FIRST FIVE-YEAR REVIEW REPORT FOR BRIDGEPORT RENTALS & OIL SERVICES SUPERFUND SITE GLOUCESTER COUNTY, NEW JERSEY

Prepared by

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Region 2
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LIST OF ABBREVIATIONS & ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AWTS	Aqueous Wastewater Treatment System
BROS	BridgeportBridgeport Rentals Oil and Services Rentals Oil and Services
CEA/WRA	Classification Exception Area/Well Restriction Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	Contaminants of Concern
EPA	United States Environmental Protection Agency
FYR	Five-Year Review
ICs	Institutional Controls
LNAPL	Light Non-Aqueous Phase Liquid
LTC	Little Timber Creek
LTCS	Little Timber Creek Swamp
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
O&M	Operation and Maintenance
PRP	Potentially Responsible Party
RAO	Remedial Action Objectives
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
RPM	Remedial Project Manager
SVOC	Semivolatile Organic Compound
TBC	To be considereds
UU/UE	Unlimited Use and Unlimited Exposure
USACE	United States Army Corps of Engineers
VOCs	Volatile Organic Compounds

I. INTRODUCTION

The purpose of a five-year review (FYR) is to evaluate the implementation and performance of a remedy to determine if the remedy is and will continue to be protective of human health and the environment. The methods, findings, and conclusions of reviews are documented in FYR reports such as this one. In addition, FYR reports identify issues found during the review, if any, and document recommendations to address them.

The U.S. Environmental Protection Agency (EPA) is preparing this FYR pursuant to the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 121, consistent with the National Contingency Plan (NCP)(40 CFR Section 300.430(f)(4)(ii)), and considering EPA policy.

This is the first FYR for the Bridgeport Rental and Oil Services (BROS) Superfund Site. The triggering action for this statutory review is the start of the remedial action on 6/6/2012. The FYR has been prepared due to the fact that hazardous substances, pollutants or contaminants remain at the site above levels that allow for unlimited use and unrestricted exposure (UU/UE).

The Site consists of two operable units (OUs), both OUs are reviewed in this FYR. OU1 addresses lagoon remediation and the water line. OU2 addresses groundwater, wetland and soil contamination.

The BROS Superfund Site FYR was led by Brian Quinn, the EPA Remedial Project Manager. Participants included Robert McKnight, section chief; Robert Alvey, hydrogeologist; Abbey States, human health risk assessor; Michael Clemetson, ecological risk assessor; and Cecilia Echols, community involvement coordinator. The relevant entities, such as the potentially responsible parties (PRPs), were notified of the initiation of the five-year review. The review began on June 13, 2017.

Site Background

The BROS site is a 30-acre parcel of land, formerly used as a waste oil storage and recovery facility, located in Logan Township, Gloucester County, New Jersey, one mile east of Bridgeport and two miles south of the Delaware River. The property originally housed a tank farm, consisting of approximately 100 tanks and process vessels, drums, tank trucks, and a 13-acre waste oil and wastewater lagoon. Initial estimates indicated that the lagoon contained about 2.5 million gallons of oil contaminated with PCBs, 80,000 cubic yards of PCB-contaminated sediments and sludge, and 70 million gallons of contaminated wastewater. Groundwater underlying the site and extending about 6,000 feet from the lagoon was contaminated with volatile organic compounds (VOCs). The storage tanks contained sludge and sediment material similar to that in the lagoon. The area surrounding the site is primarily rural and agricultural. Little Timber Creek Swamp (LTCS) lies to the east and leads to Little Timber Creek (LTC), a tributary of the Delaware River. Cedar Swamp (CS) lies across Route 130 north of the site, and collects drainage from the site via LTC. The lagoon repeatedly threatened to breach its dike, and did so once in the early 1970s, causing widespread vegetative damage to about three acres of the adjacent wetland. Approximately ten acres of the wetland were impacted significantly enough to require active remediation. The site was listed on the National Priorities List in 1983.

The aquifer underlying the site is used for drinking water purposes in the Bridgeport area. The groundwater in the uppermost aquifer flows radially away from the site and includes a northerly flow component toward the Delaware River. At greater depths, the groundwater flows to the southeast. Domestic water supply wells historically existed to the north, northwest, and west of the site; ten are within 50 to 1,000 feet of the site. These wells have been replaced over the years by a public water supply.

FIVE-YEAR REVIEW SUMMARY FORM

SITE IDENTIFICATION		
Site	**Name:** Bridgeport Rentals and Oil Services	
EPA ID:	NJD053292652	
Region: 2	**State:** NY	**City/County:** Bridgeport, NJ/ Gloucester County

SITE STATUS	
NPL Status: Final	
Multiple OUs? Yes	**Has the site achieved construction completion?** No

REVIEW STATUS
Lead agency: EPA ***[If "Other Federal Agency", enter Agency name]*:**
Author name (Federal or State Project Manager): Brian Quinn
Author affiliation: EPA Remedial Project Manager
Review period: 7/12/2017 - 12/29/2017
Date of site inspection: 9/24/2018
Type of review: Statutory
Review number: 1
Triggering action date: 6/6/2012
Due date *(five years after triggering action date)*: 6/6/2017

II. RESPONSE ACTION SUMMARY

Basis for Taking Action

The results of the Phase 1 RI/FS indicated that there was significant contamination at BROS. Specifically, three distinct sources of potential contamination were defined: the tank farm area, the 12.7-acre lagoon and the groundwater. Analyses of the three indicate that the BROS lagoon posed the most serious threat to the health and the environment. The lagoon oil and sediment were laden with PCBs at concentrations above 500 ppm, as well as other organics, and the lagoon water and oil contained significant concentrations of a variety of pollutants. Without any action, the lagoon would pose a health threat from direct contact, and the level would continue to rise from rainwater input, and eventually overflow the existing dike to cause substantial contamination of the local environment. The lagoon did overflow in the mid 1970's resulting in the contamination of approximately 3 acres of marshland. This area had severely stressed vegetation and represented a potential source for the introduction of PCBs into the surrounding wetland ecosystem. Furthermore, the lagoon wastes were in contact with the underlying aquifer, which was used for potable water.

The Phase 2 Remedial Investigation/Feasibility Study (RI/FS) estimated that over 300,000 cubic yards of COC-contaminated soil remained on property with levels above preliminary remediation goals (PRGs). While the 13-acre waste oil lagoon had been remediated and the surface of the production area cleaned, the subsurface zone outside of the former lagoon area footprint contained most of this residual contamination. There were also some areas of residual contamination beneath the former lagoon and areas where mobile LNAPL had re-infiltrated into formerly remediated areas. It was estimated that over 100,000 gallons of free phase LNAPL were present, significant amounts of residual LNAPL remained and roughly 350 million gallons of groundwater were contaminated. The RI/FS included the installation and sampling of 44 new groundwater monitoring wells, which indicated that groundwater contamination had migrated farther from the site. The Phase 2 Wetlands RI involved the evaluation of approximately 300 acres of wetlands within LTCS and CS. The results indicated contamination of a portion of LTCS adjacent to the site and the potential for contamination farther downstream in LTC. (Figure 5)

The phase 2 RI/FS determined that VOCs, including tricholoroethene (TCE) and its breakdown products, as well as BTEX, methylene chloride and a semi-volatile organic compound (SVOC), Bis (2-chloroethyl) ether, entered groundwater from materials disposed of at the site. Lagoon sediments and sludges contained organic contaminants such as benzene, polychlorinated biphenyls (PCBs), and metals, including lead, cadmium, and chromium. Tanks on the site contained a wide range of organic contaminants and metals. Both free and residual light non-aqueous phase liquid (LNAPL) contamination were present in the subsurface and contained varying amounts of site-related compounds such as PCBs and VOCs. PCB-laden oil residues were found in surface water. Contamination threatened to drain to CS, an ecologically sensitive area.

A human health risk assessment was conducted as part of the RI/FS and concluded that unacceptable risks were present. Specifically, noncarcinogenic effects associated with construction worker dermal exposure to shallow groundwater exceeds EPA's benchmark value of 1.0. In addition, the combined adult and child resident exposed to contaminated groundwater in the deep aquifer under the potential future use scenario of potable use exceeded EPA’s benchmark value primarily due to TCE and vinyl chloride. Also, the excess lifetime cancer risks estimated at this site were above the acceptable risk range for the combined adult and child resident, primarily due to bis (2-chloroethyl) ether, TCE, and vinyl chloride.

An ecological risk assessment was conducted and observed potential adverse effects to benthic organisms as well as other ecological receptors throughout the food chain from exposure to PCBs and metals (predominately lead).

Response Actions

In 1984, EPA issued a Record of Decision (ROD) for the Phase 1 or OU1 remedy for the site. The 1984 ROD selected the remedies for the waste lagoon, tank farm, potentially contaminated residential wells, and also included a second phase remedial investigation to determine the appropriate groundwater and wetland cleanup actions. The following actions were taken as part of the 1984 ROD: (1) removing oily waste and contaminated sludge from the lagoon and treating them via on-site incineration; (2) excavating and disposing of drums; (3) continuing to pump aqueous waste from within the lagoon to prevent the further spread of contaminated groundwater and to contain any pollutants that might escape during the lagoon excavation effort; (4) removing all tanks and contained waste; and (5) installing a public water supply line from Bridgeport to homes with contaminated or threatened wells.

Under a settlement arrangement (discussed below), a group of PRPs became responsible for completing the Phase 2 RI/FS under the direction of EPA. EPA issued a ROD for the Phase 2 or OU2 remedy for the site in September 2006. Due to the complexity of the BROS site along with the nature of the innovative remedial technologies, an adaptive phased management approach was considered appropriate to achieve the desired human health and ecological risk management goals. This included utilization of a number of sequenced or phased remedial technologies and/or program controls with contingency actions if the planned measures were not successful. This prioritized approach would ensure protection of human health throughout the remedial process by reducing the mobility of chemicals of concern from the principal threat areas through their removal, destruction or containment as a first priority. Success would be based on site-specific technology performance criteria. The following approaches were outlined for the various site media:

Wetlands

- Wetland sediment management through excavation, ex-situ treatment and off-site disposal (via landfilling), in-situ treatment with sorptive agents, backfilling and wetland restoration for the more highly contaminated areas, and monitored natural attenuation with institutional controls for the less contaminated wetland areas.

Soil, LNAPL, and Shallow Groundwater

- Soil, LNAPL and Shallow Groundwater management through cover and drainage improvements, water budget management (using phytoremediation techniques), bioslurping with steam injection (where warranted), enhanced biodegradation. and institutional controls.

Deep Groundwater

- Deep Groundwater management through extraction and treatment followed by in-situ chemical and biological treatment (with a contingency for hydraulic containment of groundwater contamination).

As stated in the ROD, initially, deep groundwater would be extracted in the central and southern portions of the BROS property to remove contaminant mass. This would include pumping groundwater from the principal threat zone (PTZ) or area of highest contaminant concentrations. This would be followed by in-situ chemical oxidation treatment (the subsurface injection of oxidizing compounds) along with groundwater pumping. Pumping during injection would optimize the delivery of treatment chemicals to the zones of concern. The cycle of chemical oxidation treatment with pumping would be repeated as necessary in contaminant concentration rebound areas. The lower threat zone, or area immediately surrounding the PTZ, would undergo bioremediation (the addition of amendments to enhance or accelerate naturally occurring COC degradation mechanisms) following pumping. Areas further downgradient to the southeast would undergo enhanced biodegradation treatment as necessary.

The ROD contained a contingency action that involved long-term hydraulic containment pumping of the deep groundwater in place of in-situ chemical and biological treatment. As stated in the ROD, the contingency action would be implemented, at EPA's discretion, if the data from the completed sequential remedial process (i.e., multiple rounds of chemical and biological treatment with pumping of the deep groundwater) indicates that the established remedial goals have not and/or cannot be achieved.

The remedial action objectives (RAOs) for OU2 are:

Shallow/Deep Groundwater

- Reduce or eliminate ingestion and/or direct contact with VOCs, SVOCs and metals in groundwater above federal MCLs and New Jersey groundwater quality standards. Restore off-property groundwater to its expected beneficial use as a potable drinking water supply.
- Reduce or eliminate vapor intrusion from VOCs, SVOCs and PCBs in groundwater above acceptable site-specific, risk-based levels.
- Reduce or eliminate direct contact with VOCs, SVOCs, LNAPLs, PCBs and metals in groundwater above acceptable site-specific, risk-based levels to the public, construction workers and utility workers.

Soil

- Reduce or eliminate vapor intrusion and inhalation from adsorbed VOCs, SVOCs and PCBs in the soil above acceptable site-specific, risk-based levels.
- Reduce or eliminate the migration to groundwater of the adsorbed VOCs in the soil above acceptable site-specific, risk-based levels.
- Reduce or eliminate direct contact with adsorbed VOCs, SVOCs, LNAPLs PCBs and metals in soil above acceptable site-specific, risk-based levels to the public, construction workers, and utility workers.
- Reduce or eliminate the uptake of adsorbed VOCs, SVOCs and metals into the soil and into crops off-property.
- Reduce or eliminate impacts from contact with contaminated soils to ecological receptors, including food web effects.

LNAPL

- Consistent with ARARs (State of New Jersey requirement N.J.A.C. 7:26E-6. l(d), N.J.A.C. 26E 2.1(a)(l1)), remove LNAPL and contain residuals, to the extent practicable.

Sediment

- Reduce or eliminate ingestion or direct contact with residual LNAPL and PCBs greater than 50ppm and reduce exposure to other chemical constituents exceeding the severe effects level concentrations in hydric soils and sediments in the DeManifestis Zone in LTCS II and III (see figure 5).
- Reduce or eliminate exposure to constituents exceeding the severe effects level concentrations in the intermediate zone.

Status of Implementation

OU1 Activities:

A public water supply water line, providing potable water to 15 affected homes, was completed in 1987. The State undertook responsibility for the design and implementation of this action.

In 1990, in addition to the OU1 ROD activities, drums of hazardous materials were removed from an on-Property building by EPA's Removal Branch. Some limited sediment removal in Gaventa Pond, which borders

the southwest portion of the site, was also stipulated in the OU1 ROD , but was completed as part of the OU2 remedy.

Between 1987 and 1988, 100 tanks, many of which still contained hazardous wastes, were emptied, demolished and removed. More than 350,000 gallons of oils and sludges contaminated with PCBs and about one million gallons of liquids were removed from the tanks and taken to EPA-approved disposal facilities, as was debris from the buildings, tanks, vessels, drums and subsurface pipelines.

An on-property aqueous wastewater treatment system (AWTS) was constructed and an on-property transportable incinerator was permitted in 1988. In 1989, a contract was awarded to commence incineration of lagoon wastes (oil, sediment, and sludges) and area soils. The on-site aqueous treatment system was also utilized to treat lagoon wastewater. The incinerator was used for the thermal destruction of over 172,000 tons of material, including 138,500 tons of lagoon levee material, 4,250 tons of soil reportedly as a result of lagoon overflows in previous years, and 13,000 tons of debris. During excavation of the lagoon, approximately 190 million gallons of groundwater were removed from the lagoon by pumping and treating using the AWTS prior to discharge to LTC. The lagoon was backfilled with sand, lime-treated ash, and stone to grade and is currently covered by topsoil and grass. The design and remediation activities for the lagoon remedial actions were performed between 1988 and 1996 under the oversight of the United States Corps of Engineers (USACE). Operation of the on-site incinerator ceased in January 1996, upon completion of the lagoon cleanup effort.

Demolition and removal of on-Property buildings and approximately 100 tanks and process vessels used to store hazardous wastes in the tank farm, and the off-site disposal of approximately 400,000 gallons of oils and sludges, 5,200 floating and buried drums, and 4,300 tons of debris was completed in 1996.

OU2 ROD activities

***Groundwater/LNAPL*:**

Groundwater and LNAPL cleanup at the BROS Site has a shallow and deep groundwater component. Shallow groundwater comprises the upper-most, water-bearing soils. The shallow groundwater and LNAPL component of the remedy is essentially limited to the BROS Property itself. Deep groundwater comprises the water-bearing soils beneath the shallow groundwater, separated by a clay layer in many areas. The Deep groundwater remedy targets the areas beneath the BROS Property that are most affected by contaminants of concern (COCs), to reduce COCs migrating in deep groundwater to the southwest. The remedial actions for OU2 are implemented using an interative, or adaptive approach. Activities are ongoing and efforts to date are summarized below.

Shallow Groundwater/LNAPL - The remedy integrates a combination of hybrid poplar trees, a surface water drainage system, and bioslurping to enhance the subsurface bioremediation and recovery of LNAPL/used oil and other chemicals from the soils and shallow groundwater. In addition, a more conventional oil recovery system (i.e., belt skimmers) has been included in the LNAPL/used oil collection system to provide for recovery when conditions are not favorable for bioslurping. This system continued to operate through 2018. Recovery of LNAPL has declined, but the systems have been optimized to enable additional removal of LNAPL. The bioslurping system was decommissioned in 2018. Belt skimmers and the use of a vacuum truck continue and an additional 350 gallons of LNAPL were recovered in July 2018.

During 2017 the PRPS conducted a study to evaluate remedial actions performed to date to address LNAPL and COCs in soils. The study determined the distribution of LNAPL and COCs in soils is stable, and that some natural attenuation of the residual contamination is occurring. A further

evaluation was completed to determine if additional remedial actions would assist in ensuring protectiveness, consistent with the ROD. The PRPs proposed an additional source remedy which consists of installing sheet piling around the former lagoon to prevent potential LNAPL migration in the sandy soils and shallow groundwater adjacent to the former lagoon. A full containment system of vertical sheetpiling to surround the former lagoon area is in the process of design. The containment system is anticipated to be installed in FY 2019-20.

Deep Groundwater – An in-situ chemical oxidation (ISCO) pilot test was conducted in 2012 and 2013. Remediation of groundwater contamination using ISCO involved injecting oxidants and other amendments directly into the PTZ of the deep groundwater beneath the BROS Property. This pilot technology destroyed approximately fifty percent of the COCs beneath the BROS Property. The effects of the ISCO pilot testing continue to be monitored. Currently, areas further downgradient to the southeast are being evaluated for and will undergo enhanced biodegradation treatment as necessary. A proposal on enhanced biodegradation will be submitted to EPA in mid-2019 and implementation of enhanced biodegradation will occur following approval of proposal.

The groundwater extraction and treatment system for deep groundwater is housed in a building on the BROS Property just south of CS Road/Route 130. Operation began in October 2013 and the pumping rates have been maintained in accordance with the design based on Site conditions and treatment system performance.

***Wetlands*:**

Remedial actions involved the excavation of LNAPL-impacted soil/sediment, which resulted in the temporary disturbance of 15.30 acres of wetland, 1.43 acres of wetland transition area and 11.71 acres of riparian zone within two areas of LTCS designated as LTCS-II and LTCS-III (see Figure 5).

Consistent with adaptive site management strategy, modifications to permanent and temporary (during construction) design features presented in the Remedial Design were implemented during the remedial construction activities to improve efficiencies and address changes in conditions encountered during the work. Some of these adaptive modifications included:

- Due to the unusually high seasonal and fluctuating high water table and surface water conditions within the construction area, temporary surface water controls (Eastern Diversion Berms, localized earthen berms, sump pumps, aqua barriers, filter bags) were used throughout the work to divert and remove water from the active work areas.

  Additionally, active work areas were maintained relatively small area (<100' width/length) to allow prompt excavation and backfilling to reduce potential impact of water intrusion or rain events on the operations.

- The vertical extent of the excavation was largely a field determination, recognizing that the COCs were highly correlated with the distribution of LNAPL residuals that were visibly apparent in the field. Sediment characterization data from the RI were also used to guide the depth of exaction. The objective was to remove contaminated sediment to a depth that ensured clean surface sediment to a depth sufficient to support wetlands vegetation after the area was backfilled to the pre-existing grade. The final depth of excavation was decided on an area by area basis taking into account the sediment compaction potential (related to underlying organic content) and the depth of the water table.

- Prior to placing backfill, each excavation area was evaluated in relation to the potential for underlying contaminants taking into account the visual observations during the sediment removal (e.g. presence of LNAPL residuals) and potential for elevated COC residuals based on the RI sediment data.
    - If the area was likely clean of LNAPL and COCs (e.g. underlying sediment a distinct clay layer), clean backfill was placed directly in the excavation.
    - If the area might have some residual COCs but no significant LNAPL residuals were evident, a geotextile was placed to stabilize the area ensure separation of the underlying sediment and the backfill.
    - If the observations and RI data indicated some elevated COCs and LNAPL residuals might be present, an organoclay Reactive Core Mat (RCM) was placed prior to backfilling.

  Following this decision process, the excavation and backfilling was adaptively managed.

Upon completion of the sediment removal/backfilling activities, wetland restoration activities were implemented in accordance with the New Jersey Department of Environmental Protection, Division of Land Use Regulation (NJDEP, DLUR)-approved restoration plans and the Remedial Design and the Wetlands Restoration and Monitoring Plan (mitigation project below).

Wetland restoration success is largely tied to the site-specific hydrology. The scope of the BROS mitigation project had to be adaptively adjusted as the baseline hydrology changed substantially from largely dry conditions at the surface throughout most of the summer months during the RI to continuously inundated post-ROD. The causes for this change included, the frequency and duration of flooding events has increased due to increased frequency high precipitation events and there has been a notable increase in the influence of storm tides throughout this low gradient site. This change is being amplified by colonization of the area by beavers, which have had to be controlled (e.g. continuously monitored and dispatched) during the restoration.

Given the complex and dynamic nature of the Site, restoration activities were implemented in a phased approach with construction activities occurring over several years to complete the approximately 15+ acre restoration. Because it was never intended that construction would be completed in one season, an adaptive site management approach was adopted in the FS and established by ROD.

Specifically related to the BROS Site, the adaptive management (Figure 6) was structured such that lessons learned related to construction techniques, water management, wildlife management, trends in water levels based on on-going monitoring and planting elevations for successful establishment of desired communities were applied on an ongoing basis. Adaptive measures included, but were not limited to:

- Detailed analysis of water elevation dynamics and adjustments to the planting plans;
- Monitoring of the plant survival over the range of conditions and adjusting replanting to improve the success rate;
- Creating new components of the restoration design (e.g. higher elevation areas [mini-island]) to establish areas where less water tolerant overstory vegetation can become established and serve as seed source for the restoration area;
- Based on monitoring of sediment thickness over liners placed during sediment and backfilling, stabilizing localized areas with thin sediment cover with placement of geogrids filled with stone and additional sediment, as well application of particulate organoclay products. In addition, as the plantings became better established, the berms around the restoration area were opened to provide increased flow of sediment rich runoff to deposit in the restoration area; and

- Adjustments to the proportion of emergent to woody stem plantings considering the likely impacts of beaver induced flooding when the current trapping program is discontinued. Also, planned for more open water habitat as a result of higher water table conditions.

On-going restoration activities have been summarized in mitigation monitoring reports previously provided to EPA and NJDEP from 2013 through 2016, with the final permit-equivalency report submitted to NJDEP on December 8, 2017. Based on the post-remediation surface water and sediment data presented below, the adaptive implementation of the remedy described above has met the remedial action objectives for the wetlands area at the BROS Site. In addition, based on the June 2018 inspection with the NJDEP wetlands staff, the restoration work has met its permit-equivalency goals. A final approval is pending from NJDEP.

IC Summary Table

A Deed Restriction was put in place on October 28, 1997 to control the future use of the site. Also, a Classification Exception Area has been submitted to and is currently under review by NJDEP.

Table 1: Summary of Planned and/or Implemented ICs

Media, engineered controls, and areas that do not support UU/UE based on current conditions	ICs Needed	ICs Called for in the Decision Documents	Impacted Parcel(s)	IC Objective	Title of IC Instrument Implemented and Date (or planned)
Groundwater, soil	Yes	Yes	BROS property	Control future use of the property	Deed restriction (October 28, 1997)
Groundwater	Yes	Yes	BROS property and downgradient	Maintaining the State of New Jersey groundwater use restrictions until such time as water quality standards are met	Classification Exception Area (Under Revision)

Operation and Maintenance

As stated previously, the shallow groundwater remedy integrates a combination of hybrid poplar trees, a surface water drainage system, and bioslurping to enhance the subsurface bioremediation and recovery of LNAPL/used oil and other chemicals from the soils and shallow groundwater. In addition, a more conventional oil recovery system (i.e., belt skimmers) has been included in the LNAPL/used oil collection system to provide for recovery when conditions are not favorable for bioslurping. This oil collection system was discontinued in 2017 and a design and installation of a sheet pile wall to contain the former lagoon area should be completed in 2018. Once the sheet pile wall is installed, wells inside the wall will be monitored for accumulation of LNAPL oils will be pumped out and a formal schedule will be developed to pump out LNAPL accumulations going forward.

The deep ground remedy includes an adaptive strategy integrating in-situ remdiation and groundwater extraction and treatment.

The distribution and attenuation of COCs in deep groundwater over time at the Site is determined through comprehensive and semi-annual sampling and laboratory analysis that is approved and reviewed by the EPA. In early 2015, an additional monitoring well (MW-54D) was installed along the southern end of the extent of COCs and screened at the base of the deep groundwater aquifer. Laboratory analysis of groundwater collected from this new monitoring well did not detect COCs, further confirming the downgradient bounds of the COCs. Specifically related to the BROS Site, the adaptive management approach (Figure 6) was structured such that lessons learned related to construction techniques, water management, wildlife management, trends in water levels based on on-going monitoring and planting elevations for successful establishment of desired communities were applied on an ongoing basis.

Specific to the groundwater extraction and treatement system, to date, approximately 180,000,000 gallons of contaminated groundwater have been extracted and treated. Additional extraction wells have been installed which focus recovery on current hot spot locations or elevated concentrations in the groundwater. The individual well pumpage is monitored and adjusted as necessary to ensure optimal recovery and treatment.

Continuous operation of several extraction wells initially was problematic due to unforeseen clogging of wells and extraction lines from heavy precipitation of iron and aluminum. The cause of this heavy precipitaton was determined to be caused from the effects of historic acid waste disposal interacting with subsurface soils materials. Extraction pumping was temporarily suspended in 2017 and an optimization program was prepared and put into effect. The treatment system was enhanced, lines cleaned and pumps replaced while monitoring was conducted to more fully identify groundwater areas of significant impact. Groundwater extraction resumed and an adaptive pumping system is in place to target high areas of concentration of COCs. An additional sampling program was conducted to collect data on pH, dissolved oxygen and other parameters to assess natural attenuation and biological factors contributing to the breakdown of groundwater COCs.

The goals of the wetland mitigation project have been satisfied and the final Mitigation Monitoring Report has been submitted to the NJDEP satisfies the mitigation monitoring and reporting requirements for the areas temporarily impacted during remediation activities. Therefore, future permit-equivalency mitigation monitoring is not anticipated. The Site will continue to be monitored as required by USEPA to ensure continued stability of the wetland remediation area and ongoing remedy protectiveness. The wetland monitoring will include but not be limited to continued documentation of wildlife activities and impacts on vegetation and the status of restoration area via unmannded aircraft system.

Potential site impacts due to climate change have been assessed, and the performance of the remedy may be impacted in the future by water level rise due to long-term ocean level rise. The Site area is known to have water level fluctuations due to tidal effects and a tidal gate is located north of the site near the treated effluent discharge. However, the O&M plan addresses these impacts by monitoring water levels and there has been no significant effects at the site to date. The Site has experienced many large storms since the ROD in 2006 (e.g., Hurricanes Sandy and Irene, Tropical Storm Lee). Prior to each major storm, the project team takes precautionary actions to minimize the potential for damage. Following each storm the facilities and site at large are inspected for damage. To date, there has not been any significant impacts to the site from storms; except for power outages, limited damage to the phytoremediation trees and some localized damage to fencing. Flooding has not caused any damage to structures or significant erosion and the storm water management system was capable of conveying the peak flows.

III. PROGRESS SINCE THE LAST REVIEW

This is the first FYR for the site.

IV. FIVE-YEAR REVIEW PROCESS

Community Notification, Involvement & Site Interviews

On October 2, 2017, EPA Region 2 posted a notice on its website indicating that it would be reviewing site cleanups and remedies at 31 Superfund sites in New York and New Jersey, including the BROS site. The announcement can be found at the following web address: https://www.epa.gov/sites/production/files/2016-11/documents/five_year_reviews_fy2017_final.pdf. In addition to this notification, a public notice was made available on the Logan Township webpage, on October 12, 2017, stating that there was an FYR and inviting the public to submit any comments to the EPA. The results of the review and the report will be made available at the public website: https://www.epa.gov/superfund/bridgeport and at the site information repository located at Logan Township Municipal Building at 125 Main Street, Bridgeport, New Jersey 08014.

Data Review

Chemical Evaluation of Surface Water and Sediments

The surface water and sediment were sampled post-remediation in the spring of 2017. A discussion the data is provided below.

Surface Water Results

The surface water sampling results were compared to the NJDEP Fresh Water (FW2) chronic criteria SWQS for lead (5.4 ug/L), total PCBs (0.014 ug/L), and Mercury (0.77ug/L). This comparison demonstrates that all measured constituents are either non-detect or below the relevant SWQS within the former de manifestis zone (DMZ), intermediate zone (IZ), and de minimis zone (DZ). Lead was detected in all surface water samples, with concentrations ranging from 0.49 ug/L to 1.3 ug/L (mean: 0.88 ug/L). However, these concentrations are approximately five to ten times less than the applicable SWQS. Furthermore, no pattern of lead concentrations that would suggest the remediation area has any meaningful effect on surface water concentrations was apparent.

No difference in concentrations was evident among the surface water samples collected in the DMZ, IZ, or DZ. Mercury and total PCBs were non-detect at all surface water sampling locations.

In general, surface water sample results detected lead in all former DMZ, IZ, and DZ surface water samples, but did not exceed 1.3 µg/L and none of the samples exceeded SWQS. Total PCBs and mercury were non-detect in all former DMZ, IZ, and DZ samples. Relative to results from the RI Report, lead was previously detected to 62.1 µg/L in unfiltered water samples within the DMZ and to 3.78 µg/L outside the DMZ. Results from the 2017 surface water sampling are substantially reduced in comparison to pre-remedial conditions and well below SWQS for lead. Additionally, concentrations have been significantly reduced for total PCBs to levels that are non-detect.

Sediment Results

Sediment texture was generally consistent among sample locations and typically consisted of very fine sands and coarse to fine-grained silts. Sediments within upper the 1" of the Former DMZ, IZ, and DZ all had recently deposited layers of detritus throughout. Within areas of open water in the former DMZ, there were fewer living roots and less detritus within the upper 1" of sediment relative to the majority of samples within the IZ and DZ.

Except for these open water areas, there was no observable difference between former DMZ and IZ/DZ sample locations. There were no observations of sheen, discoloration, or unusual odor at any location during sampling.

Lead

The lead concentrations within sediment samples results did not exceed the PRG (1,000 mg/Kg) at any locations within the Former DMZ, IZ, or DZ.

Lead concentrations were lowest within the Former DMZ, highest in the IZ, and intermediate in the DZ. Within the DMZ, lead was detected in the 18 sediment samples with a mean of 38.4 mg/Kg; substantially lower than the SEL of 250 mg/Kg2. The range was from 3.8 to 84.5 mg/Kg, with the highest sediment lead concentration at LTC-SED-40 in the northern portion of LTCS-II. None of the DMZ lead results exceeded the SEL of 250 mg/kg.

Within the IZ, lead was detected in the 12 sediment samples, with a mean concentration of 229.75 mg/Kg (less than the SEL of 250 mg/Kg2) and a range of 100 to 466 mg/Kg.

Within the DZ, lead was detected in the six sediment samples with a mean of 81.5 with a range of 9 to 170 mg/Kg.

Total PCBs

The sediment sampling results show that total PCBs do not exceed the PRG (50 mg/Kg or surface average of 10 mg/Kg) within the Former DMZ, IZ, or DZ.

As for lead, total PCBs concentrations were lowest within the Former DMZ and highest in the IZ. Total PCBs concentrations in the DZ were similar to those in the DMZ.

Within the Former DMZ, PCBs were non-detect for all 18 sediment samples.

Within the IZ, total PCBs were detected in 9 of 12 sediment samples, with a mean concentration 3.3 mg/Kg; substantially less than the PRG of 10 mg/Kg. The concentrations ranged from non-detection to 12 mg/Kg.

Within the DZ, total PCBs were detected in 1 of 6 sediment samples (LTC-SED-26; 3.7 mg/Kg).

Extractable Petroleum Hydrocarbons

EPH was detected at all locations within the former DMZ, IZ, and DZ. The ROD did not establish a numerical PRG for EPH, and there is no NJDEP ESC for sediment EPH. Rather, the ROD established an objective of reducing or eliminating contact with LNAPL. The NJDEP limit for residual/free product is 17,000 mg/kg EPH; this value has been used as a screening criterion that could indicate potential presence of LNAPL.

Within the former DMZ, EPH was detected in the 18 sediment samples ranging from 130 to 3,200 mg/Kg (mean: 712 mg/Kg). No results exceeded the 17,000 mg/Kg residual/free product-related PRG. No LNAPL (e.g. sheen, odor) was observed during sample collection. The range of concentrations was somewhat higher within LTCS-II ranging from 420 to 3,200 mg/Kg (mean: 979 mg/Kg) while LTCS-III ranged from 130 to 740 mg/Kg (mean: 444 mg/Kg). These EPH concentrations are over 5 times lower than what might be indicative of the potential presence of residual LNAPL, which was a concern related to the potential to impact vegetation if free product were present.

Within the IZ, EPH was detected in the 12 sediment samples, with concentrations ranging from 660 to 4,600 mg/Kg (mean: 2,427 mg/Kg). The highest sediment EPH concentration within the IZ was located at LTC-SED-37 within the southwest portion of LTCS-III along Route 130.

Within the DZ, EPH was detected in the 6 sediment sample locations. EPH concentrations within the DZ ranged from 130 to 3900 mg/Kg (mean: 1,154 mg/Kg).

Summary of Sediment and Surface Water Data Analysis

The results of the 2017 sediment and surface water samples within the remediated area (Former DMZ) confirm that the remedy is effective and stable. In former DMZ sediments, lead was well below the PRG (1,000 mg/Kg). PCBs were not detected in any former DMZ sediment samples. All results were below the EPH residual product threshold of 17,000 mg/kg and no indications of LNAPL were observed during the sampling event. Also, the residual LNAPL will continue to degrade in situ over time. Furthermore, maximum concentrations in 2017 sediments were approximately one hundredth of the concentration for lead than the maximum concentrations measured during the RI and total PCBs were non-detect within the Former DMZ sediments. Finally, none of the target constituents (lead, mercury, PCBs) were detected in surface water in excess of SWQS. These findings collectively support a conclusion that the remedy implemented in the Former DMZ has achieved the RAOs.

Groundwater data

Shallow groundwater monitoring wells X-002, X-003 and x006 are downgradient of contaminated soil location and VOCs were below MCLs. Manganese was detected in X-006 at 103 ug/l versus the 50 ug/l standard. The results indicated COC concentrations in shallow groundwater are stable or decreasing slowly, and are related to the distribution of LNAPL residuals below the site. Installation of the sheet-pile wall is expected to further improve LNAPL recovery.

Deep Groundwater

This review addresses groundwater data collected since the groundwater extraction and treatment system began operation in 2013. In 2015 a sentinel well , monitoring well 54D, was installed to verify that the extent of the plume has been determined. Since installation, MW-54D has been sampled and results have been non-detect for site COCs.

Due to active treatment at the site, concentrations of COCs have reduced by approximately 75%. The groundwater extraction and treatment system to address the PTZ and contamination in the Lower Threat Zone has been augmented by a course of ISCO injections.

Overall concentrations of bis(2-chloroethylether) have been reduced by approximately 40%, Benzene has been reduced by 65%, and TCE has been reduced by 88%. Groundwater extraction and treatment will continue while further enhancements are being evaluated.

Figure 1 shows the network of wells for monitoring the deep groundwater plume associated with the BROS Site. A routine well sampling program has been in effect since 2008. Benzene results for selected monitoring wells sampled between 2008 and 2018 are provided in Figure 2. Monitoring Well MW-11B, located closest to the Site, shows a significant downward trend direction with benzene concentrations approximately 60 ug/l in 2008 to currently below 10 ug/l. Monitoring well MW-12B, also located near the source, shows a similar downward trend declining from roughly 65 ug/l in 2008 to currently 23 ug/l. MW-17D, further downgradient, initially at 50 ug/l

in 2008, increased to 70 ug/l by 2014, but has also shown a declining trend to 50 ug/l in 2018. Far downgradient Monitoring Wells MW-45C and MW-46D continue to be stable at approximately 13 ug/l and 9 ug/l respectively.

Figure 3 shows sample results for TCE at the same wells. The trends are similar. MW-11D shows a hard downward trend reducing from about 280 ug/l in 2008 to currently less than 50 ug/l in 2018. MW-12D reveals a downward trend from 150 ug/l in 2008 to below 100 ug/l in 2018. The overall trend for MW-17D is also downward from about 130 uh/l in 2008 to 100 ug/l in 2018. The far downgradient monitoring wells MW-45C and MW-46D indicate a slight upward trend, and this will continued to be monitored. No detections have been reported at the sentinel monitoring wells.

BCEE concentration trends for the wells are provided in Figure 4. Monitoring wells MW-11B and MW-12D show similar downward trends for BCEE. The overall trend for the midddle monitoring well MW-17D is slightly upward while the downgradient wells MW-45C and MW-46D show basically flat trends at low concentrations.

1,4-dioxane was detected in the treatment plant influent in a sample taken on March 10, 2016 at a concentration of 280 ug/l. Future sampling will include this compound.

Summary of Groundwater Data

The adaptive management techniques employed at the site have provided the ability to employ different treatment technologies to attempt to reduce the contamination in the deep and shallow groundwater. These efforts have led to concentration reductions of 40-88% for the COCs. By the next five-year review, additional treatment technologies will be employed to further reduce the COCs. The groundwater monitoring program is effective and review of data indicates the plume is stable to declining slightly. Additionally, there have been no detections of COCs at the sentinel wells. It is expected that by the next FYR, concentrations will have declined further.

Site Inspection

The inspection of the Site was conducted on 8/23/2017. In attendance were Brian Quinn, EPA RPM; Robert Alvey, EPA hydrogeologist; Abbey States, EPA human health risk assessor; Michael Clemetson, EPA ecological risk assessor; and Robert Alvey, EPA hydrogeologist. The purpose of the inspection was to assess the protectiveness of the remedy. The purpose of the inspection was to assess the protectiveness of the remedy. During the site visit the attendees toured the treatment plant, walked the site to ensure the cap was not compromised, inspected fence line and also viewed the wetlands.

All facilities appeared in good condition and maintained in accordance with the O&M plans. The wells are secure, accessible, and well maintained. Robert Alvey verified site conditions on September 25, 2018.

V. TECHNICAL ASSESSMENT

QUESTION A: Is the remedy functioning as intended by the decision documents?

Question A Summary:

The remedy called for in the 2006 ROD (OU2) was excavation of wetlands sediments/soil and groundwater extraction and treatment. A groundwater extraction and treatment system was constructed and is operating effectively, with adaptive management to enhace recovery. The remedy is functioning as intended. A wetland monitoring program is currently being conducted to evaluate the success of the restoration. Additionally,

sediment and surface water samples are being collected in the remediation areas. Based on the review of the wetland monitoring reports, the wetland restoration continues to be effective. Therefore, it appears that the remedy is functioning as intended for ecological receptors.

OU1

On-site structures and Investigation Derived Waste were removed from the site prior to 1997 and contaminated soils were excavated down to a technically practicable depth before being covered with a layer of ash and soil, removing potential direct contact exposures to on-site soil contamination. Since the OU2 ROD was signed, there have been improvements to the cover and storm water drainage over the property, therefore, no potential for direct contact with the contaminated subsurface soil and ash remains in the short-term. Additionally, the site has fencing and security measures in place for the ongoing groundwater remedy.

In the next FYR period, the hybrid poplars will be cut down, removed and a final cover plan will be designed and implemented to ensure long-term protectiveness from subsurface soil contamination and shallow groundwater.

OU2

Deep Groundwater:

The OU2 groundwater extraction and treatment system was constructed in 2013 and is currently remediating groundwater in the bedrock aquifer. Both shallow groundwater in the vicinity of the BROS property and deep groundwater on-site and downgradient of the property continue to exceed NJGQS. However, there are no impacted private water supply wells within or near the groundwater plume. Potential exposure to contaminated groundwater has been eliminated since residents were connected to a public supply, which is treated to meet state and federal drinking water standards, as part of the initial response. The CEA/WRA prevents the installation of new wells in the in the contaminated plume and a Gloucester County Deed Restriction prohibits residential redevelopment on the property and restricts subsurface activities. The groundwater monitoring program is effective and review of data indicates the plume is stable to declining slightly. There have been no detections of COCs at the sentinel wells, and a modification to slightly reduce the extent of the CEA/WRA is under preparation for review by NJDEP.

Shallow Groundwater:

Since the start of the active recovery efforts for COCs in shallow groundwater has resulted in the depletion of approximately 40,577 gallons of LNAPL.

Active LNAPL recovery in the shallow aquifer has been completed and efforts to permanently restrict potential contaminant migration outside of the site boundaries to the neighboring Gaventa Farm, located on the west boundary of the site, through physical source containment with sheet piling should be implemented in 2019.

Wetlands:

On-going restoration activities have been summarized in mitigation monitoring reports previously provided to EPA and NJDEP from 2013 through 2016, with the final permit-equivalency report submitted to NJDEP on December 8, 2017. Based on the post-remediation surface water and sediment data presented above, the adaptive implementation of the remedy described above has met the remedial action objectives for the wetlands

area at the BROS Site. In addition, based on the June 2018 inspection with the NJDEP wetlands staff, the restoration work has permit-equivalency goals. A final approval is pending from NJDEP.

QUESTION B: Are the exposure assumptions, toxicity data, cleanup levels, and remedial action objectives (RAOs) used at the time of the remedy selection still valid?

Although specific parameters may have changed since the time the human health risk assessment was completed, the process that was used remains valid and is not expected to affect the remedy. The exposure assumptions, toxicity data, cleanup levels and RAOs identified for the site remain valid. There are no changes in the physical conditions of the site or site uses that would affect the protectiveness of the selected remedy. Commercial land use assumptions and pathways evaluated in the RI/FS and considered in the decision documents remain valid.

The RAOs identified for the site are to reduce or eliminate direct and indirect (via vapor intrusion) contact with COCs in soil and groundwater and to restore contaminated groundwater, in the shallow and deep aquifers, to applicable groundwater quality standards. On-site structures and IDW were removed from the site prior to 1997 and contaminated soils were excavated down to a technically practicable depth before being covered with a cap, removing potential direct contact exposures to on-site soil contamination. The composition and depth of the soil cover are uncertain since there is no OU-1 completion report. Since the OU2 ROD was signed, there have been improvements to the cover and storm water drainage over the property, therefore there remains no potential for direct contact with the contaminated subsurface soil and ash in the short-term. Additionally, the site has fencing and security measures in place for the ongoing groundwater remedy. In the next FYR period, the hybrid poplars will be cut down and a final cover plan will be designed and implemented to ensure long-term protectiveness from subsurface soil contamination and shallow groundwater.

The OU2 groundwater extraction and treatment system was constructed in 2013 and is currently remediating groundwater in the bedrock aquifer. Both shallow groundwater in the vicinity of the BROS property and deep groundwater on-site and downgradient of the property continue to exceed MCLs. However, there are no impacted private water supply wells within or near the groundwater plume. Potential exposure to contaminated groundwater has been eliminated since residents were connected to the public supply, which is treated to meet state and federal drinking water standards, as part of the initial response. The CEA/WRA prevent the installation of new wells in the contaminated plume and the Gloucester County Deed Restriction prohibits residential redevelopment on the property and restricts subsurface activities.

Monitoring well results collected from the shallow aquifer were compared to EPA's vapor intrusion screening levels for groundwater (set at a cancer risk of 10^{-4} and Hazard Quotient of 1). The maximum detected COC values during the FYR period exceed the screening levels by a factor of 100. Since the site does not contain any permanent structures above or within 100 ft of the groundwater plume at this time, the vapor intrusion pathway is incomplete. If additional buildings were constructed near the groundwater plume in the future, vapor intrusion mitigation measures should be considered.

Ecological Risk Assessment

Although the ecological risk assessment screening and toxicity values used to support the 1984 and 2006 RODs may not necessarily reflect the current values, the lagoon/soil, sediment excavations and groundwater extraction system have reduced the potential risk to ecological receptors. Although specific parameters may have changed since the time the risk assessment was completed, the process that was used remains valid and is not expected to affect the remedy. The exposure assumptions, toxicity data, cleanup levels and RAOs identified for the site remain valid. There are no changes in the physical conditions of the site or site uses that would affect the

protectiveness of the selected remedy. Commercial land use assumptions and pathways evaluated in the RI/FS and considered in the decision documents remain valid.

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QUESTION C: Has any **other** information come to light that could call into question the protectiveness of the remedy?

No other information has come to light which calls into question the protectiveness of the remedy.

VI. ISSUES/RECOMMENDATIONS

Issues/Recommendations
OU(s) without Issues/Recommendations Identified in the Five-Year Review:
No issues identified

Issues and Recommendations Identified in the Five-Year Review:

OU(s): **OU1**	**Issue Category: Remedy Performance**
	Issue: Thickness of soil cap is not known.
	Recommendation: Evaluate the thickness of soil cap and supplement as necessary.

VII. PROTECTIVNESS STATEMENT

Protectiveness Statement(s)		
Operable Unit: 01	*Protectiveness Determination:* Short-term Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy at OU 1 is protective of human health and the environment in the short term because the water line was installed and lagoon material was excavated and treated on-site and the area was covered with a soil cap. In order to be protective in the long term, the cap needs to be evaluated for thickness and suplmented as necessary.		
Operable Unit: 02	*Protectiveness Determination:* Will be Protective	*Planned Addendum Completion Date:* N/A
Protectiveness Statement: The remedy at OU 2 is expected to be protective of human health and the environment upon completion. In the interim, remedial activities completed to date have adequately addressed all exposure pathways that could result in unacceptable risks in these areas.		

The next FYR report for the Bridgeport Rental & Oil Services Superfund Site is required five years from the completion date of this review.

APPENDIX A – REFERENCE LIST

Remedial Investigation/Feasibility Study, July 1984

Record of Decision, December 1984

Remedial Investigation/Feasibility Study, June 2006

Record of Decision, September 2006

Remedial Action Summary and Strategy Update, ELM Group, Inc. July 2017.

FIGURES

Figure 1 - BROS Deep Groundwater Monitoring Well Location

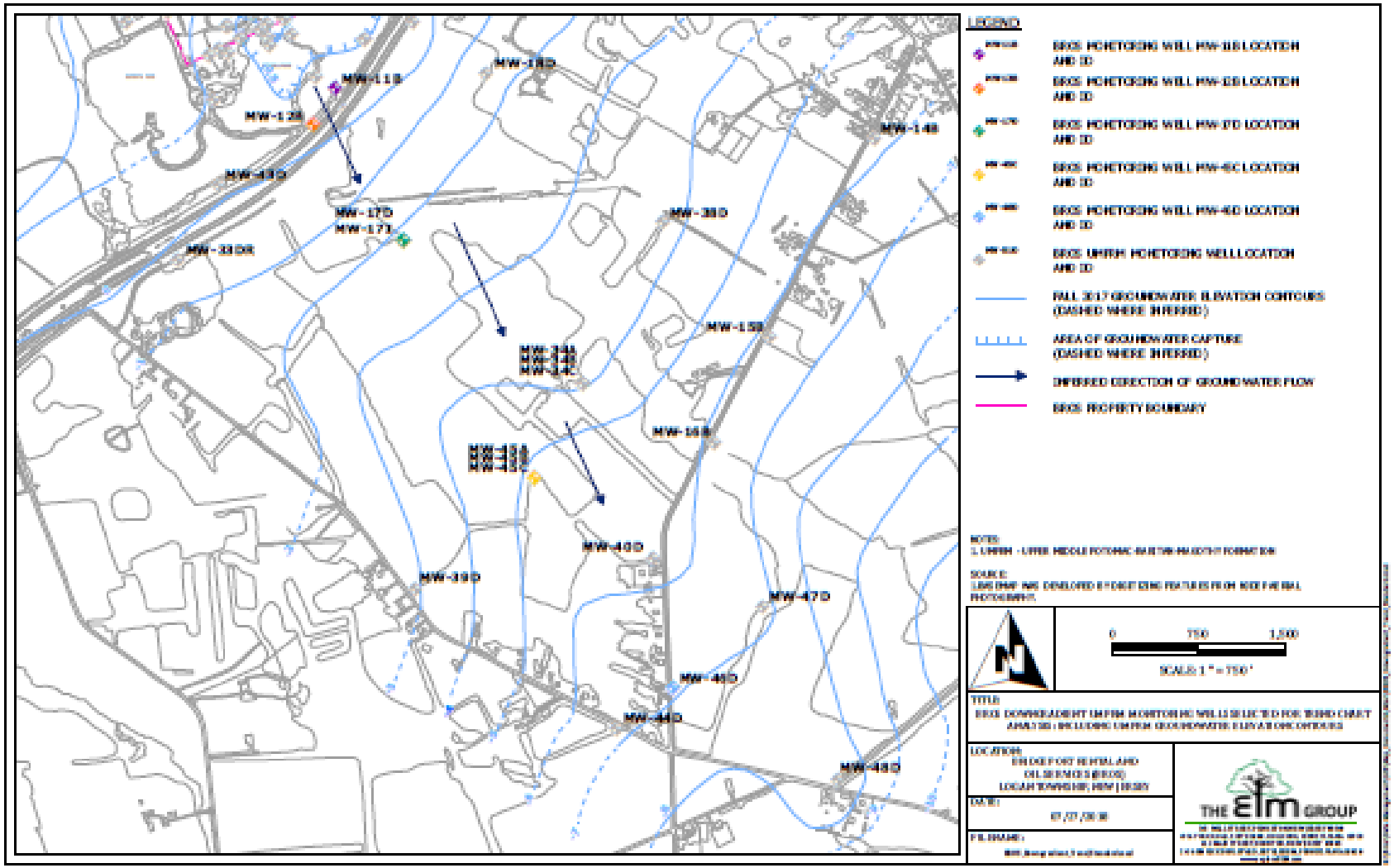


Figure 2- Benzene Concentration Temporal Trends BROS

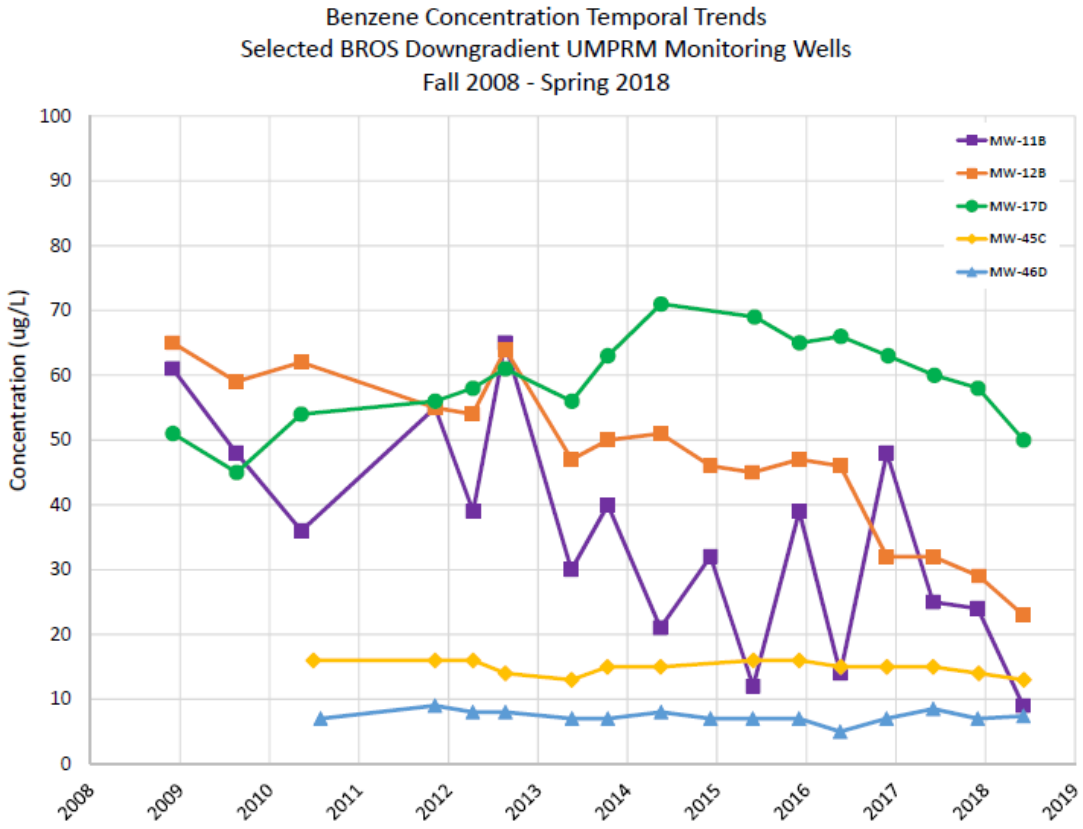


Figure 3 – TCE Concentration Temporal Trends BROS

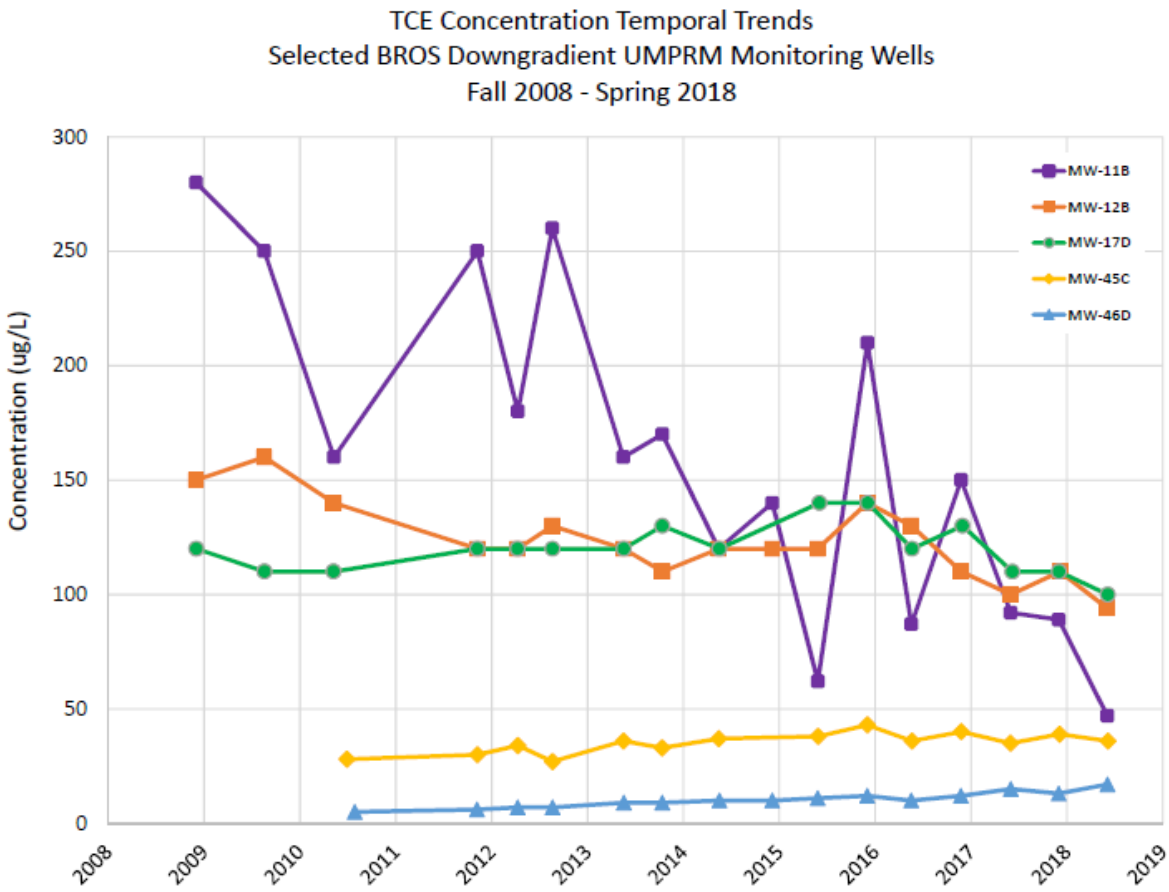


Figure 4 – BCEE Temporal Concentration Trends BROS

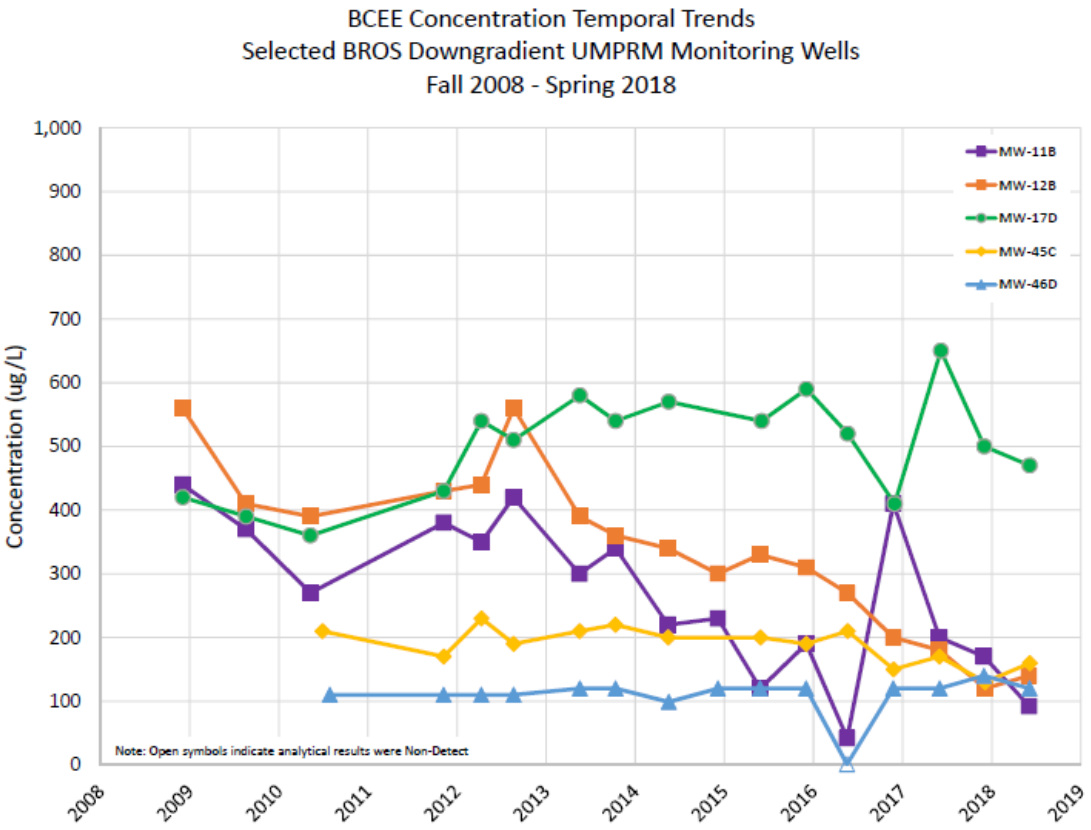
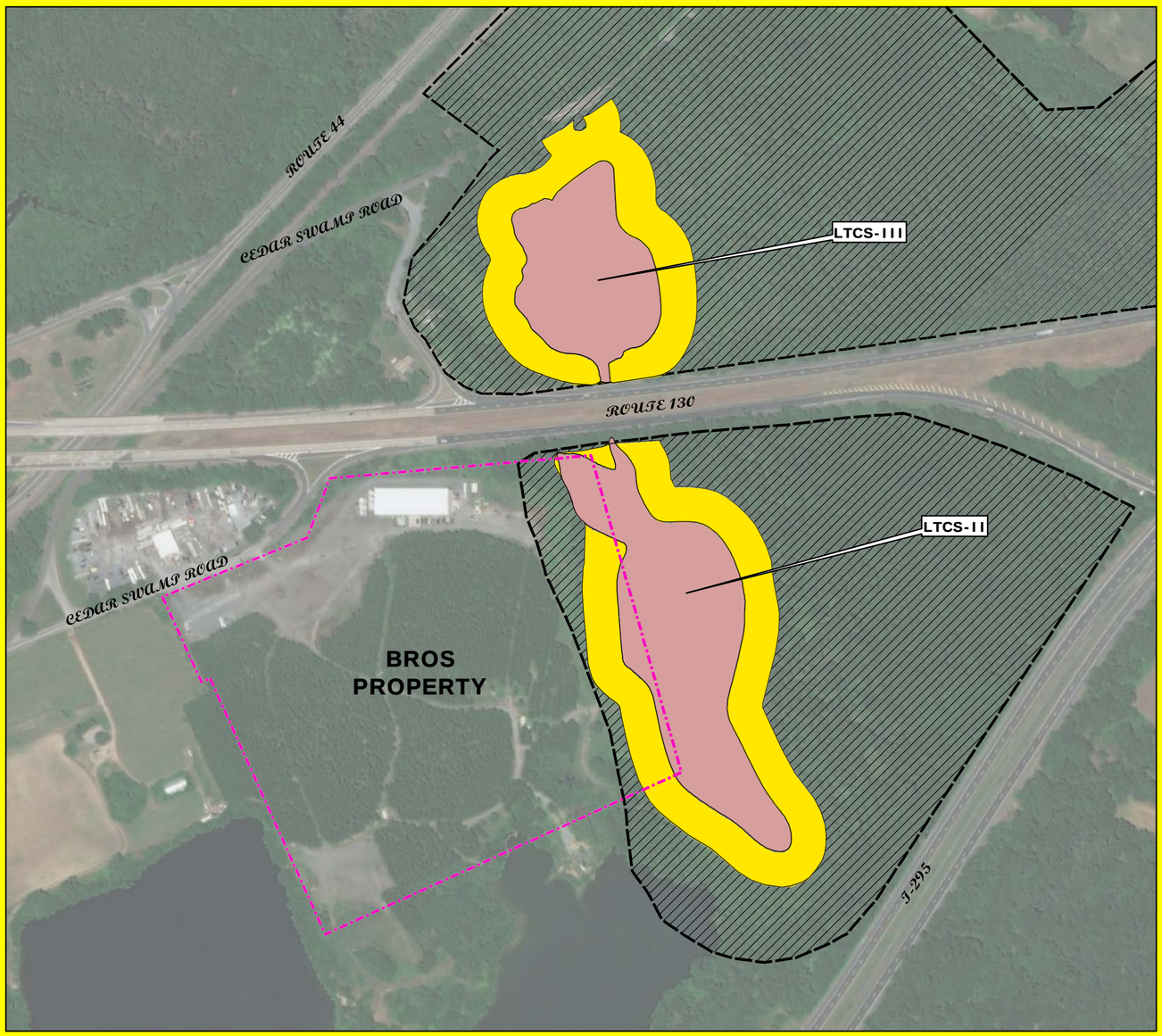


Figure 5- BROS Wetlands Remediation Zones



LEGEND

DRAFT

- BROS PROPERTY BOUNDARY
- DE MANIFESTIS ZONE (DMZ)
- INTERMEDIATE ZONE (IZ)
- DE MINIMUS ZONE (DZ)

SOURCE:
1. ERM "AS-BUILT SURVEY DATA FOR 2009 AND 2010 WORK LITTLE TIMBER CREEK SWAMP II", DATED 7/20/10.
2. DZ LIMIT BASED ON THE 'LIMIT OF WETLANDS / OPEN WATER AREAS' AS PROVIDED ON FIGURE 1-1 BROS RI\FS (USEPA 2006)
3. MONARCH SURVEYING & ENGINEERING "PROGRESS PLOT", DATED 5/18/12.
4. A GLOBAL POSITIONING SYSTEM (GPS) WAS UTILIZED TO OBTAIN LIMITED FIELD VERIFICATION INFORMATION REGARDING THE LIMITS/EXTENTS OF DISTURBANCES AND FIELD LOCATE THE MITIGATION MONITORING STATIONS.
5. ESRI, I-CUBED, USDA, USGS, AEX, GEOEYE, GETMAPPING, AEROGRID, IGN, IGP, AND THE GIS USER COMMUNITY.

0 300 600

SCALE:1 " = 300 '

TITLE:
FIGURE X
BROS WETLAND REMEDIATION ZONES

LOCATION:
BRIDGEPORT RENTAL AND
OIL SERVICES (BROS)
LOGAN TOWNSHIP, NEW JERSEY

DATE:
07/23/2018

FILENAME:
206165_Remediation_Zones.mxd

THE ELM GROUP
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K:\Bros\Data Management\GIS\Map_Documents\Wetlands\206165_Remediation_Zones.mxd

Table 6 Adaptive Site Management Approach