal spacing varies from 34 to 50 feet to maximize coverage in the river. Samples will be collected along four transects (Transects A, B, C, and D) running longitudinally or parallel to the river flow. Transect A is the transect on the side of the river adjacent to the Facility. The 50-foot on center sampling frequency will provide the level of characterization needed to evaluate the current conditions of PCB and VOC concentrations in the sediment and provide a delineation longitudinally (upstream and downstream), latitudinally (across the river), and horizontally (depth). The information presented in Section 1 has been used to inform the sampling program presented below.

At each sampling location, sediment cores will be advanced via vibracore to 6 feet below sediment surface (bss) or refusal (or indication of native materials [i.e., silt with clay]) and sub-divided into discrete sampling horizons. As described below, some sediment samples will be analyzed immediately, and other samples will be archived (stored at the laboratory) for potential future analysis, pending review of results of the initial analyses.

Sediment samples collected from Study Area 1 will be evaluated for the following parameters:

- PCB Aroclors (EPA method 8082A)

- VOCs (Method SW-846 82620C)
- Total Organic Carbon (TOC) (Lloyd Kahn method) and
- Grain size (Method ASTM D422).

Samples will be collected and held at the laboratory for potential analysis of PCB congeners using EPA Method 1668C. Samples will be collected from every location and every horizon, but only a subset of the samples will be analyzed. The PCB Aroclor data will be reviewed with the sample physical characteristics such as sediment type (i.e., grain size, color, etc.) from the core logs. The objective, as described in DQO 3, is to provide data adequate to develop a total PCB congener to total PCB Aroclor relationship.

Details of the analyses are provided in the Quality Assurance Project Plan (QAPP) (AECOM, 2012) and the QAPP Addendum (Appendix C). This sampling and analysis program has been designed to maximize efficiency with sampling (collection of cores in one vessel mobilization) and provide flexibility in the analytical approach. Sampling depths have been selected based on evidence (i.e., PCB and VOC concentrations) from previous investigations; therefore, not all cores will have samples from all horizons analyzed immediately.

As depicted in Figures 4 and 5, and based on the historical information presented in Section 3, the following sampling and analysis approach will be used in Study Area 1, which includes the Study Area 1 Transects the Upstream and Downstream River Transects:

1. Sediment cores will be advanced to six feet bss or refusal at all sampling locations (n = 38), and sub-divided into the following distinct sediment horizons based on core recovery:
  - 0.0 to 0.5 feet bss
  - 0.5 to 1.5 feet bss
  - 1.5 to 2.5 feet bss
  - 2.5 to 3.5 feet bss
  - 3.5 to 4.5 feet bss and
  - 4.5 to 6.0 feet bss.
2. All sediment samples collected will be collected in the field in appropriate containers using preservation per the QAPP in Appendix C (whether analyzed immediately or archived).
3. Based on the results of the historical sampling efforts described above, the following sampling and analysis program will be performed in Study Area 1:
  - **Transect A and Transect B:** all sediment samples, at all depths will be analyzed for PCB Aroclors, VOCs, TOC, and grain size.
  - **Transect C:** The top 2 intervals of sediment (0 to 0.5, and 0.5 to 1.5 foot horizons) will be initially analyzed for PCBs, TOC, and grain size. The samples from the remaining horizons will be archived at the laboratory. VOCs have not been detected historically in this portion of the river. Samples will be collected for VOCs from five locations in Transect C and archived at the laboratory.
  - **Transect D:** The top 2 intervals of sediment (0 to 0.5, and 0.5 to 1.5 foot horizons) will be initially analyzed for PCBs, TOC, and grain size. Samples from horizons below 1.5 ft in Transect D will be archived and analyzed as needed, pending the results of the analyses in the top intervals. VOCs have not been detected historically in this portion of the river and will not be collected from Transect D.

Samples that have been archived at the laboratory will be analyzed following a review of sample results from the adjacent transects and, if applicable, the surficial horizons from that core.

- **PCBs:** If PCB Aroclors are detected in adjacent samples (latitudinally or longitudinally) above 1 mg/kg, a subset of archived samples will be analyzed for PCB Aroclors.

- **VOCs:** Due to the shorter holding time for VOCs (i.e., 28 days), additional samples for VOCs will be analyzed if concentrations detected in adjacent samples (latitudinally or longitudinally) exceed risk-based screening values<sup>3</sup> for benthic organisms.

**Table 2 Proposed Samples and Analyses – Study Area 1 Grid Sampling Sediment Chemistry Program (PCB Aroclors, PCB Congeners, VOCs, TOC, and Grain Size)**

Sampling Horizon (ft bss)	Number of Samples Analyzed for PCB Aroclors, TOC, and Grain size	Number of Samples Placed on Hold for PCB Aroclors, TOC, and Grain size	Number of Samples Placed on Hold for PCB Congeners	Number of Samples Analyzed for VOCs	Number of Samples Placed on Hold for VOCs
0 to 0.5	38	0	38	17	5
0.5 to 1.5	38	0	38	17	5
1.5 to 2.5	17	21	38	7	15
2.5 to 3.5	17	21	38	7	15
3.5 to 4.5	17	21	38	7	15
4.5 to 6.0	17	21	38	7	15
Total	144	84	228	62	70

*Notes:*

1. Sampling to 6 feet dependent on field conditions. Cores will be collected to a maximum of 6 feet or to refusal.

### 2.1.3 Study Area 2

Sampling and analysis in Study Area 2, located approximately 200 linear feet downstream of Study Area 1, will focus on the nearshore environment. Based on the historical information presented in Section 1, while there is no indication of VOC impacts in this portion of the Site, it is possible that elevated PCBs occur in the sediment and that these PCBs may be representative of migration from the site and/or urban river background conditions. Therefore, a sediment coring and PCB sampling and analysis program will be conducted in this area to better delineate current day conditions.

Figure 4 presents the Study Area 2 sampling grid. Sediment cores will be advanced to 6 feet or refusal, and sediment samples will be collected as follows:

- 0.0 to 0.5 feet bss
- 0.5 to 1.5 feet bss
- 1.5 to 2.5 feet bss
- 2.5 to 3.5 feet bss
- 3.5 to 4.5 feet bss and
- 4.5 to 6.0 feet bss.

Sediment samples collected from Study Area 2 will be evaluated for the following parameters:

- PCB Aroclors (Method 8082A)
- TOC (Lloyd Kahn) and
- Grain size (Method D422).

<sup>3</sup> The benthic screening values will include NYSDEC and USEPA Region 4 screening values, adjusted to site-specific organic carbon content.

1. Based on the results of the historical sampling efforts described above, the following sampling and analysis program will be performed in Study Area 2:
  - **Transect A and Transect B:** all sediment samples, at all depths will be analyzed for PCBs, TOC, and grain size.
  - **Transect C:** The top 2 intervals of sediment (0 to 0.5, and 0.5 to 1.5 foot horizons) will be initially analyzed for PCBs, TOC, and grain size. The remaining horizons will be archived at the laboratory.
2. Samples that have been archived at the laboratory will be analyzed following a review of sample results from the adjacent transects and, if applicable, the surficial horizons from that core.
  - **PCBs:** If PCB Aroclors are detected in adjacent samples (latitudinally or longitudinally) above 1 mg/kg, a subset of archived samples will be analyzed for PCB Aroclors.

Samples will be collected and held at the laboratory for potential analysis of PCB congeners using EPA Method 1668C. Samples will be collected from every location and every horizon, but only a subset of the samples will be analyzed. The PCB Aroclor data will be reviewed with the sample physical characteristics such as sediment type (i.e., grain size, color, etc.) from the core logs. The objective, as described in DQO 3, is to provide data adequate to develop a total PCB congener to total PCB Aroclor relationship.

**Table 3 Proposed Samples and Analyses – Study Area 2 Grid Sampling Sediment Chemistry Program (PCB Aroclors, PCB Congeners, TOC, and Grain Size)**

Sampling Horizon (ft)	Number of Samples Analyzed for PCB Aroclors, TOC, and Grain size	Number of Samples Placed on Hold for PCB Aroclors, TOC, and Grain size	Number of Samples Placed on Hold for PCB Congeners
0 to 0.5	12	0	12
0.5 to 1.5	12	0	12
1.5 to 2.5	8	4	12
2.5 to 3.5	8	4	12
3.5 to 4.5	8	4	12
4.5 to 6.0	8	4	12
Total	56	16	72

Notes:

1. Sampling to 6 feet dependent on field conditions. Cores will be collected to a maximum of 6 feet or to refusal.

## 2.1.4 Background

Given the urban and historic industrialized nature of the Pawtuxet River, an understanding of potential continuing sources to the sediments in the vicinity of the Site is an important element to future planning at the Site. Sediment grabs will be collected from twenty (20) background sampling locations. All sediment samples collected will be collected in the field in appropriate containers using preservation per the QAPP Addendum in Appendix C (whether analyzed immediately or archived).

Sediment cores will be advanced to six feet bss or refusal at all background sampling locations (n = 20), and subdivided into the following distinct sediment horizons based on core recovery:

- 0.0 to 0.5 feet bss
- 0.5 to 1.5 feet bss
- 1.5 to 2.5 feet bss
- 2.5 to 3.5 feet bss
- 3.5 to 4.5 feet bss and
- 4.5 to 6.0 feet bss.

Sediment samples collected from Background locations will be evaluated for the following parameters:

- PCB Aroclors
- VOCs
- TOC and
- Grain size.

The top two intervals of sediment (0 to 0.5, and 0.5 to 1.5 foot bss horizons) will be initially analyzed for PCB Aroclors, VOCs, TOC, and grain size. The samples from the remaining horizons will be archived at the laboratory. Samples will be collected and held at the laboratory for potential analysis of PCB congeners using EPA Method 1668C. Samples will be collected from every location, but only a subset of the samples will be analyzed. The PCB Aroclor data will be reviewed with the sample physical characteristics such as sediment type (i.e., grain size, color, etc.) from the core logs. The objective, as described in DQO 3, is to provide data adequate to develop a total PCB congener to total PCB Aroclor relationship.

#### 2.1.4.1 Background Area 1

Ten locations have been selected for sampling in Background Area 1. A grid of four (4) sediment samples have been placed located approximately 150 ft upstream of Study Area 1. Stormwater from Roger Williams Park, located north of the Site, drains through a culvert into the Pawtuxet River upstream of the Site. Background Area 1 will be located downstream of the culvert. Six (6) sediment sample locations have been placed approximately 600 feet upstream of Study Area 1.

**Table 4 Proposed Samples and Analyses – Background Area 1 Grid Sampling Sediment Chemistry Program (PCB Aroclors, PCB Congeners, VOCs, TOC, and Grain Size)**

Sampling Horizon (ft bss)	Number of Samples Analyzed for PCB Aroclors, VOCs, TOC, and Grain size	Number of Samples Placed on Hold for PCB Aroclors, VOCs, TOC, and Grain size	Number of Samples Placed on Hold for PCB Congeners
0 to 0.5	10	0	10
0.5 to 1.5	10	0	10
1.5 to 2.5	0	10	10
2.5 to 3.5	0	10	10
3.5 to 4.5	0	10	10
4.5 to 6.0	0	10	10

#### 2.1.4.2 Background Area 2

A literature review of historic or current sources of contamination upstream has been conducted. Potential sources were identified upstream of the Site within 0.25 miles of the river. Additional sediment background samples will be collected in Background Area 2. The locations will be determined based on the characteristics and general lithology of the sediments collected from Study Area 1 and 2. This process will attempt to match the characteristics, creating a background envelope for the Site. For example, should the sediments in Study Areas 1 and 2 be depositional, bends in the river will be examined. Examples of these potential target areas are provided in Figure 6.

The 2012 QAPP (AECOM, 2012) includes additional detail regarding Quality Control (QC) samples and data validation. The QAPP Addendum (Appendix C) provides additional detail regarding sample containers, preservatives, holding times, and special QC samples.

**Table 5 Proposed Samples and Analyses – Background Area 2 Sampling Sediment Chemistry Program (PCB Aroclors, PCB Congeners, VOCs, TOC, and Grain Size)**

Sampling Horizon (ft bss)	Number of Samples Analyzed for PCB Aroclors, VOCs, TOC, and Grain size	Number of Samples Placed on Hold for PCB Aroclors, VOCs, TOC, and Grain size	Number of Samples Placed on Hold for PCB Congeners
0 to 0.5	10	0	10
0.5 to 1.5	10	0	10
1.5 to 2.5	0	10	10
2.5 to 3.5	0	10	10
3.5 to 4.5	0	10	10
4.5 to 6.0	0	10	10

## 2.2 Physical Characterization of the Pawtuxet River

BASF is anticipating that additional information could be useful to both the sediment characterization described in this SSP and the SSP Addendum – Sediment Cap Inspection Work Plan (SCIWP, AECOM 2024). Given the logistical challenges associated with vessel work in the Pawtuxet River adjacent to the Facility, this work will be conducted as part of this field mobilization.

Georeferenced water level meters (transducers) will be installed at locations in the Pawtuxet River adjacent to the Site. The number of transducers will depend on identification of secure deployment locations for these meters. It is anticipated that up to four (4) transducers may be installed for redundancy.

The transducers will be deployed for the duration of this field survey. Upon completion of the field survey, the data will be downloaded. The data will be used to (1) confirm no fluctuations in water levels that may be construed as downstream upwelling and (2) correlate the water levels adjacent to the Facility to the gage on the Pawtuxet River maintained by the United States Geological Survey (USGS) in Cranston (01116500).

A bathymetric survey will also be conducted adjacent to the Facility. The specifics of the survey will depend on flow conditions and water depths during the deployment. Preferentially, a multibeam echo sounder (MBES) will be used to map the sediments at a line spacing of approximately 10 feet. Should site conditions prohibit use of MBES, depths will be measured by hand and georeferenced to vertical datum using the water level meters.

The bathymetry data will be combined with light detection and ranging (LiDAR) and any available survey data for the onshore portion of the Site to create a holistic mapping to support the conceptual site model.

## 3. Reporting

Following completion of the field sampling and analyses, electronic data deliverables (EDDs) consisting of data summary tables and sample location figures will be provided as an interim deliverable.

The results of the sediment investigation will be provided in a summary report of the data. Data collected in support of the cap monitoring and sampling (addressed in the SCIWP) will be integrated into this report. The SSP report will present details of the field sampling procedures, a discussion of the results, and recommendations. The report will also contain field sampling records, site plan figures, data summary tables, laboratory analytical reports and data usability evaluations.



## 4. References

AECOM, 2012. Quality Assurance Project Plan for Supplemental Remedial Investigation at BASF (Former Ciba-Geigy Facility), 180 Main Street, Cranston, Rhode Island. May 23, 2012.

AECOM, 2016a. Supplemental Remedial Investigation Report (Revised). Former Ciba-Geigy Facility, Cranston, Rhode Island. April 2016.

AECOM, 2016b. Final Corrective Measures Study. BASF Corporation, Former Ciba-Geigy Facility, 180 Mill Street, Cranston, Rhode Island. April 29, 2016.

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AEI Consultants, 2020. Corrective Measures Implementation Closure Report: Soil Remedy for Former Production Area (Lot 1102). February 5, 2020.

CIBA Corporation, 1995. RCRA Facility Investigation Report On-Site Areas. Former CIBA Site, Cranston, Rhode Island. Volume 1: Chapters 1-7. July 31, 1995.

CIBA Corporation, 1996. RCRA Facility Investigation Report Pawtuxet River. Former CIBA Site, Cranston, Rhode Island. Volume 3: Aquatic Baseline Ecological Risk Assessment. March 31, 1996.

CIBA-GEIGY Corporation, 1996. Sediment Interim Remedial Measures Report. Pawtuxet River. July 31, 1996.

United States Environmental Protection Agency (USEPA). 2016. Statement of Basis for the Proposed Remedy Determination for the Former Ciba-Geigy Facility, 180 Mill Street, Cranston, Rhode Island. U.S. Environmental Protection Agency (EPA) – Region 1, RCRA Corrective Action Program. May 25, 2016.

## Appendix A Field Sampling Procedures

This appendix describes the procedures that will be implemented for the field sampling activities in the Pawtuxet River adjacent to the Facility. The field program will include surficial and sub-surficial sediment sampling and analysis. Data generated through this field program will be used to further the evaluation of the nature and extent of potentially impacted sediments in the river adjacent to the Site.

The proposed sampling locations are shown on Figure 4 of the Sediment Sampling Plan (SSP). Station locations may be slightly modified from points presented in Figure 4 based on conditions encountered in the field. Locations may be moved up to 10 feet from the proposed location due to issues with the substrate, penetration, or recovery. Cores will be collected beginning with downstream stations and continue towards the upstream locations. Sediment sampling station locations will be documented using a portable differential global positioning system (GPS) unit with sub-meter accuracy and real-time radial beacon correction.

### A.1 Mobilization and Demobilization

The USEPA and Rhode Island Department of Environmental Management (RIDEM) will be given a minimum of two weeks' notice prior to the initiation of the field activities identified in this SSP. Mobilization for the field effort will include a kick-off meeting for the field team (and USEPA and RIDEM, should they be interested), subcontracting all required laboratories, subcontractors, purchasing/renting field equipment, coordinating receipt of sample bottles from the laboratory and verifying mass and volume requirements, and obtaining site clearance for the field team (if required). It is anticipated that the vessel to be used for coring will need to be launched using a crane from the Site. Prior to conducting any work at the Site, a Health and Safety Plan (or addendum) will be prepared including Task Hazard Analysis (THA) forms for each step in the program. Subcontractors will be vetted within the AECOM system for safety.

Field data sheets will be prepared during project mobilization. Prior to the mobilization/demobilization, a field reconnaissance trip may be held to refine sampling location selection.

### A.2 Sediment Sampling and Analysis

The sediment sampling program is expected to commence pending approval of this SSP by USEPA. Sediment samples will be analyzed for the parameters listed in Appendix C.

As described in the USEPA's (2001) Method for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analysis: Technical Manual<sup>4</sup>, the sampling station locations were selected following a "Systematic Sampling Design". Sample locations were identified in a grid pattern.

Whenever boat access is feasible (i.e., when river water levels and conditions permit), sediment sampling will be conducted via a vibracore-equipped hydraulic sampling device mounted aboard a sampling vessel. A decontaminated Ted Young grab, Ekman Dredge, petite Ponar, or equivalent sampling device will be used to collect additional volume for the surficial (0 to 0.5 ft bss) sediment samples. The deployment and retrieval of the sampling device will be conducted in a controlled manner to avoid deficient samples. All samples will be visually inspected immediately upon retrieval. Sample acceptability will be based on the guidelines outlined in Section 3.3 of the USEPA(2001) Technical Manual whereas samples may be rejected based on lack of penetration, over penetration, loss of fine-grained particulates on sediment surface, etc.

Based on the earlier studies, it is anticipated that the core sample will demonstrate a layer of native materials at a depth of approximately 4 to 6 feet in the Pawtuxet River. Each core will be logged, photographed, and sub-sampled as per the specified analytes require. It is anticipated that collecting sub-surficial sediment samples from certain portions of the Site may be challenging due to geological constraints, and that therefore deeper sediment samples may not be obtainable from all target stations.

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<sup>4</sup> Available online: <https://www.epa.gov/sites/default/files/2015-09/documents/collectionmanual.pdf>

As described in Appendix C and Table 1 of the SSP, surficial and sub-surficial sediment samples will be evaluated for the following parameters:

- PCB Aroclors,
- PCB congeners,
- VOCs,
- TOC, and
- Grain size.

Additional detail regarding sampling (including sample containers, preservatives, holding times, and QC samples) and validation is presented in Appendix C, which provides the QAPP Addendum for this program.

### **A.3 General sediment sampling procedures**

Upon retrieval of the core and examination for acceptable recovery, the core will be laid on its side and the liner split from surface to bottom. The core will be screened using a photoionization detector (PID). Locations of PID detections will be documented and sampled immediately for VOCs, up to one sample per horizon as defined above. If the PID does not indicate the presence of volatile organics, the VOC samples will be collected from each horizon using small amounts of sediment composited from along the length of sampling horizon.

VOC samples will be collected per the QAPP and preserved in methanol and deionized water. The preservative will be added to the vials by the laboratory prior to sending bottleware the site.

Following collection of VOC samples, the core will be characterized and described. Each core will be visually examined for physical characteristics such as composition, layering, odor, and discoloration. This information will be recorded in electronic field forms.

The appropriate sediment horizon (surficial or sub-surficial) will be removed from the coring device using a stainless steel or dedicated disposable plastic spoon/scoop and placed in a decontaminated 1-gallon stainless steel or Pyrex glass mixing bowl. Samples will be homogenized in the mixing bowl and placed in appropriate sample containers. Sediment sampling equipment such as bowls, spoons, augers, and dredges will be decontaminated prior to and following sample collection as described below.

The sample containers will be pre-labeled by the sampling task manager at the beginning of each day. Electronic sample collection forms will be used to record pertinent data while sampling. The time of sampling will be recorded on each pre-labeled bottle. All samples will be stored on ice (at  $4^{\circ}\text{C} \pm 2^{\circ}\text{C}$ ), packed in coolers, and shipped under chain of custody for laboratory analysis as described in the QAPP. All laboratories used for sediment analyses are listed in the QAPP.

Samples that will not be immediately analyzed by the laboratory will be archived for possible future analysis. Such samples will initially be stored at the analytical laboratory pending review of other analytical data. Samples analysis may be required of the archived samples to delineate concentrations at other sample locations/horizons. Archive samples will be clearly marked on the sample containers and the chain of custody. The laboratory and the AECOM chemist will keep a record of samples held as archive including the holding times.

### **A.4 Field Records**

The Field Team Leader (FTL) will be responsible for maintaining a detailed digital log of field activities. The field log will contain a chronological description of sample collection activities. The log will include information such as names and times for which all project-related personnel (consultant, subcontractors, and client) who are on-site, health and safety information, work-area assignments and goals, general notation of time and weather conditions, description of work-related problems and their solutions, any specific scope of work deviations, among other information. The log will identify the project name and the date and location of each activity completed.

Other field records such as sampling logs will also be collected using a tablet. Logs will include entries in every blank, with appropriate use of the abbreviations NA (not available) and NR (not recorded). The electronic forms will be developed in coordination with the database manager to provide data in a format easily imported into a database. Core logs will be developed using these data. At the end of each day, all completed field records will be uploaded to the AECOM servers. Shipping and other paper forms will be scanned and uploaded. Originals will be retained by the FTL.

Shipping forms will be recorded in black waterproof ink. Corrections will include a single line crossing out the incorrect data, such that the incorrect data remains legible, and initialed by the field staff member.

## **A.5 Decontamination**

Non-disposable or non-dedicated sampling equipment (e.g., grab sampler, stainless spoons, stainless bowls, etc.) will be decontaminated prior to sampling and between samples. Cleaning of equipment is performed to prevent cross-contamination between samples and to maintain a clean working environment for all personnel. Decontamination will generally consist of a station river water rinse to remove gross contamination (if needed), followed by a non-phosphate detergent (e.g., Alconox) water rinse, a rinse with a solvent (e.g., methanol), and a final rinse with de-ionized water. If equipment is to be stored or transported, it will be wrapped in aluminum foil after air-drying.

## **A.6 Sample documentation**

### **A.6.1 Photographic records**

Photographs from the site investigations and from site visits will be included in the reporting process. Photographs will be numbered and documented sequentially. The numbering system will include date and location for each photograph taken.

### **A.6.2 Sample labels**

The sample containers will be labeled with a pre-printed adhesive label, which includes the site name, the analysis to be performed, the preservative, and a unique sample identifier. Field personnel will use a permanent marker to mark the date and time of collection and the sampler's initials once the label is affixed to the sampling container.

### **A.6.3 Chain-of-custody records**

Samples will be accompanied by a properly completed chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents the transfer of custody of samples from the FTL to another person, to the permanent laboratory, or to/from a secure storage location.

The minimum information that will be recorded on the chain-of-custody in addition to the signatures and dates of all custodians will be:

- Client/project name,
- Project location,
- Project number,
- Field logbook number,
- Chain-of-custody tape numbers,
- The person to whom results should be reported,
- Field sampling number/identification,
- Sampling date and time,
- Type of sample (grab or composite),

- Identification of sample collector and his/her affiliation,
- Sample container number, size, and material,
- Sample description (matrix),
- Sample preservative (if any), and
- Analyses to be performed.

The FTL will be personally responsible for the care and custody of the samples until the samples are transferred or dispatched properly. As few people as possible should handle the samples. The FTL will review field activities to determine whether proper custody procedures were followed during the field work and will decide if additional samples are required.

#### **A.6.4 Sample packaging and shipping requirements**

Samples will be packaged properly for shipment and dispatched to the laboratories for analysis. A separate signed custody record will be enclosed in each sample cooler. Shipping containers will be locked or secured with strapping tape and sealed with custody seals. The preferred procedure is to attach a custody seal to the front right and back left of the cooler. The cooler will be taped closed with fiberglass tape covering the chain-of-custody seals.

Samples will be shipped daily from the field to the laboratory using an overnight courier or onsite pickup by the laboratory to allow freezing of VOC samples within 48 hours of collection. All shipments will be accompanied by the chain-of-custody record identifying the contents. The back copy of the chain-of-custody will be detached and kept as part of the field records. The original record and remaining copies will accompany the shipment.

#### **A.7 Investigation derived wastes**

Given the nature of the field sampling effort (e.g., sediment), it is anticipated that only very limited waste materials will be generated during the field investigation. These materials include:

- Decontamination fluid
- Used personnel protective equipment (PPE)
- Used sampling equipment.

These wastes will be handled in the following manner:

- River water as well as de-ionized water used for final rinsing sampling equipment will be released back to the water body in the immediate vicinity of its point of generation.
- Phosphate-free detergent wash water used for decontamination will be contained in 55-gallon drums or bulk containers.
- Solvents will be retained in a container designed to hold flammable materials.
- Used PPE, such as sampling gloves, paper towels, or other materials will be bagged and sealed prior to disposal as general refuse. If PPE becomes grossly contaminated, it will be segregated from other PPE, labeled, and staged as "contaminated material". Contaminated material will be drummed and staged in the IDW area designated by BASF or AECOM personnel. The field team will arrange for off-site disposal of drums by a licensed waste hauler at an approved facility.
- Used disposable sampling equipment, which generally has minor contamination, will be disposed of with the PPE as general refuse. Contaminated disposable equipment will require segregation from other equipment and proper disposal.

## Appendix B Data Quality Objectives

<b>Data Quality Objective 1 (DQO 1): Supplement existing sediment data to characterize the extent of site-related constituents in the Pawtuxet River and to support further evaluation of sediment management strategies at the Site.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 1 State the problem</b>	<p>The former Ciba-Geigy Facility was a chemical manufacturing facility operated by Alrose Chemical Company beginning in 1939. Geigy Chemical Corporation began operating at the Site in 1954 and continued operations until May 1986. Following closure, the facility was decommissioned, and former production area buildings were demolished to grade. In 2009, BASF acquired Ciba Corporation which acquisition included the Site. Investigation and remediation activities at the Site have been conducted under regulatory oversight of the United States Environmental Protection Agency (USEPA) since 1989 as part of the USEPA Resource Conservation and Recovery Act (RCRA) Corrective Action program.</p> <p>Sediment sampling in the Pawtuxet River (an urban river adjacent to the former Ciba site) has been conducted as part of the RCRA program. Site-related constituents have been detected in sediments but require further delineation.</p>
<b>STEP 2 Identify the goals of the study</b>	<p><b><u>Principal Study Questions</u></b></p> <ul style="list-style-type: none"> <li>• What are the patterns of physical characteristics of sediment in the Pawtuxet River?</li> <li>• What is the horizontal and vertical extent of site-related constituents in the Pawtuxet River sediment?</li> </ul> <p><b><u>Program Goals</u></b></p> <p>This program will supplement the existing sediment data. Analyses will include:</p> <ul style="list-style-type: none"> <li>• PCB Aroclors using EPA Method 8082A</li> <li>• PCBs (congeners) using EPA Method 1668C (subset)</li> <li>• Volatile organic compounds (VOCs) using EPA Method 8260C (subset)</li> <li>• TOC using the Lloyd Kahn Method</li> <li>• Grain size using ASTM Method D422</li> <li>• Physical / visual evaluation of cores</li> </ul> <p><b><u>Alternative Actions</u></b></p> <p>The following alternative actions could result from resolution of the principal study questions:</p> <ul style="list-style-type: none"> <li>• Confirm (and/or refine as appropriate) the area of site-related impacts to the river sediments.</li> <li>• Refine the existing conceptual site model (CSM).</li> </ul> <p><b><u>Decision Statements</u></b></p> <ul style="list-style-type: none"> <li>• If the extent of site-related constituents in sediment cannot be determined using the sediment data being collected for this program, additional, focused data collection may be warranted to reduce uncertainty.</li> </ul>

<b>Data Quality Objective 1 (DQO 1): Supplement existing sediment data to characterize the extent of site-related constituents in the Pawtuxet River and to support further evaluation of sediment management strategies at the Site.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 3 Identify the information inputs</b>	<p>Information required to answer the decision statement will include the existing field data and data to be obtained from the planned sampling events (See Step 5 of DQO 1), as summarized below.</p> <p><b><u>New Data Needed</u></b> Sediment cores will be collected from 50 locations in the Pawtuxet River adjacent to and immediately downstream of the site. Physical and chemical data to be collected are detailed below in Step 5. Vibracoring and grab sampling will be used to collect the 0 to 0.5 foot segment for all analytes. Deeper samples (1-foot intervals greater than 0.5 foot below the sediment water interface to a target depth of 6 feet (or refusal) will be collected using vibracoring techniques.</p> <p><b><u>Existing Field Data</u></b> A summary of the existing data are provided in the Sediment Sampling Plan (SSP).</p>
<b>STEP 4 Define the boundaries of the study</b>	<p><b><u>Geographic Area</u></b> The Site includes the former Ciby-Geigy Facility located at 180 Mill Street in Cranston, Rhode Island (see Figure 1 in the SSP). The Site is bounded to the south by the Pawtuxet River, to the north and east by residential properties on Mill Street and Robert Circle, respectively, and to the west by industrial properties and undeveloped land. The focus of this investigation is the sediments in the river adjacent to and immediately downstream of the former manufacturing facility. These areas are presented as Study Area 1 and Study Area 2, respectively, in Figure 4.</p> <p><b><u>Timeframe</u></b> Data will be collected over an estimated 2-week period in Spring, 2024. Data will be reviewed in Summer 2024, and a draft report will be submitted to USEPA in late Summer or Fall 2024.</p> <p><b><u>Sample Type</u></b> Sampling intervals for COPCs will include surface sediment (0 to 0.5 foot grab and core) samples, 0.5 to 1.5 foot interval, and consecutively deeper 1-foot sediment core segments to a depth of 6 feet or refusal.</p>
<b>STEP 5 Develop the analytical approach</b>	<p><b><u>Approach for Collecting Sediment Samples</u></b> Vibracoring will be used to collect sediment cores at each location up to 6 feet below sediment surface or to refusal. To augment volume in the top 0 to 0.5 foot interval, a petite ponar grab sample will be collected from each location. Sample processing and transfer to sample containers will be performed on shore at the Site.</p> <p><b><u>Anticipated Analytical Methods for Sediment Samples</u></b> The following lists the analytical methods for sediment sampling:</p> <ul style="list-style-type: none"> <li>• PCB Aroclors</li> <li>• PCBs (congeners)</li> <li>• VOCs</li> <li>• TOC</li> <li>• Grain size</li> </ul> <p><b><u>Project Quantification Limits</u></b></p>

<b>Data Quality Objective 1 (DQO 1): Supplement existing sediment data to characterize the extent of site-related constituents in the Pawtuxet River and to support further evaluation of sediment management strategies at the Site.</b>	
DQO Step	Description
	<p>Project action levels (PALs) are included in Appendix C of the SSP.</p> <p><b><u>Quality Assurance/Quality Control (QA/QC) Program</u></b></p> <p>QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test, such as field duplicates, laboratory duplicates, laboratory control, and matrix control spikes (optional). Performance criteria of these precision and accuracy measurements, data verification, and validation protocols are provided in the 2012 QAPP (AECOM, 2012).</p> <p>Field duplicates and matrix spike / duplicate samples will be collected at a frequency of 1 per 20 samples (5%). Equipment blanks will be collected once per week per team.</p> <p><b><u>Anticipated Data Evaluations</u></b></p> <ul style="list-style-type: none"> <li>• Evaluation of sediment constituent concentrations to determine if the horizontal and vertical extents of constituents detected in Site sediments have been delineated.</li> <li>• Spatial evaluation of newly collected sediment constituent concentrations relative to historic data to better characterize patterns and trends over time.</li> <li>• Evaluate constituent patterns relative to grain size and TOC data.</li> </ul>
<p><b>STEP 6</b>  <b>Specify performance or acceptance criteria</b></p>	<p>Uncertainty is always present in the measurement and interpretation of environmental data. In this case, the focus is on collecting and interpreting data to understand the physical and chemical characteristics of the sediment in the Pawtuxet River.</p> <p>In the absence of defined decision tolerance limits, the sampling design should be developed to identify possible sources of error and minimize them, to the extent practical. The most significant type of error that may be encountered includes that associated with sediment sampling and program design. Both random and systematic errors can be introduced during the physical collection of the sample, sample handling, sample analysis, and data handling.</p> <p>Errors introduced through these steps will be controlled by preparing and following SOPs and establishing appropriate controls for data quality. These controls apply to field procedures (e.g., adherence to SOPs, field equipment calibration, and collection and analysis of field duplicates), laboratory analytical errors (e.g., calibration standard, internal standard, surrogate recoveries, and laboratory control sample [LCS]), and data validation. The QAPP provides further detail on error control procedures, both in the field and in the laboratory.</p> <p>Sampling design error is the result of the inherent variability of the sampled population over space and time, the sample collection design, and the number of samples available upon which to base the decision. Because it is impossible to sample every inch of the study area, there is always a possibility that some feature of the natural variability is missed. Sampling design error can increase the chance for misrepresenting the natural variability by random error (imprecision) or systematic error (bias).</p> <p>Because the number of samples controls how well the sampled population is characterized, use of the DQO process requires that the variability of data be understood to evaluate the tradeoff between uncertainty (confidence limit) and sampling intensity.</p> <p>This investigation is meant to supplement characterization of the extent of PCBs and VOCs in sediments of the Pawtuxet River using a robust data set. The induced variability of the data set can be minimized by reducing the errors associated with sample collection handling, analyses, and reporting with the strict adherence to and use of standardized and documented procedures, as well as the noting of deviations from these procedures. With this</p>



<b>Data Quality Objective 1 (DQO 1): Supplement existing sediment data to characterize the extent of site-related constituents in the Pawtuxet River and to support further evaluation of sediment management strategies at the Site.</b>	
<b>DQO Step</b>	<b>Description</b>
	minimization of variability, the data set will then be a better representation of the sediments allowing improved determination of the extent of constituents in the river sediments.
<b>STEP 7 Develop the detailed plan for obtaining data</b>	<p><b><u>Sediment Sampling in the Pawtuxet River</u></b></p> <p>Details of the field program are provided in the SSP. The currently proposed sampling program will consist of:</p> <ul style="list-style-type: none"> <li>• 50 sampling locations</li> <li>• One sampling event (up to 2 weeks of field work)</li> <li>• At each location, one surface sediment grab sample and one core up to 6 feet or refusal will be collected. The grab will augment the volume from the 0 to 0.5 foot interval from the core.</li> <li>• Sediment from the cores will be photographed and described on sediment core logs for color, general grain size, and natural or anthropogenic debris.</li> </ul> <p>Samples should have sufficient mass to analyze for the following suite of analytes:</p> <ul style="list-style-type: none"> <li>• PCB Aroclors</li> <li>• PCB congeners</li> <li>• VOCs</li> <li>• TOC</li> <li>• Grain size</li> </ul>

<b>Data Quality Objective 2 (DQO 2): Evaluate Site sediment constituent concentrations relative to upgradient constituent concentrations in the Pawtuxet River.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 1 State the problem</b>	<p>The former Ciba-Geigy Facility was a chemical manufacturing facility operated by Alrose Chemical Company beginning in 1939. Geigy Chemical Corporation began operating at the Site in 1954 and continued operations until May 1986. Following closure, the facility was decommissioned, and former production area buildings were demolished to grade. In 2009, BASF acquired Ciba Corporation which acquisition included the Site. Investigation and remediation activities at the Site have been conducted under regulatory oversight of the United States Environmental Protection Agency (USEPA) since 1989 as part of the USEPA Resource Conservation and Recovery Act (RCRA) Corrective Action program..The Pawtuxet River has a long history of industrial and commercial development. The 2022 Impaired Waters Report (Rhode Island Department of Environmental Management, 2021) has listed seven waterbodies in the Pawtuxet River Basin upstream of the Site for metals and listed one waterbody for PCBs (in fish tissue). Understanding the regional urban background condition and the potential contribution of these waterbodies to the Site sediment is an important part of the remedial process.</p>
<b>STEP 2 Identify the goals of the study</b>	<p><b><u>Principal Study Questions</u></b></p> <ul style="list-style-type: none"> <li>• Are there constituents present in sediments upstream of the Site that may be contributing to contamination adjacent to the Site?</li> <li>• Is there any upstream movement of water in the Pawtuxet River from tidal force that may have transported constituents upstream?</li> <li>• Does the constituent profile adjacent to the site differ from the condition upstream of the Site</li> </ul> <p><b><u>Program Goals</u></b></p> <p>This program will provide sediment data from locations upstream of the Site that may be used to support the remedial evaluation of ongoing sources. Data collection will include analysis of:</p> <ul style="list-style-type: none"> <li>• PCB Aroclors</li> <li>• PCB congeners (subset of PCB Aroclor samples)</li> <li>• VOCs</li> <li>• TOC</li> <li>• Grain size</li> </ul> <p>In addition to the analytical data, georeferenced transducers will be installed near the Site to monitor water levels during the sampling.</p> <p><b><u>Alternative Actions</u></b></p> <p>The following alternative actions could result from resolution of the principal study questions:</p> <ul style="list-style-type: none"> <li>• Are there upstream sources of constituents that warrant consideration when looking at site-related constituents?</li> <li>• Refine the CSM</li> <li>• Does flow in the river reverse on a daily tidal cycle adjacent to the Site, potentially causing upstream transport of sediment-sorbed materials?</li> </ul> <p><b><u>Decision Statement on Characterization of Potential Background Contribution</u></b></p>

<b>Data Quality Objective 2 (DQO 2): Evaluate Site sediment constituent concentrations relative to upgradient constituent concentrations in the Pawtuxet River.</b>	
<b>DQO Step</b>	<b>Description</b>
	<ul style="list-style-type: none"> <li>BASF will review the data collected from the background areas. Additional data or information may be required to quantify background contributions.</li> </ul>
<b>STEP 3 Identify the information inputs</b>	<p>Information required to answer the decision statement will include the existing field data and data to be obtained from the planned sampling events (See Step 5 of DQO 2), as summarized below.</p> <p><b><u>New Data Needed</u></b></p> <p>In addition to the river sediments near the Site (DQO 1), background locations have been identified immediately upstream of the Site boundary (Figure 4; Background Area 1). A second background area, Background Area 2 (Figure 6) will be identified pending an evaluation of the sediment characteristics in Study Areas 1 and 2.</p> <p>Background Area 1: Sediment cores will be collected from 10 locations in the Pawtuxet River immediately upstream of the site, downgradient of the culvert that drains stormwater from Roger Williams Park.</p> <p>Background Area 2: An Environmental Data Resources (EDR) due diligence report was reviewed, and potential sources were identified upstream of the site within 0.25 miles of the river. Additional sediment background locations will be determined based on the characteristics and general lithology of the surface sediments collected from Study Area 1 and Study Area 2. BASF will attempt to match the characteristics, creating a background envelope for the site. For example, should the sediments in Study Areas 1 and 2 be depositional, bends in the river will be examined. Based on the review of the EDRs, samples will not be located immediately adjacent to sites with known PCB contamination. Samples will also not be collected in the immediate vicinity of bridges.</p> <p>Vibracoring and grab sampling will be used for collection of the 0 to 0.5 foot segment for all analytes. Deeper samples (1-foot intervals greater than 0.5 foot below the sediment water interface to a target depth of 6 feet (or refusal) will be collected using vibracoring techniques.</p> <p>Geo-referenced surface water levels will be recorded at the Site using temporary transducers.</p> <p><b><u>Existing Field Data (to be Augmented)</u></b></p> <p>A summary of the existing data are provided in the SSP.</p>
<b>STEP 4 Define the boundaries of the study</b>	<p><b><u>Geographic Area</u></b></p> <p>The Site includes the former Ciby-Geigy Facility located at 180 Mill Street in Cranston, Rhode Island (see Figure 1 in the SSP). The Site is bounded to the south by the Pawtuxet River, to the north and east by residential properties on Mill Street and Robert Circle, respectively, and to the west by industrial properties and undeveloped land.</p> <p><b><u>Timeframe</u></b></p> <p>Data will be collected over an estimated 2-week period in Spring 2024. Data will be reviewed Summer 2024, and a draft report will be submitted to USEPA in later Summer or early Fall 2024.</p> <p><b><u>Sample Type</u></b></p>

<b>Data Quality Objective 2 (DQO 2): Evaluate Site sediment constituent concentrations relative to upgradient constituent concentrations in the Pawtuxet River.</b>	
<b>DQO Step</b>	<b>Description</b>
	Sampling intervals for COPCs will include surface sediment (0 to 0.5 foot grab and core) samples, 0.5 to 2 foot interval, and consecutively deeper 1-foot sediment core segments to a depth of 6 feet or refusal.
<b>STEP 5 Develop the analytical approach</b>	<p><b><u>Approach for Collecting Sediment Samples</u></b></p> <p>Vibracoring will be used to collect sediment cores at each location up to 6 feet below sediment surface or to refusal. To augment volume in the top 0 to 0.5 foot interval, a petite ponar grab sample will be collected from each location. Sample processing and transfer to sample containers will be performed on shore at the Site.</p> <p><b><u>Anticipated Analytical Methods for Sediment Samples</u></b></p> <p>The following lists the analytical methods for sediment sampling:</p> <ul style="list-style-type: none"> <li>• Volatile organic compounds (VOCs) using EPA Method 8260C</li> <li>• PCB Aroclors using EPA Method 8082A</li> <li>• PCBs (congeners) using EPA Method 1668C</li> <li>• TOC using the Lloyd Kahn Method</li> <li>• Grain size using ASTM Method D422</li> </ul> <p><b><u>Project Quantification Limits</u></b></p> <p>Project action levels (PALs) are included in Appendix C of the SSP.</p> <p><b><u>Quality Assurance/Quality Control (QA/QC) Program</u></b></p> <p>QA/QC samples will be analyzed with the sediment samples appropriate for each analytical test, such as field duplicates, laboratory duplicates, laboratory control, and matrix control spikes (optional). Performance criteria of these precision and accuracy measurements, data verification, and validation protocols are provided in the 2012 QAPP (AECOM, 2012).</p> <p>Field duplicates and matrix spike / duplicate samples will be collected at a frequency of 1 per 20 samples (5%). Equipment blanks will be collected once per week per team.</p> <p><b><u>Approach for Collecting Water Level Data</u></b></p> <p>Transducers will be installed adjacent to the Site. The exact locations of the transducers will be determined in the field. The instruments will be georeferenced. Data will be recorded during the duration of the sediment sampling event.</p> <p><b><u>Anticipated Data Evaluations</u></b></p> <ul style="list-style-type: none"> <li>• Qualitatively compare concentrations (i.e., range and average) of constituents from Background Area 1 to Background Area 2 to determine if they are similar.</li> <li>• Compare concentrations of constituents in sediments from the Site to background concentrations. Depending on the data, this comparison may be quantitative or qualitative.</li> <li>• Compare surface water levels from the transducers to data from the USGS gaging station on the Pawtuxet River in Cranston, RI (01116500) to develop a relationship in water levels.</li> <li>• Evaluate data from the transducers to confirm there is no semi-diurnal pattern. Such a pattern may indicate the Site is subject to tidal movement.</li> </ul>

<b>Data Quality Objective 2 (DQO 2): Evaluate Site sediment constituent concentrations relative to upgradient constituent concentrations in the Pawtuxet River.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 6 Specify performance or acceptance criteria</b>	Data quality measures are described in DQO 1.
<b>STEP 7 Develop the detailed plan for obtaining data</b>	<p><b><u>Sediment Sampling in the Pawtuxet River</u></b></p> <p>Details of the field program are provided in the SSP. The currently proposed background sampling program will consist of:</p> <ul style="list-style-type: none"> <li>• 20 sampling locations</li> <li>• One sampling event (up to 2 weeks of field work)</li> <li>• At each location, one surface sediment grab sample and one core up to 6 feet or refusal will be collected. The grab will augment the volume from the 0–0.5 foot interval from the core.</li> <li>• Sediment from the cores will be photographed and described on sediment core logs for color, general grain size, and natural or anthropogenic debris.</li> </ul> <p>Samples should have sufficient mass to analyze for the following suite of analytes:</p> <ul style="list-style-type: none"> <li>• PCB Aroclors</li> <li>• PCB congeners</li> <li>• VOCs</li> <li>• TOC</li> <li>• Grain size</li> </ul>

<b>Data Quality Objective 3 (DQO 3): Evaluate relationship between total PCB congener concentrations and total PCB Aroclor concentrations.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 1 State the problem</b>	<p>PCBs have been linked to the former Ciba-Geigy facility, and their presence in the Pawtuxet River adjacent to the Site are due, at least in part, to former operations. PCBs likely occur in the urban river corridor upstream of the Site as well. Horizontal and vertical delineation of PCBs in sediments is warranted.</p> <p>Due to the size of the potentially impacted area, the PCB sampling program has been optimized. A dense grid of PCB Aroclor samples has been established across the entire footprint of potentially impacted sediment. A robust sub-set of the Aroclor samples will also be evaluated for congeners to establish relationships between concentrations of PCBs obtained via these 2 analytical methods.</p>
<b>STEP 2 Identify the goals of the study</b>	<p><b><u>Principal Study Questions</u></b></p> <ul style="list-style-type: none"> <li>• Can a quantitative relationship between total PCB congener and total PCB Aroclor concentrations be developed for sediments in the Pawtuxet River?</li> </ul> <p><b><u>Program Goals</u></b></p> <p>Collect sufficient paired Aroclor and congener data to estimate total PCB concentration using a relationship between concentrations determined from 1668C and 8082A.</p> <p>Data collection will include analysis of:</p> <ul style="list-style-type: none"> <li>• TOC</li> <li>• Grain size</li> <li>• PCB Aroclors</li> <li>• PCB congeners</li> </ul> <p><b><u>Alternative Actions</u></b></p> <p>The following alternative action could result from resolution of the principal study question:</p> <ul style="list-style-type: none"> <li>• Confirm or revise the methods for analysis of PCBs in future sediment sampling events.</li> </ul> <p><b><u>Decision Statement on Characterization of Potential Exposure Areas</u></b></p> <ul style="list-style-type: none"> <li>• If no relationship can be elucidated between total PCBs by congener analysis and total PCBs by Aroclor analysis, BASF will discuss the path forward with USEPA.</li> </ul>
<b>STEP 3 Identify the information inputs</b>	<p>Information required to answer the decision statement will include data to be obtained from the planned sampling events (See Step 5 of DQO 2), as summarized below.</p> <p><b><u>New Data Needed</u></b></p> <p>Sediment samples will be collected and analyzed for PCBs by two methods. Qualifying data such as TOC and grain size will be collected to parse data into groups using these characteristics as variables (e.g., organic carbon normalization of data, relationships based on samples with similar grain size distribution, etc.).</p> <p><b><u>Existing Field Data (to be Augmented)</u></b></p> <p>Only Aroclor data have been collected from the sediments. A summary of the existing data are provided in the SSP.</p>

<b>Data Quality Objective 3 (DQO 3): Evaluate relationship between total PCB congener concentrations and total PCB Aroclor concentrations.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 4</b> <b>Define the boundaries of the study</b>	<p><b><u>Geographic Area</u></b></p> <p>The Site includes the former Ciby-Geigy Facility located at 180 Mill Street in Cranston, Rhode Island (see Figure 1 in the SSP). The Site is bounded to the south by the Pawtuxet River, to the north and east by residential properties on Mill Street and Robert Circle, respectively, and to the west by industrial properties and undeveloped land. The focus of this investigation is the sediments in the river adjacent to and immediately downstream of the former manufacturing facility. These areas are presented as Study Area 1 and Study Area 2, respectively, in Figure 4.</p> <p>In addition to the river sediments near the Site, background locations have been identified immediately upstream of the Site boundary (Figure 4; Background Area 1). A second background area, Background Area 2 (Figure 6) will be identified pending an evaluation of the sediment characteristics in Study Areas 1 and 2.</p> <p><b><u>Timeframe</u></b></p> <p>Data will be collected over an estimated 2-week period in Spring 2024. Data analysis will continue through Summer 2024.</p> <p><b><u>Sample Type</u></b></p> <p>All sediment samples analyzed will be included in the analysis.</p>
<b>STEP 5</b> <b>Develop the analytical approach</b>	<p><b><u>Approach for Determining Relationship</u></b></p> <p>As described in the SSP, a subset of sediment samples will first be analyzed for PCBs using Aroclor analysis. These data will be reviewed and additional samples that will be stored at the laboratory may be analyzed to complete evaluation of the extent of PCBs.</p> <p>From these samples, a subset will be analyzed for PCBs using congener analysis. The variables to be considered when selecting samples include:</p> <ul style="list-style-type: none"> <li>• Selecting a range of concentrations representative of the site and background conditions</li> <li>• Selecting from a range of sediment grainsize distributions (using both the core logs and quantitative laboratory data)</li> <li>• Selecting from a range of organic carbon content.</li> </ul> <p><b><u>Project Quantification Limits</u></b></p> <p>Project action levels (PALs) are included in Appendix C of the SSP.</p> <p><b><u>Quality Assurance/Quality Control (QA/QC) Program</u></b></p> <p>QA/QC has been included per the QAPP.</p> <p><b><u>Anticipated Data Evaluations</u></b></p> <ul style="list-style-type: none"> <li>• A series of correlation or other statistical relationship evaluations will be conducted.</li> <li>• The data may be separated into “bins” based on grain size distribution.</li> <li>• The data may be organic carbon normalized.</li> </ul>

<b>Data Quality Objective 3 (DQO 3): Evaluate relationship between total PCB congener concentrations and total PCB Aroclor concentrations.</b>	
<b>DQO Step</b>	<b>Description</b>
<b>STEP 6 Specify performance or acceptance criteria</b>	Data quality measures are described in DQO 1.
<b>STEP 7 Develop the detailed plan for obtaining data</b>	<p>Sediment samples collected per the SSP and DQO 1 and DQO 2 will be analyzed for:</p> <ul style="list-style-type: none"> <li>• TOC</li> <li>• Grain size</li> <li>• PCB Aroclors</li> <li>• PCB congeners</li> </ul> <p>Using these data, a relationship between concentrations determined using Aroclor analysis (EPA Method 8082A) and congener analysis (EPA Method 1668C) will be determined.</p>



## Appendix C Quality Assurance Project Plan Addendum

### C.1 Analytical information

Tables of laboratory reporting limits may change should an alternative laboratory be selected.

**Table C-1. Project Action Levels (PALs) and Laboratory Reporting Limits for VOCs in Sediment.**

Parameter (Low-Level)	CAS #	PAL (mg/kg)	PAL Source	Laboratory Reporting Limit (mg/kg)	Laboratory Method Limit (mg/kg)
1,1,1-Trichloroethane	71-55-6	0.07	(a*)	0.005	0.00341
1,1,2,2-Tetrachloroethane	79-34-5	0.25	(a)	0.005	0.00458
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	4,3000	[c]	0.005	0.00326
1,1,2-Trichloroethane	79-00-5	0.538	(a)	0.005	0.00377
1,1-Dichloroethane	75-34-3	0.02	(a*)	0.005	0.00339
1,1-Dichloroethene	75-35-4	0.1	(a*)	0.005	0.00306
1,2,3-Trichlorobenzene	87-61-6	0.113	(a)	0.005	0.00422
1,2,4-Trichlorobenzene	120-82-1	0.011	(a*)	0.005	0.00461
1,2-Dibromo-3-chloropropane	96-12-8	0.0054	[c]	0.01	0.00424
1,2-Dibromoethane	106-93-4	0.034	[c]	0.005	0.00359
1,2-Dichlorobenzene	95-50-1	0.095	(a)	0.005	0.00464
1,2-Dichloroethane	107-06-2	0.986	(a)	0.005	0.00337
1,2-Dichloropropane	78-87-5	0.428	(a)	0.005	0.00331
1,3-Dichlorobenzene	541-73-1	0.089	(a)	0.005	0.00401
1,4-Dichlorobenzene	106-46-7	0.03	(a*)	0.005	0.00474
1,4-Dioxane	123-91-1	4.9	[c]	0.1	0.0311
2-Butanone	78-93-3	7.604	(a)	0.01	0.00398
2-Hexanone	591-78-6	0.045	(a)	0.01	0.00294
4-Methyl-2-pentanone	108-10-1	0.073	(a)	0.01	0.00323
Acetone	67-64-1	0.065	(a*)	0.05	0.0112
Benzene	71-43-2	0.01	(a*)	0.005	0.00334
Bromochloromethane	74-97-5	16	[c]	0.005	0.00284
Bromodichloromethane	75-27-4	0.27	[c]	0.005	0.00367
Bromoform	75-25-2	0.142	(a)	0.005	0.00382
Bromomethane	74-83-9	0.0065	(a)	0.01	0.00623
Carbon disulfide	75-15-0	0.0078	(a)	0.01	0.00351
Carbon tetrachloride	56-23-5	0.057	(a)	0.005	0.00315
Chlorobenzene	108-90-7	0.03	(a*)	0.005	0.00366
Chloroethane	75-00-3	1,500	[c]	0.01	0.00367
Chloroform	67-66-3	0.087	(a)	0.005	0.00336
Chloromethane	74-87-3	12	[c]	0.01	0.00384
cis-1,2-Dichloroethene	540-59-0	0.2	(a*)	0.005	0.00289
cis-1,3-Dichloropropene	542-75-6	0.0015	(a)	0.005	0.00326
Dibromochloromethane	124-48-1	0.198	(a)	0.005	0.00331
Dichlorodifluoromethane	75-71-8	9.4	[c]	0.01	0.00268
Ethylbenzene	100-41-4	0.29	(a)	0.005	0.00357

Parameter (Low-Level)	CAS #	PAL (mg/kg)	PAL Source	Laboratory Reporting Limit (mg/kg)	Laboratory Method Limit (mg/kg)
Isopropylbenzene	98-82-8	0.035	(a)	0.005	0.00378
Methylene chloride	75-09-2	0.018	(a*)	0.01	0.00268
Methyl-tert-butyl ether	1634-04-4	0.304	(a)	0.005	0.00288
o-Xylene	95-47-6	69	[c]	0.005	0.00365
p/m-Xylene	106-42-3 and 108-38-3	59	[c]	0.005	0.00683
Styrene	100-42-5	0.126	(a)	0.005	0.00387
Tetrachloroethene	127-18-4	0.002	(a*)	0.005	0.00278
Toluene	108-88-3	0.01	(a*)	0.005	0.00317
trans-1,2-Dichloroethene	156-60-5	0.389	(a)	0.005	0.00311
trans-1,3-Dichloropropene	10061-02-6	0.0015 [b]	(a)	0.005	0.0038
Trichloroethene	79-01-6	0.078	(a*)	0.005	0.00336
Trichlorofluoromethane	75-69-4	79	[c]	0.005	0.00382
Vinyl chloride	75-01-4	0.482	(a)	0.005	0.00305

Note:

[a] USEPA Region 4 Freshwater Ecological Screening Value - assumes 1% total organic carbon

[a\*] USEPA Region 4 Freshwater Ecological Screening Value - not adjusted for organic carbon; units are mg/kg dry weight

[b] This value is for 1,3-Dichloropropene (CAS: 542-75-6)

[c] No ecological value determined. PALs listed are for human exposure to VOCs in soil and are provided for reference only. See AECOM, 2012 for details.

**Table C-2. Analytical Method Detection Limits and Laboratory Reporting Limits for PCB Aroclors in Sediment.**

Parameter	CAS #	PAL (mg/kg)	Laboratory Reporting Limit (mg/kg)	Laboratory Method Detection Limit (mg/kg)
Aroclor 1016	12674-11-2	0.06 (a)	0.02	0.0144
Aroclor 1221	11104-28-2	0.06 (a)	0.02	0.0059
Aroclor 1232	11141-16-5	0.06 (a)	0.02	0.0055
Aroclor 1242	53469-21-9	0.06 (a)	0.02	0.0032
Aroclor 1248	12672-29-6	0.06 (a)	0.02	0.0062
Aroclor 1254	11097-69-1	0.06	0.02	0.0156
Aroclor 1260	11096-82-5	0.06 (a)	0.02	0.0043
Aroclor 1262	37324-23-5	0.06 (a)	0.02	0.0047
Aroclor 1268	11100-14-4	0.06 (a)	0.02	0.0043

Note:

PALs are threshold effect concentrations (TECs) from MacDonald, D. D., C. G. Ingersoll, T. A. Berger. 2000. Development and evaluation of consensus-based sediment quality guidelines for freshwater systems. Archives of Environmental Contamination and Toxicology 39, 20-31. January 13, 2000.

(a) Value for Aroclor 1254 used.

**Table C-3. Analytical Method Detection Limits and Laboratory Reporting Limits for PCB Congeners in Sediment.**

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-1	2051-60-7	15.0	7.00
PCB-10	33146-45-1	15.0	7.00
PCB-103	60145-21-3	8.00	2.00
PCB-104	56558-16-8	8.00	3.00
PCB-105	32598-14-4	13.0	6.00
PCB-106	70424-69-0	8.00	2.00
PCB-107	70424-68-9	8.00	3.00
PCB-108/124	STL02294	16.0	6.00
PCB-11	2050-67-1	67.0	33.0
PCB-110/115	STL01826	17.0	8.00
PCB-111	39635-32-0	9.00	4.00
PCB-112	74472-36-9	8.00	2.00
PCB-114	74472-37-0	8.00	2.00
PCB-118	31508-00-6	19.0	9.00
PCB-12/13	STL01797	16.0	7.00
PCB-120	68194-12-7	9.00	4.00
PCB-121	56558-18-0	8.00	2.00
PCB-122	76842-07-4	8.00	3.00
PCB-123	65510-44-3	8.00	3.00
PCB-126	57465-28-8	8.00	3.00
PCB-127	39635-33-1	8.00	3.00
PCB-128/166	STL01816	16.0	5.00
PCB-129/138/163	STL01817	24.0	7.00
PCB-130	52663-66-8	8.00	3.00
PCB-131	61798-70-7	8.00	2.00
PCB-132	38380-05-1	8.00	3.00
PCB-133	35694-04-3	8.00	2.00
PCB-134	52704-70-8	8.00	2.00
PCB-135/151	STL01819	16.0	4.00
PCB-136	38411-22-2	8.00	2.00
PCB-137	35694-06-5	8.00	3.00
PCB-139/140	STL01820	16.0	3.00
PCB-14	34883-41-5	9.00	4.00
PCB-141	52712-04-6	9.00	4.00
PCB-142	41411-61-4	8.00	2.00
PCB-143	68194-15-0	8.00	3.00
PCB-144	68194-14-9	8.00	2.00

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-145	74472-40-5	8.00	2.00
PCB-146	51908-16-8	8.00	3.00
PCB-147/149	STL01821	16.0	5.00
PCB-148	74472-41-6	8.00	3.00
PCB-15	2050-68-2	11.0	5.00
PCB-150	68194-08-1	8.00	3.00
PCB-152	68194-09-2	8.00	2.00
PCB-153/168	STL01822	16.0	5.00
PCB-154	60145-22-4	41.0	20.0
PCB-155	33979-03-2	9.00	4.00
PCB-156/157	STL01792	16.0	4.00
PCB-158	74472-42-7	8.00	2.00
PCB-159	39635-35-3	8.00	3.00
PCB-16	38444-78-9	8.00	2.00
PCB-160	41411-62-5	8.00	3.00
PCB-161	74472-43-8	8.00	3.00
PCB-162	39635-34-2	8.00	3.00
PCB-164	74472-45-0	8.00	3.00
PCB-165	74472-46-1	8.00	2.00
PCB-167	52663-72-6	8.00	2.00
PCB-169	32774-16-6	8.00	2.00
PCB-17	37680-66-3	8.00	3.00
PCB-170	35065-30-6	11.0	5.00
PCB-171/173	STL01823	16.0	3.00
PCB-172	52663-74-8	15.0	7.00
PCB-174	38411-25-5	9.00	4.00
PCB-175	40186-70-7	8.00	3.00
PCB-176	52663-65-7	8.00	2.00
PCB-177	52663-70-4	8.00	3.00
PCB-178	52663-67-9	8.00	3.00
PCB-179	52663-64-6	8.00	2.00
PCB-18/30	STL01798	16.0	5.00
PCB-180/193	STL01824	16.0	5.00
PCB-181	74472-47-2	8.00	3.00
PCB-182	60145-23-5	8.00	3.00
PCB-183/185	STL02297	16.0	5.00
PCB-184	74472-48-3	8.00	3.00
PCB-186	74472-49-4	8.00	3.00
PCB-187	52663-68-0	8.00	3.00

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-188	74487-85-7	49.0	24.0
PCB-189	39635-31-9	8.00	2.00
PCB-19	38444-73-4	8.00	3.00
PCB-190	41411-64-7	8.00	3.00
PCB-191	74472-50-7	8.00	3.00
PCB-192	74472-51-8	8.00	3.00
PCB-194	35694-08-7	9.00	4.00
PCB-195	52663-78-2	8.00	2.00
PCB-196	42740-50-1	8.00	2.00
PCB-197/200	STL02692	16.0	5.00
PCB-198/199	STL01825	16.0	4.00
PCB-2	2051-61-8	15.0	7.00
PCB-20/28	STL01799	16.0	7.00
PCB-201	40186-71-8	45.0	22.0
PCB-202	2136-99-4	8.00	3.00
PCB-203	52663-76-0	8.00	3.00
PCB-204	74472-52-9	8.00	2.00
PCB-205	74472-53-0	8.00	3.00
PCB-206	40186-72-9	8.00	2.00
PCB-207	52663-79-3	8.00	2.00
PCB-208	52663-77-1	21.0	10.0
PCB-21/33	STL01800	16.0	4.00
PCB-22	38444-85-8	13.0	6.00
PCB-23	55720-44-0	8.00	2.00
PCB-24	55702-45-9	8.00	2.00
PCB-25	55712-37-3	8.00	2.00
PCB-26/29	STL01801	23.0	11.0
PCB-27	38444-76-7	8.00	3.00
PCB-3	2051-62-9	21.0	10.0
PCB-31	16606-02-3	11.0	5.00
PCB-32	38444-77-8	8.00	3.00
PCB-34	37680-68-5	8.00	3.00
PCB-35	37680-69-6	9.00	4.00
PCB-36	38444-87-0	8.00	2.00
PCB-37	38444-90-5	8.00	3.00
PCB-38	53555-66-1	8.00	2.00
PCB-39	38444-88-1	8.00	3.00
PCB-4	13029-08-8	19.0	9.00
PCB-40/71	STL01802	16.0	5.00

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-41	52663-59-9	8.00	3.00
PCB-42	36559-22-5	17.0	8.00
PCB-43	70362-46-8	8.00	3.00
PCB-44/47/65	STL01803	24.0	9.00
PCB-45	70362-45-7	8.00	3.00
PCB-46	41464-47-5	8.00	2.00
PCB-48	70362-47-9	9.00	4.00
PCB-49/69	STL01805	16.0	5.00
PCB-5	16605-91-7	19.0	9.00
PCB-50/53	STL01806	27.0	13.0
PCB-51	68194-04-7	9.00	4.00
PCB-52	35693-99-3	15.0	7.00
PCB-54	15968-05-5	8.00	2.00
PCB-55	74338-24-2	8.00	2.00
PCB-56	41464-43-1	31.0	15.0
PCB-57	70424-67-8	8.00	2.00
PCB-58	41464-49-7	8.00	2.00
PCB-59/62/75	STL01807	24.0	4.00
PCB-6	25569-80-6	9.00	4.00
PCB-60	33025-41-1	27.0	13.0
PCB-61/70/74/76	STL01808	32.0	14.0
PCB-63	74472-34-7	8.00	3.00
PCB-64	52663-58-8	33.0	16.0
PCB-66	32598-10-0	29.0	14.0
PCB-67	73575-53-8	8.00	2.00
PCB-68	73575-52-7	8.00	2.00
PCB-7	33284-50-3	11.0	5.00
PCB-72	41464-42-0	8.00	2.00
PCB-73	74338-23-1	8.00	3.00
PCB-77	32598-13-3	8.00	3.00
PCB-78	70362-49-1	8.00	2.00
PCB-79	41464-48-6	8.00	3.00
PCB-8	34883-43-7	9.00	4.00
PCB-80	33284-52-5	8.00	2.00
PCB-81	70362-50-4	9.00	4.00
PCB-82	52663-62-4	17.0	8.00
PCB-83	60145-20-2	8.00	3.00
PCB-84	52663-60-2	8.00	3.00
PCB-85/116/117	STL01810	24.0	7.00

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-86/87/97/109/119/125	STL02295	48.0	19.0
PCB-88	55215-17-3	8.00	3.00
PCB-89	73575-57-2	8.00	3.00
PCB-9	34883-39-1	9.00	4.00
PCB-90/101/113	STL01813	24.0	6.00
PCB-91	68194-05-8	8.00	3.00
PCB-92	52663-61-3	8.00	3.00
PCB-93/100	STL01814	16.0	4.00
PCB-94	73575-55-0	8.00	3.00
PCB-95	38379-99-6	13.0	6.00
PCB-96	73575-54-9	8.00	2.00
PCB-98/102	STL01843	16.0	6.00
PCB-99	38380-01-7	9.00	4.00
Total Monochlorobiphenyls	27323-18-8	15.0	7.00
Total Dichlorobiphenyls	25512-42-9	9.00	4.00
Total Trichlorobiphenyls	25323-68-6	8.00	2.00
Total Tetrachlorobiphenyls	26914-33-0	8.00	2.00
Total Pentachlorobiphenyls	25429-29-2	8.00	2.00
Total Hexachlorobiphenyls	26601-64-9	8.00	2.00
Total Heptachlorobiphenyls	28655-71-2	8.00	2.00
Total Octachlorobiphenyls	55722-26-4	8.00	2.00
Total Nonachlorobiphenyls	53742-07-7	8.00	2.00
DCB Decachlorobiphenyl	2051-24-3	59.0	29.0
Polychlorinated biphenyls, Total	1336-36-3	8.00	2.00
PCB-1L	234432-85-0	200	50.0
PCB-3L	208263-77-8	200	50.0
PCB-4L	234432-86-1	200	50.0
PCB-8L	STL01600	200	50.0
PCB-15L	208263-67-6	200	50.0
PCB-19L	234432-87-2	200	50.0
PCB-31L	STL01601	200	50.0
PCB-32L	STL01602	200	50.0
PCB-37L	208263-79-0	200	50.0
PCB-47L	STL02698	200	50.0
PCB-54L	234432-88-3	200	50.0
PCB-60L	STL02699	200	50.0
PCB-70L	STL02700	200	50.0
PCB-77L	105600-23-5	200	50.0
PCB-81L	208461-24-9	200	50.0

PCB Congener	CAS #	Laboratory Reporting Limits (ng/kg)	Laboratory Method Detection Limit (ng/kg)
PCB-85L	STL02701	200	50.0
PCB-95L	STL01604	200	50.0
PCB-104L	234432-89-4	200	50.0
PCB-105L	208263-62-1	200	50.0
PCB-114L	208263-63-2	200	50.0
PCB-118L	104130-40-7	200	50.0
PCB-123L	208263-64-3	200	50.0
PCB-126L	208263-65-4	200	50.0
PCB-127L	STL02202	200	50.0
PCB-155L	234432-90-7	200	50.0
PCB-156L/157L	STL01793	400	100
PCB-167L	208263-69-8	200	50.0
PCB-169L	208263-70-1	200	50.0
PCB-180L	160901-82-6	200	50.0
PCB-188L	234432-91-8	200	50.0
PCB-189L	208263-73-4	200	50.0
PCB-202L	105600-26-8	200	50.0
PCB-205L	234446-64-1	200	50.0
PCB-206L	208263-75-6	200	50.0
PCB-208L	234432-92-9	200	50.0
PCB-209L	105600-27-9	200	50.0
PCB-128L	STL02694	200	50.0
PCB-133L	STL02695	200	50.0
PCB-141L	STL02696	200	50.0
PCB-162L	STL02697	200	50.0



**Table C-3. Sample Containers, Preservation, and Holding Time Requirements**

Parameter	Container	Preservation	Holding Time
VOCs	High level analysis: 1- 40 mL vial filled with 5 mL methanol (5 g soil to 5 mL methanol) Low level analysis: 2-40 mL vials with Teflon stir bar and filled with 5 mL deionized water (5 g soil to 5 mL deionized water) % solids: 1 - 60 mL plastic	Ice, 4°C, in field	48 hours to freezing for water preserved samples  28 days from collection to analysis for methanol and water preserved samples
PCB Aroclors	1-8 oz amber glass with Teflon-lined cap	Ice, 4°C. Lab storage at <-10°C.	365 days to extraction  40 days from extraction to analysis
PCB – Congeners	1-8 oz amber glass with Teflon-lined cap	Ice, 4°C. Lab storage at <-10°C.	365 days to extraction  40 days from extraction to analysis
Total Organic Carbon	1-4 oz amber glass with Teflon-lined cap	Ice, 4°C	14 days to analysis
Grain Size Analysis	1 gallon zip-lock PE bag or gallon plastic container	none	none

**Table C-4. Analytical Methods**

Parameter	Method
PCB – Aroclors	EPA Method 8082A
PCB – congeners	EPA Method 1668C
TCL VOCs	SW-846 8260C
Total Organic Carbon	Lloyd Kahn
Grain Size Analysis	ASTM D422

**Table C-5. Laboratory Standard Operating Procedures**

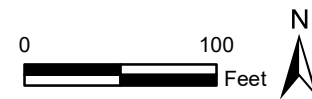
Constituent	Presumed Laboratory Performing Analysis	Title	Reference Number
PCB Aroclors	Eurofins	TBD	TBD
PCB Congeners	Eurofins	TBD	TBD
VOCs	Eurofins	TBD	TBD
Total Organic Carbon	Eurofins	TBD	TBD
Grain Size Analysis	Eurofins	TBD	TBD

## FIGURES



- Legend**
- Former Tank Farm
  - Former Building Footprint
  - Property Boundary
  - Bulkhead

Sources  
 1. Aerial Photography from RIGIS (2022).  
 2. RFI Report, Pawtuxet River, Woodward-Clyde, March 1996.



**FORMER CIBA-GEIGY  
 SITE INVESTIGATION  
 CRANSTON, RI**

DATE: 6/19/2023

DRWN: JB

**KEY MAP**

**FIGURE 1  
 SITE LOCATION MAP**





PZ-01D2  
 Chlorobenzene 410 (0.25-0.75) 8/17/2022  
 Chlorobenzene 360 (4-5.5) 8/17/2022  
 Chlorobenzene 270 (4-5.5) 8/17/2022 (Dup)  
 Chlorobenzene 4.9 (5.5-7.1) 8/17/2022  
 Chlorobenzene 5.9 (8-9) 8/17/2022  
 Chlorobenzene 6.3 (9-10.4) 8/17/2022  
 Trichlorethylene 3200 (0.25-0.75) 8/17/2022  
 Trichlorethylene 2900 (4-5.5) 8/17/2022  
 Trichlorethylene 1800 (4-5.5) 8/17/2022 (Dup)  
 Trichlorethylene 0.0053 (5.5-7.1) 8/17/2022  
 Trichlorethylene 2.3 (8-9) 8/17/2022  
 Trichlorethylene < 0.35 U (9-10.4) 8/17/2022  
 Tetrachloroethylene 14000 (0.25-0.75) 8/17/2022  
 Tetrachloroethylene 20000 (4-5.5) 8/17/2022  
 Tetrachloroethylene 13000 (4-5.5) 8/17/2022 (Dup)  
 Tetrachloroethylene 0.6 (5.5-7.1) 8/17/2022  
 Tetrachloroethylene 18 (8-9) 8/17/2022  
 Tetrachloroethylene 0.52 (9-10.4) 8/17/2022  
 Cis-1,2,-Dichloroethene 3300 (0.25-0.75) 8/17/2022  
 Cis-1,2,-Dichloroethene 3400 (4-5.5) 8/17/2022  
 Cis-1,2,-Dichloroethene 1600 (4-5.5) 8/17/2022 (Dup)  
 Cis-1,2,-Dichloroethene < 0.0053 U (5.5-7.1) 8/17/2022  
 Cis-1,2,-Dichloroethene 2.7 (8-9) 8/17/2022  
 Cis-1,2,-Dichloroethene 1.9 (9-10.4) 8/17/2022  
 1,2-Diclorobenzene < 120 U (0.25-0.75) 8/17/2022  
 1,2-Diclorobenzene < 11 U (4-5.5) 8/17/2022  
 1,2-Diclorobenzene < 91 U (4-5.5) 8/17/2022 (Dup)  
 1,2-Diclorobenzene 0.72 (5.5-7.1) 8/17/2022  
 1,2-Diclorobenzene 9.1 (8-9) 8/17/2022  
 1,2-Diclorobenzene 130 (9-10.4) 8/17/2022  
 1,2,4-Trimethylbenzene 410 (0.25-0.75) 8/17/2022  
 1,2,4-Trimethylbenzene 160 (4-5.5) 8/17/2022  
 1,2,4-Trimethylbenzene 300 (4-5.5) 8/17/2022 (Dup)  
 1,2,4-Trimethylbenzene 0.0076 (5.5-7.1) 8/17/2022  
 1,2,4-Trimethylbenzene 1.8 (8-9) 8/17/2022  
 1,2,4-Trimethylbenzene < 0.35 U (9-10.4) 8/17/2022  
 1,3,5-Trimethylbenzene 190 (0.25-0.75) 8/17/2022  
 1,3,5-Trimethylbenzene 200 (4-5.5) 8/17/2022  
 1,3,5-Trimethylbenzene 150 (4-5.5) 8/17/2022 (Dup)  
 1,3,5-Trimethylbenzene < 0.0053 U (5.5-7.1) 8/17/2022  
 1,3,5-Trimethylbenzene 1 (8-9) 8/17/2022  
 1,3,5-Trimethylbenzene < 0.35 U (9-10.4) 8/17/2022  
 Toluene < 120 U (0.25-0.75) 8/17/2022  
 Toluene 95 (4-5.5) 8/17/2022  
 Toluene < 91 U (4-5.5) 8/17/2022 (Dup)  
 Toluene < 0.0053 U (5.5-7.1) 8/17/2022  
 Toluene < 0.41 U (8-9) 8/17/2022  
 Toluene < 0.35 U (9-10.4) 8/17/2022  
 Xylene 160 (0.25-0.75) 8/17/2022  
 Xylene 233 (4-5.5) 8/17/2022  
 Xylene 120 (4-5.5) 8/17/2022 (Dup)  
 Xylene < 0.0053 U (5.5-7.1) 8/17/2022  
 Xylene 0.53 (8-9) 8/17/2022  
 Xylene < 0.35 U (9-10.4) 8/17/2022

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SD-04R  
 Chlorobenzene 0.66 (0-0.5) 11/14/2002  
 Chlorobenzene 0.17 (0-0.5) 12/1/1995  
 Chlorobenzene 0.17 (0-0.5) 1/1/1992  
 Toluene < 0 U (0-0.5) 11/14/2002  
 Toluene 0.58 (0-0.5) 12/1/1995  
 Toluene 0.58 (0-0.5) 1/1/1992

SD-03L  
 Chlorobenzene 0.008 (0-0.5) 11/14/2002  
 Chlorobenzene 0.078 J (0-0.5) 12/1/1995  
 Chlorobenzene 0.078 J (0-0.5) 1/1/1992  
 Toluene < 0 U (0-0.5) 11/14/2002  
 Toluene 0.1 J (0-0.5) 12/1/1995  
 Toluene 0.1 J (0-0.5) 1/1/1992

PZ-05D  
 Chlorobenzene 40 (0.5-1.75) 8/15/2022  
 Chlorobenzene 0.41 (4-6) 8/15/2022  
 Chlorobenzene 0.3 (6-6.5) 8/15/2022  
 Chlorobenzene < 0.67 U (8-10) 8/15/2022  
 Trichlorethylene < 0.99 U (0.5-1.75) 8/15/2022  
 Trichlorethylene < 0.0051 U (4-6) 8/15/2022  
 Trichlorethylene < 0.66 U (6-6.5) 8/15/2022  
 Trichlorethylene < 0.67 U (8-10) 8/15/2022  
 Tetrachloroethylene < 0.99 U (0.5-1.75) 8/15/2022  
 Tetrachloroethylene < 0.0051 U (4-6) 8/15/2022  
 Tetrachloroethylene 0.46 (6-6.5) 8/15/2022  
 Tetrachloroethylene < 0.67 U (8-10) 8/15/2022  
 Cis-1,2,-Dichloroethene < 0.99 U (0.5-1.75) 8/15/2022  
 Cis-1,2,-Dichloroethene < 0.0051 U (4-6) 8/15/2022  
 Cis-1,2,-Dichloroethene < 0.66 U (6-6.5) 8/15/2022  
 Cis-1,2,-Dichloroethene < 0.67 U (8-10) 8/15/2022  
 1,2-Diclorobenzene < 0.99 U (0.5-1.75) 8/15/2022  
 1,2-Diclorobenzene 0.36 (4-6) 8/15/2022  
 1,2-Diclorobenzene 43 (6-6.5) 8/15/2022  
 1,2-Diclorobenzene 22 (8-10) 8/15/2022  
 1,2,4-Trimethylbenzene 0.43 (0.5-1.75) 8/15/2022  
 1,2,4-Trimethylbenzene < 0.0051 U (4-6) 8/15/2022  
 1,2,4-Trimethylbenzene < 0.66 U (6-6.5) 8/15/2022  
 1,2,4-Trimethylbenzene < 0.67 U (8-10) 8/15/2022  
 1,3,5-Trimethylbenzene < 0.99 U (0.5-1.75) 8/15/2022  
 1,3,5-Trimethylbenzene < 0.0051 U (4-6) 8/15/2022  
 1,3,5-Trimethylbenzene < 0.66 U (6-6.5) 8/15/2022  
 1,3,5-Trimethylbenzene < 0.67 U (8-10) 8/15/2022  
 Toluene < 0.99 U (0.5-1.75) 8/15/2022  
 Toluene < 0.0051 U (4-6) 8/15/2022  
 Toluene < 0.66 U (6-6.5) 8/15/2022  
 Toluene < 0.67 U (8-10) 8/15/2022  
 Xylene < 0.99 U (0.5-1.75) 8/15/2022  
 Xylene < 0.0051 U (4-6) 8/15/2022  
 Xylene < 0.66 U (6-6.5) 8/15/2022  
 Xylene < 0.67 U (8-10) 8/15/2022

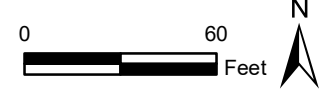
PZ-04D  
 Chlorobenzene 13 (0.5-1.4) 8/16/2022  
 Chlorobenzene 1.9 (5-6.25) 8/16/2022  
 Trichlorethylene < 0.36 U (0.5-1.4) 8/16/2022  
 Tetrachloroethylene < 0.36 U (0.5-1.4) 8/16/2022  
 Tetrachloroethylene 11 (5-6.25) 8/16/2022  
 Cis-1,2,-Dichloroethene < 0.36 U (0.5-1.4) 8/16/2022  
 Cis-1,2,-Dichloroethene < 0.34 U (5-6.25) 8/16/2022  
 1,2-Diclorobenzene < 0.36 U (0.5-1.4) 8/16/2022  
 1,2-Diclorobenzene 110 (5-6.25) 8/16/2022  
 1,2,4-Trimethylbenzene 1.1 (0.5-1.4) 8/16/2022  
 1,2,4-Trimethylbenzene < 0.34 U (5-6.25) 8/16/2022  
 1,3,5-Trimethylbenzene 0.65 (0.5-1.4) 8/16/2022  
 1,3,5-Trimethylbenzene < 0.34 U (5-6.25) 8/16/2022  
 Toluene < 0.36 U (0.5-1.4) 8/16/2022  
 Toluene < 0.34 U (5-6.25) 8/16/2022  
 Xylene 0.45 (0.5-1.4) 8/16/2022  
 Xylene < 0.34 U (5-6.25) 8/16/2022

SD-02L  
 Chlorobenzene < 0 U (0-0.5) 11/14/2002  
 Chlorobenzene 0.063 J (0-0.5) 12/1/1995  
 Chlorobenzene 0.063 J (0-0.5) 1/1/1992  
 Toluene < 0 U (0-0.5) 11/14/2002  
 Toluene 0.076 J (0-0.5) 12/1/1995  
 Toluene 0.076 J (0-0.5) 1/1/1992

**Legend**

- Sediment Sample Location
- + Historic Outfalls
- Sediment Removal Areas
- Sediment Cap Area
- Former Hot Spot Area
- Property Boundary
- Bulkhead

Sources  
 1. Aerial Photography from RIGIS (2022).  
 2. RFI Report, Pawtuxet River, Woodward-Clyde, March 1996.

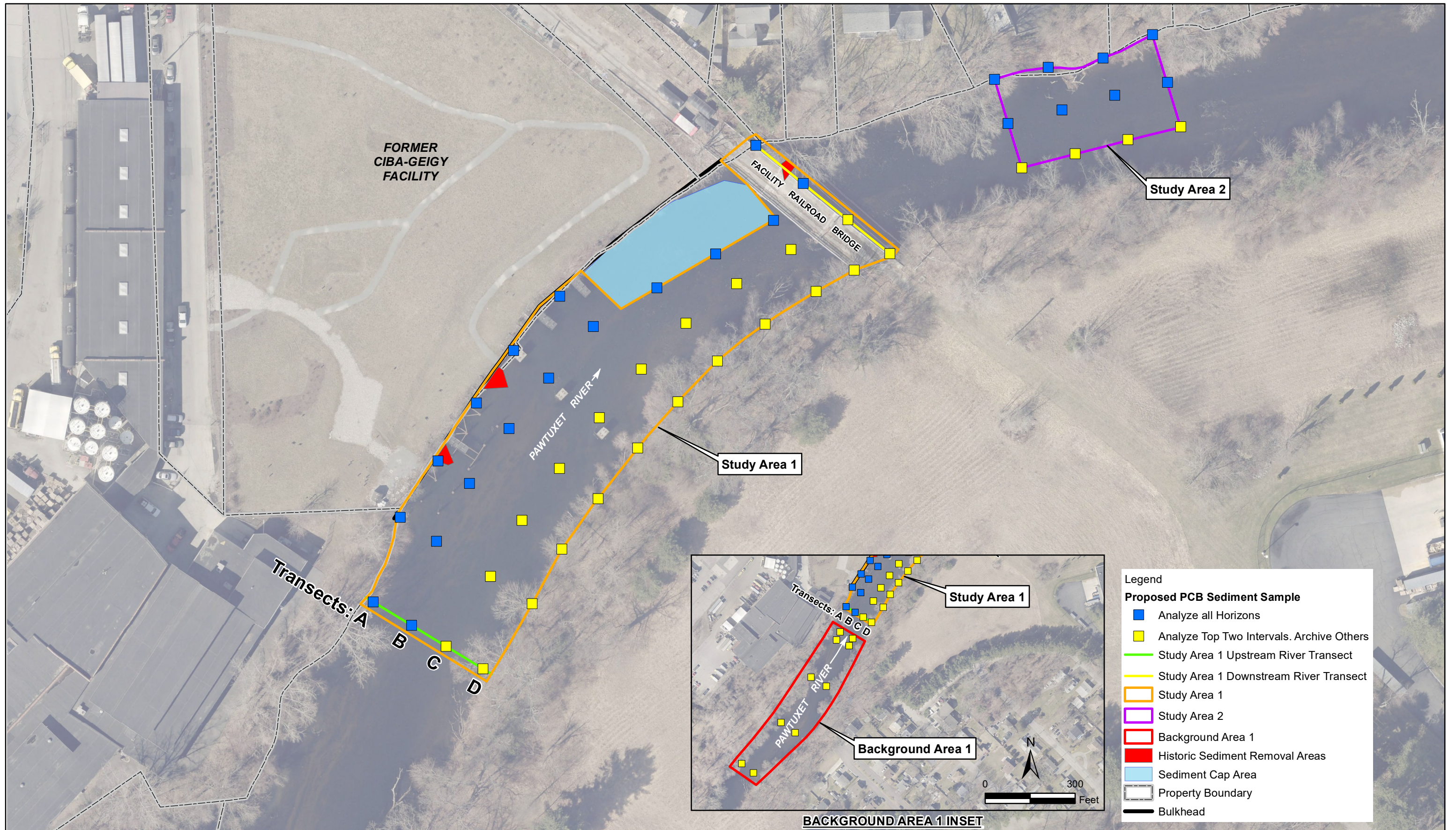


**FORMER CIBA-GEIGY  
SITE INVESTIGATION  
CRANSTON, RI**

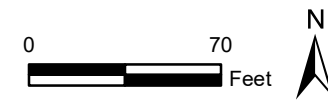
DATE: 6/15/2023    DRWN: JB

**FIGURE 3  
RESULTS OF HISTORIC SAMPLING  
IN SEDIMENT OF PAWTUXET RIVER  
SELECTED VOCs (MG/KG)**





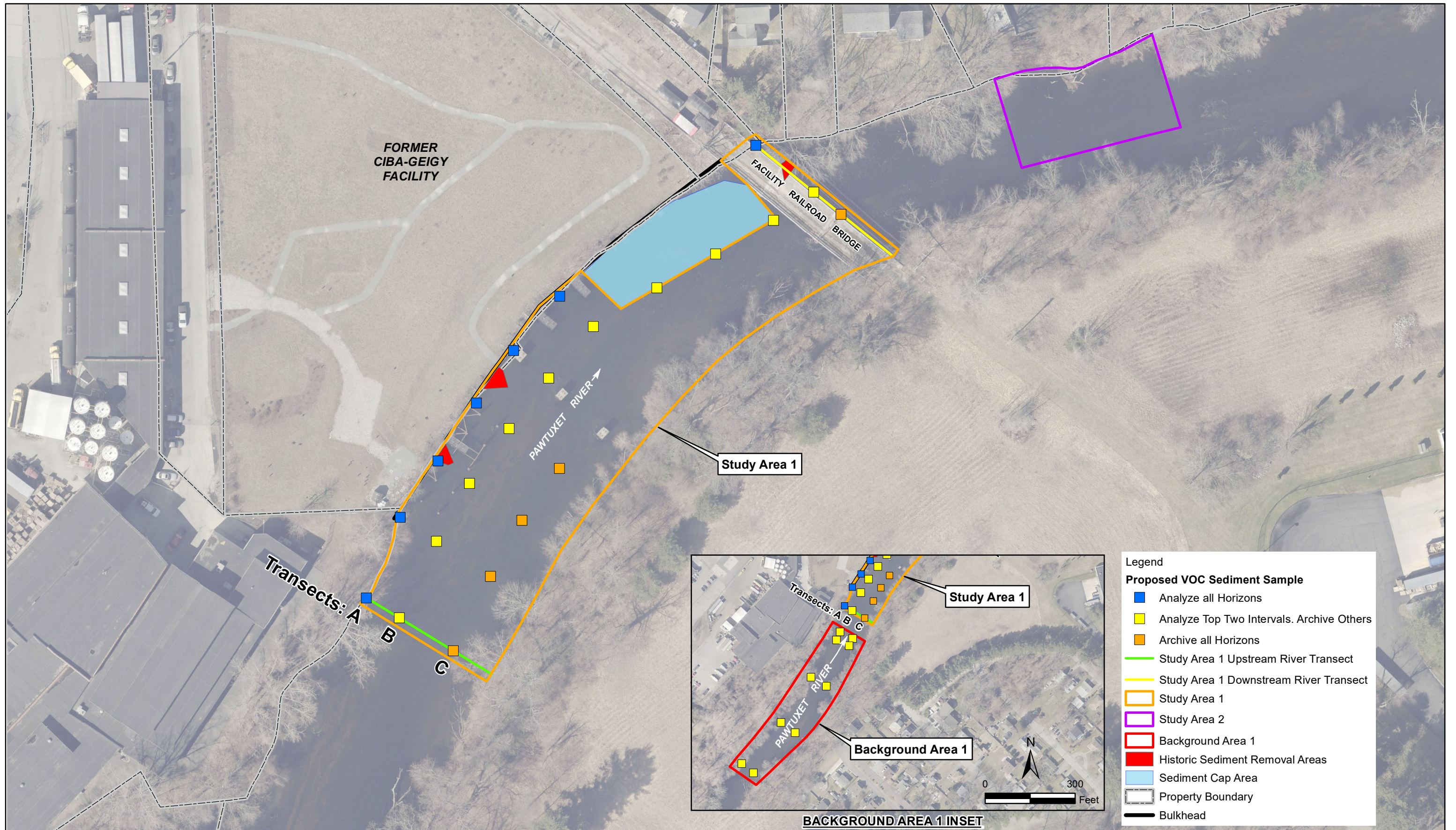
Sources  
 1. Aerial Photography from RIGIS (2022).  
 2. RFI Report, Pawtuxet River, Woodward-Clyde, March 1996.



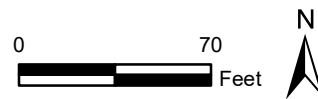
FORMER CIBA-GEIGY  
 SITE INVESTIGATION  
 CRANSTON, RI  
 DATE: 4/5/2024 | DRWN: JB

FIGURE 4  
 PROPOSED PCB SEDIMENT  
 SAMPLING LOCATIONS





Sources  
 1. Aerial Photography from RIGIS (2022).  
 2. RFI Report, Pawtuxet River, Woodward-Clyde, March 1996.

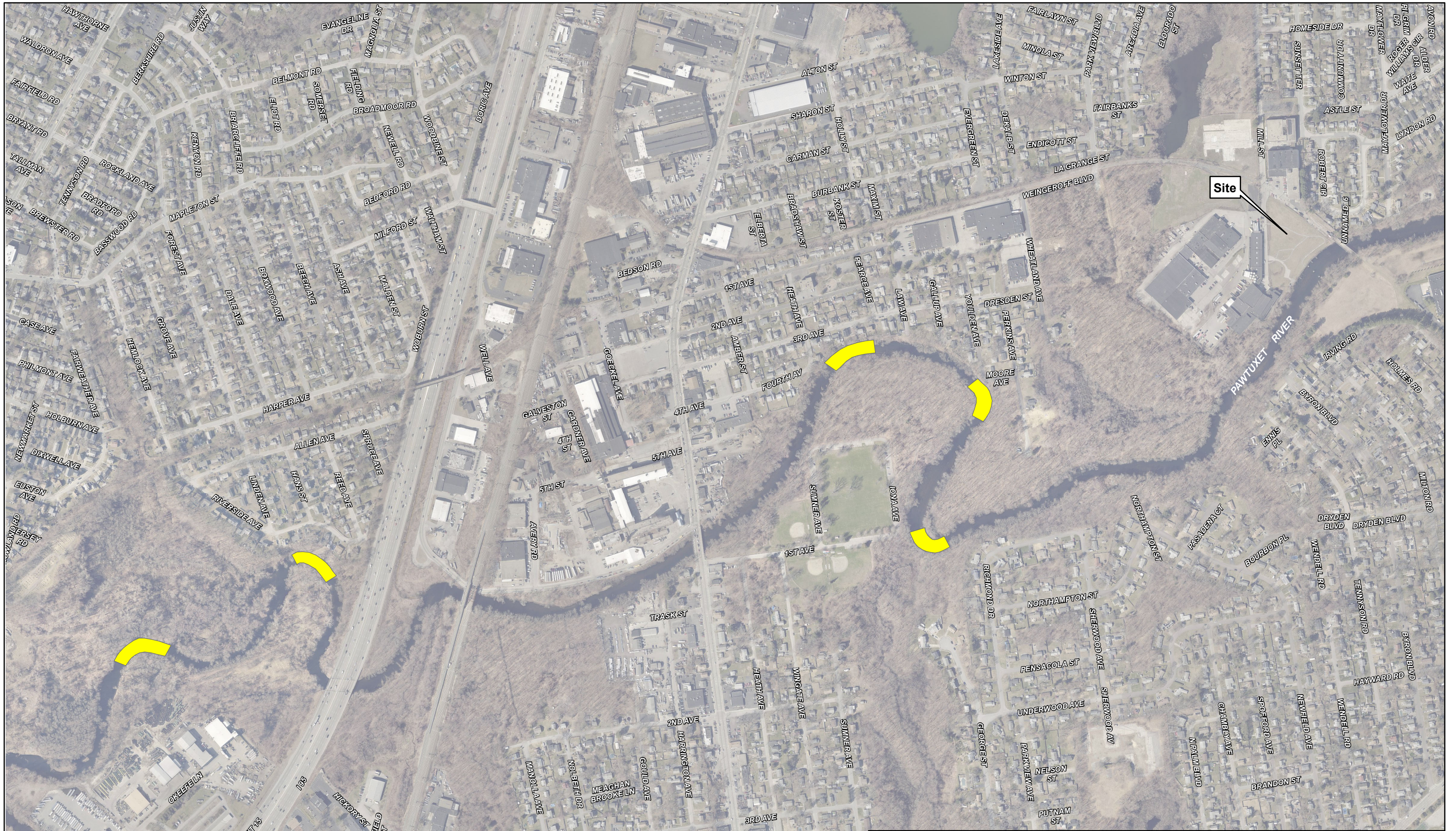


**FORMER CIBA-GEIGY SITE INVESTIGATION**  
**CRANSTON, RI**

DATE: 4/5/2024 | DRWN: JB

**FIGURE 5**  
**PROPOSED VOC SEDIMENT SAMPLING LOCATIONS**





Legend

Areas of Potential Accretion

Sources

1. Aerial Photography from RIGIS (2022).
2. RFI Report, Pawtuxet River, Woodward-Clyde, March 1996.



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DATE: 3/27/2024

DRWN: JB

FIGURE 6  
EXAMPLE LOCATIONS FOR  
BACKGROUND AREA 2



