RECORD OF DECISION

FOR AN INTERIM ACTION AT THE

BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

BERGEN COUNTY, NEW JERSEY

U.S. Environmental Protection Agency

Region 2

September 2018

DECLARATION FOR THE RECORD OF DECISION

FACILITY NAME AND LOCATION

Ventron/Velsicol Site
Operable Unit 2 – Berry's Creek Study Area
Bergen County, New Jersey

EPA Superfund Site Identification Number NJD980529879

STATEMENT OF BASIS AND PURPOSE

This Record of Decision (ROD) documents the U.S. Environmental Protection Agency's (EPA's) selection of an interim source control remedy to address contamination at the Berry's Creek Study Area (BCSA) which is Operable Unit 2 (OU2) of the Ventron/Velsicol Site. The remedy was chosen in accordance with the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), 42 U.S.C. §§ 9601-9675, and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 CFR Part 300. This decision document explains the factual and legal basis for selecting the remedy. The Administrative Record Index (see Appendix 3) identifies the items that comprise the Administrative Record upon which the selected remedy is based.

The State of New Jersey was consulted on the proposed remedy in accordance with CERCLA Section 121(f), 42 U.S.C § 9621(f). The State of New Jersey concurs with EPA's selection of Alternatives W4 for the waterways and UPIC3-A for the marsh in Upper Peach Island Creek.

ASSESSMENT OF THE SITE

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

DESCRIPTION OF THE SELECTED REMEDY

The selected remedy in this ROD is an interim action for source control in certain BCSA waterways as well as Upper Peach Island Creek (UPIC) marsh. The selected remedy addresses contaminated waterway sediment in Upper Berry's Creek (UBC), Middle Berry's Creek (MBC) and major tributaries (*e.g.*, Peach Island Creek, Ackerman's Creek) which will reduce contaminant levels in the surface sediments, which will lead to a reduction in contaminant levels in the surface water and biota within Berry's Creek. It will also address high concentrations of contamination found in the sediments of UPIC marsh. The contaminants of concern (COCs) for this action are polychlorinated biphenyls (PCBs), mercury, methyl mercury and chromium. The selected remedy requires the following components:

UBC and MBC Waterways: *Alternative W4: 2-foot Sediment Removal + Backfill/Cap*

- Bank-to-bank removal of 2 feet of soft sediment within the proposed remediation footprint (plus 6 inches of over-dredge). Where less than 2 feet of soft sediment is present, all of the soft sediment will be removed. The selected remedy is expected to remove approximately 363,000 cubic yards (yd^3) of sediment from the UBC and MBC waterways.

- Backfill/capping of the areas where sediment is removed. The backfill thickness will be equal to the thickness of sediment removed. In areas where contaminated soft sediment remains below the excavation depth, the backfill will serve as a cap to physically isolate this material. The work will include mitigation of the disturbance to habitat caused by the remedial action.

UPIC Marsh: *Alternative UPIC3-A: Hybrid – Sediment Removal + Backfill and Thin-Layer Cover*

- Removal of marsh sediments to a depth of 1 foot for most of the marsh, with removal of 2 feet of sediment within a 10-foot strip along the marsh edge at the waterway banks. The selected remedy is expected to remove approximately 69,500 yd^3 of UPIC marsh sediment.

- The excavated sediment will be replaced with backfill to maintain marsh surface elevations, isolate underlying marsh sediment, and re-establish the marsh habitat.

- A thin-layer cover of clean material (six inches) will be placed over the existing marsh in the area surrounding the radio towers in the southern portion of UPIC marsh. Approximately 3,600 yd^3 of thin-layer cover material will be placed.

Dewatering and Off-Site Disposal: The excavated/dredged sediment will be dewatered, stabilized as necessary and transported off site for disposal at a permitted facility. Water from the process will be treated and returned to the creek.

Marsh Demonstration Project: A marsh demonstration project will evaluate potential cleanup options for marshes not addressed in this action, and monitor the response of the marshes to the waterway cleanup.

Long-Term Monitoring: Long-term monitoring will be conducted to evaluate the overall effectiveness of the cleanup as well as providing information to make future decisions for the BCSA.

Institutional Controls: Institutional controls (ICs), such as the existing New Jersey fish and crab consumption advisories will remain in place. Additional restrictions will be put in place to preserve the caps, if necessary.

The selected remedy is an interim action to control the release of contamination from the sediments in Upper and Middle Berry's Creek. It is the first ROD to address Berry's Creek sediments. One or more future decision documents will be necessary to select a final remedy on the sediments in Upper and Middle Berry's Creek, and to select remedies for the marshes as well as Lower Berry's Creek and Berry's Creek Canal.

Although the COCs in the sediment act as a source of contamination to surface water and biota, these contaminants are not highly mobile and can be reliably contained, so they are not considered principal threat wastes at the BCSA. Although some concentrations of COCs are high, the exposure point concentration, *i.e.*, the statistical value calculated to represent a reasonable maximum exposure to both human and ecological receptors, results in risks that exceed acceptable levels but do not meet the principal threat waste threshold.

The environmental benefits of the selected remedy may be enhanced, during remedy design or implementation, by consideration of technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Energy Policy.

The estimated 30-year present worth cost of the selected remedy, with a seven percent discount factor, is $332,000,000.

DECLARATION OF STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed; complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action; and is cost-effective. Although this interim action is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus supports that statutory mandate. Subsequent actions will address fully the threats posed by conditions at the BCSA.

The selected remedy satisfies the statutory preference for treatment as a principal element of the remedy. Although the dredged/excavated sediment will be transported off site for disposal, an amendment (*e.g.*, Portland cement) will be added as needed to meet transportation and disposal requirements. The addition of an amendment will reduce the toxicity and the mobility of contaminants contained within the sediment, compared to untreated sediment. While treatment could be considered a secondary benefit of amendment addition for transportation and disposal requirements, the sediment will nonetheless undergo treatment, and the statutory preference will be met.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews will be required to ensure that the remedy is, or will be, protective of human health and the environment. The schedule for the five-year review has been set by the start of remediation at the upland portion of the Ventron/Velsicol Site (OU1). The first five-year review for OU1 was issued on September 25, 2017. Because this is an interim action ROD, review of this remedy will be ongoing as EPA continues to develop final remedial alternatives for the BCSA.

ROD DATA CERTIFICATION CHECKLIST

DATA CERTIFICATION CHECKLIST

The following information is included in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for the BCSA.

• COCs and their respective concentrations are in Section 5, "Summary of Site Characteristics."

• Baseline risks for human health and the environment represented by the COCs are in Section 7, "Summary of Site Risks."

• Remedial Action Objectives are in Section 8, which provide a basis for determining if the cleanup has been conducted as described by this ROD.

• Current and reasonably anticipated future use assumptions used in the baseline risk assessment and ROD are in Section 6, "Current and Potential Future Site and Resource Uses."

• Estimated capital, operation and maintenance (O&M), and total present value costs, discount rate, and the number of years over which the remedy cost estimates are projected are in Sections 10.1.2 Waterway Balancing Criteria and 10.2.2 UPIC March Balancing Criteria under the subsection on "Cost."

• Key factors that led to selecting the remedy (*i.e.*, how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, and highlighting criteria key to the decisions) are in Section 10.

AUTHORIZING SIGNATURE

[signature] 9-25-18

Andrew Wheeler, Acting Administrator | Date

DECISION SUMMARY

Berry's Creek Study Area
Ventron/Velsicol Site – Operable Unit 2

Bergen County, New Jersey

U.S. Environmental Protection Agency
Region 2
September 2018

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1. SITE NAME, LOCATION AND DESCRIPTION

The Berry's Creek watershed is located in the Hackensack River Meadowlands in Bergen County, New Jersey (Figure 1). Portions of the creek are located in the Boroughs of Teterboro, Moonachie, Wood-Ridge, Carlstadt, Rutherford and East Rutherford. The 12-square mile (mi^2) watershed consists of approximately 1.6 mi^2 of tidal waterways and marshes (the "tidal zone"), and 10.4 mi^2 of highly-urbanized upland areas that drain to the BCSA tidal zone (Figure 2).

The area surrounding Berry's Creek and the marshes have multiple uses. Most of the adjacent areas are commercial or light industrial, part of the New Jersey Sports and Exhibition Authority (NJSEA) stadium complex, or roadways. Teterboro Airport is in the northern portion of the watershed, located between the East and West Risers (which are two of the major tributaries to Berry's Creek). There are several closed municipal landfills in the southern portion of the Berry's Creek Study Area (BCSA). In addition, on Upper Peach Island Creek Marsh (UPIC) are eight large radio towers. There is limited residential use bordering the creek and marshes; however, in areas of higher elevation there is a high density of residential use.

The Remedial Investigation (RI) focused on the tidal zone and contamination in BCSA waterways and marshes associated with past releases of hazardous substances to the creek. The waterways include the main channel of Berry's Creek, which is an approximately 4.5-mile long tidal tributary of the Hackensack River, and the numerous tributary channels that flow into the main channel. The BCSA includes roughly 756 acres of common reed (*Phragmites australis* (*Phragmites*)) marshes along the tidal waterways plus UPIC marsh—an area that was formerly tidal marsh, but is now separated from routine tidal exchange by the Peach Island Creek (PIC) tide gate.

For purposes of the site investigations and remedy selection process, the BCSA has been operationally divided into five geographic study segments (see Figure 2) segregated by infrastructure and/or confluences with other waterways, and includes the section of the creek described as well as the associated tributaries and marshes:

- **Upper Berry's Creek (UBC):** extends from the West Riser tide gate south to Paterson Plank Road;
- **Middle Berry's Creek (MBC):** extends from Paterson Plank Road south to Route 3;
- **Berry's Creek Canal (BCC):** extends from Route 3 to the Hackensack River;
- **Lower Berry's Creek (LBC):** extends from MBC and BCC at its northern end through culverts near Route 3 to the Hackensack River at its southern end; and
- **Upper Peach Island Creek (UPIC):** The reach of Peach Island Creek located above the Peach Island Creek tide gate.

An overall trend of decreasing contaminant concentrations is observed from north to south across the BCSA. The industrial sources of contaminants of concern (COCs) in UBC and MBC were largely removed or controlled in the 1970s to early 1980s, and sewage effluent discharges to the BCSA had been halted by the early 1990s. Some typical urban pollution sources remain, such as runoff from roads, unpermitted oil dumping to stormwater collection systems, permitted discharges, and atmospheric deposition.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

At the time that significant human settlement of the BCSA began, the system was predominately an Atlantic white cedar swamp. The BCSA was essentially a freshwater creek with fringing wetlands that fed into the Hackensack River. Beginning in the 17th century, the Atlantic white cedar forest was cut and burned extensively. Trenches that were dug to mark property boundaries and to drain land for mosquito control, agriculture, and development significantly altered the local hydrology. However, maps in the 19th century still show the BCSA area as containing a significant cedar swamp.

The largest recent change in the system resulted from the construction of the Oradell Dam in 1902. The dam substantially reduced the flow of freshwater from the upper Hackensack River watershed into the estuary. The dam construction was closely followed by the construction of the East and West Riser tide gates in the northern end of the BCSA watershed and the dredging of BCC in 1911, which created a deep straight channel directly connecting MBC and UBC with the Hackensack River, essentially bypassing LBC. Combined with the dredging of the Hackensack River in the lower portion of the estuary, the major anthropogenic changes in the early 20th century facilitated encroachment of brackish water into the estuary and caused major habitat transitions driven by increases in the salinity in both the estuary and the BCSA. Within approximately 20 years of completion of the Oradell Dam, cattails, wild rice, and other freshwater wetlands plants were replaced by the more salt-tolerant common reed (*Phragmites*).

Through the first half of the 20th century, land development within the BCSA was largely constrained to the upland perimeter along established roadways. Development and landfilling activities in the latter part of the 20th century resulted in extensive filling of wetlands in the BCSA (more than 60 percent reduction), which altered the hydrology and salinity of the system. Today, the upland watershed is more than 90% developed and comprised of a mixture of residential, commercial, industrial, and transportation uses. Along with development came chemical inputs to the system from the full range of land uses.

Sources of chemical stressors to the BCSA, including industrial discharges, landfills, and other unpermitted discharges, have all impacted water and sediment quality in the BCSA. Waste disposal practices, particularly sewage discharges to the BCSA and the Meadowlands in general, also had detrimental effects on surface water dissolved oxygen concentrations and the aquatic community throughout the 20th century. Investigations of Berry's Creek water quality occurred as early as the 1930s, to evaluate the effects of sewage discharges to the system. By the 1970s, five sewage treatment plants discharged untreated or minimally-treated sanitary and industrial wastewater directly to the BCSA. Subsequent investigations of water, sediment, and wildlife have been conducted since the 1970s, and identified polychlorinated biphenyls (PCBs), mercury, methyl mercury and other metals as contaminants of potential concern. In addition, numerous known contaminated sites, landfills, sewage treatment plants, historical and ongoing permitted and unpermitted industrial discharges, urban runoff, and suspended solids entering from the

Hackensack River have contributed to the contaminated conditions in the BCSA. There are three Superfund sites within the watershed: Scientific Chemical Processing (SCP), Universal Oil Products (UOP), and Ventron/Velsicol.

The Ventron/Velsicol Site (Site) was placed the National Priorities List (NPL) on September 1, 1983. The Site is being addressed as two Operable Units (OUs).

OU1 of the Ventron/Velsicol Site is the upland portion of the Site, and consists of the land where several companies (F.W. Berk and Company, Inc., Wood Ridge Chemical Corporation, Velsicol Chemical Corporation, and Ventron Corporation) operated a mercury processing facility from 1929 until 1974, as well as surrounding properties. NJDEP was the lead agency for the OU1 portion of the Site through the Remedial Investigation and Feasibility Study (RI/FS) and the signing of the ROD on October 30, 2006. During the remedial action for OU1, EPA assumed the lead agency role for the Site. Site preparations for construction of the OU1 remedy began in 2008, and on-site construction was completed in December 2010. The first five-year review for the OU1 remedy was issued on September 25, 2017. The BCSA is OU2 of the Site.

Enforcement History

In March 2006, EPA sent notice letters to approximately 140 potentially responsible parties (PRPs) asking them to conduct the RI/FS for the BCSA. Prior to signing an agreement requiring performance of the full RI/FS, a group of approximately 100 PRPs agreed to conduct limited RI/FS scoping activities under an order effective July 2, 2007. Subsequently, on May 1, 2008, EPA entered into an Administrative Order on Consent (AOC) with approximately 120 parties to conduct the RI/FS. The RI was implemented in a phased approach, with annual data collection from 2009 through 2015. In April 2016, the findings of the RI were presented to EPA. It was apparent that certain areas of sediment in the BCSA presented a risk to human health and the environment and act as a source of contaminants to other portions of the BCSA. At the same time, there were still uncertainties regarding the mechanisms that control risks within the marshes. Therefore, EPA determined that an adaptive, multi-phased approach would be appropriate to address contamination in the BCSA. In a letter dated June 13, 2016, EPA requested that the PRPs submit an FS focusing on the UBC and MBC waterways and UPIC marsh so that EPA could evaluate alternatives for selection of an interim source control remedy that would prevent further migration of contaminants and be a major component of a final remedy for the BCSA. A draft FS was submitted in June 2017 consistent with this approach.

3. HIGHLIGHTS OF COMMUNITY PARTICIPATION

EPA has provided an opportunity for community participation throughout the BCSA RI/FS process. Several availability sessions were held at various stages of the study. Eight fact sheets were developed over the course of the RI/FS and were distributed when people inquired about field crew activities, and when the Berry's Creek Potentially Responsible Party Group (BCSA Group) contacted property owners for access agreements for the investigations. EPA also held a public meeting, as required, to discuss the Proposed Plan and accept comment from the public. Overall, despite EPA's efforts to involve the community, interest by the public was minimal.

Recognizing the limited participation at the public availability sessions, EPA increased its efforts, and conducted a series of briefings for local towns, the county, elected officials and several major stakeholders to discuss the interim action approach prior to the release of the Proposed Plan. Individual briefings were held for the towns of Lyndhurst, Rutherford, East Rutherford, Carlstadt, Moonachie, Little Ferry, and Teterboro. Scheduling conflicts prevented a briefing for Wood-Ridge. In addition, Bergen County officials and State Assemblyman Schaer were also briefed. On the Federal level, EPA conducted telephone briefings for the staff of Senators Menendez and Booker and Congressman Pascrell. Separate meetings were also held for stakeholders, including the New Jersey Sports and Exhibition Authority (NJSEA), the Hackensack Riverkeeper and the Meadowlands Chamber of Commerce. These meetings allowed EPA to share information about the findings of the RI Report, and to describe the plan for addressing the BCSA in a phased approach. EPA was joined in these meetings by representatives of the BCSA Group, which highlighted the cooperative working relationship between the potentially responsible parties and EPA.

During the development of the RI/FS, it became apparent that one of the major environmental concerns of people living and working in the BCSA area is flooding. Much of the area is at low elevations, and a substantial portion of the area was built on fill in areas that were previously marshes. As such, the area often floods. Flooding can occur from either rainfall events that collect water because there is insufficient gradient for drainage, or from high tidal conditions that overflow the waterways. The combination of rainfall events with high tides compounds flooding problems. Concern was heightened during the past decade with sea level rise increasing the frequency of flood events, and flooding from Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy causing massive disruption and damage to the area. In June 2014, The U.S. Department of Housing and Urban Development (HUD) awarded a grant for $150 million for the Rebuild by Design – Meadowlands (RBD-M) project, which is managed by NJDEP. The grant is for the design and construction of a solution that will reduce flooding risks and enhance resiliency in the area. Interaction with the RBD-M team has been an important aspect of the BCSA work, and will continue through design and construction. It is important that the remedy not make the potential for flooding worse.

4. SCOPE AND ROLE OF OPERABLE UNIT

4.1 Phased Approach

The BCSA is being addressed in a phased approach. This ROD addresses the waterway sediments in UBC and MBC, as well as the major tributaries in those reaches. In addition, UPIC marsh is being remediated as part of this ROD. All of these actions are considered interim source control actions, and one or more future decision documents will be required to make final decisions for the BCSA as a whole as part of an adaptive management framework. The interim source control action described above is referred to as Phase 1. Actions to address OU1 (the upland portion of the Ventron/Velsicol Site), and the other NPL sites (SCP and UOP), as well as the State hazardous waste sites, have been or will be addressed as separate decisions and actions.

4.2 Adaptive Management

Given the complexity and uncertainty involved with remediating sediment sites, EPA supports the use of an adaptive management approach to addressing such sites. As discussed in the EPA guidance titled "Contaminated Sediment Remediation Guidance for Hazardous Waste Sites" (December 2005): "Project managers are encouraged to use an adaptive management approach, especially at complex sediment sites to provide additional certainty of information to support decisions. In general, this means testing of hypotheses and conclusions and reevaluating site assumptions as new information is gathered. This is an important component of updating the conceptual site model. For example, an adaptive management approach might include gathering and evaluating multiple data sets or pilot testing to determine the effectiveness of various remedial technologies at a site. The extent to which adaptation is cost-effective is, of course, a site-specific decision."

EPA's phased approach to addressing the BCSA has allowed EPA to update and adjust the conceptual site model throughout the RI/FS.

EPA expects that during implementation of the Phase 1 remedy for the BCSA, information and experience gained as a result of earlier stages of the implementation will inform later stages of the remedial action. Further, this action will inform and be integrated with subsequent remedies for the BCSA as a whole. This will allow for appropriate adjustments or modifications to enable efficient and effective remedy implementation, providing a means to address uncertainties promptly and inform final remedy decisions. Any remedy modifications will be made and documented in accordance with the CERCLA process and EPA's "A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents" (July 1999), through a memorandum to the Site file, an Explanation of Significant Differences or an Amendment to the ROD.

5. SITE CHARACTERISTICS

The BCSA has been methodically evaluated through the RI/FS investigations, which were initiated in 2009. More than 10,000 samples were collected and analyzed over a seven-year period. The results of these studies are detailed in RI and FS Reports. The major processes controlling contaminant fate and transport in the BCSA are illustrated in the conceptual site models (see Figure 3).

5.1 Physical Characteristics

Berry's Creek is a side embayment of the larger Hackensack River estuary, and the river exerts an important influence on physical, chemical, and biological conditions in the BCSA. The BCSA tidal zone is a stable setting and favors the accumulation of sediment carried into the tidal zone by tidal exchange with the Hackensack River and by water flowing from upland tributaries.

Freshwater inputs into the BCSA are relatively low, in comparison to the tidal exchange with water from the Hackensack River. Surface water velocities are low throughout the system most of the time and are governed by the routine rise and fall of the tides twice daily. Although episodic storm flows can create higher velocities in the waterways, these effects are localized (*e.g.,* in pool areas and main channels) and of short duration. In other words, most of the sediment bed is only minimally disturbed even in high flow events, as evidenced by monitoring before and after Hurricane Irene (2011), Tropical Storm Lee (2011) and Superstorm Sandy (2012). The overall condition supports a stable sediment bed where particulate material depositing from the water column accumulates over time. This stability is exemplified in the mudflats, where the accumulation of sediment occurs consistently.

The BCSA waterways are bounded by natural features, including expansive mudflats and marshes, that dissipate flow energies and encourage deposition. This means that as the tides reach the mudflats and marshes, they lose energy and can no longer carry the particulate material. Therefore, the particulate material settles out and is deposited in the mudflats and marshes. The result is an accumulation of a "soft sediment" surface layer throughout the waterways and marshes that overlies a more consolidated sediment layer. The soft sediment is dominated by fine-grained silts and clays, as well as organic materials derived primarily from detritus (decaying plant fragments) from the *Phragmites* marshes in the BCSA and the larger estuary. The overall low permeability of soft fine-grained sediments limits the movement of water within the soft sediment layer, which also limits the movement of contaminants that preferentially adhere to particles in the pore water. Mechanisms such as tidal pumping in pore water (the movement of water within the sediment from higher elevations to lower elevations as the tide recedes) are limited by the low permeability of the fine-grained soft sediment in the BCSA. In addition, movement of water and contaminants from the sediment into the overlying water column is minimal in the BCSA because the marshes and waterways are located over a large clay formation (from a glacial lake), which effectively prevents the movement of groundwater. The underlying consolidated layer was deposited during pre-industrial times, and sampling within the consolidated clay does not indicate downward movement of contamination. The consolidated layer is also not easily eroded.

The higher elevation of the marshes and the presence of dense *Phragmites* stands with root structures which typically extend more than one foot in depth provide physical stability to the BCSA landscape by stabilizing the waterway banks, dissipating energy within the system, and facilitating deposition and retention of sediment throughout the marshes. Except for some small non-contiguous sections, the physical characteristics of the waterways have been stable for decades throughout most of the BCSA. This stable condition is projected to remain into the future.

5.1.1 Upper Peach Island Creek Marsh

The movement and deposition of sediment particles with the tides is a fundamental part of the physical system in the BCSA. Among other things, it impacts contaminant movement as well as marsh elevations. Initial investigations in UPIC found high concentrations of contaminants in the water column, and subsequently in the sediment as well. An effort to track down potentially undocumented sources of contaminants was undertaken, but no such sources were identified. Further studies yielded the current understanding that contaminants entered UPIC via tidal movement from Berry's Creek. High concentrations of contaminants were deposited on the sediment surface, as was happening in nearby portions of UBC and MBC. However, a tide gate was constructed on Peach Island Creek from 1967 to 1968, essentially eliminating a major source of sediment to the creek and marsh. This meant that high concentrations of contaminants remained near the sediment surface. The lack of sediment to replenish the system resulted in surface elevation subsidence through compaction over time, as well as decay of organic material. This may have further increased sediment contaminant concentrations as well.

5.1.2 Biologically Active Zone (BAZ)

During initial studies for the RI/FS, sediment profile images were obtained and evaluated to determine the depth of the biologically active zone (BAZ) in the aquatic sediments. The BAZ is the portion of the surface sediments where most macro-organisms come into contact with the sediment (including contaminants). In UBC, the BAZ was assessed to be approximately 6 centimeters (cm) (~2.5 inches) thick and in the waterways other than UBC the BAZ was assessed to be 10 cm (~4 inches). While the BAZ in the marshes was not assessed via sediment profile images, a coring evaluation of 2 cm increments estimated that over 90% of macroinvertebrate biological activity was within the detrital layer (layer of *Phragmites* debris) and the upper two centimeters of the sediment below the detrital layer. The BAZ is also an indication of the surface sediments that would be most available for exchange of contaminants with the surface water. Deeper sediments are less available unless there are major disturbances (*e.g.,* scour events) that occur infrequently within the waterways of the system. Scouring does not occur in the marshes as the velocities are low and the *Phragmites* marsh is highly resistant to erosion. As discussed above, the BCSA is a stable environment where sediment disturbances are limited.

5.2 Contaminants in the BCSA

It was clear from early data collections in the RI/FS that the primary COCs for the BCSA were mercury, methyl mercury and PCBs. These primary COCs are responsible for most of the risk in the BCSA, so subsequent sampling activities focused on these chemicals. Chromium is also found in the BCSA, and presents an unacceptable ecological risk as well. Most, if not all, of the COCs are co-located, so actions to address the primary COCs will also address other contaminants that may be present in the BCSA, but do not present an actionable risk. Distribution of COCs in BCSA media are presented in the RI Report. The range of concentrations of COCs are found in Table 1, below.

Table 1. Median Waterway Surface Sediment Concentrations by Reach (mg/kg)

Contaminant of Concern	UPIC	UBC	MBC	BCC	LBC
Mercury	87	43	18	5.9	3.5
Methyl Mercury	0.026	0.023	0.013	0.012	0.006
Total PCBs	2.5	1.5	1.2	0.54	0.49
Chromium	570	329	244	161	161

Polychlorinated Biphenyls (PCBs) are human health and ecological COCs. They are manmade chemicals that were banned in the late 1970s. PCBs refers to a group of 209 congeners. Some of the congeners are referred to as dioxin-like PCBs, because they have chemical structures, physico-chemical properties and toxic responses similar to 2,3,7,8-TCDD. Some commercial PCB mixtures are known in the United States by an industrial trade name, Aroclor. Because they do not burn easily and are good insulating materials, PCBs were used widely as coolants and oils, and in the manufacture of paints, caulking and building material. PCBs stay in the environment for a long time and bioaccumulate in fish and crab. PCBs are classified as probable human carcinogens. Children exposed to PCBs may develop learning and behavioral problems later in life. PCBs are known to impact the immune system and may cause cancer in people who have been exposed to them over a long time. In birds and mammals, PCBs can cause adverse effects such as anemia and injuries to the liver, stomach and thyroid gland. PCBs also can cause problems with the immune system, behavioral problems and impaired reproduction.

Mercury is a human health and ecological COC. It is a metal that is released to the environment through a variety of processes, including metals processing, burning of coal, improper disposal of medical and other wastes, industrial effluent discharge, and atmospheric deposition. Mercury stays in the environment for a long time and bioaccumulates in fish and crab. Once mercury is released to the environment, it can be converted to the more toxic form, **methyl mercury.** This conversion is influenced by factors such as pH, alkalinity, and dissolved oxygen content. Toxic effects in humans include developmental and reproductive problems, and effects on the brain, nervous system and kidney. In birds and mammals, mercury can cause adverse effects in the central nervous system.

5.3 Sediment

The distribution of COCs in BCSA sediment reflects the contribution of historical sources to the BCSA tidal zone and surrounding watershed, the physical characteristics that control water flow and sediment transport within the BCSA, the interactions of the BCSA with the Hackensack River, and the chemical characteristics of the COCs, most notably their strong association with the suspended solids and particulate organic carbon (POC) derived primarily from the marshes. In other words, the COCs are most likely to be bound to the high organic particulate material (such as the detritus) and be transported along with the suspended solids in the water column. COC concentrations generally exhibit a north to south decreasing gradient, with surface sediment concentrations higher in UPIC, UBC, and MBC as compared to the lower reaches (BCC and LBC) (see Figures 4 through 9).

Deposition of the highest concentrations of mercury, PCBs and other contaminants occurred when historical industrial discharges were at a maximum (1950s and 1960s). Subsequent burial by progressively cleaner sediment over time has resulted in the highest concentrations of these COCs typically being present at depth in the vertical sediment profile. This process has resulted in considerable reduction in COC concentrations in surface sediment in both the waterways and the marshes; however, concentrations remain elevated in waterway surface sediment in UBC (including UPIC) and much of MBC. COC concentrations in the lower system (BCC, LBC) are more like the regional conditions.

Generally, once sources of contaminants affecting a waterbody have been controlled, various natural processes can occur that might allow the waterbody to begin to recover. As stated above, many historical contaminant sources to the BCSA waterways have been controlled through previous State and EPA actions. At the BCSA, contaminant concentrations at the surface of sediment (the point of potential exposure) decrease over time as cleaner sediment is deposited on the surface. The pattern of natural recovery in BCSA sediment is evident due to the higher concentrations of COCs at depth as compared to surface sediments measured in waterways and marshes throughout much of the BCSA. However, some exceptions to the pattern of natural recovery include: localized areas in the tidal zone waterways where peak flows are more variable; UPIC marsh where the highest COC concentrations occur closer to the sediment surface compared to sediment in the tidal marshes; and for methyl mercury, the concentration of which is strongly influenced by environmental conditions that impact how mercury is converted to methyl mercury.

Contamination near the sediment surface is a concern because it is within the biologically active zone and is therefore more available for uptake by biota than more deeply buried contamination. The COC concentrations in the sediments near and at the surface of the waterways are the product of a variety of mechanisms, including, among other things, ongoing deposition to the sediment bed and episodic redistribution of shallow sediment in localized areas from within the greater regional area during large storm events. COC concentrations in marsh near-surface sediment reflect movement of COCs that are bound to particles from the waterways into the marshes. Continuing deposition of COC-contaminated particles from the waterways results in slower recovery rates in the marshes than might otherwise be observed.

5.4 Surface Water

The majority of the COCs identified in the BCSA strongly adsorb to the particulate matter suspended in surface water. Suspended particulates in BCSA surface water have high organic content because of the *Phragmites* detritus from the surrounding marshes, as well as the organic material that is present in the water that enters the creek from the Hackensack River through tidal exchange. The particulates routinely settle onto, interact with, and resuspend from the surface of the waterway sediment bed because of fluctuations in tidal and storm velocities. These processes support the presence of a thin (~0.2 inch) layer of unconsolidated, high organic content material on the surface of the sediment bed in the waterways. This easily resuspended layer is commonly referred to as the "fluff layer." The presence of a fluff layer is typical in estuarine systems. Although the fluff layer contains substantially more solids particles than the water column above it, the fluff layer behaves more like the surface water than the surficial soft sediments. Interaction of the fluff layer with the surface of the waterway sediment bed is an important mechanism for COCs to be transported from waterway sediments to surface water and, in turn, for COCs to be taken up by organisms and transported elsewhere, where they can accumulate in the tissues of biota. The suspended particulate matter and associated COCs are transported into the marshes during high tides, where a portion of the particulates are deposited and retained on the marsh surface and contribute to marsh surface sediment COC concentrations.

5.5 Biological Uptake of COCs

Mercury, methyl mercury, and PCBs have been detected in biota collected in BCSA waterways and marshes, with higher concentrations in biota from UBC and MBC and lower concentrations in biota from BCC and LBC (see Table 2 and Figure 10).

The food web in the BCSA is primarily detritus-based. This means that detritus, which predominantly originates from decaying *Phragmites* leaves and stems, serves as the primary source of energy to biota within the system. As the *Phragmites* leaves and stems grow, they do not uptake significant amounts of COCs. However, as the stems and leaves die, they generally fall to the marsh surface, where they can contact contaminants as the tide brings in contaminated particles from the waterways. In time, the *Phragmites* stems and leaves become the detritus that exits the marshes with the receding tides. Once in the waterways, a portion of the detritus will settle to the sediment surface, where it becomes part of the fluff layer or is incorporated into the surface sediments. Because the detritus is composed almost entirely of organic matter, the COCs readily adsorb to it from the surface sediments.

Shrimp, fiddler crab, and other organisms feeding on detritus and other organic matter provide the dietary link between the detritus and fish and other consumers. Thus, COC concentrations in the detritus entering the food web are linked to the COC concentrations at the surface of the waterway sediment bed. In marshes, exposure to COCs is limited primarily to the detrital layer on the marsh surface, where most of the biological activity is concentrated. Marsh invertebrates and other organisms feeding on or in the detrital layer can be exposed to COCs, and COCs have been detected in invertebrates collected from the BCSA marshes. As stated earlier, particulates transported from the waterway are an important source of COCs present in marsh detritus. Overall, the COC concentrations in marsh detritus and the waterway near-surface sediment are reflected in the COC concentrations in BCSA organisms.

Bioavailability (how readily COCs can be taken up into the tissue of organisms) is controlled by many factors in the BCSA. The bioavailability of the primary COCs in the BCSA is largely controlled by partitioning to organic matter, complexation with sulfides, as well as the burial of COCs by cleaner sediment. The understanding of bioavailability is important in the BCSA because even though the concentrations in some biota present unacceptable risk, the levels are significantly lower than might be anticipated based on the high COC concentrations present in the sediments, likely due to current conditions which do not promote bioavailability.

6. CURRENT AND POTENTIAL FUTURE LAND AND RESOURCE USES

6.1 Land Use

The BCSA waterways are used for recreational activities such as fishing, crabbing, and kayaking/canoeing. These currently are low frequency activities and are not expected to increase in the foreseeable future. Fishing and crabbing activities are focused in and around waterway areas that are accessible via upland features (*e.g.,* bridges). Boating activity in BCC from the Hackensack River also has been observed, with boat traffic mostly limited to BCC near the confluence with the river. Wide ditches around the perimeter of marshes, soft sediments and dense stands of *Phragmites* are barriers to human use of the marshes. Some recreational use of the marshes may occur adjacent to waterway access points, but otherwise, recreational use of the marshes is limited.

The BCSA uplands are dominated by industrial and commercial uses, with residential developments further upland, as well as significant transportation corridors throughout the BCSA. The New Jersey Turnpike (Interstate 95) and the New Jersey Transit Bergen County railroad lines transect these marshes and Berry's Creek. Route 17, present along a majority of the northwestern side of the BCSA, provides a distinct separation between the predominantly industrial/commercial properties closer to the Berry's Creek tidal areas, and the predominantly residential properties of the communities of Hasbrouck Heights, Wood-Ridge, and Rutherford, New Jersey. A ridge parallels Route 17 and, as a result, these residential areas are at a higher elevation than the adjacent industrial/commercial areas of the BCSA. Other notable current land uses in the BCSA include:

- Teterboro Airport: Land use in the BCSA watershed north of Paterson Plank Road is dominated by Teterboro Airport, which is the oldest operating airport in New York and New Jersey and is located north of Moonachie Avenue and south of US Highway 46. A manufacturing plant operated on the property during World War I, and the United States military operated the airport during World War II. In 1949, the property was purchased by the Port Authority of New York and New Jersey, which assumed full responsibility for the airport in 2000. The area immediately surrounding Teterboro Airport is fully developed with light industrial operations, except for areas occupied by wooded wetlands and marshes. Teterboro Airport is bordered by East Riser Ditch and West Riser Ditch. Prior to 1930, these features were initially installed and pumped to drain the wetlands formerly present in this area as part of land reclamation efforts for the Borough of Teterboro. Presently these tributaries represent the primary sources of freshwater flow to the BCSA tidal zone, draining 59 percent of the BCSA uplands watershed to UBC.

- New Jersey Meadowlands: A major component of the history of the area is the New Jersey Meadowlands (the Meadowlands) also known as the Hackensack Meadowlands. The Meadowlands is comprised of approximately 13 square miles of open undeveloped land in addition to the vast areas that have been developed but were once part of the wetlands. The Meadowlands was administered by the New Jersey Meadowlands Commission (NJMC), a state agency formed to protect the balance of nature, provide for orderly development, and manage solid waste activities in the Meadowlands, until 2015 when the NJMC was merged into the New Jersey Sports and Exposition Authority.

- New Jersey Sports and Exposition Authority (NJSEA): The NJSEA is a state-authorized entity that, in addition to having assumed the NJMC's responsibilities, oversees the development and operation of numerous sports, convention, and entertainment venues. Some of these venues include Metlife Stadium, the Meadowlands Arena, and the Meadowlands Racetrack. Portions of the complex were redeveloped in 2009, including construction of a new rail crossing south of Paterson Plank Road at the north end of Walden Swamp and Ackerman's Marsh, and construction of a new stadium and shopping/entertainment complex (currently known as American Dream Meadowlands).

6.2 Future Potential Land Use

Future potential land use in the BCSA will likely be similar to current land use. Possible future anthropogenic changes in the BCSA may include, but are not limited to, development and redevelopment consistent with zoning and development regulations; regional flood control with diking, pumping, tide gates and storm tide gates; channel filling and straightening; armored crossings (*i.e.,* bridge abutments); stormwater management, including routing and concentration of flow; sewage and combined sewer management on the Hackensack River; and upstream reservoir management for flows and sediment loads. Other anthropogenic modifications in the BCSA may include periodic repairs and replacements of tide gates, in particular the UPIC tide gate in UBC, and installation of a stormwater pump station in the vicinity of East Riser Tide Gate. In addition, the Fish Creek culvert under the landfill access road in LBC may require repair or replacement in the near future.

In the upland area surrounding the tidal area of the BCSA, most of the land is zoned non-residential with residential development concentrated above the 100-year flood zone. The upland is more than 90 percent developed and land use is not likely to change substantially within a 30-year planning horizon. The most substantial pending development/redevelopment projects near but outside the BCSA are the American Dream Meadowlands project (a shopping and entertainment complex in East Rutherford) and the Kingsland Redevelopment Plan to facilitate closure and redevelopment of former landfill areas.

6.3 Groundwater Use

The BCSA overlies the glacial Lake Passaic formation. This formation is over 100 feet thick in much of the BCSA, and has a low hydraulic conductivity (~10^{-7} cm/year). The relatively thin surface aquifer (0 to 20 feet) is not a potable water source due to its high salinity, being in contact with brackish water.

Classification Exception Areas/Well Restriction Areas (CEA/WRAs) have been established for Ventron/Velsicol OU1 and for the UOP and SCP Sites, which all are within the BCSA. The CEA/WRA is an institutional control established under New Jersey law documenting an area where water quality standards cannot be met and which limits installation of groundwater extraction wells. The surface aquifer at the UOP site also has been reclassified by the NJDEP as a Class IIIB aquifer, which is not suitable for potable use due to salinity from the tidal exchange. Similarly, while other areas in the BCSA have not been reclassified, the surface aquifer is not expected to be used as a drinking water source due to high salinity.

7. SUMMARY OF SITE RISKS

A Baseline Human Health Risk Assessment (BHHRA) was conducted to estimate current and future effects of contaminants on human health. A BHHRA is an analysis of the potential adverse human health effects caused by hazardous substance exposure in the absence of any actions to control or mitigate these exposures under current and future site uses. It provides the basis for taking an action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the BHHRA for the BCSA. Tables 3 through 8 provide a summary of relevant information from the BHHRA (*i.e.*, exposure pathways and chemicals found to pose unacceptable risk to human health).

The BHHRA, entitled *Baseline Human Health Risk Assessment,* dated August 2018 is available in the Administrative Record.

7.1 SUMMARY OF THE BASELINE HUMAN HEALTH RISK ASSESSMENT

A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios, as follows.

Hazard Identification – uses the analytical data collected to identify the contaminants of potential concern (COPCs) at the BCSA for each medium, with consideration of a number of factors explained below.

Exposure Assessment – estimates the magnitude of actual and/or potential human exposures, the frequency and duration of these exposures, and the pathways (*e.g.*, ingesting contaminated soil) by which humans are potentially exposed.

Toxicity Assessment- determines the types of adverse health effects associated with chemical exposures, and the relationship between magnitude of exposure (dose) and severity of effect (response).

Risk Characterization – summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site-related risks. The risk characterization also identifies contamination with concentrations that exceed acceptable levels, defined by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as an excess lifetime cancer risk greater than 1×10^{-6} to 1×10^{-4} or a Hazard Index greater than 1.0; contaminants at these concentrations are considered contaminants of concern (COCs) and are typically those that will require remediation at the site. Also included in this section is a discussion of the uncertainties associated with these risks.

7.1.1 Hazard Identification

In this step, analytical data collected during the RI was used to identify COPCs in the soil, sediment, surface water and groundwater at the site based on factors such as toxicity, frequency of occurrence, fate and transport of the contaminants in the environment, concentrations of the contaminants as well as their mobility, and persistence. PCBs contribute the greatest human health risk and hazard and are considered a contaminant of concern (COC) identified for the BCSA. Only exposure to PCBs via fish consumption posed an unacceptable human health risk.

Fish tissue samples were collected throughout the RI/FS from 2009 to 2015. Table 3 presents the maximum concentration of PCBs in fish tissue of 3.4 mg/kg. A comprehensive list of all site COPCs can be found in the RAGS Part D Table 2 series of the August 2018 Baseline Human Health Risk Assessment report.

7.1.2 Exposure Assessment

In this step, the different exposure scenarios and pathways through which people might be exposed to the contaminants identified in the previous step were evaluated.

Consistent with Superfund policy and guidance, the BHHRA is a baseline human health risk assessment and therefore assumes no remediation or institutional controls to mitigate or remove hazardous substance releases. Cancer risks and noncancer hazard indices were calculated based on an estimate of the reasonable maximum exposure (RME) expected to occur under current and future conditions at the site. The RME is defined as the highest exposure that is reasonably expected to occur at a site.

The exposure assessment identified potential human receptors based on a review of current and reasonably foreseeable future land use at the site. The BCSA is an urban watershed located in Bergen County, New Jersey, within the New York City metropolitan area. The areas studied as part of the BCSA include tidal waterways and associated wetlands. The upland areas bordering the tidal areas are 90 percent developed. Light industrial and commercial operations, the NJSEA development, and connecting roadways dominate the land use immediately adjacent to the BCSA tidal areas. Residential development is concentrated above the 100-year flood zone, and most land adjacent to the tidal area is zoned non-residential. Groundwater is not used as a source of domestic water in the study area. Further, shallow groundwater is unlikely to be used for water supply in the future given its brackish nature or close proximity to brackish water in addition to the low yield. A confining clay layer separates the shallow groundwater from the deeper unit which is used for domestic purposes.

Several exposure scenarios for the BCSA were selected based on information gathered during the RI such as zoning and demographic information. Based on current and future land uses, the following exposure scenarios were evaluated: anglers/crabbers (young child, older child, adults), kayakers/canoers (older child/adult), local workers (adult), constructions workers (adult). The following exposure scenarios were only evaluated as future scenarios: swimmers (older child/adult) and hikers (older child/adult). Anglers (older child, adult) and the young children who consume the catch were the only sensitive subpopulations identified for this site.

Potential exposure routes for the site varied by receptors and included incidental ingestion of and dermal contact with sediment, incidental ingestion of and dermal contact with surface water, inhalation of ambient air, and ingestion of fish (white perch) and blue crabs. Table 4 presents all exposure pathways considered in the BHHRA, and the rationale for the selection or exclusion of each pathway.

7.1.3 Toxicity Assessment

In this step, the types of adverse health effects associated with contaminant exposures and the relationship between magnitude of exposure and severity of adverse health effects were determined. Potential health effects are contaminant-specific and may include the risk of developing cancer over a lifetime or other noncancer health effects, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some contaminants are capable of causing both cancer and noncancer health effects.

Under current EPA guidelines, the likelihood of carcinogenic risks and noncancer hazards due to exposure to site chemicals are considered separately. Consistent with current EPA policy, it was assumed that the toxic effects of the site-related chemicals would be additive. Thus, cancer and noncancer risks associated with exposures to individual COPCs were summed to indicate the potential risks and hazards associated with mixtures of potential carcinogens and noncarcinogens, respectively.

Toxicity data for the human health risk assessment were provided by the Integrated Risk Information System (IRIS) database, the Provisional Peer Reviewed Toxicity Database (PPRTV), or another source that is identified as an appropriate reference for toxicity values consistent with EPA's directive on toxicity values. Noncancer and cancer toxicity information can be found in ROD Tables 5 and 6, respectively. Additional toxicity information for all COPCs is presented in Appendix M, Attachment M2 of the August 2018 BHHRA.

7.1.4 Risk Characterization

This step summarized and combined outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures were evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to a carcinogen, using the cancer slope factor (SF) for oral and dermal exposures and the inhalation unit risk (IUR) for inhalation exposures. Excess lifetime cancer risk for oral and dermal exposures is calculated from the following equation, while the equation for inhalation exposures uses the IUR, rather than the SF:

Risk = LADD x SF

Where: Risk = a unitless probability (1×10^{-6}) of an individual developing cancer)
LADD = lifetime average daily dose averaged over 70 years (mg/kg-day
SF = cancer slope factor, expressed as [1/(mg/kg-day)]

The likelihood of an individual developing cancer is expressed as a probability that is usually expressed in scientific notation (such as 1×10^{-4}). For example, a 1×10^{-4} cancer risk means a "one-in-ten-thousand excess cancer risk," or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions described in the Exposure Assessment. Current Superfund guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure.

For noncancer health effects, a hazard index (HI) is calculated. The HI is determined based on a comparison of expected contaminant intakes and benchmark comparison levels of intake (reference doses, reference concentrations). Reference doses (RfDs) and reference concentrations (RfCs) are estimates of daily exposure levels for humans (including sensitive individuals) which are thought to be safe over a lifetime of exposure. The estimated intake of chemicals identified in environmental media (*e.g.*, the amount of a chemical ingested from contaminated drinking water) is compared to the RfD or the RfC to derive the hazard quotient (HQ) for the contaminant in the particular medium. The HI is obtained by adding the hazard quotients for all compounds within a particular medium that impacts a particular receptor population.

The HQ for oral and dermal exposures is calculated as below. The HQ for inhalation exposures is calculated using a similar model that incorporates the RfC, rather than the RfD.

HQ = Intake/RfD

Where: HQ = hazard quotient
Intake = estimated intake for a chemical (mg/kg-day)
RfD = reference dose (mg/kg-day)

The intake and the RfD will represent the same exposure period (*i.e.*, chronic, subchronic, or acute).

The key concept for a noncancer HI is that a "threshold level" (measured as an HI of less than 1.0) exists below which noncancer health effects are not expected to occur.

The HI is calculated by summing the HQs for all chemicals for likely exposure scenarios for a specific population. An HI greater than 1.0 indicates that the potential exists for non-carcinogenic health effects to occur as a result of site-related exposures, with the potential for health effects increasing as the HI increases. When the HI calculated for all chemicals for a specific population exceeds 1.0, separate HI values are then calculated for those chemicals which are known to act on the same target organ. These discrete HI values are then compared to the acceptable limit of 1.0 to evaluate the potential for noncancer health effects on a specific target organ. The HI provides a useful reference point for gauging the potential significance of multiple contaminant exposures within a single medium or across media.

There were no cancer risks above 1×10^{-4} identified as a result of exposure to site contamination (Table 8). Noncancer hazards are summarized in Table 7. The potential exists for noncancer hazard greater than one as a result of ingestion of white perch fillets containing PCBs. In UBC, HIs were: 2 for the adult and older child (6-<18) and 3 for the young child who consumes the catch. In MBC and BCC, HIs were 2 for the older and young child. The cancer risks and noncancer hazards for other portions of the BCSA were lower than EPA's thresholds. Therefore, the reaches of Berry's Creek with the highest surface sediment contaminant concentrations, UBC and MBC, were also found to have the greatest human health risk. Accordingly, the source control interim action will be addressing the areas of greatest risk.

7.1.4.1 Uncertainty in the Risk Assessment

The process of evaluating human health cancer risks and noncancer health hazards involves multiple steps. Inherent in each step of the process are uncertainties that ultimately affect the final risks and hazards. Important site-specific sources of uncertainty are identified for each of the steps in the four-step risk process below.

7.1.4.1.1 Uncertainties in Hazard Identification

Uncertainty is always involved in the estimation of chemical concentrations. Errors in the analytical data may stem from errors inherent in sampling and/or laboratory procedures. Additional COPC identification uncertainties include the following.

While the datasets for the BCSA are robust, since environmental samples are variable the potential exists that these datasets might not accurately represent reasonable maximum concentrations.

Fish collected at the site and used for risk evaluation are highly mobile. Some uncertainties are associated with the representativeness of the fish species used in the risk assessment.

7.1.4.1.2 Uncertainties in Exposure Assessment

There are two major areas of uncertainty associated with exposure parameter estimation. The first relates to the estimation of EPCs. The second relates to parameter values used to estimate chemical intake (*e.g.*, ingestion rate, exposure frequency). The following reflects uncertainty related to the latter.

The target size white perch, which were used in the risk assessment, were selected because of their availability. Larger size white perch were not available in sufficient numbers to sample regularly. However, because anglers prefer fish larger than the target size white perch, additional sampling was conducted of larger white perch to determine if there was a difference in COC concentrations in larger fish. An evaluation of the two datasets suggests that risks may have been underestimated using the target size white perch, at least within UBC and MBC.

7.1.4.1.3 Uncertainties in Toxicity Assessment

A potentially large source of uncertainty is inherent in the derivation of the EPA toxicity criteria (i.e., RfDs, RfCs, SFs). Additionally, the following site-specific toxicity uncertainties were identified.

Site-specific risk-based screening levels were developed and based on lowered target risk levels (10^{-6} for cancer and HQ = 0.01 for noncancer). This more conservative screening level may have resulted in more contaminants being included in the risk assessment.

PCBs can be analyzed and evaluated in the risk assessment as Aroclors or as congeners. In the BHHRA, PCBs were evaluated as Aroclors, which as discussed above in Section 5.2 are the mixtures of PCBs that were frequently used by industry and consequently sometimes released into the environment. Aroclor laboratory analysis does not quantify the concentrations of all 209 PCB congeners (different chlorinated configurations) or of those that are potentially the most toxic. As a result, while the Aroclor analysis likely accounted for most of the risk from PCBs, it may be an underestimation of risk because the total PCB concentration may be greater when analyzed as the sum of congeners, and the Aroclor analysis does not specifically quantify the risk from dioxin-like PCBs. The uncertainty regarding PCB risk would not change the area targeted for the interim remedy.

7.1.4.1.4 Uncertainties in Risk Characterization

When all of the uncertainties from each of the previous three steps are added, uncertainties are compounded. Since a number of uncertainties evaluated resulted in an underestimation of risk, the overall risk assessment likely underestimates risks and hazards as a result of exposure to the site. However, this is an interim source control remedy; risks will be reevaluated once the interim remedy is implemented and the system is monitored to assess recovery.

7.2 SUMMARY OF THE BASELINE ECOLOGICAL RISK ASSESSMENT

The baseline ecological risk assessment (BERA) evaluated the potential for adverse effects to ecological receptors from exposure to contaminants within the BCSA. The BERA was conducted in accordance with EPA's 1997 Ecological Risk Assessment Guidance for Superfund and its updates. Several ecological receptors were evaluated for both the waterways and marshes:

- Waterway receptors – wading birds (great blue heron, black-crowned night heron), shorebird (spotted sandpiper), mammal (raccoon), fish community (mummichog, white perch), and benthic community; and

- Marsh receptors – songbird (red-winged blackbird, marsh wren), mammal (muskrat), and marsh community (*Phragmites*).

For all receptors, risks were characterized by considering the findings based on each line of evidence (LOE), the distribution of risks relative to COPC concentration gradients at the BCSA site and in reference sites, and the plausible risk range given potential uncertainties in the estimates. For LOEs based on comparisons of calculated exposures to literature-based TRVs, a hazard quotient (HQ) approach was used. An HQ greater than 1 indicates that exposure is greater than the toxicological benchmark. An HQ greater than 1 calculated using a LOAEL-based TRV is typically interpreted as indicating a greater potential for risk than HQs that use a NOAEL-based TRV. For other non-HQ LOEs (*e.g*., benthic toxicity), risks were determined by examination of COPC concentration response relationships and comparison to reference sites.

The final risk conclusion for each receptor was based on the collective weight of evidence, including consideration of uncertainty. For receptors with multiple LOEs, the strength of the individual LOE to support the assessment was considered. LOEs with greater associated uncertainty and/or with a less direct link to the assessment endpoint were given less weight in the final conclusion for that receptor. LOEs that showed a clear site-specific response to COPCs and elevated risk compared to references sites were given higher weight in the final conclusions. The risk conclusions reflect the integrated best estimate of risk along with the plausible risk range considering uncertainty. See, ecological risk tables (Tables 9 -11).

For the waterway receptors, unacceptable risks were found for shorebirds (*e.g.*, sandpiper) that are exposed to COPCs by ingesting sediment in mudflats. These risks are highest in UBC and MBC. The COPCs that are the largest contributors to risk include chromium and mercury. LOAEL-based HQs greater than 1.0 were calculated for the spotted sandpiper associated with mercury in the sediments of UBC (8.1) and MBC (1.1) and chromium in sediments of UBC (2.5) and MBC (1.2). Unacceptable risks were also found for wading birds and fish in certain reaches of BCSA but were calculated to be lower than the risks associated with shorebirds. The black-crowned night heron was estimated to have NOAEL-based HQs greater than 1.0 from methyl mercury in sediments of UBC (1.4) and MBC (1.7) and total PCBs in UBC (2.1) and MBC (1.6). NOAEL-based HQs greater than 1 were also calculated for the great blue heron based on methyl mercury in UBC (1.5) and MBC (1.7) and total PCBs in UBC (4.8) and MBC (3.7). Fish were calculated to have HQs greater than 1.0 for mercury (1.6) and total PCBs (2.6) in UPIC. Potential risks to mammals and the benthic community are within the acceptable risk range.

Ecological risks are lower in the marshes than the waterways. For the marshes, the highest risk is to muskrats, which just exceeds the acceptable risk range. Potential risks to songbirds and the marsh community are not unacceptable, although some uncertainty remains.

Elevated near-surface COC concentrations in the UPIC marsh sediment (which are elevated compared to other BCSA marshes), and relatively low sediment accumulation rates in UPIC marsh contribute to the potential for exposure of ecological receptors that may come into direct contact with the marsh sediment under current conditions.

7.3 BASIS FOR ACTION

The response action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

8. REMEDIAL ACTION OBJECTIVES

The Remedial Action Objectives (RAOs) provide a general description of what the interim remedial action is intended to accomplish. Development of the RAOs considered the understanding of the contaminants in the BCSA and is based upon an evaluation of risk to human health and the environment, control of the source of those risks, and maintaining the stability of the extensive marsh habitat. The following RAOs have been developed for the Phase 1 interim remedial action:

- Control the sources of COCs by replacing the current biologically active zone[1] in the UBC, MBC, and UPIC waterway soft sediment[2], thereby reducing exposure of human and ecological receptors to COCs in the waterways.

- Control the sources of COCs by replacing the current biologically active zone in the UBC, MBC, and UPIC waterway soft sediment, thereby reducing resuspension of COCs into the water column and transport into adjacent marshes and downstream study segments (BCC and LBC).

- Control the sources of COCs to UPIC marsh water column by replacing the current biologically active zone in the UPIC marsh sediments, thereby reducing exposure and COC transport to the UBC water column.

EPA defines the source areas for the Phase 1 interim remedial action geographically as the soft sediment in waterways of UBC, MBC (above the breakpoint[3]) and UPIC, shown on Figure 5, as well as the surface sediment in the marshes in UPIC. For the waterways, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the surface area that is targeted by the remedial action. Greater percentages of success are anticipated in the main stem waterways, compared to the narrow, shallow tributaries where implementation will be more challenging. In addition, post-remediation monitoring will include, among other things, sampling of surface sediment, surface water and biota in the remediation footprint, as well as in LBC and BCC, in order to evaluate remedy effectiveness and degree of recontamination. Specifics of the monitoring programs will be determined during the remedial design.

In UPIC marsh, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the surface area that is targeted by the remedial action. Again, most of the area should easily exceed this performance measure, with more challenging implementation around the radio towers.

The percentage of targeted areas addressed will be calculated by use of a digital mapping comparison of targeted areas to the areas remediated.

9. SUMMARY OF REMEDIAL ALTERNATIVES

Section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions

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[1] A biologically active zone thickness of 10 cm was established for MBC, BCC, and LBC waterway soft sediment, and of 6 cm for UBC waterway soft sediment, based on site-specific data collected during the RI regarding the depth to which biological activity (*e.g.*, burrowing of worms and other organisms) occurs.

[2] Soft sediment is the recently deposited (last 100 years) alluvial sediment in waterways that has not undergone longer term compaction and related geochemical changes.

[3] The breakpoint is a location in Middle Berry's Creek where changes in the physical system result in a step-wise change of contaminant concentrations upstream and downstream of this point (see, Section 9.1.1 and Figure 12).

and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. CERCLA Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants and contaminants at a site. CERCLA Section 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants that at least attains applicable or relevant and appropriate requirements (ARARs) under federal and state laws, unless a waiver can be justified pursuant to CERCLA Section 121(d)(4), 42 U.S.C. § 9621(d)(4).

Interim actions must protect human health and the environment from the threats they are addressing, be cost effective, and consistent with the final remedy. The remedial alternatives evaluated in the BCSA FS Report and presented in the Proposed Plan, except for the statutorily-required no action alternatives and Alternative W2 (capping only), are all protective of human health and the environment, comply with ARARs, and are cost-effective, thus satisfying the requirements of CERCLA. As discussed below, most alternatives include the use of treatment technologies as part of dredged materials management.

The remedial alternatives evaluated for the Phase 1 interim remedial action (except for the no action alternatives) focus on source control. Five remedial alternatives were developed for the Phase 1 interim remedial action for the UBC and MBC waterways, and five remedial alternatives were developed for UPIC marsh. Brief descriptions of the remedial alternatives evaluated for the Phase 1 interim remedial action are given below. More detailed information regarding the alternatives is provided in the BCSA FS Report.

As part of the study to evaluate potential treatment technologies and remedies for the BCSA, it was concluded that the sediments could not be treated in place. Similarly, an evaluation of alternatives for excavated/dredged sediment could not identify a cost-effective treatment technology to reduce toxicity, mobility and volume when compared to off-site disposal. However, alternatives involving sediment removal would likely require the addition of a stabilizing agent to transport the material for off-site disposal. The stabilizing material would help solidify the material so that it would comply with transportation and disposal requirements. Stabilizing agents (*e.g.*, Portland cement) also typically reduce the mobility of the contaminants and, therefore, serve as a form of treatment.

9.1 WATERWAY ALTERNATIVES

9.1.1 Common Elements of Waterway Alternatives

The areal extent of active remediation in the UBC and MBC waterways with all four alternatives is the same and is shown in Figure 11. The Phase 1 area for the waterways encompasses 87.2 acres, which represents the entire UBC and MBC main waterway down to the downstream limit of Phase 1 near the breakpoint (near the East Rutherford tide gate and NJSEA outfall). The breakpoint is a location in Middle Berry's Creek where changes in the physical system result in a step-wise change of contaminant concentrations upstream and downstream of this point (see, Figure 12).

Most of the waterway tributaries to UBC and MBC area are included in the Phase 1 area. Tributaries selected for remediation are the primary tributaries (*i.e.,* directly connected to the main channel) that were shown in the BCSA RI Report to be the primary water conveyances between the main channel and the marshes (typically 20 feet or larger in width, extend more than 500 feet from the main channel, and have elevated COC concentrations relative to the marshes).

The extent of the Phase 1 remediation area is based on the extensive characterization of waterway and marsh sediment during the RI and considers the factors, below:

- BAZ sediment in the UBC and MBC waterways exhibits elevated COC concentrations compared to the BCC and LBC waterways, where BAZ COC concentrations approach reference area levels.

- BAZ sediment in the UBC and MBC waterways is the primary source of human and ecological exposure to COCs within the BCSA. This exposure occurs through direct and indirect pathways and presents human health and ecological risks that are elevated relative to elsewhere in the BCSA.

- UBC and the upper portions of MBC are more frequently and significantly influenced by upland inputs and storm flow conditions than the lower reaches.

- Based on monitoring data, it is estimated that the Hackensack River is the source of approximately 93 percent of the inorganic sediment deposited in BCC and LBC.

- The water volume in BCC and LBC is nearly completely exchanged each day via the tides, while water in MBC and UBC typically require three to six days to exchange with incoming water from the Hackensack River.

- Due to higher COC concentrations in BAZ sediment in the UBC and MBC waterways, and the potential for sediment reworking in these areas during storm flow events, waterway BAZ sediment in UBC and MBC has a greater potential than other areas to serve as a continuing source of COCs to surface water and to other areas of the BCSA.

- A statistically-significant difference was identified in the average (mean) mercury and PCB concentrations in BAZ sediment at the lower end of MBC in the area upstream of the East Rutherford tide gate and the NJSEA outfall.

Due to the factors described above, a marked change or breakpoint in the physical conditions, chemical distribution, and risk distribution occurs in the BCSA waterway at the lower end of MBC in the area just upstream of the East Rutherford tide gate and the NJSEA outfall. Based on the foregoing, the extent of the waterway area chosen for evaluation as part of this interim action includes the entirety of the main channel (*i.e*., "bank to bank") in UBC and in MBC upstream of the breakpoint location.

9.1.1.1 Dredging

For each alternative that includes dredging, remediation would start with waterway debris removal followed by dredging of soft sediment to the specified removal depths as described below. The area to be dredged would extend across the width of the waterway from marsh bank to marsh bank and would include the soft sediments in both the channel and the mudflats (to the Mean Tide Level (MTL)). The depth of dredging would be to the depth specified in the alternative plus an additional 6-inch over-dredge to ensure that the specified depth is reached, or the entire layer of soft sediment is removed, if that is less than the selected dredging depth (plus over-dredge). While the sequence for dredging the 87.2 acres would be developed during the remedial design, the work generally is anticipated to move from upstream to downstream to better manage the recontamination potential for dredged and backfilled areas. It is also anticipated that tributaries along each reach of the waterways would be dredged prior to the adjacent main channel, again to manage recontamination potential. For planning and cost estimating purposes, it was assumed that hydraulic dredging would be conducted in most areas using 8- and 12-inch suction cutterhead dredges. In limited areas, amphibious excavators would likely be used. Dewatering was assumed to use geotextile tubes or mechanical dewatering equipment. Technical challenges associated with dredging in the Phase 1 area include shallow water depth, narrow tributaries, and the substantial diurnal tide cycle (typically 5.7 to 6.0 feet between high and low tide).

Sediment removal would be conducted using conventional construction methods, likely involving some combination of hydraulic and/or mechanical dredging and excavation. Alternatives W3, W4 and W5 would require extensive infrastructure to support the removal and backfilling operations, including: contractor staging and maintenance areas and offices; utilities; sediment conveyance infrastructure such as sediment slurry pipelines and pumps, sediment transport barges, and/or roads for material supply and sediment transport trucks; hydraulic isolation infrastructure such as sheet pile barriers and/or temporary dams; dewatering systems; storm-water management and erosion control infrastructure; and backfill stockpile areas. As part of the removal operation, engineering controls such as silt curtains or bubble curtains would be utilized to reduce transport of resuspended sediment from the dredging area. These controls would be specified as part of the remedial design, but could be modified as appropriate based on field conditions

Dredged sediment would be pumped through pipes to a central sediment management area(s), dewatered, mixed with an amendment (*e.g*., Portland cement) as needed for the sediment to meet transportation and disposal requirements, and then transported for disposal at an off-site commercial disposal facility. Based on the concentrations and generally low solubility of the contamination at the BCSA, it is anticipated that most of the dredged material will be disposed of as non-hazardous waste at a Resource Conservation and Recovery Act (RCRA) Subtitle D facility. The FS was developed assuming truck transport of the sediment to the facility. During the remedial design, train and barge transport will also be evaluated.

9.1.1.2 Backfill/Capping

Backfilling/capping are common components of all the active waterway remedial alternatives. Backfilling/capping after dredging would be applied in multiple lifts (layers) throughout the 87.2-acre remediation footprint. Backfill/cap thickness for Alternatives W3, W4, and W5 would equal the depth of the soft sediment removal for each alternative. Backfill/cap thicknesses were selected based both on considerations of performance effectiveness and maintaining the hydrodynamic and sediment-transport characteristics of the waterway. In areas where all soft sediment is removed, there is no capping function for the backfill because all the contamination has been removed. Where contaminated soft sediment remains after dredging, the backfill will serve the additional function of capping and physically isolating the remaining material. The sequencing of backfill/cap placement would be determined during the remedial design. The reason for placing multiple lifts is both to limit the effects of soft sediment resuspension and residuals during the dredging process and to maintain the stability of any remaining soft sediment in the waterways. Cap material for Alternative W2, which does not include any dredging, would also be placed in lifts for the same reasons just described for the other waterway alternatives. Backfill and cap material is anticipated to be a silty sand or sand that is stable and would not erode under the hydrodynamic forces that can exist during storm events in the BCSA. Placement methods for the backfill and cap material would be determined during the remedial design.

Contaminant transport from sediments to the water column due to groundwater upwelling and tidal pumping of pore water (movement of water through the sediments, driven by recharge during high tide and subsequent discharge during ebb tide) has very limited influence at the site due to low groundwater discharge, the fine-grained character of the soft sediments, and generally low-solubility of the site COCs. For this reason, the addition of treatment amendments to the backfill/capping material is not necessary.

Cap/cover layer construction would be accomplished using specialized, but readily available, construction equipment, such as long-reach excavators, marsh buggies, shallow-draft, barge-based spreading equipment or other technologies such as conveyors or slurry-based delivery systems. A detailed plan for the sequence, means, and methods for constructing these alternatives would be developed as part of the remedial design. The construction season for the active waterway alternatives would be limited by the need to shut down most field operations during winter and the anticipated requirement for the cessation of on-water work during the annual fish passage window. The active waterway alternatives would require substantial infrastructure to support cap/cover placement operations, including: contractor staging and maintenance areas and offices; utilities; cap/cover material stockpile and conveyance infrastructure; roads for material supply and to gain access to the waterways; hydraulic isolation infrastructure such as sheet pile barriers and/or temporary dams; and storm-water management and erosion control infrastructure.

Removal areas would be backfilled with a thickness of clean material equal to the thickness of removed material. An initial lift of backfill would be placed in each removal subarea shortly after (anticipated to be within days to weeks) removal in the subarea is complete, while suspended sediments and residuals controls are still in place. The final lift (or lifts) of backfill would be placed at a later date (or dates) based on several design considerations. These considerations include the potential for recontamination of the backfill surface layer due to nearby removal operations and the maintenance of marsh bank and sediment bed stability. Backfill in addition to that just described could be specified in the remedial design and/or applied during construction to account for material losses during placement, densification of the backfill layer after placement, and/or settlement of underlying sediments due to the weight of the backfill. Backfill placement would be accomplished using the same types of specialized, but readily available, construction equipment as described above.

Along with the backfill/cap construction, disturbance to marshes and marsh banks as part of the Phase 1 remedial action would need to be mitigated. A primary objective of the mitigation would be to re-establish the pre-remedy stability and ecological function of disturbed areas (*i.e., Phragmites* marshes). It is anticipated that mitigation would involve fill placement and grading as may be necessary to re-establish marsh elevations to pre-remediation grades and revegetate disturbed areas to restore the pre-remedy marsh habitat and to be consistent with that of adjacent marsh areas that were not disturbed by the Phase 1 remedial action. Mitigation would require careful consideration of multiple factors, such as: densification and/or compression of the fill layer after placement, settlement of underlying sediments due to the weight of the fill, and surface contouring to ensure proper marsh inundation conditions are achieved during high tides. It may also be necessary to provide erosion control and/or vegetation replanting measures to disturbed marsh banks to facilitate revegetation.

9.1.1.3 Post-Remediation Monitoring and Maintenance

All active remedial alternatives for the waterways would be monitored and maintained. Monitoring of the remedial alternatives would start during construction. Requirements for monitoring during construction will be developed during the remedial design. A key goal of the monitoring program would be to evaluate whether the Phase 1 source control measures have effectively reduced/eliminated COC migration from the UBC and MBC waterways to the marshes and to downstream waterway segments. Remedy performance monitoring would be conducted post-remediation and include the Marsh Demonstration Project (see 9.1.1.5, below) areas to further evaluate thin-layer capping technologies in the BCSA tidal marshes. The scope of this monitoring would be described in a Performance Measures Monitoring Plan (PMMP) that would be developed as part of the remedial design. In addition to post-remediation monitoring, maintenance would be conducted as necessary to ensure the effectiveness of the remedy. Maintenance could include, for example, replenishment of backfill in an area should an unanticipated significant disturbance occur, or the addition of supplemental cap/cover materials if necessary based on the performance monitoring results. See Section 9.2.1.4 for further details regarding post-remediation monitoring and maintenance.

9.1.1.4 Institutional Controls (ICs)

All active remedial alternatives for the waterways would include ICs. ICs for the waterways would include continuing New Jersey fish consumption advisories. Since Phase 1 represents an interim remedial action, ICs would need to be maintained until such time that human health risks are deemed to be at or below acceptable levels. Considering the urbanized area and regional background condition associated with the Hackensack River and Newark Bay Complex, ICs are anticipated to be a long-term feature of the BCSA remedial actions.

ICs for local waterway use restrictions (*e.g.*, no wake zones, no anchoring zones) will be considered during design, and placed as necessary. Use restriction ICs would be less necessary for alternatives that provide greater separation between residual contamination and the sediment surface.

9.1.1.5 Marsh Demonstration Project

Separate from the remediation of UPIC Marsh (described below) a demonstration project will be conducted for a portion of the tidal marshes in the BCSA. The Marsh Demonstration Project will evaluate potential cleanup options for marshes that will be useful for future BCSA decision documents, and to monitor the response of the marshes to the waterway cleanup.

The Marsh Demonstration Project will build on the work conducted as part of the Treatability Study /Pilot Study (TS/PS) program that was conducted during the RI/FS. It is anticipated that the Marsh Demonstration Project will be constructed in Eight Day Swamp, located in UBC just to the north of Peach Island Creek (see Figure 16). The project is expected to involve the construction of three pilot treatment plots, each 2 to 3 acres in size, and associated control plots. For cost estimating purposes, the three treatment plots are scoped for: (i) thin-layer cover; (ii) activated carbon (AC), alone or with fine-grained delivery material such as SediMite™ or AquaGate™; and (iii) thin-layer cover coupled with an AC amendment. As part of the Phase 1 RD, a Marsh Demonstration Project Work Plan will be developed that includes detailed information related to treatment and control plot locations, sizes, and design details, construction and quality control procedures, and details of the test-plot performance monitoring plan.

Capital Cost	$5,085,000
Annual O&M Cost	$3,350,000
Present Worth Cost	$13,322,000
Construction Time	1 year

9.1.2 Waterway Alternatives

In the description of alternatives that follow, all removal and backfill/cap material volumes contain, as applicable, allowances for over-dredging and over-excavation, material loss, and volume uncertainty contingency. All reported cost estimates include direct and indirect capital costs, direct and indirect operations and maintenance (O&M) costs (including performance monitoring), and contingency. The costs are presented as present value, discounted by the 7% discount factor specified in EPA guidance.

The following sections describe five waterway alternatives, including the "No Action" alternative as required by law.

9.1.2.1 Waterway Alternative W1: No Action

The waterway Alternative W1 is statutorily required for analysis of alternatives. Pursuant to NCP requirements, the no action alternative must be carried through the entire FS process as a baseline condition against which other alternatives are compared. The no action alternative would consist of taking no specific remedial action and allowing the waterways to continue to recover naturally. This alternative would not change or add to the current fish consumption advisories already in place in the BCSA, nor would it include monitoring of the progress of natural recovery. Thus, the "no action" Alternative would not achieve the threshold criterion of protectiveness.

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Construction Time	0 years

9.1.2.2 Waterway Alternative W2: Cap/Cover Addition + Institutional Control(s)

The waterway Alternative W2 would provide source control through the placement of a 2-foot thick (sand) cap/cover layer that would contain and isolate the current source material, without the need for dredging and dredged-material management (refer to Figure 13, Alternative W2.) Cap/cover refers to the placement of a layer of sand or other material over the existing sediment bed to isolate contaminants from the post-remediation BAZ and water column. This alternative would include post-remediation performance monitoring and maintenance, and ICs.

Isolation caps/covers in waterways typically range from 1 to 3 feet thick. For the purposes of evaluation, Alternative W2 is assumed to involve the placement of a 2-foot thick cap/cover layer from marsh bank to marsh bank throughout the Phase 1 waterway footprint. With this alternative, the cap/cover material would be placed directly onto the existing sediment bed without removing any sediments. In choosing the cap/cover thickness to be evaluated, it was recognized that the thicker the layer, the more robust and durable it would be. However, the thicker the layer, the greater the amount of net waterway filling, resulting in increasing potential for adverse impacts to marsh hydrology, upland flooding potential, and marsh sediment bed stability. In addition, the thicker the layer, the greater the challenges in maintaining sediment bed stability during construction. A 2-foot thickness was selected for the cap/cover layer to balance these competing factors. Because this alternative would result in net fill to the waterways in some areas, it is not likely to comply with the New Jersey Flood Hazard Program and Federal Floodplain Management ARARs. ARAR waivers would likely be necessary to implement this alternative, and obtaining such waivers could be difficult or infeasible.

The intent with Alternative W2 would be to achieve the Phase 1 RAOs by substantially reducing: (1) short- and long-term human and ecological exposures to COCs; and (2) sediment resuspension and associated COC transport from the UBC and MBC waterways to downstream waterway segments and the tidal marshes. It would accomplish these objectives by placing a layer of cap/cover material over the existing sediment bed, thereby isolating the sediments from the water column. A new BAZ layer would develop at the surface of the cap/cover layer over time, with a portion of the new BAZ being in the cap/cover material and another portion being in newly-deposited sediments that accumulates on top of the cap/cover layer. With an anticipated post-remediation BAZ thickness of 10 cm (about 4 inches), the new BAZ would comprise no more than 17 percent of the thickness of the cap/cover layer, thus providing at least 83 percent of the cap/cover thickness (at least 20 inches) as a separation zone between the new BAZ and the underlying contaminated sediments.

Capital Cost	$90,902,000
Annual O&M Cost	$5,433,000
Present Worth Cost	$100,544,000
Construction Time	3.3 years

9.1.2.3 Waterway Alternative W3: 1-foot Sediment Removal + Backfill + ICs

The waterway Alternative W3 would be comprised of sediment removal and management, backfill placement, post-remediation performance monitoring and maintenance, and ICs. The goal of this alternative would be to provide source control and achieve RAOs by removing sediments to a depth of 1 foot, or to firmer consolidated sediments (whichever is encountered first), followed by placing a thickness of backfill equal to the removal depth. The waterway Alternative W3 would provide source control through the removal of sediments to a depth of 1 foot plus an over-dredge depth of approximately 6 inches (refer to Figure 13, Alternative W3). This removal would include the current source material, plus an additional volume of contaminated sediments that lies beneath the current source material. A 1-foot thick (plus over-dredge) backfill layer would separate the new post-remediation BAZ from underlying sediments. Given its thickness, it would likely remain stable during major storm events.

This source control remedial action is designed to achieve the waterway RAOs by substantially reducing both human and ecological short-term and long-term exposure to COCs, while simultaneously reducing sediment resuspension and transport from the UBC and MBC waterways to downstream waterway segments and the marshes. The anticipated post-remediation BAZ would comprise 33 percent or less of the thickness of the backfill layer, which means that at least 66 percent of the thickness (at least 8 inches) would act as a separation zone between the new BAZ and any underlying contaminated sediments. Given the continuing deposition of sediments derived from both the Hackensack River and BCSA upland areas in the waterways following the Phase 1 interim remedial action, this separation zone would tend to increase over time, and the COC concentrations in the new BAZ would trend toward regional background levels.

Capital Cost	$199,951,000
Annual O&M Cost	$5,150,000
Present Worth Cost	$205,598,000
Construction Time	2.8 years

9.1.2.4 Waterway Alternative W4: 2-foot Sediment Removal + Backfill + ICs

The waterway Alternative W4 would provide source control through the removal of soft sediments to a depth of 2 feet plus an over-dredge depth (refer to Figure 13, Alternative W4). This removal would include the current source material plus a substantial additional volume of contaminated sediments that lies beneath the current source material. A 2-foot thick (plus over-dredge) backfill layer would separate the new, post-remediation BAZ and underlying sediments. This layer would result in a greater separation distance (compared to Alternative W3) while at the same time achieving a greater level of backfill stability and robustness compared to Alternative W3. This alternative would involve a deeper removal depth and a greater thickness of backfill, but follow the same general procedure as Alternative W3. With this alternative, contaminated sediments would be removed to a depth of 2 feet, or to firmer, consolidated sediments, whichever is encountered first.

Alternative W4 would have all the same attributes as described for Alternative W3, but the thickness of backfill placed over the remaining sediments would be doubled. The additional 1 foot of removal depth and backfill thickness with this alternative was chosen to produce a significant increment in the remedial action (*i.e.*, a significant increment in both removal depth and backfill thickness) as compared to the previous alternative.

Processes for sediment removal and backfilling, sediment treatment and management, and restoration of marsh disturbances under this alternative would all be essentially the same as that described in the common elements, above.

Capital Cost	$269,140,000
Annual O&M Cost	$5,193,000
Present Worth Cost	$261,242,000
Construction Time	3.5 years

9.1.2.5 Waterway Alternative W5: Removal of All Soft Sediment + Backfill + ICs

The waterway Alternative W5 would provide source control through the removal of all soft sediments (refer to Figure 13, Alternative W5). This alternative would include the current source material plus the large volume of additional contaminated sediments that lies beneath the current source. It would provide a backfill volume roughly equal to the sediment removal volume to maintain the hydrodynamic-transport and sediment-transport characteristics of the waterway. This alternative would provide a source-removal remedial action similar to both Alternative W3 and W4, except that Alternative W5 would involve a deeper removal depth and a greater thickness of backfill in areas of the Phase 1 waterways with more than 2 feet of sediments. All soft sediments would be removed, except for sediment residuals that remain after the completion of dredging operations. As with Alternatives W3 and W4, this alternative would include sediment removal and management, backfill placement, post-remediation performance monitoring and maintenance, and ICs.

The intent of Alternative W5 would be to achieve RAOs by removing all soft sediments and placing the same thickness of backfill as the removed material. The Alternative W5 removal would extend from marsh bank to marsh bank throughout the UBC and MBC main channel and tributaries to the same spatial limits as Alternatives W3 and W4.

Alternative W5 would have many of the same attributes as Alternatives W3 and W4. As with the previous removal alternatives, Alternative W5 would remove the current source material; however, Alternative W5 differs from other alternatives because it would also remove a large volume of contaminated sediments that lie buried below the current source and are not prone to erosion or resuspension. The thickness of this buried sediment varies locally, but, on average, increases in a north to south direction from the upper reach of UBC to the lower reach of MBC. Sediment erosion potential in the MBC main channel is lower than in the UBC main channel, even under rare, very large storm events such as Hurricanes Irene and Sandy. Thus, the majority of sediments that would be removed from the MBC main channel with Alternative W5 are presently buried below the current source zone and are not at risk of erosion or resuspension.

Replacement of the removed sediments with a roughly equal thickness of backfill (nearly 15 feet at the deepest RI probing location) is considered necessary to maintain the hydrodynamic and sediment transport characteristics of the waterway and to assure the long-term geotechnical stability of the marsh banks. Backfill quantities could be optimized during the remedial design if it were found that design criteria could be achieved with lesser thicknesses of material.

Capital Cost	$428,809,000
Annual O&M Cost	$5,389,000
Present Worth Cost	$393,113,000
Construction Time	4.9 years

9.2 UPPER PEACH ISLAND CREEK MARSH ALTERNATIVES

9.2.1 Common Elements of Marsh Alternatives

Except for the no action alternative, all the UPIC marsh remedial alternatives include the common source control components of sediment excavation and/or containment and address the same 28.2-acre area.

9.2.1.1 Marsh Excavation

Alternatives UPIC3, UPIC3-A, and UPIC4 all involve excavation of marsh sediments in all or a majority of the marsh to depths well below the depth at which there is a potential for human and ecological exposures, which is the marsh surface detritus layer and the top 1 to 2 inches of sediment. The excavation depth would also be significantly greater than the depth interval at which the highest COC concentrations occur. The depth of excavation would be to the depth specified in the alternative, plus an additional 6-inch over-excavation to ensure that the specified depth is reached. The horizontal extent of the excavation alternatives (UPIC3, UPIC3-A, and UPIC4) will require adjustment around the radio towers, where infrastructure limitations will influence the remedial action; adjustment will be made as part of the remedial design process.

Because the UPIC marsh is non-tidal (as it is located above a tide gate), it is anticipated that sediment excavation would be completed using conventional or light ground pressure equipment. Dewatering of the marsh during construction would likely be required in areas with standing water and following significant precipitation events. Excavated sediment would be dewatered and treated with an amendment (*e.g.*, Portland cement) so that it satisfies transportation and disposal requirements. The FS was developed assuming truck transport of the treated sediment. During the remedial design, train and barge transport will also be evaluated.

9.2.1.2 Backfilling

Backfilling for Alternatives UPIC3, UPIC3-A, and UPIC4 would be conducted throughout the excavation area. Backfill would be placed in phases as excavation activities in discrete areas of the marsh are progressively completed. Backfill thicknesses would be sufficient to maintain the current marsh elevation and hydrology. Backfill material would include a sand or silty-sand organic mix designed to promote re-establishment of the marsh at the completion of the remedial action and protect mitigated areas from upland storm water flows that enter the UPIC area at some locations.

EPA concluded that the inclusion of a treatment amendment with the backfill material would be unnecessary due to the characteristics of this non-tidal marsh, including its high level of physical stability, low recontamination potential due to lack of sediment transport from tidal areas (due to the tide gate in PIC), lack of contaminant transport potential due to groundwater upwelling or tidal pumping, high organic content of the marsh sediments coupled with the generally low solubility of the site COCs, and demonstrated absence of any significant COC translocation through the marsh biomass.

The UPIC marsh habitat would be disturbed in areas of thin-layer placement with Alternatives UPIC2 and UPIC3-A and would need to be re-established. The habitat would be destroyed in areas of excavation and backfilling with Alternatives UPIC3, UPIC3-A, and UPIC4 and this disturbance would likewise need to be mitigated. For all the alternatives, a marsh mitigation plan would be developed as part of the remedial design. For the FS cost estimates, it was assumed that for both marsh excavation and backfilling, or thin-layer cover, the entire marsh would be re-established in-kind consistent with existing vegetation (*Phragmites*).

9.2.1.3 Thin-Layer Cover

Thin-layer cover would be installed with Alternatives UPIC2 and UPIC3-A. This technology would involve placement of sand or finer-grained soil material in a thin layer over the surface of the marsh. The objective would be to maintain long term stability of the underlying contaminated sediment and eliminate the ecological exposure pathways that pose an unacceptable risk. A cover layer thickness of 6 inches has been chosen to provide a substantial layer of fill to establish a clean post-remediation surface and to isolate underlying marsh sediment. Pilot studies conducted at multiple locations in the BCSA as part of the RI/FS demonstrated the implementability and stability of thin-layer test plots in BCSA marshes. The plots have remained stable since their construction in 2012 and 2013 through several large storm events, including Hurricane Sandy in 2012.

Similar to the backfill material that would be placed in excavated areas of UPIC marsh, inclusion of a treatment amendment with the thin-layer cover material was judged to be unnecessary.

9.2.1.4 Post-Remediation Monitoring and Maintenance

As with the waterway remedial alternatives, all active remedial alternatives for UPIC marsh would be monitored and maintained. Monitoring of the remedial alternatives would start during construction. Remedy performance monitoring would be conducted post-remediation with all the active remedial alternatives. As described in Section 9.1.1.3, the scope of such monitoring would be described in the PMMP which will be developed during the remedial design. The PMMP will be based on a multiple-lines-of-evidence approach informed by the BCSA CSM.

Monitoring of the performance of the Phase 1 interim remedial action is expected to include a mix of physical, chemical, and biological measures. Potential physical monitoring measures include bathymetry, surveying, sediment morphology, and newly-deposited sediment thickness. Chemical measures may include COC concentrations in newly-deposited surface sediment and/or BAZ sediment, and for the waterways, COC concentrations in surface water and/or on suspended particulates. Biological measures may include biota tissue, marsh vegetation, and marsh function and values.

Maintenance could include, for example, backfill replenishment in an area should unanticipated significant disturbance occur and/or replanting of marsh vegetation. ICs for all the active marsh remedial alternatives may include property use and access restrictions. Because Alternative UPIC4 would involve the removal of essentially all sediment with elevated COC concentrations, property use and access restrictions are not considered necessary.

9.2.1.5 Institutional Controls

Since Phase 1 is an interim remedial action, ICs would need to be maintained until such time that human health risks are deemed to be at or below acceptable levels. Considering the urbanized area and regional background condition associated with the Hackensack River and Newark Bay Complex, ICs such as the New Jersey fish consumption advisories are anticipated to be a long-term feature of the BCSA remedial actions. ICs to be considered for the UPIC marsh could include property use restrictions and property access restrictions.

9.2 Marsh Alternatives

The following subsections describe five marsh alternatives, including the "no action" alternative.

9.2.1 Marsh Alternative UPIC1: No Action

The marsh Alternative UPIC1 is statutorily required for analysis of alternatives. The no action alternative was carried through the entire FS process as a baseline condition against which other UPIC marsh remedial alternatives are compared. The no action alternative would consist of taking no specific remedial action and allowing the UPIC marsh to continue to recover naturally. This alternative would not include ICs, nor would it include monitoring of the progress of natural recovery.

Capital Cost	$0
Annual O&M Cost	$0
Present Worth Cost	$0
Construction Time	0 years

9.2.2 Marsh Alternative UPIC2: Thin-Layer Cover + ICs

The marsh Alternative UPIC2 would provide a substantial reduction in the potential for exposure of ecological receptors to elevated COC concentrations in shallow marsh sediments through the containment and isolation provided by a 6-inch thin-layer cover (refer to Figure 14, Alternative UPIC2). Alternative UPIC2 would involve placement of sand or finer-grained soil material in a thin layer over the surface of the marsh. The objective would be to eliminate the ecological exposure pathways that pose an unacceptable risk. Thin-layer covers typically have thicknesses in the range of 2 to 6 inches. For this alternative, a cover layer thickness of 6 inches has been chosen to provide a substantial layer of fill to establish a clean post-remediation surface and to isolate underlying marsh sediments, and in recognition of the goal of achieving long-term effectiveness and permanence.

The intent of Alternative UPIC2 would be to achieve an immediate reduction in COC concentrations at the marsh surface sediments where ecological exposure potential is greatest. Given that UPIC is non-tidal and is associated with a small uplands watershed, it is a low-energy setting, and there is little to no potential to mobilize marsh sediments. Within this setting, a thin layer cover, once revegetated, could achieve long-term stability and provide long-term reduction in COC concentrations at the surface of the marsh. In doing so, the UPIC marsh RAO would be achieved.

This alternative would result in an increase, albeit small, in UPIC marsh surface elevations. Note though, surface elevations in the marsh (approximate average elevation of 0.7 feet MSL) are, on average, 2 feet lower than in the BCSA tidal marshes. This condition is due to very low sedimentation rates in the marsh since installation of the PIC tide gate in 1967 to 1968 as well as the consolidation of marsh sediments due to the degradation of organic matter in the sediments resulting from the reduced frequency of marsh inundation created by the tide gate. The thin-layer cover could be used to bring the elevation of the UPIC marsh closer to that of the tidal zone marshes, without impacting to a significant degree the functioning of the marsh. The evaluation of potential impacts associated with an increased marsh surface elevation would also need to consider hydrologic factors related to stormwater storage capacity. Since the area is above a tide gate, it is not generally influenced by the tides, but the area does provide some storage of draining upland stormwater, especially during high tides when discharge to the BCSA tidal zone is inhibited by the tide level.

Pilot studies conducted in two marshes along Berry's Creek, Walden Swamp and Nevertouch Marsh, have demonstrated the implementability and stability of thin-layer test plots in the BCSA marshes. Construction of the test plots showed that truck-mounted conveyors (*e.g.*, Telebelt®) and slurry pipelines are effective methods in delivering clean fill. Other methods for delivering fill to the UPIC marsh would be investigated as part of the remedial design. The test plots remained stable through several large storm events, including Hurricane Sandy in 2012.

The UPIC marsh would be disturbed during thin-layer placement and the disturbance would need to be mitigated. The mitigation plan would require careful consideration of many of the same factors described for mitigating the tidal zone marshes that could be disturbed by the Phase 1 waterway remedy. Because UPIC is above a tide gate, it is a non-tidal, freshwater marsh, and is less frequently inundated than the BCSA tidal marshes. It is only subject to deep freshwater inundation during episodic, large storm events. These conditions place significant limits on the types of vegetation and habitat that could be sustained through the mitigation. Further, the revegetated marsh would also need to temporarily endure brackish conditions that could result from the potential future malfunction or overtopping of the tide gate. All these factors would need to be considered in mitigation planning. The construction season for this alternative, as well as with UPIC marsh Alternatives UPIC3 and UPIC4, would be limited by the need to shut down most field operations during winter.

This alternative would include a post-remediation performance monitoring program to assess remedy performance and achievement of the UPIC marsh RAO. The alternative would also include post-remediation maintenance as necessary to re-establish the marsh habitat and address any substantial disturbances of the thin-layer cover that resulted in potentially unacceptable exposure pathways.

Capital Cost	$17,945,000
Annual O&M Cost	$1,628,000
Present Worth Cost	$24,621,000
Construction Time	1 year

9.2.3 Marsh Alternative UPIC3: 1-foot Sediment Removal + Backfill + ICs

Marsh Alternative UPIC3 would provide source control through the removal of marsh sediments to a depth of 1 foot (plus an over-excavation thickness), including sediments with the most-elevated COC concentrations (refer to Figure 14 Alternative UPIC3). Backfill would be placed to maintain marsh surface elevations, isolate underlying sediments, and re-establish the existing *Phragmites* marsh habitat. This alternative would involve excavation of contaminated sediments in UPIC marsh to the bottom of the dense, fibrous portion of the *Phragmites* root mat. Based on a review of UPIC marsh sediment high resolution core logs, this bottom occurs at a depth below ground surface at about 1 foot. While the highest concentrations of mercury and PCBs were measured in the uppermost 3 to 5 inches of the UPIC marsh high resolution cores, a 1-foot removal depth was chosen over a shallower removal depth due to the improved implementability of a remedy involving excavation to the bottom of the dense, fibrous portion of the root mat compared to a shallower excavation that stops within that portion of the root mat. Excavation to a 1-foot depth would be adequate to remove most of the mercury COC mass in UPIC marsh sediments. Backfilling would provide a substantial physical barrier to potential human and ecological exposure to contaminated sediments that would remain below the 1-foot removal depth.

With this alternative, additional excavation of the marsh (more than a 1-foot depth) would be expected along the banks where the marsh adjoins the waterway. The additional excavation would be used to create an engineered transition between waterway excavation and backfill grades and adjacent marsh excavation and backfill grades, and to assure that the remediated marsh banks would be stable. This engineered transition would be developed as part of the remedial design. The volume uncertainty contingency was selected considering this additional excavation volume.

Means and methods for a marsh removal would be determined as part of the remedial design. Because the UPIC marsh is located above a tide gate, it is anticipated that sediment excavation could be completed using conventional or light ground pressure equipment. Dewatering using conventional methods would likely be required in areas with standing water and following significant precipitation events. The remedial design would also determine areas for contractor access and staging and whether ex situ sediment solidification (*e.g.*, cement addition) would be necessary for the sediments to pass the paint filter test prior to landfill disposal. Special construction procedures or construction setbacks could be required in the radio tower area to assure that construction operations do not impact the tower foundations and associated infrastructure.

This alternative would require the removal of the *Phragmites* plants throughout the 28.2-acre remediation area, followed by the removal of the co-mingled sediments and root mass. As part of the remedial design, an evaluation regarding the potential for the root mat in the sediments to create challenges (*i.e.*, dewatering, solidification, and/or disposal) that would affect implementability and cost would be undertaken.

Engineering controls would be used for construction-stage stormwater run-on control (to prevent stormwater from entering excavation areas), run-off control (to prevent stormwater containing entrained sediments and COCs from leaving the excavation area), and erosion and sediment control. Stormwater run-off from excavation areas would be collected and treated as necessary prior to discharge. Sequential excavation and backfilling procedures would be used to limit the size of the exposed sediment surface. The settlement of the marsh under the incremental weight of the backfill layer is expected to be small. Additional backfill that could be necessary to account for such settlement to maintain the marsh surface elevation is within the range of backfill volume uncertainty included in the cost estimate. The remedial design would also establish whether any additional features would be needed to assure satisfactory remedy performance, such as a geotextile separation layer between the excavated sediment surface and backfill, or erosion protection along the banks to prevent erosion during the timeframe needed to re-establish the marsh habitat.

Given the non-tidal nature of the UPIC marsh and the hydraulic control that could be provided by the tide gate, remediation of the marsh could be accomplished with a high degree of control of sediment residuals.

Because this alternative involves complete removal of the existing marsh vegetation and most of the root mat, a detailed marsh mitigation plan would need to be developed as part of the remedial design. Mitigation would need to consider many of the same factors and would be subject to the same limitations described for Alternative UPIC2. However, the marsh would need to be completely re-planted with this alternative, whereas re-plantings would only be necessary with Alternative UPIC2 if the *Phragmites* plants did not grow back after placement of the thin layer cover.

The performance monitoring program would be used to assess remedy performance and achievement of the RAOs for UPIC marsh. Maintenance would be conducted as needed to maintain marsh surface elevations and to re-establish the marsh habitat.

Capital Cost	$57,213,000
Annual O&M Cost	$1,798,000
Present Worth Cost	$62,231,000
Construction Time	1.4 years

9.2.4 Marsh Alternative UPIC3-A: Hybrid Sediment Removal + Backfill + Thin-Layer Cover + ICs

Marsh Alternative UPIC3-A is very similar to Marsh Alternative UPIC3. UPIC3-A would remove most of the UPIC marsh sediments to a depth of 1 foot. In areas within ten feet of the waterways, the marsh banks would be excavated to a depth of 2 feet. The increased excavation from the engineered transition described in UPIC3 would help ensure that the transition zone between the marsh and waterways (an area frequently utilized by burrowing animals), would be clean. In the area of the radio towers, which has been reported to have substantial buried infrastructure in support of the radio towers, a thin-layer cover would be applied. UPIC3-A will include an over-excavation thickness of 6 inches (refer to Figure 14, Alternatives UPIC 2, UPIC3 and UPIC4). Backfill would be placed to maintain marsh surface elevations, isolate underlying legacy sediments, and re-establish the existing *Phragmites* marsh habitat. This alternative would involve excavation of contaminated sediments in UPIC marsh to the bottom of the dense, fibrous portion of the *Phragmites* root mat. Based on a review of UPIC marsh sediment high resolution core logs, this bottom occurs at a depth below ground surface at about 1 foot. While the highest concentrations of mercury and PCBs were measured in the uppermost 3 to 5 inches of the UPIC marsh high resolution cores, a 1-foot removal depth was chosen over a shallower removal depth due to the improved implementability of a remedy involving excavation to the bottom of the dense, fibrous portion of the root mat compared to a shallower excavation that stops within that portion of the root mat. Excavation to a 1-foot depth would be adequate to remove most of the COC mass in UPIC marsh sediments. Backfilling would provide a substantial physical barrier to potential human and ecological exposure to contaminated sediments that would remain below the 1-foot removal depth. Treatment amendments were not included in the backfill of the Phase 1 marsh removal and backfill alternatives. UPIC3-A would address contamination in an area of approximately 3.8 acres around the radio towers by the placement of a thin-layer cover in that area. The thin-layer cover, as discussed in the description of UPIC2 above, will provide a substantial reduction in the potential for exposure of ecological receptors to elevated COC concentrations in shallow marsh sediments through the containment and isolation provided by the 6-inch thin-layer cover (refer to Figure 14, Alternative UPIC2). The anticipated areas that will be excavated and those that will be covered are shown on Figure 15, but final delineation will occur during remedial design.

Post-remediation performance monitoring and maintenance and ICs would be included as part of this remedial alternative. The performance monitoring program would be used to assess remedy performance and achievement of the RAO for UPIC marsh. Maintenance would be conducted as needed to maintain marsh surface elevations and to re-establish the marsh habitat.

Capital Cost	$53,219,000
Annual O&M Cost	$1,757,000
Present Worth Cost	$58,212,000
Construction Time	1.1 years

9.2.5 Marsh Alternative UPIC4: 2-foot Sediment Removal + Backfill

Marsh Alternative UPIC4 would provide source control through the removal of marsh sediments to a depth of 2 feet (plus an over-excavation thickness), including essentially all contaminated marsh sediments (refer to Figure 14, Alternative UPIC4). Backfill would be placed to maintain the marsh surface elevations and re-establish the existing *Phragmites* marsh habitat. The alternative would involve sediment excavation in the UPIC marsh down to the bottom of soft sediments.

A 2-foot excavation depth would be much deeper than the depth of the highest concentrations of primary COCs based on data from high resolution cores collected in UPIC marsh. At a depth of 2 feet, COC concentrations are very low to non-detect. In addition, the core logs show increasing sediment dry density and decreasing sediment organic content at a depth of 20 to 24 inches. This physical change is interpreted to represent the transition to older, firmer, pre-industrial sediment, which supports the selection of a 2-foot removal depth for this alternative.

The intent of this alternative would be to achieve the UPIC marsh RAO by removing essentially all of the soft sediment and replacing it with clean backfill. The backfill would be placed to cover any sediment residuals, re-establish pre-remedy marsh elevations, and support marsh mitigation.

Capital Cost	$81,609,000
Annual O&M Cost	$1,755,000
Present Worth Cost	$85,664,000
Construction Time	1.9 years

10. COMPARATIVE ANALYSIS OF REMEDIAL ALTERNATIVES

In selecting a remedy for a site, EPA considers the factors set forth in Section 121 of CERCLA 42 U.S.C. § 9621, and conducts a detailed analysis of the viable remedial alternatives pursuant to Section 300.430(e)(9) of the NCP, 40 C.F.R § 300.430(e)(9), EPA's Guidance for Conducting Remedial Investigations and Feasibility Studies, OSWER Directive 9355.3-01, and EPA's A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents, OSWER 9200.1-23.P. The detailed analysis consists of an assessment of the individual alternatives against each of the nine evaluation criteria at 40 C.F.R. § 300.430(e)(9)(iii) and a comparative analysis focusing upon the relative performance of each alternative against those criteria.

The waterway and marsh Phase 1 interim source control alternatives were evaluated using these nine criteria.

Threshold Criteria – The first two criteria are known as "threshold criteria" because they are the minimum requirements that each response measure must meet in order to be eligible for selection as a remedy.

- **Overall protection of human health and the environment:** addresses whether or not an alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls.
- **Compliance with Applicable or Relevant and Appropriate Requirements (ARARs):** addresses whether or not an alternative will meet all of the applicable or relevant and appropriate requirements of other federal and state environmental statutes and requirements or provide grounds for invoking a waiver.

Primary Balancing Criteria – The next five criteria are known as "primary balancing criteria." These criteria are factors by which tradeoffs between response measures are assessed so that the best options will be chosen, given site-specific data and conditions.

- **Long-term effectiveness and permanence:** considers the ability of an alternative to maintain reliable protection of human health and the environment over time.
- **Reduction of toxicity, mobility, or volume through treatment:** evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.
- **Short-term effectiveness:** addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and implementation.
- **Implementability:** the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.
- **Cost:** includes the estimated capital and operation and maintenance costs, and net present worth costs.

Modifying Criteria – The final two evaluation criteria are called "modifying criteria" because new information or comments from the state or the community on the Proposed Plan may modify the preferred response measure or cause another response measure to be considered.

- **State acceptance:** State agency acceptance considers whether the State agrees with EPA's analyses and recommendations.
- **Community acceptance**: considers whether the local community agrees with EPA's analyses and preferred alternative. Comments on the Proposed Plan received during the public comment period are an important indicator of community acceptance.

The results of the comparative analyses follow. In the evaluation of balancing criteria, EPA has assigned each alternative a relative rating between low and high based on the analysis results. A low rating shows that the alternative has a low level of achievement of some or all the factors considered for the criterion compared to other alternatives, while a high rating indicates a high relative level of achievement. Intermediate levels of achievement are rated as low to moderate, moderate, and moderate to high.

10.1 Comparative Analysis of Waterway Alternatives

10.1.1 Waterway Threshold Criterion

Protection of Human Health and the Environment: Alternative W1 (No Action) would not be protective of human health and the environment because it would not reduce the potential exposure of human and ecological receptors to COCs in BAZ sediment in the UBC and MBC waterways within a reasonable timeframe. In addition, Alternative W1 would not reduce particulate-bound COC resuspension into the water column. As it would not meet this threshold criterion, Alternative W1 was not evaluated against the NCP balancing criteria. Alternatives W2 to W5 would all satisfy this NCP threshold criterion. UBC and MBC are the areas of the BCSA that have been identified to date as posing the greatest risk. Alternative W2 would be protective of human health and the environment through installation of a 2-foot thick cap layer over the existing waterway sediment sources in the Phase 1 remediation area. Alternatives W3 and W4 would achieve this threshold criterion by removing a 1-foot (Alternative W3) or 2-foot (Alternative W4) thickness of sediments (including the sediments that comprise the current source of COCs in the Phase 1 waterways) and by placing a backfill/cap layer designed to prevent the remaining underlying contaminated sediments from being re-exposed and, therefore, becoming potential sources of COCs to the post-remediation BAZ or water column. Alternative W5 would achieve the threshold criterion by removing all soft sediments except for residuals and replacing them with backfill.

Compliance with ARARs: Alternative W1 would not comply with certain ARARs (such as surface water quality criteria) since the criteria are exceeded presently, and no action would be undertaken. Location-specific and action-specific ARARs associated with the Phase 1 interim remedial action would not apply to Alternative W1.

Alternatives W3 to W5 could be implemented to meet the location-specific and action-specific ARARs that apply to the Phase 1 such as the requirements of the Clean Water Act that apply to dredging, 33 U.S.C. §404(b)(1) and 40 CFR Part 230, which require that disturbance to aquatic habitat be minimized to the extent possible, and the RCRA requirements that would apply to management of dredged materials and thus satisfy this NCP threshold criterion for the sediments. Because it adds a 2-foot layer of net fill to the waterways, Alternative W2 would likely not meet the substantive standards of the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. For Alternative W2 to be selected by EPA, ARAR waivers would likely be needed (assuming a basis could be established), along with design measures to address an increased potential for upland flooding and other impacts associated with the net waterway fill. To summarize: ARARs do not apply to W1, since no action would be taken, W2 could be selected only if a basis could be established for ARAR waivers, and alternatives W3, W4 and W5 would comply with ARARs.

A complete list of ARARs can be found in Tables 12 and 13.

10.1.2 Waterway Balancing Criteria

Long-Term Effectiveness and Permanence*:* Alternative W2 is given a low to moderate rating based on the impacts of the placement of 2 feet of cap in the UBC/MBC waterways. This net fill would likely lead to adverse impacts on waterway hydrodynamics, sediment erosion and scour potential, upland flooding potential, and marsh stability and habitat quality. Unlike Alternative W2, because they incorporate sediment removal prior to placement of backfill/cap material, Alternatives W3 to W5 would not adversely change the waterway bathymetry or hydrodynamics, which have shown a high level of resiliency, observed through tropical storms and two hurricanes during the remedial investigation.

Alternatives W3 to W5 would remove sediment that serves as the current source for potential human and ecological exposures and COC transport. For these alternatives, remedy effectiveness would be enhanced by placing the backfill/cap material in several lifts to minimize residuals. Alternative W3 would include a 1-foot sediment removal depth and backfill/cap thickness, adequate to isolate the new, post-remediation BAZ from remaining contaminated soft sediment below the backfill/cap, effectively mitigating exposure to and transport of the COCs. Alternative W3 is given a moderate rating. While the backfill/cap layer for W3 would be robust, the potential need for future backfill/cap maintenance with this alternative would be higher than with Alternatives W4 and W5. The sediment removal and backfill/cap thicknesses for Alternatives W4 and W5 would both be more than adequate and would have high long-term effectiveness. Alternative W4 is given the same high rating as Alternative W5 because it achieves the Phase 1 RAOs in a robust manner and there is no further reduction in human or ecological exposure risk with Alternative W5 compared to Alternative W4, because the additional sediments that would be removed do not represent an active source of COCs to the BAZ or water column under current conditions. To summarize: W2 is rated low to moderate, W3 moderate, and W4 and W5 are rated high for long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment: Alternatives W3, W4 and W5 would include *ex situ* sediment dewatering followed by the addition of a treatment amendment, as needed to allow the sediment to meet transportation and disposal requirements. The same moderate relative rating was given to all alternatives involving sediment dredging (*i.e.*, Alternatives W3 to W5), as the same treatment process would be applied to all dredged sediment under each of these alternatives. This rating was selected recognizing that all dredged sediment would be treated by mixing with a stabilizing agent, as necessary, to meet requirements for waste transportation and disposal. The specific details of the treatment design and specifications will be established during the remedial design. The specifications may include, for example, required minimum dosages of treatment reagent, maximum allowable moisture content of treated sediment, and/or maximum-acceptable levels of liquids release from treated sediment under unconfined (*e.g.*, paint filter test) and/or confined (*e.g.*, compression test) conditions.

As Alternative W2 would not involve a dredging component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to this balancing criterion.

Short-Term Effectiveness: Alternatives W2 to W5 would all be fully effective in achieving the Phase 1 waterway RAOs upon the completion of construction (*i.e.*, 3.3, 2.8, 3.5, and 4.9 years for Alternatives W2, W3, W4, and W5, respectively). During construction, however, there would be several short-term impacts that would need to be mitigated through community outreach, design, engineering controls, construction planning and scheduling, construction management and monitoring, and contingency planning. The main factors contributing to the short-term effectiveness ratings for the waterway alternatives are impacts on the local community (including level of local traffic impact, exhaust emissions, dust, noise, and possibly odors), potential accident risks to construction workers, construction durations, water quality (including resuspension of sediments during dredging and backfill placement operations and potential of erosion and resuspension during storm events), and geotechnical impacts associated with construction operations.

Alternative W2 would have the fewest potential community impacts and construction worker risks, primarily because it does not have a dredging and sediment management component. Potential community impacts and construction worker risks are generally proportional to the extent and duration of sediment dredging, because dredging involves management of large volumes of sediment and backfill/cap material using heavy equipment and truck transportation of dewatered sediment and backfill/cap material through the community. However, Alternative W2 would have more potential to cause sediment bed instability and lateral movement of mud than the other alternatives, it would cause short-term water quality impacts, and it would take longer to implement than Alternative W3. Based on these considerations, Alternative W2 was given a moderate to high short-term effectiveness rating.

Comparing the removal and backfilling alternatives (W3 to W5), Alternative W5 would have the most significant community impacts and worker risks because it involves the largest volumes of sediment dredging, dredged material management, and backfilling; Alternative W3 would have the least community impacts and worker risks; and Alternative W4 would have intermediate impacts and risks. Alternative W3 would have the shortest construction duration and Alternative W5 the longest. All the removal and backfilling/capping alternatives would also have short-term water quality impacts associated with dredging, filling, and water management operations, with Alternative W5 again having the largest impacts and Alternative W3 the smallest. Alternative W5 has the potential to cause water quality impacts due to the risk of marsh bank instability and the need for temporary marsh bank stabilization measures in areas of deep dredging.

Environmental impacts would include temporary loss of benthic organisms, as well as habitat for the ecological community in the Phase 1 remediation areas. Post remediation, fine-grained sediment will deposit over the capping or backfill material, which will provide improved conditions for the organisms as the material will be much cleaner than the pre-remediation sediment. Since the remedial action would replace existing habitat (and slightly improve it), no additional compensatory mitigation measures would be necessary for this aspect of the remediation under the Clean Water Act requirements discussed above. On a relative basis, the short-term effectiveness of Alternative W3 was rated moderate to high, the short-term effectiveness of Alternative W4 was rated moderate, and the short-term effectiveness of

Alternative W5 was rated low to moderate. To summarize: W2 and W3 are rated moderate to high, W4 is lower at moderate and W5 is the lowest, being rated low to moderate.

Implementability: This balancing criterion considers the technical and administrative feasibility of implementing the remedy, including the potential for constructability issues and challenges. Alternative W2 was given a low to moderate implementability rating due to sediment bed settlement and stability challenges, and potential flooding impacts, associated with placement of 2 feet of net fill, the shortest tide windows of all the alternatives for working in the mudflats and shallow tributaries, and the administrative challenges related to the potential need for ARAR waivers. Alternative W5 was given the same low to moderate rating, based on the substantial marsh bank stability challenges associated with complete soft sediment removal and the substantially larger depth of dredging in some areas compared to the other alternatives. Alternative W5 would also involve more substantial sediment management and water treatment volumes than the other alternatives. Both Alternatives W3 and W4 were given a moderate to high rating due to their limited maximum dredging depths, smaller magnitudes of sediment bed settlement, and lower risks to sediment bed and marsh bank stability.

Cost:

The total estimated present value cost for each waterway alternative is presented below:

Waterway Alternative	Present Value Cost
W1	$0
W2	$100,544,000
W3	$205,598,000
W4	$261,242,000
W5	$393,113,000

The cost estimates have been developed based on assumptions and are presented for comparing the alternatives. The cost of the selected remedy will depend on the actual labor and material costs, market conditions, final project scope, the implementation schedule, and other variables. Consistent with EPA guidance, the cost estimates are order of magnitude estimates with an intended accuracy range of plus 50 to minus 30 percent of present value. The least expensive active remediation option is Alternative W2. Costs for the removal and backfill/cap alternatives increase with the depth of sediment removal, as the increased amount of dredging and disposal is more resource-intensive. Alternative W3 is about double the cost of Alternative W2. Alternative W4 is about 1.6 times the cost of Alternative W2 and about 30% more costly than Alternative W3. Alternative W5 is almost double the cost of Alternative W3 and 66% more costly than Alternative W4 (due to the much larger sediment removal and backfill volumes involved with Alternative W5).

10.1.3 Waterway Modifying Criteria

State Acceptance:

The New Jersey Department of Environmental Protection has concurred on this ROD.

Community Acceptance:

The community was given the opportunity to provide comment at the public meeting on May 9, 2018, and during the public comment period. Overall, the public supported the preferred alternative, with a concern being raised that the remedy was not permanent. Only three letters were received during the public comment period, and all supported moving forward with the remedy. These letters are included in the Responsiveness Summary.

10.2 Comparative Analysis of UPIC Marsh Alternatives

10.2.1 UPIC Marsh Threshold Criteria

Protection of Human Health and the Environment: Alternative UPIC1 would not be protective of human health and the environment because it would not reduce the potential exposure of ecological receptors to COCs from UPIC marsh sediment. As it does not meet this threshold criterion, Alternative UPIC1 was not evaluated against the NCP balancing criteria. Alternatives UPIC2 to UPIC4 would all satisfy this NCP threshold criterion by eliminating exposure to BCSA COCs. Alternative UPIC2 would be protective of human health and the environment through installation of a 6-inch thick cover layer over the existing marsh surface. Alternatives UPIC3 and UPIC4 would achieve this criterion by removing the contaminated sediment that is the source of potential ecological exposures and replacing it with a backfill layer that would isolate any remaining contaminated sediment or residuals from the marsh surface. Alternative UPIC3-A would achieve this threshold criterion through the hybrid application of the remedial technologies of Alternatives UPIC2 and UPIC3.

Compliance with ARARs: ARARs applicable to the Phase 1 interim remedial action would not apply to Alternative UPIC1 since no action would be undertaken. Alternatives UPIC3, UPIC3-A, and UPIC4 would comply with the Phase 1 ARARs, thus satisfying this NCP threshold criterion. Alternatives UPIC2 and UPIC3-A would result in placement of a small amount of net fill into the marsh. These alternatives would be designed to comply with the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. For example, if necessary, flood storage would be addressed as part of the remedial design to account for the net fill placed in the marsh with either alternative.

A complete list of ARARs can be found in Tables 12 and 13.

10.2.2 UPIC Marsh Balancing Criteria

Long-Term Effectiveness and Permanence: Based on high resolution core data, peak COC levels in UPIC marsh are within 3 to 5 inches of the ground surface. Alternative UPIC2 would leave in place this shallow horizon of high COC concentrations, while Alternatives UPIC3, 3-A and UPIC4 would remove this horizon. While the risk of long-term COC exposure with Alternative UPIC2 is low, it would be higher than with the other alternatives. Therefore, Alternative UPIC2 is given a moderate relative rating with respect to long-term effectiveness and permanence, while Alternatives UPIC3, UPIC3-A, and UPIC4 are given a high rating.

All four active remediation alternatives would reduce or eliminate the potential for exposure of human and ecological receptors to COCs from shallow marsh sediment. Alternatives UPIC3, UPIC3-A, and UPIC4 rate higher than Alternative UPIC2 because the backfill layers would be thicker than the cover layer thickness of Alternative UPIC2. While it is given a lower rating, Alternative UPIC2 would still achieve long-term effectiveness and permanence, but due to UPIC-specific conditions (*e.g*., hydrology, elevation, and presence of tide gates), it would potentially require more maintenance than Alternatives UPIC3, UPIC3-A, and UPIC4. Alternatives UPIC3, UPIC3-A, and UPIC4 are given the same high rating because they would remove the great majority of the sediment with elevated COC concentrations and they all would provide a backfill thickness more than adequate to provide long-term isolation of the post-remediation marsh habitat from COCs in underlying sediment or residuals. Alternative UPIC3-A includes a thin-layer cover over a relatively small portion of the marsh near the existing radio towers. The thin-layer cover provides long-term effectiveness in this area since this portion of the marsh is located on the southern portion of UPIC in an area that has generally lower COC concentrations than the rest of UPIC marsh and is not adjacent to the UPIC waterways and not subject to erosive forces. Alternative UPIC3-A would provide a high degree of long-term effectiveness while avoiding negative impacts to the radio towers and infrastructure on the southern portion of UPIC marsh. For these reasons, there is no meaningful difference in ecological exposure risk reduction between Alternatives UPIC3, UPIC3-A, and UPIC4.

Reduction of Toxicity, Mobility, or Volume through Treatment: All the marsh sediment excavation alternatives received the same relative rating for the "treatment" balancing criterion, for the same reasons as described for the waterway dredging alternatives, including application of the same treatment process to all dredged sediment. The specific details of the treatment design and specifications will be established during the remedial design. The specifications may include, for example, required minimum dosages of treatment reagent, maximum allowable moisture content of treated sediment, and/or maximum-acceptable levels of liquids release from treated sediment under unconfined (*e.g*., paint filter test) and/or confined (*e.g*., compression test) conditions. As Alternative UPIC2 would not involve a sediment excavation component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to the treatment balancing criterion.

Short-Term Effectiveness: Alternatives UPIC2 to UPIC4 would all be fully effective in achieving the UPIC Marsh RAO upon the completion of construction (*i.e*., 1.0, 1.4, 1.1, and 1.9 years for Alternatives UPIC2, UPIC3, UPIC3-A, and UPIC4, respectively). Alternative UPIC2 is given a high short-term effectiveness rating due to the fewer community impacts and construction worker risks, shortest construction duration, absence of a marsh excavation remedy component, and lesser challenges in re-establishing the marsh vegetation compared to the other marsh alternatives. Construction of Alternative UPIC2 would result in disturbance and damage to the marsh vegetation, whereas construction of Alternatives UPIC3, UPIC3-A and UPIC4 would result in complete destruction of the marsh vegetation. Marsh restoration would be necessary with all four alternatives, with the restoration efforts for Alternatives UPIC3, UPIC3-A and UPIC4 being more substantial and challenging than for Alternative UPIC2. This is because with UPIC2 marsh vegetation would be cut down only to the marsh surface, while with UPIC3, UPIC3-A and UPIC4, the marsh root mat would be removed, requiring complete replacement of vegetation.

The ratings for Alternatives UPIC3, UPIC3-A, and UPIC4 recognize that there would be short-term impacts associated with the marsh excavation and backfilling operations, including temporary loss of habitat, but these impacts would be limited and manageable. Habitat will re-establish itself naturally following the completion of remedial activities. Because the remedial action would improve and replace existing habitat, no additional compensatory mitigation measures would be necessary. Alternative UPIC3 is rated moderate to high and Alternative UPIC4 is rated moderate in recognition of the larger sediment excavation and backfill volumes and the concomitant greater impacts related to construction duration, truck trips, noise, potential odors, water management, and other factors associated with these operations. Given the relative ratings for Alternative UPIC2 (high) and UPIC3 (moderate to high), and the fact that approximately 86.5% of UPIC marsh would undergo excavation and backfill with Alternative UPIC3-A, this latter alternative is given a short-term effectiveness rating of moderate to high.

Implementability: Alternative UPIC2 is given a high implementability rating as technical and construction implementation challenges would be minor and it would not involve excavation activities around the eight radio towers present in the marsh, which simplifies implementation. There could be administrative challenges for UPIC2 related to net fill being placed into a non-tidal marsh, though the amount of net fill is small enough that any issues related to flood storage capacity could be addressed in remedial design.

While Alternative UPIC3 would have a sediment excavation and management component, it is given a moderate to high implementability rating due to the limited depth of excavation and the relative accessibility of the marsh. Alternative UPIC4 is given a moderate implementability rating in that no significant administrative challenges are anticipated, but it would have twice the volume of sediment to manage, twice the amount of backfill to place, and more substantial sediment management, water treatment, odor control, and other requirements compared to Alternative UPIC3. In the case of Alternatives UPIC3 and UPIC4, the alternatives assume that all 28.2 acres of the UPIC marsh can be excavated, including contaminated sediments in the radio tower area (covering approximately 7 acres of the 28.2-acre UPIC marsh); however, working around the radio towers poses several implementability challenges. It is questionable whether the structural stability of the radio towers can be maintained during excavation, and temporary or permanent relocation of the towers to allow for full excavation poses a number of administrative challenges. These issues led to the consideration of thin-layer capping of about 3.8 acres of the 7 acres that are directly under the structural footprint of the radio towers, as part of the hybrid alternative, UPIC3-A. Implementation of Alternative UPIC3-A would be much like that of Alternative UPIC3 across much of the marsh. Importantly, however, Alternative UPIC3-

A would not involve excavation in 3.8 acres of the radio tower area, which simplifies implementation. For this reason, Alternative UPIC3-A is given a high implementability rating.

Cost:

The total estimated present value cost for each UPIC marsh alternative is presented below:

UPIC Marsh Alternative	Present Value Cost
UPIC1	$0
UPIC2	$24,621,000
UPIC3	$62,231,000
UPIC3-A	$58,212,000
UPIC4	$85,664,000

Alternative UPIC2 is the least expensive of the alternatives. Alternative UPIC4 has the highest overall cost: about 39% higher than Alternative UPIC3, 48% higher than Alternative UPIC3-A, and nearly 350% higher than Alternative UPIC2. Alternative UPIC3-A is a little more than double the cost of Alternative UPIC2, while Alternative UPIC3 is about two and one-half times the cost of Alternative UPIC2.

10.2.3 UPIC Marsh Modifying Criteria

State Acceptance:

The New Jersey Department of Environmental Protection has concurred with the selected remedy.

Community Acceptance:

The community was given the opportunity to provide comment at the public meeting on May 9, 2018, and during the public comment period. Overall, the public supported the preferred alternative, with a concern being raised that the remedy was not permanent. Only three letters were received during the public comment period, and all supported moving forward with the remedy. These letters are included in the Responsiveness Summary.

11. PRINCIPAL THREAT WASTES

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (40 CFR §300.430(a)(1)(iii)(A)). Identifying principal threat wastes (PTW) combines concepts of both hazard and risk. In general, PTW are those source materials considered to be highly toxic or highly mobile which generally cannot be contained in a reliable manner or would present a significant risk to human health or the environment should exposure occur. Non-PTW are those source materials that generally can be reliably contained and that would present only a low risk in the event of exposure.

Based on this definition, the waterway and marsh sediments that will be addressed in the Phase 1 remedial action are not PTW. The rationale for this conclusion is as follows:

- All sediment addressed by the Phase 1 remedial action is secondary source material consisting of environmental media (*i.e.*, sediment) previously impacted by COCs from legacy primary sources that formerly existed within the BCSA watershed.

- The COCs present in the sediments, while at concentrations sufficient to be of environmental concern, are not highly toxic to human or ecological receptors as shown by the results of the human and ecological risk assessments, and based on factors such as exposure concentration, and bioavailability. Although some concentrations of COCs are high, the exposure point concentration, the statistical value calculated to represent a reasonable maximum exposure to both human and ecological receptors, results in risks that exceed acceptable levels but do not meet the PTW threshold. EPA PTW guidance suggests that "where toxicity and mobility of source material combine to pose a risk of 10^{-3} or greater" the material may be considered a principal threat waste and treatment remedial alternatives should be evaluated in the FS. The BCSA BHHRA resulted in a calculated RME excess cancer risk of 9×10^{-8} to 3×10^{-5}, well below the EPA 10^{-3} risk level suggested by the guidance.

- COCs in the BCSA are not highly mobile, most fundamentally due to the high level of sediment stability in the system and the net depositional conditions throughout the system, as discussed in the FS. Sediment resuspension is generally limited to the thin unconsolidated fluff layer during typical, tidally-dominated flow conditions, and is substantially limited even during rare, very large storm events such as Hurricane Irene.

- Also contributing to limited COC mobility in the BCSA is the strong association of the COCs to sediment particulates due to organic matter partitioning, sulfide complexation, and binding to other mineral phases, as discussed in the FS. These processes combine to limit COC mobility in the system. Other potential mechanisms for COC transport, such as groundwater upwelling and translocation through plant uptake, were shown in the RI to be of *de minimis* influence in the BCSA system.

Distinct from PTW, which generally cannot be reliably contained, BCSA waterway and marsh sediment can be reliably contained and/or removed using proven technologies such as capping and dredging. EPA has incorporated treatment as a component of dredged material management, to the extent necessary to meet transportation and disposal requirements, and does not believe that additional treatment for dredged material is necessary.

12. SELECTED REMEDY

The remedy selected in this ROD is an interim action for source control in certain BCSA waterways as well as Upper Peach Island Creek (UPIC) marsh. The selected remedy addresses contaminated waterway sediment in Upper Berry's Creek (UBC), Middle Berry's Creek (MBC) and major tributaries (*e.g.*, Peach Island Creek, Ackerman's Creek) which will lead to a reduction of contaminant levels in the surface water and biota within Berry's Creek. It will also address high concentrations of contamination found in UPIC marsh. The selected remedy includes the following components:

UBC and MBC Waterways: *Alternative W4: 2-foot Sediment Removal + Backfill/Cap*

- Bank-to-bank removal of 2 feet of soft sediment within the proposed remediation footprint (plus 6 inches of over-dredge). Where less than 2 feet of soft sediment is present, the soft sediment removal thickness will be the soft-sediment thickness. The selected remedy is expected to remove approximately 363,000 yd^3 of sediment from the UBC and MBC waterways.

- Backfill/capping of the areas where sediment is removed. The backfill thickness will be equal to the thickness of sediment removed. In areas where contaminated soft sediment remains below the excavation depth, the backfill will serve as a cap to physically isolate this material. The work will include mitigation of the disturbance to habitat caused by the remedial action.

UPIC Marsh: *Alternative UPIC3-A: Hybrid – Sediment Removal + Backfill and Thin-Layer Cover*

- Removal of marsh sediments to a depth of 1 foot, with removal of 2 feet of sediment within a 10-foot strip along the marsh edge at the waterway banks. The selected remedy is expected to remove approximately 69,500 yd^3 of UPIC marsh sediment.

- The excavated sediment will be replaced with backfill to maintain marsh surface elevations, isolate underlying marsh sediment, and re-establish the marsh habitat.

- In the area surrounding the radio towers in the southern portion of UPIC marsh, in lieu of excavation, a thin-layer cover of clean material (six inches) will be placed over the existing marsh. Approximately 3,600 yd^3 of thin-layer cover material will be placed.

Dewatering and Off-Site Disposal: The excavated/dredged sediment will be dewatered, stabilized as necessary and transported off site for disposal at a permitted facility. Water from the process will be treated and returned to the creek.

Marsh Demonstration Project: A marsh demonstration project will evaluate potential cleanup options for marshes not addressed in this action, and monitor the response of the marshes to the waterway cleanup.

Long-Term Monitoring: Long-term monitoring will be conducted to evaluate the overall effectiveness of the cleanup as well as providing information to make future decisions for the BCSA.

Institutional Controls: ICs, such as the existing New Jersey fish and crab consumption advisories will remain in place. Additional restrictions will be put in place to preserve the caps, if necessary.

13. STATUTORY DETERMINATIONS

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final ROD is signed; complies with those federal and state requirements that are applicable or relevant and appropriate for this limited-scope action; and is cost-effective. Although this interim action is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus supports that statutory mandate. Subsequent actions will address fully the threats posed by conditions at the BCSA.

Because this is an interim action ROD, review of this remedy will be ongoing as EPA continues to develop final remedial alternatives for the BCSA.

13.1 Protection of Human Health and the Environment

As an interim remedy, the selected remedy should provide adequate protection until a final ROD is signed. The selected remedy is expected to be protective of human health and the environment in the short term. EPA expects to evaluate cleanup levels in the final remedy decision for the BCSA.

13.2 Compliance with ARARs

The selected remedy will comply with location-specific and action-specific ARARs and other criteria, advisories, or guidance presented in Tables 11 and 12, respectively. There are no chemical-specific ARARs for this interim remedy.

13.3 Cost-Effectiveness

A cost-effective remedy is one whose costs are proportional to its overall effectiveness (NCP at 40 CFR Section 300.430(f)(1)(ii)(D)). Overall effectiveness is based on the evaluation of the following: long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness. Overall effectiveness is then compared to cost, to determine cost-effectiveness. Costs for each alternative were evaluated in detail. Capital and annual O&M costs were estimated and used to develop present worth costs. In the present worth costs, annual O&M costs were calculated for the life of the alternative using a seven percent discount rate and a 30-year interval. Based on the comparison of overall effectiveness to cost, the selected remedy meets the statutory requirement that Superfund remedies be cost-effective. The detailed cost estimates for the selected remedy, Alternative W4, UPIC3-A and the Marsh

Demonstration Project are in Tables 14, 15, and 16, respectively. The estimated capital cost of the selected remedy is $268,618,000. The annual O&M cost is $33,000,000. The present value cost is $332,000,000.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies

The selected remedy provides the best balance of tradeoffs among the alternatives with respect to the balancing criteria set forth in the NCP at 40 CFR Section 300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the BCSA. The selected remedy will leave contamination below the caps in certain mudflats, however, the depositional nature of the mudflats, and thus protectiveness of the caps, is expected to continue unless the hydrology of the system is changed by anthropogenic or natural events. ICs, such as fish consumption advisories are based on area-wide concerns, and will remain in place despite the implementation of the selected remedy.

13.5 Preference for Treatment as a Principal Element

The selected remedy satisfies the statutory preference for treatment as a principal element of the remedy. Although the dredged/excavated sediment will be transported off site for disposal, an amendment (*e.g.*, Portland cement) will be added as needed to meet transportation and disposal requirements. The addition of an amendment will reduce the toxicity and the mobility of contaminants contained within the sediment, compared to untreated sediment. While treatment could be considered a secondary benefit of amendment addition for transportation and disposal requirements, the sediment will nonetheless undergo treatment, and the statutory preference will be met.

13.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site above levels that allow for unlimited use and unrestricted exposure, five-year reviews will be required ensure that the remedy is, or will be, protective of human health and the environment. The schedule for the five-year review has been set by the start of remediation at the upland portion of the Ventron/Velsicol Site (OU1). The first five-year review for OU1 was issued on September 25, 2017.

Because this is an interim action ROD, review of this remedy will be ongoing as EPA continues to develop final remedial alternatives for the BCSA.

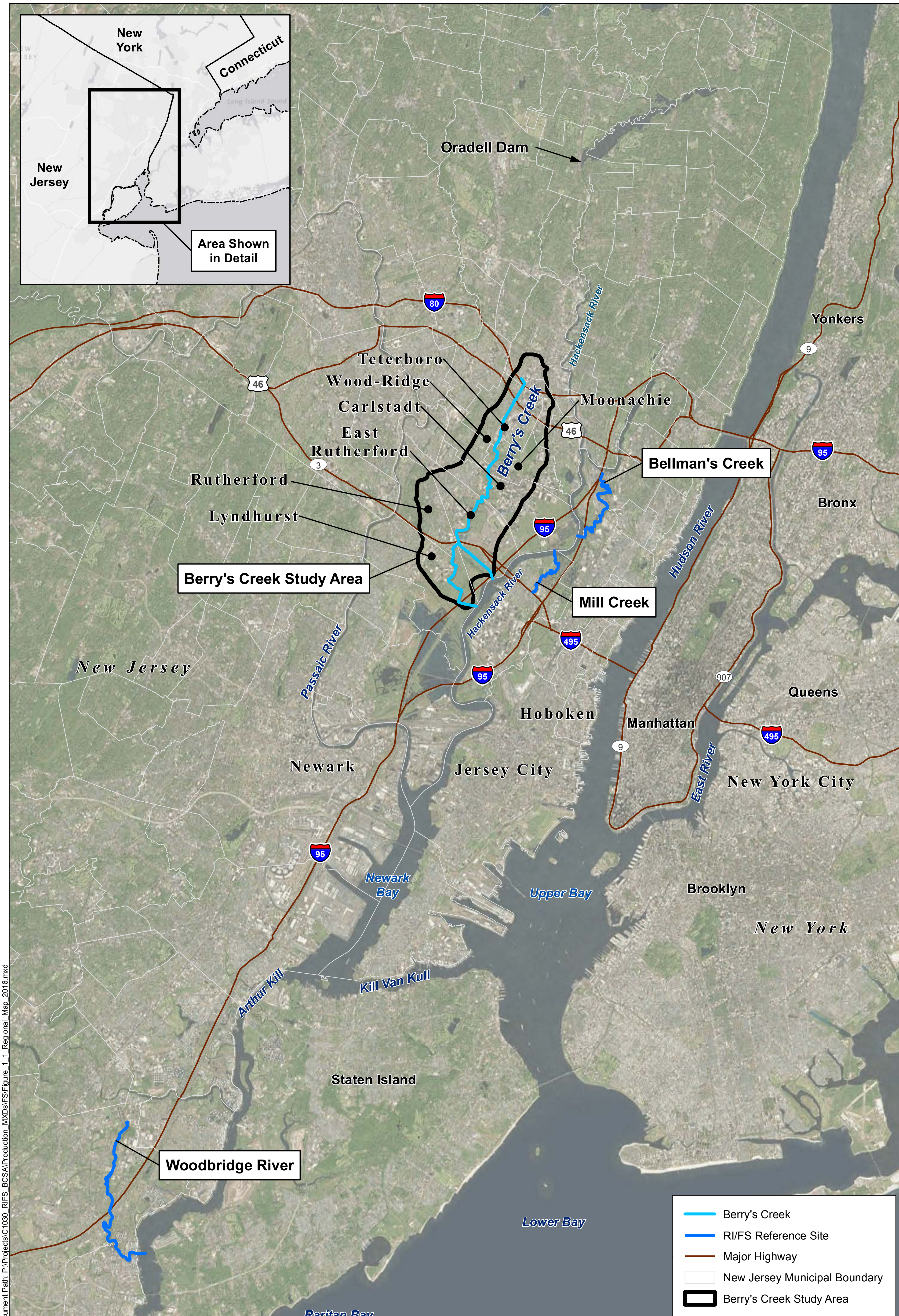
14. DOCUMENTATION OF SIGNIFICANT CHANGES

The Proposed Plan identified the preferred alternative for the BCSA as: Alternative W4: 2-foot Sediment Removal + Backfill/Cap and Alternative and UPIC3-A: Hybrid – Sediment Removal + Backfill and Thin-Layer Cover. Upon review of all comments submitted during the public comment period from May 2, 2018 to June 6, 2018, and at the public meeting on May 9, 2018, there was one minor revision from the Proposed Plan. Whereas the Proposed Plan stated that

"…additional institutional controls (*e.g*., property use and access restrictions) would be implemented as part of the Phase 1 interim remedial action..." the ROD only requires "…additional restrictions [institutional controls] will be put in place to preserve the caps, if necessary." This is not considered a significant change to the selected remedy.

EPA has determined that no significant changes to the selected remedy, as it was presented in the Proposed Plan, are warranted.

BERRY'S CREEK STUDY AREA
OU2 of the VENTRON/VELSICOL SITE
RECORD OF DECISION
APPENDIX 1 FIGURES



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Note: Lake Tappan and Lake DeForest are located to the north of the map extent.
Basemap Source: ESRI World Imagery, 2011.

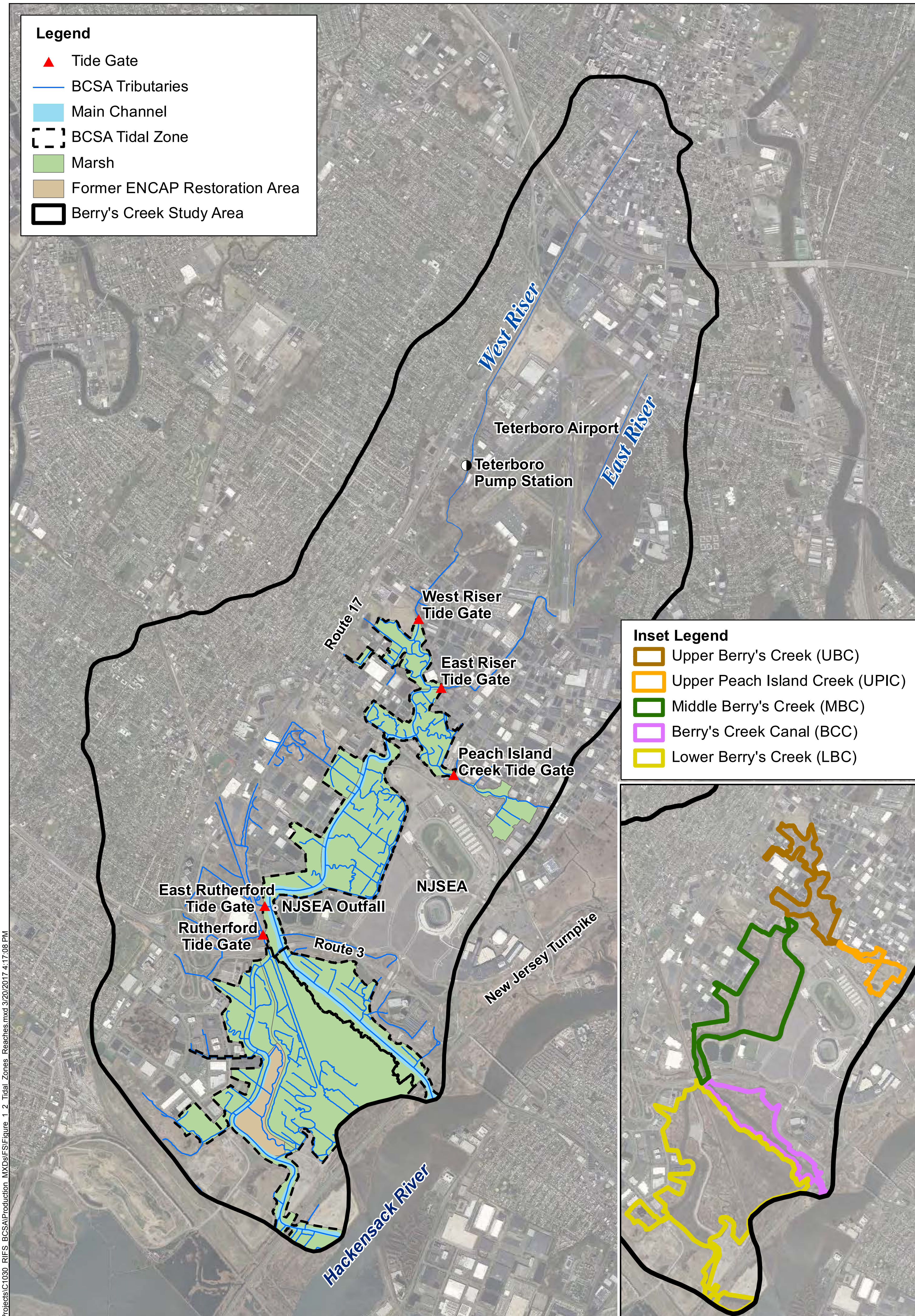
0 0.5 1 2 Miles

N

Regional Setting of the BCSA

Berry's Creek Study Area Record of Decision

Figure 1



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Basemap Source: NJ Imagery, Natural, 2012.
Hydrography Source: U.S. Geological Survey
National Hydrography Dataset (NHD), 2014.
Note: Not all tide gates are shown.
NJSEA = New Jersey Sports and Exposition Authority

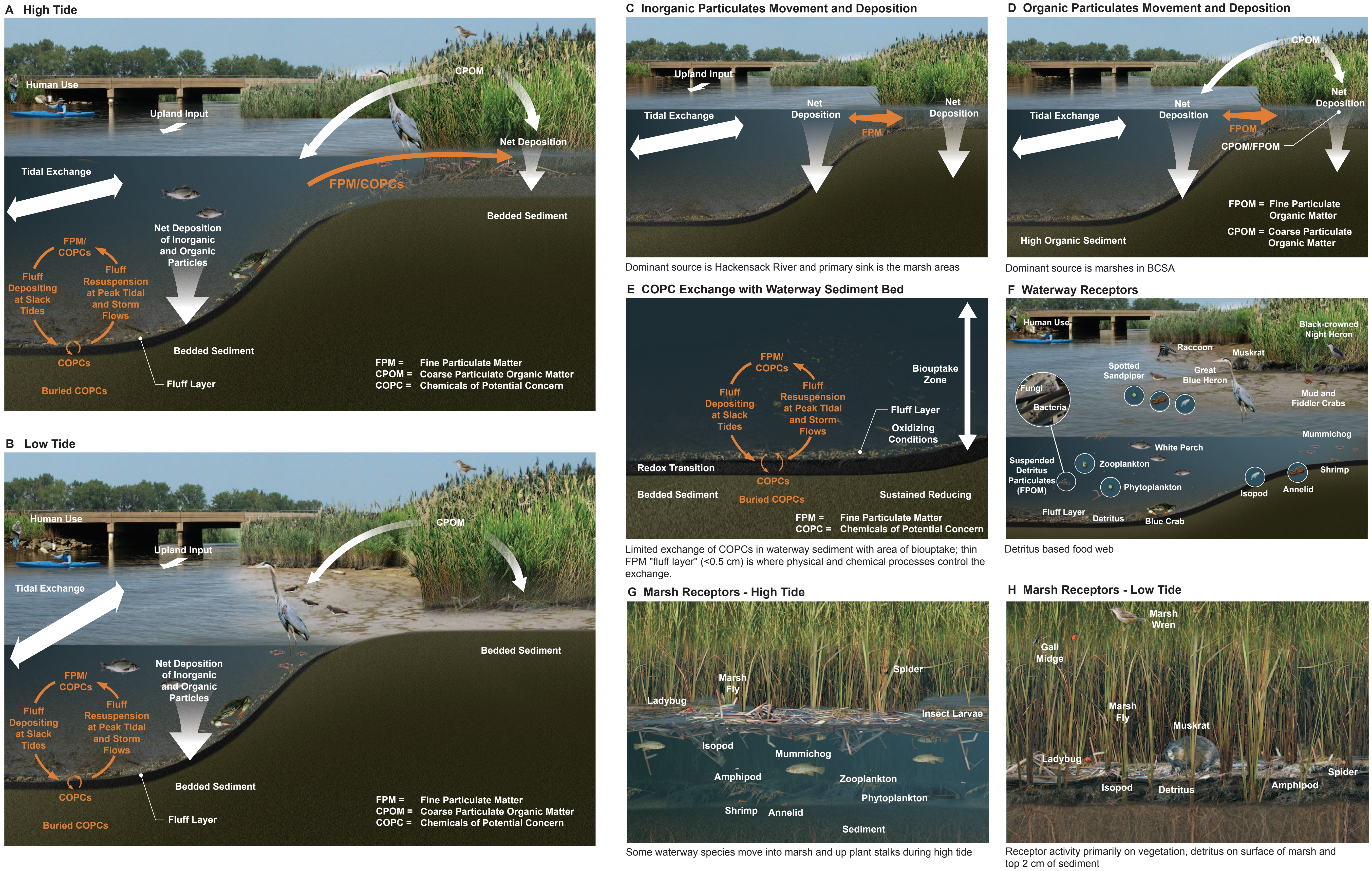
0 0.25 0.5 1 Miles

N

BCSA Watershed, Tidal Zone, and Study Segments

Berry's Creek Study Area Record of Decision

Figure 2



BCSA Conceptual Site Model of Key Physical and Chemical Processes; Human Use and Ecological Receptors

Berry's Creek Study Area Record of Decision

Figure 3

Surface Sediment Morphology

△ Marsh

◇ Tributary

○ Main Channel

▽ Above Tide Gate

Mercury Concentration (mg/kg)

● ≤2.5

● >2.5 - 5

● >5 - 10

● >10 - 25

● >25 - 50

● >50 - 175

● >175

⊙ Nondetect

Reach

Above Tide Gate

Upper Berry's Creek (UBC)

Upper Peach Island Creek (UPIC)

Middle Berry's Creek (MBC)

Berry's Creek Canal (BCC)

Lower Berry's Creek (LBC)

Morphology

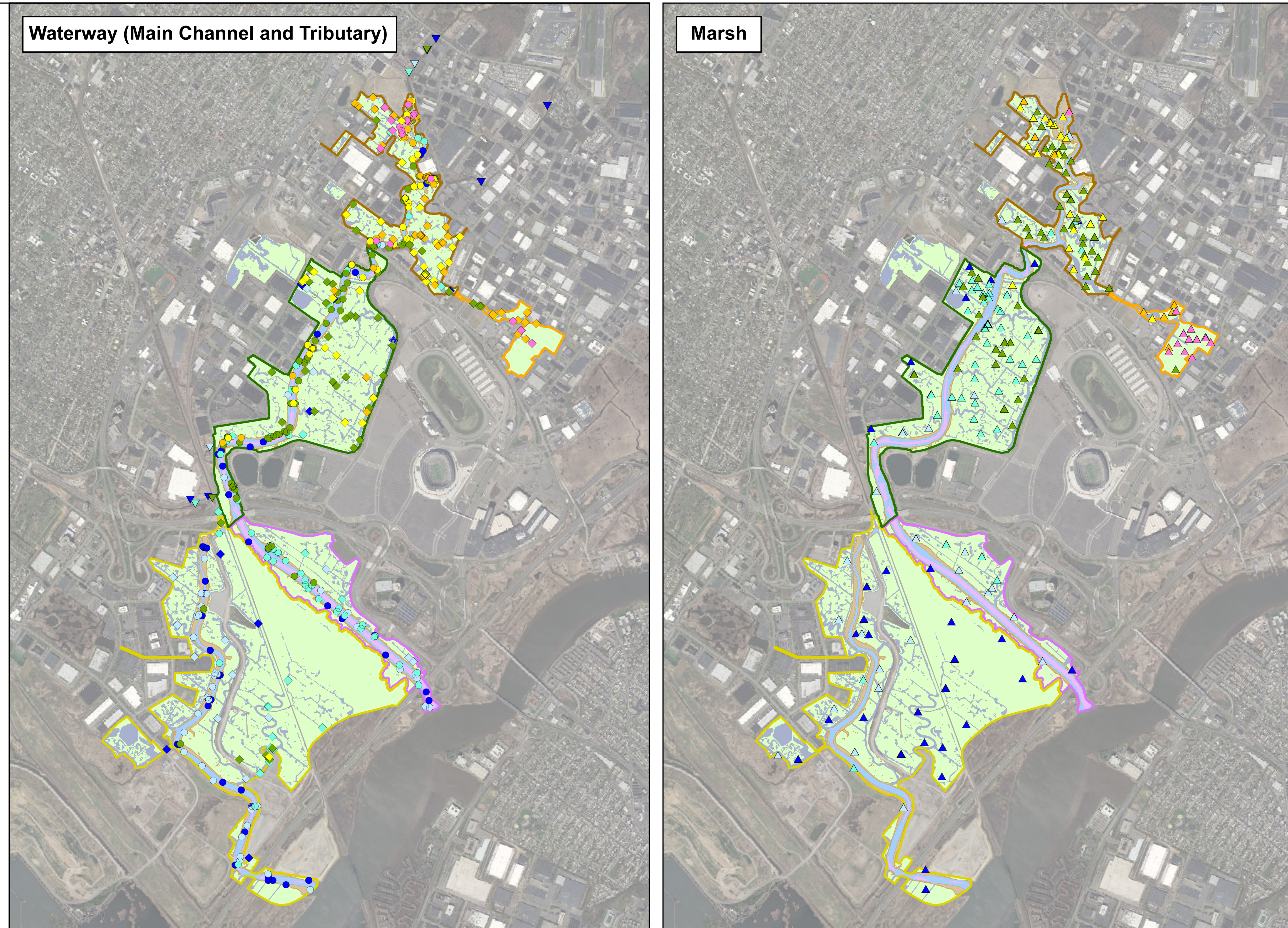
Main Channel, Deep Subtidal

Main Channel, Subtidal

Main Channel, Mudflat

Tributary or Pool

Marsh



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0 1,250 2,500 Feet

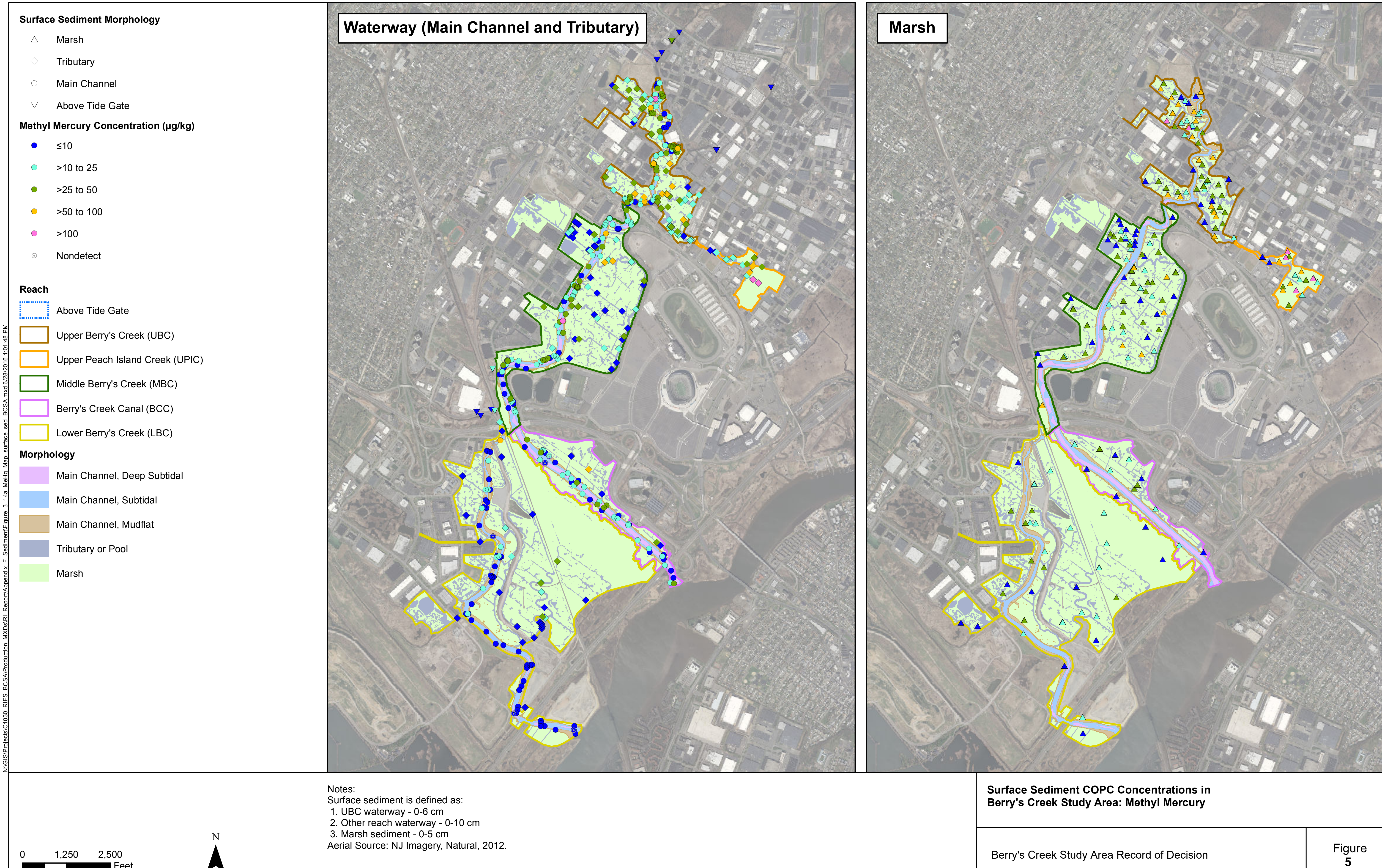
N

Notes:
Surface sediment is defined as:
1. UBC waterway - 0-6 cm
2. Other reach waterway - 0-10 cm
3. Marsh sediment - 0-5 cm
Aerial Source: NJ Imagery, Natural, 2012.

Surface Sediment COPC Concentrations in Berry's Creek Study Area: Mercury

Berry's Creek Study Area Record of Decision

Figure 4



Notes:
Surface sediment is defined as:
1. UBC waterway - 0-6 cm
2. Other reach waterway - 0-10 cm
3. Marsh sediment - 0-5 cm
Aerial Source: NJ Imagery, Natural, 2012.

Surface Sediment COPC Concentrations in Berry's Creek Study Area: Methyl Mercury

Berry's Creek Study Area Record of Decision

Figure 5

Surface Sediment Morphology

- △ Marsh
- ◇ Tributary
- ○ Main Channel
- ▽ Above Tide Gate

PCBs (Total Aroclors) Concentration (mg/kg)

- ≤0.5
- >0.5 to 2
- >2 to 5
- >5 to 10
- >10 to 15
- >15
- Nondetect

Reach

- Above Tide Gate
- Upper Berry's Creek (UBC)
- Upper Peach Island Creek (UPIC)
- Middle Berry's Creek (MBC)
- Berry's Creek Canal (BCC)
- Lower Berry's Creek (LBC)

Morphology

- Main Channel, Deep Subtidal
- Main Channel, Subtidal
- Main Channel, Mudflat
- Tributary or Pool
- Marsh

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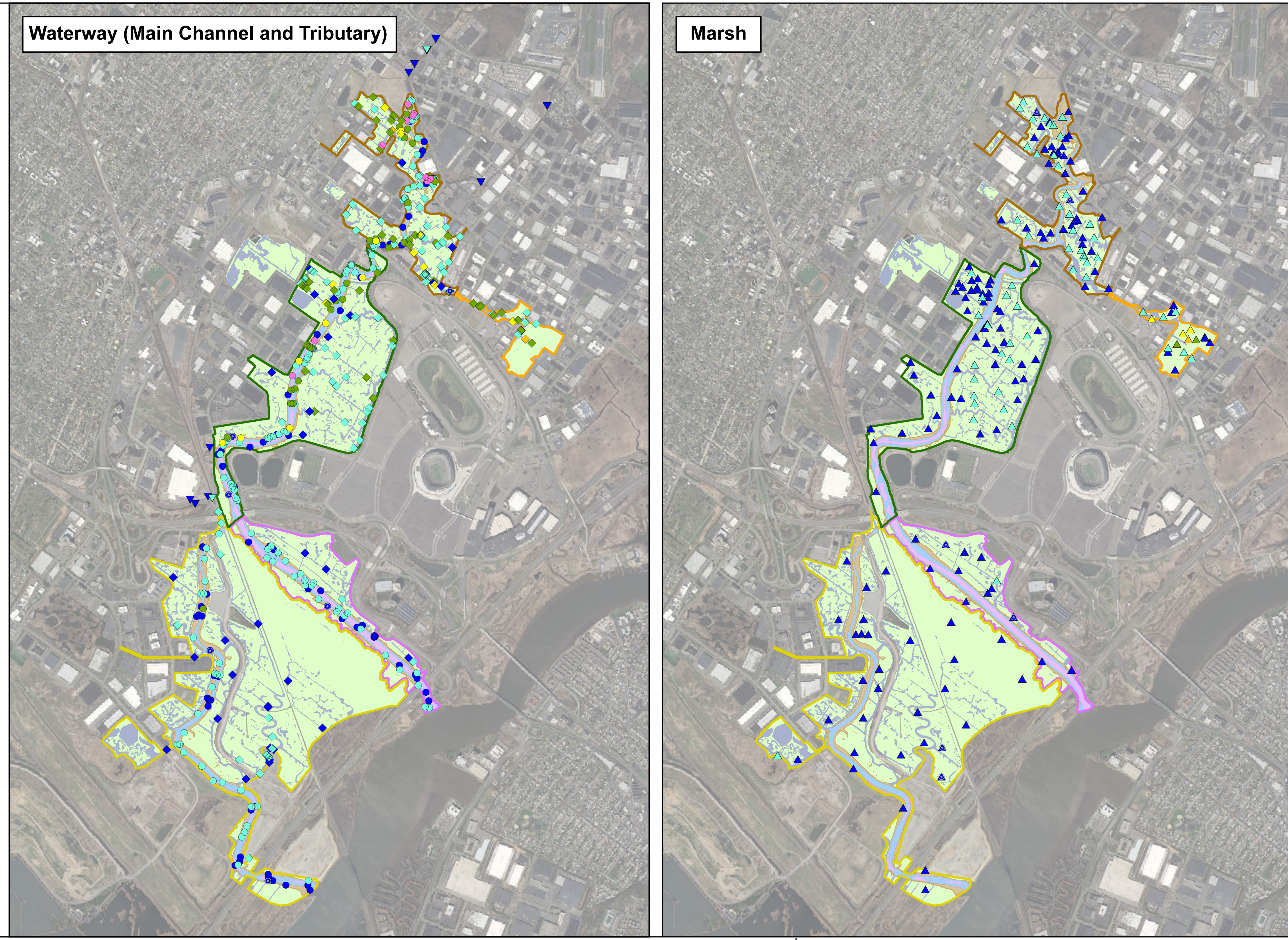


0 1,250 2,500 Feet

N

Notes:
Surface sediment is defined as:
1. UBC waterway - 0-6 cm
2. Other reach waterway - 0-10 cm
3. Marsh sediment - 0-5 cm
Aerial Source: NJ Imagery, Natural, 2012.

Surface Sediment COPC Concentrations in Berry's Creek Study Area: PCBs (Total Aroclors)

Berry's Creek Study Area Record of Decision

Figure 6

Figure 7

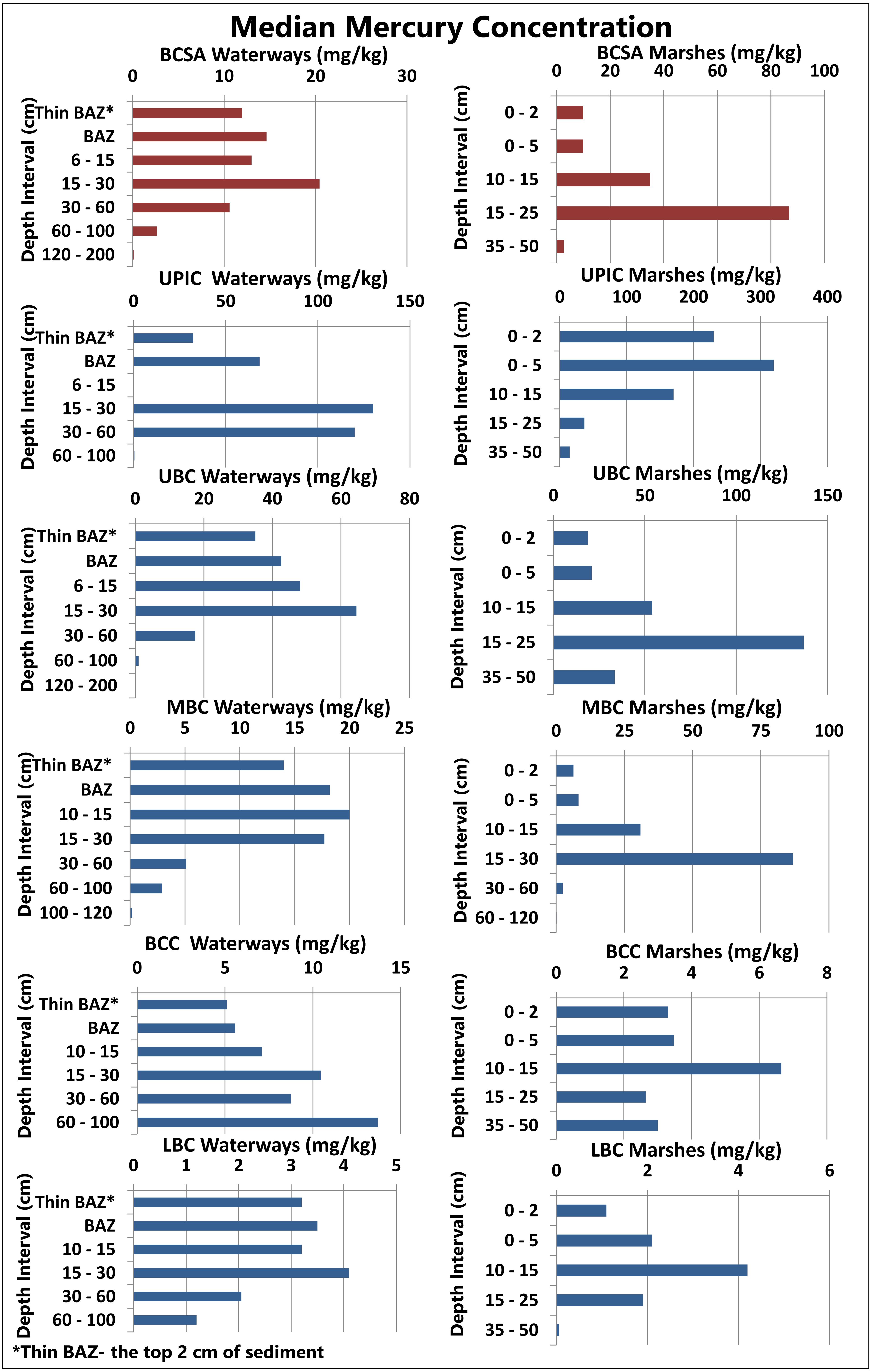
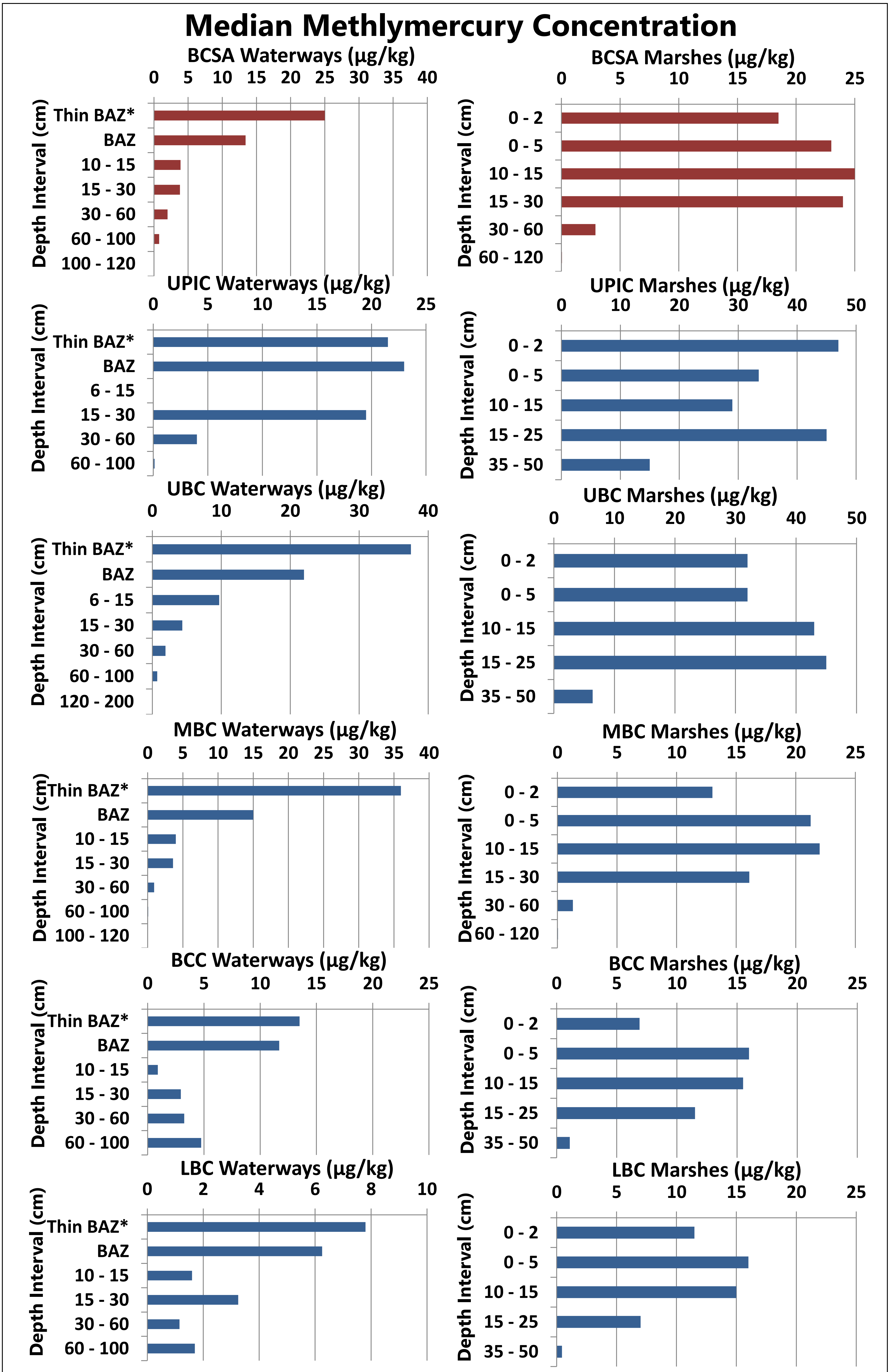
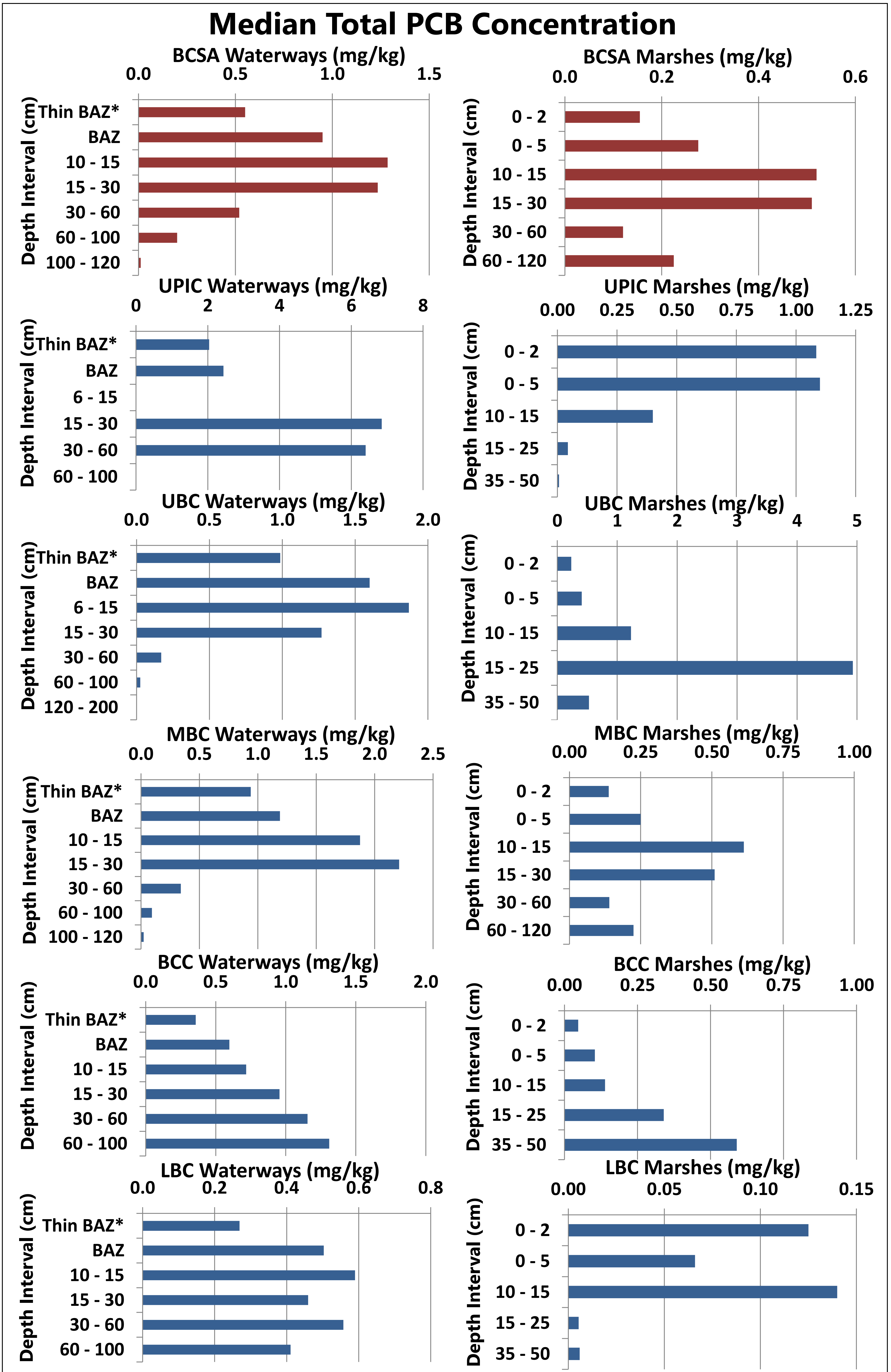

Median Mercury Concentration
BCSA Waterways (mg/kg)
0 10 20 30
Depth Interval (cm)
Thin BAZ*
BAZ
6 - 15
15 - 30
30 - 60
60 - 100
120 - 200
BCSA Marshes (mg/kg)
0 20 40 60 80 100
0 - 2
0 - 5
10 - 15
15 - 25
35 - 50
UPIC Waterways (mg/kg)
0 50 100 150
Thin BAZ*
BAZ
6 - 15
15 - 30
30 - 60
60 - 100
UPIC Marshes (mg/kg)
0 100 200 300 400
0 - 2
0 - 5
10 - 15
15 - 25
35 - 50
UBC Waterways (mg/kg)
0 20 40 60 80
Thin BAZ*
BAZ
6 - 15
15 - 30
30 - 60
60 - 100
120 - 200
UBC Marshes (mg/kg)
0 50 100 150
0 - 2
0 - 5
10 - 15
15 - 25
35 - 50
MBC Waterways (mg/kg)
0 5 10 15 20 25
Thin BAZ*
BAZ
10 - 15
15 - 30
30 - 60
60 - 100
100 - 120
MBC Marshes (mg/kg)
0 25 50 75 100
0 - 2
0 - 5
10 - 15
15 - 30
30 - 60
60 - 120
BCC Waterways (mg/kg)
0 5 10 15
Thin BAZ*
BAZ
10 - 15
15 - 30
30 - 60
60 - 100
BCC Marshes (mg/kg)
0 2 4 6 8
0 - 2
0 - 5
10 - 15
15 - 25
35 - 50
LBC Waterways (mg/kg)
0 1 2 3 4 5
Thin BAZ*
BAZ
10 - 15
15 - 30
30 - 60
60 - 100
LBC Marshes (mg/kg)
0 2 4 6
0 - 2
0 - 5
10 - 15
15 - 25
35 - 50
*Thin BAZ- the top 2 cm of sediment

Figure 8

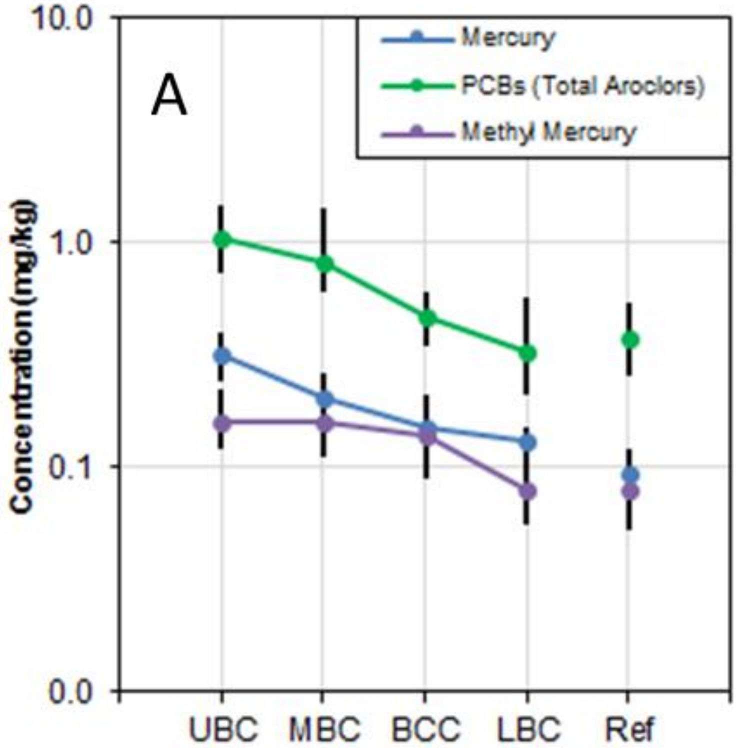


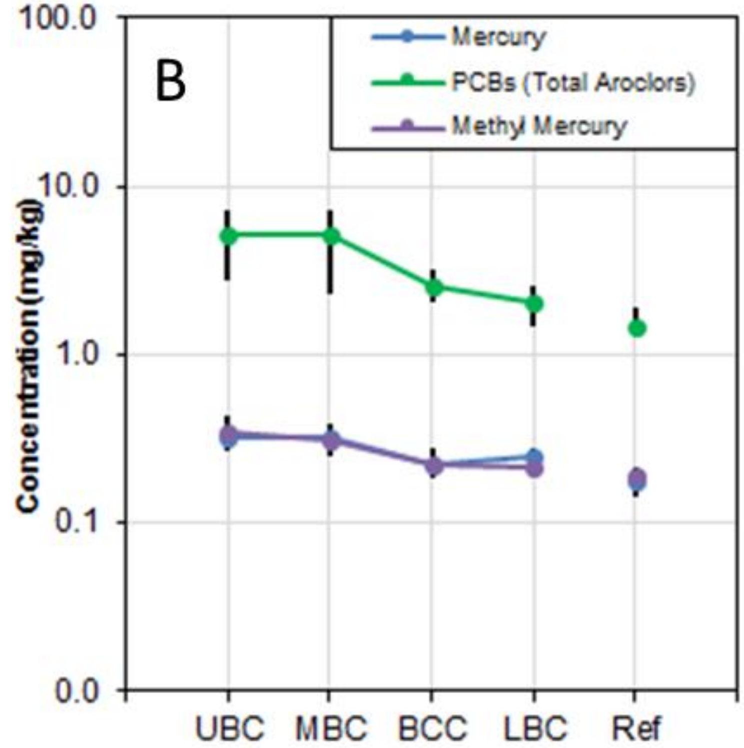
*Thin BAZ- the top 2 cm of sediment

Figure 9



*Thin BAZ- the top 2 cm of sediment

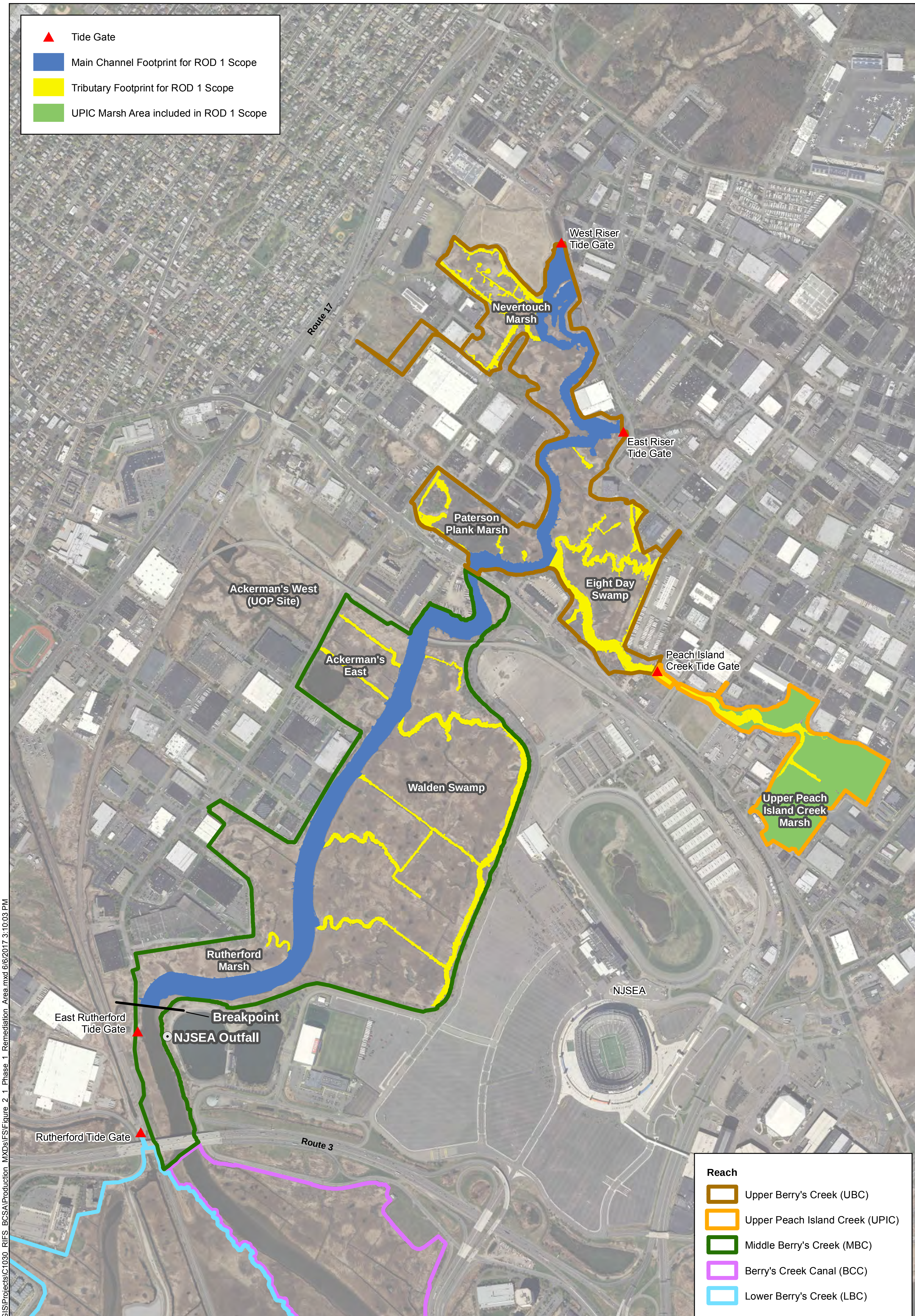




COC Concentrations in Mummichog (A) and Whole Body White Perch (B) (median, 25th, and 75th percentiles)

Berry's Creek Study Area Record of Decision

Figure **10**



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Basemap Source: NJ Imagery, Natural, 2012.
Note: Not all tide gates are shown.
NJSEA = New Jersey Sports and Exposition Authority

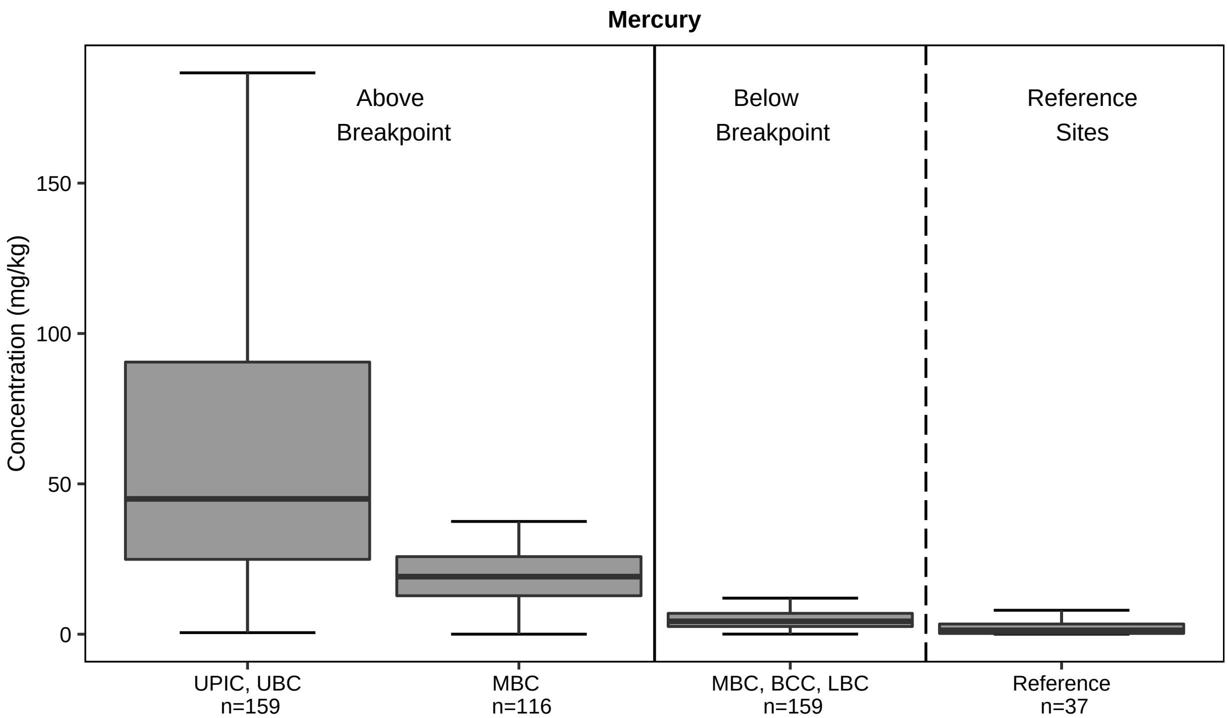
0 250 500 1,000 Feet

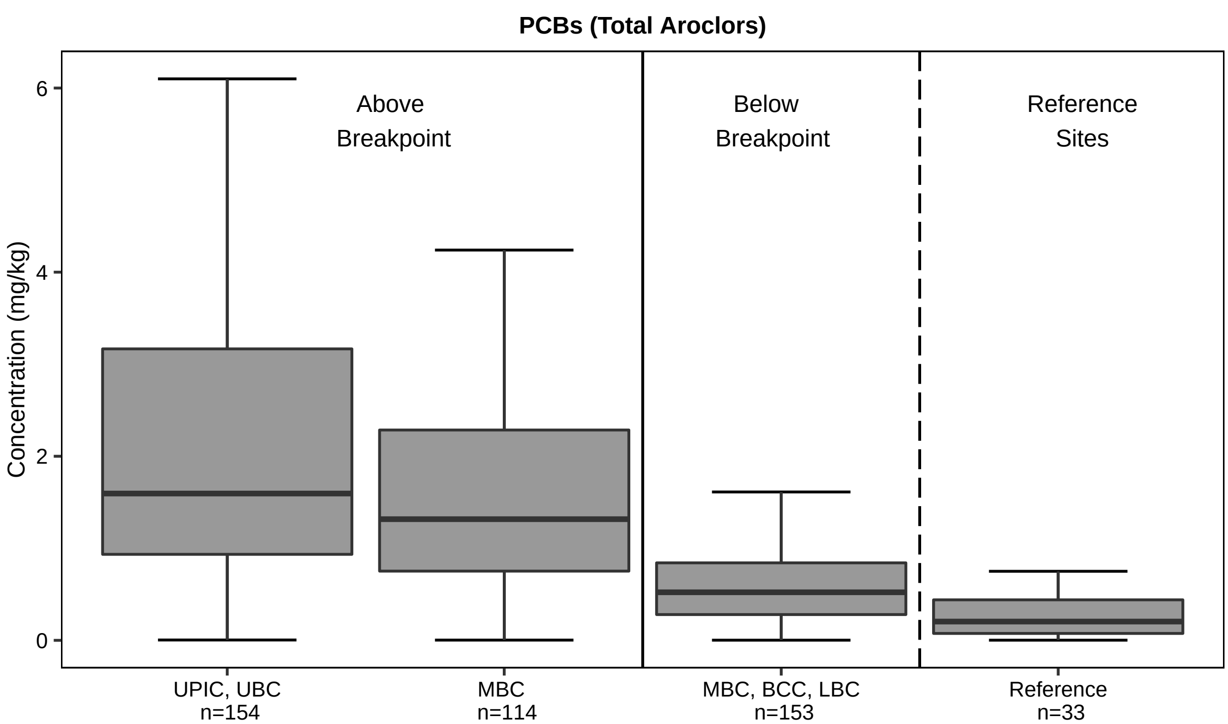
N

Scope of the Phase 1 Remediation Area

Berry's Creek Study Area Record of Decision

Figure 11





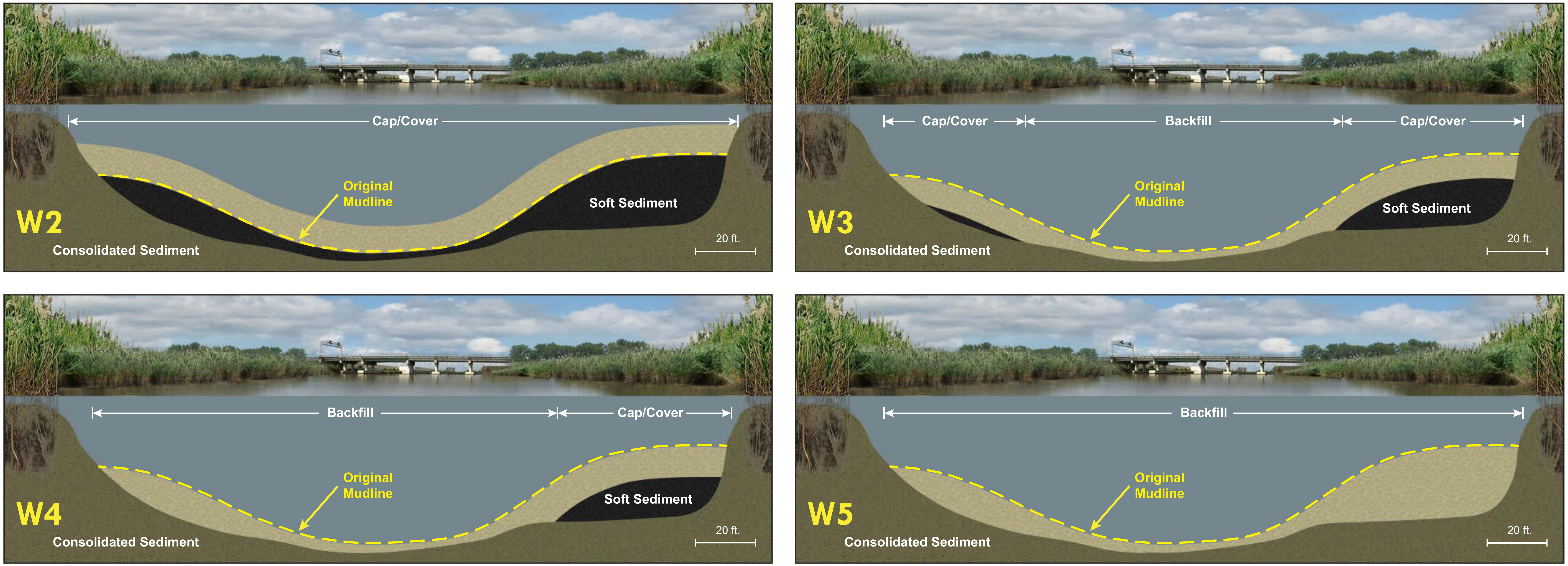
Horizontal lines are medians, boxes show the interquartile range (IQR; data range for 25th−75th percentile), and whiskers show the full range excluding outliers (<1.5 times the IQR).

Notes:
BAZ sediment represents samples collected from the waterways and tributaries. Nondetects included at the minimum detection limit. BAZ = biologically active zone.

COC Concentrations in Waterway BAZ Sediment - Breakpoint

Berry's Creek Study Area Record of Decision

Figure **12**

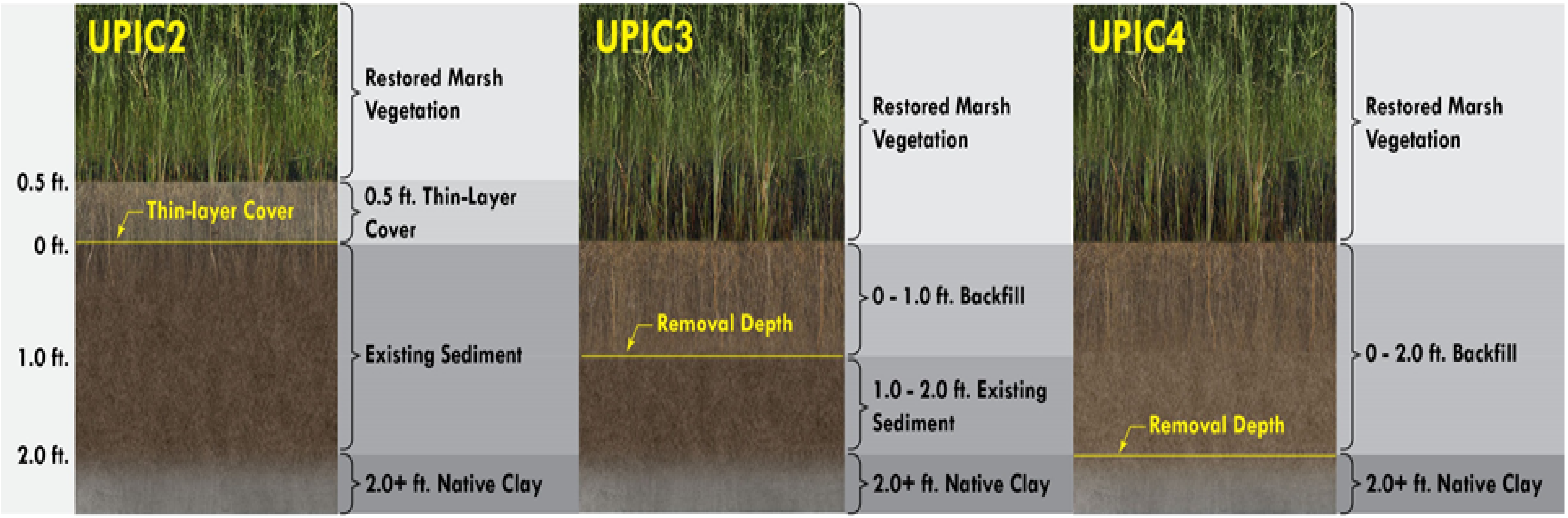


Notes:
1. Cross sections are shown at approximate 3X vertical exaggeration.

Illustration of BCSA Alternatives W2 through W5 Showing Areas of Partial and Full Removal of Soft Sediment

Berry's Creek Study Area Record of Decision

Figure
13



UPIC3-A is a hybrid of the above:

- 1-foot excavation/backfill for most of UPIC marsh
- 2-feet excavation/backfill within 10 feet of waterways
- Thin-layer cover near radio towers

Illustrations of UPIC Marsh ALternatives UPIC2, UPIC3 and UPIC4

Berry's Creek Study Area Record of Decision

Figure **14**

Segment	Area (acres)
1-foot removal + backfill	22.8
Thin-layer cover	3.8
2-foot removal along marsh banks	1.6

Notes:
- 2014 Bathymetry Digital Elevation Model (DEM) is based on LiDAR data collected by Meadowlands Environmental Research Institute (MERI) and bathymetric surveys performed in 2008 and 2014 as part of the Remedial Investigation.
- Base map source: NJ Imagery, Natural, 2012.
- Boundary of thin-layer cover area provides minimum 20-foot offset from radio towers.

Upper Peach Island Creek Marsh Alternative UPIC3-A: Hybrid - Removal + Backfill and Thin-layer Cover

Berry's Creek Study Area Record of Decision

Figure 15

Path: P:\GIS\GISProjects\CHR8261 - BCSA\Feasibility Study\MXDs\Figure 10 UPIC5 20180205.mxd; Author: ARO-DMeric; Date Saved: 2/5/2018

Marsh Demonstration Project Location – Eight Day Swamp

Berry's Creek Study Area Record of Decision

Figure 16

BERRY'S CREEK STUDY AREA
OU2 of the VENTRON/VELSICOL SITE
RECORD OF DECISION
APPENDIX 2 TABLES

Berry's Creek Study Area Record of Decision
Table 1. Median Waterway Surface Sediment Concentrations by Reach (mg/kg)

Contaminant of Concern	UPIC	UBC	MBC	BCC	LBC
Mercury	87	43	18	5.9	3.5
Methyl Mercury	0.026	0.023	0.013	0.012	0.006
Total PCBs	2.5	1.5	1.2	0.54	0.49
Chromium	570	329	244	161	161

Reach	Concentration (mg/kg wet weight)								
	Mummichog			White Perch			Fiddler Crab		
	Mercury	Methyl Mercury	PCBs	Mercury	Methyl Mercury	PCBs	Mercury	Methyl Mercury	PCBs
UPIC	0.29	0.11	1.2	--	--	--	--	--	--
UBC	0.31	0.16	1.1	0.32	0.35	5.1	0.72	0.080	1.3
MBC	0.21	0.16	0.81	0.32	0.31	5.2	0.29	0.061	0.53
BCC	0.15	0.14	0.47	0.22	0.22	2.6	0.16	0.039	0.26
LBC	0.13	0.080	0.33	0.25	0.22	2.1	0.14	0.040	0.18
REF	0.095	0.079	0.38	0.18	0.19	1.5	0.092	0.027	0.24

Notes:

REF = reference site

-- = No data

All concentrations are for composited whole body samples.

White perch are for target size (150–190 mm) samples.

Median COPC Concentrations in Biota in BCSA Reaches and Reference Sites

Berry's Creek Study Area Record of Decision -Table 3 BHHRA - Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations								
Scenario Timeframe: Current/future **Medium: Surface Water and Sediment - UBC** **Exposure Medium: Fish**								
Exposure Point	**Chemical of Concern**	**Concentration Detected**		**Concentration Units**	**Frequency of Detection**	**Exposure Point Concentration**	**Exposure Point Concentration Units**	**Statistical Measure**
		Min	**Max**					
white perch - fillet	PCBs (total Aroclors)	0.13	3.4	mg/kg	52/52	1.5	mg/kg	95% Chebyshev (Mean, SD) UCL

Berry's Creek Study Area Record of Decision -Table 3
BHHRA - Summary of Chemicals of Concern and
Medium-Specific Exposure Point Concentrations

Berry's Creek Study Area Record of Decision -Table 3 BHHRA - Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations								
Scenario Timeframe: Current/future **Medium: Surface Water and Sediment - MBC** **Exposure Medium: Fish**								
Exposure Point	**Chemical of Concern**	**Concentration Detected**		**Concentration Units**	**Frequency of Detection**	**Exposure Point Concentration**	**Exposure Point Concentration Units**	**Statistical Measure**
		Min	**Max**					
white perch - fillet	PCBs (total Aroclors)	0.11	3.2J	mg/kg	59/59	1.2	mg/kg	95% Chebyshev (Mean, SD) UCL

Berry's Creek Study Area Record of Decision -Table 3 BHHRA - Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations								
Scenario Timeframe: Current/future **Medium: Surface Water and Sediment - BCC** **Exposure Medium: Fish**								
Exposure Point	**Chemical of Concern**	**Concentration Detected**		**Concentration Units**	**Frequency of Detection**	**Exposure Point Concentration**	**Exposure Point Concentration Units**	**Statistical Measure**
		Min	**Max**					
white perch - fillet	PCBs (total Aroclors)	0.056J	2.9	mg/kg	59/59	1.2	mg/kg	95% Chebyshev (Mean, SD) UCL

Summary of Chemicals of Concern and Medium-Specific Exposure Point Concentrations

This table presents the primary chemical of concern (COC) and its exposure point concentration in white perch fillet (i.e., the concentration that will be used to estimate the exposure and risk from PCBs (total Aroclors)). The table includes the range of concentrations detected for PCBs, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC and how it was derived.

Berry's Creek Study Area Record of Decision - Table 4
BHHRA - Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Sediment	Sediment	Surface sediment (0-15 cm) Marsh and mudflat at access points, all reaches	Angler/Crabber	Adult and Older child (6 to <18)	Ingestion	Quantitative	Recreational users may incidentally ingest particles of bank or nearshore sediment while fishing of crabbing. Contact with bank/nearshore sediment less likely in BCC (which has less exposed shoreline) and in UBC, where recreational us is less likely due to shallow waters, compared to other study segments. Contact with marsh sediment may occur while they are walking to waterway access point.
						Dermal contact	Quantitative	Recreational users may come into contact with bank or nearshore sediment while fishing or crabbing. Contact with marsh sediment may occur while they are walking to waterway access point.
			Surface sediment (0-15 cm) Marsh and mudflat at access points, all reaches	Kayaker/Canoer	Adult and Older child (6 to <18)	Ingestion	Quantitative	Kayakers and canoers may incidentally ingest particles of nearshore sediment while recreating in the area. Contact with nearshore sediment is less likely in BCC and UBC for reasons noted above. Contact with marsh sediment may occur while they are walking to waterway access point.
						Dermal contact	Quantitative	Kayakers and canoers may come into contact with nearshore sediment while recreating. Contact with mudflat sediment is less likely in BCC and UBC for reasons noted above. Contact with marsh sediment may occur while they are walking to waterway access point.
			Surface sediment (0-15 cm) Marsh and mudflat at access points, all reaches	Local worker	Adult	Ingestion	Qualitative	Local workers may incidentally ingest particles of bank or nearshore sediment while fishing or crabbing. Contact with marsh sediment may occur while they are walking to walkway access point. Adult angler/crabber sediment ingestion will serve as a surrogate for this receptor group.
						Dermal contact	Qualitative	Local workers may come into contact with bank or nearshore sediment while fishing or crabbing. Contact with marsh sediment may occur while they are walking to walkway access point. Adult angler/crabber sediment dermal contact will serve as a surrogate for this receptor group.
			Waterway and marsh sediment, all depths, all reaches	Construction worker	Adult	Ingestion	Quantitative	Workers may be involved in construction or maintenance activities that result in direct contact with waterway and marsh sediment.
						Dermal contact	Quantitative	Workers may be involved in construction or maintenance activities that result in direct contact with waterway and marsh sediment.

Berry's Creek Study Area Record of Decision - Table 4
BHHRA - Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Current/Future	Surface water	Surface water	Surface water, waterways, all reaches	Angler/Crabber	Adult Older child (6 to <18)	Dermal contact	Quantitative	Construction/Utility workers may come into contact with contaminants in soil through incidental ingestion of and dermal contact with soil, and inhalation of particulates released from soil while working in the upland areas.
				Kayaker/Canoer	Adult Older child (6 to <18)	Dermal contact	Quantitative	Recreational users may contact surface water while fishing or crabbing.
						Ingestion	Quantitative	Overboard kayakers/canoers will be exposed via dermal contact with surface water.
				Local worker	Adult	Dermal contact	Qualitative	Local workers may come into contact with surface water while fishing or crabbing. Adult angler/crabber surface water dermal contact will serve as a surrogate for this receptor group.
				Construction worker	Adult	Dermal contact	Qualitative	Construction workers may come into contact with surface water. Potential contact will likely be minimal because the exposure will be infrquent and of short duration.
		Ambient air	Ambient air - Mercury vapor, waterways, all reaches	Angler/crabber	Adult Older child (6 to <18)	Inhalation	Quantitative	Receptors could inhale volatiles released to ambient air from surface water.
				Kayaker/Canoer	Adult Older child (6 to <18)	Inhalation	Quantitative	Kayakers and canoers could inhale volatiles relesased to ambient air from surface water.
				Local and construction	Adult	Inhalation	Quantitative	Workers could inhale volatiles released to ambient air from surface water.
	Surface water & sediment	Fish	Finfish - Fillets, Shellfish - Blue crab, waterways, all reaches	Angler/Crabber	Adult Older child (6 to <18) Younger child (0 to <6)	Ingestion	Quantitative	Recreational anglers may consume some portion of catch. This exposure could occur in all study segments; however, the species caught and consumed could vary given the variable salinity conditions throughout BCSA which could affect species presence and abundance. Adult anglers are assumed to bring home catch for a younger child to consume.
				Local worker	Adult	Ingestion	Qualitative	Local workers who fish are expected to consume some portion of each catch. This exposure could occur in all study segments; however, the species caught and consumed could cary given the variable salinity conditions throughout BCSA which could affect species presence and abundance. Adult recreational fish ingestion exposure will serve as a surrogate for this receptor group.

Berry's Creek Study Area Record of Decision - Table 4
BHHRA - Selection of Exposure Pathways

Scenario Timeframe	Medium	Exposure Medium	Exposure Point	Receptor Population	Receptor Age	Exposure Route	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Future Only	Surface water	Surface water	Surface water, waterways, all reaches	Swimmer	Adult Older child (6 to <18)	Dermal contact Ingestion	Qualitative	Swimming is not a current recreational activity in BCSA waterways. Future exposures will be evaluated qualitatively based on the current use Kayaker/Canoer exposure.
		Ambient air	Ambient air - Mercury vapor, waterways, all reaches	Swimmer	Adult Older child (6 to <18)	Inhalation	Qualitative	Swimming is not a current recreational activity in BCSA waterways. Future exposures will be evaluated qualitatively based on the current use Kayaker/Canoer exposure.
				Hiker in marsh	Adult Older child (6 to <18)	Inhalation	Qualitative	Future recreational improvements to BCSA could allow receptros to enter portions of the marsh beyond the existing waterway access areas evalauted for recreational receptor groups under the current land use scenarios. Future exposures will be evaluated qualititaively based on the current use evaluation.
	Sediment	Sediment	Surface sediment (0-15 cm) Mudflat at waterway access points, all reaches	Swimmer	Adult Older child (6 to <18)	Dermal contact Ingestion	Qualitative	Swimming is not a current recreational activity in BCSA waterways. Future exposures will be evaluated qualitatively based on the current use Kayaker/Canoer exposure.
			Surface sediment (0-15 cm) Mudflat at waterway access points, all reaches	Swimmer	Adult Older child (6 to <18)	Dermal contact Ingestion	Qualitative	Swimming is not a current recreational activity in BCSA waterways. Future exposures will be evaluated qualitatively based on the current use Kayaker/Canoer exposure.
			Surface sediment (0-15 cm) Marsh at future recreational areas	Hiker in marsh	Adult Older child (6 to <18)	Dermal contact Ingestion	Qualitative	Future recreational improvements to BCSA could allow receptros to enter portions of the marsh beyond the existing waterway access areas evalauted for recreational receptro groups under the current land use scenarios. Future exposures will be evaluated qualitatively based on the current use evalaution.

Key
cm: centimeter
Quantitative = Quantitative risk analysis performed
Qualitative = Qualitative risk analysis performed.

Berry's Creek Study Area Record of Decision - Table 5
BHHRA - Noncancer Toxicity Data Summary

Pathway: Ingestion of fish										
Chemicals of Concern	**Chronic/ Subchronic**	**Oral RfD Value**	**Oral RfD Units**	**Absorp. Efficiency (Dermal)**	**Adjusted RfD (Dermal)**	**Adj. Dermal RfD Units**	**Primary Target Organ**	**Combined Uncertainty /Modifying Factors**	**Sources of RfD Target Organ**	**Dates of RfD**
PCBs (total Aroclors)	Chronic	2.00E-05	mg/kg-day	1	2.00E-05	mg/kg-day	immunological, dermal, ocular	300	IRIS	Sept. 2017

Key
mg/kg-day: milligram per kilogram-day

Berry's Creek Study Area Record of Decision - Table 6 BHHRA - Cancer Toxicity Data Summary							
Pathway: Ingestion of fish							
Chemical of Concern	**Oral Cancer Slope Factor**	**Units**	**Adjusted Cancer Slope Factor (for Dermal)**	**Slope Factor Units**	**Weight of Evidence/ Cancer Guideline**	**Source**	**Date**
PCBs (total Aroclors)	2.00E+00	per mg/kg-day	2.00E+00	per mg/kg-day	B2	IRIS	Sept. 2017

Key
per mg/kg-day: per milligram per killigram-day or 1/(milligram per killigram-day)
IRIS: Integrated Risk Information System

Weight of Evidence definitions:

A: Human carcinogen
B1: Probable human carcinogen - Indicates that limited human data are available
B2: Probable human carcinogen - Indicates sufficient evidence in animals and inadequate or no evidence in humans
C: Possible human carcinogen
D: Not classifiable as a human carcinogen
E: Evidence of noncarcinogenicity

BHHRA -Cancer Toxicity Data Summary

While PCBs may be carcinogenic, they did not pose an unacceptable carcinogenic risk via any of the exposure pathways evaluated at the site.

Berry's Creek Study Area Record of Decision - Table 7
BHHRA - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Adult

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
UBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Older child (6 - <18)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
UBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Young child (0 - <6)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
UBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	3	-	-	3

Berry's Creek Study Area Record of Decision - Table 7
BHHRA - Risk Characterization Summary - Non-Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Older child (6 - <18)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
MBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Young child (0 - <6)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
MBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Older child (6 - <18)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
BCC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Young child (0 - <6)

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Primary target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
BCC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	immunological, dermal, ocular	2	-	-	2

Key

- : no available data

BHHRA - Risk Characterization Summary - Non-Carcinogens

PCBs (total Aroclors) in white perch fillets posed the sole unnaceptable noncancer hazard at the site. Hazard indices in LBC were below 1 and therefore, not included here. Hazard indices for adults consuming fish in MBC and BCC were at 1 and also not included in this table.

Berry's Creek Study Area Record of Decision - Table 8
BHHRA - Risk Characterization Summary - Carcinogens

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
UBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	3.00E-05	-	-	3.00E-05

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
MBC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	2.00E-05	-	-	2.00E-05

Scenario Timeframe: Current/Future
Receptor Population: Anglers
Receptor Age: Lifetime

Medium	Exposure Medium	Exposure Point	Chemical Of Concern	Carcinogenic Risk			
				Ingestion	Inhalation	Dermal	Exposure Routes Total
BCC surface water & sediment	fish	white perch fillet	PCBs (total Aroclors)	2.00E-05	-	-	2.00E-05

Key
- : no available data

BHHRA - Risk Characterization Summary - Carcinogens

While PCBs may be carcinogenic, they did not pose an unacceptable carcinogenic risk via any of the exposure pathways evaluated at the site.

Table 9: BERA - Summary Hazard Quotients for Waterway Wildlife Receptors

Receptor	Contaminants	NOAEL HQ						LOAEL HQ					
		UPIC	UBC	MBC	BCC	LBC	Ref	UPIC	UBC	MBC	BCC	LBC	Ref
Spotted Sandpiper	Mercury (inorganic)	12	16	2.3	0.73	1.0	0.73	5.9	8.1	1.1	0.37	0.50	0.36
	Chromium (total)	12	15	6.8	3.1	3.9	5.4	2.0	2.5	1.2	0.52	0.66	0.91
Black-Crowned Night Heron	Methyl mercury	--	1.4	1.7	1.4	0.81	0.74	--	0.28	0.34	0.28	0.16	0.15
	PCBs (total Aroclors)	--	2.1	1.6	0.64	0.58	0.53	--	0.21	0.16	0.064	0.058	0.053
Great Blue Heron	Methyl mercury	0.76	1.5	1.7	1.2	1.0	0.83	0.15	0.31	0.33	0.24	0.20	0.17
	PCBs (total Aroclors)	1.4	4.8	3.7	1.6	1.3	1.0	0.14	0.48	0.37	0.16	0.13	0.10

BCC = Berry's Creek Canal
HQ = hazard quotient
LBC = Lower Berry's Creek
LOAEL = lowest-observed-adverse-effects level
MBC = Middle Berry's Creek
NOAEL = no-observed-adverse-effects level
PCB = polychlorinated biphenyl
Ref = Reference location
TRV = toxicity reference value
UBC = Upper Berry's Creek
UPIC = Upper Peach Island Creek
-- = not available/no data
Shaded = HQ>1

Table 10: BERA - Summary Surface Water Hazard Quotients for Fish

Contaminants	Total/Dissolved	Hazard Quotient					
		UPIC	UBC	MBC	BCC	LBC	Reference
Mercury (total)	Dissolved	1.6	0.021	0.011	0.0046	0.0039	0.0037
PCBs (total Aroclors)	Total	2.6	0.62	0.31	0.50	0.12	0.21

BCC = Berry's Creek Canal
MBC = Middle Berry's Creek
PCB = polychlorinated biphenyl
HQ = hazard quotient
LBC = Lower Berry's Creek
UBC = Upper Berry's Creek
Shaded = HQ>1
UPIC= Upper Peach Island Creek
-- = not available/no data

Berry's Creek Study Area Record of Decision

Table 11: BERA - Summary of Hazard Quotients for Muskrat (Marsh Receptor)

Contaminant	**NOAEL HQ**									**LOAEL HQ**								
	Nevertouch Marsh	Eight Day Swamp	Paterson Plank Marsh	Walden Swamp	Ackerman's East Marsh	Rutherford Marsh	Oritani Marsh	EnCap	Reference	Nevertouch Marsh	Eight Day Swamp	Paterson Plank Marsh	Walden Swamp	Ackerman's East Marsh	Rutherford Marsh	Oritani Marsh	EnCap	Reference
Chromium (total)	1.3	3.5	0.64	2.0	19	0.65	0.92	2.0	2.7	0.055	0.14	0.027	0.082	0.79	0.027	0.038	0.082	0.11

EnCap = Former EnCap Restoration Area
HQ = hazard quotient
LOAEL = lowest-observed-adverse-effects level
NOAEL = no-observed-adverse-effects level
TRV = toxicity reference value
-- = not available/no data
Shaded = HQ>1

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
Executive Order 11988, Floodplain Management 40 CFR Part 6, Appendix A, §3a,	Requires federal agencies to evaluate the potential adverse effects associated with direct and indirect development of a floodplain. Alternatives that involve modification/construction within a floodplain may not be selected unless a determination is made that no practicable alternative exists. If no practicable alternative exists, potential harm must be minimized, and action taken to restore and preserve the natural and beneficial values of the floodplain.	TBC	Applicable because the remedy involves potential effects on BCSA floodplains.
Executive Order 11990, Wetlands Protection 40 CFR Part 6, Appendix A, §3c	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands, and preserve and enhance natural and beneficial values of wetlands. If remediation is required within wetland areas and no practical alternative exists, potential harm must be minimized, and the agency must act to restore and preserve the wetlands' natural and beneficial values.	TBC	Applicable. Disturbance to waterway sediments and marshes in the BCSA will be mitigated by reestablishing the pre-remedy stability and ecological function of the disturbed areas.
FISH AND WILDLIFE COORDINATION ACT			
Fish and Wildlife Coordination Act 16 U.S.C §662	Whenever the waters of any stream or other body of water are proposed or authorized to be impounded, diverted, the channel deepened, or the stream or other body of water otherwise controlled or modified for any purpose, by any department or agency of the United States, such department or agency shall first consult with the United States Fish and Wildlife Service (USFWS), Department of the Interior, and with the head of the agency exercising administration over the wildlife resources of the particular State in which the impoundment, diversion, or other control facility is to be constructed, with a view to the conservation of wildlife resources by preventing loss of and damage to such resources.	ARAR	Applicable. The remedy involves disturbance or construction in Berry's Creek or its tributaries. Consultation with USFWS will occur during remedial design.

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT			
Public Law 94-265, as amended through Oct. 11, 1996	Requires that federal agencies consult with National Marine Fisheries Services on actions that may adversely affect essential fish habitats, defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity."	ARAR	Applicable. Portions of the BCSA have been designated as essential fish habitat.
MIGRATORY BIRD TREATY ACT			
16 U.S.C. § 703-712	Requires that federal agencies consult with USFWS during the RD and remedial construction to ensure that the cleanup of the site does not unnecessarily impact migratory birds.	ARAR	Applicable. Consultation with USFWS will occur during remedial design.
ENDANGERED SPECIES			
Endangered Species Act of 1973 as amended 16 U.S.C. §§1530–1544 50 CFR Part 17, Subpart I; Part 402	Requires federal agencies to verify that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of any endangered species or threatened species, or result in the destruction or adverse modification of a critical habitat of such species, unless such agency has been granted an appropriate exemption by the Endangered Species Committee (16 U.S.C. § 1536).	ARAR	Applicable. Migratory endangered species may be found in the BCSA on occasion.
New Jersey Endangered Species Conservation Act N.J.S.A. 23:2A N.J.A.C. 7:5C	Prohibits the unauthorized taking of endangered wildlife.	ARAR	Applicable. Listed species may be present in the BCSA.

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJDEP)			
New Jersey Coastal Zone Management Rules N.J.A.C. 7:7	Provides rules and standards for any development, including sediment removal and fill, at or below mean high water line of all coastal and tidal waters, up to 500 feet from the mean high water of coastal and tidal waters of the State, in all areas containing tidal wetlands, and in the Hackensack Meadowlands District. The rules are used in the review of water quality certificates subject to Section 401 of the Federal Clean Water Act, and Federal consistency determinations under Section 307 of the Federal Coastal Zone Management Act, 16 U.S.C. § 1456.	ARAR	Applicable to the elements of the remedy that involve construction, sediment removal, and fill in or adjacent to Berry's Creek or its tributaries.
Freshwater Wetlands Protection Act N.J.A.C. 7:7A	Regulates all dredging and sediment disturbance or removal activities in freshwater wetlands.	ARAR	Substantive standards applicable to the disturbance of Berry's Creek and UPIC marsh. Disturbance to waterway sediments and marshes in the BCSA will be mitigated by reestablishing the pre-remedy stability and ecological function of the disturbed areas.
New Jersey Flood Hazard Area Control Act, N.J.S.A. 58:16A-50, Flood Hazard Area Program N.J.A.C. 7:13	Establishes standards for regulated activities (including remedial actions) in flood hazard areas and riparian zones adjacent to surface waters throughout the State, to protect the public from the hazards of flooding, preserve the quality of surface waters, and protect the wildlife and vegetation that exist within and depend upon such areas for sustenance and habitat. EPA does not expect the elevation of Berry's Creek or the marsh to be increased above current conditions. Potentially applicable to placement of cover material over existing marsh near radio towers, and to construction of support facilities, depending on location.	ARAR	Potentially applicable. Substantive standards will be met for elements of the remedy that may increase impacts of flood water. If necessary, flood storage will be addressed during remedial design to account for net fill placed in marsh. .

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
New Jersey Meadowlands Commission N.J.A.C. 19:3-4	Regulates all activities in the Hackensack Meadowlands District. Contains performance standards regarding wastewater, hazardous substances, noise, and vibrations.	ARAR	Applicable. Performance standards will be addressed in remedial design.
RIVERS AND HARBORS ACT OF 1899			
33 U.S.C. §§ 401–403. Dredging in Navigable Waters of the US 33 CFR Part 322	Requires coordination with United States Army Corps of Engineers (USACE) for dredging and filling work performed in navigable waters of the US as part of the remedy. Activities that could impede navigation and commerce are prohibited.	ARAR	Substantive standards applicable because the remedial action involves dredging and filling of navigable water (see also Nationwide Permit 38 standards).
HISTORIC PRESERVATION			
National Historic Preservation Act 16 U.S.C. § 470 et seq. 36 CFR Part 800	Establishes procedures to provide for preservation of scientific, historical, and archaeological data that might be destroyed through alteration of terrain as a result of a federal construction project or a federally licensed activity or program. If scientific, historical, or archaeological artifacts are discovered at the site, work affected by such discovery will be halted pending the completion of any data recovery and preservation activities required pursuant to the Act and its implementing regulations. New Jersey administers this program within the state and has integrated the New Jersey Register of Historic Places program with the National Register Program.	ARAR	Applicable if any part of the BCSA is listed or is eligible for listing in the National Register of Historic Places. Potentially applicable during remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy. During remedial design, efforts will be conducted as necessary to comply with the NHPA and aid in consultations with the New Jersey Historic Preservation Office. (See below.)
New Jersey Register of Historic Places Act N.J.S.A. 13:1B-15.128 et seq N.J.A.C. 7:4	The New Jersey Register of Historic Places Act requires that actions by state, county, or local governments, which may impact a property listed in the New Jersey Register of Historic Places, be reviewed and authorized through the Historic Preservation Office ("HPO"). The HPO also provides advice and comment for a number of permitting programs within the Department of Environmental Protection.	ARAR	Applicable if any part of the BCSA is listed in the New Jersey Register of Historic Places. Potentially applicable during remedial activities if scientific, historic, or archaeological artifacts are identified during implementation of the remedy.

Table 13 - Action-Specific Federal and State ARARs and TBCs

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
CLEAN WATER ACT (CWA)			
Water Quality Certification CWA § 401, 40 CFR §121.2	Requires any applicant for a federal license or permit which may result in a discharge into navigable waters to obtain certification of compliance with state effluent discharge standards.	ARAR	Substantive standards applicable because the remedy will include discharges to navigable waters.
National Pollutant Discharge Elimination System (NPDES) CWA § 402 40 CFR Parts 122, 401	Regulates discharges of pollutants into navigable waters.	ARAR	Substantive standards applicable because the remedy will include discharges to surface water.
Federal Ambient Water Quality Criteria CWA § 304(a)	Requires EPA to establish ambient water quality criteria that will be used by states as guidance for state water quality standards.	ARAR	Along with State water quality standards, federal criteria may be applicable if the remedial action involves discharges to surface water or groundwater.
Guidelines for Specification of Disposal Sites for Dredged or Fill Material CWA §404 40 CFR Part 230 40 CFR §§ 230.91–.98	Regulates the discharge of dredged or fill material into the waters of the U.S., including wetlands. This program is implemented through regulations set forth in the 404(b)(1) guidelines, 40 CFR Part 230. The guidelines specify the types of information and environmental conditions that need to be evaluated for impacts on the aquatic ecosystem and provide for compensatory mitigation when there will be unavoidable impacts to waters of the United States.	ARAR	Applicable. During remedial design, best management practices and engineering practices will be identified for use during implementation of the remedy to avoid or minimize adverse impacts to aquatic habitat. The aquatic habitat affected by the remedy will be replaced with habitat of similar size and location, but significantly improved quality, so no additional mitigation is anticipated.

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
TOXIC SUBSTANCES CONTROL ACT OF 1976 (TSCA)			
15 U.S.C. §§ 2601 et seq. 40 CFR Part 761 Subpart D	Regulates disposal of PCB remediation waste.	ARAR	Applicable if the remedial alternative involves removal and disposal of sediment that is classified as PCB remediation waste.
MERCURY EXPORT BAN ACT OF 2008			
15 U.S.C. Section 2611 Public Law 110-414 (122 STAT. 4341–4348)	Establishes export and resale ban of elemental mercury containing materials. Remediation waste may be exported for treatment/disposal but not for sale or reuse of any recovered mercury.	ARAR	Applicable if the remedy generates dredged material for disposal containing elemental mercury.
RESOURCE CONSERVATION AND RECOVERY ACT OF 1976 (RCRA)			
40 CFR Parts 260-268: Off-site Land Disposal, Subtitle C	Soil and/or sediment that is excavated for off-site disposal and hazardous waste must be managed in accordance with the requirements of RCRA.	ARAR	Applicable if the remedial alternative involves off-site disposal of hazardous waste.
40 CFR Part 258: Off-site Land Disposal, Subtitle D	Provides criteria for municipal solid waste landfills, establishes requirements for the operation of landfills accepting non-hazardous solid waste.	ARAR	Applicable to the dredged material that is being managed as non-hazardous waste. Substantive standards applicable to the on-site construction and operations of a facility for the disposal of non-hazardous waste.
40 CFR 262, Subparts C and D: Standards Applicable to Generators of Hazardous Waste: The Manifest, Pre-transport Requirements, Record Keeping and Reporting	Provides criteria that generators must follow for determining if a waste is hazardous, and for transporting, recordkeeping, and other activities involving hazardous waste.	ARAR	Applicable to the dredged material that is being managed as hazardous waste.

Relevant and Appropriate Requirements and TBCs	**Descriptive Summary**	**ARAR or TBC**	**Comment**
49 CFR 172, 173, 178 and 179: Department of Transportation Requirements for Packaging, Labeling and Marking Hazardous Waste for Transport	Transportation of hazardous materials on public roadways must comply with these requirements.	ARAR	Applicable to the dredged material that is being managed as hazardous waste.
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJDEP)			
New Jersey Water Pollution Control Act N.J.S.A. 58:10A et seq. New Jersey Pollutant Discharge Elimination System (NJPDES) N.J.A.C. 7:14A	Prohibits all unpermitted discharges into surface and ground waters, pursuant to federal and New Jersey law. Establishes effluent discharge standards to protect water quality. Specifically, NJAC 7:14A-12.11(d) and -12 Appendix B provide toxic effluent standards for site remediation projects.	ARAR	Substantive requirements applicable because the remedy will include discharges to surface water.
Surface Water Quality Standards N.J.A.C. 7:9B	Establishes the designated uses and antidegradation categories of the State's surface waters, classifies surface waters based on those uses (*i.e.*, stream classifications), and specifies the water quality criteria and other policies and provisions necessary to attain those designated uses.	ARAR	Applicable if the remedial alternative involves discharges to surface water.[1]
Technical Requirements for Site Remediation N.J.A.C. 7:26E	Establishes the technical requirements to remediate a contaminated site under New Jersey cleanup programs.	ARAR	Substantive technical requirements of N.J.A.C 7:26 E are potentially relevant and appropriate to the BCSA; the procedural requirements are not ARARs or TBCs.

[1] In 2001, EPA published a methylmercury criterion based on tissue sampling methodologies and data on human exposure to mercury. EPA, *Water Quality Criterion for the Protection of Human Health: Methylmercury*, EPA-823-R-01-001 (2001); 66 Fed. Reg. 1344 (Jan. 8, 2001). This approach is expressed as a fish and shellfish tissue value rather than as a water column value. In the event that the remediation action involves discharges to surface waters, the federal criterion for methylmercury may be relevant and appropriate.

Relevant and Appropriate Requirements and TBCs	Descriptive Summary	ARAR or TBC	Comment
New Jersey Noise Control N.J.S.A. § 13:1g-1 et seq. N.J.A.C. 7:27	Regulates noise levels for certain types of activities and facilities such as commercial, industrial, community service and public service facilities.	ARAR	Relevant and appropriate.
U.S. ENVIRONMENTAL PROTECTION AGENCY			
Treatment Technologies for Mercury in Soil, Waste, and Water (EPA 2007)	Mercury treatment for disposal or site specification. As a technology overview document, the report is intended to be used as a screening tool for mercury treatment technologies and the information can serve as a starting point to identify options for mercury treatment.	TBC	

Table 14: Summary of Cost Estimate - Alternative W4: 2-foot Sediment Removal + Backfill

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
DIRECT CAPITAL COSTS (DCC)					
A. Pre-Construction Activities (PCA)					
Property Access Agreements	LS	1	$250,000	$250,000	- Lump Sum cost to obtain necessary property access agreements
Property Leasing for Support Areas	YR	4	$7,200,000	$28,800,000	- 24 acres (22 acre upland areas and two (2) 1-acre sites adjacent to waterways/tributaries) @ $300,000/acre/year. See Notes 9 and 16.
Institutional and Access Controls	YR	2	$117,000	$234,000	- Includes fish advisories, controls to protect backfill layer, and site access restrictions - Two (2) individuals @ 0.25 full time equivalents @$100/hr for every other year of project (years 1 and 3) - Includes $13,000/yr for equipment and materials required for signage
Contractor Plans & Submittals	LS	1	$334,000	$334,000	- Costs associated with preparation of pre-construction and monthly operational submittals
Subtotal Pre-Construction Activities				***$29,618,000***	
B. Mobilization/Demobilization					
Initial	LS	1	$5,640,000	$5,640,000	- Includes all equipment, labor and materials required for mobilization/demobilization - Initial mobilization/demobilization costs equal to 5% of related direct capital costs
Seasonal	EA	3	$2,233,300	$6,700,000	- 50% of initial mobilization/demobilization cost for each applicable remedial task per season - 2 seasonal mob/demob for dredging/backfilling and 3 seasonal mob/demob for site support and sediment processing
Storm Related	EA	1	$1,410,000	$1,410,000	- Assume one (1) storm-event during duration of project @ 25% of initial mobilization/demobilization costs
Subtotal Mobilization/Demobilization				***$13,750,000***	
C. Site Staging/Support/Access					
Site Development	AC	24	$346,500	$8,316,000	- Costs associated with development of 24 acres of support areas (clearing/grubbing, grading, paving, fencing, access roads, etc.)
Site Facilities	YR	3.5	$821,700	$2,876,000	- Includes monthly costs for offices/trailers, utilities, facilities, security and stormwater management - Unit rates are based on total costs divided by the duration (years) or size of sites (acres). Unit rates will vary between alternatives due to fixed costs.
Subtotal Site Staging/Support/Access				***$11,192,000***	
D. Sediment Removal					
Debris Removal	Week	54	$48,900	$2,640,600	- $4,500/DY for debris removal equipment and materials which is incurred each day of dredging (54 weeks) - $14,600/DY for labor costs which are only incurred 25% of dredging duration (avg 1.5 days/week)
Debris Removal - T&D	Ton	174	$85	$14,800	- Assume 2 ton/acre @ $85/ton
Mudflats/Tributaries Hydraulic Isolation - Tide gate Repair/Replacement	EA	1	$29,000	$29,000	- Includes $29,000 for tide gate repair/replacement
Mudflats/Tributaries Hydraulic Isolation - Sheet Pile Cofferdam	SQFT	7,500	$65	$488,000	- Includes 500 LF of cofferdams (15 ft long sheet pile - 7,500 ft^2) @ $65/$ft^2$
Mudflats/Tributaries Hydraulic Isolation - Portable Dams	LF	500	$200	$100,000	- Includes installation and removal of 500 LF of portable dams (sand filled Super Sacks) @ $200/LF
Mudflats/Tributaries Hydraulic Isolation - Pumps/Hoses	Week	102	12,040	$1,228,000	- Includes equipment, labor and materials required to maintain water levels within tributaries/marshes during construction four 3,000-gpm pumps @ $44,153/pump; 1,000 LF of pipe @ $20.82/LF and 1 operator 24 hrs/day, 7 days/week@ $1,408/DY; 102 weeks
Dredging - Waterways	CY	217,043	$39.70	$8,618,000	- Volumes and associated duration include a 6 inch over-dredge allowance and an additional 20% volume contingency factor - 8-in cutter suction dredge used for approximately 38,155 CY of main channel dredging @ $39/CY - 12-in cutter suction dredge used for approximately 153,388 CY of main channel dredging @ $39/CY - Approximately 25,499 CY of main channel dredging removed with amphibious excavator with 6 inch hydraulic cutting head @ $45/CY - Costs include hydraulic transport of the dredge material to the sediment management area
Dredging - Tributaries	CY	145,957	$42.81	$6,248,000	- Volumes and associated duration include a 6 inch over-dredge allowance and an additional 20% volume contingency factor - 8-in cutter suction dredge used for approximately 53,383 CY of tributaries dredging @ $39/CY - Approximately 92,574 CY of tributaries dredging removed with amphibious excavator with 6 inch hydraulic cutting head @$45/CY - Costs include hydraulic transport of the dredge material to the sediment management area
Temporary Bank Stabilization	SQFT	40,000	$65	$2,600,000	- Barge driven sheet pile - 1,000 LF (40 ft in length) @ $40/SQFT for installation and $25/SQFT for removal
Turbidity Control - Silt Curtains	LF	7,282	$100	$728,000	- 300 LF/yr of silt curtain per dredging/backfill operation (7,282 LF total) @ $100/LF
Turbidity Control - Air Curtains	LS	1	$2,704,000	$2,704,000	- Includes costs for installation of two (2) air curtain systems ($52,000/each) and associated operational costs during waterways dredging/backfilling (52 weeks @ $50,000/wk)
Bathymetric Surveys	Week	66	$21,600	$1,426,000	- $3,600/DY; 6 days/wk for duration of cap/cover placement (66 weeks)
Environmental Monitoring - Water Quality	Week	121	$17,570	$2,126,000	- Monitoring to be conducted continuously from 4 weeks prior to start of dredging to 4 weeks after completion of backfill placement (121 weeks)
Environmental Monitoring - Air/Noise	Week	149	$14,420	$2,148,000	- Monitoring to be conducted continuously from 4 weeks prior to start of dredging to 4 weeks after completion of dewatering operations (149 weeks)
Subtotal Sediment Removal				***$31,098,400***	
E. Material Processing					
Barge Berth	EA	2	$65,000	$130,000	- Construction of two (2) docks, gangways and support platforms @ $65,000/barge berth
Material Processing - Waterways/Tributaries	CY	363,000	$51.56	$18,717,000	- Includes costs for geotube dewatering, solidification with 8% (by weight) Portland Cement and material handling
Water Treatment	YR	3.5	$3,712,000	$12,992,000	- 24 hrs/DY; 7 days/week during on water operations (26 weeks); 24/6 during 12 week dewatering period following dredging and 24/2 during 14 week winter shutdown - Assumes operation of a 1,000 gpm system during dredging; a 500 gpm system during dewatering and winter shutdown @ $8,000/DY per 500 gpm
Subtotal Dredge Material Processing				***$31,839,000***	
F. Transportation & Disposal (T&D)					
Transportation & Disposal - Subtitle D	Ton	484,170	$85	$41,154,000	- 95% of loaded material to be placed in Subtitle D facility
Transportation & Disposal - Subtitle C	Ton	25,483	$185	$4,714,000	- 5% of loaded material to be placed in Subtitle C facility
Subtotal Transportation & Disposal				***$45,868,000***	
G. Backfilling					
Material Purchase/Delivery/Placement - Waterways/Tributaries	CY	417,450	$65	$27,134,000	- $30/CY for sand purchase and delivery and $35/CY for sand placement - Approximately 417,450 CY to be mechanically placed from water. See Note 15
Backfill Placement Monitoring and Verification	DY	397	$2,500	$993,000	- Daily rate for QC verification that cap/cover meets design specifications
Subtotal Backfilling				***$28,127,000***	
H. Marsh Restoration					
Marsh Restoration	AC	8	$100,000	$800,000	- Restoration of 8 acres (support areas, access roads and shoreline) disturbed during remedial activities @ $100,000/acre
Subtotal Marsh Restoration				***$800,000***	
I. Infrastructure Accommodation					
Infrastructure Accommodation	LS	1	$875,000	$875,000	- Lump sum estimate for possible additional work to accommodate Rebuild by Design or other projects in Phase I waterways footprint
Subtotal Infrastructure Accommodation				***$875,000***	

Table 14: Summary of Cost Estimate - Alternative W4: 2-foot Sediment Removal + Backfill

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
J. Storm Damage Rework					
Storm Damage Rework	CY	20,873	$65	$1,357,000	- Costs associated with replacement of 10% of backfill material halfway through backfill placement due to storm damage - Approximately 20,873 CY of sand to be placed @ $65/CY
Subtotal Storm Damage Rework				***$1,357,000***	
SUBTOTAL DIRECT CAPITAL COSTS				**$194,524,400**	- Subtotal Direct Capital Costs includes the Volume Uncertainty Contingency ($21,799,800).
Volume Uncertainty Contingency (20%)				**$0**	- Volume Uncertainty Contingency ($21,799,800) is included in the individual direct capital cost quantities and totals for Tasks A through J. These individual contingency amounts have been summed and included in Subtotal Direct Capital Costs.
General Contingency (20%)				**$38,905,000**	- Includes scope and bid contingency as defined in EPA (2000) "A Guide to Developing and Documenting Cost Estimates During Feasibility Study", exclusive of Volume Uncertainty Contingency. General Contingency is applied to Subtotal Direct Capital Costs which includes the Volume Uncertainty Contingency.
INDIRECT CAPITAL COSTS (ICC)					
K. Indirect Capital Costs					
Pre-Design Activities (8% of DCC excluding PCA and T&D)	LS	1	$9,523,000	$9,523,000	- Indirect capital costs are calculated as a percentage of Subtotal Direct Capital Costs (excluding PCA, T&D and General Contingency). See Note 4.
Regulatory/ARARs (1% of DCC excluding PCA and T&D)	LS	1	$1,190,000	$1,190,000	
Design/Procurement (5% of DCC excluding PCA and T&D)	LS	1	$5,952,000	$5,952,000	
Construction Management (6% of DCC excluding PCA and T&D)	LS	1	$7,142,000	$7,142,000	
Project Management (5% of DCC excluding PCA and T&D)	LS	1	$5,952,000	$5,952,000	
EPA/NJDEP Oversight (5% of DCC excluding PCA and T&D)	LS	1	$5,952,000	$5,952,000	
SUBTOTAL INDIRECT CAPITAL COSTS				**$35,711,000**	- Total ICCs include $4,241,000 associated with Volume Uncertainty Contingency (excluding PCA and T&D). General Contingency is not applied to ICCs.
OPERATION AND MAINTENANCE (O&M) COSTS (5 YEARS)					
L. Performance Monitoring					
Evaluating/Updating/Maintaining Institutional Access Controls (Years 1 through 5)	YR	5	$93,600	$468,000	- Two (2) individuals @ 0.25 full time equivalents @$100/hr for 5 years. Includes $13,000/yr for placement of signage - Allocate 80% of IC for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Site Wide Monitoring (Years 1 through 5)	YR	5	$1,600,000	$8,000,000	- $2,000,000/yr for UBC/MBC waterways/tributaries and UPIC marsh - Allocate 80% of Site Wide Monitoring for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Subtotal Performance Monitoring				***$8,468,000***	
M. Monitoring Data Analysis (MDA)					
MDA (Years 1 through 5)	YR	5	$160,000	$800,000	- $200,000/yr for UBC/MBC waterways/tributaries and UPIC marsh - Allocate 80% of MDA for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Subtotal MDA				***$800,000***	
N. Backfill Maintenance					
Periodic Backfill Maintenance (Years 1 through 5)	LS	1	$1,564,000	$1,564,000	- Assume 3% of backfill placed within main waterway (52 acres) will require repair/replacement one time in 5 year period - Cost includes pre-construction activities, plans & submittals, mob/demob, site staging, turbidity control, bathymetric surveys, environmental monitoring and placement. Cost includes $85,000 associated with Volume Uncertainty Contingency.
Subtotal Backfill Maintenance				***$1,564,000***	
O. Adaptive Management Actions					
Periodic Adaptive Management Actions (Years 1 through 5)	AC	52	$157,400	$8,248,000	- Includes all costs associated with a one-time placement of treatment amendment (1 lb/ft^2) to Phase 1 main waterway (52 acres) as a contingent post-remediation adaptive management action if determined necessary (based on performance monitoring) to improve remedy performance
Subtotal Adaptive Management Actions				***$8,248,000***	
SUBTOTAL DIRECT O&M COSTS				**$19,080,000**	
General Contingency (20%)				**$3,816,000**	- General Contingency is applied to the Subtotal Annual O&M Costs which includes the Volume Uncertainty Contingency of O&M task N.
P. Indirect O&M Costs					
Design (3% of Subtotal Direct O&M Costs)	LS	1	$572,000	$572,000	- Indirect O&M costs calculated as a percentage of the sum of O&M tasks L, M, N, and O. See Note 4.
Project Management (5% of Subtotal Direct O&M Costs)	LS	1	$954,000	$954,000	
Construction Management (6% of Backfill Maintenance & Adaptive Management Actions)	LS	1	$589,000	$589,000	- Construction Management costs are only associated with Backfill Maintenance (Task N) and the Adaptive Management Action (Task O).
EPA/NJDEP Oversight (5% of Subtotal Direct O&M Costs O&M Costs)	LS	1	$954,000	$954,000	
SUBTOTAL INDIRECT O&M COSTS				**$3,069,000**	- Total ICCs include $15,000 associated with Volume Uncertainty Contingency. General Contingency is not applied to ICCs.
TOTAL OPERATIONS & MAINTENANCE COSTS				**$25,965,000**	
TOTAL UNDISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL UNDISCOUNTED PROJECT COST				**$269,140,000**	
O&M UNDISCOUNTED PROJECT COST				**$25,965,000**	
TOTAL UNDISCOUNTED PROJECT COST (TUPC)				**$295,105,000**	
TUPC (Excluding Contingency)				**$226,243,000**	- Excludes both General and Volume Uncertainty Contingencies
TOTAL DISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL DISCOUNTED PROJECT COST				**$243,861,000**	- 7% Real Discount Rate
O&M DISCOUNTED PROJECT COST				**$17,381,000**	- 7% Real Discount Rate
TOTAL DISCOUNTED PROJECT COST				**$261,242,000**	

General Notes:

1. All costs rounded to nearest $1,000.
2. Cost estimate is based on current and past project experience, cost estimating resources, and vendor estimates. Costs are provided in 2018 dollars.
3. This estimate has been prepared for the purpose of comparing FS Report remedial alternatives. The information in this cost estimate is based on available information regarding the BCSA and the anticipated scope of the remedial alternative. Changes in cost elements are likely as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost if this alternative is constructed.
4. Indirect capital costs are based on *A Guide to Developing and Documenting Cost Estimates During Feasibility Study* , prepared by EPA and United States Army Corps of Engineers (USACE),. July 2000.
5. Work involves the removal, dewatering, solidification, and disposal of approximately 302,500 CY of soft sediment (including 6 inch over-dredge), plus 20% for a volume uncertainty contingency (363,000 CY total).
6. Removal and backfill volumes in this appendix may be slightly different than the volumes given in the FS Report due to the different rounding conventions used in the FS Report versus for cost estimating.
7. Backfill volume equals dredge volume plus 15% to account for material losses and settlement during placement.
8. Institutional controls include fish advisories, controls to protect backfill layer, and site access restrictions.
9. Support areas include 17 acres for a upland sediment processing and water treatment area (to include offices, trailers, etc.), 5 acres for an upland equipment and material staging area adjacent to sediment processing/water treatment area, and two, 1-acre on-water support areas adjacent to waterways/tributaries.
10. Initial mobilization/demobilization is estimated as 5% of applicable direct capital costs. Seasonal mobilization/demobilization costs are estimated as 50% of initial mob/demob. Storm related mob/demob costs are to move large equipment to high ground and are estimated as 25% of initial mob/demob.
11. Estimate based on dredging and backfilling being conducted in parallel with one month lag time.
12. Dredged material dewatering costs estimated assuming the use of geotubes. Actual method to be used will be determined as part of the remedial design.
13. Estimate based on dewatered material being solidified with 8% (by weight) Portland Cement.
14. Estimate based on 95% of material being acceptable for Subtitle D disposal.
15. Estimate based on backfill volume equaling removal volume plus an additional 15% to account for material loss, densification, and settlement during placement.
16. Project duration is estimated to be 3.5 years based on a 22-week on-water construction season assuming 3 months for winter shutdown and 3 months for fish migration an allowance of 2 weeks for contractor delays and 2 weeks for weather delays.

Table 15: Summary of Cost Estimate - Alternative UPIC3-A: Hybrid - Removal + Backfill and Thin-layer Cover

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
DIRECT CAPITAL COSTS (DCC)					
A. Pre-Construction Activities (PCA)					
Property Access Agreements	LS	1	$250,000	$250,000	- Lump Sum cost to obtain necessary access agreements for proposed remedial activities
Property Leasing for Support Areas	YR	2	$1,500,000	$3,000,000	- 5 acres for an upland site staging/processing area to be used for material handling, equipment/material storage and project administration @ $300,000/acre/year. See Notes 10 and 17.
Institutional and Access Controls	YR	1	$117,000	$117,000	- Two (2) individuals @ 0.25 Full-Time Equivalents (based on 2,080 hrs/yr) @$100/hr for first year of project - Includes $13,000/yr for equipment and materials required for signage
Contractor Plans & Submittals	LS	1	$351,000	$351,000	- Costs associated with preparation of pre-construction and monthly operational submittals
Subtotal Pre-Construction Activities				***$3,718,000***	
B. Mobilization/Demobilization					
Initial	LS	1	$1,686,000	$1,686,000	- Includes all equipment, labor and materials required for mobilization/demobilization - Initial mobilization/demobilization costs equal to 5% of related direct capital costs
Seasonal	EA	1	$80,000	$80,000	- 50% of initial mobilization/demobilization cost for each applicable remedial task per season - 1 seasonal mob/demob for site support (i.e., trailers, utilities, security, etc). Excavation/backfilling duration is estimated to be 0.7 years, therefore no seasonal mob/demob required.
Storm Related	EA	1	$418,000	$418,000	- Accounts for one (1) storm-event during duration of project @ 25% of initial mobilization/demobilization costs
Subtotal Mobilization/Demobilization				***$2,184,000***	
C. Site Staging/Support/Access					
Site Development	AC	5	$435,200	$2,176,000	- Costs associated with development of 5 acres of support areas (clearing/grubbing, grading, paving, fencing, access roads, etc.)
Site Facilities	YR	1.1	$921,000	$1,013,000	- Includes monthly costs for offices/trailers, utilities, facilities, security and stormwater management - Unit rates based on total costs divided by the duration (years) or size of sites (acres). Unit rates will vary between alternatives due to fixed costs
Subtotal Site Staging/Support/Access				***$3,189,000***	
D. Sediment Removal					
Debris Removal	DY	28.2	$8,830	$249,000	- 2 excavators @ $4,325/day each - 28.2 acres @ 1 acre/day
Debris Removal - T&D	Ton	28.2	$85	$2,400	- Based on debris removal @1 ton/acre @ $85/ton
Excavation (UPIC Marsh)	CY	69,390	$20	$1,388,000	- Two excavators @ 300 CY/Day each (600 CY/DY total) - Volumes and associated duration include a 15% volume contingency factor (69,390 CY)
Marsh Dewatering - Tide gate Repair/Replacement	EA	1	$29,000	$29,000	- Includes $29,000 for tide gate repair/replacement
Marsh Dewatering - Sheet Pile Cofferdam	SQFT	7,500	$65	$488,000	- Includes 500 LF of cofferdams (15 ft long sheet pile - 7,500 ft^2) @ $65/$ft^2$
Marsh Dewatering - Portable Dams	LF	2,000	$200	$400,000	- Includes installation and removal of 2,000 LF of portable dams (sand filled Super Sacks) @ $200/LF
Marsh Dewatering - Pumps/Hoses	Week	56	$11,860	$666,000	- Includes equipment, labor and materials required to maintain water levels within marsh during construction: two 3,000 gpm pumps @ $44,153/pump; 1,000 LF of pipe @ $22.82/LF and 1 operator 24 hrs/day, 7 days/week @ $1,408/DY; 56 weeks
Turbidity Control - Silt Curtains	LF	344	$100	$34,000	- 300 LF/yr of silt curtain per excavation/backfill operation (344 LF total) @ $100/LF
Turbidity Control - Sediment and Erosion Control	LF	5,000	$15.55	$79,000	- 5,000 LF of silt fence and hay bales to be installed around perimeter of marsh @$15.55/LF
Truck Transport (On-Site)	CY	69,390	$12	$833,000	- On-site truck transport to sediment processing area (2 mile roundtrip @ 15 mph)
Topographic Surveys	AC	98	$4,970	$485,000	- Required for excavation/backfilling - 24.4 acres (pre and post placement plus 2 interim surveys)
Environmental Monitoring - Water Quality	Week	54	$7,020	$379,000	- Monitoring to be conducted continuously from 4 weeks prior to start of construction season to 4 weeks after completion of construction season (54 weeks)
Environmental Monitoring - Air/Noise	Week	54	$7,200	$389,000	- Monitoring to be conducted continuously from 4 weeks prior to start of construction season to 4 weeks after completion of construction season (54 weeks)
Subtotal Sediment Removal				***$5,421,400***	
E. Material Processing					
Material Processing - Marsh	CY	69,390	$40.47	$2,808,000	- Includes costs for solidification with 8% (by weight) Portland Cement and material handling
Water Treatment	Week	34	$56,000	$1,904,000	- 24 hrs/DY; 7 days/week during excavation/backfilling (28 weeks) plus 4 weeks prior to and after excavation operations (36 weeks total) - 24 hrs/DY; 3 days/week during winter shutdown (16 Weeks) - Assumes operation of a 500 gpm system which includes equalization tanks, sand filter and GAC @ $8,000/DY - Includes treatment of contact water during active excavation operations
Subtotal Dredge Material Processing				***$4,712,000***	
F. Transportation & Disposal (T&D)					
Transportation & Disposal - Subtitle D	Ton	92,552	$85	$7,867,000	- 95% of loaded material to be placed in Subtitle D facility
Transportation & Disposal - Subtitle C	Ton	4,871	$185	$901,000	- 5% of loaded material to be placed in Subtitle C facility
Subtotal Transportation & Disposal				***$8,768,000***	
G. Backfilling					
Material Purchase/Delivery/Placement - Marsh: Organic Blend	CY	79,798	$80	$6,384,000	- $40/CY for organic blend purchase and delivery and $40/CY for placement - Approximately 79,798 CY to be mechanically placed. See Note 16
Backfill Placement Monitoring and Verification	DY	157	$2,500	$393,000	- Daily rate for QC verification that backfill placement meets design specifications
Subtotal Backfilling				***$6,777,000***	
H. Thin-Layer Cap					
Material Purchase/Delivery/Placement - Marsh: Organic Blend	CY	3,525	$80	$282,000	- $40/CY for organic blend purchase and delivery - $40/CY for placement of organic blend - Approximately 3,525 CY to be mechanically placed. See Note 7.
Topographic Surveys	AC	15	$4,970	$75,000	- Required for cover placement 3.8 acres (pre and post placement plus 2 interim surveys)
Thin-Layer Cap Placement Monitoring and Verification	DY	12	$2,500	$30,000	- Daily rate for QC verification that thin-layer cap/cover meets design specifications
Subtotal Thin-Layer Cap				***$387,000***	
I. Marsh Restoration					
Marsh Restoration	AC	28.2	$100,000	$2,820,000	- Restoration of 28.2 acres (support areas, access roads and shoreline) disturbed during remedial activities @ $100,000/acre
Subtotal Marsh Restoration				***$2,820,000***	
SUBTOTAL DIRECT CAPITAL COSTS				**$37,976,400**	- Subtotal Direct Capital Costs includes the Volume Uncertainty Contingency ($2,993,000).
Volume Uncertainty Contingency (15%)				**$0**	- Volume Uncertainty Contingency ($2,993,000) is included in the individual direct capital cost quantities and totals for Tasks A through H. These individual contingency amounts have been summed and included in the Subtotal Direct Capital Costs.
General Contingency (20%)				**$7,595,000**	- Includes scope and bid contingency as defined in EPA (2000) "A Guide to Developing and Documenting Cost Estimates During Feasibility Study", exclusive of Volume Uncertainty Contingency. General Contingency is applied to Subtotal Direct Capital Costs which includes the Volume Uncertainty Contingency.

Table 15: Summary of Cost Estimate - Alternative UPIC3-A: Hybrid - Removal + Backfill and Thin-layer Cover

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
INDIRECT CAPITAL COSTS (ICC)					
J. Indirect Capital Costs					
Pre-Design Activities (8% of DCC excluding PCA and T&D)	LS	1	$2,039,000	$2,039,000	- Indirect capital costs are calculated as a percentage of Subtotal Direct Capital Costs (excluding PCA and T&D). See Note 4.
Regulatory/ARARs (1% of DCC excluding PCA and T&D)	LS	1	$255,000	$255,000	
Design/Procurement (5% of DCC excluding PCA and T&D)	LS	1	$1,275,000	$1,275,000	
Construction Management (6% of DCC excluding PCA and T&D)	LS	1	$1,529,000	$1,529,000	
Project Management (5% of DCC excluding PCA and T&D)	LS	1	$1,275,000	$1,275,000	
EPA/NJDEP Oversight (5% of DCC excluding PCA and T&D)	LS	1	$1,275,000	$1,275,000	
SUBTOTAL INDIRECT CAPITAL COSTS				**$7,648,000**	- Total ICCs include $556,000 associated with Volume Uncertainty Contingency (excluding PCA and T&D). General Contingency is not applied to ICCs.
OPERATION AND MAINTENANCE (O&M) COSTS (5 YEARS)					
K. Performance Monitoring					
Evaluating/Updating/Maintaining Institutional Access Controls (Years 1 through 5)	YR	5	$20,800	$104,000	- Two (2) individuals @ 0.25 full time equivalents @$100/hr for 5 years - Allocate 80% of IC for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Site Wide Monitoring (Years 1 through 5)	YR	5	$400,000	$2,000,000	- $2,000,000/yr for UBC/MBC waterways/tributaries and UPIC marsh - Allocate 80% of Site Wide Monitoring for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Subtotal Performance Monitoring				***$2,104,000***	
L. Monitoring Data Analysis (MDA)					
MDA (Years 1 through 5)	YR	5	$40,000	$200,000	- $200,000/yr for UBC/MBC waterways/tributaries and UPIC marsh - Allocate 80% of MDA for UBC/MBC waterways/tributaries and 20% for UPIC marsh
Subtotal MDA				***$200,000***	
M. Backfill Maintenance					
Periodic Backfill Maintenance (Years 1 through 5)	AC	12.2	$151,500	$1,848,000	- Includes all costs associated with one-time backfill repair and marsh vegetation replanting - Assume backfill maintenance volume is equivalent to 3 inches of backfill applied to 50% of marsh receiving backfill (12.2 acres) - 5,659 CY @$80/CY - Assume plug (80%) and rose pot (20%) plantings on 18 in centers for 50% of marsh (12.2 acres) @$25,000/acre
Subtotal Backfill Maintenance				***$1,848,000***	
N. Thin-Layer Cover Maintenance					
Periodic Thin-Layer Cover Maintenance (Years 1 through 5)	AC	1.25	$185,000	$232,000	- Includes all costs associated with one-time thin-layer cover repair and marsh vegetation replanting - Assume thin-layer cover maintenance occurs in parallel with backfill maintenance. No costs associated with pre-construction activities, site staging, and environmental controls. - Assume backfill maintenance volume is equivalent to 3 inches of fill applied to 33% of marsh receiving thin-layer cover (1.25 acres - 582 CY @$80/CY) - Assume plug (80%) and rose pot (20%) plantings on 18 in centers for 33% of marsh (1.25 acres) @$25,000/acre
Subtotal Cap Maintenance				***$232,000***	
O. Adaptive Management Actions					
Periodic Adaptive Management Actions (Years 1 through 5)	AC	7	$291,100	$2,038,000	- Includes all costs associated with placement of treatment amendment to 25% of marsh (7 acres) as a contingent post-remediation adaptive management action if determined necessary (based on performance monitoring) to improve remedy performance.
Subtotal Adaptive Management Actions				***$2,038,000***	
SUBTOTAL DIRECT O&M COSTS				**$6,422,000**	
General Contingency (20%)				**$1,284,000**	- General Contingency is applied to the Subtotal Direct O&M Costs.
P. Indirect O&M Costs					
Design (3% of Subtotal Direct O&M Costs)	LS	1	$193,000	$193,000	- Indirect O&M Costs calculated as a percentage of the sum of O&M tasks K, L, M, N and O. See Note 4.
Project Management (5% of Subtotal Direct O&M Costs)	LS	1	$321,000	$321,000	
Construction Management (6% of Subtotal Direct O&M Costs)	LS	1	$247,000	$247,000	- Construction Management costs only associated with Backfill/Thin Layer Cover Maintenance (Tasks M & N) and the Adaptive Management Action (Task O).
EPA/NJDEP Oversight (5% of Subtotal Direct O&M Costs)	LS	1	$321,000	$321,000	
SUBTOTAL INDIRECT O&M COSTS				**$1,082,000**	- General Contingency is not applied to ICCs.
TOTAL OPERATIONS & MAINTENANCE COSTS				**$8,788,000**	
TOTAL UNDISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL UNDISCOUNTED PROJECT COST				**$53,219,000**	
O&M UNDISCOUNTED PROJECT COST				**$8,788,000**	
TOTAL UNDISCOUNTED PROJECT COST (TUPC)				**$62,007,000**	
TUPC (Excluding Contingency)				**$49,579,000**	- Excludes both General and Volume Uncertainty Contingencies
TOTAL DISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL DISCOUNTED PROJECT COST				**$51,477,000**	- 7% Real Discount Rate
O&M DISCOUNTED PROJECT COST				**$6,735,000**	- 7% Real Discount Rate
TOTAL DISCOUNTED PROJECT COST				**$58,212,000**	

General Notes:

1. All costs rounded to nearest $1,000.
2. Cost estimate is based on current and past project experience, cost estimating resources, and vendor estimates. Costs are provided in 2018 dollars.
3. This estimate has been prepared for the purpose of comparing FS Report remedial alternatives. The information in this cost estimate is based on available information regarding the BCSA and the anticipated scope of the remedial alternative. Changes in cost elements are likely as a result of new information and data collected during the engineering design of the remedial alternative. This cost estimate is expected to be within -30% to +50% of the actual project cost if this alternative is constructed.
4. Indirect capital costs are based on *A Guide to Developing and Documenting Cost Estimates During Feasibility Study* , prepared by EPA and United States Army Corps of Engineers (USACE),. July 2000.
5. Work includes a 1 ft excavation (plus 6 inch over excavation) from 22.8 acres of UPIC marsh; 2 ft excavation from areas within 10 ft of UPIC (1.6 acres), and placement of a thin layer cover in area surrounding radio towers (3.8 acres).
6. Work involves the removal, dewatering, solidification and disposal of approximately 60,339 CY of sediment from 24.4 acres of UPIC marsh plus 15% for volume uncertainty contingency (69,390 CY total).
7. Work includes the placement of a 6-inch thick thin-layer cover (3,065 CY), plus 15% for material loss, densification, and settlement during placement (3,025 CY).
8. Removal and backfill volumes in this appendix may be slightly different than the volumes given in the FS Report due to the different rounding conventions used in the FS Report versus for cost estimating.
9. Institutional controls include fish advisories, controls to protect backfill layer, and site access restrictions.
10. Support areas include a 5-acre upland site staging/processing area to be used for gravity dewatering, solidification, material handling, equipment/material storage, and project administration.
11. Initial mobilization/demobilization is judged to be equal to UPIC4 costs which are estimated as 5% of applicable direct capital costs. Seasonal mobilization/demobilization costs are estimated as 50% of initial mob/demob costs. Storm related mob/demob costs involve moving large equipment to high ground are estimated as 25% of initial mob/demob costs.
12. Estimate based on excavation and backfilling being conducted in parallel with one month lag time.
13. Excavated material will be passively dewatered at the processing area.
14. Estimate based on dewatered material being solidified with 8% (by weight) Portland Cement.
15. Estimate based on 95% of material being acceptable for Subtitle D disposal.
16. Estimate based on backfill volume equaling removal volume plus an additional 15% to account for material loss, densification, and settlement during placement.
17. Project duration assumes excavation/backfilling and thin layer cover will be placed in series and is estimated to be 1.1 years based on a 35 week construction season assuming 3 months for winter shutdown and an allowance of 2 weeks for contractor delays and 2 weeks for weather delays.

Table 16: Summary of Cost Estimate - Marsh Demonstration Project

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
DIRECT CAPITAL COST					
A. Pre-Construction Activities (PCA)					
Property Access Agreements	LS	1	$0	$0	- Cost to obtain necessary access agreements for Marsh Demonstration Project are covered by Phase 1 waterway estimates
Property Leasing for Support Areas	YR	1	$600,000	$600,000	- 2 acres for an upland site staging/processing area to be used for material handling, equipment/material storage and project administration @ $300,000/acre/year. See Notes 8 and 10.
Institutional and Access Controls	YR	1	$0	$0	- Institutional Controls for the Marsh Demonstration Project area are covered by Phase 1 waterway estimates
Contractor Plans & Submittals	LS	1	$64,000	$64,000	- Costs are associated with preparation of pre-construction and monthly operational submittals
Subtotal Pre-Construction Activities				***$664,000***	
B. Mobilization/Demobilization					
Initial	LS	1	$210,000	$210,000	- Includes all equipment, labor and materials required for mobilization/demobilization - Based on costs provided for BCSA FS Phase I Pilot Study
Seasonal (Not Applicable)	LS	0	$0	$0	- Work assumed to be completed in one construction season
Storm Related (Not Applicable)	LS	0	$0	$0	- Based on no major storm event during project duration requiring demobilization
Subtotal Mobilization/Demobilization				***$210,000***	
C. Site Staging/Support/Access					
Site Development	AC	15.5	$39,032	$605,000	- Costs associated with development of 15,5 acres: 2 acres of support area (clearing/grubbing, grading, paving, fencing, access roads, etc.); development of three 3-acre test plots; and development of six 0.75-acre control plots (two control plots per test plot)
Site Facilities	YR	1	$16,000	$16,000	- Includes monthly costs for offices/trailers, utilities, facilities, and site security. - Based on sharing of site facilities with Phase 1 waterway work - Unit rates based on total costs divided by the duration (years) or size of sites (acres). Unit rates will vary between alternatives due to fixed costs.
Subtotal Site Staging/Support/Access				***$621,000***	
D. Marsh Work (Excluding Demonstration Plots)					
Debris Removal	DY	16	$4,400	$71,000	- 1 excavator @ $4,300/day each - 16 acres of marsh @ 1 acre/day
Debris Removal - T&D	Ton	16	$85	$1,400	- Based on debris removal @1 ton/acre @ $85/ton
Marsh Dewatering (Not Applicable)	LS	1	$0	$0	
Turbidity Control - Sediment & Erosion Control	LF	4,800	$15.85	$76,000	- Install hay bales and silt curtains around perimeter of Marsh Demonstration Project
Topographic Surveys	AC	27	$5,000	$134,000	- Pre-construction and post-construction surveys of test plots (three 3-acre test plots and six 0.75-acre control plots; 13.5 acres total)
Environmental Monitoring				$0	- Environmental monitoring costs covered by Phase 1 waterway estimates
Subtotal Marsh Work				***$282,400***	
E. Material Processing (Not Applicable)					
Material Processing	CY	0	$0	$0	
Water Treatment	YR	0	$0	$0	
Subtotal Dredge Material Processing				***$0***	
F. Transportation & Disposal (Not Applicable)					
Transportation & Disposal - Subtitle D	Ton	0	$85	$0	
Transportation & Disposal - Subtitle C	Ton	0	$185	$0	
Subtotal Transportation & Disposal				***$0***	
G. Marsh Demonstration Plots					
Material Purchase/Delivery/Placement - Thin Layer Addition w/o Amendments	AC	3	$65,000	$195,000	- Placement of 6 inches of silty sand (2,783 CY) over existing marsh surface. Includes an additional 15% for material losses, densification and settlement. - Silty Sand @$30/CY to be mechanically placed with Telebelt @$40/CY
Material Purchase/Delivery/Placement - Thin-layers Addition over Activated Carbon	AC	3	176,300	$529,000	- 6 inches of Silty Sand (2,783 CY) @$30/CY to be mechanically placed with Telebelt @$40/CY over an Activated Carbon amendmen - Activated carbon placed with a telebelt @$100/CY - Based on application of 1 lbs/ft² of SediMite™ @$2.14/lb. Includes an additional 15% for material losses, densification and settlement (124 CY).
Material Purchase/Delivery/Placement - Activated Carbon Amendment	AC	3	111,300	$334,000	- Based on application of 1 lbs/ft² of SediMite™ @$2.14/lb. Includes an additional 15% for material losses, densification and settlement (124 CY). - Based on mechanical placement of 124 CY of material with telebelt @$100/CY. - Material and installation cost equal to $2.14/ft² at a unit weight of 45 lbs/ft³.
Marsh Demonstration Plot Placement Monitoring and Verification	DY	108	$2,500	$270,000	- Daily rate for QC verification that Marsh Demonstration Plots meet design specifications.
Subtotal Marsh Demonstration Plots				***$1,328,000***	
H. Marsh Restoration					
Marsh Restoration	AC	4	$100,000	$400,000	- Restoration of 4 acres (support areas, access roads and shoreline) disturbed during remedial activities @ $100,000/acre; excludes test plots
Subtotal Marsh Restoration				***$400,000***	
SUBTOTAL DIRECT CAPITAL COSTS				**$3,505,400**	
General Contingency (20%)				**$701,000**	- Includes scope and bid contingency as defined in EPA (2000) "A Guide to Developing and Documenting Cost Estimates During Feasibility Study." General Contingency is applied to Subtotal Direct Capital Costs.
INDIRECT CAPITAL COSTS					
J. Indirect Capital Costs					
Pre-Design Activities (8% of Direct Capital Costs excluding PCA and T&D)				$227,000	- Indirect capital costs calculated as a percentage of Subtotal Direct Capital Costs excluding PCA and associated contingency. See Note 4.
Permitting (1% of Direct Capital Costs excluding PCA and T&D)				$28,000	
Design/Procurement (6% of Direct Capital Costs excluding PCA and T&D)				$170,000	
Construction Management (6% of Direct Capital Costs excluding PCA and T&D)				$170,000	
Project Management (5% of Direct Capital Costs excluding PCA and T&D)				$142,000	
USEPA/NJDEP Oversight (5% of Direct Capital Costs excluding PCA and T&D)				$142,000	
SUBTOTAL INDIRECT CAPITAL COSTS				**$879,000**	- General Contingency is not applied to ICCs.

Table 16: Summary of Cost Estimate - Marsh Demonstration Project

TASK	Unit	Quantity	Unit Rate	Total[1]	BASIS
OPERATION AND MAINTENANCE (O&M) COSTS (5 YEARS)					
K. Performance Monitoring					
Evaluating/Updating/Maintaining Institutional Controls (Years 1 through 5)	YR	1	$0	$0	- Institutional Controls for Marsh Demonstration Project are covered in Phase 1 waterway estimates
Performance Monitoring (Years 1 through 3)	YR	3	$1,639,700	$4,919,000	- Marsh performance measures monitoring based on BCSA Pilot Study - Includes annual physical, chemical, and biological monitoring of each test plot and control plot - Includes annual mobilization ($45,000/yr)
Performance Monitoring (Years 4 and 5)	YR	2	$1,054,000	$2,108,000	- Assume reduced scope of monitoring for years 4 and 5 (66% of Years 1- 3) - Includes annual physical, chemical and biological monitoring of each test plot and control plot - Includes annual mobilization ($45,000/yr)
Subtotal Performance Monitoring				***$7,027,000***	
L. Monitoring Data Analysis (MDA)					
MDA (Years 1 through 5)	LS	1	$700,000	$700,000	- $100,000/year - Includes Lump Sum cost of $200,000 for final report
Subtotal MDA				***$700,000***	
M. Marsh Demonstration Plots Maintenance					
Periodic Demonstration Plot Maintenance (Years 1 through 5)				$0	- No cost assumed for Marsh Demonstration Project
Subtotal Cap Maintenance				***$0***	
SUBTOTAL DIRECT O&M COSTS				**$7,727,000**	
General Contingency (20%)				**$1,550,000**	- General Contingency is applied to the Subtotal Direct O&M Costs.
N. Indirect O&M Costs					
Design (3% of Subtotal O&M Costs)				$0	- No design costs for Performance Monitoring Tasks
Project Management (5% of Subtotal O&M Costs)				$386,000	- Indirect O&M costs calculated as a percentage of the sum of O&M tasks K, L, and M, excluding general contingency. See Note 4.
USEPA/NJDEP Oversight (5% of Subtotal O&M Costs)				$386,000	
SUBTOTAL INDIRECT O&M COSTS				**$772,000**	- General Contingency is not applied to ICCs.
SUBTOTAL ANNUAL OPERATONS & MAINTENANCE				**$10,049,000**	
TOTAL UNDISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL UNDISCOUNTED PROJECT COST				**$5,085,000**	
O&M UNDISCOUNTED PROJECT COST				**$10,049,000**	
TOTAL UNDISCOUNTED PROJECT COST (TUPC)				**$15,134,000**	
TUPC (Excluding Contingency)				**$12,880,000**	- Excludes General Contingency
TOTAL DISCOUNTED PROJECT COST (2018 DOLLARS)					
DIRECT CAPITAL DISCOUNTED PROJECT COST				**$5,085,000**	- 7% Real Discount Rate
O&M DISCOUNTED PROJECT COST				**$8,237,000**	- 7% Real Discount Rate
TOTAL DISCOUNTED PROJECT COST				**$13,322,000**	

General Notes:
1. All total costs rounded to nearest $1,000.
2. Cost estimate is based on past and current project experience, cost estimating resources, and vendor estimates. Costs provided in 2018 dollars.
3. This estimate has been prepared for implementing a Marsh Demonstration Project as described in Appendix F. Changes in cost elements are likely as a result of the further development of the project details and engineering design.
4. Cost factors based on *A Guide to Developing and Documenting Cost Estimates During Feasibility Study*, prepared by the USEPA and United States Army Corps of Engineers (USACE). July 2000.
5. Work is anticipated to include the construction of three 2- to 3-acre marsh test plots, plus six 0.75-acre control plots (two for each test plot). For planning purposes one test plot will consist of a silty sand thin-layer cover, one will consist of the application of an activated carbon amendment to the surface of the marsh, and one will consist of a combination of a silty sand thin-layer cover overlying an activated carbon amendment. For cost estimating purposes, it has been assumed that each test plot will be three acres in size.
6. The type of activated carbon (granular, powdered, other) and any delivery medium for it (e.g., SediMite™, AquaGate™) will be determined as part of the test plot design. For cost estimating purposes, it is conservatively assumed that the activated carbon will be delivered as SediMite™ at 1 lb/ft^2 (as delivered).
7. Placement volumes in this appendix may be slightly different than the volumes given in the FS Report due to the different rounding conventions used in the FS Report versus for cost estimating.
8. The support area for the Marsh Demonstration Project consists of a 2-acre upland to be used for material handling, equipment/material storage, and project administration.
9. Mobilization/demobilization costs are based on actual contractor costs from BCSA FS Pilot Study. No seasonal or storm related mob/demob costs are anticipated.
10. Project duration is estimated to be 1 year based on a 35 week construction season assuming 3 months for winter shutdown and an allowance of 2 weeks for contractor delays and 2 weeks for weather delays.

BERRY’S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 3 ADMINISTRATIVE RECORD INDEX

ADMINISTRATIVE RECORD INDEX OF DOCUMENTS

FINAL

09/24/2018

REGION ID: 02

Site Name: VENTRON/VELSICOL
EPA ID: NJD980529879
OUID: 02
SSID: 02C7
Action: BERRY'S CREEK STUDY AREA

DocID:	Doc Date:	Title:	Image Count:	Doc Type:	Addressee Name/Organization:	Author Name/Organization:
538160	9/24/2018	ADMINISTRATIVE RECORD INDEX FOR OU2 - BERRY'S CREEK FOR THE VENTRON/VELSICOL SITE	14	Administrative Record Index		(US ENVIRONMENTAL PROTECTION AGENCY)
111349	05/01/2008	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY, BERRY'S CREEK STUDY AREA - US EPA INDEX NO.: II-CERCLA-2008-2011 FOR THE VENTRON/VELSICOL SITE	300	Legal Instrument		(US ENVIRONMENTAL PROTECTION AGENCY)
348751	08/01/2008	COMMUNITY UPDATE AUGUST 2008 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Publication		
206014	03/12/2009	WORK PLAN FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	761	Work Plan	(THE BCSA COOPERATING PRP GROUP)	(GEOSYNTEC CONSULTANTS INCORPORATED)
205754	04/01/2009	SUBMITTAL OF DRAFT OVERSIGHT QUALITY ASSURANCE PROJECT PLAN - BERRY'S CREEK STUDY AREA REMEDIATION INVESTIGATION / FEASIBILITY STUDY PHASE I OVERSIGHT FOR THE VENTRON/VELSICOL SITE	2	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	ACCARDI-DEY,AMYMARIE (MALCOLM PIRNIE, INCORPORATED)
206011	04/28/2009	WORK PLAN FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	764	Work Plan	(BERRYS CREEK COOPERATING PRP GROUP)	(GEOSYNTEC CONSULTANTS INCORPORATED)
206012	04/28/2009	QUALITY ASSURANCE PROJECT PLAN FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2511	Work Plan	(THE BCSA COOPERATING PRP GROUP)	(GEOSYNTEC CONSULTANTS INCORPORATED)

550184

ADMINISTRATIVE RECORD INDEX OF DOCUMENTS

FINAL
09/24/2018

REGION ID: 02

Site Name: VENTRON/VELSICOL
EPA ID: NJD980529879
OUID: 02
SSID: 02C7
Action: BERRY'S CREEK STUDY AREA

DocID:	Doc Date:	Title:	Image Count:	Doc Type:	Addressee Name/Organization:	Author Name/Organization:
284885	04/28/2009	ELM GROUP'S RESPONSE TO 04/09/2009 US EPA'S COMMENTS ON THE REVISED WORK PLAN AND QUALITY ASSURANCE PROJECT PLAN FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	5	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (ELM)
538144	07/06/2010	CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) RECOMMENDATIONS ON THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	8	Letter		
538132	11/05/2010	US EPA REGION 2 RESPONSE TO CONTAMINATED SEDIMENT TECHNICAL ADVISORY GROUP (CSTAG) RECOMMENDATIONS FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	14	Letter		
205760	04/01/2011	REVISION 1 PHASE 2 WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	153	Work Plan	(BERRYS CREEK COOPERATING PRP GROUP)	(GEOSYNTEC CONSULTANTS)
205769	04/01/2011	REVISION 1 APPENDIX B FIELD SAMPLING PLAN PHASE 2 QAPP ADDENDUM - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	297	Work Plan	(BERRYS CREEK COOPERATING PRP GROUP)	(GEOSYNTEC CONSULTANTS)
205763	04/20/2011	SUBMITTAL OF RE-SUBMISSION OF THE REVISED PHASE 2 WORK PLAN ADDENDUM / QAPP / FSP & RESPONSES TO US EPA COMMENTS - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	22	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (ELM)
348823	05/01/2011	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA MAY 2011 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)

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538136	05/02/2011	US EPA APPROVAL OF THE REVISED PHASE 2 WORK PLAN ADDENDUM AND QUALITY ASSURANCE PROJECT PLAN FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter		
284902	09/01/2011	PHASE 2 SUPPLEMENTAL WORK PLAN ADDENDUM - STANDARD OPERATING PROCEDURES NO. 4.4 FOR THE VENTRON/VELSICOL SITE	6	Other	(US ENVIRONMENTAL PROTECTION AGENCY)	(GEOSYNTEC CONSULTANTS INCORPORATED)
538143	09/21/2011	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION AND FEASIBILITY STUDY - US EPA INDEX NO. II-CERCLA-2008-2011 - AMENDMENT NO. 3 FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	17	Letter		
538108	03/01/2012	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA MARCH 2012 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)
538142	04/05/2012	US EPA APPROVAL OF THE TREATABILITY STUDY / PILOT STUDY (TS/PS) WORK PLAN FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter		
284901	06/01/2012	PHASE 3 WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY - SCOPE OF WORK FOR ADDITIONAL MARSH INVERTEBRATE COPC EVALUATION FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	18	Work Plan	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
178499	07/01/2012	PHASE 3A ADDENDUM QUALITY ASSURANCE PROJECT PLAN/FIELD SAMPLING PLAN FOR THE VENTRON/VELSICOL SITE	325	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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205758	07/01/2012	DRAFT PHASE 3a WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	80	Work Plan	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRYS CREEK COOPERATING PRP GROUP)
538121	07/19/2012	US EPA APPROVAL OF THE INVERTEBRATE AND WHITE PERCH SAMPLING FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2	Email	BRUSSOCK,PETER (THE ELM GROUP INCORPORATED)	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)
538139	08/16/2012	US EPA APPROVAL OF THE PHASE 3A WORK PLAN ADDENDUM FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	10	Letter		
284900	10/01/2012	AMENDMENT 1 TO PHASE 3A WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	46	Work Plan	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
284911	11/10/2012	TRANSMITTAL OF AMENDMENT 1 TO PHASE 3A WORK PLAN ADDENDUM REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (ELM)
284903	11/16/2012	REVISED DATA QUALITY OBJECTIVES - APPENDIX E DATED 10/2012 FOR THE VENTRON/VELSICOL SITE	3	Other		
284887	12/03/2012	INTERIM REMEDIAL MEASURE EARLY ACTION LETTER REPORT FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	16	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
284883	06/01/2013	DRAFT PHASE 3B ADDENDUM TO REMEDIAL INVESTIGATION / FEASIBILITY STUDY WORK PLAN FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	61	Work Plan	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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284884	06/01/2013	PHASE 3B ADDENDUM TO QUALITY ASSURANCE PROJECT PLAN AND FIELD SAMPLING PLAN FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	533	Work Plan	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
284882	06/10/2013	TRANSMITTAL FOR REVIEW AND APPROVAL OF PHASE 3B ADDENDUM TO REMEDIAL INVESTIGATION / FEASIBILITY STUDY WORK PLAN - QUALITY ASSURANCE PROJECT PLAN AND FIELD SAMPLING PLAN FOR THE VENTRON/VELSICOL SITE	1	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (ELM)
538137	07/16/2013	US EPA APPROVAL OF PHASE 3B WORK PLAN ADDENDUM FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter		
348853	08/01/2013	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA AUGUST 2013 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY, REGION 2)
538131	05/28/2014	ADMINISTRATIVE SETTLEMENT AGREEMENT AND ORDER ON CONSENT FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY - US EPA INDEX NO. II-CERCLA-2008-2011 - AMENDMENT NO. 4 FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	14	Letter		
348852	09/01/2014	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA SEPTEMBER 2014 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)

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538101	10/01/2014	PHASE 3B 2014 WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR OU2 -BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	78	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538105	10/01/2014	PHASE 3B 201 WORK PLAN ADDENDUM HIGH-RESOLUTION SEDIMENT CORING FOR THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	32	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538100	10/01/2014	PHASE 3B 2014 ADDENDUM QUALITY ASSURANCE PROJECT PLAN / FIELD SAMPLING PLAN FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR OU2 -BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	118	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538106	10/29/2014	TRANSMITTAL FOR USEPA REVIEW AND APPROVAL - REVISED PHASE 3B 2014 WORK PLAN ADDENDUM, QUALITY ASSURANCE PROJECT PLAN ADDENDUM, AND TASK 21 (HIGH RESOLUTION CORING) FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (THE ELM GROUP INCORPORATED)
538122	12/01/2014	PHASE 3B 2014 WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	88	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538102	08/01/2015	PHASE 3B 2015 ADDENDUM QUALITY ASSURANCE PROJECT PLAN / FIELD SAMPLING PLAN FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR OU2 -BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	104	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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538103	08/01/2015	PHASE 3B 2015 WORK PLAN ADDENDUM FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR OU2 -BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	50	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538107	08/12/2015	TRANSMITTAL FOR USEPA REVIEW AND APPROVAL - PHASE 3B 2015 WORK PLAN AND THE FIELD SAMPLING PLAN ADDENDA FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	BRUSSOCK,PETER (THE ELM GROUP INCORPORATED)
538130	08/20/2015	US EPA APPROVAL FOR THE PHASE 3B-2015 WORK PLAN, QUALITY ASSURANCE PROJECT PLAN, AND FIELD SAMPLING PLAN ADDENDA FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter		
451975	09/01/2015	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA SEPTEMBER 2015 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)
538140	10/07/2015	US EPA APPROVAL OF THE REVISED SCHEDULE FOR THE REMEDIAL INVESTIGATION / FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2	Letter		
538141	06/13/2016	CORRESPONDENCE REGARDING PHASED APPROACH TO REMEDY IMPLEMENTATION FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2	Letter		
538129	12/22/2016	UPDATED SCIENTIFIC CONSIDERATIONS FOR LEAD IN SOIL CLEANUPS	3	Memorandum		STANISLAUS,MATHY (US ENVIRONMENTAL PROTECTION AGENCY)

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451967	01/09/2017	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA JANUARY 2017 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)
538104	02/01/2017	REMEDIAL INVESTIGATION / FEASIBILITY STUDY WORK PLAN ADDENDUM FOR OU2 -BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	31	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538134	05/16/2017	US EPA COMMENTS ON THE DRAFT REMEDIAL INVESTIGATION REPORT (EXCEPT FOR APPENDIX L - BERA) FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	59	Letter		
538133	06/27/2017	US EPA COMMENTS ON APPENDIX L - BASELINE ECOLOGICAL RISK ASSESSMENT OF THE DRAFT REMEDIAL INVESTIGATION REPORT FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	30	Letter		
538125	08/01/2017	NATIONAL REMEDY REVIEW BOARD BRIEFING REGARDING REIBLE MODEL CALCULATIONS FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	4	Report		
538124	08/11/2017	NOAA FEASIBILITY STUDY REVIEW FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	3	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	FINKELSTEIN,KENNETH (NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION (NOAA))
538109	09/01/2017	COMMUNITY UPDATE ON THE BERRY'S CREEK STUDY AREA SEPTEMBER 2017 FOR THE VENTRON/VELSICOL SITE	2	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)

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538110	09/07/2017	US EPA COMMENTS ON THE DRAFT FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	16	Letter	BRUSSOCK,PETER (THE ELM GROUP INCORPORATED)	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)
538150	09/22/2017	BCSA COOPERATING PRP GROUP'S RESPONSES TO US EPA COMMENTS DATED 05/16/2017 AND 06/27/2017 ON THE DRAFT REMEDIAL INVESTIGATION REPORT FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	201	Letter		
538128	09/25/2017	BCSA GROUP MEMORANDUM REGARDING INFLUENTIAL FACTORS AND BASIS FOR SUPPORT OF A MULTI-PHASED ADAPTIVE REMEDIAL ACTION AT THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	6	Memorandum	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538123	10/03/2017	NJDEP CORRESPONDENCE REGARDING THE DRAFT FEASIBILITY STUDY REPORT DATED JUNE 2017 FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	ZERVAS,GWEN (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
538126	10/06/2017	US FISH AND WILDLIFE SERVICE COMMENTS ON THE FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	7	Letter	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)	SCHRADING,ERIC (US FISH & WILDLIFE SERVICE)
538120	10/20/2017	HACKENSACK RIVERKEEPER INCORPORATED'S COMMENTS ON PLANS FOR THE BERRY'S CREEK STUDY AREA CLEANUP FOR THE VENTRON/VELSICOL SITE	2	Letter	(US ENVIRONMENTAL PROTECTION AGENCY)	SHEEHAN,BILL (HACKENSACK RIVERKEEPER INCORPORATED)

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538145	03/01/2018	FINAL RESPONSES TO EPA COMMENTS OF 09/07/2017 ON THE DRAFT FEASIBILITY STUDY REPORT FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	37	Letter		
538149	03/12/2018	TRANSMITTAL OF BCSA COOPERATING PARTIES GROUP'S RESPONSES TO US EPA COMMENTS DATED 09/17/2017 AND 02/20/2018 ON THE FEASIBILITY STUDY FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter		
533935	04/02/2018	DRAFT FINAL FEASIBILITY STUDY REPORT FOR OU2 FOR THE VENTRON/VELSICOL SITE	1796	Report	(US ENVIRONMENTAL PROTECTION AGENCY, REGION 2)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538127	04/18/2018	CORRESPONDENCE REGARDING UPPER PEACH ISLAND CREEK MARSH REMEDIAL ALTERNATIVES FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	3	Memorandum	WOOLFORD,JAMES (US ENVIRONMENTAL PROTECTION AGENCY)	PRINCE,JOHN (US ENVIRONMENTAL PROTECTION AGENCY)
351709	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	265	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538056	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES A AND B FOR THE VENTRON/VELSICOL SITE	547	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538057	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX C FOR THE VENTRON/VELSICOL SITE	7486	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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538058	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX D FOR THE VENTRON/VELSICOL SITE	382	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538059	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX E FOR THE VENTRON/VELSICOL SITE	564	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538060	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX F FOR THE VENTRON/VELSICOL SITE	622	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538061	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX G FOR THE VENTRON/VELSICOL SITE	1101	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538062	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES H, I, J, AND K FOR THE VENTRON/VELSICOL SITE	694	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538063	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX L - BASELINE ECOLOGICAL RISK ASSESSMENT FOR THE VENTRON/VELSICOL SITE	3631	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538064	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX M - BASELINE HUMAN HEALTH RISK ASSESSMENT FOR THE VENTRON/VELSICOL SITE	1885	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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538065	04/23/2018	DRAFT FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES N AND O FOR THE VENTRON/VELSICOL SITE	73	Report	(US ENVIRONMENTAL PROTECTION AGENCY)	(BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
538146	04/25/2018	NATIONAL REMEDY REVIEW BOARD (NRRB) AND CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) RECOMMENDATIONS FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	7	Letter		
538147	04/26/2018	RESPONSE TO NATIONAL REMEDY REVIEW BOARD (NRRB) AND CONTAMINATED SEDIMENTS TECHNICAL ADVISORY GROUP (CSTAG) RECOMMENDATIONS FOR THE BERRY'S CREEK STUDY AREA OU2 FOR THE VENTRON/VELSICOL SITE	16	Letter	AMMON,DOUG (US ENVIRONMENTAL PROTECTION AGENCY)	PRINCE,JOHN (US ENVIRONMENTAL PROTECTION AGENCY)
538175	04/27/2018	CORRESPONDENCE REGARDING THE DRAFT FINAL REMEDIAL INVESTIGATION REPORT AND THE DRAFT FINAL FEASIBILITY STUDY ACCEPTABLE FOR PUBLIC RELEASE FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter	BRUSSOCK,PETER (THE ELM GROUP INCORPORATED)	TOMCHUK,DOUGLAS (US ENVIRONMENTAL PROTECTION AGENCY)
538159	04/27/2018	PROPOSED PLAN FOR OU2 BERRY'S CREEK FOR THE VENTRON/VELSICOL SITE	29	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)
538080	4/30/2018	NJDEP CONCURRENCE ON THE PROPOSED PLAN FOR OU2 FOR THE BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	1	Letter	PRINCE,JOHN (US ENVIRONMENTAL PROTECTION AGENCY)	PEDERSEN,MARK (NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION)
538081	5/1/2018	BERRY'S CREEK PROPOSED PLAN UPDATED FACT SHEET FOR THE VENTRON/VELSICOL SITE	4	Publication		(US ENVIRONMENTAL PROTECTION AGENCY)

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FINAL
09/24/2018

REGION ID: 02

Site Name: VENTRON/VELSICOL
EPA ID: NJD980529879
OUID: 02
SSID: 02C7
Action: BERRY'S CREEK STUDY AREA

DocID:	Doc Date:	Title:	Image Count:	Doc Type:	Addressee Name/Organization:	Author Name/Organization:
538446	8/9/2018	FINAL FEASIBILITY STUDY FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	2142	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550104	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA FOR THE VENTRON/VELSICOL SITE	265	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550105	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES A AND B FOR THE VENTRON/VELSICOL SITE	547	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550106	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX C FOR THE VENTRON/VELSICOL SITE	7486	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550107	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX D FOR THE VENTRON/VELSICOL SITE	382	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550108	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX E FOR THE VENTRON/VELSICOL SITE	564	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550109	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX F FOR THE VENTRON/VELSICOL SITE	622	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550110	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX G FOR THE VENTRON/VELSICOL SITE	1101	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550111	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES H, I, J, AND K FOR THE VENTRON/VELSICOL SITE	694	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

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550112	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX L - BASELINE ECOLOGICAL RISK ASSESSMENT FOR THE VENTRON/VELSICOL SITE	3631	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550114	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDIX M - BASELINE HUMAN HEALTH RISK ASSESSMETN FOR THE VENTRON/VELSICOL SITE	1885	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)
550113	8/27/2018	FINAL REMEDIAL INVESTIGATION REPORT FOR OU2 - BERRY'S CREEK STUDY AREA - APPENDICES N AND O FOR THE VENTRON/VELSICOL SITE	73	RPT / Report	R02: (US ENVIRONMENTAL PROTECTION AGENCY)	R02: (BERRY'S CREEK STUDY AREA COOPERATING PRP GROUP)

BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 4 STATE LETTER

State of New Jersey

PHILIP D. MURPHY
Governor

SHEILA Y. OLIVER
Lt. Governor

DEPARTMENT OF ENVIRONMENTAL PROTECTION
Site Remediation and Waste Management Program
Mail Code 401-406
P.O. Box 420
Trenton, New Jersey 08625-0420
Telephone: 609-292-1250

CATHERINE R. McCABE
Commissioner

September 12, 2018

John Prince, Acting Director
Emergency and Remedial Response Division
U.S. Environmental Protection Agency Region II
290 Broadway
New York, NY 10007-1866

RE: Berry's Creek Study Area Record of Decision

Dear Mr. Prince:

The New Jersey Department of Environmental Protection (Department) has completed its review of the Record of Decision (ROD) for the Berry's Creek Study Area (BCSA). The Department concurs with the selected remedial action. The remedial action is an interim action and consists of the following:

- In Upper Berry's Creek and Middle Berry's Creek waterways, dredging of 2 feet of soft sediment or to consolidated clay, if soft sediment is less than two feet, with placement of clean backfill/cap over remaining soft sediment to return to original elevation;
- In Upper Peach Island Creek (UPIC) Marsh, removal of 1 foot of sediment and placement of 1 foot of clean backfill/cap over most of UPIC marsh, with 2 feet of sediment removal and backfill/cap within 10 feet of the waterways, and a thin-layer cover in the area of the radio towers; and
- A marsh demonstration project and monitoring of the BCSA.

The selected remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, and is cost effective.

DEP appreciates the opportunity to participate in the decision-making process to select an appropriate remedy. If you have any questions, please call me at 609-292-1250.

Sincerely,

Mark J. Pedersen
Assistant Commissioner

BERRY'S CREEK STUDY AREA
OU2 of the VENTRON/VELSICOL SITE
RECORD OF DECISION
APPENDIX 5 RESPONSIVENESS SUMMARY

APPENDIX 5

RESPONSIVENESS SUMMARY
Berry's Creek Study Area
Operable Unit 2 of the Ventron/Velsicol Superfund Site

LIST OF ATTACHMENTS
ATTACHMENT A Proposed Plan
ATTACHMENT B Public Notice
ATTACHMENT C Transcript from Public Meeting
ATTACHMENT D Public Comments Received During the Public Comment Period

Overview

This Responsiveness Summary provides a summary of the public's comments submitted to EPA regarding the Proposed Plan (Attachment A) for the interim cleanup action at Berry's Creek Study Area (BCSA) which is operable unit 2 of the Ventron/Velsicol Superfund Site, and EPA's responses to those comments. A responsiveness summary is required by the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 C.F.R. 300.430(f)(3)(F). All comments summarized in this document have been considered in EPA's decision for the selection of the interim remedy for the source areas of the BCSA.

Background on Community Involvement

EPA has provided an opportunity for community participation throughout the BCSA RI/FS process. Several availability sessions were held at various stages of the study. Eight fact sheets were developed over the course of the RI/FS and were distributed when people inquired about field crew activities, and when the Berry's Creek Potentially Responsible Party Group (BCSA Group) contacted property owners for access agreements for the investigations. EPA also held a public meeting, as required, to discuss the Proposed Plan and accept comment from the public.

In the early stages of EPA's outreach to the community, turnout at public events was relatively minimal. Recognizing the limited participation at the public availability sessions, EPA increased its efforts, and conducted a series of briefings for local towns, Bergen County, elected officials and several major stakeholders to discuss the interim action approach prior to the release of the Proposed Plan. Individual briefings were held for the municipal officials in Lyndhurst, Rutherford, East Rutherford, Carlstadt, Moonachie, Little Ferry, and Teterboro. Scheduling conflicts prevented a briefing for Wood-Ridge. In addition, Bergen County officials and State Assemblyman Schaer were also briefed. On the Federal level, EPA conducted telephone briefings for the staff of Senators Menendez and Booker and Congressman Pascrell. Separate meetings were also held for stakeholders, including the New Jersey Sports and Exhibition Authority (NJSEA), the Hackensack Riverkeeper and the Meadowlands Chamber of Commerce. These meetings allowed EPA to share information about the findings of the RI Report, and to describe the plan for addressing the BCSA in a phased approach that is based on adaptive management[1]. EPA was joined in these meetings by representatives of the BCSA Group, which highlighted the cooperative working relationship between the potentially responsible parties and EPA.

During the development of the RI/FS, it became apparent that one of the major environmental concerns of people living and working in the BCSA area is flooding. Much of the area is at low elevations, and a substantial portion of the area was built on fill in areas that were previously marshes. As such, the area often floods. Flooding can occur from either rainfall events that collect water because there is insufficient gradient for drainage, or from high tidal conditions that overflow the waterways. The combination of rainfall events with high tides compounds flooding problems. Concern was heightened during the past decade with sea level rise increasing the frequency of flood events, and flooding from Hurricane Irene, Tropical Storm Lee, and Superstorm Sandy causing massive disruption and damage to the area. In June 2014, The U.S. Department of Housing and Urban Development (HUD) awarded a grant for $150 million for the Rebuild by Design – Meadowlands (RBD-M) project, which is managed by the New Jersey Department of Environmental Protection (NJDEP). The grant is for the design and construction of a solution that will reduce flooding risks and enhance resiliency in the area. Interaction between EPA, the BCSA Group and the RBD-M team has been an important aspect of the BCSA work, and will continue through design and construction. It is important that the remedy not make the potential for flooding worse.

The Proposed Plan was released on April 30, 2018 and a notice was published in the Bergen Record on May 2, 2018 (see Attachment B). A public meeting was held on May 9, 2018 in Little Ferry, NJ. After a brief presentation, the public was given an opportunity to ask questions and make comments. The public comment period went through June 6, 2018. Two comment letters were received.

Summary of Comments and Responses

The community was given the opportunity to provide oral comments at the public meeting on May 9, 2018 which were recorded by a stenographer (see, Attachment C). Written comment was also received during the public comment period. Overall, the public supported the preferred alternative, although one commenter was concerned that capping was not a permanent remedy. Only two letters were received during the public comment period, and both supported moving forward with the remedy. These letters are included as Attachment D.

Comment 1

What is the cleanup level?

[1] Adaptive management is a project management approach based on continuous monitoring and re-evaluation to account for new information and changing site conditions.

Response 1

Numerical cleanup levels were not developed for this action. However, because this is an interim action a future decision document will be necessary; EPA expects to evaluate cleanup levels in the final remedy decision for the BCSA.

The Feasibility Study evaluated an interim action for Upper and Middle Berry's Creek waterways and major tributaries, and Upper Peach Island Creek Marsh. The selected remedy includes, among other things, capping of the entirety of these areas, (*i.e.,* bank-to-bank in the waterways and the entire surface of Upper Peach Island Creek Marsh). Therefore, upon completion of construction, the remedy will leave a clean surface for the entire remediation footprint, within the limitations of controlling resuspended contamination from settling on the cap. During the placement of caps, sediment resuspended from the dredging and/or capping operations can settle on the cap, leaving a low level of contamination on the cap surface. In order to minimize the surface concentration of contaminants, the capping will be done by placing the backfill in two lifts, with the initial layer of capping material placed soon after dredging is completed in each subarea, followed by the placement of a second layer of capping material the next year to bring the surface back to the original grades. This added effort will help minimize the surface concentration of contamination upon completion of cap construction.

EPA also notes that contamination on suspended sediment in the water will continue to enter the BCSA from the Hackensack River, and that low levels of contamination are expected to deposit on the surface of the remediated areas. Future monitoring and risk assessments will determine whether the sediment deposited on the remediated surface presents an unacceptable risk.

Comment 2

The Hudson River PCB cleanup decision removed much more sediment, however, PCB concentrations increased in fish downstream of the remediation because of the dredging. Dredging in the Passaic River was conducted in a contained area to limit downstream movement. Will dredging in BCSA be compartmentalized?

Response 2

As discussed in Response 1, some amount of resuspension and redistribution of contamination during dredging is inevitable. However, the design and implementation of the dredging, along with controls to limit the extent of release can help reduce the amount of recontamination. The Hudson River and Passaic River are both quite different systems than Berry's Creek, so some of the control processes that may work for those cleanup projects may not be effective for the BCSA. The processes to control sediment resuspension and redistribution during dredging in the BCSA will be determined as part of the remedial design, and may be modified as the dredging proceeds based on the performance during the remedial action.

Recontamination of remediated areas due to tidal currents moving resuspended contaminated sediment from areas that are being dredged, or have not yet been addressed, will occur to some degree. One of the ways that this will be countered will be by placement of the initial layer of capping material soon after dredging is completed in each subarea, followed by the placement of a second layer of capping material the next year to bring the surface back to the original grades. This added effort will help minimize the surface concentration of contamination upon completion of cap construction.

Comment 3

What is the nature of the cap? How is a sand cap different than just fill?

Response 3

The capping material is expected to be sand, although the specific characteristics of the material will be determined in the remedial design. In the waterways, the cap will be the depth of soft sediment removed, which will be two feet, plus a six-inch overcut. In some areas where there is less than 2 feet of soft sediment, the dredging will remove the contamination to the underlying consolidated clay. Sand will be placed over these areas equivalent to the depth of material removed. In these areas, where there is no remaining soft sediment (and accordingly, contamination) the sand is acting only as backfill to return the creek bottom to the original grade and, thereby, not changing the hydrodynamics of the system. In areas where soft sediment (and contamination) remains after 2.5 feet of dredging, the sand will act as a cap, isolating the contamination, thereby preventing contaminant movement or uptake by biota. The RI/FS demonstrated through multiple lines of evidence that the BCSA is a low energy system with little potential for sediment movement even during major storm events. Therefore, armoring of the cap with stone or other material to prevent erosion is not necessary. In addition, the glacial lake clays underlying the sediment bed effectively eliminate groundwater discharge to the creek, so convective transport of contamination through the cap is not a concern. EPA expects that a newer layer of fine-grained sediment will be deposited over time on the caps, as is the normal process in tidal embayments such as the BCSA.

Comment 4

Were treatment options looked at?

Response 4

Treatment options were evaluated in earlier stages of the Feasibility Study, and extensive laboratory treatability and field pilot studies were conducted for the BCSA waterways and marshes. The evaluations did not identify in-situ treatment options that would effectively address both the PCBs and mercury in the waterways. The marsh demonstration project that is part of the interim remedy will provide additional information regarding the effectiveness of amendment addition to the marshes.

Post-excavation treatment of the dredged material was also considered during the Feasibility Study, but the evaluation could not identify a cost-effective technology. As part of the selected remedy, the addition of an amendment (*e.g.,* Portland cement) prior to shipment for off-site disposal to meet transportation and disposal requirements will act as a stabilizing agent on the sediment. The stabilizing agent limits the mobility (and therefore potential for future exposure) of the contaminants in the sediment. EPA expects that almost all the excavated material can be disposed of at a commercial disposal facility designed for non-hazardous waste, but that determination will be based on testing prior to shipping.

Comment 5

How is the cap thickness measured?

Response 5

Bathymetric surveys will be conducted prior to excavation and after capping. Excavation depths will be measured by GPS devices that are mounted to the excavation equipment. The precision of the measurements is approximately a quarter of a foot. The excavation will be ensured to remove at least two feet by adding 6 inches of overcut (making the excavation actually 2.5 feet). After the capping material has been placed, the subsequent bathymetric survey will measure the depth again, to establish that the correct thickness has been placed.

Comment 6

What happens to the sediment after dredging and the water that is removed from it?

Response 6

The sediment will be dewatered and shipped to an off-site commercial disposal facility for disposal. In order to meet transportation and disposal requirements, it is expected that the material will need to have an amendment added such as Portland cement. The cement reduces the water content in the sediment and makes the material more stable during transportation and within the landfill (prevents slumping). Prior to the addition of a stabilizing agent, the sediment will first undergo physical dewatering. The specific method for dewatering will be determined during remedial design, and may depend on the area available for such operations. The water removed from the sediment will be treated on-site to remove contaminants and discharged to the creek. Treatment requirements are determined during design in coordination with the NJDEP.

Comment 7

Will institutional controls be lifted after the two-foot cap is in place? Will more people utilizing the resource impact the integrity of the cap?

Response 7

The existing New Jersey fish consumption advisories for the Newark Bay Complex (of which Berry's Creek is a part) will remain in place after the interim remedy is complete. Contamination in fish and crabs within the Newark Bay Complex is the result of multiple sources throughout the system. While this cleanup is an important step in reducing the exposure of fish and crabs to contaminants, it is not expected to reduce biota concentrations sufficiently to allow New Jersey to ease the fish consumption advisories. In addition, because this is an interim remedy, maintaining the fish consumption advisories is an important part of the remedy, until such time as a final remedy is selected.

Other institutional controls may need to be considered during remedial design to ensure that the cap is protected, such as no-wake zones, or anchoring restrictions. Whether such additional institutional controls are necessary will be determined during the remedial design. Recreational use of the creek such as kayaking/canoeing or wading should not require institutional controls to protect the cap and should not limit cap effectiveness.

Comment 8

Upper Berry's Creek is an extremely shallow waterway that will limit the type of equipment used for dredging.

Response 8

The Feasibility Study acknowledged that the dredging of the BCSA will need to account for shallow drafts and mudflats during implementation, and that this is one of the many complications that will need to be evaluated during the remedial design. Additional factors, such as water level changes with the tides, low bridge heights and marsh stability also add to the design complications. While the remedial design will identity the actual approach, the Feasibility Study includes consideration of options such as conducting the dredging from the marsh banks (using crane mats for support) or launching a small barge which would dig its way as it went through shallow sediments. Working in shallow water and with limited access increases the cost of this project in comparison to other deep water dredging projects on a per unit (cubic yard dredged) basis.

Comment 9

It has been reported that the each of the radio towers in Upper Peach Island Creek marsh has an underground array of copper plates that influence their function which reach out far from the actual towers.

Response 9

EPA expects that the remedial design team will be in contact with the owner of the radio towers and will try to obtain as-built diagrams for the towers that will provide information regarding how close to the towers excavation can occur in Upper Peach Island Creek marsh. As described in the ROD, in the area where excavation is not possible, a thin-layer cover, consisting of approximately 6 inches of sand will be placed on the surface of the marsh. Construction of such a cover is not expected to have any negative impact on the functioning of the towers. It should be added that the contaminant concentrations in this area are substantially lower than in other areas of the marsh, and that the thin-layer cover will be protective to human and ecological receptors.

Comment 10

Is the firm selected for the remedial design going to be allowed to bid on construction?

Response 10

EPA expects that some or all of the BCSA Group, the PRPs that conducted the RI/FS, will conduct the remedial design work under EPA oversight. An agreement will need to be negotiated after the Record of Decision is signed, or another such enforcement document put in place. It will be up to the parties conducting the work to determine bidding requirements.

Comment 11

Continued coordination with the NJDEP Rebuild by Design Meadowlands (RBDM) team is important for sequencing of activities in the vicinity of East Riser Tide Gate, management of materials in the construction areas and outreach to the community.

Response 11

EPA, in conjunction with the parties carrying out the remedial design and remedial action, will continue to coordinate with the NJDEP RBDM team to ensure that the projects not interfere with each other. It is important that the remedy not make the potential for flooding worse.

Comment 12

The Proposed Plan has strong technical support.

Response 12

EPA acknowledges the comment, and the robust scientific and technical efforts that have gone into development of the RI/FS, which provided multiple lines of evidence to support the adaptive, interim action for the BCSA.

Comment 13

The ROD should include the Green and Sustainable Remediation (GSR) analysis presented in the Feasibility Study.

Response 13

EPA supports the use of green remediation strategies in the cleanup of Superfund sites. The selection of a remedy under Superfund is based on the nine criteria, consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) 40 CFR 300.430. Green remediation, including environmental footprint considerations such as energy use, is typically addressed in the balancing criterion “short-term effectiveness.” Sustainability (*e.g.,* increased flooding potential) would be addressed in “long-term effectiveness.”

EPA reviewed and accepted the Feasibility Study, which includes the GSR analysis, and it is included in the administrative record for OU2. The factors addressed by the GSR analysis were considered in the preparation of the Proposed Plan, although the analysis was not specifically mentioned. To the extent the factors have site specific impacts, greenhouse gas emissions/energy use and accident risk were incorporated in the evaluation of short-term effectiveness, and increased flooding potential is addressed within the long-term effectiveness balancing criterion. These concerns all are factored into the selected remedy.

Further, as stated in the ROD, the environmental benefits of the selected remedy may be enhanced, during remedy design or implementation, by consideration of technologies and practices that are sustainable in accordance with EPA Region 2's Clean and Green Energy Policy. EPA hopes that the green remediation strategies to save energy and minimize the environmental footprint of the remedy will carry through the remedial design and actions for the BCSA.

Comment 14

Property use and access restrictions beyond existing wetland regulations may not be required.

Response 14

In the Proposed Plan, EPA stated that institutional controls would be implemented as part of the preferred alternative. In response to comments received during the public comment period, EPA has revisited this conclusion and determined that it would be appropriate to undertake further analysis of the need for use restrictions such as no wake zones and no anchoring zones. As described in the ROD, the remedy now says: "Institutional controls, such as the existing New Jersey fish and crab consumption advisories will remain in place. Additional restrictions will be put in place to preserve the caps, if necessary."

Comment 15

All caps fail over time. At this site it will fail even sooner because there are strong river and tidal flows. Need to include Universal Oil Products site as well.

Response 15

In order to respond to this comment, EPA notes that it is not clear what the commenter means by failure. If the commenter means that eventually, the cap will no longer function to fully (100 percent) isolate the contamination remaining in the BCSA, eliminating exposure, then EPA agrees with the comment. However, the success of the response action does not require complete elimination of all exposure to chemical contamination. The remedy must be protective of human health and the environment, which includes addressing unacceptable risk. If the remedy results in hazardous substances, pollutants or contaminants remaining on-site above level that allow for unlimited use or unrestricted exposure, EPA will perform five-year reviews to ensure that the remedy remains protective. As such, capping can be a successful technology approach for contaminated sediment sites, even if there is some degree of chemical breakthrough or cap erosion, if the risk from the exposure is within an acceptable range. Additionally, operation and maintenance requirements are typically incorporated in a capping remedy, providing that if the cap is disturbed or compromised, these conditions will be addressed.

If the commenter means to suggest that the BCSA cap will fail even sooner than would be typical because of strong river and tidal flows in Berry's Creek, EPA respectfully disagrees. The RI/FS presented multiple lines of evidence demonstrating sediment stability in the Berry's Creek waterways and marshes. Further, EPA had the benefit of sampling before, during and after Hurricane Irene, and before and after Tropical Storm Lee and Superstorm Sandy. High rainfall events like Irene and Lee did rework some sediment in limited areas of Berry's Creek. However, Superstorm Sandy deposited several centimeters of sediment throughout the BCSA, with little if any signs of erosion. These findings correlate well with the expect deposition patterns in fringing marshes.

EPA currently anticipates that a remedy will be selected for the waterways of the Universal Oil Products site within less than a year after the issuance of the ROD for the BCSA.

Comment 16

Contamination will be left on site.

Response 16

Under the Superfund law, EPA cleans up contamination that presents an unacceptable human health or ecological risk. The determination is based on whether there is an unacceptable risk determined through the human health and ecological risk assessments. This corresponds with a 10^{-4} to 10^{-6} increase in cancer risk or a hazard index of 1. Please see the risk section of the Proposed Plan or ROD for more information on how this is determined.

When EPA selects a remedial action, while there is a preference for treatment, it does not guarantee that all contamination will be removed from a site. At some sites, remedies can result in hazardous substances, pollutants or contaminants remaining on-site above levels that allow for unlimited use or unrestricted exposure, in which case engineering controls (such as a cap) and institutional controls (such as fish consumption advisories) help maintain the protectiveness of the remedy. In such cases, the Superfund law requires that EPA perform five-year reviews to ensure that the remedy remains protective.

As noted above, there will likely be low levels of recontamination of the surface sediments from sediment that enters the BCSA from the Hackensack River. The potential for recontamination is one of the reasons for proceeding with an interim remedy, as it provides the Agency the opportunity to monitor the levels of recontamination before selecting a final remedy.

Comment 17

The Hackensack River is one of the most complex sites to clean up because of the different types of pollutants and toxic chemicals here. Part of the problem has been the piecemeal approach of trying to clean up one site at a time without looking at all the contaminated sites in the river.

Response 17

The interim remedy for source control selected for the BCSA addresses contamination in Upper Berry's Creek and Middle Berry's Creek and the main tributaries to these parts of the creek. Contamination in Lower Berry's Creek and Berry's Creek Canal was studied during the RI and found to be at levels similar to or consistent with contaminant levels in the Hackensack River. Additional monitoring and risk assessment efforts will be conducted in the future in order to determine how to address contamination in Lower Berry's Creek and Berry's Creek Canal. Additionally, EPA has received a request from the Hackensack Riverkeeper to evaluate the Hackensack River for possible nomination to the National Priorities List. EPA has completed sampling for the nomination evaluation and the data are currently under review by EPA and NJDEP.

BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 5

ATTACHMENT A - PROPOSED PLAN

US Environmental Protection Agency
Region 2

Berry's Creek Study Area Proposed Plan

Part of the Ventron/Velsicol Superfund Site **May 2018**

PURPOSE OF THIS PROPOSED PLAN

This Proposed Plan describes remedial alternatives considered for: (1) sediments of the Upper and Middle Berry's Creek waterways and their associated tributaries; and (2) the marsh sediments in Upper Peach Island Creek. It also identifies the preferred remedial alternatives with the rationale for this preference. The Berry's Creek Study Area (BCSA) is Operable Unit 2 (OU2) of the Ventron/Velsicol Superfund Site.

This Proposed Plan was developed by the U.S. Environmental Protection Agency (EPA), in consultation with the New Jersey Department of Environmental Protection (NJDEP). In addition, EPA has consulted with the National Oceanic and Atmospheric Administration (NOAA) and U.S. Fish and Wildlife Service (USFWS). EPA is issuing the Proposed Plan as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), and Section 300.430(f)(2) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The nature and extent of the contamination in the BCSA and the remedial alternatives summarized in this Proposed Plan are described in greater detail in two documents, the *Remedial Investigation Report, Berry's Creek Study Area* (RI Report) and the *Feasibility Study Report, Berry's Creek Study Area* (FS Report). These and other documents are part of the publicly available administrative record file and are located in the information repository for the Site. EPA encourages the public to review these documents to gain a more comprehensive understanding of the Site and the Superfund activities that have been conducted at the Site.

The findings of the RI Report support an adaptive, multi-phased approach to remediating

MARK YOUR CALENDAR

Public Comment Period:

May 2 to June 6, 2018

EPA will accept written comments on the Proposed Plan during the public comment period. Written comments should be addressed to:

Doug Tomchuk
Remedial Project Manager
US Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007-1866

Or e-mail: tomchuk.doug@epa.gov
Please include subject line:
BCSA Public Comment

Public Meeting
EPA will hold a public meeting to explain the Proposed Plan and all the alternatives presented in the Feasibility Study. Oral and written comments will also be accepted at the meeting. The meeting will be held:

Wednesday May 9, 2018
6:30 to 8:30 PM

Little Ferry Public Library
239 Liberty Street - Little Ferry, NJ 07643

A poster session will start at 6:30 pm and a formal presentation be held from 7:00 to 8:30 pm.

EPA's website:
www.epa.gov/superfund/ventron-velsicol

Additional information:
http://berryscreekstudyarea.com

contamination in the BCSA. The initial phase of cleanup, described in this Proposed Plan, addresses the sediments in the northern portion of the BCSA that present the highest risk, and act as a source of contamination to the wetlands and other segments of the BCSA. This source control action will be an interim action for the BCSA (the "Phase 1 interim remedial action"). The FS Report evaluated remedial alternatives for the source control interim remedial action. EPA's preferred alternative for the northern portion of the BCSA (the "Phase 1 area") includes two major elements:

1) In Upper Berry's Creek (UBC) and Middle Berry's Creek (MBC) waterways, dredging of 2 feet of soft sediment or to consolidated clay, if soft sediment is less than two feet, with placement of clean backfill/cap over remaining soft sediment to return to original elevation; and

2) In Upper Peach Island Creek (UPIC) Marsh, removal of 1 foot of sediment and placement of 1 foot of clean backfill/cap over most of UPIC marsh, with 2 feet of sediment removal and backfill/cap within 10 feet of the waterways, and a thin-layer cover in the area of the radio towers.

Sediment removed from the UBC and MBC waterways and UPIC marsh will be dewatered, treated, and transported for off-site disposal. The estimated cost of the preferred remedy is $332 million. The existing fish and crab consumption advisories (issued by NJDEP and New Jersey Department of Health (NJDOH)) would remain in place and additional institutional controls (*e.g.*, property use and access restrictions) would be implemented as part of the Phase 1 interim remedial action. Monitoring would be conducted to evaluate the performance of the Phase 1 interim remedial action, as well as the associated response of the marshes and the waterways outside of the Phase 1 area to the post-remedy conditions. The data generated through the performance monitoring program will support the evaluation of additional remedial action(s) for the BCSA in the future. Included in the monitoring program will be a Marsh Demonstration Project which will evaluate potential remedial options for the marshes, as well as monitor the response of the marshes to the waterway remediation.

EPA in consultation with NJDEP, may modify the preferred alternative or select another alternative presented in this Proposed Plan based on new information and public comments. The final decision regarding the selected remedy will be made after EPA has taken into consideration all public comments. EPA is soliciting comment on all the alternatives considered because EPA may select a remedy other than the preferred remedy.

Site Description

The Berry's Creek watershed is located in the Hackensack River Meadowlands in Bergen County, New Jersey (Figure 1). Portions of the creek are located in the Boroughs of Teterboro, Moonachie, Wood-Ridge, Carlstadt, Rutherford and East Rutherford. The 12-square mile (mi^2) watershed consists of approximately 1.6 mi^2 of tidal waterways and marshes (the "tidal zone"), and 10.4 mi^2 of highly-urbanized upland areas that drain to the BCSA tidal zone (Figure 2).

The area surrounding Berry's Creek and the marshes have multiple uses. Most of the adjacent areas are commercial or light industrial, part of the New Jersey Sports and Exhibition Authority (NJSEA) stadium complex, or roadways. Teterboro Airport is in the northern portion of the watershed, located between the East and West Risers (which are two of the major tributaries to Berry's Creek). There are several closed municipal landfills in the southern portion of the BCSA. In addition, in Upper Peach Island Creek Marsh is a group of eight large radio towers. There is limited residential use bordering the creek and marshes, however, in areas of higher elevation there is a high density of residential use.

The RI focused on the tidal zone and contamination in BCSA waterways and marshes associated with past releases of hazardous substances to the creek. The waterways include the main channel of Berry's Creek, which is an approximately 4.5-mile long tidal tributary of the Hackensack River, and the numerous tributary channels that flow into the main channel. The BCSA includes roughly 756 acres of common reed (*Phragmites australis* (*Phragmites*)) marshes along the tidal waterways plus UPIC marsh—an area that was formerly tidal marsh, but is now separated from routine tidal exchange by the Peach Island Creek (PIC) tide gate.

For purposes of the site investigations and remedy selection process, the BCSA has been operationally divided into five geographic study segments (see Figure 1) segregated by infrastructure and/or

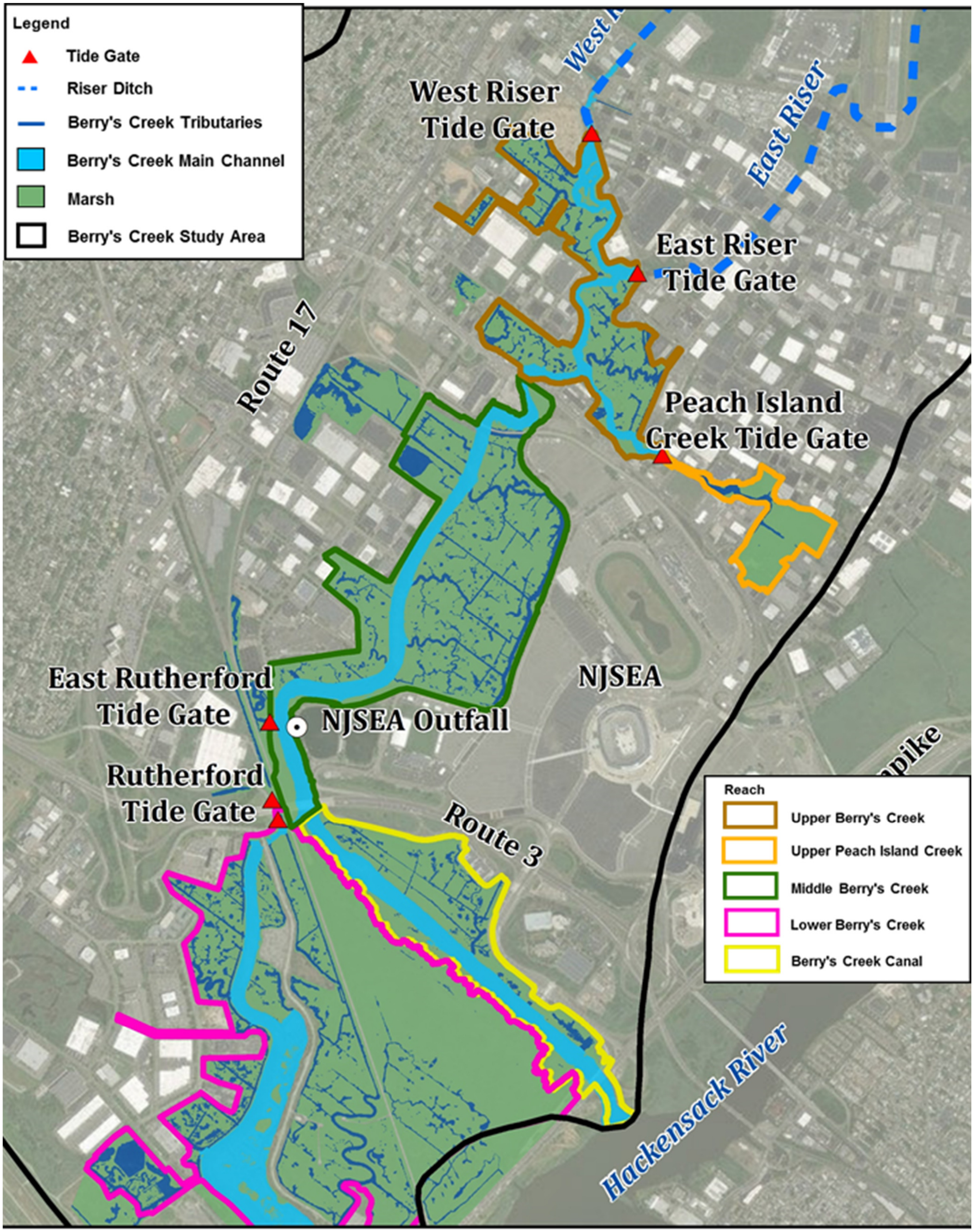


Figure 1. Site map with study segments

confluences with other waterways, and includes the section of the creek described as well as the associated tributaries and marshes:

- Upper Berry's Creek: extends from the West Riser tide gate south to Paterson Plank Road;
- Middle Berry's Creek: extends from Paterson Plank Road south to Route 3;
- Berry's Creek Canal (BCC): constructed in 1911, extends from Route 3 to the Hackensack River;
- Lower Berry's Creek (LBC): extends from MBC and BCC at its northern end through culverts near Route 3 to the Hackensack River at its southern end; and,
- Upper Peach Island Creek (UPIC): The reach of Peach Island Creek located above the Peach Island Creek tide gate.

An overall trend of decreasing contaminant concentrations is observed from north to south across the BCSA. The industrial sources of chemicals of concern (COCs) in UBC and MBC were largely removed or controlled in the 1970s to early 1980s, and sewage effluent discharges were removed from the BCSA by the early 1990s. Some typical urban pollution sources remain, such as runoff from roads, unpermitted oil dumping to stormwater collection systems, permitted discharges, and atmospheric deposition.

Site History

At the time that significant human settlement of the BCSA began, the system was predominately an Atlantic white cedar swamp. The BCSA was essentially a freshwater creek with fringing wetlands that fed into the Hackensack River. Beginning in the17th century, the Atlantic white cedar forest was cut and burned extensively. Trenches that were dug to mark property boundaries and to drain land for mosquito control, agriculture, and development significantly altered the local hydrology. However, maps in the 19th century still show the BCSA area as containing a significant cedar swamp.

The largest recent change in the system resulted from the construction of the Oradell Dam in 1902. The dam substantially reduced the flow of freshwater from the upper Hackensack River watershed into the estuary. The dam construction was closely followed by the construction of the East and West Riser tide gates in the northern end of the BCSA watershed and the dredging of BCC in 1911, which created a deep straight channel directly connecting MBC and UBC with the Hackensack River and essentially bypassing LBC. Combined with the dredging of the Hackensack River in the lower portion of the estuary, the major anthropogenic (man-made) changes in the early 20th century facilitated encroachment of brackish water into the estuary and caused major habitat transitions driven by increases in the amount of salt water (salinity) in both the estuary and the BCSA. Within approximately 20 years of completion of the Oradell Dam, cattails, wild rice, and other freshwater wetlands plants were replaced by the more salt-tolerant common reed (*Phragmites*).

Through the first half of the 20th century, land development within the BCSA was largely constrained to the upland perimeter along established roadways. Development and landfilling activities in the latter part of the 20th century resulted in extensive filling of wetlands in the BCSA (more than 60 percent reduction), which altered the hydrology and salinity of the system. Further, along with development came chemical inputs to the system from the full range of land uses. Sources of chemical stressors to the BCSA, including industrial discharges, landfills, and other unpermitted discharges, have all impacted water and sediment quality in the BCSA. Waste disposal practices, particularly sewage discharges to the BCSA and the Meadowlands in general, also had detrimental effects on surface water dissolved oxygen concentrations and the aquatic community throughout the 20th century. By the 1970s, five sewage treatment plants discharged untreated or minimally-treated sanitary and industrial wastewater directly to the BCSA.

Today, the upland watershed is more than 90% developed and comprised of a mixture of residential, commercial, industrial, and transportation uses. There are three Superfund sites within the watershed: Scientific Chemical Processing (SCP), Universal Oil Products (UOP), and Ventron/Velsicol. As noted previously, the BCSA is being addressed as Operable Unit 2 (OU2) of the Ventron/Velsicol site. In addition, numerous other known contaminated sites, landfills, sewage treatment plants, historical and ongoing permitted and unpermitted industrial discharges, urban runoff, and suspended solids entering from the Hackensack

River have contributed to the contaminated conditions in the BCSA.

Investigations of Berry's Creek water quality occurred as early as the 1930s, to evaluate the effects of sewage discharges to the system. Subsequent investigations of water, sediment, and wildlife have been conducted since the 1970s, and identified polychlorinated biphenyls (PCBs), mercury, and other metals as contaminants of potential concern. The BCSA Remedial Investigation and Feasibility Study (RI/FS) was initiated in 2008 and a Record of Decision (ROD) is anticipated to be issued in 2018, based on this Proposed Plan.

SITE CHARACTERISTICS

The BCSA Site has been methodically evaluated through the RI/FS investigations. More than 10,000 samples were collected and analyzed over a seven-year period. The results of these studies are detailed in RI and FS Reports. The major processes controlling contaminant fate and transport in the BCSA are illustrated in the conceptual site models (see Figure 2), and discussion below.

Physical Characteristics

Berry's Creek is a side embayment of the larger Hackensack River estuary, and the river exerts an important influence on physical, chemical, and biological conditions in the BCSA. Consistent with the typical functioning of a fringing marsh system, the BCSA tidal zone is a stable setting and favors the accumulation of sediment carried into the tidal zone by tidal exchange with the Hackensack River and by water flowing from upland tributaries.

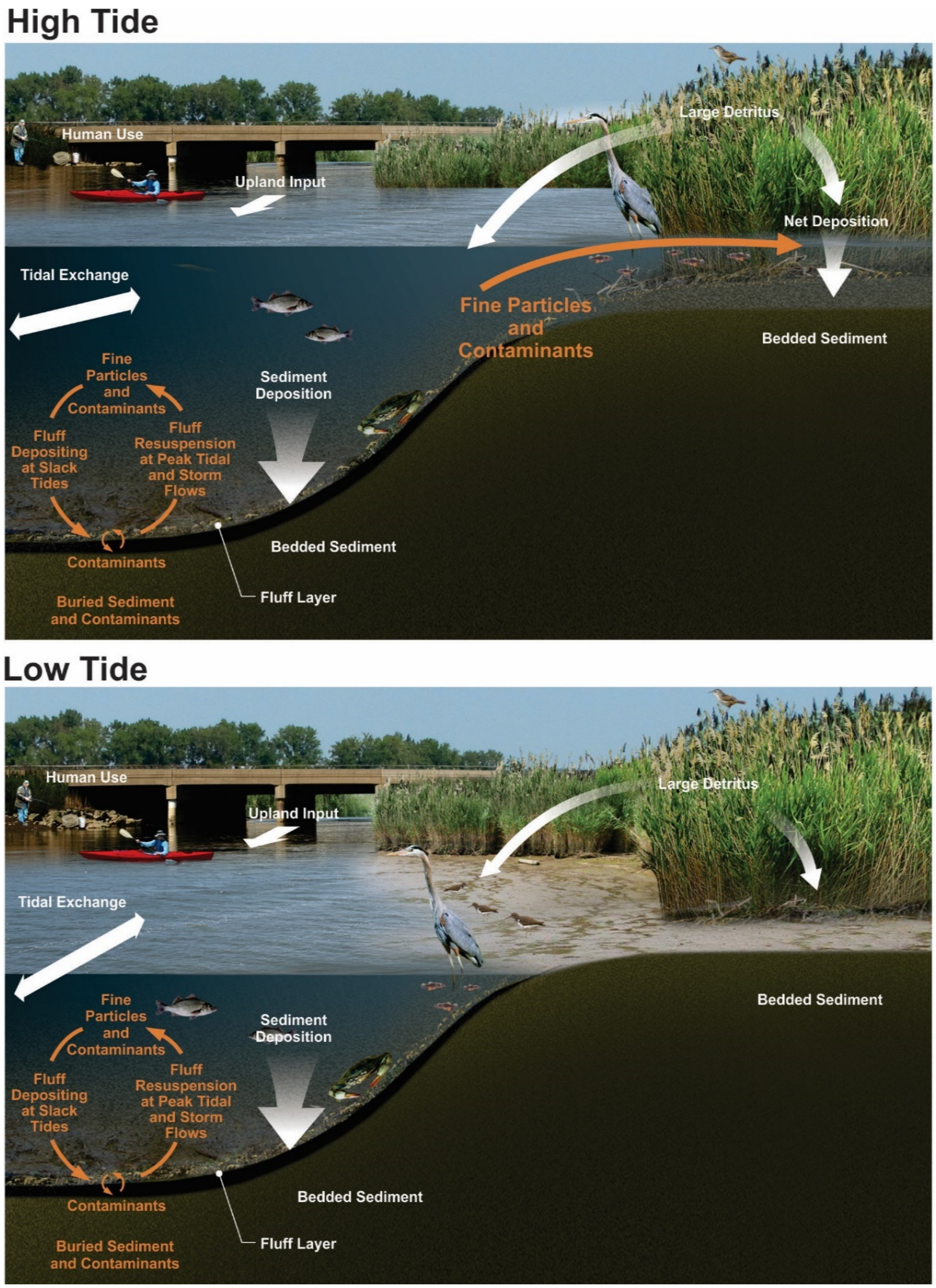


Figure 2. Conceptual site model of water and sediment dynamics at high tide and low tide, as well as potential human health and ecological risk receptors, for the Berry's Creek waterways and marshes.

Freshwater inputs into the BCSA are relatively low, in comparison to the tidal exchange with water from the Hackensack River. Surface water velocities are low throughout the system most of the time and are governed by the routine rise and fall of the tides diurnally (twice daily). Although episodic storm flows can create higher velocities in the waterways, these effects are localized (*e.g.*, in pool areas and main channels) and of short duration. In other words, most of the sediment bed is only minimally disturbed even in high flow events, as evidenced by monitoring before and after Hurricane Irene (2011), Tropical Storm Lee (2011) and Superstorm Sandy (2012). The overall condition supports a stable sediment bed where particulate material depositing from the water column accumulates over time. This stability is exemplified in the mudflats, where the accumulation of sediment occurs consistently.

The BCSA waterways are also bounded by natural features, including expansive mudflats and marshes, that dissipate flow energies and encourage deposition. This means that as the tides reach the mudflats and marshes, they lose energy and can no longer carry the particulate material. Therefore, the particulate material settles out and is deposited in the mudflats and marshes. The result is an accumulation of a "soft sediment" surface layer throughout the waterways and marshes that overlies a more consolidated sediment layer. The consolidated layer was deposited during pre-industrial times, and sampling within the consolidated clay does not indicate downward movement of contamination. The consolidated layer is also not easily eroded. The soft sediment is dominated by fine-grained silts and clays, as well as organic materials derived primarily from detritus (decaying plant fragments) from the *Phragmites* marshes in the BCSA and the larger estuary. The overall low permeability of soft fine-grained sediments limits the movement of water within the soft sediment layer, which also limits the movement of contaminants that preferentially adhere to particles in the water. Mechanisms such as tidal pumping (the movement of water from higher elevations to lower elevations as the tide recedes) are limited by the low permeability of the fine-grained soft sediment in the BCSA. In addition, movement of water and contaminants from the sediment into the overlying water column is minimal at the BCSA because the marshes and waterways are located over a large clay formation (from a glacial lake), which effectively prevents the movement of groundwater.

The higher elevation of the marshes and the presence of dense *Phragmites* stands with root structures which typically extend more than one-foot in depth provide physical stability to the BCSA landscape by stabilizing the waterway banks, dissipating energy within the system, and facilitating deposition and retention of sediment throughout the marshes. Except for some small non-contiguous sections, the physical characteristics of the waterways have been stable for decades throughout most of the BCSA. This stable condition is projected to remain into the future.

Nature and Extent of Contamination

It was clear from early data collections in the RI/FS that the primary contaminants of potential concern (COPCs) for the BCSA were mercury, methyl mercury and PCBs. These COPCs are responsible for most of the risk in the BCSA, so subsequent sampling activities focused on these chemicals. Mercury, methyl mercury and PCBs are the primary contaminants of concern (COCs) for the BCSA. Most, if not all, of the COCs are co-located, so actions to address the primary COCs will also address other contaminants that may be present in the BCSA, but do not present an actionable risk. Distribution of COCs in BCSA media are presented in the RI Report. The range of concentrations of primary COCs (plus chromium) are found on Table 1, below.

Sediment

The distribution of COCs in BCSA sediment reflects the contribution of historical sources to the BCSA tidal zone and surrounding watershed, the physical characteristics that control water flow and sediment

Table 1. Median waterway surface sediment concentrations (mg/kg) by reach. Upstream (north) on left. Reference includes data from Bellman's Creek, Mill Creek, and Woodbridge River.

Contaminant of Concern	Median Waterway Surface Sediment Concentrations by Reach (mg/kg)					
	UPIC	UBC	MBC	BCC	LBC	Reference
Mercury	87	43	18	5.9	3.5	1.3
Methyl Mercury	0.026	0.023	0.013	0.012	0.006	0.003
Total PCBs	2.5	1.5	1.2	0.54	0.49	0.2
Chromium	570	329	244	161	161	43.3

transport within the BCSA, the interactions of the BCSA with the Hackensack River, and the chemical characteristics of the COCs, most notably their strong association with the solid particles and particulate organic carbon (POC) derived primarily from the marshes. In other words, the COCs are most likely to be bound to the high organic particulate material (such as the detritus) and move where the particulate material moves. COC concentrations generally exhibit a north to south decreasing gradient, with surface sediment concentrations higher in UPIC, UBC, and MBC as compared to the lower reaches (BCC and LBC) (Figure 3).

Deposition of the highest concentrations of mercury, PCBs and other contaminants occurred when historical industrial discharges were at a maximum (1950s and 1960s). Subsequent burial by progressively cleaner sediment over time has resulted in the highest concentrations of these COCs typically being present at depth in the vertical sediment profile. This process has resulted in considerable reduction in COC concentrations in surface sediment in both the waterways and the marshes; however, concentrations remain elevated in waterway surface sediment in UBC (including UPIC) and much of MBC. COC concentrations in the lower system (BCC, LBC) are more like the regional conditions.

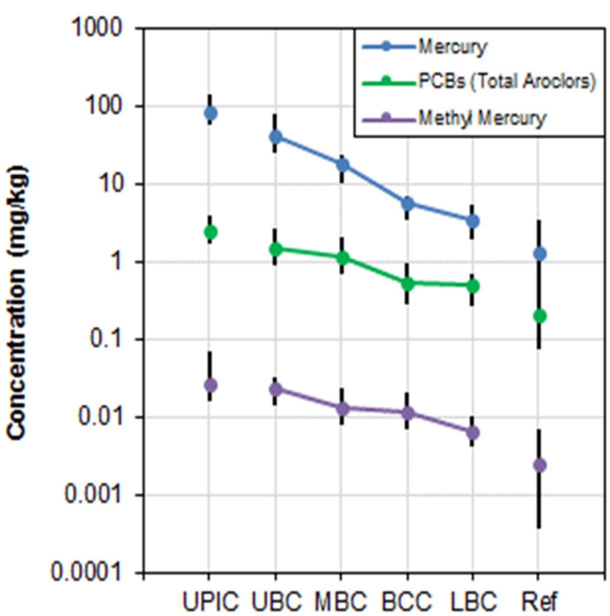


Figure 3. Concentrations in Waterway Surface Sediment (median, 25th, and 75th percentiles; mg/kg = milligram per kilogram), Upstream (North) on Left

Natural recovery can occur at sediment sites through various processes. At the BCSA, the prominent natural recovery process that occurs is the decrease in contaminant concentrations at the point of potential exposure (*e.g.*, surface of sediment) over time as cleaner sediment is deposited on the surface. The pattern of natural recovery in BCSA sediment is evident due to the higher concentrations of COCs at depth as compared to surface sediments measured in waterways and marshes throughout much of the BCSA. However, some exceptions to the pattern of natural recovery include: localized areas in the tidal zone waterways where peak flows are more variable; UPIC marsh where the highest COC concentrations occur closer to the sediment surface compared to sediment in the tidal marshes; and for methyl mercury, the concentration of which is strongly influenced by environmental conditions that impact how mercury is converted to methyl mercury.

Contamination near the sediment surface is a concern because it is within the biologically active zone and is therefore more available for uptake by biota than more deeply buried contamination. The COC concentrations in the sediments near and at the surface of the waterways are the product of a variety of mechanisms, including, among other things, ongoing deposition to the sediment bed and episodic redistribution of shallow sediment in localized areas during large storm events. COC concentrations in marsh near-surface sediment reflect movement of COCs that are bound to particles from the waterways into the marshes. Continuing deposition of COC-contaminated particles from the waterways results in slower recovery rates in the marshes than might otherwise be observed.

Surface Water

The majority of the COCs identified in the BCSA strongly adsorb to the particulate matter suspended in surface water. Suspended particulates in BCSA surface water have high organic content because of the P*hragmites* detritus from the surrounding marshes, as well as the organic material that is present in the water that enters the creek from the Hackensack River through tidal exchange. The particulates routinely settle onto, interact with, and resuspend from the surface of the waterway sediment bed because of fluctuations in tidal and storm velocities. These processes support the presence of a thin (~0.2 inch) layer of unconsolidated, high organic content material on the surface of the sediment bed in the waterways. This easily resuspended layer is commonly referred to as the "fluff layer." The presence of a fluff layer is typical in estuarine systems. Although the fluff layer contains substantially more solids particles than the water column above it, the fluff layer behaves more like the surface water than the surficial soft sediments. Interaction of the fluff layer with the surface of the waterway sediment bed is an important mechanism for COCs to be transported from waterway sediments to surface water and, in turn, for COCs to be taken up by organisms and transported elsewhere, where they can accumulate in the tissues of biota. The suspended particulate matter and associated COCs are transported into the marshes during high tides, where a portion of the particulates are deposited and retained on the marsh surface and contribute to marsh surface sediment COC concentrations.

Biological Uptake of COCs

Mercury, methyl mercury, and PCBs have been detected in biota collected in BCSA waterways and marshes, with higher concentrations in biota from UBC and MBC and lower concentrations in biota from BCC and LBC (see Figure 4).

The food web in the BCSA is primarily detritus based. This means that detritus, which predominantly originates from decaying *Phragmites* leaves and stems, serves as the primary source of energy to biota within the system. As the *Phragmites* leaves and stems grow, they do not uptake significant amounts of COCs. However, as the stems and leaves die, they generally fall to the marsh surface, where they can contact contaminants as the tide brings in contaminated particles from the waterways. In time, the *Phragmites* stems and leaves become the detritus that exits the marshes with the receding tides. Once in the waterways, a portion of the detritus will settle to the sediment surface, where it becomes part of the fluff layer or is incorporated into the surface sediments. Because the detritus is composed almost entirely of organic matter, the COCs readily adsorb to it from the surface sediments.

Shrimp, fiddler crab, and other organisms feeding on detritus and other organic matter provide the dietary link between the detritus and fish and other consumers. Thus, COC concentrations in the detritus entering the food web are linked to the COC concentrations at the surface of the waterway sediment bed. In marshes, exposure to COCs is

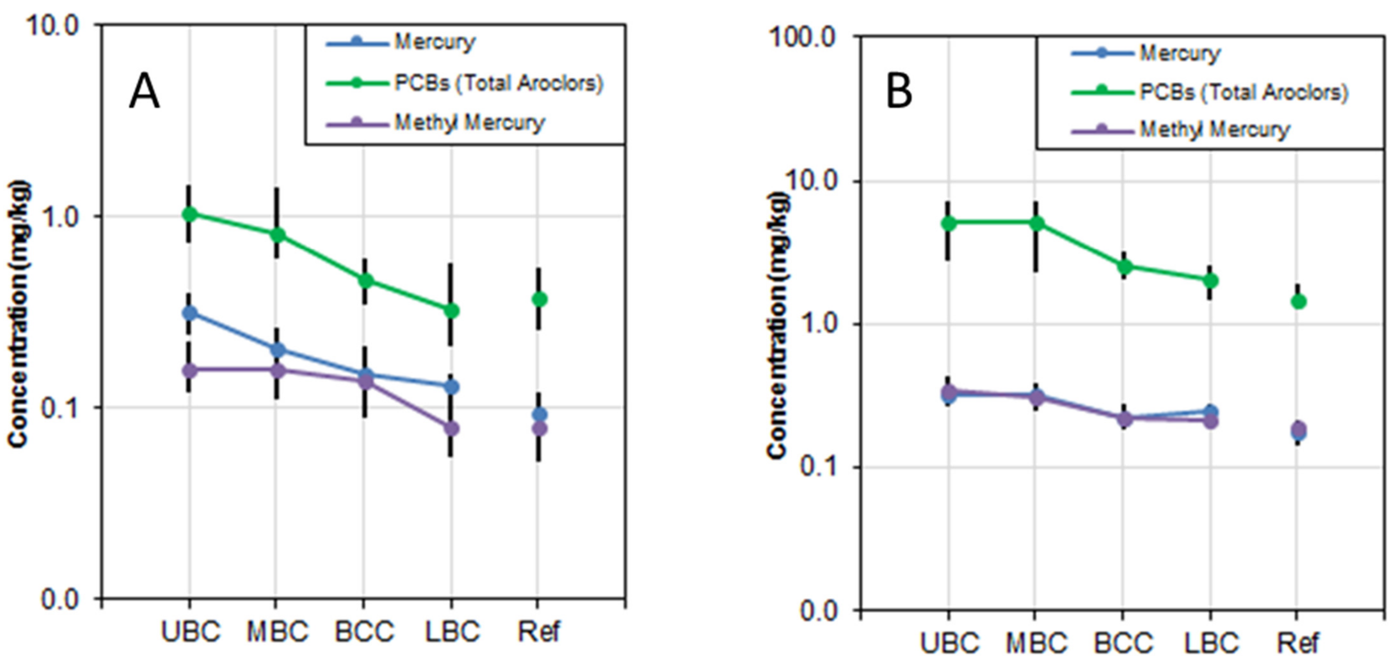


Figure 4. COC Concentrations in Mummichog (A) and Whole Body White Perch (B) (median, 25th, and 75th percentiles), Upstream (North) on Left

limited primarily to the detrital layer on the marsh surface, where most of the biological activity is concentrated. Marsh invertebrates and other organisms feeding on or in the detrital layer can be exposed to COCs and COCs have been detected in invertebrates collected from the BCSA marshes. As stated earlier, particulates transported from the waterway are an important source of COCs present in marsh detritus. Overall, the COC concentrations in marsh detritus and the waterway near-surface sediment are reflected in the COC concentrations in BCSA organisms.

Bioavailability (how readily COCs can be taken up into the tissue of organisms) is controlled by many factors in the BCSA. The bioavailability of the primary COCs in the BCSA is largely controlled by partitioning to organic matter, complexation with sulfides, as well as the burial of COCs by cleaner sediment. The understanding of bioavailability is important in the BCSA because even though the concentrations in some biota present unacceptable risk, the levels are significantly less than might be anticipated based on the high COC concentrations present in the sediments.

SCOPE AND ROLE OF THE ACTION

The BCSA is being addressed by EPA through an adaptive, multi-phased cleanup approach. Although the RI Report included investigations that were developed for the entire BCSA, it became clear during the process that the sediments in Upper and Middle Berry's Creek are:

- the areas of highest contaminant concentrations at the surface[1] of the sediment,
- the primary source of exposure and risks from the COCs, and
- the on-going source that contributes to surface contamination in the tidal marshes and downstream segments (LBC and BCC) as a result of fine sediment resuspension and transport in surface water.

Despite rigorous efforts to characterize the BCSA, uncertainties regarding the transport of contaminants from the waterways to the marshes make it premature to select a remedy for the tidal marshes until the effectiveness of the waterway cleanup can be evaluated. Therefore, in June 2016, EPA requested that the Berry's Creek Study Area Group evaluate alternatives to remediate the waterway sediments in UBC and MBC as an interim, source-control action. In addition, the high contaminant concentrations in the surface sediments of UPIC Marsh would be addressed because concentrations in the surface water in UPIC were among the highest recorded at the BCSA, and therefore it was appropriate to address the UPIC source area at the same time as UBC and MBC. This approach is consistent with EPA policy and practice to address sources first. It should be noted that the upland facilities (*e.g.*, Ventron/Velsicol (OU1), etc.) that were the initial sources of contamination to the BCSA have mostly been or are being addressed through separate actions. The Phase 1 interim remedial action is considered "interim" because one or more additional remedies will need to be selected in the future, as described below.

Uncertainties remain regarding both the response of the BCSA system to potential remedial actions and the mechanisms that contribute to exposure, risks, and the rate of natural recovery in the BCSA marshes. To address these uncertainties in a planned and systematic way, an adaptive management approach will be used to (a) promote intentional learning during the design and implementation of the Phase 1 interim remedial action to respond to changes and new information and ensure the remedy achieves the objectives, (b) collect and evaluate additional information to reduce uncertainties associated with the recovery of the marshes and downstream segments resulting from source removal, and (c) support evaluation and selection of further remedial actions. EPA expects that additional risk assessments and one or more Supplemental Feasibility Studies and decision documents will be developed following completion of these activities to address the remainder of the BCSA. The multi-phased remedy approach is illustrated in Figure 10 on the last page of this Proposed Plan. Because the subsequent and final remedial action for the BCSA will be developed based on these evaluations that rely in part on the results of the Phase 1 interim remedial action, this interim action will necessarily be consistent with those future actions.

Implementation of this initial phase would (a) reduce exposure of birds, fish, crabs, people (via ingestion of fish or crabs) and other biota to COCs in sediment

[1] Surface sediments in the BCSA were defined by field observations as 6 centimeters (cm) (2.4 inches) in UBC and 10 cm (4 inches) in the rest of the BCSA.

What is Human Health Risk and How is it Calculated?

A Superfund baseline human health risk assessment is an analysis of the potential adverse health effects caused by hazardous substance releases from a site in the absence of any actions to control or mitigate the hazardous substances under current- and future-land uses. A four-step process is utilized for assessing site-related human health risks for reasonable maximum exposure scenarios.

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at the site in various media (for Berry's Creek, sediment, surface water, air and tissue) are identified based on such factors as toxicity, concentration and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the COPCs in the various media identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of and dermal contact with contaminated surface water and sediment. Factors relating to the exposure assessment include, but are not limited to, the concentrations in specific media that people might be exposed to and the frequency and duration of that exposure. Using these factors, a "reasonable maximum exposure" scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated. A "central tendency exposure" scenario, which portrays the average or typical level of human exposure that could occur, is calculated when the reasonable maximum exposure scenario results in unacceptable risks, as discussed below under *Risk Characterization.*

Toxicity Assessment: In this step, the types of adverse health effects associated with chemical exposures and the relationship between magnitude of exposure and severity of adverse effects are determined. Potential health effects are chemical-specific and may include the risk of developing cancer over a lifetime or other noncancer health hazards, such as changes in the normal functions of organs within the body (*e.g.*, changes in the effectiveness of the immune system). Some chemicals are capable of causing both cancer and noncancer health hazards.

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks for all COPCs. Exposures are evaluated based on the potential risk of developing cancer and the potential for noncancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a "one-in-ten-thousand excess lifetime cancer risk;" or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions identified in the Exposure Assessment. Current Superfund regulations for exposures identify the range for determining whether remedial action is necessary as an individual excess lifetime cancer risk of 10^{-4} to 10^{-6}, corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk. For noncancer health effects, a "hazard index" (HI) is calculated. The key concept for a noncancer HI is that a threshold (measured as an HI of less than or equal to 1) exists below which noncancer health hazards are not expected to occur. The goal of protection is 10^{-6} and an HI of 1 for a noncancer health hazard. Cumulative risks that exceed a 10^{-4} cancer risk or an HI of 1 require remedial action at the site.

and (b) prevent these sediments from being an ongoing source of contaminants to the adjacent marshes and downstream areas. Future phases of work will consider the extent to which this initial phase reduced risk in the BCSA waterways and reduced uncertainty regarding the extent of risk and the of natural recovery in the BCSA marshes and downstream areas, taking regional conditions affecting the BCSA into account.

PRINCIPAL THREAT WASTE

Although mercury, PCBs and methyl mercury in sediment act as a source to surface water contamination and to the biota, these sediments are not highly mobile and can be reliably contained, so they are not considered principal threat wastes at the BCSA. Although some concentrations of the COCs are high, the exposure point concentration, the statistical value calculated to represent a reasonable maximum exposure to both human and ecological receptors, results in risks that exceed acceptable levels but do not meet the principal threat waste threshold.

SUMMARY OF SITE RISKS

Baseline human health and ecological risk assessments were conducted for the Site to estimate the risks associated with exposure to contaminants based on current and likely future uses of the BCSA. These baseline risk assessments are detailed in Appendix L and Appendix M of the RI Report.

Baseline Human Health Risk Assessment

A Baseline Human Health Risk Assessment (BHHRA) was conducted to assess the cancer risks and non-cancer health hazards associated with exposure to COCs present at the Site. The risk assessment was conducted using the standard EPA risk assessment process comprised of Hazard Identification, Exposure Assessment, Toxicity Assessment, and Risk Characterization (see adjacent text box).

People can be exposed to COCs present within the BCSA in air, surface water, sediment, crabs, and fish, through a variety of activities that are consistent with current and potential future uses of the BCSA. There are no residences within the marshes along Berry's Creek and the dense stands of *Phragmites* limit use by people. Recreational use of Berry's Creek waterways is the main way that people are exposed to COCs. These recreational uses may include fishing, crabbing, and kayaking/canoeing/boating. Fishing and crabbing activities are focused in and around the creek in areas that are readily accessible from roads. Construction workers conducting routine inspections or maintenance activities related to road, bridge, or rail infrastructure may also be exposed to COCs. For each assumed use, a reasonable maximum exposure (RME), which uses conservative exposure values, was evaluated to estimate cancer risks and non-cancer hazard.

The estimated cancer risks for all potential exposure pathways calculated using the RME are within EPA's acceptable risk range (less than $1x10^{-4}$). Estimated cancer risks range from 2×10^{-7} (construction worker) to 3×10^{-5} (angler) for all exposure scenarios. For non-cancer hazards, the calculated hazard indices (HIs) for all receptor groups range from less than 1 to 3 (angler). PCBs are the primary contributor to the estimated risks from fish consumption.

Baseline Ecological Risk Assessment

The baseline ecological risk assessment (BERA) evaluated the potential for adverse effects to ecological receptors from exposure to contaminants within the BCSA. The BERA was conducted in accordance with EPA's 1997 *Ecological Risk Assessment Guidance for Superfund* and its updates. Several ecological receptors were evaluated for both the waterways and marshes:

- Waterway receptors – wading birds (Great blue heron, Black-crowned night heron); shorebird (Spotted sandpiper); mammal (Raccoon); fish community (Mummichog, White perch); and benthic community

What Is Ecological Risk and How Is It Calculated?

A Superfund baseline ecological risk assessment is an analysis of the potential adverse health effects to biota caused by hazardous substance releases from a site in the absence of any actions to control or mitigate these under current and future land and resource uses. The process used for assessing site-related ecological risks includes:

Problem Formulation: In this step, the contaminants of potential concern (COPCs) at the site are identified. Assessment endpoints are defined to determine what ecological entities are important to protect. Then, the specific attributes of the entities that are potentially at risk and important to protect are determined. This provides a basis for measurement in the risk assessment. Once assessment endpoints are chosen, a conceptual model is developed to provide a visual representation of hypothesized relationships between ecological entities (receptors) and the stressors to which they may be exposed.

Exposure Assessment: In this step, a quantitative evaluation is made of what plants and animals are exposed to and to what degree they are exposed. This estimation of exposure point concentrations includes various parameters to determine the levels of exposure to a chemical contaminant by a selected plant or animal (receptor), such as area use (how much of the site an animal typically uses during normal activities); food ingestion rate (how much food is consumed by an animal over a period of time); bioaccumulation rates (the process by which chemicals are taken up by a plant or animal either directly from exposure to contaminated soil, sediment or water, or by eating contaminated food); bioavailability (how easily a plant or animal can take up a contaminant from the environment); and life stage (*e.g.*, juvenile, adult).

Ecological Effects Assessment: In this step, literature reviews, field studies or toxicity tests are conducted to describe the relationship between chemical contaminant concentrations and their effects on ecological receptors, on a media-, receptor- and chemical-specific basis. In order to provide upper and lower bound estimates of risk, toxicological benchmarks are identified to describe the level of contamination below which adverse effects are unlikely to occur and the level of contamination at which adverse effects are more likely to occur.

Risk Characterization: In this step, the results of the previous steps are used to estimate the risk posed to ecological receptors. Individual risk estimates for a given receptor for each chemical are calculated as a hazard quotient (HQ), which is the ratio of contaminant concentration to a given toxicological benchmark. In general, an HQ above 1 indicates the potential for unacceptable risk. The risk is described, including the overall degree of confidence in the risk estimates, summarizing uncertainties, citing evidence supporting the risk estimates and interpreting the adversity of ecological effects.

- Marsh receptors – songbird (Red-winged blackbird, Marsh wren); Mammal (Muskrat); and marsh community (*Phragmites*)

For the waterway receptors, unacceptable risks were found for shorebirds *(e.g.*, sandpiper) that are exposed to COCs by ingesting sediment in mudflats. These risks are highest in UBC and MBC. The COCs that are the largest contributors to risk include chromium and mercury. Unacceptable risks were also found for wading birds and fish in certain reaches of BCSA but were calculated to be lower than the risks associated with shorebirds. Potential risks to mammals and the benthic community are within the acceptable risk range.

Ecological risks are lower in the marshes than the waterways. For the marshes, the highest risk is to muskrats, which just exceeds the acceptable risk range. Potential risks to songbirds and the marsh community are not unacceptable, although some uncertainty remains.

Elevated near-surface COC concentrations in the UPIC marsh sediment (which are elevated compared to other BCSA marshes), and relatively low sediment accumulation rates in UPIC marsh, contribute to the potential for exposure of ecological receptors that may come into direct contact with the marsh sediment under current conditions.

Basis for Action

It is EPA's current judgment that the preferred alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) provide a general description of what the interim remedial action is intended to accomplish. Development of the RAOs considered the understanding of the contaminants in the BCSA and is based upon an evaluation of risk to human health and the environment, control of the source of those risks, and maintaining the stability of the extensive marsh habitat. The following RAOs have been developed for the Phase 1 Remedy:

- Control the sources of COCs by replacing the current biologically active zone[2] in the UBC, MBC, and UPIC waterway soft sediment[3], thereby reducing exposure of human and ecological receptors to COCs in the waterways.

- Control the sources of COCs by replacing the current biologically active zone in the UBC, MBC, and UPIC waterway soft sediment, thereby reducing resuspension of COCs into the water column and transport into adjacent marshes and downstream study segments (BCC and LBC).

- Control the sources of COCs to UPIC marsh water column by replacing the current biologically active zone in the UPIC marsh sediments, thereby reducing exposure and COC transport to the UBC water column.

EPA defines the source areas for the Phase 1 interim remedial action geographically as the soft sediment in waterways of UBC, MBC (above the breakpoint[4]) and UPIC, shown on Figure 5, as well as the surface sediment in the marshes in UPIC. For the waterways, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the targeted surface area that is addressed by the remedial action. Greater percentages of success are anticipated in the main stem waterways, compared to the narrow, shallow tributaries where implementation will be more challenging. In addition, post-remediation monitoring will include, among other things, sampling of surface sediment, surface water and biota in the remediation footprint, as well as in LBC and BCC, in order to evaluate remedy effectiveness and degree of recontamination. Specifics of the monitoring

[2] A biologically active zone thickness of 10 cm was established for MBC, BCC, and LBC waterway soft sediment, and of 6 cm for UBC waterway soft sediment, based on site-specific data collected during the RI regarding the depth to which biological activity (*e.g.*, burrowing of worms and other organisms) occurs.

[3] Soft sediment is the recently deposited (last 100 years) alluvial sediment in waterways that has not undergone longer term compaction and related geochemical changes.

[4] The breakpoint is a location in Middle Berry's Creek where changes in the physical system result in a step-wise change of contaminant concentrations upstream and downstream of this point (See, Figure 6)

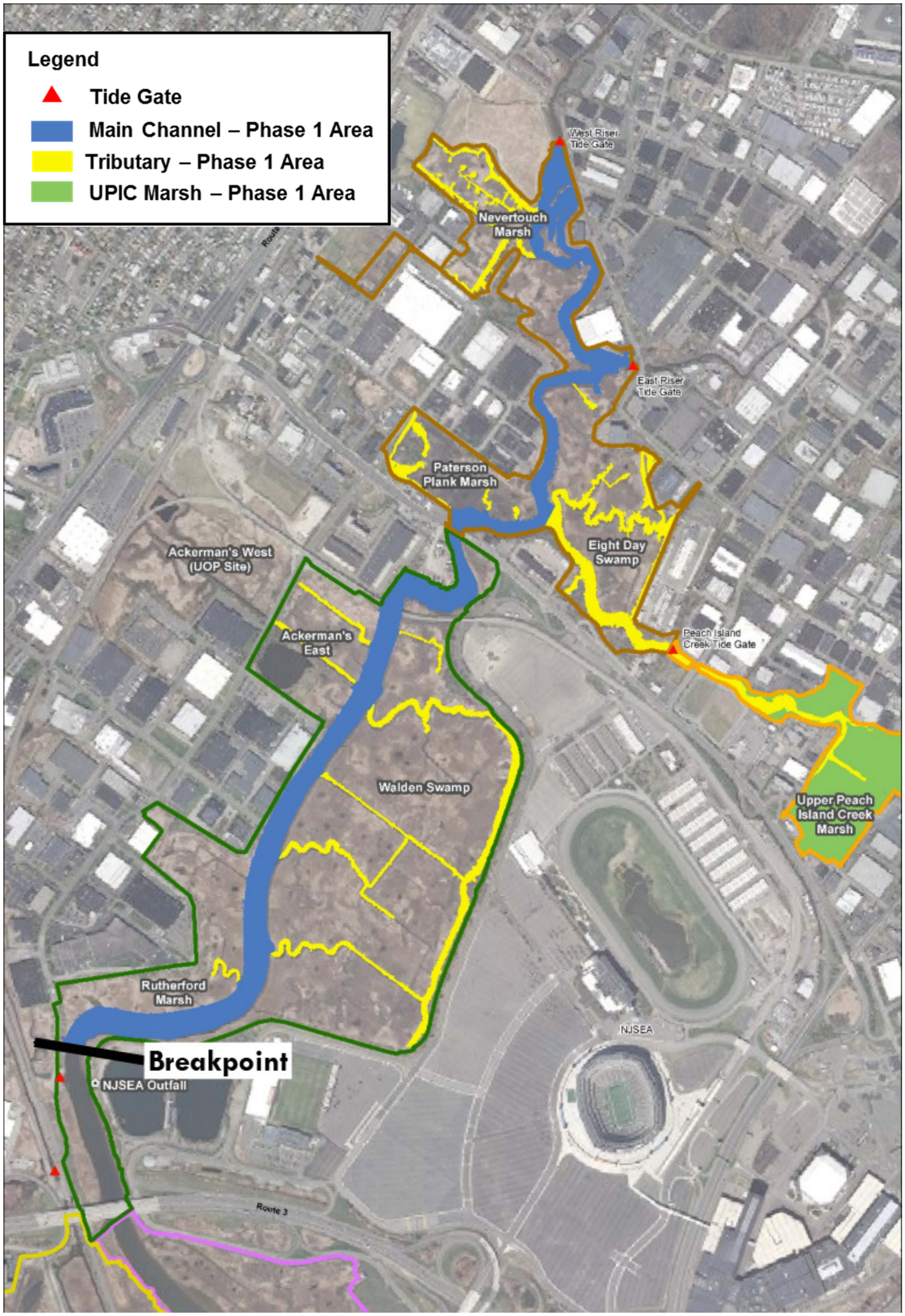


Figure 5. Extent of BCSA Phase 1 Interim Remedial Action

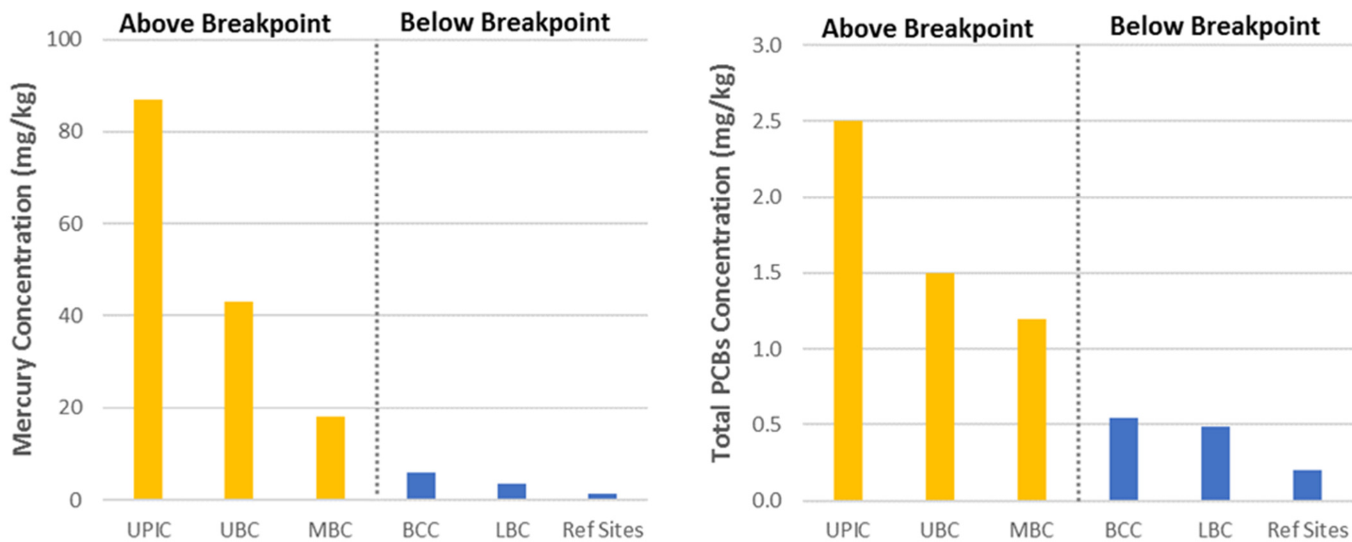


Figure 6. Median concentrations above and below the breakpoint for Mercury and PCB

programs will be determined during the Remedial Design.

In UPIC marsh, the near-term performance measure is to ensure that the interim remedial action controls the sources of COCs in more than 95% of the targeted surface area that is addressed by the remedial action Again, most of the area should easily exceed this performance measure, with more challenging implementation around the radio towers.

The percentage of targeted areas addressed will be calculated by use of a digital mapping comparison of targeted areas to the areas remediated.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA Requirements

Section 121(b)(1) of CERCLA, 42 U.S.C. § 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, be cost-effective, and use permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. CERCLA § 121(d), 42 U.S.C. § 9621(d), further specifies that a remedial action must require a level or standard of control of the hazardous substances, pollutants, and contaminants that at least attains applicable or relevant and appropriate requirements (ARARs) under federal and state laws, unless a waiver can be justified pursuant to CERCLA § 121(d)(4), 42 U.S.C. § 9621(d)(4).

This Proposed Plan presents EPA's preferred interim source control remedy for the BCSA and evaluates whether it satisfies the various mandates of CERCLA. Interim actions must protect human health and the environment from the threats they are addressing, be cost effective, and consistent with the final remedy. The remedial alternatives evaluated in the BCSA FS Report, except for the statutorily-required no action alternatives and Alternative W2 (capping only), are all protective of human health and the environment, comply with ARARs, and are cost-effective, thus satisfying the requirements of CERCLA. As discussed below, most alternatives include the use of treatment technologies as part of dredged materials management.

The remedial alternatives evaluated for the Phase 1 interim remedial action (except for the no action alternatives) focus on source control. Five remedial alternatives were developed for the Phase 1 interim remedial action for the UBC and MBC waterways, and five remedial alternatives were developed for UPIC marsh. Brief descriptions of the remedial alternatives evaluated for the Phase 1 interim remedial action are given below. More detailed information regarding the alternatives is provided in the BCSA FS Report.

As part of the study to evaluate potential treatment technologies and remedies for the BCSA, it was concluded that the sediments could not be treated in place. Similarly, an evaluation of alternatives for excavated/dredged sediment could not identify a cost-effective treatment technology to reduce toxicity, mobility and volume when compared to off-site disposal. However, alternatives involving sediment removal would likely require the addition of a stabilizing agent to transport the material for off-site disposal. The stabilizing material would help solidify the material so that it would comply with transportation requirements. Stabilizing agents (*e.g.*, Portland cement) also typically reduce the mobility of the contaminants and, therefore, serve as a form of treatment.

The areal extent of active remediation in the UBC and MBC waterways with all four alternatives is the same and is shown in Figure 5. The Phase 1 area for the waterways encompasses 87.2 acres, which represents the entire UBC and MBC main waterway down to the downstream limit of Phase 1 near the breakpoint (near the East Rutherford tide gate and NJSEA outfall).

Most of the waterway tributaries to UBC and MBC area are included in the Phase 1 area. Tributaries selected for remediation are the primary tributaries (*i.e.*, directly connected to the main channel) that were shown in the BCSA RI Report to be the primary water conveyances between the main channel and the marshes (typically 20 feet or larger in width, extend more than 500 feet from the main channel, and have elevated COC concentrations relative to the marshes). Other common elements include post-remediation monitoring and maintenance and institutional controls (ICs) Five-year reviews would be conducted since contamination would remain above levels that allow for unlimited use and unrestricted exposure.

Dredging: For each alternative that includes dredging, remediation would start with waterway debris removal followed by dredging of soft sediment to the specified removal depths as described below. The area to be dredged would extend across the width of the waterway from marsh bank to marsh bank and would include the soft sediments in both the channel and the mudflats (to the Mean Tide Level (MTL)). The depth of dredging would be to the depth specified in the alternative, plus an additional 6-inch over-dredge to ensure that the specified depth is reached. While the sequence for dredging the 87.2 acres would be developed during the remedial design, the work generally is anticipated to move from upstream to downstream to better manage the recontamination potential for dredged and backfilled areas. It is also anticipated that tributaries along each reach of the waterways would be dredged prior to the adjacent main channel, again to manage recontamination potential. For planning and cost estimating purposes, the FS anticipated that hydraulic dredging would be conducted in most areas using 8- and 12-inch suction cutterhead dredges. In limited areas, amphibious excavators would likely be used. Technical challenges associated with dredging in the Phase 1 area include shallow water depth, narrow tributaries, and the substantial diurnal tide cycle (typically 5.7 to 6.0 feet between high and low tide). Throughout the dredging program, sediment resuspension and residuals will be limited through the use of appropriate management practices.

Dredged sediment would be pumped through pipes to a central sediment management area(s), dewatered using geotextile tubes or mechanical dewatering equipment, mixed with an amendment (*e.g.*, Portland cement) as needed for the sediment to meet transportation and disposal requirements, and then transported for disposal at an off-site commercial disposal facility. Based on the concentrations and generally low solubility of the contamination at the BCSA, it is anticipated that most of the dredged material will be disposed of as non-hazardous waste at a RCRA Subtitle D facility. The FS was developed assuming truck transport of the sediment to the facility. During the remedial design, train and barge transport will also be evaluated.

Backfill/Capping: Backfilling/capping are common components of all the active waterway remedial alternatives. Backfilling/capping after dredging would be applied in multiple lifts after dredging throughout the 87.2-acre Phase 1 remediation footprint. Backfill/cap thickness for Alternatives W3, W4, and W5 would equal soft sediment removal thicknesses. Backfill/cap thicknesses were selected based both on considerations of performance effectiveness and maintaining the hydrodynamic and sediment-transport characteristics of the waterway. In areas where all soft sediment is removed, there is no capping function for the backfill because all the contamination has been removed. Where contaminated soft sediment remains after dredging, the backfill will serve the additional function of capping and physically isolating the remaining material. The sequencing of backfill/cap placement would be determined during the remedial design. The reason for placing multiple lifts (layers) is both to limit the effects of soft sediment resuspension and residuals during the dredging process and to maintain the stability of any remaining soft sediment in the waterways. Cap material for Alternative W2, which does not include any dredging, would also be placed in lifts for the same reasons just described for the other waterway alternatives. Backfill and cap material is anticipated to be a silty sand or sand that is stable and would not erode under the hydrodynamic forces that can exist during storm events in the BCSA. Placement methods for the backfill and cap material would be determined during the remedial design.

Post-Remediation Monitoring and Maintenance, and Institutional Controls (ICs): All active remedial alternatives for the waterways would be monitored and maintained, and all will include ICs. Monitoring of the remedial alternatives would start during their construction. Requirements for monitoring during construction will be developed during the remedial design. Remedy performance monitoring would be conducted post-remediation and include monitoring of Marsh Demonstration Project areas (to be detailed in the Remedial Design [RD] Work Plan) to further evaluate thin-layer capping technologies in the BCSA tidal marshes. The scope of such monitoring would be described in a Performance Measures Monitoring Plan (PMMP) that would also be developed as part of the remedial design. In addition to post-remediation monitoring, maintenance would be conducted as necessary to ensure the effectiveness of the remedy. Maintenance could include, for example, replenishment of backfill in an area should an unanticipated significant disturbance occur. ICs for the waterways would include continuing New Jersey fish consumption advisories as well as setting local waterway use restrictions.

In the description of alternatives that follow, all removal and backfill/cap material volumes contain, as applicable, allowances for over-dredging and over-excavation, material loss, and volume uncertainty contingency. All reported cost estimates include direct and indirect capital costs, direct and indirect operations and maintenance (O&M) costs (including performance monitoring), and contingency. The costs are presented as present value, discounted by the 7% discount factor specified in EPA guidance.

Description of Waterway Alternatives

Alternative W1: No Action: The Superfund program requires that the No Action alternative be considered as a baseline for comparison with the other alternatives. The No Action alternative would consist of taking no specific remedial action and allowing the waterways to continue to recover naturally. This alternative would not change or add to the current fish consumption advisories already in place in the BCSA, nor would it include monitoring of the progress of natural recovery.

- Volume of sediment removal: 0 cubic yards
- Volume of backfill (backfill/cap) material: 0 cubic yards
- Present Value: $0
- Estimated construction time: 0 years

Alternative W2: Cap Addition: Alternative W2 would involve placement of a 2-foot thick cap/cover layer from marsh bank to marsh bank throughout the Phase 1 waterway footprint. Figure 7 presents an illustrative cross section of such a 2-foot thick cap/cover layer. With this alternative, the cap/cover material would be placed directly onto the existing sediment bed without removing any sediment. The intent with Alternative W2 would be to achieve the Phase 1 waterway source control RAOs at the end of construction by isolating COCs in the sediment from the water column. A new BAZ layer would develop at the surface of the cap/cover layer over time.

- Volume of sediment removal: 0 cubic yards
- Volume of backfill (cap) material: 335,900 cubic yards
- Estimated present value: $101 million
- Estimated construction time: 3.3 years

Alternative W3: 1-foot Sediment Removal + Backfill/Cap: Alternative W3 would provide source control and achieve the Phase 1 RAOs at the end of construction by removing soft sediment to a depth of 1 foot (plus over-dredge), or to firmer consolidated sediment[5], whichever is encountered first. This would be followed by placing a thickness of

[5] Testing conducted within the BCSA has demonstrated that COCs do not penetrate into this firmer consolidated sediment, which usually consists of significant amounts of clay.

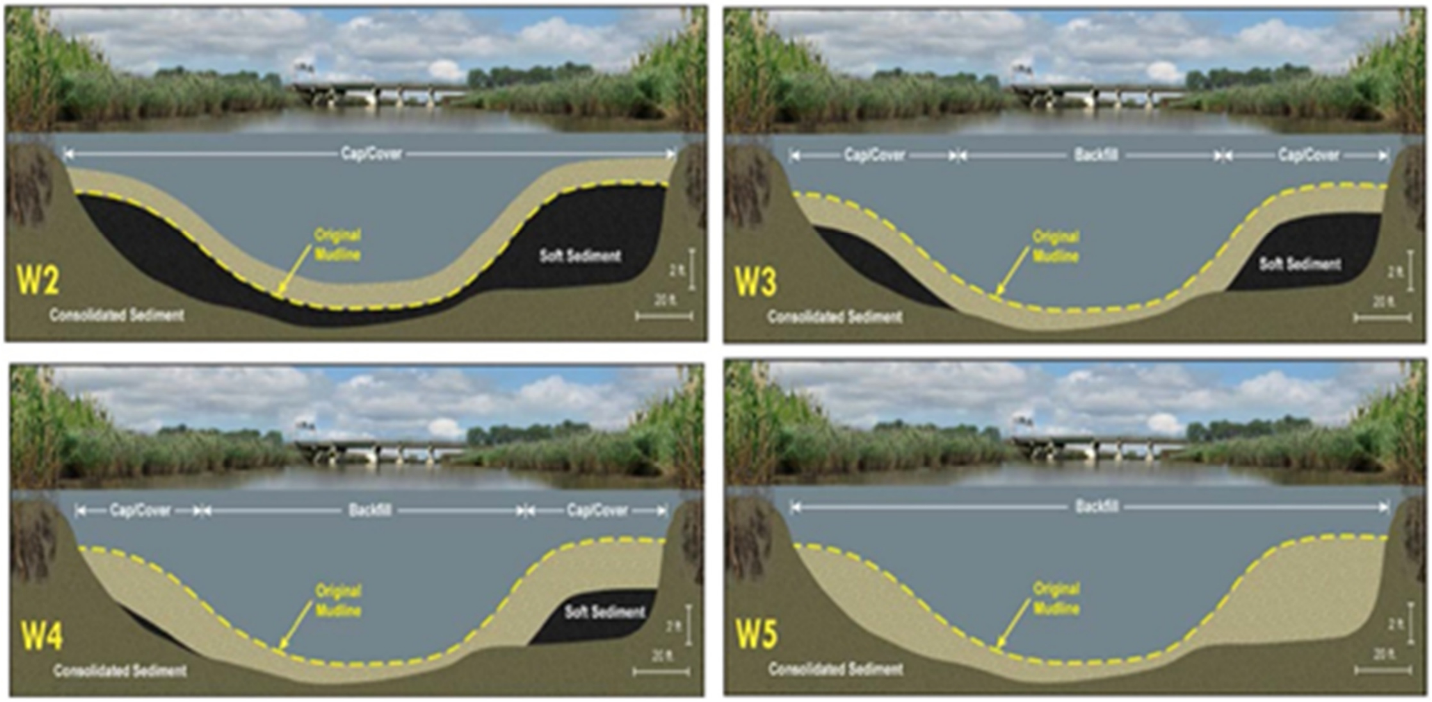


Figure 7. Illustrations of BCSA Alternatives W2 through W5

backfill/cap material into the dredged waterway equal to the removal thickness. This removal depth

includes the current BAZ plus a substantial additional thickness of soft sediment. An illustrative cross section of this alternative is shown in Figure 7. After backfilling/capping is complete, a new BAZ would become established over time on top of the backfill/cap material.

- Volume of sediment removal: 245,700 cubic yards
- Volume of backfill/cap material: 282,500 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 35%
- Estimated present value: $206 million
- Estimated construction time: 2.8 years

Alternative W4: 2-foot Sediment Removal + Backfill/Cap: Alternative W4 would provide source control and achieve the Phase 1 RAOs at the end of construction by removing soft sediment to a depth of 2 feet (plus over-dredge), or to firmer consolidated sediment, whichever is encountered first. This would be followed by placing a thickness of backfill/cap material equal to the removal thickness. This removal depth includes the current BAZ plus an even more substantial additional thickness of soft sediment than for Alternative W3. An illustrative

cross section of this alternative is shown in Figure 7. After backfilling/capping is complete, a new BAZ would become established over time on top of the backfill/cap material.

- Volume of sediment removal: 363,000 cubic yards
- Volume of backfill (cap/cover) material: 417,500 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 64%
- Estimated present value: $261 million
- Estimated construction time: 3.5 years

Alternative W5: Removal of All Soft Sediment + Backfill: This alternative would provide source control and achieve the Phase 1 RAOs at the end of construction through the removal of all soft sediment except for sediment residuals remaining after the completion of dredging operations. This would include the current BAZ plus the large volume of additional soft sediment. After dredging, a backfill thickness up to the sediment removal thickness

ALTERNATIVE #	WATERWAY ALTERNATIVE	VOLUME REMOVED (cubic yards)	VOLUME BACKFILL / CAP (cubic yards)	ESTIMATED COST	ESTIMATED CONSTRUCTION TIME (years)
W1	No Action	0	0	0	0.0
W2	Cap Only	0	335,900	$101 M	3.3
W3	One-foot Sediment Removal + Backfill/Cap	245,700	282,500	$206 M	2.8
W4	Two-foot Sediment Removal + Backfill/Cap	363,000	417,500	$261 M	3.5
W5	Removal of All Soft Sediment + Backfill	646,000	743,400	$393 M	4.9

Table 2. Waterways Alternatives Summary

would be placed. An illustrative cross section of this alternative is shown in Figure 7. After backfilling is complete, a new BAZ would become established over time on top of the backfill.

- Volume of sediment removal: 646,000 cubic yards
- Volume of backfill material: 743,400 cubic yards
- Approximate percentage of Phase 1 waterway footprint undergoing complete soft sediment removal: 100%
- Estimated cost: $393 million
- Estimated construction time: 4.9 years

Alternatives for UPIC Marsh

Common Elements

General Description: Except for the no action alternative, all the UPIC marsh remedial alternatives include the common source control components of sediment excavation and/or containment. Alternatives UPIC3, UPIC3-A and UPIC4 (described in detail below) all involve sediment excavation and backfilling. Alternatives UPIC3 and UPIC4 involve sediment excavation and backfilling throughout the 28.2-acre marsh. Alternative UPIC3-A involves excavation and backfilling in approximately 86.5% of the marsh with thin layer cover being the selected remedial technology in the remainder of the marsh. With Alternative UPIC-3-A, thin layer cover would be applied in the southern portion of the marsh in the vicinity of the eight tall radio towers in that area. This is also an area that contains lower COC concentrations compared to other areas of UPIC marsh. Alternative UPIC2 would involve the application of thin-layer cover throughout the entire UPIC marsh. These remedial alternatives also include the common components of marsh mitigation, post-remediation monitoring and maintenance, and ICs.

Marsh Excavation: Alternatives UPIC3, UPIC3-A, and UPIC4 would all involve excavation of marsh sediments in all or a majority of the marsh to depths well below the depth at which there is a potential for human and ecological exposures, which is the marsh surface detritus layer and the top 1 to 2 inches of sediment. The excavation depth would also be significantly greater than the depth interval at which the highest COC concentrations occur. The depth of excavation would be to the depth specified in the alternative, plus an additional 6-inch over-excavation to ensure that the specified depth is reached. The horizontal extent of the excavation alternatives (UPIC3, UPIC3-A, and UPIC4) will require adjustment around the radio towers, where infrastructure limitations will influence the remedial action and will be made as part of the remedial design process.

Because the UPIC marsh is non-tidal (as it is located above a tide gate), it is anticipated that sediment excavation would be completed using conventional or light ground pressure equipment. Dewatering of the marsh during construction would likely be required in areas with standing water and following significant precipitation events. Excavated sediment would be dewatered and treated with an amendment (*e.g.*, Portland cement) so that it satisfies transportation and disposal requirements. The FS was developed assuming truck transport of the treated sediment. During the remedial design, train and barge transport will also be evaluated.

Backfilling: Backfilling for Alternatives UPIC3, UPIC3-A, and UPIC4 would be conducted throughout the excavation area. Backfill would be placed in phases as excavation activities in discrete areas of the marsh are progressively completed. Backfill thicknesses would be sufficient to maintain the current marsh elevation and hydrology. Backfill material would include a sand or silty-sand organic mix designed to promote re-establishment of the marsh at the completion of the remedial action and protect restored areas from upland storm water flows that enter the UPIC area at some locations.

Thin-Layer Cover: Thin-layer cover would be installed with Alternatives UPIC2 and UPIC3-A. This technology would involve placement of sand or finer-grained soil material in a thin layer over the surface of the marsh. The objective would be to maintain long term stability of the underlying contaminated sediment and eliminate the ecological exposure pathways that pose an unacceptable risk. A cover layer thickness of 6 inches has been chosen to provide a substantial layer of fill to establish a clean post-remediation surface and to isolate underlying marsh sediment. Pilot studies conducted at multiple locations in the BCSA as part of the RI/FS demonstrated the implementability and stability of thin-layer test plots in BCSA marshes. The plots have remained stable since their construction in 2012 and 2013 through several large storm events, including Hurricane Sandy in 2012.

Marsh Mitigation: The UPIC marsh habitat would be disturbed in areas of thin-layer placement with Alternatives UPIC2 and UPIC3-A and would need to be re-established. The habitat would be destroyed in areas of excavation and backfilling with Alternatives UPIC3, UPIC3-A, and UPIC4 and would likewise need to be mitigated. For all the alternatives, a marsh mitigation plan would be developed as part of the remedial design. For the FS cost estimates, it was assumed that for both marsh excavation and backfilling, or thin-layer cover, the entire marsh would be re-established in-kind consistent with existing vegetation (*Phragmites*).

Post-Remediation Monitoring and Maintenance, and ICs: As with the waterway remedial alternatives, all active remedial alternatives for the waterways would be monitored and maintained, and 3 of the 4 alternatives would include ICs. Monitoring of the remedial alternatives would start during construction. Remedy performance monitoring would be conducted post-remediation with all the active remedial alternatives. The scope of such monitoring would be described in the PMMP. In addition to post-remediation monitoring,

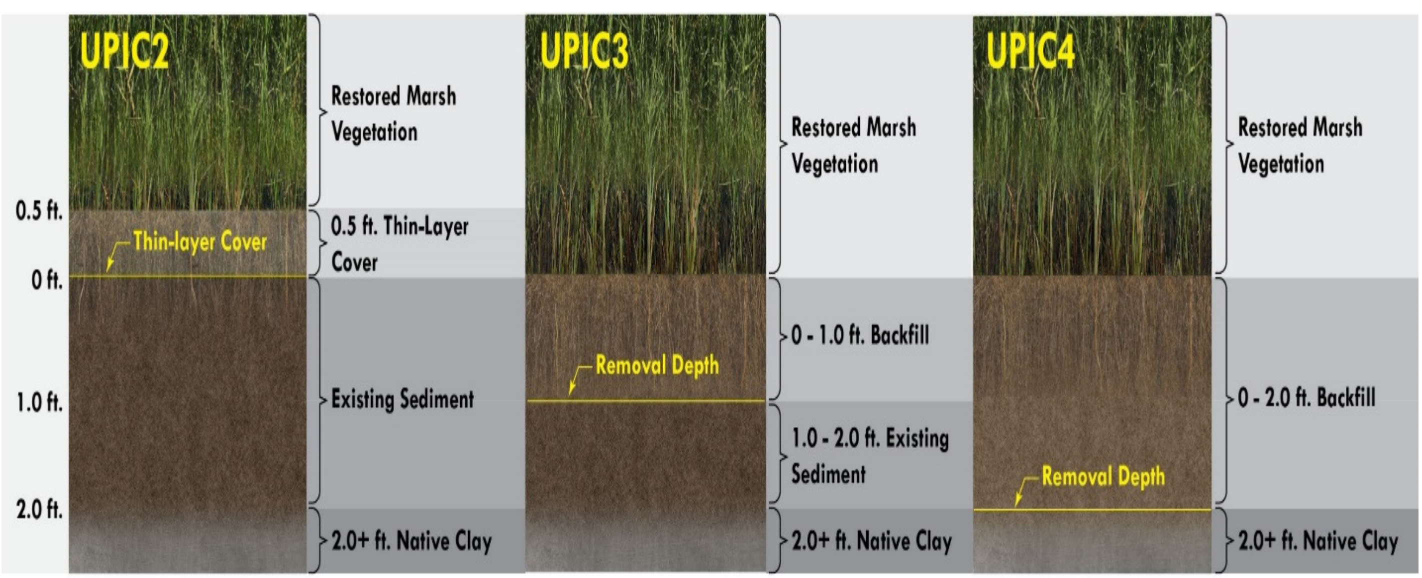


Figure 8. Illustrations of UPIC Marsh Alternatives UPIC2, UPIC3, and UPIC4

maintenance would be conducted as necessary to assure the effectiveness of the remedy.

Maintenance could include, for example, backfill replenishment in an area should unanticipated significant disturbance occur and/or replanting of marsh vegetation. ICs for all the active marsh remedial alternatives may include property use and access restrictions. Because Alternative UPIC4 would involve the removal of essentially all sediment with elevated COC concentrations, property use and access restrictions are not considered necessary.

Description of UPIC Marsh Alternatives

Alternative W1: No Action: The No Action alternative would consist of taking no specific remedial action and allowing the UPIC marsh to continue to recover naturally. This alternative would not include ICs nor would it include monitoring of the progress of natural recovery.

- Volume of sediment excavation: 0 cubic yards
- Volume of backfill or thin-layer cover: 0 cubic yards
- Cost: $0
- Estimated construction time: 0 years

Alternative UPIC2: Thin-Layer Cover: This alternative would involve placement of a thin layer of approximately six inches of sand or fine-grained material over the surface of the marsh. The intent of Alternative UPIC2 would be to achieve an immediate reduction in COC concentrations at the surface of the marsh where ecological exposure potential is greatest. In doing so, the UPIC marsh source control RAO would be achieved at the end of construction. Figure 8 presents an illustrative cross section of the alternative. This alternative would result in an increase, albeit small, in UPIC marsh surface elevations. Note though, surface elevations in the marsh are, on average, 2 feet lower than in the BCSA tidal marshes. The net fill to the marsh is small enough that this alternative could meet the substantive standards of the New Jersey Flood Hazard Control Act and Federal Floodplain Management requirements that address net filling in floodplains.

- Volume of sediment excavation: 0 cubic yards
- Volume of backfill or thin-layer cover: 26,200 cubic yards
- Estimated present value: $25 million
- Estimated construction time: 1.0 years

Alternative UPIC3: 1-foot Sediment Removal + Backfill: This alternative would involve excavation of contaminated sediment in UPIC marsh to the bottom of the dense, fibrous portion of the *Phragmites* root mat. This bottom occurs at a depth below ground surface of about 1 foot. The depth of excavation would be increased at the marsh banks next to the UPIC waterways, to effectuate a smooth transition between the marsh and waterway remedial components and to assure ongoing stability of the marsh banks. The extent of removal in the area of the radio towers would be determined during design. Figure 8 presents an illustrative cross section of the alternative. Excavated marsh areas would be backfilled as described above and the marsh habitat restored. This alternative would achieve the UPIC marsh source control RAO at the end of construction.

- Volume of sediment excavation: 78,500 cubic yards
- Volume of backfill or thin-layer cover: 90,300 cubic yards
- Estimated present value: $62 million
- Estimated construction time: 1.4 years

Alternative UPIC3-A: Hybrid – Removal + Backfill and Thin-Layer Cover: Alternative UPIC3-A essentially involves implementation of Alternative UPIC3 throughout the majority of the marsh and Alternative UPIC2 in a small portion of the marsh. The portion of UPIC marsh that would undergo a 1-foot removal followed by backfilling under Alternative UPIC3-A is shown in Figure 8. The estimated area of sediment removal and backfilling is approximately 24.4 acres (86.5 percent of the total UPIC marsh area). Along the banks of the UPIC waterways, the removal would be extended to a depth of 2 feet in a zone approximately 10 feet wide, to effectuate a smooth transition between the marsh and waterway remedial components and to assure ongoing stability of the marsh banks. A 6-inch thin layer cover would be placed in the vicinity of the radio

Alternative #	UPIC MARSH ALTERNATIVE	VOLUME REMOVED (cubic yards)	VOLUME BACKFILL / CAP (cubic yards)	VOLUME THIN-LAYER COVER (cubic yards)	ESTIMATED COST	ESTIMATED CONSTRUCTION TIME (years)
UPIC1	No Action	0	0	0	$0	0.0
UPIC2	Thin-Layer Cover	0	0	26,200	$25 M	1.0
UPIC3	One-foot Sediment Removal + Backfill	78,500	90,300	N/A	$62 M	1.4
UPIC3-A	Hybrid - Removal + Backfill + Thin-Layer Cover	69,500	80,000	3,600	$58 M	1.1
UPIC4	Two-foot Sediment Removal + Backfill	130,800	150,400	N/A	$86 M	1.9

Table 3. Upper Peach Island Creek Marsh Alternatives Summary

towers (see, Figure 9), due to logistical, health and safety and sediment stability considerations associated with marsh excavation near the towers. The estimated area that would receive this thin-layer cover is 3.8 acres (13.5 percent of the total UPIC marsh area of 28.2 acres). This alternative would achieve the UPIC marsh source control RAO at the end of construction.

- Volume of sediment excavation: 69,500 cubic yards
- Volume of backfill: 80,000 cubic yards
- Volume of thin-layer cover: 3,600 cubic yards
- Estimated present value: $58 million
- Estimated construction time: 1.1 years

Alternative UPIC4: 2-foot Sediment Removal + Backfill: This alternative would involve sediment excavation in the UPIC marsh down to the bottom of the soft sediment. Figure 8 presents an illustrative cross section for the alternative. A 2-foot excavation depth would be much deeper than the depth of the highest concentrations of COCs in UPIC marsh. At a depth of 2 feet, COC concentrations are very low to non-detect. The intent of this alternative would be to achieve the UPIC marsh RAO at the end of construction by removing essentially all the soft sediment and replacing it with clean backfill. The extent of removal in the area of the radio towers would be determined during design. The functions of the backfill would be to cover any sediment residuals, re-establish pre-remedy marsh elevations, and support marsh mitigation.

- Volume of sediment excavation: 130,800 cubic yards
- Volume of backfill: 150,400 cubic yards
- Estimated present value: $86 million
- Estimated construction time: 1.9 years

EVALUATION OF REMEDIAL ALTERNATIVES

NCP Threshold, Balancing, and Modifying Criteria

In this section of the Proposed Plan, the Phase 1 remedial alternatives are evaluated and compared

to each other using the nine criteria set forth in the NCP at 40 CFR §300.430(e)(9)(iii). These criteria fall into three categories--threshold criteria, balancing criteria, and modifying criteria.

Figure 9. Layout of UPIC Marsh Alternative UPIC3-A

Threshold Criteria:

1. *Overall Protection of Human Health and the Environment* evaluates whether an alternative eliminates, or effectively controls threats to public health and the environment.
2. *Compliance with Applicable or Relevant and Appropriate Requirements (ARARs)* evaluates whether the alternative meets federal and state environmental statutes, regulations, and other promulgated requirements that pertain to the site, or whether a waiver is justified.

Balancing Criteria:

3. *Long-term Effectiveness and Permanence* considers the ability of an alternative to maintain protection of human health and the environment over time.
4. *Reduction of Toxicity, Mobility, or Volume of Contaminants through Treatment* evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, or the amount of contamination present.
5. *Short-term Effectiveness* considers the length of time needed to implement an

alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

6. *Implementability* considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.
7. *Cost* includes estimated direct and indirect capital and O&M costs, as well as present value cost. Present value cost is the total cost of an alternative over time in terms of today's dollar value, calculated using a discount rate of 7%, consistent with EPA guidance. Cost estimates are expected to be accurate within a range of +50 to -30 percent of the actual cost to implement the alternative. A remedy is cost effective if its costs are proportional to its overall effectiveness (40 CFR Section 300.430(f)(1)(ii)(D).

Modifying Criteria:

8. *State/Support Agency Acceptance* considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.
9. *Community Acceptance* considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

All NCP evaluation criteria, except the two modifying criteria (*i.e.*, state acceptance and community acceptance) were evaluated as part of the FS. State acceptance was discussed between EPA and NJDEP during the preparation of this Proposed Plan. Community acceptance will be evaluated following receipt and consideration of comments on this Proposed Plan. A summary of the comparative analysis of alternatives contained in the BCSA FS Report is given below.

In the evaluation of balancing criteria, EPA has assigned each alternative a relative rating between low and high based on the analysis results. A low rating shows that the alternative has a low level of achievement of some or all the factors considered for the criterion compared to other alternatives, while a high rating indicates a high relative level of achievement. Intermediate levels of achievement are rated as low to moderate, moderate, and moderate to high.

Analysis of Waterway Alternatives

Protection of Human Health and the Environment: Alternative W1 (No Action) would not be protective of human health and the environment because it would not reduce the potential exposure of human and ecological receptors to COCs in BAZ sediment in the UBC and MBC waterways within a reasonable timeframe. In addition, Alternative W1 would not reduce particulate-bound COC resuspension into the water column. As it would not meet this threshold criterion, Alternative W1 was not evaluated against the NCP balancing criteria. Alternatives W2 to W5 would all satisfy this NCP threshold criterion. Alternative W2 would be protective of human health and the environment through installation of a 2-foot thick cap layer over the existing waterway sediment sources. Alternatives W3 to W5 would achieve this threshold criterion by removing the source of COCs in the Phase 1 waterways and by placing a backfill/cap layer designed to prevent COCs at depth from being re-exposed and, therefore, becoming potential sources for human or ecological exposures.

Compliance with ARARs: Alternative W1 would not comply with certain ARARs (such as surface water quality criteria) since the criteria are exceeded presently, and no action would be undertaken. Alternatives W3 to W5 could be implemented to meet the Phase 1 ARARs described in the FS Report and thus satisfy this NCP threshold criterion for the sediments. Because it adds a 2-foot layer of net fill to the waterways, Alternative W2 would likely not meet the substantive standards of the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. As described in the FS Report, for Alternative W2 to be selected by EPA, ARAR waivers would likely be needed (assuming a basis could be established), along with design measures to address an increased potential for upland flooding and other impacts associated with the net waterway fill. To summarize: ARARs do not apply to W1, since no action would be taken, W2 could be selected only if a basis could be established for ARAR waivers, and alternatives W3, W4 and W5 would comply with ARARs.

Long-Term Effectiveness and Permanence*:* Alternative W2 is given a low to moderate rating based on the impacts of the placement of 2 feet of cap in the UBC/MBC waterways. This net fill would likely lead to adverse impacts on waterway hydrodynamics, sediment erosion and scour potential, upland flooding potential, and marsh stability and habitat quality. Unlike Alternative W2, Alternatives W3 to W5 would not adversely change the waterway bathymetry or hydrodynamics, which have shown a high level of resiliency, observed through tropical storms and two hurricanes during the remedial investigation.

Alternatives W3 to W5 would remove sediment that serves as the current source for potential human and ecological exposures and COC transport. For these alternatives, remedy effectiveness would be enhanced by placing the backfill/cap material in several lifts to minimize residuals. Alternative W3 would include a 1-foot sediment removal depth and backfill/cap thickness, adequate to isolate the new, post-remediation BAZ from remaining soft sediment below the backfill/cap, effectively mitigating exposure to and transport of the COCs. Alternative W3 is given a moderate rating. While the backfill/cap layer for W3 would be robust, the potential need for future backfill/cap maintenance with this alternative would be higher than with Alternatives W4 and W5. The sediment removal and backfill/cap thicknesses for Alternatives W4 and W5 would both be more than adequate and would have high long-term effectiveness. Alternative W4 is given the same high rating as Alternative W5 because it achieves the Phase 1 RAOs in a robust manner and there is no further reduction in human or ecological exposure risk with Alternative W5 compared to Alternative W4. To summarize: W2 is rated low to moderate, W3 moderate, and W4 and W5 are rated high for long-term effectiveness and permanence.

Reduction of Toxicity, Mobility, or Volume through Treatment: The same moderate relative rating was given to all alternatives involving sediment dredging (*i.e.*, Alternatives W3 to W5), as the same treatment process would be applied to all dredged sediment with these alternatives. This rating was selected recognizing that all dredged sediment would be treated by mixing with a stabilizing agent, as necessary, to meet requirements for waste transportation and disposal. As Alternative W2 would not involve a dredging component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to this balancing criterion.

Short-Term Effectiveness: Alternative W2 would have the fewest potential community impacts and construction worker risks, primarily because it does not have a dredging and sediment management component. Potential community impacts and construction worker risks are generally proportional to the extent and duration of sediment dredging, because dredging involves management of large volumes of sediment and backfill/cap material using heavy equipment and truck transportation of dewatered sediment and backfill/cap material through the community. However, Alternative W2 would have more potential to cause sediment bed instability and lateral movement of mud than the other alternatives, it would cause short-term water quality impacts, and it would take longer to implement than Alternative W3. Based on these considerations, Alternative W2 was given a moderate to high short-term effectiveness rating. Comparing the removal and backfilling alternatives (W3 to W5), Alternative W5 would have the most significant community impacts and worker risks because it involves the largest volumes of sediment dredging, dredged material management, and backfilling; Alternative W3 would have the least community impacts and worker risks; and Alternative W4 would have intermediate impacts and risks. Alternative W3 would have the shortest construction duration and Alternative W5 the longest. All the removal and backfilling/capping alternatives would also have short-term water quality impacts associated with dredging, filling, and water management operations, with Alternative W5 again having the largest impacts and Alternative W3 the smallest. Alternative W5 has the potential to cause water quality impacts due to the risk of marsh bank instability and the need for temporary marsh bank stabilization measures in areas of deep dredging. Environmental impacts would include temporary loss of benthic organisms, as well as habitat for the ecological community in the Phase 1 remediation areas. Post remediation, fine-grained sediment will deposit over the capping or backfill material, which will provide improved conditions for the organisms as the material will be much cleaner than the pre-remediation sediment. Since the remedial action would replace existing habitat (and slightly improve it), no additional compensatory mitigation measures would be necessary for this aspect of the remediation. On a relative basis, the short-term effectiveness of Alternative W3 was rated moderate to high, the short-term effectiveness of Alternative W4 was rated moderate, and the short-term effectiveness of Alternative W5 was rated low to moderate. To summarize: W2 and W3 are rated moderate to high, W4 is lower at moderate and W5

Implementability: Alternative W2 was given a low to moderate implementability rating due to sediment bed settlement and stability challenges, and potential flooding impacts, associated with placement of 2 feet of net fill, the shortest tide windows of all the alternatives for working in the mudflats and shallow tributaries, and the administrative challenges related to the potential need for ARAR waivers. Alternative W5 was given the same low to moderate rating, based on the substantial marsh bank stability challenges associated with complete soft sediment removal. Alternative W5 would also involve more substantial sediment management and water treatment volumes than the other alternatives. Both Alternatives W3 and W4 were given a moderate to high rating due to their limited maximum dredging depths, smaller magnitudes of sediment bed settlement, and lower risks to sediment bed and marsh bank stability.

Cost: A summary of the FS-level cost estimates for Alternatives W2 to W5 is presented in Table 2. The least expensive active remediation option is Alternative W2, Cap Addition. Costs for the removal and backfill/cap alternatives increase with the depth of sediment removal, as the increased amount of dredging and disposal is more resource-intensive. Alternative W3 is about double the cost of Alternative W2. Alternative W4 is about 1.6 times the cost of Alternative W2 and about 30% more costly than Alternative W3. Alternative W5 is almost double the cost of Alternative W3 and 66% more costly than Alternative W4 (due to the much larger sediment removal and backfill volumes involved with Alternative W5).

State Acceptance:

This plan is under review by the New Jersey Department of Environmental Protection.

Community Acceptance:

Community acceptance of the preferred alternative will be evaluated after the public comment period ends.

Analysis of UPIC Marsh Alternatives

Protection of Human Health and the Environment: Alternative UPIC1 would not be protective of human health and the environment because it would not reduce the potential exposure of ecological receptors to COCs from UPIC marsh sediment. As it does not meet this threshold criterion, Alternative UPIC1 was not evaluated against the NCP balancing criteria. Alternatives UPIC2 to UPIC4 would all satisfy this NCP threshold criterion. Alternative UPIC2 would be protective of human health and the environment through installation of a 6-inch thick cover layer over the existing marsh surface. Alternatives UPIC3 and UPIC4 would achieve this criterion by removing the contaminated sediment that is the source of potential ecological exposures and replacing it with a backfill layer that would isolate any remaining contaminated sediment or residuals from the marsh surface. Alternative UPIC3-A would achieve this threshold criterion through the hybrid application of the remedial technologies of Alternatives UPIC2 and UPIC3.

Compliance with ARARs: ARARs applicable to the Phase 1 interim remedial action would not apply to Alternative UPIC1 since no action would be undertaken. Alternatives UPIC3, UPIC3-A, and UPIC4 would comply with the Phase 1 ARARs, thus satisfying this NCP threshold criterion. Alternatives UPIC2 and UPIC3-A would result in placement of a small amount of net fill into the marsh. These alternatives would be designed to comply with the New Jersey Flood Hazard Control Act Rules and Federal Floodplain Management requirements. For example, if necessary, flood storage would be addressed as part of the remedial design to account for the net fill placed in the marsh with either alternative.

Long-Term Effectiveness and Permanence: Alternative UPIC2 is given a moderate relative rating with respect to long-term effectiveness and permanence, while Alternatives UPIC3, UPIC3-A, and UPIC4 are given a high rating. All four active remediation alternatives would reduce or eliminate the potential for exposure of human and ecological receptors to COCs from shallow marsh sediment. Alternatives UPIC3, UPIC3-A, and UPIC4 rate higher than Alternative UPIC2 because the backfill layers would be thicker than the cover layer thickness of Alternative UPIC2. While it is given a lower rating, Alternative UPIC2 would still achieve long-term effectiveness and permanence, but due to UPIC-specific conditions (e.g. hydrology, elevation, and presence of tide gates), it would potentially require more maintenance than Alternatives UPIC3, UPIC3-A, and UPIC4. Alternatives UPIC3, UPIC3-A, and UPIC4 are given the same high rating because they would remove the great majority of the sediment with elevated COC concentrations and they all would provide a backfill thickness more than adequate to provide long-term isolation of the post-remediation marsh habitat from COCs in underlying sediment or residuals. Alternative UPIC3-A includes a thin-layer cover over a relatively small portion of the marsh near the existing radio towers. The thin-layer cover provides long-term effectiveness in this area since this portion of the marsh is located on the southern portion of UPIC in an area that has generally lower COC concentrations than the rest of UPIC marsh and is not adjacent to the UPIC waterways and not subject to erosive forces. Alternative UPIC3-A would provide a high degree of long-term effectiveness while avoiding negative impacts to the radio towers and infrastructure on the southern portion of UPIC marsh. For these reasons, there is no meaningful difference in ecological exposure risk reduction between Alternatives UPIC3, UPIC3-A, and UPIC4.

Reduction of Toxicity, Mobility, or Volume through Treatment: The same relative rating was given for the "treatment" balancing criterion to all alternatives involving marsh sediment excavation, for the same reasons as described for the waterway remedial alternatives that involved dredging. As Alternative UPIC2 would not involve a sediment excavation component, and hence would not incorporate any sediment treatment component, it was given a low rating with respect to the treatment balancing criterion.

Short-Term Effectiveness: Alternative UPIC2 is given a high short-term effectiveness rating due to the fewer community impacts and construction worker risks, shortest construction duration, absence of a marsh excavation remedy component, and lesser challenges in re-establishing the marsh vegetation compared to the other marsh alternatives. The ratings for Alternatives UPIC3, UPIC3-A, and UPIC4 recognize that there would be short-term impacts associated with the marsh excavation and backfilling operations, including temporary loss of habitat, but that these impacts would be limited and manageable. Habitat will re-establish itself naturally following the completion of remedial activities. Because the remedial action would improve and replace existing habitat, no additional compensatory mitigation measures would be necessary. Alternative UPIC3 is rated moderate to high and Alternative UPIC4 is rated moderate in recognition of the larger sediment excavation and backfill volumes and the concomitant greater impacts related to construction duration, truck trips, noise, potential odors, water management, and other factors associated with these operations. Given the relative ratings for Alternative UPIC2 (high) and UPIC3 (moderate to high), and the fact that approximately 86.5% of UPIC marsh would undergo excavation and backfill with Alternative UPIC3-A, this latter alternative is given a short-term effectiveness rating of moderate to high.

Implementability: Alternative UPIC2 is given a high implementability rating as technical and construction implementation challenges would be minor and it would not involve excavation activities around the eight radio towers present in the marsh, which simplifies implementation. While Alternative UPIC3 would have a sediment excavation and management component, it is given a moderate to high implementability rating due to the limited depth of excavation and the relative accessibility of the marsh. Alternative UPIC4 is given a moderate implementability rating in that no significant administrative challenges are anticipated, but it would have twice the volume of sediment to manage, twice the amount of backfill to place, and more substantial sediment management, water treatment, odor control, and other requirements compared to Alternative UPIC3. In the case of Alternatives UPIC3 and UPIC4, the alternatives assume that all 28.2 acres of the UPIC marsh can be excavated, including contaminated sediments in the radio tower area (covering approximately 7 acres of the 28.2-acre UPIC marsh); however, working around the radio towers poses several implementability challenges. It is questionable whether the structural stability of the radio towers can be maintained during excavation, and temporary or permanent relocation of the towers poses to allow for full excavation poses a number of administrative challenges. These issues led to the consideration of thin-layer capping of about 3.8 acres of the 7 acres that are directly under the structural footprint of the radio towers, as part of the hybrid alternative, UPIC3-A. Implementation of Alternative UPIC3-A would be much like that of Alternative UPIC3 across much of the marsh. Importantly, however, Alternative UPIC3-A would not involve excavation in 3.8 acres of the radio tower area, which simplifies implementation. For this reason, Alternative UPIC3-A is given a high implementability rating.

Cost: A summary of the FS-level cost estimates for Alternatives UPIC2 to UPIC4 is presented in Table 3. Alternative UPIC2 is the least expensive of the alternatives. Alternative UPIC4 has the highest overall cost: about 39% higher than Alternative UPIC3, 48% higher than Alternative UPIC3-A, and nearly 350% higher than Alternative UPIC2. Alternative UPIC3-A is a little more than double the cost of Alternative UPIC2, while Alternative UPIC3 is about two and one-half times the cost of Alternative UPIC2.

State Acceptance:

This plan is under review by the New Jersey Department of Environmental Protection.

Community Acceptance:

Community acceptance of the preferred alternative will be evaluated after the public comment period ends.

SUMMARY OF PREFERRED ALTERNATIVE

EPA's preferred alternative for the Phase 1 interim remedial action for the BCSA waterways and UPIC marsh are summarized below.

UBC and MBC Waterways: *Alternative W4: 2-foot Sediment Removal + Backfill/Cap*

This alternative includes the following primary components:

- Bank-to-bank removal of 2 feet of soft sediment within the proposed remediation footprint (plus 6 inches of over-dredge). Where less than 2 feet of soft sediment is present, the soft sediment removal thickness will be the soft-sediment thickness. This alternative is expected to remove approximately 363,000 yd^3 of sediment from the UBC and MBC waterways.

- Backfill/capping of the areas where sediment is removed. The backfill thickness will be equal to the thickness of sediment removed. In areas where contaminated soft sediment remains below the excavation depth, the backfill will serve as a cap to physically isolate this material. The work will include mitigation of habitat disturbed by the remedial action.

- Institutional controls would be necessary for both the waterways and the UPIC Marsh. ICs would include; continuing fish consumption advisories in order to reduce the risk from consumption of fish and crabs from within BCSA waters, as well as use restrictions to prevent disturbance of the sand caps.

- A Marsh Demonstration project, which will provide information relating to the effectiveness of the sediment remedy in controlling deposition of contamination on the marshes, as well as provide information to evaluate alternatives for the next phase(s) of remediation.

- Monitoring of the system response to the selected remedy in the areas of active remediation, the marshes, and the downstream study segments. Marsh Demonstration Project areas will also be monitored as part of the Phase 1 monitoring program to be conducted as part of the remedial action.

This alternative provides source control through removal of soft sediment to a depth of up to 2 feet (plus 6 inches of over-dredge), which includes the current source material and placement of a backfill/cap layer (of the same thickness as the total dredging depth) that physically isolates underlying sediments and provides more than sufficient separation distance between the new, post-remediation BAZ and underlying soft sediment through a stable and robust backfill/cap layer.

UPIC Marsh: *Alternative UPIC3-A: Hybrid – Sediment Removal + Backfill and Thin-Layer Cover*

This alternative includes the following components:

- Removal of marsh sediments to a depth of 1 foot, with removal of 2 feet of sediment within a 10-foot strip along the marsh edge at the waterway banks. This alternative is expected to remove approximately 69,500 yd^3 of UPIC marsh sediment.

- The excavated sediment will be replaced with backfill to maintain marsh surface elevations, isolate underlying marsh sediment, and re-establish the marsh habitat.

- In lieu of excavation, a 6-inch thick cover of clean material will be placed over the existing marsh in the area surrounding the radio towers in the southern portion of UPIC marsh. Approximately 3,600 yd^3 of thin-layer cover material will be placed.

- Monitoring of the system response to the selected remedy in the waterways and marsh.

This alternative provides source control by removing the sediment with the highest COC concentrations within the excavation footprint. Backfill placed in the excavation areas will isolate underlying marsh sediment and facilitate reestablishment of the marsh habitat. The thin-layer cover in the radio tower area will isolate the underlying sediments and provide additional stability and protectiveness without disturbance of the existing radio tower structures and infrastructure.

Selection of the preferred alternative was accomplished through evaluation of the seven threshold and balancing remedy selection criteria as specified in the NCP. The preferred alternative meets the threshold criteria and provides the best balance of tradeoffs relative to the other alternatives with respect to the balancing and modifying criteria. It will satisfy the following statutory requirements of CERCLA 121(b): (1) be protective of human health and the environment; (2) comply with ARARs; (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the statutory preference for treatment as a principal element to the extent practicable. EPA's preferred alternative is under review by the New Jersey Department of Environmental Protection.

W4 and UPIC3-A together comprise the preferred alternative. The preferred alternative was selected over the other alternatives because this is the best tradeoff of risk reduction, long term operation and maintenance requirements, and maintaining stability of marshes. The preferred alternative will provide for long-term control of sources of COCs and will achieve the RAOs established for the Phase 1 remedy.

Overall, the preferred alternative for the UBC and MBC waterways and UPIC marsh includes active remediation of approximately 87.2 acres of waterway and 28.2 acres of marsh. The preferred alternative is expected to remove approximately 432,000 yd^3 (W4: 363,000 yd^3 + UPIC3-A: 69,000 $yd^{3)}$ of contaminated sediments from the BCSA. The total estimated cost of the remedy is $332 million (W4: $261 million + UPIC3-A: $58 million + Marsh Demonstration Project: $13 million). The preferred alternative will achieve the Phase 1 RAOs, control sources of COCs within the BCSA, and protect human health and the environment.

It is estimated that the preferred alternative will take approximately two years to design after the ROD is signed. The estimated time for construction is approximately 3.5 years. Post-construction effectiveness monitoring will take approximately 5 years following completion of the remedy. Subsequent risk assessments and Supplemental Feasibility Study efforts will then be conducted. Therefore, it is likely to take approximately 11 years after the ROD is signed until the determination for the next phase of work is presented.

COMMUNITY OUTREACH CONSIDERATIONS

The EPA has engaged with key stakeholder groups prior to the development of the Proposed Plan. EPA has held several availability sessions over the course of the RI/FS, although participation was limited. A series of briefings was held, one for each of the communities bordering Berry's Creek, Bergen County, the business community (organized through the Meadowlands Chamber of Commerce, the New Jersey Sports and Exhibition Authority (NJSEA), as well as Hackensack Riverkeeper/Baykeeper. Public comment on the Proposed Plan will be accepted during the public comment period. EPA will provide additional information regarding the proposed cleanup of the BCSA via a public meeting, access to the Administrative Record, announcements published in the local newspapers and access to a website for the BCSA (http://www.epa.gov/superfund/ventron-velsicol).

These activities will:

- Help the public to understand the alternatives presented in the Proposed Plan, including the Preferred Alternative, and EPA's evaluation criteria so that the public can effectively provide input on the Proposed Plan; and

- Make the public aware of the full range of opportunities to learn about the Proposed Plan and how to provide input.

EPA is committed to maintaining a transparent proactive community interaction process during each cleanup phase.

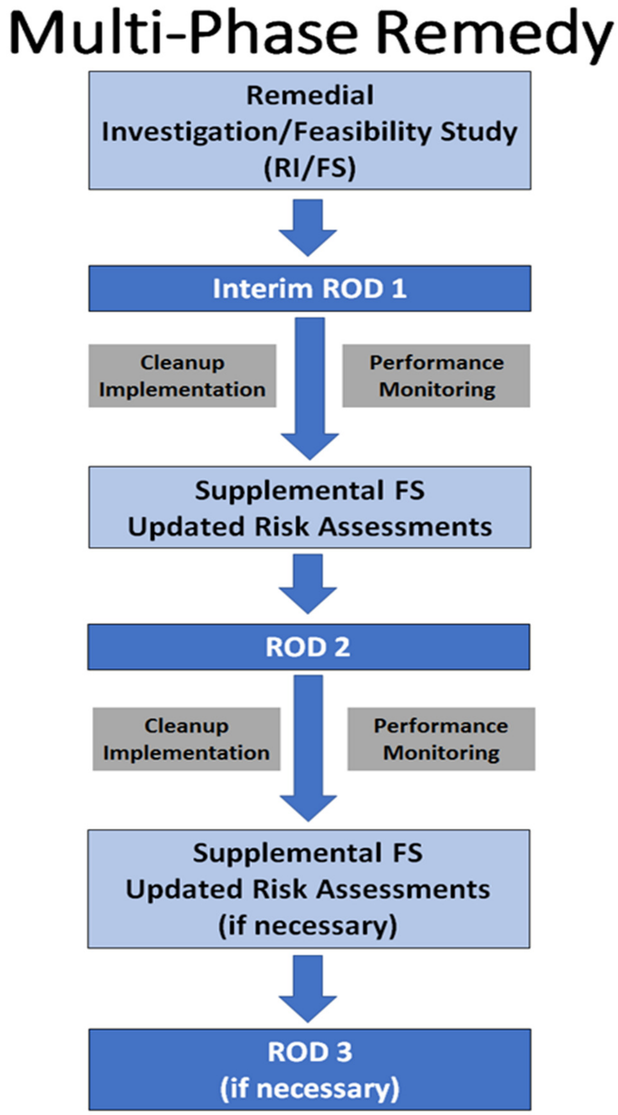


Figure 10. Illustration of RI/FS Process and Multi-Phase Remedy Process for the BCSA

FOR FURTHER INFORMATION
The administrative record file, which contains the supporting documentation for the Proposed Plan, can be viewed at the information repositories:

Wood-Ridge Memorial Library
231 Hackensack Street
Wood-Ridge, NJ 07075
PH: (201)438-2455

USEPA Records Center
290 Broadway -18th floor
New York, NY 10007
PH: (212) 637-4308

Also available at:

EPA's website: www.epa.gov/superfund/ventron-velsicol

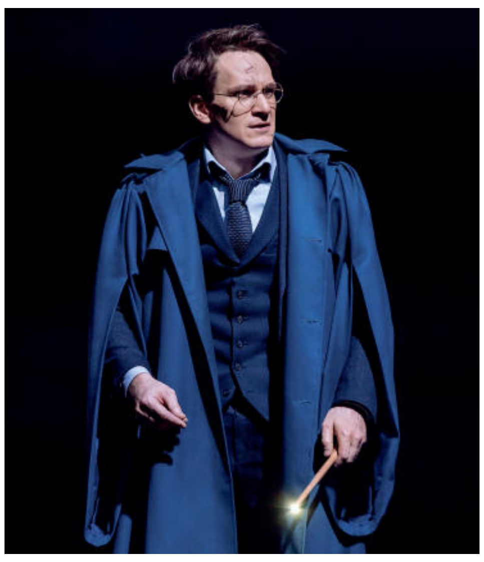
BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 5

ATTACHMENT B - PUBLIC NOTICE



Jamie Parker in "Harry Potter and the Cursed Child" at New York's Lyric Theatre. COURTESY OF MANUEL HARLAN

Ethan Slater performs with the cast of "SpongeBob SquarePants," which is up for multiple Tony Awards. COURTESY OF JOAN MARCUS

Top Tony shows focus on fun

Ilana Keller Asbury Park Press
USA TODAY NETWORK - NEW JERSEY

Bikini Bottom, Britain, Bet Hatikva, The Boss and Big Brother. Arendelle. Angsty teens. A mad king and a meteor shower. Harry and Hogwarts. History. A Caribbean island and one real nice clambake.

The 2017-18 Broadway season had it all, and the time has come to honor the best of the best.

"SpongeBob SquarePants" and "Mean Girls" led the way, with 12 Tony Award nominations apiece, while "Angels in America" squeaked past "Harry Potter and the Cursed Child" to top the plays, with 11 nods to the boy wizard's 10.

The 11 nominations for "Angels in America" make it the most-nominated play in Tony Awards history.

"The Band's Visit," "Frozen," "Mean Girls" and "SpongeBob SquarePants" will duke it out for the coveted Best Musical award, while "My Fair Lady," "Once on This Island" and "Carousel," the only eligible revivals, will compete for Best Revival.

"The Children," "Farinelli and The King," "Harry Potter and the Cursed Child," "Junk" and "Latin History for Morons" received Best Play nominations, while "Angels in America," "Three Tall Women," "The Iceman Cometh," "Lobby Hero" and "Travesties" got nods for Best Revival of a Play.

Bruce Springsteen and John Leguizamo will be given special Tony Awards.

The nominations were announced live by Leslie Odom Jr. and Katharine McPhee on Tuesday morning from the New York City Public Library for the Performing Arts at Lincoln Center.

Chita Rivera and Andrew Lloyd Webber will receive Special Tony Awards for Lifetime Achievement in the Theatre.

Katrina Lenk and Tony Shalhoub in "The Band's Visit" on Broadway. COURTESY OF MATTHEW MURPHY

On the Web

See a full list of nominees at **NorthJersey.com**.

"The cultural impact that Chita and Andrew have had on the international theater community and on theater education has been immeasurable," Heather Hitchens, president and CEO of the American Theatre Wing, and Charlotte St. Martin, president of the Broadway League, said in a statement. "They are groundbreakers, they are inspirations and we are truly honored to recognize these two incredible legends with the Tony Awards for Lifetime Achievement."

Nick Scandalios, executive vice president of the Nederlander Organization, will receive the Isabelle Stevenson Tony Award, which honors a member of the theater community who has made a difference through volunteer work with a humanitarian, social service or charitable organization. Scandalios is being honored for his advocacy work on behalf of LGBTQ families.

The eligibility cut-off date for this year's awards was April 26.

The 72nd annual Tony Awards will be hosted by Sara Bareilles and Josh Groban. They will air live at 8 p.m. on Sunday, June 10, on CBS. The awards also can be streamed with CBS' All Access subscription service. The Tonys are presented by The Broadway League and the American Theatre Wing.

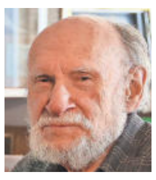
ART PAUL, 1925-2018

Playboy's bunny logo designer dies at 93

ASSOCIATED PRESS

CHICAGO – Magazine designer Art Paul, who created Playboy's famous tuxedoed bunny head logo, has died. He was 93.

Paul died of pneumonia Saturday at a Chicago-area hospital, according to his wife, Suzanne Seed.



Art Paul

Paul was a freelance illustrator when he started working with Playboy founder Hugh Hefner as the magazine's first employee in the 1950s. He said he crafted the bunny logo in about an hour. Paul also hired artists to create illustrations for Playboy, including Salvador Dali, Andy Warhol and Shel Silverstein.

Paul was the magazine's art director until he retired in 1982.

"We didn't think it would be such a success right from the beginning, just Hefner and I putting it together," Paul told the Chicago Sun-Times. "Hef was kind to me. I think I gave him a lot. He gave me a lot."

Paul was born in Chicago on Jan. 18, 1925, and studied on scholarship at the School of the Art Institute of Chicago before serving in World War II with the Army Air Corps. He returned to Chicago after the war and picked up studies at the Institute of Design at the Illinois Institute of Technology.

AIGA, the professional association for design, says it's a "testament to Paul's design acumen" that the Playboy bunny logo is universally recognized even without the Playboy name.

"Art deserves the credit for the illustrator's liberation," Christie Hefner, daughter of Hugh Hefner and former chairman and CEO of Playboy, has said. "He helped redefine the whole notion of commercial art as being able to be as well-regarded and legitimate as high art."

After his retirement he continued working, including teaching and designing for magazines, advertising, television and film.

He spent the past decade drawing and painting. He was a member of the Art Directors Hall of Fame and won many awards.

Seed said he was drawing until about a month ago, despite unsteady hands and vision problems.

"He would say to me, 'You should see what I see,' " Seed told the Chicago Tribune.

2018 Municipal Budget
of the Town of Guttenberg.
County of Hudson for the fiscal year 2018.
Revenue and Appropriation Summaries

Summary of Revenues	Anticipated	
	2018	2017
1. Surplus	1,700,000.00	1,702,073.00
2. Total Miscellaneous Revenues	2,201,677.07	1,884,971.21
3. Receipts from Delinquent Taxes	1,385,000.00	1,500,000.00
4. a) Local Tax for Municipal Purposes	13,547,563.00	13,135,839.00
b) Addition to Local District School Tax		
Tot Amt to be Rsd by Taxes for Sup of Mun. Bud	13,547,563.00	13,135,839.00
Total General Revenues	18,834,240.07	18,222,883.21
Summary of Appropriation	**2018 Budget**	**Final 2017 Budget**
1. Operating Expenses: Salaries & Wages	5,131,900.00	5,321,000.00
Other Expenses	9,905,521.07	9,109,735.21
2. Deferred Charges & Other Appropriations	1,110,597.00	1,005,948.00
3. Capital Improvements		100,000.00
4. Debt Service (Include for School Purposes)	986,222.00	986,200.00
5. Reserve for Uncollected Taxes	1,700,000.00	1,700,000.00
Total General Appropriations	18,834,240.07	18,222,883.21
Total Number of Employees	74	74
Balance of Outstanding Debt		
	General	**Water Utility**
Interest		
Principal		
Outstanding Balance		

Notice is hereby given that the budget and tax resolution was approved by the Governing Body of the Town of Guttenberg, County of Hudson on April 9, 2018.

A hearing on the Budget and Tax Resolution will be held at The Municipal Building , on May 30, 2018 at 7:00 o'clock P.M. at which time and place objections to the Budget and Copies of the Budget are available in the office of Alberto Cabrera, Town Clerk at the Municipal Building, 6808 Park Avenue, Guttenberg , New Jersey , Phone # (201) 868-2315 during the hours of 9:00 A.M. to 4:00 P.M.

NR-0004259984-01

EPA Invites Public Comment on a Proposed Cleanup Plan for the Berry's Creek Study Area in Bergen County, NJ

On Monday April 30, 2018, the U.S. Environmental Protection Agency (EPA) issued a Proposed Plan for addressing contamination in the Berry's Creek Study Area, part of the Ventron/Velsicol Superfund site. EPA's proposal focuses on the sources of contamination in the area while continuing investigatory work to address the entire area. A 30-day public comment period on the Proposed Plan, which identifies the EPA's preferred interim cleanup plan and other cleanup options that were considered by the EPA, begins on May 2, 2018 and ends on June 6, 2018.

The EPA's proposed interim cleanup plan includes actions for three portions of the Berry's Creek Study Area. For Upper Berry's Creek (UBC), Middle Berry's Creek (MBC) and Upper Peach Island Creek (UPIC) Waterways, the proposed plan calls for: 1) dredging of two feet of contaminated sediment or to clean clay layer; 2) backfilling areas with clean sand to original elevation, which will serve as a cap over any areas where contaminated sediment remains. In addition, EPA's proposal includes a plan to address contamination in the UPIC marsh, which includes: 1) removing one foot of contaminated sediment; 2) backfilling with one foot of clean sand, which also serves as a cap over any remaining contamination. For the marsh areas within 10 feet of waterways in the UPIC, the proposed cleanup plan consists of: 1) removing two feet of contaminated sediment; 2) backfilling with clean sand to original elevation, which will serve as a cap. Finally, for marsh areas near the radio towers, EPA is proposing a thin-layer cover. The projected cost of EPA's proposed interim cleanup plan is $332 million, with a construction timeline of three and a half years. EPA expects parties responsible for the site to pay for and conduct the cleanup.
EPA is seeking public comments and will hold a public meeting in Little Ferry, NJ to share detailed information about the plan and to receive public comments. **The date and location of the public meeting will be May 9, 2018 from 6:30 – 8:30 p.m. at the Little Ferry Public Library, 239 Liberty Street – Little Ferry, NJ 07643.**

The Proposed Plan and other site documents are available at www.epa.gov/superfund/ventron-velsicol or http://berryscreekstudyarea.com. The public can also call Carsen Mata, EPA's Community Involvement Coordinator for the project, at (212) 637-3652 and request a copy by mail. Written comments on the Proposed Plan, postmarked no later than June 6, 2018, may be mailed to Doug Tomchuk, EPA Project Manager, EPA, 290 Broadway, 19th floor, New York, NY 10007-1866 or emailed no later than June 6 to Tomchuk.doug@epa.gov.

The Administrative Record file containing the documents used or relied on in developing the alternatives and preferred cleanup plan is available for public review at the following information repositories:

1) Wood-Ridge Memorial Library 231 Hackensack Street Wood-Ridge, NJ 07075
(908) 526-4016
2) USEPA Records Center 290 Broadway, 18th floor New York, NY 10007
(212) 637-4308

NR-0004260096-01

BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 5

ATTACHMENT C - PUBLIC MEETING TRANSCRIPT

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 2

- -x

BERRY'S CREEK STUDY AREA

VENTRON/VELSICOL SUPERFUND SITE

PUBLIC MEETING

- -x

Library
239 Liberty Street
Little Ferry, New Jersey

May 9, 2018
6:30 p.m.

P R E S E N T:

CARSEN MATA,
Community Involvement Coordinator

DOUG TOMCHUK,
Remedial Project Manager

MICHAEL SIVAK,
Branch Chief - Passaic, Hackensack &
Newark Bay Remediation Branch

Proceedings

MS. MATA: Good evening, everyone. I just want to thank you for coming. I want to say something really quickly.

For those of you that I have not met yet, my name is Carsen Mata. I'm the community involvement coordinator for this site. Thank you for joining us. We're very grateful that you're spending this beautiful evening with us.

Doug Tomchuk is our Remedial Project Manager for this site, and he will be giving the presentation tonight. And then following the presentation, we're going to do a question-and-answer session. And if you could just say your name for the stenographer and your affiliation so that she can record that, that would be helpful.

And if you could silence your cell phones before Doug gets started, that would be also great.

Proceedings

Before we get started, I just want to acknowledge that we have a representative from Congressman Pascrell's office here and the Bergen County Freeholders Group is also represented here.

Thanks, guys. Appreciate it.

Take it away, Doug.

MR. TOMCHUK: Thank you for coming tonight. We're here to talk about the Berry's Creek Study Area, which is part of the Ventron/Velsicol Superfund Site. This is a Superfund Proposed Plan meeting. We are in the official public comment period for the site and we will be taking oral public comment tonight and we will be taking written public comment until June 6.

So, being that you're all here tonight, you kind of know where the Berry's Creek Study Area is. It's located generally -- we have a twelve square mile watershed of Berry's Creek that is considered the study area.

Proceedings

We really looked at the waterways, the main stream of Berry's Creek, the tributaries to that, and the marshes up to the tide gates. We did not really go beyond that.

Different view of the study area. I want to point out that we have a lot of commercial and industrial properties nearby. We don't have a lot of residences along the creek, which is nice for working on a project that you don't have a community that's directly impacted with people living right along the site. As far as -- that's been a good thing for me to work with.

You know, of course we listen to everybody's concern and we want to hear it. We've reached out on multiple occasions to do so.

The contamination was basically from multiple sources. We have three Superfund sites. That says Ventron/Velsicol. This is part of the

Proceedings

Ventron/Velsicol site and that's a federal Superfund site. And this is Operable Unit 2 of that site.

This is the Universal Oil Product Site.

That's the Scientific Chemical Processing Site.

So, these three sites are in the watershed and they're part of the sources. There are also numerous state Superfund sites in the area that contributed the contamination into the Berry's Creek Study Area.

For purposes of our study, we broke the study area into five sections: We have Upper Berry's Creek here; we have a branch off of that, Upper Peach Island Creek; we have Middle Berry's Creek; Lower Berry's Creek; and Berry's Creek Canal.

You'll see here the Hackensack River, just for your references, and the New Jersey Sports & Exhibition Authority there, MetLife Stadium.

Proceedings

So, these areas, we have evaluated the contamination levels in each of those areas as part of our study and we did a very comprehensive study to do that Remedial Investigation and Feasibility Study.

Most people are familiar with it. We have the waterways during high tide, which during low tide we get the bottom mudflats so we have shallow water to work in.

The signature marshes of the Meadowland area here.

And a lot of phragmites around.

One thing I wanted to point out is in the area of Upper Peach Island Creek Marsh, there are eight large radio towers that needed to be addressed. The area around there, it's not the highest contamination in that area, but there's contamination and we needed to look at that. Obviously, these are areas that are

Proceedings

tough to remediate around. I just want to point that out at this point.

Just trying to show this slide. Don't worry about the numbers, I just wanted to say we collected a lot of data over a lot of years. We went out from 2008 to 2015 and collected data every year; a lot of sediment, water column, and biota data. So, we have a lot of information to have made our decisions on.

So, basically, the contaminants of concern are -- mercury is one of the primary ones. Of course, that turns into methyl mercury in the environment, so that's of concern too. And PCBs. We also have some metals at the site, and chromium, actually, is another concern under certain scenarios here.

This is a tidal system. And most of the water that comes into the system is from the tide; up to

Proceedings

90 percent is tidal flow. So, that is also our primary source of inorganic sediment at this time.

So, I'll be talking about some of the technical aspects of this that are driving the remedy and why these are important aspects to our decision-making process.

The sediment is very stable even during high flow events. We don't see a lot of erosion in this system. It's a depositional backwater estuary and we get buildup of sediment over time in those areas.

We had sampling during Hurricane Irene and before and after Superstorm Sandy.

The marshes in the system are a sink. We generally see deposition in the marshes that builds up over time and the mudflats actually as well. So, you get layers of deposition, and we have multiple lines of evidence to support that.

Proceedings

The risks are unacceptable in Upper and Middle Berry's Creek and they are the areas with the highest risk. The waterway risks are higher than the marsh risks, and that's primarily from fish ingestion.

The mudflats also contribute to some of the biota risks. Spotted sandpiper was evaluated, and there's a risk from direct contact when they root through the mud to feed.

The fluff layer in Upper Berry's Creek and Middle Berry's Creek waterways acts as a source to other reaches and marshes. I'll touch upon this a little bit more.

Before I go there, I wanted to talk about the sediment stability a little bit more because we do have a capping remedy that we're proposing, so having a stable system is really important to have a successful cap. So, we're addressing that through design, obviously.

Proceedings

So, you can see in 1947 and 2013, these channels are virtually the same. The phragmites marshes really hold -- the root structure of the phragmites holds a lot of this together really well so that we don't see a lot of scour over time, even in large events.

This slide here shows a pilot study project that we were doing. This was put down just days before Superstorm Sandy came through the system. It's a six-inch layer of sand that's just put over some of the mudflat there.

And this is two days after Sandy, and what you see here is deposition of material over the surface of the sand. You don't see erosion. You actually even see the sticks straight up in the air, as they were beforehand.

In other words, the tide came in, the tide went out, just like it

Proceedings

does on the other days, just a lot more of it. So, not trying to say Sandy didn't scour because the mud that was deposited came from somewhere. It wasn't within the Berry's Creek system, though.

UNIDENTIFIED: Do we know where it came from?

MR. TOMCHUK: No, I don't. It came in through the Hackensack, but I don't know exactly where from.

This slide talks about the fluff layer dynamics. The fluff layer --

We might need the lights off one second. I'll try to keep it on, but...

-- if you look at the top of the sediment surface, you get a layer of sort of particulate and water mix. And that kind of swishes in with the tides in different storm cycles.

So, I'm going to draw an analogy. If people have swimming

Proceedings

pools or have been at places that you've seen after a storm some of the detritus at the bottom of a pool that you go to try to vacuum it up --

You can put the light on.

-- it kind of goes away from the vacuum head. I don't know if anybody has a pool and has seen that, but it's sort of like this fine particulate that travels with the water and kind of moves away from anything that goes there. So, you can't sample it very easily.

There are other methods to understand the movement of the fluff layer and understand the process, but the key thing about this fluff layer is that it can pick up contamination from the zones below that very readily because it has a lot of organic particulate and absorbing -- the contaminants like to stick to the organic particulate and then it can move readily into the marshes and

Proceedings

downstream.

So, that's the main concern that we have in this process here: Trying to reduce the amount of contamination that's moving, to control the source of contamination to other areas at this point.

So, EPA took the evaluation of the Remedial Investigation report and we said, well, there are some things that are pretty obvious here. We're seeing the waterway sediments in Upper and Middle Berry's Creek have the highest risk and they are acting as a source to the marshes and other stretches of the creek.

But there's still a lot of uncertainty surrounding marshes, what the best way to address that would be and whether what levels -- whether it needs addressing, some of the dynamics of the marshes.

So, therefore, we just requested the group of parties that

Proceedings

were conducting the study -- there's about 120 parties that have been conducting the Remedial Investigation under an order -- we asked them to evaluate a source control action for Upper and Middle Berry's Creek, and that's where -- the waterway sediments in there, and then Upper Peach Island Creek Marsh. So, Upper and Middle Berry's Creek and Peach Island Creek Marsh. So, it's a major portion of the whole site here.

To do that remediation, we use adaptive site management, which means that we will plan on having uncertainties that will arise during the system and do the monitoring to address those concerns later. We believe everything we are going to do is going to work, but we'll have the data to support future decisions if necessary.

This will be an interim decision, and that's an important

Proceedings

aspect here. We'll have to make the final remedy in the future, so additional decisions will be required.

Just a couple notes about interim remedies under the Superfund program.

These are all quotes from guidances or the National Contingency Plan, but, basically, we're using the interim measures to stabilize the site, to prevent further migration of contaminants, and reduce further environmental degradation.

The one requirement is it shouldn't be inconsistent with the final remedy for a site. So, we don't necessarily need to get to the long-term protection of human health and environment in the interim action, but it should not preclude that.

And this remedy will not. We'll be actually doing all the studies based off of that so that we can't be really inconsistent because

Proceedings

we are planning that into the whole process.

When we make the final decision, we will provide long-term protection of human health and the environment.

So, we worked with the Berry's Creek group that submitted the Feasibility Study for the site and came up with a remedial footprint. And that included, like I said, the waterways in Upper Berry's Creek, Middle Berry's Creek, including the major tributaries and the marshes; and then the sediment, the waterway, in Peach Island Creek and the Upper Peach Island Creek Marsh sediment itself.

This is a bank-to-bank removal. We tried to identify whether there would be hot spots and we did not find hot spots. It was basically all fairly high levels of contamination that we couldn't separate out anyhow.

Proceedings

So, being bank-to-bank and defined by the tide gates, these areas and this breakpoint, which I'll touch more on in a second, it's basically an evaluation of different depths of remediation in capping and removal.

The breakpoint is defined by concentration of contaminants and it's kind of a visual type of thing where you can see the contamination in Upper Peach Island Creek, Upper Berry's Creek, and Middle Berry's Creek are significantly higher than the contamination levels in Berry's Creek Canal, Lower Berry's Creek, and the reference sites.

This is for mercury. And, so, anything beyond that, we are not addressing in this remediation because we're trying to do this as a source control action. So, these are kind of what you see downstream. It's not source control anymore once it's very similar to the concentrations you see

Proceedings

downstream.

I'm not trying to say that those are acceptable levels yet -- we'll make that determination in the future -- but just trying to address the source areas right now.

Same thing with PCBs.

So, developing the remedial alternatives. First of all, we did have unacceptable risks for both human health and ecological risks, and that provides us with a basis for an action under a Superfund remedy.

Then we decided to implement this source control remedy as an interim remedy and use bank-to-bank remediation.

One of the nice things about this, the entire reach will be cleaned up in some fashion, whether it's capping or dredging. So, everything in this reach will be cleaned up.

Therefore, we did not actually need to set a cleanup number, which

Proceedings

was actually a little bit different than a lot of other sites where you look at concentrations and you try to draw the circle around where you reach that concentration. We're doing it all in these reaches so that we don't need that, which saved us time in developing this Proposed Plan.

We only had the Feasibility Study submitted last summer, and here we are with the Proposed Plan. We'll have to select that cleanup number in the next ROD.

UNIDENTIFIED: What's a "ROD"?

MR. TOMCHUK: Excuse me, I'm sorry. Record of Decision. It's the Government document that records why we selected a certain remedy.

I'm sorry. Thanks for asking.

This one gets really into lingo, and I apologize for that. But these are taken straight from the Proposed Plan, so they're not translated into English.

Proceedings

(Laughter)

MR. TOMCHUK: You can't read a word of that, can you?

Basically, there's three goals that we have for this remedy: The first one is to reduce the exposure for human and ecological receptors from the contaminants in the waterways; the second one is to reduce the amount of contamination that's in the waterways from moving downstream and into the marshes; the third one is to prevent the contaminants in Upper Peach Island Creek Marsh from exposure to the biota and from moving into the Berry's Creek.

In trying to determine the best way to implement this, EPA still needs some type of numerical value to say whether it's a successful remedy or not. So, we have a performance measure here, that's a near-term performance measure, and that 95 percent of the areas that are

Proceedings

delineated on these maps should be addressed during the remediation by comparing geologic -- GIS-type of views, geographical maps.

We considered a number of remedies. Under Superfund law, we're required to look at no action as a basis for comparison, so that's our first waterway remedy.

The second one was just a cap, a two-foot sand cap, that would be placed over the existing sediment layers.

The ICs are institutional controls, which it says down here but you can't catch. We do recognize that that has some drawbacks, which we'll get into later, that it can take away some of the flood storage, but I won't give away the evaluation yet.

Institution controls are things like fishing advisories and deed restrictions; in this case, it could also be no wake zones. Things

Proceedings

that you implement in institutional fashion to keep people from being exposed.

They don't work for the ecological receptors, though.

(Laughter)

MR. TOMCHUK: So, W-3 is one foot of sediment removal plus a six-inch overcut layer.

All the removals will have approximately six-inch overcut that would be built in to make sure that we achieve the objective of reaching the bottom.

And, so, one-foot sediment removal and then backfill into that same surface so that we do not change the sediment dynamics within the system, the hydraulic flow in the system.

The backfill would be placed in two lifts for all of these things so that we can control the residuals that might be in the -- happen from

Proceedings

the dredging residuals and capping residuals.

W-4, as I have highlighted here, is our preferred remedy, as you might have seen in the documents. It's two-foot sediment removal plus overcut plus the backfill and institutional controls.

And W-5 is removal of all soft sediment. When I'm talking about "soft sediment," I'm trying to compare that to the consolidated sediment that's been deposited historically over time over the glacial lake deposits, et cetera.

This is a little blurry, I'm sorry, but it's a graphical representation of some of the capping alternatives.

W-2 would just be two feet of sand in this layer here added to the surface over the soft sediment that's in the darker brown here. So, it's just a simple addition.

Proceedings

W-3 would be removal of one foot with the backfilling up to the same level. So, the yellow line stays the same in all these views here.

What we see here are two feet of removal and two feet of sand addition plus the overcut.

And then W-5 being all soft sediment being removed.

If you notice here, in many of the areas, probably 65 percent of the Upper Berry's Creek, we would not have soft sediment that contains the contamination remaining in the center of the channel. On the sides where the mudflats are, where it builds up over time, layering up over years, we would have some contamination that this backfill would act as a cap and the direct contact to the organisms or diffusion would not be a problem because of the sand layers over that.

We did the same type of analysis for Upper Peach Island Creek

Proceedings

Marsh.

No action alternative was evaluated.

A thin layer cover, which would be just six-inches of sand.

A one-foot sediment removal and backfill and the institutional controls.

Then let's skip to four for a second, a two-foot sediment removal and backfill.

And in the evaluation, we determined a hybrid approach might be appropriate to specify that we would -- that for most of the marsh, we would have a one-foot sediment removal, but within ten feet of the creek we would have a two-foot sediment removal, which is the same as what's going on in the creek. So, it just continues that.

We would also have that thin layer cover in the area of the radio towers, those big radio towers that we

Proceedings

would not be removing, and the institutional controls.

Here is our graphical representation of these.

Here's the ground surface. A thin layer cover would add approximately six-inches to that. It would probably sink in over time and depress over time, but it would add a small, half-a-foot layer. But that would be enough to prevent ecological receptors from coming in contact with the contamination there.

In the one-foot removal, you dig down a foot and place the sand, which is about the depth of a lot of the phragmites roots zone in this area. It's a little shallower than some of the areas and where most of the contamination is when you include the overcut.

So, one foot catches most of the contamination and removes a lot of phragmites roots, and two feet should

Proceedings

get most all of the contaminated layers entirely in the marsh.

As part of our evaluations, we had people that were very concerned about minimizing the footprint of the radio tower area. I actually just found out tonight that we didn't catch everything in the Proposed Plan. We had been looking at about seven acres of remediation, drawing a line across here, approximately, that we would look at the thin layer cap, and we've tried to cut that back. I think it's 3.8 acres of marsh now that would need the thin layer of cap.

These are areas that are lower in concentration than some of the other areas of the marsh and, also, further away from actually being able to get into the water column.

So, we evaluate against EPA's nine decision-making criteria for all Superfund sites. The threshold criteria are overall protection of

Proceedings

human health and the environment and compliance with applicable or relevant and appropriate requirements, so the state and local laws -- federal, state and local laws. ARARs is the acronym there.

Being an interim remedy, we don't actually have to actually reach all of those specifically at this point, but we will be moving towards that. And, actually, we would expect to be close to being within acceptable limits from these remedies because we will be addressing the whole footprint area.

We use five balancing criteria: Long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

There are also two modifying criteria: State acceptance and community acceptance. Of course, the

Proceedings

public comment period and public comment tonight is part of the community acceptance portion.

I'm using this grid here to show the different remedies for the waterways, and it gives us some of the balancing criteria on here. We see the estimated costs for these remedies and we see the construction times.

So, the balancing criteria is evaluated as well as some of the short-term impacts, which directly relate to the construction times.

We see that we are removing a lot of contaminated sediment and then placing in a lot of soils too with all these different remedies.

So, W-2 is the capping alternative. That's a concern because it adds two feet of sand and may reduce the potential for flood storage. So, EPA was concerned with the community concerns of flooding. We talked to eight of the communities

Proceedings

around here and everybody had the same concerns about flooding.

We want to make sure that we don't aggravate anything with respect to flooding, so that was kind of lower on the list, although it would be an effective remedy in this area, we believe.

W-3 and -4 would both include removal and then capping. Both of these could work. Both of them would provide reasonable risk reductions and control and be able to maintain the caps over storms, but the amount of maintenance would be a lot less with removal of two feet. And there are just a lot of concern that one foot would potentially have less long-term effectiveness than the W-4, so the two-foot removal.

And W-5 is the removal of all the soft sediment, which is something that we considered, except that when you dig down in those mudflats, you

Proceedings

have a lot of layers of contamination there that can go down six, seven, or eight feet. And we're leaving the marshes right next to that, so we're worried about the stability of those marshes during an excavation process as well as afterwards.

Of course, you can use sheet piling, but when you have heavy equipment on the banks and you're trying to drive the sheet piling in and then pulling it out afterwards, that can impact those other marshes so you have all the more mitigation to implement in those marshes after that. So, we did not think that what was the best criteria. So, we were leaning to W-4.

Similar run-through for the Upper Peach Island Creek Marsh alternatives. We see the cost here is about $60 million up to $86 million. Construction time is one year to 1.9 years. So, we evaluated these with

Proceedings

respect to each other and balanced them off.

So, basically, we felt that the thin layer of cover for Upper Peach Island Creek 2 remedy could be effective, but we were concerned about the flood storage and whether the thin layer of cover people would feel is protective enough and everything over that whole site. So, that was not our first preference.

We looked at number three, which is one foot of removal. And that left a lot of portions of the work for around the radio towers to be determined during design.

And I'm going to go to four again, which is two feet of sediment removal. It's the most permanent, but it doesn't really provide any additional risk reduction over one foot. This is an area that's not subject to a lot of movement so you really don't get more protection by

Proceedings

putting a thicker cap on there.

So, 3-A was the preferred alternative. And we are -- it's an effective remedy. It clarifies how we are going to address this area around the radio tower the most obviously.

And then the transition zone between the creek and the marshes provides a deep buffer of clean fill to protect any environmental -- ecological receptors.

So, our preferred alternative, which I think you've seen and I've been saying, is dredging two feet of sediment to the clean clay layer, or to the clean clay layer in most areas, with backfill or cap with clean sand to the original elevation.

We have six-inches of overcut too in the excavations, and then we would refill up to the original lines in two lifts to make sure that our concentrations at the surface when we're done are at the clean levels the

Proceedings

best we can. And this would include the major tributaries in the marshes.

In Upper Peach Island Creek Marsh, we selected Alternative 3-A, which is the hybrid alternative. So, that addresses most of the marsh with one foot of sediment removal and then capping with one foot of clean sand. Some overcut on that one as well.

Within 10 feet of the creek, we would do it down to two feet and then we would cap again with two feet of clean sand.

In the area near the radio towers, we would place a thin layer cover of six-inches of sand. That's about 3.8 acres.

The dredged sediment would be dewatered and disposed of offsite at a permitted facility. In order to do that, for transportation purposes, we'd probably have to add some type of Portland cement or some type of other additive.

Proceedings

Portland cement actually can be considered a treatment technology under certain cases, but -- not trying to really call that "treatment," but it would go offsite and it would probably be sent to a nonhazardous waste landfill. But that all depends on the concentrations that you measure.

Institutional controls would also be included in this remedy. Right now, there are existing New Jersey State restrictions on consumption or advisories for consumption of fish and crabs in the Newark Bay estuary, and these would remain in place.

We'd also consider no wake or anchorage zones over certain portions of the cap and deed restrictions for some of the areas in the marsh probably.

Another major portion of this study, as I said, has been an adaptive

Proceedings

management process. And, you know, having information to move forward for the next decision is important. And one of those things to do that would be a marsh demonstration project.

This is taking one of the other areas of marsh that are in the tidal zone, the Upper Peach Island Creek marshes behind the tide gate, and separate it.

This area would be capped -- one of these three areas would be capped and with different technologies to see the effectiveness of potential capping options for the next decision as well as provide us information on how effective the waterway treatment -- excuse me, how the waterway cleanup that we're doing at this point would be on reducing the concentrations in the marshes.

So, institutional controls, marsh demonstration. We have had a lot of long-term monitoring. We're

Proceedings

going into this taking all the data that we needed to make a sound scientific decision and move forward, and we would continue that into the phases of work afterwards, including biological sampling, water column sampling, and sediment sampling.

The overall estimated cost of the remedy, including the $13 million for demonstration project, is $332 million.

The State has concurred that this is an appropriate decision at this or preferred -- with our preferred alternative. And, so, we have the State acceptance and we are here talking about community acceptance.

As I said one, of the things that we are concerned with with community acceptance is the flooding concerns in the area. And we have had coordination with Rebuild By Design team from New Jersey DEP for the last

Proceedings

two years, and we recognize that their decisions impact our decisions and our decisions impact them.

Our plan is to not make any conditions worse with respect to flooding. Whatever implementation we do, we need to make sure we don't make any conditions worse.

Next, of course, we have the other part of community acceptance, receiving of comments, and there will be a chance tonight. I want to make a mention that if you do comment, you can comment on all the alternatives because we consider all these to be out there for people to comment on. And the backup documentation is in our information repositories or online. So, you can take a look at not just the preferred alternative but the other ones as well so that you can make your comments. And if we considered something else, that we have those other ideas in our head

Proceedings

from that.

Yes?

UNIDENTIFIED: What happens if you take the two feet off of the sediment and retest to see if you still have the contaminants; will you go any deeper?

MR. TOMCHUK: Let me get back to that in the questions. At this point, I'm going to say no, actually. The capping of the materials, we're not trying to get all the contamination out.

We should be clear about that in this presentation. The idea is that there would be sand that would act as a cap over that. It would prevent the organisms and the contamination from entering the water column so that we shouldn't have exposure at that point because everything would be below the sand.

Our schedule for this: Here we are with the Proposed Plan and

Proceedings

public meeting in May of 2018; public comment period ends June 6, 2018; we will have a Record of Decision this summer, according to our plans; and then after that, we go into design and we hope to implement that design under a consent order with the potentially responsible parties; and then we go into remedial action after the design is completed.

That takes two to three years. The remedial action will take three to four years. That will be done under a consent decree that's filed in court, a federal consent decree.

After that time period, we will implement -- we will do a remedy evaluation monitoring, and that will take approximately five years.

So, if you add up all of these areas here, we get to about eleven years before the next decision would be made to make a final determination for the site.

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I should clarify here that this will be -- that would be the second ROD in ten years. We are here at the interim ROD now. We will do all that work, and then all the studies, get to our second decision, and there's a possibility we might need a third one but just -- not rolling it out, just trying to say that we're trying to do it in two but it could be -- stepwise, it could be three.

So, I'll open it up to comments and questions. I urge you to look at the website, search all the documents that we've provided.

And if you want to go to the next one, it's probably best to leave this up for discussion purposes.

Again, we're supposed to -- how do you want to...

MS. MATA: If you could just stand up and then make sure that Linda can see you -- she's our stenographer,

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so -- she can record you. Say your name and if you're affiliated in any way.

MS. WALSH: Mary Walsh from the New Jersey Sierra Club. I have a few questions.

What is the level that you're reaching for? You indicated there was no way you could possibly clean it all out, but what is the level in terms of milligrams per kilogram or however you define it?

MR. TOMCHUK: We actually don't have a cleanup level in this because in the areas that we are addressing, we're going to have remediation that will clean up all those areas. So, it's virtually zero.

Will it be zero in the long-term? Well, there's dredging residuals, there's contaminations that will lie underneath some of the caps. So, it won't be zero mercury and PCBs in these areas.

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And then there is also contamination that comes in with the tide too from some of the downstream areas and the Hackensack River.

But what we'll do is reduce the source from the areas that we're remediating now from contaminating those other areas worse and, also, prevent -- we'll prevent the movement, the transport of the contamination, and, also, prevent organisms from coming in contact with that, with up to two feet of sand cap over any remaining contamination levels.

MS. WALSH: So, in 2009, they removed 2.6 million cubic yards from the Hudson River, which is a lot bigger than your number there. I think it was less than 500,000 on your chart there, the total number of cubic yards.

MR. TOMCHUK: Yes.

MS. WALSH: So, what happened was this increased the amount of PCBs

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in the fish downstream.

So, I assume that the Upper is upper because it's up and it travels down; is that correct?

MR. TOMCHUK: There are differences between the Hudson. That was a one-directional system there. That's all upstream of the federal dam in Troy. So, that was heading downstream.

So, any contaminant releases, which do happen during dredging and capping, but you reduce the amount of loading. First of all, there was loading before that and loading afterwards, so you might have slight increases during construction periods. They can be controlled with best management practices. But overall, you see a step-down reduction after the construction period.

MS. WALSH: So, you're saying that you'll start at one end and move downwards.

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MR. TOMCHUK: Yes, we are probably going to do that because there is some movement from north to south in this system that we have seen over time; however, this is a tidal system so we get two-directional flow.

MS. WALSH: And when there was a cleanup done in the Passaic River in 2015, I think also what happened was because the stuff was, during the dredging, it was compartmentalized to prevent the stuff from -- for example, if you start, my impression from what you just said is that it's going kind of horizontally back and forth.

Is that correct?

MR. TOMCHUK: There is some of that that occurs, yes.

MS. WALSH: For the sake of discussion, you clean up this end, unless you can compartmentalize the thing as you go along. Then how is it going to prevent the old contaminated stuff from going back to where you've

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just dredged?

MR. TOMCHUK: Right. Okay.

Heading from north to south helps with some of that because there is some downstream movement.

There also will be -- we will put down the caps in two layers, two lifts. So, you put down a foot of the cap in one time and then wait a year, you put down another foot of sand to make sure that the concentration at the surface remains -- will be lower on the order of what your -- the material you're putting down, which is clean fill.

MS. WALSH: What is the nature of the cap?

MR. TOMCHUK: Sand.

MS. WALSH: Some of the research that I did before this meeting said that --

How thick is the cap going to be?

MR. TOMCHUK: Two feet --

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MS. WALSH: That's not really a cap; that's fill.

MR. TOMCHUK: It's backfill in many areas.

MS. WALSH: Not to get technical, but it's not a cap.

MR. TOMCHUK: It will work as a cap in this area. It's not an engineered cap because we have a backwater area that's depositional. So, no sense in applying an engineered cap and armoring a cap where you don't have a chance of it scouring.

This is an area that's in the backwater that we get layers and layers and layers building up, and we see multiple lines of evidence that support that.

I recognize that not every site -- while you can put a cap in at many sites, there are concerns with caps at certain sites and you have to really --

MS. WALSH: So, "cap" is

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really not the right term. It's "fill," sand fill, basically.

MR. TOMCHUK: But it acts as a cap in this case, basically by the isolation of the material underneath the sand.

And we don't have groundwater pushing up in this area, we have glacial lake clays underlying for about a hundred feet of material, so that we don't see any upward movement of water, so that this will actually act as a cap in that area.

MS. MATA: We're going to take --

MS. WALSH: My last question.

Is there any reason why you didn't address things like coagulation filtration or these plants that will gobble up mercury?

MR. TOMCHUK: We looked into some of that in earlier stages and we not did not find anything that we believed would be successful on a

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large scale to implement.

And these are proven technologies that we believe should address the problem.

MS. WALSH: Perhaps bringing in other elements might contribute to the total effort.

MR. TOMCHUK: Right.

Now, we do have a long-term study to do and considerations. And we'll have mercury and PCBs know left within the system at a lower level and we will consider some of those things again to address that; natural attenuation type processes or enhanced natural attenuation type things, adding amendments, et cetera.

So, that will be considered, but at this point the idea is to get rid of most of the material. Let me just say that I think most of the source material in the area, it's probably -- if I divide it in quarters, I would say like 75 percent

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of the remedy, because I'm not going to say 100 percent of the remedy. It's a lot more than 50 percent, so I'll say it's 75 percent of the remedy for the whole site that's being implemented.

MS. WALSH: Thank you.

MR. TOMCHUK: Okay.

MR. FITAMANT: Gerard Fitimant. I'm with Langan Engineering but I'm really here as a citizen. Just a couple of questions, though.

When you said you'll remove two feet and then another six-inches --

MR. TOMCHUK: Yes.

MR. FITAMANT: -- so, you're removing two foot six and putting back two?

MR. TOMCHUK: Two foot six, back to the original elevation.

MR. FITAMANT: So, you're putting a little bit more sand than two foot six back.

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MR. TOMCHUK: Yes, we're going to back to original elevations. And we will have some compression with the sand, yes.

MR. FITAMANT: Then when you remove the -- how do you know exactly you're doing two feet? Is there a bathymetric survey before and during construction?

Just curious.

MR. TOMCHUK: There are bathymetric surveys during the design, and the equipment has -- you know, I think you can get down to about half a foot easily, or a quarter of a foot.

MR. FITAMANT: There's a tolerance plus or minus.

MR. TOMCHUK: Yes. That's why we are doing the overcut. We're making sure we get at least two feet by adding six-inches.

MR. FITAMANT: Okay. And then when you remove the sediment or the macroinvertebrates, whatever bugs and

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critters that live in that, what happens?

So, you're going to pump those out, you put them in a dredge, and then that dewaters it? That puts the water in on a dredge machine?

It would be great if you had almost the process here to see it, but that goes out to dredge and the clean water is going out and the dredged material is stored and conveyed to another --

UNIDENTIFIED: Send it to Pennsylvania.

(Laughter)

MR. FITAMANT: I'm curious whether the water that you squeeze out of the mud --

MR. TOMCHUK: Would be treated --

MR. FITAMANT: -- is treated before it goes back into the waterway.

MR. TOMCHUK: Yes, we'll have treatment of the water.

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MR. SIVAK: We will need to comply with all permits and discharge criteria.

MR. FITAMANT: I don't know what they are. I'm just speaking as a laymen here, not as engineer or environmental scientist.

And this is more of an education. I appreciate what you've done. It's really informative.

Lastly, I was wondering whether, you know -- over time, I guess you improve the waterway and you remove the institutional controls once you have a two-foot cap?

There's going to be signs now placed at places where you can possibly access the marsh areas?

In other words, if you clean up the waterway, I would think you're going to have more people that would love to visit this and then they're tromping around in the two feet and they're messing it all up; right,

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they're bringing the sediments back up to the surface?

MR. TOMCHUK: I think it would be a long time before the institutional controls would be lifted.

I don't think that -- the contamination within the Newark Bay complex goes well beyond Berry's Creek, so the fish and crabs, you know, come into Berry's Creek bearing a load of contamination from other areas. So, I don't foresee that this remedy in itself will get rid of -- will lift the fishing advisories.

What I do see is that to say that you can't do anything because there will still be a fishing advisory means that nothing will ever happen so this removes the source of contamination that's continuing to make the condition worse.

Seems to make sense to me.

MR. FITAMANT: Better than

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doing nothing, I agree. Thank you.

MS. MATA: Other questions?

MR. SHEEHAN: Bill Sheehan, Hackensack Riverkeeper. I'm very, very happy to be here tonight and I'm really supportive of the remedy that you've chosen.

Couple of questions came into my head while I was listening to you speak.

I'm familiar with the waterway, and it's very shallow up in there, so you know, this is more of a methodology question. I'm used to seeing dredges in the bay, where they're dredging 50 feet down and mud and stuff. But when you only have a few feet of water, you're not pulling the barge in there with a dredge on it, you're not pulling a scour in there to take the material away. It's going to be a difficult lift to get that stuff out, get the cap in, and handle all that material safely after

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it's out of the creek.

So, I guess that's why it's going to take a couple years to design the work plan, more or less, the actual remedy?

MR. TOMCHUK: Right. That's one part, and you forgot about Paterson Plank Road Bridge, that nothing goes under --

MR. SHEEHAN: That's true.

(Laughter)

MR. TOMCHUK: We don't have the details of the design. They're in the Feasibility Study. They look at different techniques that they can cost using certain techniques, like a crane mat along the banks, which then they would reach in and pull things out, and maybe certain equipment being launched on a small barge in the area and you dig your way through as you go to implement the remedy.

A lot of that is going to be refined during the design.

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MR. SHEEHAN: Okay.

MR. TOMCHUK: So, the specifics of that, I was not really commenting on yet.

MR. SHEEHAN: Okay.

MR. TOMCHUK: So, yes, there's a lot of implementation concerns. And if you look, the costs are probably double most of those other projects per cubic yard dredged because of all these limitations.

MR. SHEEHAN: Okay. The other thing that came into my mind when you were talking about Peach Island with the radio towers.

MR. TOMCHUK: Yes.

MR. SHEEHAN: Those radio towers, the way it was explained to me years and years ago, was that each one of those towers has an array underground of copper plates that are attached to the towers and it has to do with conductivity and how they work.

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MR. TOMCHUK: Right.

MR. SHEEHAN: And they go out pretty far from the base of the tower. It's not like across the room here, it's like, you know, a great distance from where it's attached to the tower to where it ends out in the marsh someplace.

That's all been checked out with the radio station?

You have their as-builts for those towers, I hope?

MR. TOMCHUK: We don't currently have the -- we've requested the as-built drawings for those. Of course, they were built in the '50s or '40s, approximately.

MR. SHEEHAN: They've been there all my life.

MR. TOMCHUK: So, anyhow, we still need to work with the owner of the radio towers to make sure that the thin layer cap in that area won't cause any problems to them. We do not

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want to interfere with the business, and the idea of the latticework underneath the ground is one of the reasons that we did not select remedies that included excavation in those areas.

MR. SHEEHAN: Okay. Good work, Doug. Thank you.

MR. TOMCHUK: Thanks.

MS. MATA: Any other questions?

If there are no other questions, I think we're going to keep our poster boards up outside. If you folks didn't get a chance to take a look at those, we'll keep them up another 15 minutes or so and we can have further discussions outside if anyone else has other questions. But if not --

MR. FELDMAN: Steve Feldman.

Nobody asked, but is the firm selected for the remedial design going to be permitted to also bid on the

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construction or is that a decision that will be taken later down the line?

MR. TOMCHUK: EPA is not going to be contracting with either of those construction -- the design firm or the construction firm, so I don't have an answer for that.

MR. FELDMAN: All right.

MR. SIVAK: EPA will be having discussions. Once we sign the Record of Decision and we memorialize our remedy for the site, we will be working with the responsible party group to negotiate agreement on consent to perform the remedial design. We would like them to perform the design, and then they would have to select a contractor.

We would approve that, but those decisions would be made by the group actually performing the design.

MR. FELDMAN: Thank you.

(Continued on next page.)

MS. MATA: And with that, I will say thank you again for joining us. And if you want to catch Doug or myself or anyone else on the team on your way out, please do so.

Thank you for coming.

MR. TOMCHUK: I'll definitely stay for a little while.

(Time noted: 8:01 p.m.)

C E R T I F I C A T E

STATE OF NEW JERSEY)
) ss.
COUNTY OF HUDSON)

I, LINDA A. MARINO, RPR, CCR, a Shorthand (Stenotype) Reporter and Notary Public of the State of New Jersey, do hereby certify that the foregoing transcript of the public meeting held at the time and place aforesaid is a true and correct transcription of my shorthand notes.

I further certify that I am neither counsel for nor related to any party to said action, nor in any way interested in the result or outcome thereof.

IN WITNESS WHEREOF, I have hereunto set my hand this 25th day of May, 2018.

____
LINDA A. MARINO, RPR, CCR

BERRY'S CREEK STUDY AREA

OU2 of the VENTRON/VELSICOL SITE

RECORD OF DECISION

APPENDIX 5

ATTACHMENT D - WRITTEN COMMENTS

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
Engineering and Construction
Bureau of Flood Resilience
501 East State Street
Mail Code 501-01A
P. O. Box 420
Trenton, NJ 08625-0420
Tel. 609-292-9236 FAX 609-984-1908

June 6, 2018

Doug Tomchuk
Remedial Project Manager
US Environmental Protection Agency
290 Broadway, 19th Floor
New York, NY 10007-1866

Re: BCSA Public Comment
Proposed Plan May 2018

Dear Mr. Tomchuk:

On April 30, 2018, the New Jersey Department of Environmental Protection (NJDEP) Site Remediation and Waste Management Program submitted a letter of concurrence to the United States Environmental Protection Agency (USEPA) regarding the preferred alternative identified in the Berry's Creek Study Area (BSCA) Proposed Plan. The NJDEP Bureau of Flood Resilience (BFR), which is implementing the Rebuild by Design Meadowlands (RBDM) Flood Protection Project in close proximity to the BCSA, has also reviewed the Proposed Plan for its potential to affect the RBDM project. As a result of this review, BFR recommends continued coordination between USEPA and NJDEP/BFR to identify appropriate sequencing of the potential RBDM channel dredging and the BCSA remedial activities in the vicinity of East Riser Ditch with a mutual goal of avoiding potential impacts to sediment and surface water quality for either project. Because the BCSA remedial activities will, and the RBDM activities may, involve removal and off-site disposal of contaminated sediments, both projects will have a need for materials management and may potentially have a need to coordinate community outreach.

The BFR RBDM Team looks forward to continuing these coordination efforts with USEPA on the BCSA. If you should have any questions, please contact me by email at linda.fisher@dep.nj.gov or by phone at 609-984-9339.

Best Regards,

Linda Fisher, Project Team Manager
Rebuild by Design Meadowlands

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June 6, 2018

-- Via E-Mail --

Mr. Doug Tomchuk
Remedial Project Manager
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007-1866
tomchuk.doug@epa.gov

RE: BCSA Public Comment

Dear Mr. Tomchuk:

On behalf of the BCSA Cooperating Parties Group (BCSA Group), The ELM Group, Inc. provides the following comments on the Environmental Protection Agency's (EPA) Proposed Plan for the Phase 1 remedy of the waterways in the upper and middle portions of the BCSA.

1. The Proposed Plan Has Strong Technical Support

The BCSA Group appreciates that the Proposed Plan is based on the extensive technical data and analyses in the Remedial Investigation Report and Feasibility Study Report. The Proposed Plan is tailored to the specific conditions of the BCSA and incorporates an adaptive approach consistent with EPA's sediment remediation guidance and sediment management principles. The Group agrees that the proposed remedy is structured to remove secondary source material, which will reduce the most elevated risks, and maintain the stability of the marsh system, while leading to remedial action on a faster timetable than a non-phased, single remedy approach.

2. The ROD Should Include the Green and Sustainable Remediation Analysis

The Green and Sustainable Remediation (GSR) analysis presented in the Feasibility Study Report is consistent with EPA guidance and supports the EPA preferred remedy, but was not discussed in the Proposed Plan. The Group requests that the GSR analysis and its conclusions be included in the Record of Decision.

3. Property Use and Access Restrictions Beyond Existing Wetland Regulations May Not Be Required

The Proposed Plan includes the following language related to institutional controls: "additional institutional controls (e.g., property use and access restrictions) would be implemented as part of the Phase 1 interim remedial action." The Feasibility Study Report briefly reviewed possible institutional controls, but did not indicate that such restrictions would definitely be necessary, other than continuation of the regional fish and crab consumption advisories. Given the conservative features built into the proposed remedy and the nature of the waterways and wetland areas described in the Proposed Plan (which are already subject to several statutes restricting activities in those areas), there likely will be little or no need for parcel-specific use or access restrictions, as such areas are unlikely to experience human access or related forms of human disturbance that could materially affect the protectiveness of the remedy. The Group understands that any ROD language relating to institutional controls will allow further analysis during remedial design of the need (or lack of need) for particular institutional controls in particular locations.

We hope that these comments are helpful. Please consider them and place this comment letter in the administrative record for the Site. Thank you.

Sincerely,

THE ELM GROUP, INC.

Peter P. Brussock, Ph.D.
Project Coordinator for the BCSA Cooperating Parties Group

From: Jamie Zaccaria jamie.zaccaria@sierraclub.org
Subject: Berry's Creek
Date: May 9, 2018 at 11:06 AM
To: buddy jenssen buddy.jenssen@gmail.com, Mary Walsh blehlwalsh@hotmail.com

Here is some background info on the issue:

The U.S. Environmental Protection Agency (EPA) is holding a public meeting tonight on the contamination in the Berry's Creek Study Area, which is part of the Ventron/Velsicol Superfund site in Bergen County, N.J., They are proposing a plan to take actions to address known sources of the contamination. The Berry's Creek portion of the Superfund site is on EPA Administrator Scott Pruitt's Emphasis List of Superfund sites. The proposed cleanup plan includes bank-to-bank removal of sediment down to 2 feet in portions of the creek with backfilling and capping equal to the depth removed. EPA is seeking public comment on its proposal. The meeting is being held at the Little Ferry Library at 239 Liberty St, Little Ferry, NJ 07643, USA.

Here are some bullet points that we want to make:

- Now that the EPA is moving forward on Berry's Creek, they need to develop a plan that calls for a complete clean-up.
- They plan on capping and dredging the site, which we have serious concerns with. They will only dredge 1 to 2 feet of contaminated soil which means millions of tons of toxic sediment will still be left in the creek.
- All caps will fail over time. At this site it will fail even sooner because there is strong river and tidal flows. We expect sea level rise and storms to get worse and become more frequent which will put more people at risk.
- The EPA must put forth a real remediation plan, not a cap that will fail. There needs to be a thorough remediation plan that includes removal of toxins from the different sites, including Universal Oil, to restore the wetlands and streams.
- The Hackensack River is one of the most complex sites to clean up because of the different types of pollutants and toxic chemicals here.
- Part of the problem has been the piecemeal approach of trying to clean up one site at a time without looking at all the contaminated sites in the river.

Below is the press release we are putting out tonight:

EPA Meeting on Berry's Creek Superfund Site: Need Full Clean-Up

Little Ferry, NJ- The U.S. Environmental Protection Agency (EPA) is holding a public meeting tonight on the contamination in the Berry's Creek Study Area, which is part of the Ventron/Velsicol Superfund site in Bergen County, N.J., They are proposing a plan to take actions to address known sources of the contamination. The Berry's Creek portion of the Superfund site is on EPA Administrator Scott Pruitt's Emphasis List of Superfund sites. The proposed cleanup plan includes bank-to-bank removal of sediment down to 2 feet in portions of the creek with backfilling and capping equal to the depth removed. EPA is seeking public comment on its proposal. The meeting is being held at the Little Ferry Library at 239 Liberty St, Little Ferry, NJ 07643, USA.

"Now that the EPA is moving forward on Berry's Creek, they need to develop a plan that calls for a complete clean-up, including targeting hot-spots. They plan on capping and dredging the site, which we have serious concerns with. They will only dredge 1 to 2 feet of contaminated soil which means millions of tons of toxic sediment will still be left in the creek. All caps will fail over time. At this site it will fail even sooner because there is strong river and tidal flows. We e that experience sea level rise and stronger storms. We expect sea level rise and storms to get worse and become more frequent which will put more people at risk. The EPA must put forth a real remediation plan, not a cap that will fail. There needs to be a thorough remediation plan that includes removal of toxins from the different sites, including Universal Oil, to restore the wetlands and streams," **said Jeff Tittel, Director of the New Jersey Sierra Club**. "After 40 years, we are having an interim clean-up but we need a complete cleanup. It's important that the new Regional Administrator Lopez will propose a plan to clean up the creek however the entire Hackensack River should be added as Superfund site."

Berry's Creek is a tributary to the Hackensack River traveling through Carlstadt, East Rutherford, Lyndhurst, Moonachie, Rutherford, Teterboro, and Wood-Ridge, and includes ecological area. The Meadowlands are an environmental oasis in the middle of one of the most urban areas and we must cleanup this toxic site to restore the Meadowlands and to protect the environment. More and more people are using the Hackensack River for recreation and it needs to be cleaned-up. More birds are stopping in the Meadowlands," **said Tittel.** "If we don't have a clean-up plan, all we're doing is creating a toxic nature preserve unless we clean up these sites and the river itself.

The Environmental Protection Agency has found dozens of contaminates after sampling the Hackensack River that show we need an immediate clean-up to protect public health and the environment. As part of their research to decide if the Hackensack River should be classified as a Superfund Site, they found elevated levels of cadmium, lead, mercury, cancer-causing dioxin and PCBs, enough for the EPA to conclude the river's contaminants, which is a risk to humans and wildlife. After the analyzed more than a century's worth of industrial pollution from three different toxic sites, they planned to decide if is extensive enough to put the River on the Superfund list and conduct an extensive clean-up. These toxins are a huge human health threat to anyone who lives nearby or utilizes the river.

"The Hackensack River is one of the most complex sites to clean up because of the different types of pollutants and toxic chemicals here. After 40 years of attempts to clean up the river, the pollution has not really gotten any better. That is why it should be added as a Superfund site. Part of the problem has been the piecemeal approach of trying to clean up one site at a time without looking at all the contaminated sites in the river. What's even worse is the failure to stop the toxic settlements that have been washing into the river over the years. Pruitt said he wants to speed up cleanups but the only cleanups he is checking off is on paper, not real cleanups," **said Jeff Tittel, Director of the New Jersey Sierra Club.** "We've been waiting 40 years for a remediation plan for Berry's Creek, and the EPA must come up with a permanent clean-up."

--
Jamie Zaccaria
Communications & Legislative Coordinator
New Jersey Sierra Club
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