FINAL

FEASIBILITY STUDY REPORT

Riverside Industrial Park
Superfund Site
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LIST OF ACRONYMS

Acronym	Definition
ABSd	Dermal Absorption Fraction
ACO	Administrative Settlement Agreement and Order on Consent
AEC	Area of Environmental Concern
ALM	Adult Lead Methodology
AMSL	Above Mean Sea Level
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirements
AST	Aboveground Storage Tank
ATSDR	Agency for Toxic Substances and Disease Registry
BBI	Baron Blakeslee, Inc.
BER	Baseline Environmental Risk
bgs	Below Ground Surface
BHHRA	Baseline Health Human Health Risk Assessment
Birdsall	Birdsall Services Group
BLL	Blood Lead Level
BN	Base Neutral
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
CCI	Chemical Compounds, Inc.
CEA	Classification Exception Area
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulations
cm/s	Centimeter per Second
COC	Chemical of Concern
COEC	Chemicals of Ecological Concern
COPC	Chemicals of Potential Concern
COPEC	Chemicals of Potential Ecological Concern
CRS	Cultural Resource Survey
CY	Cubic Yard
DASRAT	Development and Screening of Remedial Alternatives Technical
Davion	Davion Inc.
DCE	Dichloroethene
DER	Declaration of Environmental Restriction
DNAPL	Dense Non-Aqueous Phase Liquid
ECRA	Environmental Cleanup Responsibility Act
EPC	Exposure Point Concentration
ESC	Ecology Screening Criteria
ESV	Ecological Screening Value
Federal	Federal Refining Company

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Acronym	Definition
First Environment	First Environment, Inc.
FS	Feasibility Study
Frey	Frey Industries
ft/day	Feet per Day
Gloss Tex	Gloss Tex Industries, Inc.
GPM	Gallon per Minute
GRA	General Response Action
GWQS	Groundwater Quality Standard
HABA	HABA International, Inc.
HI	Hazard Index
Honeywell	Honeywell International, Inc.
HQ	Hazard Quotient
ICT	Identification of Candidate Technologies
IDA	Industrial Development Associates/Corporation
IEUBK	Integrated Exposure Uptake Biokinetic Model
IGWSSL	Impact to Groundwater Soil Screening Level
ISRA	Industrial Site Recovery Act
LDR	Land Disposal Restriction
LNAPL	Light Non-Aqueous Phase Liquid
LSRP	Licensed Site Remediation Professional
MCL	Maximum Contaminant Level
MEK	Methyl Ethyl Ketone
MIBK	methyl isobutyl ketone
mg/kg	Milligram per Kilogram
mg/L	Milligram per Liter
MNA	Monitored Natural Attenuation
MSL	Mean Sea Level
MTBE	Methyl Tert-Butyl Ether
NAPL	Non-Aqueous Phase Liquid
NCP	National Contingency Plan
NFA	No Further Action
ng/kg	Nanograms per Kilogram
N.J.A.C.	New Jersey Administrative Code
NJDEP	New Jersey Department of Environmental Protection
NRDCSRS	Non-Residential Direct Contact Soil Remediation Standard
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbons

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Acronym	Definition
PAL	Project Action Level
PAR	Preliminary Assessment Report
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethylene
PHC	Petroleum Hydrocarbons
PI	Primary Identification
PMK	PMK Group, Inc.
POTW	Publicly Owned Treatment Works
PPG	PPG Industries, Inc.
ppm	Parts per Million
PRG	Preliminary Remediation Goals
PVSC	Passaic Valley Sewer Commission
Ramboll	Ramboll US Corporation
RAO	Remedial Action Objectives
RAP	Remedial Action Permit
RAWP	Remedial Action Work Plan
RBC	Risk Based Concentrations
RCRA	Resource Conservation and Recovery Act
RfC	Reference Concentration
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RIP	Riverside Industrial Park
RIR	Remedial Investigation Report
RME	Reasonable Maximum Exposure
ROD	Record of Decision
Roloc	Roloc Film
RPD	Relative Percent Difference
RSL	Regional Screening Levels
Samax	Samax Enterprises
SCSR	Site Characterization Summary Report
SF	Square Foot
Site	Riverside Industrial Park Superfund Site
SLERA	Screening Level Ecological Risk Assessment
SRP	Site Remediation Program
SRS	Soil Remediation Standards
SSDS	Subsurface Depressurization System
SVE	Soil Vapor Extraction
SVOC	Semivolatile Organic Compound
SY	Square Yard

Acronym	Definition
TBC	To Be Considered
TCDD	Tetrachlorodibenzoparadioxin
TCA	Trichloroethane
TCE	Trichloroethene
TCLP	Toxicity Characteristics Leaching Procedure
Tetra Tech	Tetra Tech Inc.
TEX	Toluene, Ethylbenzene, Xylene
TIC	Tentatively Identified Compound
TMV	Toxicity, Mobility, or Volume
TPH	Total Petroleum Hydrocarbon
TSCA	Toxic Substances Control Act
TSD	Treatment, Storage or Disposal
TWP	Temporary Well Point
µg/dL	Microgram per Deciliter
µg/kg	Microgram per kilogram
µg/L	Microgram per Liter
$\mu g/m^3$	Microgram per Cubic Meter
USEPA	U.S. Environmental Protection Agency
UST	Underground Storage Tank
VISL	Vapor Intrusion Screening Level
VIT	Vapor Intrusion Technical Guidance
VOC	Volatile Organic Compound
Woodard & Curran	Woodard & Curran, Inc.
WRA	Well Restriction Area

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EXECUTIVE SUMMARY

Introduction

This report presents the results of the Feasibility Study (FS) conducted at the Riverside Industrial Park Superfund Site (the Site) located in Newark, Essex County, New Jersey. The FS was conducted in accordance with the Administrative Settlement Agreement and Order on Consent (ACO) (Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA] Docket No. 02-2014-2011) and prepared on behalf of PPG Industries (PPG). The FS conducted under this Settlement Agreement is subject to approval by U.S. Environmental Protection Agency (USEPA).

Site Location and Description

The Site is a 7.6-acre active industrial site, previously owned by Patton Paint Company until 1971 and located in Newark, Essex County, New Jersey. After 1971, the Site was subdivided into 15 parcels/lots, and is identified as the Riverside Industrial Park (RIP). There are 14 buildings at the Site with five of the buildings being vacant (Buildings #6, #7, #12, #15, and #17). At the time of the remedial investigation (RI), Buildings #1, #2, #3, #9, #10, #13, #14, and #16 had ongoing business operations, and a small garage building (Building #19) was used for storage by the occupant of Building #13. Portions of Lot 64 and former Building #4 had vehicle dismantling activities during some of the RI activities.

Historic fill is present across the site. The origin of fill material at the Site is unknown.

Site History

The Site housed paint and varnish manufacturing operations from approximately 1902 until 1971. Since then, the Site has continued to be used for a wide variety of industrial purposes by a multitude of companies and was subdivided into 15 parcels/lots. Buildings #4 and #5 are no longer present at the Site as a result of a fire in approximately 1982 which caused significant damage and resulted in the building remnants being demolished. Several of the site lots have deed notices regarding engineering controls (pavement surface cover) related to New Jersey's remediation program.

Remedial Investigation

The Remedial Investigation/Feasibility Study (RI/FS) Work Plan (Woodard & Curran, Inc. [Woodard & Curran], 2017) was approved by USEPA in August 2017 which initiated the Phase 1 field site reconnaissance, geophysical survey, building safety assessment, bulkhead wall assessment, soil/fill investigation, groundwater investigation, waste container investigation, indoor air investigation, sump and sewer investigation, and Cultural Resource Survey (NV5, Inc., 2017). After the Phase 1 RI activities were completed in October 2018, a Site Characterization Summary Report (SCSR) Addendum (Woodard & Curran, 2018) was prepared. This document presented the Phase 1 results and was conditionally approved with comments on May 16, 2019 by USEPA.

Phase 2 RI field activities began in December 2018 and included additional soil/fill and groundwater investigation using the Phase 1 results to identify data gaps and to provide greater special coverage of the Site. The Remedial Investigation Report (RIR) prepared by Woodard & Curran, Inc. (Woodard & Curran, 2020), and the Baseline Health Human Health Risk Assessment (BHHRA) and Screening Level Ecological Risk Assessment (SLERA), both prepared by Ramboll US Corporation (Ramboll, 2020), were approved by USEPA on April 21, 2020.

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Physical Setting

The majority of the Site is paved or under roof. The topographic survey map of the Site (RIR, Figure 3-2A) shows ground surface elevations ranging from approximately 6 to nearly 12 feet above mean sea level (AMSL), with between 40 and 50 percent of the Site within the 100-year floodplain of the Passaic River. The top of the river bulkhead is between 6 and 7 feet mean sea level (MSL).

Up to 15 feet of fill exists beneath the Site. The sources of fill are unknown. As fill placement occurred over a more than 30-year period, the sources and thus physical and chemical properties could be different. The fill material consists predominantly of sands, silts, and gravel along with man-made materials such as brick, pieces of concrete block, wood, glass, and cinders. The fraction of each material in the fill varies across the Site. This material is considered "historic fill" as it complies with the New Jersey Department of Environmental Protection (NJDEP) definition of historic fill. Historic fill in some areas appears to have been impacted due to historical and/or current operations and chemical/waste handling at the Site. Lower portions of the fill are saturated as evidenced by groundwater depths that are typically less than 6 feet below grade.

A silt loam underlies the fill unit over the majority of the Site except in areas to the northwest. The silt loam is underlain by alluvium deposits.

Two groundwater units were investigated: shallow fill and deep. Shallow groundwater is within the fill material, and deep groundwater is within native materials. The primary groundwater flow direction in the shallow fill unit and deep unit is to the east toward the Passaic River. Groundwater elevations are and were typically influenced by tidal changes which are greatest in areas adjacent to the river.

Evaluation of slug test data for shallow fill unit wells at the Site indicated hydraulic conductivities between approximately 4 to 235 feet per day (ft/day). While the data indicate a range of approximately three orders of magnitude for hydraulic conductivity, the fact that these wells are constructed in fill materials suggests this range is reasonable given the heterogeneity of fill. Slug test data for wells in the deep unit wells indicated higher hydraulic conductivities in the north (162 to 264 ft/day) compared to hydraulic conductivities in the south (4 to 84 ft/day).

Nature and Extent of Contamination

In the assessment of nature and extent, sample analytical results were compared to Project Action Levels (PALs) or other screening values such as hazardous waste characteristics. Exceedance of a PAL does not indicate an unacceptable risk to that media. PALs are screening values that can help decision makers target a course of action prior to the risk assessment.

Waste

There is a limited volume of non-hazardous waste materials (not associated with current operations) at the Site. Light non-aqueous phase liquid (LNAPL), identified is diesel/heating oil, is present in an underground storage tank (UST) (Lot 64) and Building #15A (Lot 58). Surface waste piles on the southern portion of the Site and Building #7 asbestos-containing materials were removed by USEPA during the RI but were not part of the RI.

Six USTs contained liquid, five of which did not contain liquids identifiable as a product or waste product; therefore, groundwater and/or surface water infiltration may have occurred.

Soil/Fill

Observations of a thick, oil-like substance were noted in soil/fill in two areas of the Site. Soil/fill contains various metals, volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and polychlorinated biphenyls (PCBs). Monitoring wells at the Site did not have a measurable thickness of LNAPL.

No pesticides/herbicides, except heptachlor epoxide, were detected in soil/fill samples.

Groundwater

Groundwater contains various metals, VOCs, PCBs, and SVOCs. Measurable LNAPL was not observed in a shallow fill unit monitoring well. LNAPL was observed in soil/fill in the area of Lot 64 USTs. No dense non-aqueous phase liquid (DNAPL) was observed in the RI monitoring wells. The site-specific conductivity readings of the shallow groundwater indicate possible brackish conditions, and Lots 67, 68, 69 and 70 currently have restrictions in place to prevent groundwater use.

Sewer

Sewer Manhole 8 had methylene chloride and trichloroethene (TCE). A solid sample collected from Manhole 8 contained methylene chloride and toluene concentrations that were above 1 mg/kg. The sewer at this location was classified as inactive based on observations of no flow and lack of current users upstream of the location.

Lot 57 Sewer/Groundwater

The Lot 57 wall sewer sample contained elevated toluene and acetone concentrations. The acetone concentration was 83,000 micrograms per liter (µg/L).

In March 2020, USEPA directed that the remediation of Lot 57 be conducted under NJDEP via a Licensed Site Remediation Professional (LSRP) outside of the FS. The NJDEP assigned case number via the NJDEP Hotline is 20-04-05-0923-04. The remediation activities will be conducted by the person responsible for remediation (Lot 57 owner/operator). LSRP is to communicate and work with USEPA on Lot 57 remedial action. USEPA through NJDEP is to approve of any work.

Indoor Air

Indoor air and exterior ambient air samples were collected and analyzed from occupied buildings. VOCs were measured in indoor air. Operations in several buildings sampled use organic solvents in their process or routinely have gasoline/diesel powered vehicles/equipment in the building sampled. Gasoline/diesel equipment was not operating during sampling.

Fate and Transport

VOCs, SVOCs (represented by polycyclic aromatic hydrocarbon [PAH] compounds and petroleum hydrocarbon [PHCs]), metals, PCB aroclors, and tetrachlorodibenzoparadioxin (TCDD)) have been detected in soil/fill and groundwater.

Biodegradation of some compounds like VOCs is rapid. SVOCs and metals at the Site are less susceptible to degradation and, therefore, are relatively persistent in the environment. The RI did not include a monitored natural attenuation (MNA) study at the Site. In addition to biodegradation, the chemical solubility, volatility, and its tendency to absorb to soil/fill, all affect the fate and movement through soil/fill and groundwater.

Potential transport interactions at the Site include the following:

- Overland stormwater,
- UST contents to groundwater,
- Soil to groundwater,
- One sewer manhole to soil/groundwater,
- Groundwater - surface water potential interaction,
- River - site soil/fill potential interaction,
- Soil gas to indoor air,
- Soil to airborne dust, and
- One sewer pipe (Lot 57).

Additional details on fate and transport are provided in Section 5 of the RIR.

Risk Assessment

The BHHRA and SLERA for the Site were prepared by Ramboll and provide the full details on these assessments. Both risk assessments were performed without consideration of existing or planned engineering and institutional controls.

Based on the risk assessments, response actions are being evaluated for unacceptable human health risks, which will address copper (Lot 63), lead (Lots 1, 61, 62, 63, 64, 65, 68, and 70), VOCs (Lots 58 and 68), and naphthalene (Lot 62) contamination, and the response action for these contaminants and areas will consider the potential ecological risk identified in the SLERA for Lots 67 and 69, which are currently undeveloped and represent the only potentially significant ecological habitat at the Site.

The SLERA evaluated risks to terrestrial receptors at the Site, although little habitat exists for wildlife or soil biota. The SLERA identified concentrations of VOCs, SVOCs, metals, pesticides and PCBs above screening levels in shallow soils from across the Site, indicating a potential for ecological risk to one or more receptors. The SLERA did not account for existing surface barriers (pavement and buildings) that prevent the potential ecological risks presented in the SLERA. Most of the exceedances were in the same lots as identified human health COPCs; however, two lots - Lots 67 and 69 - were identified that are currently undeveloped and present a potential for ecological risk but no human health risk. Ecological PRGs were thus developed based on these two lots.

Remedial Action Objectives

Medium-specific remedial action objectives (RAOs) have been developed to mitigate potential site-related health risks, and corresponding General Response Actions (GRAs) have been identified that could potentially satisfy the RAOs. The medium-specific RAOs focus on the specific areas and regulated substances to which exceedances of USEPA's target risk criteria are attributed. RAOs were developed for wastes, soil/fill, groundwater, soil gas and sewer water as follows:

<u>Wastes</u>

Secure or remove wastes to the extent practicable to prevent human and ecological exposures.

Prevent uncontrolled movement of wastes (i.e., spills and free-phase liquid) to environmental media.

Minimize or eliminate human and ecological exposure to waste materials.

Soil/Fill

Remove or minimize chemicals of potential concern (COPC) concentrations and eliminate human exposure pathways to COPCs in soil/fill and fill material.

Remove or minimize chemicals of potential ecological concern (COPEC) concentrations and eliminate or minimize ecological exposure pathways to COPECs in surface soil/fill and surface fill material.

Prevent or minimize off-site transport of soil/fill containing COPCs to minimize the potential for interaction between the Site and the Passaic River.

Prevent or minimize potential for leaching of COPCs to groundwater and surface water from soil/fill and fill.

Groundwater

Minimize contaminant concentrations and restore groundwater quality.

Prevent exposure to COPCs in groundwater.

Prevent or minimize migration of groundwater containing COPCs.

Prevent or minimize discharge of groundwater containing COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.

Soil Gas

Minimize contaminant levels in sources of COPCs in soil gas that may migrate to indoor air.

Sewer Water

Prevent exposure to COPCs in sewer water and solids associated with a release from the inactive sewer system.

Minimize concentrations of COPCs in sewer water (inactive system).

Prevent or minimize discharge of sewer water COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.

Preliminary Remediation Goals

Preliminary remediation goals (PRGs) are chemical-specific, quantitative goals for each medium and/or exposure route that are intended to be protective of human health and the environment and meet RAOs. PRGs were developed based on both ARARs and risk-based levels (human health and ecological), with consideration of current and reasonably anticipated future use, background concentrations, analytical detection limits, guidance values, and other available information to aid in defining the extent of contaminated media and enable remedial action cost estimation.

Preliminary Remediation Goals for Wastes

Wastes will be remediated via removal from the Site.

Preliminary Remediation Goals for Soil/Fill

COPCs that have unacceptable risks/hazards, as identified in the BHHRA and SLERA, and/or exceed ARARs as described above are identified as chemicals of concern (COCs) that will be the focus of the remedial alternatives

presented. PRGs for COCs associated with unacceptable human health risks listed in the RIR were developed for lead, copper, TCE, xylenes (total) and naphthalene.

In addition, PRGs were developed for additional constituents (PCB-1260, benzene, arsenic and benzo(a)pyrene) identified as soil/fill COPCs because RI results indicated levels of these constituents exceed ARARs (NJDEP Non-Residential Direct Contact Soil Remediation Standards [NRDCSRS]).

The SLERA identified numerous constituents with concentrations exceeding Ecological Screening Criteria. Ecological PRGs were derived for Lots 67 and 69, the two undeveloped parcels, and were based on the lowest value among ESC, human health RBC, and ARAR, taking into consideration typical historical/urban fill concentrations for metals and PAHs.

Preliminary Remediation Goals for Groundwater

Groundwater in some wells contains contamination above ARARs. Site-related COPCs that exceed ARARs are identified as COCs that will be the focus of the remedial alternatives. The groundwater COCs with PRGs are as follows:

VOCs

- Acetone
- Benzene
- Ethylbenzene
- Tetrachloroethane, 1,1,2,2-
- Tetrachloroethylene
- Toluene
- Trichloroethane, 1,1,2-
- Trichloroethylene
- Xylene, m,p
- Xylene, o-

SVOCs

- Cresol, p-
- Benzo[a]pyrene
- Dioxane, 1,4-
- Benzo(a)anthracene
- Indeno(1,2,3-cd)pyrene
- Pentachlorophenol

Metals

- Antinomy
- Arsenic
- Cadmium
- Lead

Preliminary Remediation Goals for Soil Gas

Soil gas concentrations attributed to COCs in soil/fill present unacceptable human health risks to future indoor workers. PRGs for soil gas are the same as listed for TCE, total xylenes, and naphthalene for soil/fill.

Preliminary Remediation Goals for Sewer Water

The remediation goal for sewer water at an inactive portion of the northern sewer line (Manhole 8) on Lot 1 is removal followed by reduction of toxicity, mobility, or volume (TMV). Remedial alternatives will address the contents of Manhole 8 (water and solids) and the accessible pipe with the wastes.

Alternatives

Initial alternatives were developed for wastes, soil/fill, groundwater, sewer water, and soil gas. A preliminary screening evaluation of assembled alternatives was performed including a general evaluation of effectiveness, implementability and cost for each initial alternative. The alternatives remaining after preliminary screening for detail analyses are listed below.

Waste Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the National Contingency Plan (NCP). Under no action, remaining source materials at the Site would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented. The No Action Alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $15,500.

Waste Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of wastes into appropriate containers or transport vehicles for off-site recycling or disposal, along with proper closure of USTs by removal. The means for disposal of the various wastes would be determined during the remedial design. Upon removal of contents, the USTs would be removed in accordance with New Jersey tank closure regulations. The present worth cost of this alternative is $1,602,000 for 30 years.

Soil/Fill Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, new deed restrictions and other institutional controls would not be implemented, and future use of the subject areas would be unrestricted except that existing NJDEP-approved institutional and engineering controls would remain intact.

The No Action Alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $49,000.

Soil/Fill Alternative 2 – Institutional Controls and LNAPL Removal

For this alternative, deed notices would be recorded on all 15 lots. Existing deed notices would be revised to reflect RI results and existing engineering controls for applicable lots. Fencing would be maintained and enhanced as appropriate in order to limit unauthorized access to the area and prohibit future use of the area in a manner which may expose human receptors to unacceptable risk. Other institutional controls include existing zoning and local ordinances associated with use of the Site which would also be reviewed and modified as appropriate to ensure compliance with the objectives of this alternative. Institutional controls include access restrictions (to be determined during remedial design) and will reflect the ongoing business operations at the Site.

Soil/fill with LNAPL will be excavated and disposed off Site under this alternative. LNAPL in soil/fill associated with the USTs is addressed under waste alternatives. A predesign investigation will be completed to further refine the extent of LNAPL in soil/fill. The present worth cost of this alternative is $333,000 for 30 years.

Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls and NAPL Removal

Under Alternative 3, the same institutional controls and LNAPL removal listed under Soil/Fill Alternative 2 would be implemented. Soil/fill containing COCs would be left in place and would be addressed by engineering controls (cover system) and institutional controls. Soil/fill presenting potential unacceptable ecological risks on Lots 67 and 69 would also be addressed by these controls. In addition, the bulkhead would be reinforced or reconstructed, as appropriate, with new sheet piling or shoreline revetment in order to minimize the potential for interaction between the Site and surface water.

The areas with potential unacceptable risks for soil/fill would be capped. Existing surface cover would be inspected during remedial design to determine if the existing cover meets the objective of this alternative. Existing building floor

slabs in contact with soil/fill is incorporated into the cap. If a building is demolished in the future and its floor slab removed, a new surface barrier could be warranted at that location.

The use of existing pavement as surface cap would reduce the amount of material resources as encouraged under Region 2 Clean & Green Policy. Using existing asphalt or concrete pavement reduces the environmental footprint of the remedial action.

The existing bulkhead along the riverfront consists of various materials (e.g., steel, wood, concrete) and varies in condition from poor/failing to good, with the wood bulkhead sections generally in the worst condition and the steel and concrete sections generally in the best condition. A geotechnical investigation would be necessary for both bulkhead enhancement process options. There are two process options for the bulkhead. One process option is that affected bulkhead sections would be replaced with new sheet piling tied into the adjacent steel and concrete sections of the wall. The second bulkhead enhancement process option is shoreline revetment which would require sloping the shoreline back and placement of an impermeable liner and R-6 or larger riprap.

Design and installation of either bulkhead enhancement will incorporate active stormwater discharge pipes as appropriate, and existing inactive river wall pipes would be sealed.

Both bulkhead enhancement options reduce the potential interaction between the Site and the Passaic River. Coordination with the implementation of the remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River may be required. Currently, the OU2 remedial design anticipates bank-to-bank sediment dredging with dredging offsets and placement of a cap over remaining river sediment. The installation of the shoreline revetment option would disturb less river sediment than the sheet pile wall. The present worth cost of this alternative is $6,565,000 (sheet pile) or $5,077,000 (geomembrane) for 30 years.

Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls, Focused Removal with Off-Site Disposal of Lead, and NAPL Removal

Institutional controls and LNAPL removal as described in Soil/Fill Alternative 2 would be implemented under this alternative. This alternative also includes the cover/cap system described in Soil/Fill Alternative 3. Existing building floor slabs in contact with soil/fill is incorporated into the cap. If a building is demolished in the future and its floor slab removed, a new surface barrier could be warranted at that location.

The same bulkhead enhancements for Soil/Fill Alternative 3 are components of Soil/Fill Alternative 4.

This alternative includes excavation and off-site disposal of lead-impacted soil/fill around Building #7. Although the excavation is focused on lead, there are other co-located COCs that will be removed. The extent of focused excavation will be determined during the remedial design. The limits of focused excavation will be based on assessment of soil/fill COCs to be removed or managed to achieve cumulative cancer risk estimates below or within the NCP risk range (10^{-4} to 10^{-6}), and the non-cancer hazard index (HI) estimates are at or below the protection goal of 1 or to achieve ARAR compliance. The excavation will be backfilled.

Removal of soil/fill eliminates potential impact to groundwater sources, primarily localized lead concentrations. Because of the extent of soil/fill, some of which has been identified as historic fill, excavation under this alternative does not reduce the extent of capping. The present worth cost of this alternative is $7,578,000 (sheet pile) or $6,135,000 (geomembrane) for 30 years.

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Soil/Fill Alternative 5 - Institutional Controls, In-Situ Remediation, Engineering Controls, and LNAPL Removal

Under this alternative, the affected soil/fill would be subject to institutional and engineering controls, LNAPL removal, and one or more in-situ treatment methods. The specific in-situ methods to be implemented for each lot will depend on the nature of the contaminants to be treated.

For the soil/fill where the primary COC is metals, stabilization/solidification would be the most applicable means of treatment. Treatability studies and/or pilot test(s) are warranted to determine the most effective binding agent and mixing ratio to treat site soil/fill.

After completion of stabilization activities, the treated areas would be capped as described under Soil/Fill Alternative 3. Note that due to the increase in soil/fill volume inherent with this approach, along with the need to cap treated soils, it may be necessary to remove and properly dispose of the top 12 to 18 inches of soil/fill prior to treatment, so that the elevation of the final surface does not change.

For the soils where organics are COCs, soil/fill mixing with a chemical oxidant, such as a persulfate or hydrogen peroxide, is considered an applicable in-situ treatment approach. Treatability studies and/or pilot test(s) are warranted to determine the most effective oxidant. For areas where lead and organics are both present above target concentrations chemical oxidation could be followed by stabilization.

After completion of stabilization activities, the treated areas would be capped as described under Soil/Fill Alternative 3.

As part of this alternative, an asphalt cap would be placed on Lots 67 and 69 to address potential ecological exposure associated with COCs in surface soil/fill on those lots. The asphalt cap construction will be consistent with Soil/Fill Alternative 3. Removal of soil/fill contaminated with LNAPL under this alternative is as described in Soil/Fill Alternative 2. Institutional controls would be implemented, as described in Soil/Fill Alternative 2. Engineering controls as related to the bulkhead are described in Soil/Fill Alternative 3. The present worth cost of this alternative is $10,324,000 (sheet pile) or $8,881,000 (geomembrane) for 30 years.

Groundwater Alternative 1 – No Action

Under this alternative, no action would be taken to reduce the potential for unacceptable exposures of humans to impacted groundwater or minimize further aquifer degradation. Existing NJDEP-approved institutional controls would remain intact. This alternative is retained for comparison with the other alternatives as required by the NCP. The No Action Alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $38,800.

Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge and Monitored Natural Attenuation

Groundwater Alternative 2 includes placement of institutional controls on the entire Site with the natural degradation of COCs in the aquifer by natural biological, chemical, and/or physical processes. Interaction with the existing classification exception areas (CEAs) and well restriction areas (WRAs) would be coordinated with NJDEP along with LSRPs and responsible parties for these controls. The CEAs provide notice that groundwater in the area does not meet designated use requirements, and the WRAs prohibit the installation and use of wells for potable and other uses within the designated area. During remedial design, groundwater samples will be collected, analyzed, and reported to update shallow fill and deep groundwater quality. Updated results will be used for institutional controls. Periodic monitoring and reporting to demonstrate compliance with the restrictions would be required.

A vertical sheet pile barrier would be constructed along the river's edge as a means of reducing the potential for interaction between Site groundwater and the river. Sheet piling would be constructed to the top of an underlying confining layer, most likely the glacial lake bottom silt deposits with a depth to be determined during remedial design.

The sheet piling is not intended to address geotechnical issues related to property redevelopment or to enhance the structural stability of the current bulkhead.

An assessment of the potential occurrence of MNA processes was not conducted as part of the RI. However, as indicated by RI results, benzene, ethylbenzene, TCE, toluene, vinyl chloride, m,p-xylene, 1,4-dioxane, and selenium concentrations were lower for the February 2019 event than prior events. Decreasing organic concentrations would be consistent with the occurrence of natural attenuation processes. Additionally, dissolved oxygen and redox potential field measurements and the presence of abundant iron and manganese represent conditions that are favorable for natural anaerobic biodegradation of benzene, toluene, ethylbenzene, xylenes (BTEX) compounds.

Groundwater monitoring focused on MNA processes during the remedial design is included in this alternative. Ongoing groundwater monitoring would be performed to confirm that these natural processes are occurring, and that this alternative continues to be protective of human health and the environment. As part of the monitoring program, the installation of additional groundwater monitoring wells may be appropriate. The present worth cost of this alternative is $4,821,000 for 30 years.

Groundwater Alternative 3 – Institutional Controls, Site Containment at River Edge, and Pump and Treat

Alternative 3 combines the institutional controls and vertical barrier wall along the river's edge described for Groundwater Alternative 2, and active remediating site groundwater to achieve ARARs. Additionally, between 15 and 20 extraction wells would be installed throughout the site in order to recover both shallow and deep groundwater impacted by organics and metals. Extracted groundwater would be pumped to a new groundwater treatment facility, to be constructed at an appropriate location on the property. The vertical sheet barrier wall would reduce volume of river water being recovered and treated by extraction wells. The sheet piling is not intended to address geotechnical issues related to property redevelopment or to enhance the structural stability of the current bulkhead.

The number of extraction wells, pumping rate, and individual processes to be utilized for treatment will be determined during the remedial design. The present worth cost of this alternative is $15,575,000 for 30 years.

Groundwater Alternative 4 – Institutional Controls and In-Situ Remediation

Groundwater Alternative 4 includes the institutional controls described for Groundwater Alternative 2. Additionally, impacted groundwater would be subject to in-situ remediation. The objective of this alternative is to reduce COC concentrations in groundwater, eventually restoring groundwater quality.

The lateral extent of the remedial effort would depend on the cleanup goals for the aquifer and whether the effort would be a "hot-spot" treatment (including the UST excavation water and areas where measurable non-aqueous phase liquids (NAPLs) in groundwater are observed) or a broader effort to treat groundwater containing COCs above PRGs. Although COCs include inorganic constituents which are largely associated with soil/fill and tend to be less amenable to in-situ remediation efforts, and although treatment of relatively low concentrations away from the hot-spot areas would be extremely inefficient, this alternative is a broader effort to treat all groundwater containing COCs above PRGs. USTs and associated LNAPL-impacted soil/fill are addressed in waste alternatives, and other LNAPL-impacted soil/fill are addressed in soil/fill alternatives.

For organic COCs, the most likely in-situ treatment methods include in-situ chemical treatment, biosparging, and air sparging. Pilot- and bench-scale testing would be required as part of the remedial design to determine the most appropriate treatment approach and reagents for site groundwater. However, tidal influences and brackish water quality effects on in-situ treatment may limit effectiveness and may need to be assessed.

Metal COCs in groundwater are less amenable for in-situ remediation because of their ubiquitous presence in historic fill, and because they cannot be destroyed, but only changed in form or become attached to particles. As described in

the RIR (Section 7), fill material is present in surface and subsurface soil/fill throughout the Site. This material is considered "historic fill" as it complies with the NJDEP definition of historic fill. Defining the fraction of impacts associated with natural conditions, pre-placement of contaminated fill, or a release(s) was not an RI objective. For the purposes of this FS, injection of an iron sulfide amendment to form metal sulfide complexes in the soil/fill is assumed.

Additional groundwater sampling and performance of treatability studies would be required as part of the remedial design to evaluate and select the most cost-effective means for addressing both organic and inorganic constituents in groundwater, including means of reagent delivery to the subsurface and evaluation of tidal influences on that delivery. Chemical oxidation is generally preferred over reductive dechlorination due to the presence of arsenic and the likely decrease of arsenic mobility with increasing oxidation state. This alternative does not eliminate the need for institutional controls or reduce their expected duration. The present worth cost of this alternative is $45,187,000 for 30 years.

Groundwater Alternative 5 – Institutional Controls, In-Situ Remediation, and Targeted Pump and Treat

This alternative combines the institutional controls of Groundwater Alternative 2 with the in-situ treatment aspects of Groundwater Alternative 5 for upgradient portions of the Site and the pump and treat aspects of Groundwater Alternative 4 for downgradient portions of the Site.

As with Groundwater Alternatives 3 and 4, the extent of groundwater to be addressed and the specific means for addressing would be determined during the remedial design, including additional groundwater sampling and the performance of treatability studies. Under this currently envisioned hybrid approach, in-situ remediation would be focused on the upgradient portion of the Site, targeting metals in the shallow fill unit and organics in both the shallow fill and deep units. As above, a means of chemical oxidation for organics and fixation of metals is assumed. Chemical oxidation is generally preferred over reductive dechlorination due to the presence of arsenic and the likely decrease of arsenic mobility with increasing oxidation state. The present worth cost of this alternative is $19,453,000 for 30 years.

Groundwater Alternative 6 – Institutional Controls, Site Containment at River Edge, and Focused In-Situ Remediation

This alternative combines the institutional controls and vertical barrier components of Groundwater Alternative 2 with the focused in-situ treatment of VOC contaminated groundwater.

Updating of groundwater quality during the remedial design is included in this alternative. Ongoing groundwater monitoring would be performed under institutional controls to confirm that this alternative continues to be protective of human health and the environment. As part of the monitoring program, the installation of additional groundwater monitoring wells may be appropriate. The present worth cost of this alternative is $6,798,000 for 30 years.

Sewer Water Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, the water and solids in the designated section of sewer and associated line would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented. The No Action Alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $15,500.

Sewer Water Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of the water and solids into appropriate containers or transport vehicles for off-site treatment and/or disposal. Liquid materials would be pumped into drums and transferred to an appropriate facility for treatment and disposal. Remaining solids in the manhole would be vacuumed into a drum and disposed of in an appropriate solid waste landfill. Upon removal of the contents, the interior of the manhole and associated line would be closed in place by plugging/filling. The present worth cost of this alternative is $60,800 for 30 years.

Soil Gas Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, no measures would be taken to protect future indoor workers from exposure to organic soil vapors. Existing NJDEP-approved institutional and engineering controls would remain intact. The No Action Alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $23,300.

Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings) and Site-Wide Engineering Controls (future buildings)

This alternative consists of establishing or enhancing deed notices and/or CEAs site-wide to provide certain restrictions upon the use of the property. Such restrictions (institutional controls) would require that prior to existing buildings being occupied in the future, a building-specific assessment of sub-slab soil gas and/or indoor air quality would be performed, and if needed, some means of protecting the future occupants of such existing buildings from vapor intrusion risks would be implemented. Additional restrictions would require that future new construction include a vapor barrier or other appropriate means of sealing the ground surface underneath the new building slab or installation of a sub-slab depressurization system. Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to confirm previous assessment results and to ensure the indoor workers are protected, due to the presence of VOCs in groundwater above NJDEP Vapor Intrusion Screening Levels (VISLs) in certain shallow monitoring wells.

The present worth cost of this alternative is $339,000 for 30 years.

Soil Gas Alternative 3 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and In-Situ Remediation of Soil/Fill (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings as described for Soil Gas Alternative 2.

In lieu of air monitoring and engineering controls (subsurface depressurization system [SSDS]) for existing occupied buildings, this alternative includes in-situ remediation soil/fill containing TCE, total xylenes and naphthalene above target remediation goals. In-situ remediation of the designated soil/fill would be performed as described under Soil/Fill Alternative 7.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells. The present worth cost of this alternative is $1,895,000 for 30 years.

Soil Gas Alternative 4 - Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Removal/Off-Site Disposal of Soils (existing occupied buildings)

This alternative includes establishing or enhancing institutional controls as described for Soil Gas Alternative 2. In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative includes removal and off-site disposal soils containing TCE, total xylenes and naphthalene above target remediation goals. Removal of the designated soils would be performed as described under Soil/Fill Alternative 5.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells. The present worth cost of this alternative is $3,680,000 for 30 years.

Soil Gas Alternative 5 - Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Ex-Situ Treatment and On-Site Placement of Soil/Fill (existing occupied buildings)

This alternative consists of establishing or enhancing institutional controls as described for Soil Gas Alternative 2. In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative includes ex-situ treatment and on-site placement of soil/fill containing TCE, total xylenes and naphthalene. Removal, treatment, and replacement of the designated soil/fill would be performed as described under Soil/Fill Alternative 6.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells. The present worth cost of this alternative is $1,933,000 for 30 years.

Comparative Analysis of Alternatives

This comparative analysis section evaluates how each of the remedial alternatives achieves the evaluation criteria relative to one another. To compare the alternatives, ratings of poor, fair, good, or excellent (low, medium, or high for costs) were assigned to each of the evaluation criteria used in the analysis of the alternatives.

Waste

In terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, Alternative 2 (removal and off-site disposal) is rated better than Alternative 1 (no action), which rates poorly in each of those categories. In terms of short-term effectiveness, implementability, and cost, Alternative 1 rates better as no action is taken. Alternative 2 would need to be combined with a soil/fill alternative addressing LNAPL-impacted soil/fill not associated with the USTs.

Soil/Fill

Compliance with chemical-specific ARARs for some COCs may not be feasible due to the nature of the soil/fill. Up to 15 feet of NJDEP defined historic fill exists beneath the Site. The sources of fill are unknown. As fill placement occurred over a more than 30-year period, the sources and thus physical and chemical properties could be different. The fill material consists predominantly of sands, silts, and gravel along with man-made materials such as brick, pieces of concrete block, wood, glass, and cinders. The fraction of each material in the fill varies across the Site.

In terms of protectiveness, compliance with ARARs, and long-term effectiveness, Alternatives 3 (cap and bulkhead enhancement), 4 (focused excavation/disposal with capping) and 5 (in-situ remediation) rate better compared to the remaining alternatives, with Alternative 5 rating the best among these criteria. Alternative 5 also rating best for reduction of TMV by treatment. However, Alternative 5 rates the worst for implementability and short-term effectiveness. Alternatives 2 through 5 will be disruptive to the industrial park's businesses. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Alternative 5 treatment areas in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, and closely spaced injection points, due to the relatively shallow depth of impacts. If additional injections under Alternative 5 are warranted, business disruption would occur again.

Alternative 1 (no action) would not meet the chemical-specific ARARs since no action would be taken. Alternative 2 (institutional controls and LNAPL removal) would not meet chemical-specific ARARs other than as provided by institutional controls. Alternative 3 would comply with chemical-specific ARARs through capping of soil/fill, and Alternative 4 would offer better compliance with the chemical-specific ARARs than the other alternatives since some

contaminated soil/fill would be removed from the Site. Stabilization/solidification methods for metals (Alternative 5) would not meet ARARs.

Location- and action-specific ARARs are met by Alternatives 2 through 5. None of the Alternatives eliminate the need for institutional controls.

Alternatives 3 through 5 rate the best for minimizing human and ecological exposure to soil/fill and preventing off-site transport of soil/fill containing COCs. Not including the No Action alternative, Alternative 2 (limited action) rates best for short-term effectiveness, implementability, and cost. Alternatives 3 through 5 provide similar long-term effectiveness with Alternatives 4 and 5 providing better permanence due to excavation/disposal or in-situ treatment.

Alternatives 2 through 5 have similar long-term O&M obligations through institutional controls. Other than No Action alternative, none of the soil/fill alternatives reduce these obligations to less than 30 years assumed in the FS process.

Two options are presented for the engineering controls along the river, i.e., bulkhead enhancements, including either sheet pile or geomembrane/riprap to replace approximately 800 feet of missing or deteriorating bulkheads along the river. Both approaches would meet the RAO of minimizing off-site transport of soil/fill containing COPCs to minimize the potential for interaction between the Site and the Passaic River. The two approaches would have similar implementability, with the geomembrane/riprap approach having a lower cost.

Groundwater

Groundwater Alternative 4 (in-situ remediation) rates the best in terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, with Alternatives 3 (pump and treat) and 5 (targeted in-situ and pump/treat) rating slightly lower in these criteria largely due their reliance on pump and treat as a significant remedy component, which will likely extend the timeframe for achieve the goal of groundwater restoration, particularly with respect to metals in groundwater within soil/fill. Alternative 6 offers compliance with ARARs with in-situ treatment and institutional controls. Alternatives 2 and 6 rank highest for implementability. Three alternatives (Alternatives 3 through 5) rate lower for implementability due to the challenge of addressing metals in groundwater, potential business disruptions, and/or the need to designate a significant portion of the property for construction of a new treatment facility. The handling of treatment reagents also lowers the short-term effectiveness rating for Alternatives 4 and 5. The vertical barrier wall alternatives address the off-site movement of groundwater better than other alternatives which depend on active controls (i.e., pump and treat).

Alternative 2 (barrier wall and MNA) and Alternative 6 (barrier wall and focused in-situ) rate well for short-term effectiveness (implementation risks are primarily associated with construction hazards of installing the barrier wall along the river) and implementability. Alternative 1 would not meet the chemical-specific ARARs since no action would be taken. Location- and action-specific ARARs are met by Alternatives 3 through 6.

Alternatives 4 and 5 rate the lowest for environmental sustainability because of the resources expanded to manage river water which is not a site-related media.

In terms of cost, Alternative 2 rates the best, followed by Alternative 6, while Alternatives 3 through 5 rate the worst. Alternatives 2, 4 and 6 have similar long-term O&M obligations through institutional controls and long-term groundwater monitoring, whereas Alternatives 3 and 5 have substantial long-term costs associated with operation and maintenance of pump and treat systems. None of these five groundwater alternatives eliminate O&M obligations to less than 30 years assumed in the FS process, although it is possible that the source (LNAPL) removal activities included in the waste and soil/fill alternatives may reduce certain O&M obligations related to organic COCs over time.

Sewer Water

In terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, Alternative 2 (removal and off-site disposal) is rated better than Alternative 1 (no action), which rates poorly in each of those categories. In terms of short-term effectiveness, implementability, and cost, Alternative 1 rates better as no action is taken.

Soil Gas

All soil gas alternatives (except No Action) rate well for compliance with ARARs, as potential risks associated with soil gas are directly addressed through air monitoring and engineering controls for both existing occupied buildings and future construction. Alternatives 3 through 5 rate highest for protectiveness and long-term effectiveness, as they include provisions to directly address soil/fill associated with potential vapor intrusion risks at occupied buildings. Only Alternatives 3 and 5 provide reduction of TMV through treatment, although Alternative 4 may provide treatment if removed soil/fill is determined to be hazardous. Alternative 2 (institutional and engineering controls) rates best in terms of short-term effectiveness, implementability, and cost.

1. INTRODUCTION

This Draft Feasibility Study Report (FS Report) describes the performance of the feasibility study (FS) at the Riverside Industrial Park Superfund Site (the Site) located in Newark, Essex County, New Jersey (Figure 1-1). The FS was conducted in accordance with the Administrative Settlement Agreement and Order on Consent (ACO) (Comprehensive Environmental Response, Compensation, and Liability Act of 1980 [CERCLA] Docket No. 02-2014-2011) and prepared on behalf of PPG Industries (PPG). The FS conducted under this Settlement Agreement is subject to approval by U.S. Environmental Protection Agency (USEPA).

The Feasibility Study was prepared in accordance with USEPA's Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, October 1988 (Office of Solid Waste and Emergency Response [OSWER] Directive Number 9355.3-01) (hereafter referred to as the Remedial Investigation/Feasibility Study [RI/FS] Guidance). The FS contains remedial alternatives that have been evaluated by USEPA as a basis for determining an appropriate course of action for the Site in order to protect human health and the environment.

The FS Report represents the third and final deliverable in the FS process and builds upon the two previous FS deliverables for the Site. The Remedial Investigation Report (RIR) (Woodard & Curran, Inc. [Woodard & Curran], 2020) along with the risk assessments provide data collected in the remedial investigation (RI) for the development of remedial alternatives in the FS.

The initial FS deliverable is the Identification of Candidate Technologies (ICT) Memorandum (Woodard & Curran, 2019a). This ICT Memorandum constitutes Task 5 of the Statement of Work contained in the ACO. The ICT Memorandum is an initial analysis of potential candidate remedial technologies that were considered later in the FS process as potential components of remedial alternatives for the Site. It includes an initial evaluation of available information on the performance, relative costs, applicability, effectiveness and implementability of the candidate technologies.

The ICT Memorandum was prepared prior to the completion of RI data collection and preparation of the Baseline Human Health Risk Assessment (BHHRA) (Ramboll US Corporation [Ramboll], 2020a) and Screening Level Ecological Risk Assessment (SLERA) (Ramboll, 2020b). The ICT Memorandum was submitted in September 2018 shortly after RI Phase 1 was completed. Information on site conditions gathered during Phase 1 provided the basis for the ICT Memorandum. The ICT Memorandum was revised based upon USEPA comments (October 31, 2018 and April 3, 2019) and discussions between PPG and USEPA. The June 12, 2019 ICT Memorandum was approved by USEPA on July 17, 2019.

The Development and Screening of Remedial Alternatives Technical (DASRAT) Memorandum (Woodard & Curran, 2019b), the second FS deliverable, was also prepared and submitted to USEPA prior to the completion of the RI including the risk assessments. The DASRAT Memorandum further refined the candidate technologies from the ICT Memorandum using site characterization information and USEPA's comments on the ICT Memorandum. The DASRAT Memorandum was submitted to USEPA on August 28, 2019. USEPA provided comments in November and December 2019 on the DASRAT Memorandum and responses were submitted to USEPA. USEPA conditionally approved the August 2019 DASRAT Memorandum on February 27, 2020 with the condition that USEPA comments be incorporated into the FS. The FS Report builds upon the information presented in the DASRAT Memorandum, incorporates updates based on additional information and changes in site conditions since the preparation of the DASRAT Memorandum, and presents a focused evaluation and comparative analysis of remedial alternatives.

1.1 Purpose of Report

This FS Report develops and examines remedial action alternatives and presents a remediation strategy to address risk and hazards that exceed applicable risk management criteria or standards and are attributable to site-related constituents in environmental media at the Site. Remedial action alternative development and screening considered:

- Site characterization results, including the findings of the human health and ecological risk assessments, as presented in the RIR (Woodard & Curran, 2020);
- Federal and State regulations that are applicable or relevant and appropriate requirements (ARARs);
- Preliminary remediation goals (PRGs)/remedial action objectives (RAOs); and
- Nature and extent of impact at the Site.

This FS Report further evaluates, refines, and analyses the remedial alternatives presented in the DASRAT Memorandum.

In accordance with USEPA protocols, this FS Report provides information for decision-makers to compare alternatives and develop a Proposed Plan identifying the agency's preferred alternative and the rationale for the preference. After consideration of public comment, USEPA will issue a Record of Decision (ROD) setting forth the selected remedy.

1.2 Organization

The remainder of the FS Report is organized as follows:

- Section 2, Background, provides an overview of the physical and ecological setting of the Site, chronicles the site's ownership and operational history, and summarizes the results of activities conducted in support of the RI/FS.
- Section 3, Objectives and Requirements of Site Remediation, provides an overview of remediation requirements based on RI results, and related site-specific PRGs/RAOs, ARARs, and General Response Actions (GRAs); and identifies areas and volumes to be remediated.
- Section 4, Identification and Screening of Technologies and Process Options, identifies and screens process options based on effectiveness, implementability, and relative cost; and provides a general description of selected process options considered for remedial action alternative development.
- Section 5, Development and Screening of Alternatives, presents remedial action alternatives that have been developed from the retained process options.
- Section 6, Detailed Analysis of Alternatives, presents an analysis and comparison of remedial action alternatives identified in Section 5 based on seven evaluation criteria. The remaining two criteria, State acceptance and community acceptance, will be evaluated in the ROD.
- Section 7, References, provides references used in the preparation of this FS Report.

Tables, figures, appendices, and attachments support the text and are referenced where appropriate.

2. BACKGROUND

The following information is from the RIR (Woodard & Curran, 2020) and provides a site description, an overview of the site history, and a summary of previous environmental investigations and removals performed at the Site on behalf of responsible parties through the New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) or via independent actions performed by USEPA. The results of the 2017-2019 USEPA CERCLA RI are also summarized in this section.

2.1 Site Description

The Site is a 7.6-acre active industrial site, previously owned by Patton Paint Company until 1971, and located in Newark, Essex County, New Jersey (Figure 1-1). After 1971, the Site was subdivided into 15 parcels/lots, and is identified as the Riverside Industrial Park (RIP). The lots in the northern portion of the Site have Riverside Avenue addresses (Lots 1, 57, 58, 59, 60, 69, and 70), while the lots in the southern portion of the Site have McCarter Highway addresses (Lots 61, 62, 63, 64, 65, 66, 67, and 68). Both Riverside Avenue and McCarter Highway border the Site to the west along with a segment of railroad track adjacent to McCarter Highway (Figure 2-1). Vehicle access is from Riverside Avenue. Much of the surface area of the Site is covered by buildings or pavement. The Passaic River and tidal mudflat border the Site on the east side. A steel, concrete, or wooden bulkhead provides a retaining wall along most of the Site adjacent to the Passaic River; however, the bulkhead has fallen into disrepair in some locations and is collapsed in several sections. Recent site observations indicate a combined sewer outfall pipe under the area of Lot 63 has collapsed, causing subsidence and a collapse of a section of the bulkhead.

There are 14 buildings at the Site with five of the buildings being vacant (Buildings #6, #7, #12, #15, and #17). At the time of the FS, Buildings #1, #2, #3, #9, #10, #13, #14, and #16 had ongoing business operations, and a small garage building (Building #19) was used for storage by the occupant of Building #13. Portions of Lot 64 and former Building #4 had vehicle dismantling activities during some of the FS activities. Surface waste piles on the south portion of the Site and asbestos-containing materials within Building #7 were removed by USEPA during the RI but are not part of the FS.

2.2 Site History

An 1873 map from Atlas of the City of Newark indicates that most of the Site was reclaimed from the Passaic River with imported fill. An 1892 Certified Sanborn Map suggests that some filling occurred in the late 1800s; however, the major filling events at the Site occurred from 1892 to 1909. The origin of fill material at the Site is unknown. Boating docks shown on the north and central portions of the Site in 1892 suggest some placement of fill and reclamation of land from the Passaic River occurred. Most of Lots 57, 61, 62, 63, 64, 66, 67, 68, and 70 were within the footprint of the Passaic River with the Triton Boat Club operating a dock area on the north side of Lot 60. By 1909, most of the lots had been created via filling and land development and included Patton Paint Company structures, a hotel, and a boat club. Portions of Lots 57 and 70 remained part of the Passaic River in 1909 but were created by placement of fill prior to 1931.

Detailed descriptions of the site's ownership history, operational history, historical activities, documented releases, and previous site investigations are provided in RIR Sections 1.3 and 1.4. Highlights from those descriptions are provided below.

- PPG housed paint and varnish manufacturing operations from approximately 1902 to 1971. PPG's operations involved current Lot 1 and Lots 57 through 70.
- Frey Industries, Inc. (Frey) occupied Lots 1, 61, 62, 63, and 64 from 1981 to 2007 when operations ceased. Frey warehoused, packaged, repackaged, and distributed client-owned chemicals. Jobar operated on a portion of Frey's leased property between 1979 and 1982 before its assets were acquired by Frey in 1983.

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- Baron Blakeslee, Inc. (BBI) was a sub-tenant of Frey since the early 1980s. BBI occupied Lot 61 for product distribution, warehousing a variety of chemical products, and analysis of various chemical blends and waste samples. They also reportedly used Building #7 (Lot 63) as a laboratory, Lot 62 for drum storage, and Lot 68 as a common truck and tanker parking area. Purex (BBI's parent company) was acquired by Allied Signal. After a series of mergers and acquisitions, BBI became part of Honeywell International, Inc. (Honeywell) in 1999. The City of Newark currently owns Lots 58, 61, 63, 64, and 68.
- Universal International Industries was identified as conducting various manufacturing operations on Lots 1, 63, and 64. No specific information was located regarding its manufacturing activities.
- Samax Enterprises (Samax) occupied Lot 1 from 1999 to 2011 when operations ceased. Samax stored various raw materials on-site and manufactured various chemicals under the brand name Rock Miracle. An industrial company 29 Riverside, LLC currently occupies Lot 1. (The property is currently owned by Hatzlucha on Riverside, LLC.)
- HABA International, Inc. (HABA) occupied Lot 57 from at least 1982 until 1988. Davion Inc. (Davion), successor to HABA, currently operates on Lot 57. (The property is owned by Plagro Realty, Inc.) HABA and Davion manufactured nail polish remover and related products. Acupak, Inc. was a sub-tenant of HABA on Lot 57 from at least 1987 to 1988 and conducted packaging for HABA.
- Roloc Film Processing (Roloc) occupied Lot 60 from 1985 until 2008 when operations ceased and manufactured foils.
- Gilbert Tire Corporation occupied Lot 60 since at least 2015 (following Roloc's occupation) and is the current occupant. (The property is owned by Shefah in Newark, LLC.) There is no manufacturing equipment. Used tires and wheel rims are stored until transferred off property.
- Chemical Compounds, Inc. (CCI) is the listed owner of Celcor Associates, LLC and occupied Lots 62, 66, and 67 from at least the early 1990s and are the current owners. These companies manufactured hair dyes and other personal hygiene products. Beginning in 2015, Teluca began operating on Lot 62. Teluca packages and distributes hair dyes, hair color, and related ingredients to hair color marketers. The facility includes a laboratory for completing hair dye research, offices, and warehousing.
- Gloss Tex Industries, Inc. (Gloss Tex) occupied Lot 69 from 1979 to at least 1989 when operations ceased. Gloss Tex manufactured bulk nail enamel, lacquer, and related cosmetic products. Gloss Tex leased the property from Industrial Development Associates/Corporation (IDA), who currently owns Lot 65.
- Ardmore, Inc. occupied Lots 59 and 69 (following Gloss Tex's occupation) since 1982 and is the current occupant. (The properties are owned by Sharpmore Holdings, Inc. and Albert Sharphouse.) Ardmore, Inc. manufactures soaps and detergents on Lot 59 and stores empty drums on Lot 69.
- Monaco RR Construction Company stored railroad rails, cross ties, and spikes on Lot 70. Following their operation, Federal Refining Company (Federal) occupied Lot 70 from 1985 to 2007 when operations ceased. Federal was a scrap metal recycler, specializing in recovery of precious metals. The current tenant is Midwest Construction Company. Material and equipment used by the company are stored and maintained at the property. (The property is owned by the Estate of Carole Graifman.)

Since 1971, at least 11 documented spills and releases have occurred at the Site, and the Site is subject to at least seven New Jersey Industrial Site Recovery Act (ISRA) remediation cases under NJDEP environmental regulations. Prior to 1971, a vapor cloud released in 1969 from one of the resin reactors in the former PPG Resin Plant (Building #17) ignited, causing a fire/explosion. No discharges to the sewer system or the Passaic River are known to have occurred during this incident. Resin material burned and several process tanks failed during the fire, thus releasing their contents, as discussed in RIR Section 7.2.

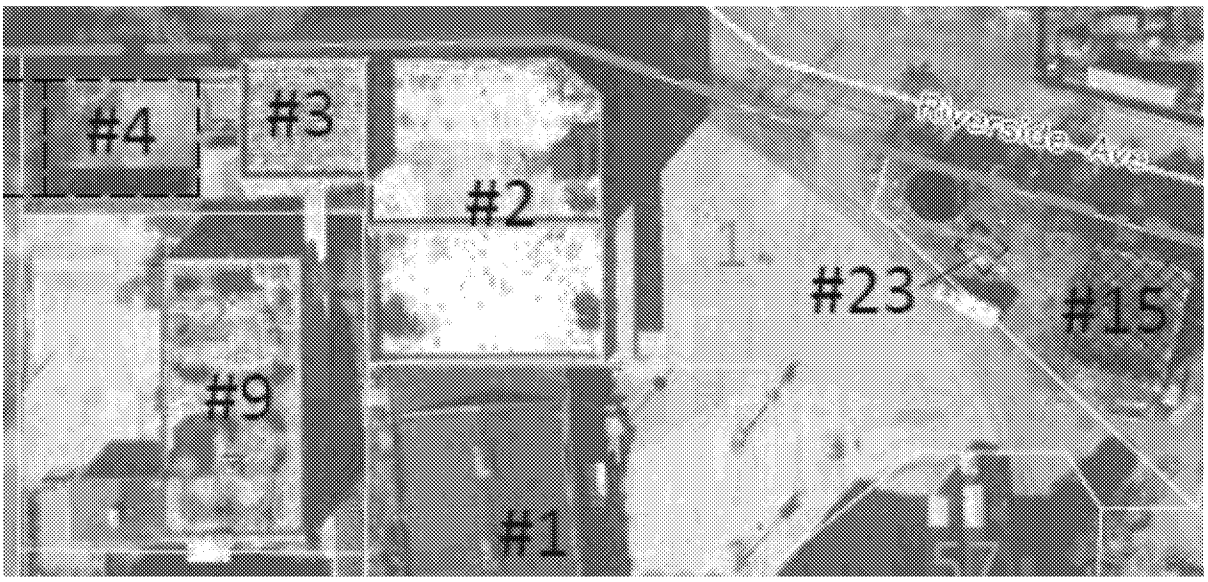
Numerous environmental investigations and NJDEP-led remedial actions have been completed on the Site prior to initiating the USEPA CERCLA RI in 2017. The previous areas of concern (AOCs) identified on individual lots were described in the April 2015 Site Characterization Summary Report (SCSR) (Woodard & Curran, 2015). The previous AOCs were investigated during implementation of the NJDEP-led RIs. References to "exceedances" in this section pertain to the specific standards and criteria available at the time of previous investigations and remedial actions which may not be equal to the Project Action Limits (PALs) evaluated for the USEPA CERCLA RI or ARARs cited herein.

2.3 Previous Investigations

As summarized in the SCSR and RIR, numerous environmental investigations and NJDEP-led remedial actions have been completed on the Site prior to initiating the USEPA CERCLA RI in 2017. Applicable results were considered in the FS in evaluating remedial action areas. The sections below provide a summary of previous investigations.

2.3.1 Lot 1

Lot 1 (1.229 acres) contains current Buildings #2 and #3 (Figure 2-1) and former Building #4. Building #4 and a portion of Building #3 were demolished in 1982 after a fire. Buildings #2 and #3 are interconnected and have a common basement.



Lot 1 is a New Jersey known contaminated site associated with Acupak Inc. (ISRA Case #88484) and Samax (ISRA Case #E20110199). The Samax case is still active as ISRA Case #E20110199, the only remedial action proposed was for historic fill and included the implementation of engineering and institutional controls to address soil/fill contamination and a historic fill classification exception area (CEA) for groundwater. The historic fill CEA indicates arsenic, iron, lead, manganese, and sodium concentrations above the NJDEP Groundwater Quality Standard (GWQS) are a result of historical fill. Samax is awaiting direction from USEPA on implementation of the remedial actions under New Jersey PI #563216.

Based upon November 2019 observations, the property has tenants with ongoing commercial activities. Refer to RIR Section 1.4.1 for details and previous investigations.

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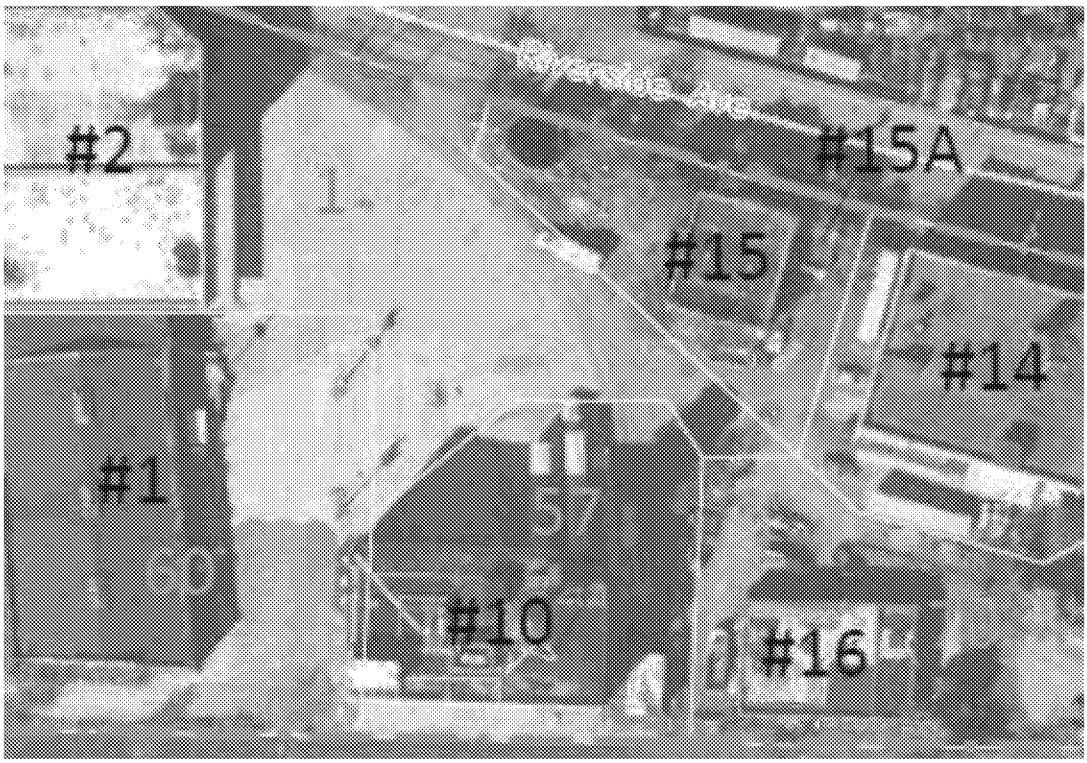
2.3.2 Lot 57

Building #10 is on Lot 57, which is 0.42-acre (Figure 2-1). The entire surface is paved or under a building. Based upon November 2019 observations, the property has ongoing industrial activities.



An acetone spill occurred in 1988 which resulted in acetone-impacted soil/fill being removed from Lot 57 by HABA. Although the post-excavation soil/fill results reportedly indicated that no volatile organic compound (VOC) contamination existed, tabulated results or laboratory reports had not been located in NJDEP files.

2.3.3 Lot 58

Buildings #15 and #15A are located on this Newark-owned property which has an area of 0.2523 acre (Figure 2-1). Former Building #23 was removed between 1979 and 1987. Based upon November 2019 observations, the property is vacant.

As described in the SCSR and RIR, AOCs pertaining to environmental conditions were identified at Lot 58 in 2009 by Newark's consultant (PMK Group, Inc. [PMK]/Birdsall Services Group [Birdsall], 2009).

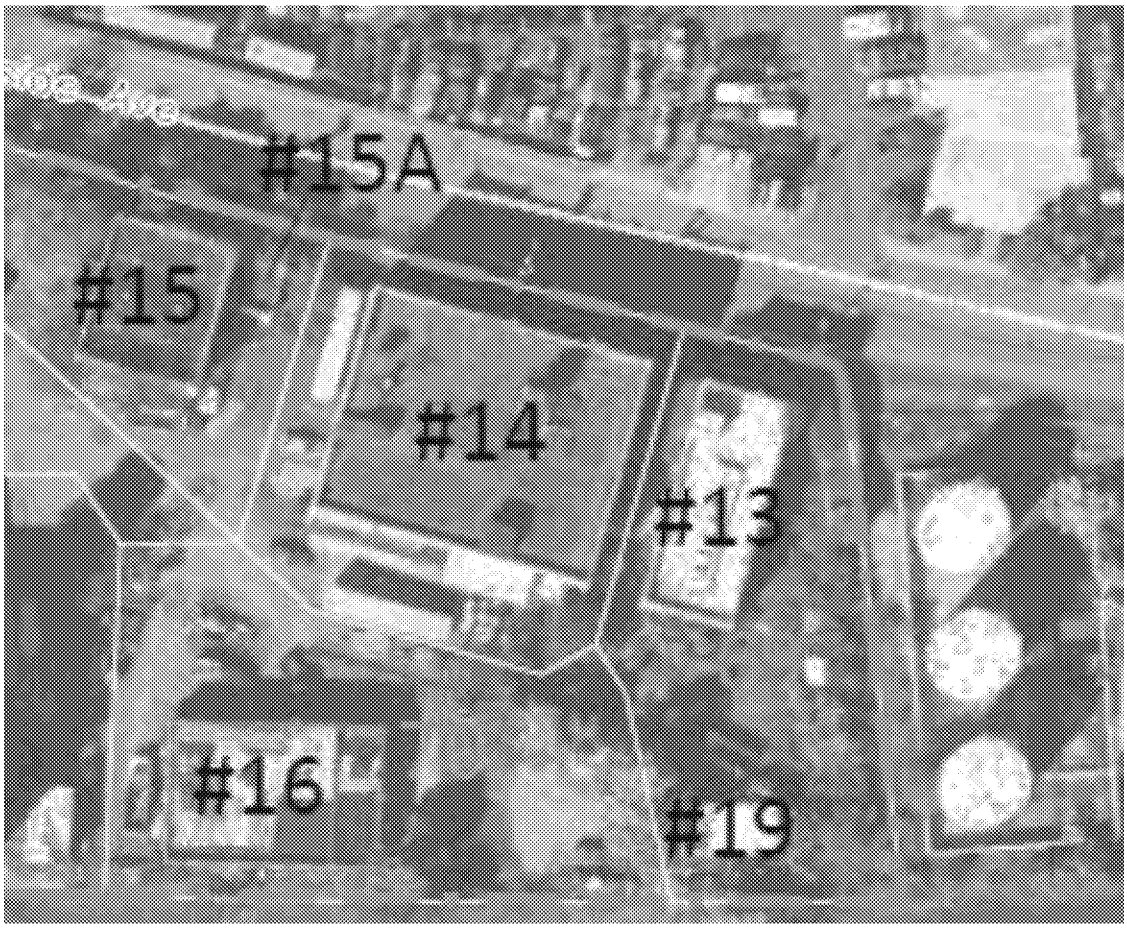
Following NJDEP regulations, six AOCs were investigated via a surficial geophysical survey, soil borings and sampling, and groundwater sample (temporary well point [TWP]) collection from soil borings. Historical (2009) groundwater samples from TWPs indicated concentrations of metals, VOCs, semivolatile organic compounds (SVOCs), and pesticides above the NJDEP GWQS. These soil and groundwater results were considered in the RIR and FS.

The USEPA inspected tanks in Building #15 after precipitation water was removed from the building to determine if hazardous material was present in the building during a Time Critical CERCLA Removal Action. The tanks were determined to be empty. There were also no visible signs of contamination in the 2 inches of water remaining in the building floor, and sample results received later confirmed that observation. USEPA then determined that there were no hazardous materials present and, therefore, Building #15 posed no threat to human health and the environment (USEPA, 2011). Refer to RIR Section 1.4.3 for previous investigation details.

At the completion of RI field activities (February 2019), the interior aboveground storage tanks (ASTs) and one exterior AST are still present. The small security building at the site entrance has been damaged by fire. Surface debris piles are present on the lot. Portions of the property are used for parking by employees from other lots.

2.3.4 Lot 59

Building #14 is on 0.405 acre on Lot 59 (Figure 2-1). Based upon November 2019 observations, the property has ongoing industrial operations.



No environmental investigations have been identified at the property. As summarized in the RIR and SCSR, several spills have been associated with Lot 59. Documentation of the specific locations of the spills/releases has not been found.

2.3.5 Lot 60

Lot 60 is 0.703 acre and includes Building #1, and during the RI, had ongoing commercial activities (Figure 2-1).

The property has been subjected to a NJDEP-led remediation. The Site is identified as Roloc/Color Enterprises (PI #467682) with investigation activities occurring in 2009 and 2017. Applicable results from these investigations were considered in the CERCLA RIR and FS.

Following these investigations, First Environment, Inc. (First Environment) (consultant to Responsible Party) determined that no further action (NFA) was required for the soil and a CEA for historic fill impacts to groundwater. The historic fill CEA indicated mercury, arsenic, aluminum, chromium, iron, and lead concentrations were above the NJDEP GWQS. The Responsible Party is awaiting direction from USEPA on implementation of their Remedial Action Work Plan (RAWP) (First Environment, 2017). Refer to RIR Section 1.4.5 for details on previous investigations.

2.3.6 Lot 61

Lot 61 is 0.265 acre and includes Building #6 (Figure 2-1), and during the RI, the property was vacant.

No investigations have specifically addressed potential environmental impacts on this lot. The deed notice filed by the property owner (City of Newark) indicates there is potential for encountering contaminated historic fill beneath Building #6. The concrete building slab is identified as an engineering control. The Responsible Party associated with the deed notice is Honeywell, successor to BBI. The deed notice identifies contaminants associated with the historic fill as being VOCs and metals. The New Jersey PI number is G0000005586. RIR Section 1.4.6 provides details on Lot 61 previous investigations.

2.3.7 Lot 62

Two-story Building #9 is located on Lot 62 (0.492 acre). Based upon November 2019 observations, the building (Figure 2-1) was occupied by a commercial tenant.

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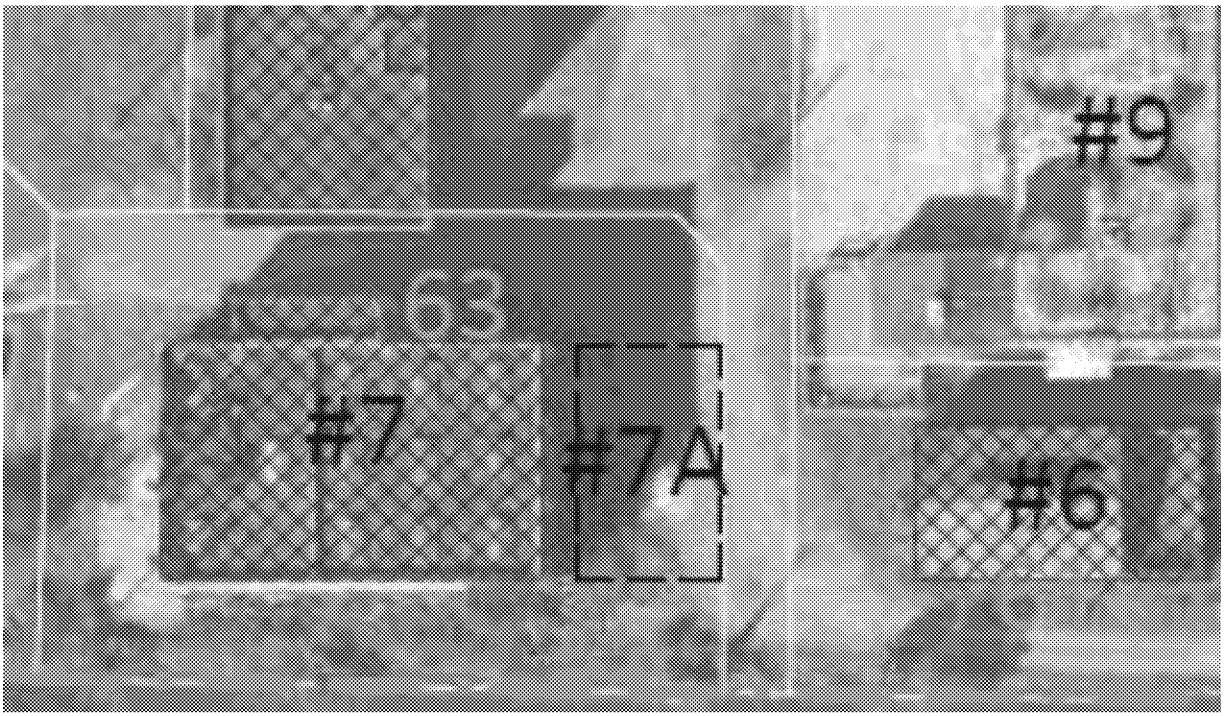
In 1998, IDA (property owner) received an NFA determination from NJDEP related to CCI operations. In 2008, an investigation including the collection and analyses of soil and groundwater samples was conducted on behalf of CCI (Whitman, 2012b). The soil samples were considered to be representative of historic fill (Whitman, 2012b). Refer to RIR Section 1.4.7 for previous investigation details.

2.3.8 Lot 63

Lot 63 is 0.541 acre and contains Building #7 and the former Building #7A (Figure 2-1). The City of Newark is the property owner through foreclosure and based upon November 2019 observations, the property is vacant.



A 2010 Building #7 AST inventory by USEPA indicated 10 empty ASTs on the second floor and 93 ASTs (79 empty) located on the third floor. Beginning in late 2011, USEPA started the process of the solid residue removal from the tanks. The majority of the tanks were empty. The tank contents varied from a "caramel-like" substance to a hardened material that required chipping. Simultaneously, USEPA began the process of removing basement liquid and sludge.

In early 2012, Floor 2 and Floor 3 tank work along with basement liquid/sludge removal was stopped due to USEPA budget constraints. In October 2012, Hurricane Sandy caused flooding at the Site. USEPA reported that the basements in Buildings #7 and #15 were flooded after the hurricane. In May 2014, the removal of Building #7 basement liquids and sludges resumed and was completed in August 2014.

The (2009) soil analytical results indicated exceedances of total petroleum hydrocarbon (TPH), VOCs, SVOCs, metals, and polychlorinated biphenyls (PCBs) above NJDEP criteria. The petroleum fingerprint analysis performed on the groundwater sample indicated the presence of mineral spirits and diesel fuel/fuel oil #2 (PMK/Birdsall, 2009b).

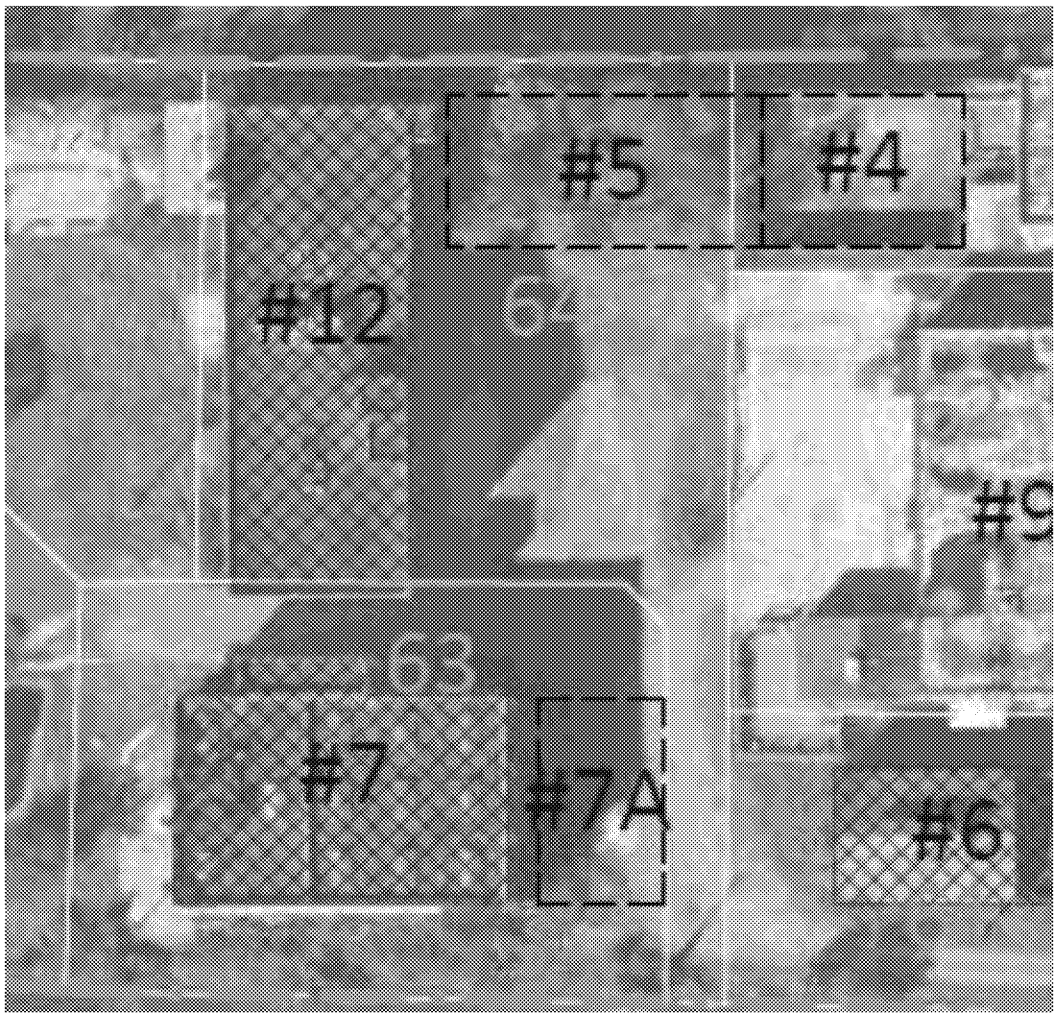
Two monitoring wells (ERT-2 and ERT-3) were installed in 2011 on Lot 63. Benzene was the only compound reported above NJDEP GWQS in Lot 63 groundwater (Lockheed Martin, 2011). These monitoring wells were not located or observed during the RI. It is unknown whether the wells were properly decommissioned.

A 2008 deed notice identifies two areas beneath the footprint of Building #7 on the north and east sides as being potentially impacted by historic fill, with the building slab acting as an engineering control. Honeywell is the Responsible Party for maintaining the engineering control. The New Jersey PI number is G0000005586.

In 2017, USEPA initiated an emergency response action to remove debris and biohazard labeled medical waste scattered on the ground (USEPA, 2017). Dumping continued in 2019 on Lot 63. Refer to RIR Section 1.4.8 for previous investigation and remedial action details.

2.3.9 Lot 64

Former Building #5 and Building #12 are on Lot 64 (0.934 acre). The City of Newark is the current property owner through foreclosure (Figure 2-1). Based upon November 2019 observations, the property is vacant.



Building #5 was demolished in 1982 along with Lot 1 Buildings #3 (northern portion) and #4.

Subsequent to a 2009 inventory, USEPA planned to remove the 10 USTs. The contents were removed, but due to structural integrity concerns, only two tanks were reportedly removed and soil sampling via test pits was undertaken by Tetra Tech Inc. (Tetra Tech) in 2012. A black viscous light non-aqueous phase liquid (LNAPL) sheen/film was observed in several test pits. Because of data quality issues, no usable results were generated from the test pit soil samples. No formal underground storage tank (UST) closure reports have been identified; however, USEPA documentation indicates that 2 of the 10 USTs were removed by USEPA (USEPA electronic correspondence, January 13, 2012).

The October 2009 "The Passaic River Mystery Oil Spill" (Case #09-10-29-1320-36) was attributed to ASTs in the basement of Building #12. According to USEPA documents, the source of the spill was identified at low tide when a pipe discharging the spill was observed. The pipe was sealed, stopping the release. The pipe that discharged into the Passaic River was traced to a catch basin. An oily substance in the discharge was observed in the catch basin; a sewer

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pipe from Building #12 was observed to discharge into the basin. The discharge from the Building #12 sewer pipe resembled the spill material observed in the Passaic River. Section V.16 of the ACO states that USEPA traced the source to two basement tanks in a vacant building located on Lot 64 that had recently been connected to a storm sewer by a hose. Based on its investigation during removal activities, USEPA expressed the opinion that contents of the two basement tanks appeared to have been intentionally discharged into the sewer. The sewer line was plugged and tanks secured by USEPA.

As described in the SCSR, a 2009 Preliminary Assessment Report (PAR) for Lot 64 (Weston, 2009) was completed.

Samples were collected by Birdsall (PMK/Birdsall, 2009b) and USEPA (Tetra Tech, 2010a, 2010b and Lockheed Martin, 2010a, 2010b). As part of the Lot 64 investigation, there was one monitoring well installed (ERT-1/2011) on adjacent Lot 65. Benzene and methylene chloride were the only compounds reported above NJDEP GWQS in Lot 65 groundwater (Lockheed Martin, 2011).

In conjunction with the surface waste removal on Lot 63, Lot 64 surface debris and waste were removed by USEPA in 2017 and 2018. Refer to RIR Section 1.4.10 for details on previous investigations and remedial actions.

2.3.10 Lot 65

Lot 65 is a 0.289-acre vacant lot (Figure 2-1). Based upon historical aerial photographs, PPG records, and Sanborn maps, there were no buildings situated on this lot.

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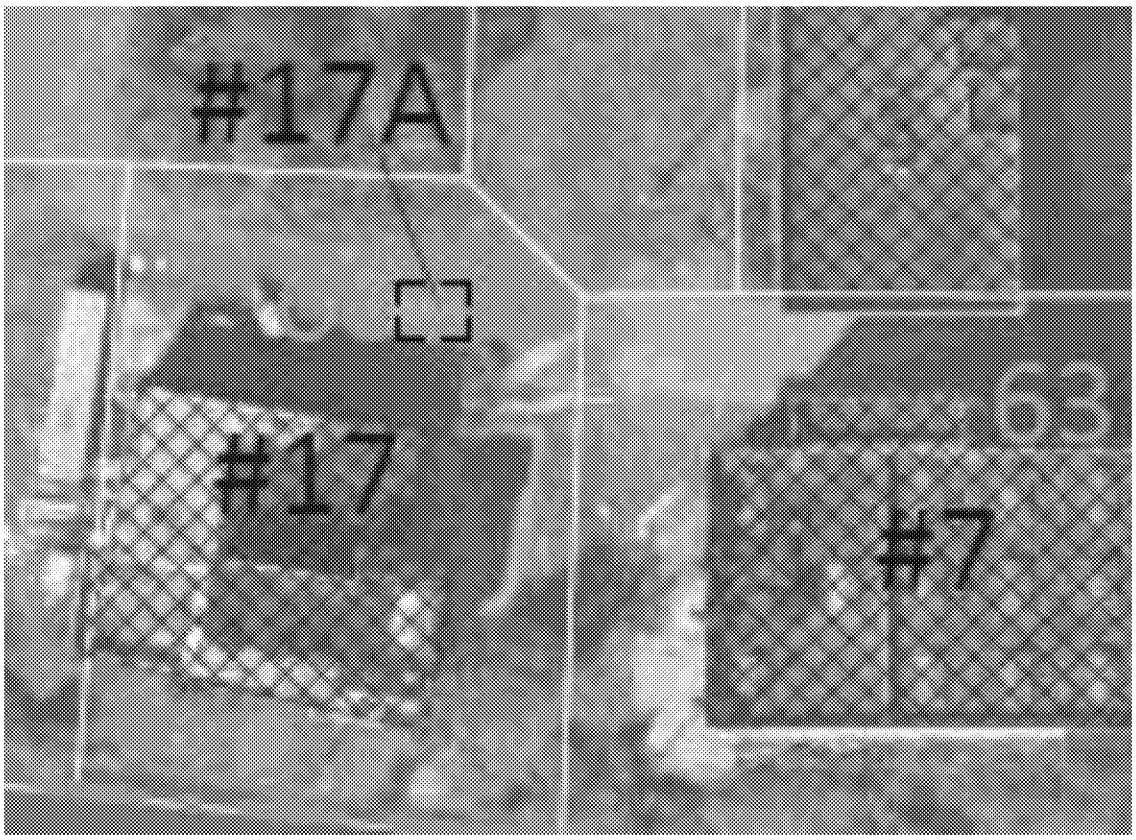
No environmental investigation reports have been found which were completed specifically for this lot; however, in 2006, a groundwater sample was collected from a soil boring on Lot 65 for limited parameters. Lead and 4-chloroaniline were detected above NJDEP GWQS at TB-7 (Whitman, 2012a).

Surface debris piles were present in June 2015 along with a vandalized office trailer. Additional surface debris piles were observed in July 2015 indicating an active dumping area for construction and miscellaneous debris. Surface debris and waste were removed by USEPA in 2017 (USEPA, 2017). The office trailer was removed in 2019.

2.3.11 Lot 66

Lot 66 (0.345 acre) contains vacant Building #17 (Figure 2-1) and former Building #17A. The property is currently (July 2015) in bankruptcy. A small building was located west of Building #17 designated on drawings as Building #17A.



An unknown liquid was released to the Passaic River on January 9, 1992 as a result of illegal dumping. CCI was reportedly pumping the contents of a pit into an open lot (NJDEP Case #92-1-9-1027-18).

A July 1992 release to the Passaic River was reportedly caused by the failure of an industrial sewer line. The release likely occurred in the vicinity of Lot 66. The release was described as a blue/purple dye, wastewater liquid with aniline being a component. The location of the sewer line breach was not found in historical records.

One soil boring (SB-COMP) was advanced in May 2008, and a subsurface soil sample was collected and analyzed from the boring. TPH was detected at 1,400 milligrams per kilogram (mg/kg) and polycyclic aromatic hydrocarbons (PAHs) were not detected (Whitman, 2012a).

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A 2010 vapor intrusion investigation of Building #17 was performed because of a tetrachloroethylene (PCE) spill on Lot 68. The conclusions indicated that the results for the Celcor Building/Building #17 did not exceed NJDEP vapor intrusion screening limits.

Three TWPs were installed on Lot 66 and grab groundwater samples were collected in 2006. NJDEP GWQS exceedances of isopropylbenzene, chromium, and lead were identified northwest of Building #17 (upgradient, TB-4 and TB-5). NJDEP GWQS exceedances of carbon disulfide, benzo(a)anthracene, benzo(a)pyrene, chrysene, fluoranthene, pyrene, chromium, and lead were identified at TB-6 located downgradient of the wastewater AST. One monitoring well (MW-2) was installed and sampled in 2008 and is identified as RI existing Well E-2.

In July 2015, surface debris and waste piles were present and removed by USEPA in 2017 under an emergency response action (USEPA, 2017). CCI Monitoring Well MW-2 is present on the east side of Building #17 (Lot 66) and was evaluated and sampled during the RI. This well is E-2 in the RI. Refer to RIR Section 1.4.11 for previous investigation details.

2.3.12 Lot 67

Lot 67 is a 0.394-acre vacant lot owned by CCI (Figure 2-1). According to USEPA, the property went through bankruptcy proceedings. A small building with unknown use exists on the eastern side of the lot adjacent to the Passaic River.

According to public records, Lot 67 could be the location of the pit mentioned in allegations of CCI's 1992 illegal dumping on an open lot (NJDEP Case #92-1-9-1027-18).

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The southwestern portion of Lot 67 is under a groundwater CEA and deed notice with engineering controls to address groundwater impacts and soil contamination related to historic fill and a Lot 68 PCE spill in 1987 (RIR Figure 1-3). Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586.

Soil samples were collected in 2008 from Lot 67 with several metals and SVOCs detected above USEPA Regional Screening Levels (RSL) (industrial) or Impact to Groundwater Soil Screening Levels (IGWSSL) (Whitman, 2012a). Soil data obtained from the three borings indicated that TCE (up to 0.13 mg/kg), lead (up to 950 mg/kg), mercury (up to 0.18 mg/kg), and benzo(a)pyrene (0.58 mg/kg) were detected.

In July 2015, surface debris piles along with abandoned equipment were present. USEPA removed these piles in 2017 under an emergency response action (USEPA, 2017). Refer to RIR Section 1.4.12 for previous investigation details.

2.3.13 Lot 68

Lot 68 is a 0.534-acre vacant lot owned by the City of Newark (Figure 2-1). Former Building #20, referred to as a shed, was located along the southern property line of this lot. The majority of the property was covered with asphalt based upon June 2015 observations. During PPG operations, two naphtha ASTs with 5-foot-high dike containment walls were present along with a 1,400-square foot (SF) drum storage shed (Building #20). The naphtha AST area is currently overgrown and covered by a debris pile. In 2019, vegetation was removed from the former AST area by a City of Newark tenant.

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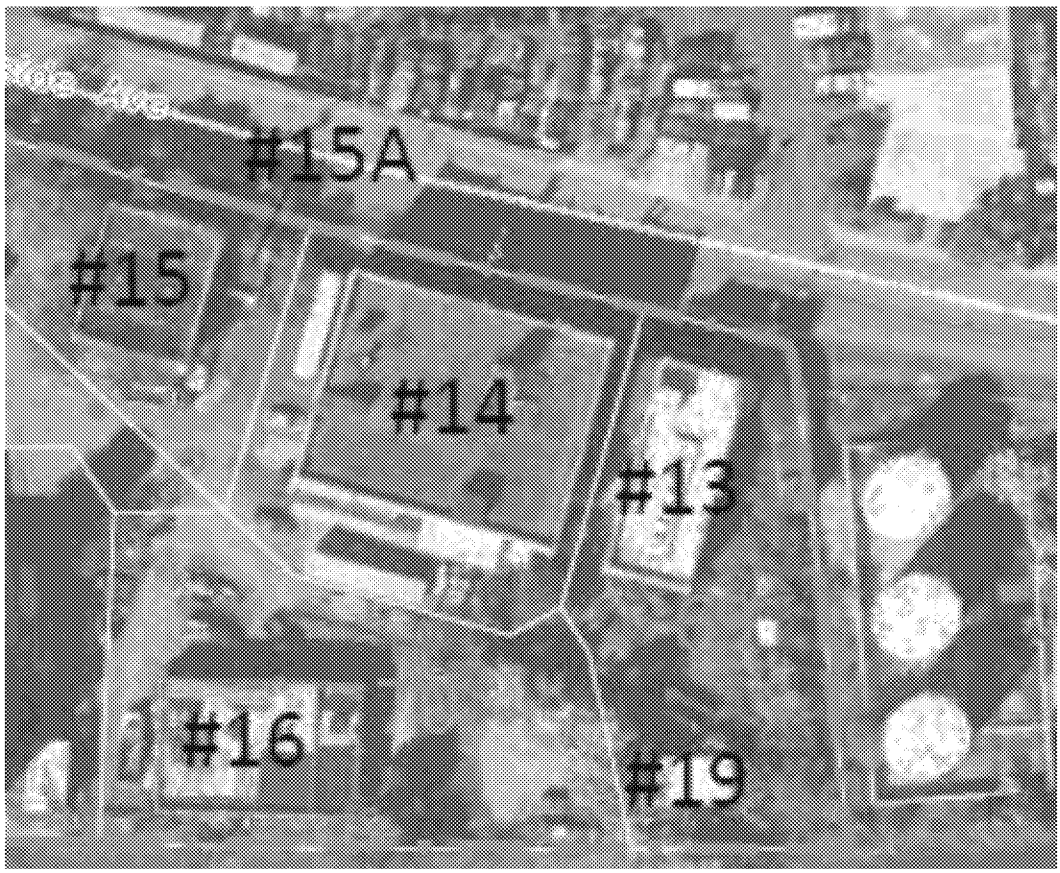
A PCE spill occurred in 1987. Delineation of the spill-related contamination was performed and a cleanup plan developed (Dunn, 1990, 1991, and 1992). Soil was removed from the lot in April 1992. Post-remediation soil sampling was conducted in 1995 (Rust, 1995).

Lot 68 is a New Jersey known contaminated site (NJDEP Case No. 88434). A deed notice with an engineered asphalt/concrete cap is present related to shallow soil impacts of arsenic, lead, PCE, trichloroethene (TCE), and zinc. There is also a groundwater CEA covering *cis*-1,2-dichloroethene (DCE), *trans*-1,2-DCE, PCE, TCE, and vinyl chloride. Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586. Details on Lot 68 previous investigations and remedial activities are in RIR Section 1.4.13.

2.3.14 Lot 69

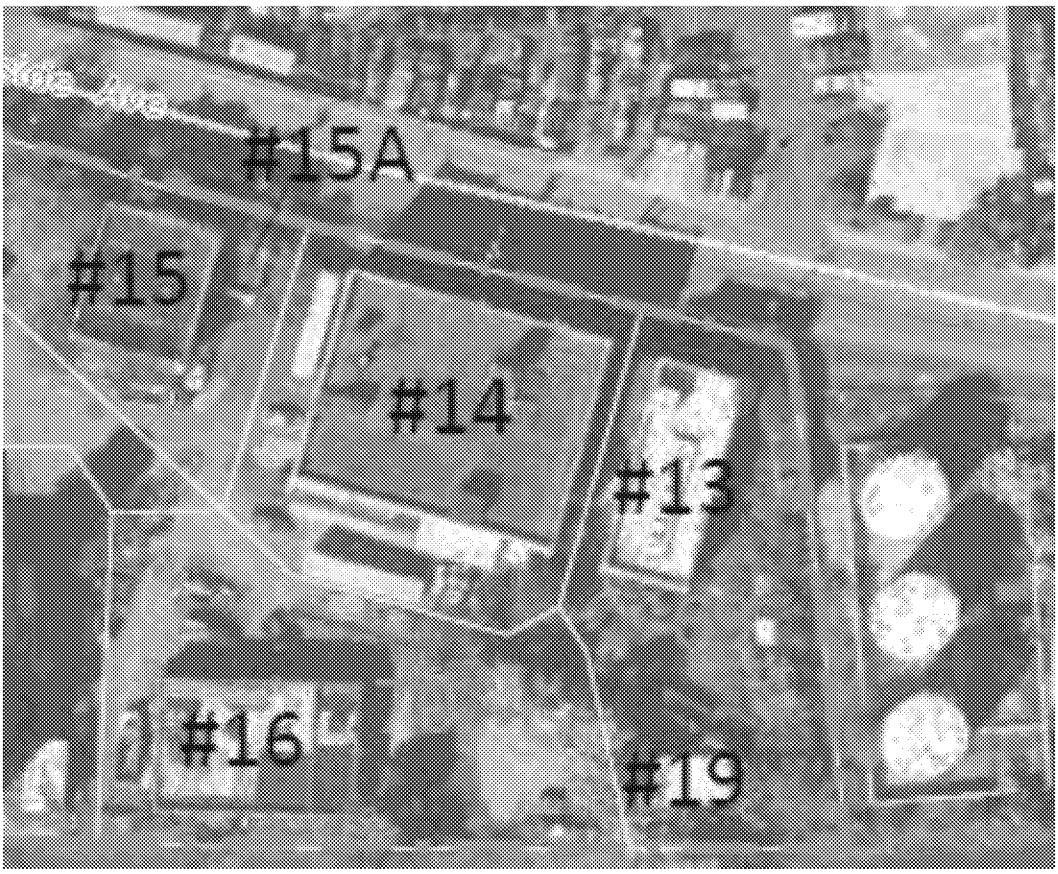
Building #13 is located on Lot 69. Lot 69 is the northern most parcel with a size of 0.326 acre (Figure 2-1). The property is currently owned by Sharpmore Holdings, Inc. (Sharpmore). Old, inactive Ardmore tanks are located to the north and south of the building. The small garage building along the river is currently used for storage (Building #19).



In 1989, three areas of potential environmental concern, including a drum handling area, the loading dock area, and the tractor trailer product transfer area, were identified and excavations were completed with visually contaminated soil removed. Confirmatory soil samples were collected from the excavations. The Responsible Party's (Gloss Tex) post-remediation soil samples collected from the three excavation areas indicated petroleum hydrocarbon (PHC) and base neutral (BN) concentrations below New Jersey standards at the time (AccuTech Environmental Services, 1989). A negative declaration affidavit was submitted to the NJDEP in November 1989 indicating no additional remedial measures were warranted. Refer to RIR Section 1.4.14 for previous investigation details.

2.3.15 Lot 70

Building #16 (Figure 2-1) is on Lot 70 (0.456 acre). Based upon November 2019 observations, the property has a commercial tenant.



A Responsible Party (Federal) spilled an unknown quantity of nitrocellulose in 1990 and released hydrochloric acid gas in 1993. Federal assessed groundwater quality in 2001. Groundwater contained elevated concentrations of acetone (14,000 to 29,000 milligrams per liter [mg/L]), barium, and lead above the NJDEP GWQS. The occurrence of acetone was attributed to an adjacent property (Lot 57 – HABA acetone release).

Other assessments, investigations and remedial action at Lot 70 began in 2001. According to the 2008 RAWP (TRC Environmental Corporation, 2008), the NJDEP agreed to list the groundwater CEA contaminants related to historic fill (arsenic, barium, cadmium, lead, and zinc) for Lot 70 and directed Federal to list benzene as a site chemical of concern in the CEA. The CEA for Lot 70 was reportedly established on March 30, 2010 for an indeterminate duration.

In March 2012, soil/fill with PCB concentrations greater than 50 parts per million (ppm) was excavated. A deed notice was recorded on December 4, 2014, restricting the Site to non-residential use only and incudes engineering controls. Refer to RIR Section 1.4.15 for details on previous investigations and remedial actions.

2.4 Physical Characteristics of the Site

2.4.1 Surface Features

The majority of the Site (70 percent) is covered with impervious surfaces, such as asphalt (approximately 19 percent), foundation and buildings (approximately 27 percent), and concrete (approximately 24 percent). The remaining portion of the Site is indicated to be pervious (approximately 30 percent) (Figure 2-3).

There are 14 buildings at the Site with five of the buildings being vacant (Buildings #6, #7, #12, #15, and #17). At the time of the RI, Buildings #1, #2, #3, #9, #10, #13, #14, and #16 had ongoing business operations along with a small garage building (Building #19) that was used for storage by the occupant of Building #13. The southern portion of the Site is primarily vacant with four of the five unoccupied buildings located there. Former Building #4 was damaged by fire and was demolished in 1982, a sub-grade concrete slab with concrete walls is currently present that was previously used by post-PPG occupants as secondary containment for multiple ASTs and also for auto-dismantling activities. Former Building #5 was also damaged by fire and demolished in 1982, a vegetated soil/fill mound currently occupies much of the footprint of the building. Debris/soil mounds are also present within a former AST dike on Lot 68 and on the south side of Building #15 on Lot 58. These soil/fill mounds are of unknown origin.

Smaller structures that are present on the Site include a vacant guard-shack at the entrance to the Site along Riverside Avenue and a small concrete structure of unknown use on the eastern side of Lot 67.

Empty ASTs and/or process vessels are present on the exterior of Lots 58, 67, and 69. The empty AST on Lot 58 is a remnant feature from PPG occupation.

At initiation of the RI, un-authorized surface dumping was prevalent in the southern portion of the Site. Under an emergency removal action, these surficial wastes removed by USEPA in 2017 and 2018 included asbestos-containing materials, household trash, construction debris, bio-hazard waste, and petroleum-impacted materials (USEPA, 2017).

The Passaic River borders the Site on the east side. A steel, concrete, or wooden bulkhead provides a retaining wall along the eastern edge of most of the Site adjacent to the Passaic River. The bulkhead has fallen into disrepair in some locations.

2.4.2 Surface Water Hydrology

An assessment of current topography and resulting surface water patterns at the Site was undertaken in the RI (RIR, Section 3.2). Approximately 15 percent of site surface drains toward the west (railroad tracks and Riverside Avenue) while approximately 57 percent of the Site drains toward the east. The remaining area (28 percent) is occupied by buildings or hydraulically isolated structures.

The Passaic River has a history of high water events. The topographic survey map of the Site (RIR, Figure 3-2A) has ground surface elevations that range from approximately 6 to nearly 12 feet above mean sea level (AMSL). It appears that 40 to 50 percent of the Site lies at an elevation of 9 feet below mean sea level (MSL) (which is designated by FEMA as the 100-year flood elevation), including Buildings #6, #10, #13, #14, and #16, and portions of Buildings #1, #7, and #9. The top of the river bulkhead is between 6 and 7 feet MSL. This means water levels above 6 feet MSL would cause high water at some portions of the Site, and water levels of 9 feet MSL would represent a 100-year flood at the Site.

2.4.3 Geology and Hydrogeology

The Site consists of large quantities of fill material that were historically placed into the river and adjacent shore to raise the surface elevation to today's approximate elevation, most of which was completed from 1892 to 1909. The majority

of the current lots that comprise the Site is located within the footprint of the historical Passaic River. The thickness of fill material ranges in thickness from 6 to 15 feet. The fill material consists predominantly of sands, silts, and gravel along with man-made materials such as brick, pieces of concrete block, wood, glass, and cinders. The fraction of each material in the fill varies across the Site, however, most of the historic fill material at the Site is characterized as a Loamy Sand or Sand Loam. Based upon historical maps, previous investigations, and data obtained during the RI, fill material is present in surface soil/fill throughout the Site and in subsurface soil/fill where historical filling was conducted to reclaim land from the Passaic River. This material is considered "historic fill" as it complies with the NJDEP definition of historic fill and, therefore, is impacted by chemicals and metals as shown by RI data and NJDEP historic fill designations. Historic fill may also have been impacted due to historical and/or current operations and recent and illegal disposal. Lower portions of the fill are saturated as evidenced by groundwater depths that are typically less than 6 feet below grade. A silt loam underlies the fill unit over the majority of the Site except in areas to the northwest. The sources of fill are unknown. As fill placement occurred over a more than 30-year period, the sources and thus physical and chemical properties could be different.

The silt loam is underlain by alluvium deposits. Two groundwater units were investigated: shallow fill and deep. The primary groundwater flow direction in the shallow fill unit and deep unit is to the east toward the Passaic River.

Groundwater elevations are and were typically influenced by tidal changes which are greatest in areas adjacent to the river. The tidal influences were observed in both the shallow fill unit and deep unit. Tidal influence appears to be greater in the northern portion of the Site compared to the southern portion.

RIR Sections 3.3 and 3.4 provide details on Site geology and hydrogeology.

2.4.4 Demography and Land Use

The Site is located within a designated "Dedicated Industrial Zone" allowing commercial and industrial uses and is sub-divided into 15 properties. Currently, seven properties are in use and eight properties are vacant. Seven occupied properties (Lots 1, 57, 59, 60, 62, 69, and 70) and three of the vacant properties (Lots 65, 66 and 67) are owned by several entities, and the other five vacant properties (Lots 58, 61, 63, 64, and 68) are owned by the City of Newark. The Site is partially fenced. Based upon observations during the RI, 30 to 40 employees work in the several businesses (warehousing/storage, distribution, or manufacturing) at the Site. There are no residents at the Site.

Surrounding properties include an abandoned petroleum bulk storage facility to the north of Lot 69; an auto body/salvage business to the northwest of Lots 58, 59, and 69 across Riverside Avenue; a construction contracting business to the south of Lots 67 and 68; and a residential neighborhood to the west of McCarter Highway. According to historical maps, the adjoining properties to the north and northwest have been used for fuel oil storage, a retail gas station, and a coal yard.

Based on U.S. Census Bureau data, as of 2017, Newark's population is diverse with African American being the largest group followed by Hispanic/Latino, together making up over 75 percent of the population. Median household income is $34,826. Population density is 11,458 per square mile. English is a second language in almost 50 percent of households.

2.4.5 Ecology

The Site is mostly paved or covered by buildings and is partially fenced. Because habitat is restricted, ecological receptors on Site are limited to urban wildlife. Some pervious areas of the Site include opportunistic, low-value ecological habitat that is primarily interspersed between the paved areas and/or buildings and foundations. This habitat is in various stages of growth and/or regrowth due to disturbances from remedial activities. Several types of flora and fauna are present on Site, although most are opportunistic or invasive species. Waterfowl are transient visitors. No raptors or deer have been observed, and no wildlife (other than passerines) was observed during the site visit. Feral

cats are prevalent among the vacant buildings. There are no aquatic resources on Site. However, the Passaic River and a tidal mudflat are adjacent to the eastern edge of the Site. The SLERA contains details on ecological conditions at the Site.

2.5 Nature and Extent of Contamination

This section summarizes the nature and extent of contamination presented in RIR Section 4. In the assessment of nature and extent, sample analytical results were compared to PALs or other screening values such as hazardous waste characteristics. Exceedance of a PAL does not indicate an unacceptable risk to that media. PALs are screening values that can help decision makers target a course of action prior to the risk assessment.

PALs for soil/fill were based on the lowest regulatory criteria of: (1) USEPA RSLs for Resident Soil (May 2016), (2) New Jersey Remediation Standards (Residential Soil) 7:26D, or (3) New Jersey Impact to Groundwater Criteria (November 2013).

PALs for groundwater were based on the lowest regulatory criteria of: (1) USEPA RSLs for Tap Water (November 2017), (2) USEPA Maximum Contaminant Levels (MCLs) (November 2017), or (3) NJDEP GWQS (New Jersey Administrative Code [N.J.A.C.] 7:9C – January 18, 2018).

Soil Gas PAL is based on the lowest regulatory criteria of: (1) USEPA Vapor Intrusion Screening Levels (VISL; November 2015) Sub-Slab Soil and Exterior Soil Gas, and (2) NJDEP VISL (March 2013) Soil Gas Screening Levels Residential.

Indoor Air PAL is based on the lowest regulatory criteria of: (1) USEPA VISL (November 2015) Indoor Air Cancer, (2) USEPA VISL (November 2015) Indoor Air Non-Cancer, and (3) NJDEP VISL (March 2013) Indoor Air Screening Levels Residential.

2.5.1 Waste

There are a limited number and volume of waste containers and materials (not associated with current operations) observed and sampled in the RI. The limited volume of waste materials is consistent with waste removal actions undertaken by USEPA at the Site. The wastes are not characterized as hazardous wastes based on RI results. LNAPL, identified as diesel/heating oil, is present in a UST (Lot 64) and Building #15A (Lot 58).

Six USTs were identified in a tank field north of Building #12. All six USTs contained liquid that was sampled; five tanks did not contain liquids identifiable as a product or waste product, and groundwater and/or surface water infiltration may have occurred. One UST (UST-5) was found to contain a diesel/heating oil layer approximately 0.9-foot thick. Based on the laboratory waste characterization results, none of the UST liquid was classified as a hazardous waste. The primary VOCs (xylenes and ethylbenzene) reported in nearby groundwater wells (MW-106 and E-3) are the same as the VOCs in the tanks. UST-7 also contained several chlorinated VOCs above 100 µg/L. UST-7 still has the same two primary VOCs (xylenes and ethylbenzene) as other USTs but the lack of chlorinated VOCs in the other tanks indicates that these other tanks held different material. Because UST VOC concentrations from five USTs are higher than nearby groundwater, these tank contents remain a potential source of groundwater contamination.

Based on results, Building #15 standing water was not considered a waste. Water was found beneath a steel grated floor in this portion of Building #15A (pump house). A viscose non-aqueous phase liquid (NAPL) layer was identified consistent with diesel/heating oil approximately 0.5-foot to 0.65-foot thick.

2.5.2 Soil

Surface, subsurface, and vadose zone soils were sampled during the RI. Soil samples collected in 2017 focused on potential AOCs including loading docks, material handling areas, and raw material storage areas (Figure 2-5). Soil samples collected in December 2018 (Phase 2) were based on the 2017 soil results and included investigation of the saturated zone along with providing spatial coverage at the Site. Additional details on soil results are provided in RIR Section 4.

The majority of the Site (except the northwest section) was reclaimed from the Passaic River with imported fill. Fill material is documented at the surface throughout the Site with greater fill thicknesses associated with areas reclaimed from the Passaic River (up to 15 feet thick) and is generally described as a Loamy Sand or Sand Loam in most areas. Permeability testing conducted on two soil samples collected beneath the fill unit representative of the former river bed indicated permeabilities of 1.1×10^{-5} to 3.3×10^{-7} centimeters per second (cm/s). Geotechnical data provided by USEPA indicated that this former riverbed material beneath the fill is more appropriately described as a silt loam. The silt loam layer grades into a fine to coarse-grained sand and gravel with depth which includes alluvium deposits (Qal) and glacial lake deltaic deposits (Qbn) followed by a silt unit (Qbnl) identified as glacial lake bottom deposits.

Observations of a thick, oil-like substance were noted at Borings B-34, B-35, and B-90 east and south of the UST area. Monitoring wells and TWPs in the vicinity of the USTs did not have a measurable thickness of NAPL; but they did have elevated benzene, toluene, ethylbenzene, and xylenes (BTEX) concentrations, which are potentially indicative of petroleum impacts to groundwater. Isolated areas of LNAPL staining were also observed in soil during the drilling of Monitoring Well MW-201 between the ground surface and 7.2 feet below ground surface (bgs). Monitoring wells in this area of the Site (including Monitoring Well MW-201) did not have a measurable thickness of LNAPL.

Thirty-four VOCs (67 percent) were not detected in soil samples or not reported at concentrations above their PALs. Eight VOCs were identified as soil chemicals of potential concern (COPCs) in the BHHRA. The VOCs that exceeded a PAL most frequently were benzene, methylene chloride, PCE, and TCE. Although toluene, ethylbenzene, and xylene (TEX) (total) were reported at elevated concentrations, most results were below their PALs. The source of BTEX on Lots 63 and 64 is likely the petroleum waste in USTs and soil and recent illegal storage or recent dumping. The highest chlorinated VOC results were from Lot 68 where a PCE release occurred in 1987. BTEX was also reported in that area. The likely source of these VOCs are illegal dumping and residual contamination from the PCE spill. BTEX and chlorinated VOCs were detected around Building #15. The likely source is recent spills in the area. Elevated acetone concentrations were reported in subsurface soil on Lot 57, but the results were less than 60 percent of the acetone PAL. The source of acetone is likely the acetone storage area associated with current operations on Lot 57.

Fifty-six SVOCs did not exceed PALs. Eight SVOCs were identified as COPCs in the BHHRA. SVOCs above a PAL were widespread with the majority being on Lots 63, 64, 67, and 68 in surface soil. Benzo(a)pyrene was the SVOC with the most PAL exceedances. Of the SVOC detected above PALs, benzo(a)pyrene and dibenzo(a,h)anthracene have the lowest PAL at 110 micrograms per kilogram (µg/kg). The sources of the SVOC above PALs are likely a combination of historic fill, illegal petroleum material spills/storage, petroleum waste in USTs, and surrounding area historical/current operations.

Twenty-four metals including mercury were analyzed in soil samples. The highest lead and zinc soil concentrations were generally on Lots 63, 64, and 70. The majority of zinc concentrations were below PAL on these lots and the other 12 lots. Mercury was detected in the majority of soil samples above its PAL (0.1 mg/kg) with most PAL exceedance on the southern portion of the Site. The source of the metals is likely a combination of historic fill, operations releases, and illegal dumping.

PCB-1254 exceedances were mostly concentrated on the southern portion of the Site in Lots 63, 64, and 65. PCB-1260 exceedances were almost entirely from surface samples collected in the northern portion of the Site and were found on Lots 58, 69, and 70. An NJDEP-led PCB soil excavation occurred on Lot 70.

No pesticides/herbicides, except heptachlor epoxide, were detected in soil samples.

Dioxin/furan results for four of the nine surface soil samples exceeded the PAL for 2,3,7,8-tetrachlorodibenzoparadioxin (TCDD); the highest 2,3,7,8-TCDD concentration was detected at location DF-4 at 20.8 nanograms per kilogram (ng/kg). The four highest 2,3,7,8-TCDD soil results are on the eastern edge of the Site adjacent to the Passaic River.

2.5.3 Groundwater

The RI characterized the nature and extent of groundwater quality beneath the Site. There are 31 monitoring wells in the shallow fill unit (eight wells were present prior to RI) and five monitoring wells in the deep unit. The primary groundwater flow direction in the shallow fill unit and deep unit is to the south-southeast toward the Passaic River.

Evaluation of slug test data for shallow fill unit wells at the Site indicated hydraulic conductivities between approximately 4 and 233 feet per day (ft/day). While the data indicate a range of approximately three orders of magnitude for hydraulic conductivity, the fact that many of the wells are constructed in shallow fill materials suggests this range is reasonable given the heterogeneity of fill. Slug test data for wells in the deep unit indicated higher hydraulic conductivities in the north (average of approximately 210 ft/day) compared to hydraulic conductivities in the south (average of approximately 44 ft/day).

Tidal fluctuations in the deep unit also indicated that deep wells on the north end of the Site also appear to exhibit more tidal influence suggesting that the subsurface materials on the more northern and inland portions (near MW-205) are more conductive or better connected to the river than areas to the south. Unfiltered groundwater samples were collected and analyzed in March 2018, June 2018, and February 2019. The Phase 1 wells including the pre-RI wells have been sampled three times within a year, while the Phase 2 wells were sampled once. Additional groundwater quality information is provided in RIR Section 4.4.

2.5.3.1 Shallow Fill Unit

Over the three sampling events, results for the shallow fill unit well samples were consistent except as noted below. Variations for many of the results may be within reproducibility range of measurement or reflect site conditions at the time of sampling (seasonal variations, tides or recent precipitation events). More significant VOC concentration changes in the shallow fill unit wells are noted below.

- Monitoring Well E-4: Ethylbenzene concentrations increased from not detected in the two 2018 samples to 48 µg/L in 2019. 2018 TCE concentrations changed from non-detect to 5.6 µg/L in 2019.
- Monitoring Well MW-106: Concentrations from 2018 to 2019 for ethylbenzene, TCE, and xylenes decreased.
- Monitoring Well MW-107: Benzene, ethylbenzene, and xylenes decreased in 2019 from 2018 results.
- Monitoring Well MW-115: Ethylbenzene and xylenes concentrations decreased since March 2018 while benzene and other VOC concentrations have remained consistent.
- Monitoring Well MW-117: Methyl ethyl ketone (MEK) concentrations increased from not detected in 2018 to 330 µg/L in 2019.

Monitoring Well MW-124 was installed in Phase 2 and sampled once. It has the highest TEX concentrations in the shallow fill unit.

VOCs: Benzene detections were the most common VOC to exceed the PALs in the shallow fill unit, followed by vinyl chloride, ethylbenzene, 1,1,2-trichloroethane (TCA), 1,1,2,2-tetrachloroethane, and m,p-xylenes. Fourteen VOCs including benzene, vinyl chloride, ethylbenzene, 1,1,2-TCA and xylenes (total) are groundwater COPCs in the BHHRA.

SVOCs: 1,4-Dioxane was the most common SVOC detected (above PALs) followed by naphthalene, benzo(a)anthracene, benzo(a)pyrene, and 1,1'-biphenyl in the shallow fill unit. Twelve SVOCs were identified as COPCs.

Metals: Arsenic, manganese, iron, sodium, cyanide and lead were detected most often above their respective PALs. Mercury was not detected above its PAL. Eight other metals were detected above their PALs in at least one sampling event.

PCBs: Aroclor 1260 was detected in groundwater above its PAL at four shallow fill unit well locations during at least one sampling event (MW-108, MW-118, MW-119, and MW-121). One other PCB (Aroclor 1254) was detected above its PAL in one sampling event.

NAPLs: Measurable LNAPL was not observed in shallow fill unit monitoring wells. LNAPL was observed in soil/fill in the area of Lot 64 USTs. No dense non-aqueous phase liquid (DNAPL) was observed in the RI monitoring wells.

The groundwater areas with the highest concentrations above PALs are as follows:

- Lots 63/64
- Lot 58/Building #15
- Lot 57/Building #10

The first two areas above are contaminated with BTEX and chlorinated solvents. Lot 57 contamination is primarily acetone. Arsenic and lead concentrations above PAL are site-wide with the most exceedances on Lots 63/64. 1,4-dioxane concentrations above PAL were primarily along the river.

2.5.3.2 Deep Unit

The number of parameters above PAL is less in the deep unit groundwater than in the shallow fill unit. Concentrations were also lower in the deep unit.

VOCs: Benzene, 1,1,2,2-tetrachloroethane, and 1,1,2-TCA were the most common VOCs to exceed their PAL in the deep unit groundwater. The methyl tert-butyl ether (MTBE) PAL exceedance is unique to the deep unit as it was not detected in a shallow fill unit well above its PAL. Ten VOCs including MTBE were identified as deep unit COPCs in the BHHRA.

SVOCs: In the deep unit groundwater, naphthalene was the most common SVOC detected exceeding its PAL. Three SVOCs were identified as COPCs in the BHHRA.

Metals: Arsenic, manganese, and sodium were detected most often above their respective PALs in deep unit groundwater. Eight metals were identified as COPCs in the human health risk assessment.

PCBs: No PCBs were detected in deep unit groundwater.

NAPLs: LNAPLs or DNAPLs were not observed in deep unit monitoring wells.

2.5.4 Sump

Sumps were identified in Buildings #2, #4 (demolished), and #17 and were sampled in conjunction with groundwater sampling events. The results were compared to groundwater PAL although, as noted below, several sumps do not contain groundwater.

The Building #2 sump is in the basement and has a pump with an on/off float that conveys water to a sewer pipe. The water in the sump was sampled twice. No odors or sheen were noted at the time of sampling. Chloroform, benzo(a)pyrene, arsenic, sodium, and Aroclor 1260 were reported at concentrations above PAL. Aroclor 1260 and benzo(a)pyrene were only detected once above PALs. It is noted that several VOC results were rejected and unusable as quantified results. The closest monitoring well (E-9) to this sump had similar chloroform concentrations and no other VOC PAL exceedances consistent with the Building #2 sump. Chloroform was detected (0.98 microgram per cubic meter [$\mu g/m^3$]) in the Building #2 basement indoor air. The Building #2 sump is below grade and regularly pumps water, indicating it may be communicating with the shallow fill unit groundwater.

The Building #4 sump is in the floor slab of the demolished Building #4. At the beginning of the RI, vehicle dismantling occurred on the former Building #4 concrete slab. The sump is exposed to weather, and no VOCs were reported above groundwater PALs. Several SVOCs and metals were above PALs. Aroclor 1260 was detected above its PAL. The contents of the sump represent precipitation runoff from the Building #4 floor slab and not groundwater.

There are two sumps inside the vacant, deteriorating Building #17. The sumps are in the bottom floor which is partially below grade. This floor becomes submerged by water after precipitation events resulting in a determination that the liquids in the sumps are suspected to be related to precipitation entering into the building and not groundwater. No VOCs were above the groundwater PALs. No PCBs were detected. 1,4-Dioxane (Sump 2 only) and several metals were above groundwater PALs. Additional details on sump results are provided in RIR Section 4.5.

2.5.5 Sewer

The assessment of the sewer system resulted in the collection of water samples at four Lot 1 manholes. Samples from Manholes 17 and 20 were from active sewers where site tenants/owners are discharging to these publicly owned treatment works (POTW) sewers.

Three of the four sewer water samples had no PAL exceedances. Manhole 8 (Lot 1) had methylene chloride and TCE above the PALs. A solid sample collected from Manhole 8 contained methylene chloride and toluene concentrations that were above 1 mg/kg. Two SVOCs and several metal concentrations were above 1 mg/kg. The sewer at this location was classified as inactive based on observations of no flow and lack of current users upstream of the location.

The water and solid results at Manhole 8 were higher than nearby groundwater concentrations. The source of VOCs in this manhole is unknown but a former recent operator used VOCs in its manufacturing operations. This is an inactive sewer at this location and based on results, its contents would be a source material, if released into the environment. Based on RI results, other sewer locations are not sources of groundwater or soil/fill impacts reported in the RI. Additional details on sewer results are provided in RIR Section 4.6.1.

2.5.6 Lot 57/Sewer Pipe and Groundwater

The Lot 57 wall sewer sample contained elevated toluene and acetone concentrations. Other VOC results were rejected due to holding time exceedances except for toluene and acetone. The acetone concentration was 83,000 µg/L. Concentrations of ethyl acetate (a tentatively identified compound [TIC]) was estimated to be 7,000 µg/L. TIC concentrations are estimates because the target compound is tentatively identified by the laboratory instrument. Additional details on Lot 57 sewer water results are provided in RIR Section 4.6.2.

The nearest shallow fill well (MW-118) to the wall sewer sample had acetone concentrations from 51,000 to 71,000 µg/L. Ethyl acetate was not identified as a TIC in this well. Ethanol and isopropyl alcohol had the highest concentrations of VOC TIC reported in this well.

The deep unit well (MW-204) adjacent to MW-118 was non-detect for acetone and ethyl acetate. Ethanol and isopropyl alcohol were not identified as TICs in this deep well.

In the wall sewer sample, SVOCs and PCBs were below PALs with one metal (lead) exceeding the PAL. Various metals were present at concentrations below 50 µg/L in the wall water sample.

The flow from the pipe increased during sampling indicating that the source may not always be a passive source. An additional VOC sample can be collected to more fully characterize this water, but the presence of acetone and likely ethyl acetate in the wall sewer pipe and acetone in shallow groundwater indicates this water in the pipe and well should be evaluated in the FS to assess whether manufacturing activities in Building #10 are contributing to groundwater and surface water contamination.

2.5.7 Indoor Air

Indoor air and exterior ambient air samples were collected and analyzed from occupied buildings (Buildings #1, #2, #3, #9, #10, #14, and #16) during the heating season (as defined by NJDEP). The samples were analyzed for benzene, ethylbenzene, xylenes, 1,1,2-TCA, carbon tetrachloride, chloroform, isopropylbenzene, naphthalene, TCE, and vinyl chloride.

Benzene concentrations were above the benzene PAL (0.36 µg/m^3) in each building's indoor air samples and in ambient air. Chloroform was above its PAL in Buildings #2, #10, and #14. Ethylbenzene and TCE concentrations in Building #1 were above PALs. Other parameters were not above a PAL. In addition to benzene, xylenes were detected in ambient air.

The three highest VOC concentrations in ambient air are as follows:

- 0.99J µg/m^3 - m,p-Xylene
- 0.76J µg/m^3 - Benzene
- 0.45J µg/m^3 - o-Xylene

Operations in several buildings (Buildings #9, #10, #14 and #16) sampled use organic solvents in their process or routinely have gasoline/diesel powered vehicles/equipment stored in the building sampled. Gasoline/diesel equipment was not operating during sampling. RIR Section 4.7 provides additional details on indoor and ambient air samples.

2.6 Existing Institutional and Engineering Controls

Portions of five lots within the Site are currently subject to NJDEP Deed Notice/Declaration of Environmental Restriction (DER), which are institutional controls that limit use of the properties to non-residential uses. Also, several CEAs are established or proposed under NJDEP-led remediations (Figure 2-2). CEAs proposed but not approved by NJDEP are not on Figure 2-2 and were not considered in the risk assessments.

Lot 1

A historic fill CEA (arsenic, iron, lead, manganese, and sodium) was proposed for Lot 1 in 2017 by Samax under New Jersey PI #563216. Samax is awaiting direction from USEPA on implementation of the CEA.

Lot 60

In 2017, a historic fill CEA was submitted to NJDEP on behalf of Roloc for Lot 60. The CEA indicated mercury, arsenic, aluminum, chromium, iron, and lead concentrations were above the NJDEP GWQS. The Responsible Party is awaiting direction from USEPA on implementation of the CEA.

Lot 61

The deed notice filed by the property owner (City of Newark) indicates there is potential for encountering contaminated historic fill beneath Building #6 on Lot 61 (Figure 2-2). The concrete building slab is identified as an engineering control. The Responsible Party associated with the deed notice is Honeywell, successor to BBI. The deed notice identifies contaminants associated with the historic fill as being VOCs and metals. The New Jersey PI number is G0000005586.

Lot 63

A 2008 deed notice identifies two areas on Lot 63 beneath the footprint of Building #7 on the north and east sides as being potentially impacted by historic fill, with the building slab acting as an engineering control (Figure 2-2). Honeywell is the Responsible Party for maintaining the engineering control. The New Jersey PI number is G0000005586.

Lot 67

The southwestern portion of Lot 67 is under a groundwater CEA and deed notice with engineering controls to address groundwater impacts and soil/fill contamination related to historic fill and a Lot 68 PCE spill (Figure 2-2). Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586.

Lot 68

Lot 68 is a New Jersey known contaminated site (NJDEP Case No. 88434). A deed notice with an engineered asphalt/concrete cap is present related to shallow soil/fill impacts of arsenic, lead, PCE, TCE, and zinc. There is also a groundwater CEA covering *cis*-1,2-DCE, *trans*-1,2-DCE, PCE, TCE, and vinyl chloride (Figure 2-2). Honeywell is responsible for maintaining the CEA as well as the engineering controls. The New Jersey PI number is G0000005586.

Lot 69

An abandoned off-site petroleum bulk storage facility to the north of Lot 69 has a CEA that extends onto Lot 69. The CEA is for benzene; however, benzene was below the NJDEP GWQS in the on-site portion of the CEA area during the RI.

Lot 70

Lot 70 May 1998 DER was terminated and replaced by a deed notice recorded on December 4, 2014, restricting the Site to non-residential use only. In August 2014 engineering controls (4-inch-thick asphalt cap over the entire exterior of the parcel) were installed and are included in the deed notice. A 2010 historic fill CEA (arsenic, barium, benzene, cadmium, lead, and zinc) was established for Lot 70.

2.7 Fate and Transport

VOCs, SVOCs (represented by PAH compounds and PHCs), metals, PCB aroclors, and TCDD have been detected in soil/fill and groundwater.

Biodegradation of some compounds like VOCs is rapid. SVOCs and metals at the Site are less susceptible to degradation and, therefore, are relatively persistent in the environment. The RI did not include a monitored natural

attenuation (MNA) study at the Site. In addition to biodegradation, the chemical solubility, volatility, and its tendency to absorb to soil/fill, all affect the fate and movement through soil/fill and groundwater.

Potential transport interactions at the Site include the following:

- Overland stormwater
- UST contents to groundwater
- Soil to groundwater
- One sewer manhole to soil/groundwater
- Groundwater - surface water interaction
- River - site soil interaction
- Soil gas to indoor air
- Soil to airborne dust
- One sewer pipe (P57-1)

Additional details on fate and transport are provided in RIR Section 5.

2.8 Risk Assessments

The BHHRA and SLERA for the Site were prepared by Ramboll and provide the full details on these assessments. Both risk assessments were performed without consideration of existing or planned engineering and institutional controls.

To summarize the risk assessments, response actions are being evaluated for unacceptable human health risks and will address copper (Lot 63), lead (Lots 1, 61, 62, 63, 64, 65, 68, and 70), VOCs (Lots 58 and 68), and naphthalene (Lot 62) contamination, and the response action for these contaminants and areas will consider the potential ecological risk identified in the SLERA. Additional response actions will be evaluated for Lot 67 and Lot 69, where there were no estimated human health risks above the USEPA risk limits, but the SLERA identified unacceptable ecological risk with hazard quotients (HQs) greater than 1 in surface soil/fill (refer to Figure 8-1). Lastly, as described in more detail in Section 3.4, this FS includes a comparison of Site COPC concentrations across the Site to ARARs, including point by point comparisons to delineate functional areas, and compliance averaging within those delineated areas, as appropriate.

Human Health Risk Assessment Summary

The significance of potential exposures to concentrations of COPCs in soil/fill, indoor air, and groundwater was evaluated based on estimates of reasonable maximum exposure (RME) under current and potential future land use at the Site. The significance of potential exposures was determined by comparing estimates of cumulative cancer risks to the National Contingency Plan (NCP) risk range (10^{-4} to 10^{-6}) and non-cancer hazard indices (HIs) to the protection goal of 1.

Under current land use, the potentially exposed populations at and around the Site are assumed to include outdoor workers (only at occupied Lots 1, 57, 59, 60, 62, 69, and 70), indoor workers (only at occupied lots), utility workers, construction workers (only at lots slated for redevelopment in the near future, which are Lots 57, 58, 61, 63, 64, 68, and 70), trespassers, visitors (only at occupied lots), and off-site workers and residents (via wind transport).

Under future commercial/industrial land use, the potentially exposed populations at and around the Site are assumed to be the same as those for current land use except that exposures to impacted media within each of the 15 properties, regardless of whether currently developed or not, is evaluated for all receptors (i.e., receptors may be present at

redeveloped lots). The potentially exposed populations at and around the Site are assumed to include outdoor workers, indoor workers, utility workers, construction workers, trespassers, visitors, off-site workers (via wind transport and future shallow groundwater migration), and off-site residents (via wind transport).

As required by USEPA, in addition to the above scenarios evaluated assuming the continued foreseeable use of the Site for commercial/industrial purposes, the BHHRA includes a future hypothetical residential scenario which assumes the Site will be redeveloped and have medium-density residential units. Additionally, hypothetical potable shallow and deep groundwater use is evaluated for on- and off-site workers, visitors and residents to facilitate development of appropriate institutional controls for the Site.

Any COPC in soil/fill under a current and/or future commercial/industrial land use that has cumulative cancer risks greater than the NCP risk range (10^{-4} to 10^{-6}), or non-cancer HIs greater than the protection goal of 1, or for lead, exceedance of 800 mg/kg (USEPA Region 2 non-residential screening level) or greater than a 5 percent probability that estimated blood lead levels are above 5 microgram per deciliter (µg/dL), is retained for further evaluation under a current and/or future scenario. These conclusions remain the same for the future land use scenario in which soil/fill below the 0 to 2 ft. depth interval (or 0 to 4 ft. depth interval for utility worker) may be brought to the surface in the course of site redevelopment, except for the select points with elevated concentrations of lead identified in the BHHRA outlier analysis. This analysis identified three locations from Lot 64 (B-75 at 1 to 3 feet bgs of 8,690 mg/kg, B-74 at 3 to 4 feet bgs of 3,080 mg/kg, and B-70 at 5 to 7 feet bgs of 3,020 mg/kg, which are adjacent to Lot 63) that could affect the conclusions of the risk assessment for a future outdoor worker and trespasser exposure to lead in soil/fill from the subsurface that may be brought to the surface during site redevelopment. Although prolonged exposure to these locations in isolation is not anticipated, they are retained for further evaluation in the FS.

The following table lists soil/fill COPCs and receptors under current and future conditions that were retained for evaluation in this FS. These are presented for both lots associated with excess risk as well as specific points identified in the BHHRA outlier analysis associated with excess risk.

Lot	Receptor	COPC	Lead Exceeded Action Level or Blood Lead Level
Current Scenarios			
1	Visitors	Lead	Blood Lead Level
61	Construction worker	Lead	Blood Lead Level
62	Visitors	Lead	Blood Lead Level
63	Trespasser	Lead	Both
	Construction worker		Both
	Utility worker		Action Level
64	Construction worker (outlier locations B-70, B-74, B-75)	Lead	Blood Lead Level
	Trespasser (outlier/hot spot locations B-70, B-74, B-75)		Hot Spot
68	Construction worker	Lead	Blood Lead Level
70	Construction worker	Lead	Both
	Trespasser		Both
	Outdoor worker		Both
	Visitor		Blood Lead Level
	Indoor worker		Action Level
	Utility worker		Action Level

Lot	Receptor	COPC	Lead Exceeded Action Level or Blood Lead Level
Future Scenarios			
1	Visitor - child	Lead	Blood Lead Level
58	Indoor worker (vapor intrusion)	TCE, xylenes	--
61	Construction worker	Lead	Blood Lead Level
62	Indoor worker (vapor intrusion)	Naphthalene	--
	Construction worker, visitor - child	Lead	Blood Lead Level
	Visitor - child	Lead	Blood Lead Level
63	Outdoor worker	Lead	Both
	Indoor worker (dust)		Both
	Trespasser		Both
	Construction worker		Both
	Visitor - child		Both
	Utility worker		Action Level
	Visitor - child	Copper	--
64 (outlier locations B-70, B-74, B-75)	Construction worker	Lead	Blood Lead Level
	Visitor - child		Blood Lead Level
	Outdoor worker		Outlier
	Trespasser		Outlier
65	Construction worker	Lead	Blood Lead Level
	Visitor - child		Blood Lead Level
68	Construction worker		Blood Lead Level
	Visitor - child	Lead	Blood Lead Level
	Indoor worker (vapor intrusion)	TCE	--
70	Outdoor worker	Lead	Both
	Trespasser		Both
	Construction worker		Both
	Visitor - child		Both
	Indoor worker		Action Level
	Utility worker		Action Level

Risks associated with potable use of shallow and deep groundwater, if to occur in the future, are also unacceptable. Although groundwater is designated as Class IIA, future potable use of shallow groundwater at the Site is not expected, since the Site and surrounding area are served by the City of Newark's potable water system, and the site-specific conductivity readings of the shallow groundwater indicate possible brackish conditions. However, as described in more detail in Section 3.7.3, PRGs, in the form of ARARs, were identified for all of the groundwater COPCs with hypothetical risk, and response actions to address these groundwater risks were identified in this FS.

Screening Level Ecological Risk Assessment

The SLERA used the site characterization data that were collected during the RI to assess potential risks to ecological receptors that may be exposed to Site-related constituents in surface soil/fill. Only samples within or adjacent to areas identified as within potential ecological habitat were included in this SLERA.

Findings of the SLERA are as follows:

- Approximately 70 percent of the Site is covered with impervious surfaces, and <20 percent of this Site is pervious and may support potential ecological habitat. Some areas within the pervious portion have developed fragmented and low-value ecological habitat populated with mostly opportunistic, invasive, and transient species, such as Japanese knotweed.
- Terrestrial exposure pathways for plants, soil invertebrates, birds, and mammals are potentially complete for a small portion of the Site. Primary exposure pathways include direct contact (e.g., plant roots and soil invertebrates), soil ingestion (e.g., earthworms), incidental soil ingestion (e.g., preening), and prey ingestion. For wildlife, prey ingestion is assumed to dominate exposure.
- Due to the limited, fragmented, and low-quality ecological habitat available on-site and the proximity to active industrial and commercial operations, it is unlikely that Federal- or state-listed sensitive species would be present on-site.
- Selected receptors of interest for the SLERA consisted of terrestrial plants, soil-associated invertebrates, and terrestrial-feeding birds and mammals.
- Assessment endpoints for the SLERA consisted of maintenance of the current: (1) community structure and function level for plants and invertebrates; and (2) survival and reproduction levels for terrestrial-feeding birds and mammals. Exposure point concentrations (EPCs) used in the SLERA were the maximum concentrations of chemicals detected in surface soil locations within or adjacent to areas identified as within potential ecological habitat.
- Measurement endpoints for the SLERA were New Jersey ecological screening criteria (ESCs). Maximum concentrations of constituents in surface soils were compared to ESCs, and constituents with maximum concentrations higher than ESCs were identified as chemicals of potential ecological concern (COPECs) requiring further investigation.

The SLERA identified the following COPECs in surface soil:

- VOCs: acetone, chloroform, cumene, cyclohexane (no criteria), ethyl benzene, 2-hexanone, methyl acetate (no criteria), methylcyclohexane (no criteria), toluene, TCE, and total xylenes.
- SVOCs: PAHs (both low and high molecular weight), benzaldehyde (no criteria), 1,1-biphenyl, carbazole, dibenzofuran, bis(2-ethylhexyl)phthalate, butylbenzylphthalate, dimethylphthalate, and di-n-butylphthalate.
- Pesticides: heptachlor epoxide.
- PCBs and dioxins: total PCBs and Aroclor 1254, Aroclor 1260, and Aroclor 1262, and dioxins exceeded ESCs.
- Metals: antimony, barium, cadmium, chromium, cobalt, copper, cyanide, iron (no criteria), lead, manganese, mercury, nickel, selenium, vanadium, and zinc.

Although several COPECs have been identified in this SLERA, the likely future use of this Site is to remain developed for commercial/industrial purposes. As such, the eight currently occupied lots have indicated their intention to continue current commercial and industrial uses, and the remaining seven lots are expected to be redeveloped for

commercial/industrial use in the near future. The industrial nature of the Site limits the amount of available ecological habitat, as well as influences the quality of that habitat. Redevelopment of any portion of the Site will remove or alter the existing ecological resources in that area.

While the findings of the SLERA identified the potential for unacceptable ecological risk, no additional ecological investigation is needed, provided that the proposed remedial alternatives will address the COPECs associated with HQs greater than 1 in surface soil/fill, and that remediation goals that are protective of ecological receptors are used. Additional response actions will be evaluated for Lot 67 and Lot 69, where the SLERA identified unacceptable ecological risk with HQs greater than 1 in surface soil/fill but excess risks for human health were not observed. Below is the list of COPECs for these two undeveloped parcels based on exceedances of ESCs.

ECOLOGICAL COPECs

Volatile Organic Compounds (VOCs)

- Cumene
- Ethyl Benzene
- 2-Hexanone
- Toluene
- 1,1,1-Trichloroethane
- Xylenes (total)
- PAHs (High MW)
- Benzo(a)anthracene
- Benzo(a)pyrene
- Benzo(b)fluoranthene
- Benzo(g,h,i)perylene
- Benzo(k)fluoranthene
- bis(2-Ethylhexyl)phthalate
- Carbazole
- Chrysene
- Dimethylphthalate
- Di-n-butylphthalate
- Fluoranthene
- Indeno(1,2,3-cd)pyrene
- Pyrene

Polychlorinated Biphenyls (PCBs)

- PCBs (total)
- Aroclor-1254
- Aroclor-1260
- Aroclor-1262

Inorganics

- Aluminum
- Antimony
- Barium
- Cadmium
- Chromium (total)
- Chromium VI
- Copper
- Cyanide (total)
- Lead
- Manganese
- Mercury
- Nickel
- Selenium
- Vanadium
- Zinc

Additional Chemicals

- 2,3,7,8-Tetrachlorodibenzo-p-dioxin

2.9 Reuse Assessment

The reuse assessment involved collecting and evaluating information to develop assumptions regarding the types or broad categories of reuse that might reasonably occur at a Superfund Site (e.g., residential, commercial/industrial, recreational, and ecological), so that cleanup standards and remedies can be tied to reasonably expected future land

use. The findings of the reuse assessment indicated that both the current and reasonably anticipated future land use at the Site are consistent with industrial, non-residential uses.

2.10 Cultural Resource Survey

The findings of the Phase 1A Cultural Resource Survey (CRS; NV5, Inc., 2017) indicated that no archaeological resources that might meet the evaluation criteria for inclusion in the National Register are present within the Site. No further archaeological study is recommended.

2.11 Response Action Evaluations

Based on the risk assessments and ARAR compliance, response actions for those media potentially posing unacceptable human health risks and/or risks to the environment will be evaluated in the FS. In addition, waste is a non-environmental media that will also be addressed in the FS as potential source material.

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3. OBJECTIVES AND REQUIREMENTS OF SITE REMEDIATION

This section introduces the requirements and objectives that remedial actions are to achieve and the risk-based selection of target areas for remediation. In addition, concentrations of COPCs in soil/fill and groundwater were compared to numeric ARARs, including the New Jersey Nonresidential Direct Contact Soil Remediation Standards (NRDCSRS) and NJDEP GWQS, and USEPA's MCLs and NJDEP MCLs for groundwater. NJDEP VISL are to be considered (TBC) and are compared separately to groundwater concentrations. These comparisons, which were performed as an additional evaluation in this FS, are provided in Section 3.4. RAOs specify how the cleanup will protect human health and the environment and serve as the basis for the development of remedial action alternatives. The process of identifying the RAOs follows the identification of affected media, contaminant characteristics, contaminant migration, exposure pathways, and receptor exposure limits. To achieve the RAOs, PRGs are developed as the benchmarks for the technology screening process and the assembly, screening, and detailed evaluation of alternatives.

3.1 Identification of Site-Related Contaminants

Several contaminants were identified as COPCs in the BHHRA and COPECS in the SLERA. These COPCs and COPECs pose unacceptable human health and/or ecological risks under current and/or future use scenarios, are addressed in the FS and are listed below. Identification of other COPCs by comparison to ARARs and TBC is provided in Section 3.4.

3.1.1 Soil/Fill

On select lots, RIR and BHHRA findings indicate that copper, lead, naphthalene, TCE, and xylenes are the site-related soil/fill COPC that pose unacceptable human health risks under current and/or future use scenarios. In the case of lead, which is a naturally occurring metal, the source of elevated concentrations is likely historical fill, which may also have been impacted by operations releases and illegal dumping. Defining the fraction of lead concentrations associated with natural conditions, historical fill, or a release(s) was not an RI objective. The presence of these contaminants in soil/fill on remaining lots was also evaluated to determine the potential need for response actions.

As listed in the BHHRA and shown on Figure 2-6, lead is a COPC that has unacceptable risks/hazards on Lots 1, 61, 62, 63, 64, 65, 68, and 70.

Copper associated with unacceptable human health (future visitor child) and ecological risk is collocated with lead-impacted soil (Lot 63).

Naphthalene, TCE, and xylenes are soil/fill COPCs associated with soil gas (Section 3.1.3).

3.1.2 Groundwater

As stated in the RIR, groundwater is not currently used for potable water and is not reasonably expected to be used as a potable source in the future. However, the aquifer underlying the Site is classified by NJDEP as Class IIA, regardless of whether the groundwater is currently being used as a potable source However, hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of facilitating development of appropriate institutional controls. Table 3-1 presents a list of shallow and deep groundwater COPCs identified in the BHHRA. Results of the BHHRA indicated cumulative hazard and risk for a hypothetical potable use scenario above USEPA risk limits.

3.1.3 Soil Gas

Results of the BHHRA indicate that soil/fill concentrations of naphthalene, TCE, and xylenes potentially present unacceptable risks to future indoor workers from potential soil gas intrusion (modelled from soil/fill concentrations) on three lots (Lots 58, 62, and 68), should these currently vacant areas be subject to improvement via construction of new buildings or occupation of existing vacant buildings. The presence of these contaminants in soil/fill on remaining lots was also evaluated to determine the potential need for response actions.

3.1.4 Sewer Water

Manhole 8 is an inactive sewer that consists of nine, 4-inch diameter steel pipe terminations. Only one of the pipes (Line L) is not blocked. Concentrations of TCE, methylene chloride, benzo(a)pyrene, lead, and manganese were detected in water from Manhole 8 on Lot 1. Sewer water is currently contained within Manhole 8 and was not quantitatively addressed by the BHHRA.

3.2 ARARs and TBCs

ARARs and numeric PRGs are components of the RAOs. As appropriate, TBCs can be used to develop PRGs in the absence of ARARs. This section describes these terms and their implications for RAO and GRA development and subsequent alternatives analysis.

The national goal of remedy selection is to protect human health and the environment, to maintain that protection over time, and to minimize untreated waste (40 Code of Federal Regulations [CFR] Part 300.430 of the NCP). In accordance with Section 121(d) of CERCLA, 42 U.S.C. § 9621, site remediation must comply with all applicable or relevant and appropriate laws, regulations, and standards promulgated by the federal government, except where waived. Substantive state environmental and facility siting requirements must also be attained, under Section 121(d)(2)(c) of CERCLA, 42 U.S.C. § 9621, if they are legally enforceable and consistently enforced statewide, and if the state standard is more stringent than the federal standard. If a state is authorized to implement a program in lieu of a federal agency, state laws arising out of that program provide the "applicable" standards. However, federal standards of that program that are more stringent may be considered "relevant and appropriate." TBCs are non-promulgated guidance and policy documents, advisories, and other criteria that do not have the enforcement status of ARARs but support the development and evaluation of remedial alternatives. While TBCs are not promulgated or enforceable, TBCs may be consulted to interpret ARARs or to establish PRGs when ARARs do not exist for particular contaminants or do not sufficiently eliminate identified risks.

Section 121(e) of CERCLA, 42 U.S.C. § 9621, also codified in the NCP at 40 CFR Part 300.400(e), exempts any response action conducted entirely on site from having to obtain federal, state, or local permits, where the action is carried out in compliance with Section 121. Remedial actions conducted on CERCLA sites need to comply only with the substantive aspects of laws that qualify as ARARs and not with the corresponding administrative requirements.

As defined by the NCP, ARARs are placed into two classifications: applicable requirements and relevant and appropriate requirements. The two classifications are defined as follows:

- Applicable requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site. State standards that are more stringent than federal requirements may be applicable.
- Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility

siting laws that, while not applicable to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances at a CERCLA site, address problems or situations sufficiently similar (relevant) to those encountered at the CERCLA site that their use is well suited (appropriate) to the particular site.

The term "relevant" was included so that a requirement initially screened as non-applicable because of jurisdictional restrictions could be reconsidered and, if appropriate, included as an ARAR for a given site. For example, MCLs would not be applicable, but are relevant and appropriate for a site with groundwater contamination in a potential (as opposed to an actual) drinking water source. A requirement may be either "applicable" or "relevant and appropriate," but not both. There are three categories of ARARs: chemical-specific, location-specific, and action-specific.

- Chemical-specific ARARs are numeric values that provide criteria for evaluating concentrations of specific hazardous contaminants and are developed based upon protection of human health and the environment. These values establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment. Chemical-specific ARARs provide a basis for the development of numerical PRGs. For the purpose of this FS, chemical specific ARARs include New Jersey soil and groundwater standards, NJDEP MCLs and USEPA MCLs (Table 3-1).
- Location-specific ARARs serve to protect individual characteristics, resources, and specific environmental features, such as wetlands, water bodies, floodplains, and sensitive ecosystems. Location-specific ARARs may affect or restrict remediation and appurtenant activities. The general types of location-specific requirements that may be applied to the Site include floodplain and waterfront development regulations.
- Action-specific ARARs are technology- or activity-based requirements of activities or processes, including storage, transportation, and disposal methods of hazardous substances as well as construction of facilities or treatment processes. Action-specific ARARs are defined by the components of a potential remedy and will be discussed as appropriate for each remedial alternative during detailed evaluation of alternatives.

The identification of ARARs began during the initial scoping of RAOs and GRAs and is completed during alternatives development. Tables 3-2, 3-3 and 3-4 lists ARARs and TBCs for the Site by each of the three categories described above. TBCs include non-promulgated criteria, advisories, guidance, screening levels, and proposed standards issued by Federal or State governments. TBCs are not potential ARARs because they are neither promulgated nor enforceable.

In August 2016, USEPA issued a memorandum titled "Consideration of Greener Cleanup Activities in the Superfund Cleanup Process" that provides guidance on the use of Green and Sustainable Remediation in the CERCLA site remediation process. The memorandum states that "In addition to ensuring that CERCLA response actions are protective of human health and the environment, the Agency may consider a number of factors when evaluating remedial action alternatives, including response actions' potential environmental impacts, mitigative measures' effectiveness and reliability during implementation, and innovative technologies' use."

3.3 Statutory Waivers for ARARs

CERCLA Section 121 (d) provides that under certain circumstances an ARAR may be waived. The six statutory waivers are as follows:

- **Interim Measure:** Occurs when the selected remedial action is only part of a total remedial action that will attain ARARs when completed.
- **Greater Risk to Health and the Environment:** Occurs when compliance with such requirements will result in greater risk to human health and the environment than noncompliance.

- **Technical Impracticability:** Occurs when compliance with such requirements is technically impracticable from an engineering perspective.
- **Equivalent Standard of Performance:** Occurs when the selected remedial action will provide a standard of performance equivalent to that required under the otherwise applicable standard, requirement, criteria, or limitation through use of another method or approach.
- **Inconsistent Application of State Requirements:** Occurs when a state requirement has been inconsistently applied in similar circumstances at other remedial actions within the state.
- **Fund-Balancing:** Occurs when, in case of an action undertaken using Superfund resources, the attainments of the ARAR would entail extremely high costs relative to the added degree of reduction of risk afforded by the standard such that remedial actions at other sites would be jeopardized.

3.4 Chemical-Specific ARAR Evaluation

This section compares contaminants that were identified at the Site, but that do not necessarily give rise to unacceptable risk, to ARAR values to identify any additional COPCs for further evaluation in this FS. Detected soil/fill and groundwater constituents site-wide were elevated with respect to chemical specific ARARs. New Jersey NRDCSRS are soil/fill ARARs, and the lowest value of NJDEP GWQS and MCLs and USEPA's MCLs are groundwater ARARs, used for the ARAR compliance evaluation. Because the Site is non-residential/industrial and projected future use remains unchanged, NRDCSRS was used as the soil/fill ARAR.

Compliance determination was undertaken in accordance with NJDEP Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria (September 24, 2012). Soil/fill ARAR evaluation was a two-step process. Step 1 was the determination of each point above chemical-specific ARARs. Step 2 was applying compliance averaging to the delineation areas defined by single-point compliance. Delineation to ARARs was primarily based on RI soil/fill results and existing features (i.e., buildings) for each soil/fill parameter above its ARAR. For delineation to ARAR, historical borings locations typically were not used because historical locations were interpreted from historical reports with unknown location accuracy which results in uncertainty to actual location. Because historical data are not of known quality, it was not used in compliance averaging. Because of this uncertainty, remedial design samples based on RI locations and results will be used to refine the selected soil/fill alternative areas.

For compliance averaging, soil/fill sample results were divided into two vertical zones (0 up to 2 feet and equal to or greater than 2 feet) per NJDEP guidance. Zone designation for samples is based on the shallowest depth interval for each sample. Data used for delineation and within a delineation area are utilized in the evaluation. Each vertical zone with an ARAR exceedance in a delineation area was compared to ARARs. Table 3-5 summarizes ARAR compliance findings.

For groundwater, single-point compliance was used to evaluate compliance with the ARAR. The most recent groundwater results were used. When the remedial design occurs, groundwater quality will be updated and remedial design results will be used to revise the ARAR comparison, as necessary, for the selected groundwater alternative.

Fill material is present in surface soils throughout the Site and in subsurface soils where historical filling was conducted to reclaim land from the Passaic River. This material is considered "historic fill" as it complies with the NJDEP definition of historic fill. Historic fill in some areas appears to have been impacted due to historical and/or current operations and chemical/waste handling at the Site. The source of soil/fill contaminants depends on area and contaminants and is likely due to historic fill, past/current operations (spills/releases), and illegal disposal. Lower portions of the fill are saturated as evidenced by groundwater depths that are typically less than 6 feet below grade. Defining the fraction of impacts associated with natural conditions, pre-placement of contaminated fill, or a release(s) was not an RI objective. Groundwater contains many of the typical historic fill contaminants including but not limited to lead, arsenic,

benzo(a)pyrene, iron, and manganese. Due to these factors, development of a site-specific IGWSSL and subsequent IGWSSL ARAR comparison was not warranted.

3.4.1 Soil/Fill

Individual soil/fill results for a single sample location were compared to applicable chemical-specific ARARs, and the table below summarizes locations where exceedances were observed. Note that the specific delineation areas that contain these exceedances are provided in the referenced Appendix A figures.

COPC	ARAR (mg/kg)	ARAR Exceedance Figure	ARAR Exceedance Delineation Figure
Arsenic	19	3-1	A-1
Benzene	5	3-2	A-2
Benzo(a)anthracene	17	3-3	A-3
Benzo(a)pyrene	2	3-4	A-4
Benzo(b)fluoranthene	2	3-5	A-5
Dibenz(a,h)anthracene	2	3-6	A-6
Lead	800	3-7	A-7
Manganese	5,900	3-8	A-8
Naphthalene	17	3-9	A-9
PCB-1254	1	3-10	A-10
PCB-1260	1	3-11	A-11
PCB-1262	1	3-12	A-12
Vinyl Chloride	2	3-13	A-13

As shown in Appendix A, delineation area boundaries were not confined to lot boundaries. Table 3-5 summarizes ARAR compliance via the steps outlined above.

Based on compliance averaging findings, PCB-1254, PCB-1262, manganese, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(a)anthracene, vinyl chloride and naphthalene are in compliance with applicable ARARs.

The following COPCs exceed applicable ARARs:

- Arsenic – 2 delineation areas (one surface, one subsurface),
- Lead – 4 delineation areas (two shallow, two subsurface),
- Benzene – 1 delineation area (subsurface only),
- Benzo(a)pyrene – 7 delineation areas (five surface, two subsurface), and
- PCB-1260 – 1 delineation area (subsurface only).

3.4.2 Groundwater

The most recent concentrations of VOCs, SVOCs, and metals detected in groundwater were compared to ARARs. Table 3-6 summarizes ARAR exceedances in groundwater. The ARAR was the lower of NJDEP GWQS, New Jersey MCLs, and USEPA MCLs. Although groundwater is designated as Class IIA, potable use of shallow groundwater at the Site is unlikely since the Site and surrounding area are served by the City of Newark's potable water system, and the site-specific conductivity readings of the shallow groundwater indicate possible brackish conditions.

Regardless, these ARAR comparisons were performed to assist in evaluating potential response actions to meet RAOs.

Shallow Fill Unit

Shallow fill groundwater ARAR exceedances in the most recent groundwater samples are shown on the following figures:

Figure 3-14: 1,1,2-TCA Groundwater Sampling Results - Fill Unit
Figure 3-15: 1,4-Dioxane Groundwater Sampling Results - Fill Unit
Figure 3-16: Acetone Groundwater Sampling Results - Fill Unit
Figure 3-17: Antimony Groundwater Sampling Results - Fill Unit
Figure 3-18: Arsenic Groundwater Sampling Results - Fill Unit
Figure 3-19: Benzene Groundwater Sampling Results - Fill Unit
Figure 3-20: Benzo(a)pyrene Groundwater Sampling Results - Fill Unit
Figure 3-21: Cadmium Groundwater Sampling Results - Fill Unit
Figure 3-22: Benzo(a)anthracene Groundwater Sampling Results - Fill Unit
Figure 3-23: Ethyl Benzene Groundwater Sampling Results - Fill Unit
Figure 3-24: Indeno(1,2,3-cd)pyrene Groundwater Sampling Results - Fill Unit
Figure 3-25: Lead Groundwater Sampling Results - Fill Unit
Figure 3-26: m,p-Xylene Groundwater Sampling Results - Fill Unit
Figure 3-27: Methyl ethyl ketone Groundwater Sampling Results - Fill Unit
Figure 3-28: p-Cresol Groundwater Sampling Results - Fill Unit
Figure 3-29: Pentachlorophenol Groundwater Sampling Results - Fill Unit
Figure 3-30: Toluene Groundwater Sampling Results - Fill Unit

The following COPCs were not detected in the most recent groundwater samples but were previously detected above ARARs:

- 1,2-Dibromo-3-chloropropane
- 1,1,2,2-Tetrachlorothane
- TCE
- Aluminum
- Nickel
- 1,3-Dichloropropene (trans)
- Methylene chloride
- Vinyl chloride
- Barium
- Selenium
- 2-Hexanone
- Tetrachloroethene
- 2-Methylnaphthalene
- Beryllium

The detection of aluminum, iron, manganese, and sodium above ARARs was widespread in the most recent sample results.

The BHHRA vapor intrusion modeling indicated that there were no unacceptable health risks/hazards. A comparison of the most recent shallow groundwater concentration to NJDEP's VISLs Guidance identified benzene, ethylbenzene,

and total xylenes above NJDEP groundwater screening levels. VISLs are a TBC. 1,3-Dichloropropene (total), TCE, and vinyl chloride also were detected above exceeded groundwater screening in older RI groundwater samples.

Deep Unit

In the deep unit, 1,1,2-TCA (Figure 3-32), PCE (Figure 3-33), benzo(a)anthracene (Figure 3-32), 1,1,2,2-tetrachloroethane (Figure 3-33), benzene (Figure 3-34) and 1,4-dioxane (Figure 3-34) exceeded ARARs. The deep groundwater was only sampled once in the RI. The deep unit exceedances were at lower concentrations than the shallow fill unit. Metals above ARARs were the fill-related metals described above (iron, arsenic, manganese, and sodium). Lead was not detected above its ARAR (5 µg/L) in the deep unit (Figure 3-34).

3.5 Identification of Contaminated Media

Based on the results of the RI, BHHRA, and SLERA, as well as the comparisons to ARARs performed in the previous section, risks to human health, welfare, and the environment posed by the identified COPCs in waste, soil/fill, soil gas, groundwater, and sewer water may warrant the need for remedial action.

3.5.1 Waste

As discussed in the RIR, "waste" includes containerized waste, LNAPL in USTs and Building #15A, and solids in Manhole 8, and only acts as a potential source material if released into the environment. With the exception of solids in Manhole 8, wastes are addressed by remedial alternatives (Section 5.1). LNAPL in a UST is considered to constitute a principal threat waste. Manhole 8 solids are addressed in conjunction with sewer water (Section 3.5.5). LNAPL-impacted soil/fill adjacent to the USTs is managed with the waste remedial alternatives (Section 5.1).

Based on results for water in Building #15 and the contents in the active sewer system, neither is classified as a potential source material or principal threat waste. Sumps in Building #17 and former Building #4 collect precipitation. Based on the RI results and the source of water in sumps, the sump contents do not require remedial action. Building #2 sump is an active water control measure for the Buildings #2 and #3 basements which are occupied. Because the sump water is pumped into a pipe connected to the Passaic Valley Sewer Commission (PVSC) system, this sump is not subject to remedial action.

LNAPL-impacted soil/fill not directly associated with a UST is also discussed in Section 3.5.2 and the corresponding Soil/Fill Alternatives (Section 5.2). LNAPL in USTs is considered to constitute a principal threat waste.

3.5.2 Soil/Fill

Soil/fill in select areas contain site COPCs in surface and subsurface soil/fill that exceed ARARs (Section 3.4.1) and/or pose unacceptable risks per the BHHRA or SLERA (Section 3.1.1). Some site contaminants, including metals and PAHs, are commonly found in historic fill and urban soil. COPCs from the BHHRA and/or ARAR non-compliance are lead, copper, PCB-1260, benzo(a)pyrene, arsenic, benzene, naphthalene, m,p- xylenes, and TCE. PRGs are developed for these soil/fill COPCs (total xylenes) to ensure that remedial alternatives are protective of human health and the environment and comply with CERCLA requirements (Section 3.7.2). Soil/fill containing these COPCs in delineated areas failing ARAR compliance or presenting unacceptable human health or ecological risks is a contaminated medium addressed by remedial alternatives (Section 5.2).

Lot 64 soil/fill where LNAPL (residual petroleum waste) was observed is a contaminated medium addressed in Section 5.2. Per RAOs (Section 3.6), the potential off-site movement of soil/fill is a pathway to be addressed in Section 5.2.

Surface soil/fill due to potential ecological risk on Lots 67 and 69 is a medium to be addressed in the FS. Ecological COPECs are listed in Section 2.8.

3.5.3 Groundwater

As stated in the RIR, groundwater use is not reasonably expected in the future. However, hypothetical future potable use of groundwater is presented in the BHHRA for the purpose of ensuring that the FS includes remedial action to prevent potable use. Groundwater is classified by NJDEP as Class IIA groundwater. Based on the hypothetical future potable use, the COPCs listed in Table 3-1 result in groundwater being a medium addressed in FS alternatives.

COPCs were also identified based on concentrations compared to applicable groundwater ARARs. As presented in Section 3.4.2, COPCs implicate groundwater as a medium of interest. Many of these COPCs are the same chemicals as listed above for hypothetical future potable use. Some of the ARAR COPCs that are due to historic fill or brackish tidal water (iron, manganese, sodium) will be addressed via institutional controls. Potential groundwater response actions are addressed in Section 5.3.

A comparison of the most recent shallow groundwater concentration to NJDEP's VISLs Guidance identified benzene, ethylbenzene, and xylenes (total) above NJDEP groundwater screening levels. These chemicals are to be considered by FS alternatives.

3.5.4 Soil Gas

Soil/fill associated with COPCs presenting unacceptable risks due to potential indoor vapor intrusion for future indoor workers as identified from the BHHRA on Lots 58, 62, and 68 is addressed in Section 5.5. The results of additional evaluation of soil/fill with respect to soil gas consideration is presented in Section 5.5. The NJDEP Vapor Intrusion Technical Guidance (VIT) found at [HYPERLINK "https://www.state.nj.us/dep/srp/guidance/vaporintrusion/"] is a TBC for soil gas.

3.5.5 Sewer Water

The Manhole 8 sewer water along with solids (Section 3.5.1) are media addressed in Section 5.4. The Lot 57 sewer wall pipe and shallow groundwater (MW-118) contained COPCs (acetone) above ARAR. The remediation of Lot 57 is being conducted under NJDEP via a Licensed Site Remediation Professional (LSRP) outside of the FS. The NJDEP assigned case number via the NJDEP Hotline is 20-04-05-0923-04.

The remediation activities are being conducted by the person responsible for remediation (Lot 57 owner/operator). LSRP is to communicate and work with USEPA on Lot 57 remedial action. USEPA through NJDEP is to approve of any work.

3.6 Remedial Action Objectives and General Response Actions

Medium-specific RAOs have been developed to mitigate potential site-related health risks, and corresponding GRAs have been identified that could potentially satisfy the RAOs. The medium-specific RAOs focus on the specific areas and regulated substances to which exceedances of USEPA's target risk criteria are attributed.

In accordance with CERCLA guidance (Land Use in the CERCLA Remedy Selection Process, OSWER Directive No. 9355.7-04), RAOs and remedial alternatives should be developed to achieve cleanup levels that are consistent with the reasonable anticipated future land use over as much of the Site as possible. Because the Site is located within a dedicated industrial zone where residential use is prohibited and current owners and operators have expressed no intent in changing use, land use is expected to remain non-residential for the foreseeable future. Accordingly, RAOs and GRAs have been drafted using the results of the RIR, BHHRA and SLERA to address those media posing risk to

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human health, welfare, or the environment that are consistent with anticipated future site use for non-residential purposes. A deed recording prohibiting such residential use would need to be implemented to enforce use restrictions.

Results of the SLERA indicate that risks to ecological site receptors that exceed screening thresholds will be addressed via remedial actions designed to protect risks to human health. Additionally, there are two lots (67 and 69) that will require consideration of remedial actions to address risks specific to ecological receptors from surface soil/fill. RAOs and GRAs for each medium of interest are summarized below.

REMEDIAL ACTION OBJECTIVES AND GENERAL RESPONSE ACTIONS

Media of Interest	RAO	GRA
Wastes	Secure or remove wastes to the extent practicable to prevent human and ecological exposures.	No Action Removal Disposal
	Prevent uncontrolled movement of wastes (i.e., spills and free-phase liquid) to environmental media.	
	Minimize or eliminate human and ecological exposure to waste materials.	
Soil/Fill	Remove or minimize COPC concentrations and eliminate human exposure pathways to COPCs in soil/fill material.	No action Institutional controls/ access restrictions Engineering controls Treatment Removal Disposal
	Remove or minimize COPEC concentrations and eliminate or minimize ecological exposure pathways to COPECs in surface soil/fill material.	
	Prevent or minimize off-site transport of soil/fill containing COPCs to minimize the potential for interaction between the Site and the Passaic River.	
	Prevent or minimize potential for leaching of COPCs to groundwater and surface water from soil/fill.	
Groundwater	Minimize contaminant concentrations and restore groundwater quality.	No action Institutional controls/use restrictions Engineering controls Removal Treatment MNA Disposal
	Prevent exposure to COPCs in groundwater.	
	Prevent or minimize migration of groundwater containing COPCs.	
	Prevent or minimize discharge of groundwater containing COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.	

Media of Interest	RAO	GRA
Soil Gas	Minimize contaminant levels in sources of COPCs in soil gas that may migrate to indoor air of overlying buildings.	No action Institutional controls Engineering controls Removal Treatment (if necessary)
Sewer Water	Prevent exposure to COPCs in sewer water and solids associated with a release from the inactive sewer system.	No action Removal Disposal
	Minimize concentrations of COPCs in sewer water (inactive system).	
	Prevent or minimize discharge of sewer water COPCs to surface water to minimize the potential for interaction between the Site and the Passaic River.	

3.7 Preliminary Remediation Goals

PRGs are chemical-specific, quantitative goals for each medium and/or exposure route that are intended to be protective of human health and the environment and meet RAOs. PRGs were developed based on ARARs and risk-based levels (human health and ecological), with consideration of current and reasonably anticipated future use, background concentrations, analytical detection limits, guidance values, and other available information to aid in defining the extent of contaminated media and enable remedial action cost estimation. During the remedial design, future land assumptions used in developing PRGs will be confirmed. As noted previously, the Site has a lengthy industrial history, is zoned for industrial non-residential purposes, which is consistent with findings of the reuse assessment conducted in the RI.

The PRG for wastes remaining on Site will be addressed through removal followed by reduction of toxicity, mobility, or volume (TMV). If wastes are determined to be characteristically hazardous, the Resource Conservation and Recovery Act (RCRA) Land Disposal Restriction (LDR) will be an ARAR.

3.7.1 Preliminary Remediation Goals for Soil/Fill

As described in the BHHRA and RIR, the COPC, human receptors and media with unacceptable risks are as follows:

Receptor	COPC	Medium	Exposure Routes
Child visitor	Lead, copper	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Trespasser	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Construction worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Utility worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation

Receptor	COPC	Medium	Exposure Routes
Outdoor worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
Indoor worker	Lead	Soil/fill	Dermal contact, incidental ingestion, dust inhalation
	TCE, xylenes, naphthalene	Soil/fill	Inhalation of indoor air (vapor intrusion)

Soil/Fill PRGs or risk-based concentrations (RBCs) were developed for soil/fill with consideration of these risk drivers and then used in conjunction with the ARAR comparisons to identify areas of the Site requiring remedial actions and to support estimations of areas and/or volumes of impacted media. The general PRG selection process is based on USEPA (1991b) guidance and is as follows:

Step 1: Calculate RBCs for human health and ecological receptors. Human health RBCs (see Step 1a) are derived for each risk driver/receptor scenario identified as posing risk in excess of USEPA risk limits in the risk assessment, for both cancer and non-cancer-based effects, as applicable. Cancer-based RBCs are calculated for the 10^{-6}, 10^{-5} and 10^{-4} cancer risk levels. Ecological RBCs (Step 1b) are based on screening criteria as described further below.

Step 2: Identify any numeric ARARs or TBCs.

Step 3: Identify a background concentration, if available. PRGs should not be set at a level that is lower than expected background concentrations.

Step 4: Identify a laboratory reporting limit deemed reasonably achievable for the constituent and medium in question; PRGs should not be set at a level that is technically unachievable in the laboratory.

Step 5: Selection of final PRGs.

RBCs, ARARs/TBCs, laboratory limits and background concentrations are then all considered in conjunction with other site-specific information when selecting the PRG. Each step of this process is described in further detail below.

Step 1a: Calculation of the RBCs for Human Health

Direct with Soil/Fill: Copper and Lead

Copper

A non-cancer soil/fill RBC for copper, based on direct contact exposure routes, was developed for the child visitor scenario. Because no cancer-based toxicity values are available for copper (which is classified by USEPA as Class D, not classifiable as to human carcinogenicity, USEPA, 2020), a cancer-based RBC was not calculated.

The non-cancer RBC was derived based on the exposure assumptions and toxicity values specified in the BHHRA. The soil/fill RBC accounts for multiple exposure routes, including incidental ingestion of and dermal contact with copper in soil/fill, and inhalation of copper entrained on fugitive dust particles. However, because USEPA currently does not provide a dermal absorption fraction (ABSd) in soil and no inhalation reference concentration (RfC) was identified for copper, complete information is not available to calculate RBCs for either the dermal contact or dust inhalation route, an RBC was calculated for only the incidental ingestion route of exposure. Thus, the soil/fill RBC for copper is based only on incidental ingestion. A reference dose (RfD) of 0.001 mg/kg per day was used to calculate the incidental ingestion RBC. This RfD was derived by dividing the Agency for Toxic Substances and Disease Registry (ATSDR)

intermediate minimal risk level by an uncertainty factor if 10, per USEPA Region 2 (Ramboll, 2020).[1] The copper RBC is based on a target HI of one, in accordance with USEPA guidance (USEPA, 1991).

Table 3-7 presents the equations and input parameters for the child visitor scenario, for which a soil direct contact RBC of 526 mg/kg was derived.

Lead

Health risks associated with exposure to lead in soil/fill are evaluated using an approach different from that of other types of contaminants. For lead, biokinetic uptake models are used to estimate a theoretical probability that the blood lead level (BLL) will exceed a target BLL. Lead risks were evaluated in the human health risk assessment for all exposure scenarios. Lead risks for young children (6 and under, such as the child visitor) were evaluated using the USEPA Integrated Exposure Uptake Biokinetic Model (IEUBK), whereas older receptors were evaluated using the Adult Lead Methodology (ALM).

The IEUBK model is applicable for the child visitor scenario. The human health risk assessment indicated that, using the IEUBK: "the USEPA Region 2 soil screening level of 200 mg/kg based on evaluation of the 12 to 72-month age range [USEPA, 2017] corresponds to a blood lead distribution that does not exceed 5 µg/dL for 5% of the population" (BHHRA; Section 4.5.4). However, this soil concentration represents the entire daily dose of soil at a residence. The BHHRA noted various uncertainties that could potentially over- or underestimate health risks associated with the child visitor scenario (see Section 6.3.3 of BHHRA), that includes routine exposures to both interior (vapor intrusion) and exterior (soil/fill contact and ingestion) site COPCs and which is an unlikely scenario given that the Site is an industrial property. As noted, future residential use of the Site is not planned, will be restricted, and is not considered in development of cleanup objectives.

The BHHRA assumed that 1/7th of the daily dose of soil/fill would occur at the Site, while the remainder (6/7th) of the home exposure would occur at an average lead soil levels for urban piedmont in New Jersey of 139 mg/kg (BHHRA Section 4.5.6). Adjusting the 200 mg/kg soil screening value for time spent at the Site results in a lead RBC for the child visitor of 567 mg/kg[2]. Therefore, an RBC of 567 mg/kg was selected as the child visitor RBC for lead.

The lead RBCs for other receptor scenarios, including the indoor worker, outdoor worker, utility worker and construction worker, were derived using the ALM. (According to the BHHRA, the adolescent trespasser lead exposure was qualitatively assessed using the outdoor worker scenario; therefore, the outdoor worker RBC is assumed protective of the adolescent trespasser.) All input parameters for the ALM for each scenario are the same as those used in the BHHRA and include both USEPA default values and site-specific values. Tables 3-8 through 3-11 provide the ALM input values and calculation of RBCs.

Soil RBCs protective of direct contact exposures for lead are summarized below.

Receptor	Lead Soil RBC – direct contact (mg/kg)
Child Visitor	567

[1] Note that the RfD used as the basis of the NJDEP soil remediation standard (ARARs for the Site) is based on an oral RfD of 0.04 mg/kg per day, referenced to the USEPA Health Effects Assessment Summary Tables (1997), which partially accounts for the large discrepancy in concentration between the ARAR and RBC.

[2] Verification of lead visitor cleanup number is as follows:
(6/7 * 139 mg/kg [background level]) + (1/7 * 567 [site RBC] mg/kg) = 200 mg/kg (IEUBK-based cleanup number).

Receptor	Lead Soil RBC – direct contact (mg/kg)
Indoor Worker	1,050
Outdoor Worker	784
Utility Worker	3,292
Construction Worker	441

Vapor Intrusion of VOCs via Subsurface Soil

Cancer risk exceeding the upper end of the USEPA cancer risk range and/or a non-cancer HI exceeding one was identified for an indoor worker exposed to TCE, naphthalene and total xylenes via vapor intrusion of VOCs from soil. Both non-cancer and cancer risk-based soil RBCs were thus developed for these three constituents. The cancer-based RBC is based on a target cancer risk of one in one million (1E-06), which is the lower end of the USEPA target range for cancer risk. The non-cancer-based RBC is based on a HI of one.

To calculate a soil RBC protective of the vapor intrusion pathway, a target indoor air concentration was first derived. This indoor air concentration (IA) was calculated using the equations and input parameters provided in Table 3-12. Exposure assumptions and toxicity values used in the derivation of this indoor air concentration are the same as those used in the BHHRA for the indoor worker scenario (Ramboll, 2020).

This target indoor air concentration was then divided by an attenuation factor, alpha (α), which accounts for the attenuation of VOCs between subsurface soil gas and indoor air of a theoretical building. Alpha values for the COPCs were obtained from the BHHRA (BHHRA, Appendix D). The resulting quotient (IA / α) is the target soil gas concentration (Csg). The soil RBC was then back-calculated from Csg using chemical-specific characteristics (Henry's Law soil and organic carbon-water partition coefficients) in conjunction with soil characteristics specific to sand (organic carbon content, effective air-filled and water-filled porosity and bulk density values) and chemical characteristics. Equations and input values for calculation of IA, Csg and RBC are provided in Table 3-12.

The lowest value between the cancer-based RBC based on 1.0E-05 and the non-cancer-based RBC was selected as the final soil/fill RBC protective of the vapor intrusion pathway. The resulting soil/fill RBCs for volatile COPCs are summarized below.

COPC	RBC – vapor intrusion (mg/kg)
TCE	0.02
Total Xylenes	6.5
Naphthalene	0.62

These RBCs were calculated using attenuation factors for soil vapor intrusion (see Appendix D of the BHHRA) assuming an infinite source and are applicable for the determination of appropriate response actions (e.g., vapor barriers or vapor mitigation systems). The soil vapor intrusion evaluation in the BHHRA included a mass balance check that is not incorporated into these RBCs.

Step 1B: Calculation of the RBCs for Ecological Receptors.

An ecological RBC was identified for any constituent in the Ramboll April 2020 SLERA that had a hazard quotient greater than 1.0 at Lots 67 and 69, the only lots where ecological risk is the sole driver for remediation. RBCs for these

constituents consist of the New Jersey ecological screening values (ESVs) used in the SLERA. These values are shown in Table 3-13.

Step 2: Identification of ARARs/TBCs

The Site is an industrial property and is zoned for non-residential use. Future residential use is not expected to occur, and existing and additional land use restrictions will continue industrial or commercial uses of the Site and prohibit redevelopment for residential use[3]. In light of this, Step 2 of the PRG evaluation focused on non-residential ARARs.

ARARs applicable to non-residential use of soil include the NJDEP non-residential direct-contact soil remediation standards (N.J.A.C. 7:26D-4.3). These ARAR are summarized in Table 3-13.

These soil ARARs are compared to the RBC when selecting the final PRG (see Step 5 below).

Step 3: Identification of Background Concentrations

Site-specific background concentrations are not available. The background concentrations for volatile organic COPCs (TCE, xylenes) are expected to be below detection limits. While naphthalene could be attributed to off-site anthropogenic sources (such as fuel emissions), it was assumed that the background concentration for this COPC is below detection limits absent any data specific to the Site.

Both copper and lead may be present in soil/fill due to natural underlying geochemistry and/or non-point anthropogenic sources such as cinders, ash and fill materials. Because the soil/fill is non-native material placed at the Site over a 20-year period, there is likely more than one soil/fill source. As described in the RIR, the fill is classified as historical fill in accordance with NJDEP regulations. For this reason, representative values for historical fill were factored into the selection of all PRGs in lieu of background data. These values were drawn from Table 4-2 in the 2009 N.J.A.C. 7:26E Technical Requirements for Site Remediation and are shown in Table 3-13. These values provide a point of comparison to ensure that final PRGs are not lower than background levels.

Step 4: Identification of Laboratory Reporting Limits

RBCs and ARARs for copper and lead are at levels reasonably expected to be achieved via laboratory analysis. The ranges of laboratory reporting limits for other COPCs, as reported in the BHHRA (Table 2.01 of Appendix A) are as follows:

COPC	Range of Laboratory Reporting Limits (mg/kg)
Copper	(all detected)
Lead	(all detected)
TCE	0.00027 – 0.081
Total Xylenes	0.00057 – 0.00092
Naphthalene	0.011 – 0.056

The reporting limits achievable for site soils/fill are lower than any of the RBCs or ARARs identified in Steps 1-2 above. Therefore, laboratory reporting limits were not considered further in development of PRGs.

[3] As noted before, it is also assumed that potable use of the brackish site groundwater will be prohibited through use of an institutional control.

Step 5: Selection of Final PRGs

Based on consideration of criteria described in Steps 1 through 4 above, PRGs were identified for each COPC.

Human health-based PRGs are applicable across the entire Site. The human health PRGs were selected as follows:

- Comparison of the non-cancer RBC and the cancer RBCs at multiple cancer risk levels (10^{-6} through 10^{-4}) and selection of a 'final' RBC; and
- Comparison of this 'final' RBC to the ARAR.

Note that RBCs were calculated for only the risk drivers identified in the BHHRA. Constituents that were not identified as risk drivers in the BHHRA but had concentrations exceeding ARARs were retained as COPCs. The PRG for each of these contaminants is the ARAR.

Ecological PRGs are applicable only to the two undeveloped lots (67 and 69). Because no ARAR exceedances or human health risks were identified for these two lots, PRGs specific to ecological receptors are to be applied to this portion of the Site.

The selected PRGs are discussed below.

Human Health PRGs

For **lead**, RBCs range from 441 mg/kg to 3,292 mg/kg, based on the ALM for adult receptors and the IEUBK for the child visitor receptor; the ARAR for lead is 800 mg/kg, and the NJDEP historic fill average value is 574 mg/kg. Of these considered values, the ARAR of 800 mg/kg is selected as the PRG for lead. This concentration is similar to the RBC for the outdoor worker and adequately protective of both the indoor worker and utility worker receptors. While lower RBCs were derived for the child visitor and construction worker scenarios, these values were not selected as PRGs because: 1) the child visitor scenario, that assumed both indoor and outdoor, routine exposures to a young child, is a highly unlikely scenario for an industrial property that is now and likely in the future to be largely paved/covered and because the higher intensity soil/fill exposures assumed for this young receptor are unlikely to occur if accompanied by an adult; and 2) while a construction worker scenario is plausible considering the potential for redevelopment of the Site, exposures to lead during any future excavation work can be managed appropriately with institutional controls that mandate both a soil/fill management plan and health and safety plan for workers that would include specifications for personal protective equipment.

For **copper**, the RBC of 526 mg/kg is substantially lower than the ARAR of 45,000 mg/kg. Note there was not an NJDEP historical fill average value available for copper. As discussed, the child visitor scenario, which included high intensity outdoor soil/fill exposures, is highly unlikely to occur at the Site. The BHHRA identified a HI greater than one for the child visitor scenario at only Lot 63; it is noted that the EPC for copper at this lot is driven primarily by one sample location (B-33), which is also co-located with an elevated lead concentration that exceeds the lead PRG, and thus is already being addressed in the FS. However, use of the ARAR as a cleanup objective may not be adequately protective of other non-residential receptors if basing health risk off of the oral RfD used in the BHHRA, given the 40-fold difference in toxicity values between those that form the basis of the ARAR (0.04 mg/kg/day) and the RBC (0.001 mg/kg/day). Thus, the RBC of 526 mg/kg is conservatively selected as the PRG for copper.

The RBCs for **TCE, total xylenes and naphthalene** are based on the vapor intrusion pathway, whereas the ARARs are based on the direct contact pathway. The BHHRA did not indicate unacceptable cancer risk/hazards for these COPCs based on direct contact. Because the ARARs would not be protective of the vapor intrusion pathway, the RBCs for TCE, total xylenes and naphthalene are selected as the PRGs. The RBC for xylenes is based on a non-cancer HQ of one since no cancer toxicity value is available for this compound. For both TCE and naphthalene, a cancer risk level

of 10^{-5} was compared to the non-cancer-based RBC, and the lower of the two values was selected. The 10^{-5} cancer risk level was used since TCE and naphthalene are the only two carcinogenic risk drivers identified in the BHHRA; all other carcinogenic compounds are presumed to have *de minimis* associated risk, and cumulative risk associated with these RBCs at a 10^{-5} risk level is not expected to exceed the upper end of the USEPA cancer risk range. Furthermore, the soil/fill RBCs for these compounds is based on a hypothetical future vapor intrusion pathway and developed using the highly conservative assumption of an infinite source mass, justifying use of a higher target risk level. Empirical indoor air data from existing buildings with similar levels of soil/fill contamination as those of parcels without current buildings indicate that risk from the vapor intrusion pathway is negligible. Lastly, the FS will evaluate potential response actions for the vapor intrusion related PRGs, including consideration of requirements for vapor barriers/sub-slab depressurization systems and/or building design to mitigate the potential vapor intrusion pathway.

COPCs that have unacceptable risks/hazards and/or exceed ARARs are identified as COCs and will be the focus of the remedial alternatives presented. PRGs for COCs associated with unacceptable risks listed in the RIR and BHHRA are summarized in the table below:

Chemical of Concern	Selected PRG (mg/kg)	Basis of PRG	Reference Figure
Lead	800	ARAR/ALM-outdoor worker	3-7
Copper	526	Non-cancer - child visitor	3-34
Naphthalene	6.2	Cancer - vapor intrusion, worker	3-35
TCE	0.05	Noncancer - vapor intrusion, worker	3-36
Total Xylenes	6.5	Non-cancer - vapor intrusion, worker	3-37

Table 3-13 presents the selection of PRGs for human health soil/fill COPCs. The PRGs selected for the BHHRA risk drivers were evaluated to determine if the PRGs would result in cumulative non-cancer hazard or cancer risks exceeding the acceptable USEPA cancer risk range of 1E-04 to 1E-06 and target HI of 1.0. HIs and incremental lifetime cancer risks associated with the above PRGs are presented in Table 3-14. As shown in Table 3-14, the cumulative cancer risk for the future indoor worker was 1E-05, which is within the acceptable USEPA cancer risk range. However, the total HI for the future indoor worker was 2. A target organ analysis was completed for the future indoor worker, as shown in Table 3-14. Based on the target organ analysis, naphthalene and xylenes target organ is decreased body weight/mortality, which results in a target organ HI of 1.0. TCE's target organ is the immune, development/reproductive, and cardiovascular which results in a HI of 0.9. Based on the target organ analysis, the HI for the primary target organs are at or below 1, which is at or below the acceptable USEPA noncancer benchmark of 1.0. A cumulative risk was not calculated for a future child visitor because copper is not identified as a carcinogen. The HI for the future child visitor was 1.0, which is at the USPEA noncancer benchmark.

ARAR Exceedances

As discussed, the ARAR was selected as the soil/fill PRG for constituents with ARAR exceedances but not identified as risk drivers in the BHHRA. For soil/fill COPCs associated with ARAR non-compliance (see Section 3.4.1), the PRGs are the NJDEP NRDCSRS:

- Arsenic - 19 mg/kg
- PCB - 1 mg/kg
- Lead - 800 mg/kg
- Benzene - 5 mg/kg

- Benzo(a)anthracene - 17 mg/kg
- Benzo(a)pyrene - 2 mg/kg
- Benzo(b)fluoranthene - 17 mg/kg
- Dibenz(a,h)anthracene - 2 mg/kg
- Manganese - 5,900 mg/kg
- Vinyl chloride - 2 mg/kg

Arsenic, lead, copper, benzo(a)pyrene, TCE, xylene, naphthalene, PCB and benzene are soil/fill COCs to be addressed by remedial alternatives in the FS.

In developing the PRGs, a number of assumptions regarding the future land use and zoning were used (Section 2.9). These assumptions should be confirmed during final remedial design.

Ecological PRGs

The SLERA did not account for existing surface barriers (buildings, pavement) over most of the Site. These barriers eliminate potential ecological risks at these locations. Lots 67 and 69, located at the southern and northern ends respectively of the Site, both have one or more shallow soil/fill samples with concentrations of select COPECs exceeding ESC but neither lot has concentrations that exceed either ARARs or human-health risk-based values. Lots 67 and 69 are unpaved except for two buildings located on Lot 69. Remedial decisions for these areas considered ecological receptors hypothetically present in either the undeveloped portion of these lots or adjacent ecological habitat, which typically consists of vegetated margins around paved areas. These areas, like others in the site-wide SLERA, were evaluated by comparing shallow sample results to screening values for birds, mammals, plants, and soil invertebrates. Constituents exceeding screening values consisted primarily of PAHs and some metals, and are listed in Table 3-13.

For PAHs, the lowest of available ESV, 1.1 mg/kg of total high-molecular-weight PAHs based on the protection of small mammals, was used to evaluate soil/fill data from samples collected both within the vegetated areas (designated as "ecological habitat") and adjacent to these areas. However, this PAH value is unrepresentative of actual risks from PAHs at the Site. The mammal ESV is an USEPA ecological soil screening level based solely on the toxicity of benzo(a)pyrene, considered the most toxic of the PAHs; however, Lot 67 and Lot 69 samples contain a greater proportion of less toxic high- and low-molecular weight PAHs. In addition, the unusually low ESV of 1.1 mg/kg is below the average concentration of total PAHs (1.8 mg/kg) detected in NJDEP surface soil sampling of relatively unimpacted areas in Newark and elsewhere in Essex County (NJDEP, 2020; Appendix 3). The potential site-related risk from PAHs at Lots 67 and 69 is thus likely to be less than suggested by the use of the ESV.

Regardless of the screening levels, the potential ecological risk from these lots is reduced due to the low value of the habitat generally, particularly for wildlife receptors. A review of the environment represented by samples identified as collected from "ecological habitat" (B-53 in Lot 67 and B-63 and DF-7 in Lot 69) indicates that these areas are comprised of vegetation around the edges of pavement or other developed parts of the lots. Vegetated areas are small and highly fragmented, separated by open areas of pavement where small mammals would be exposed to predation by raptors and other predators. Vegetation consists largely of invasive species, which typically provide less suitable forage material for herbivores, and the small size of the areas would provide a limit prey base for invertebrate-eating carnivores such as the robin or shrew. For these reasons, Lot 67 and Lot 69 areas are unlikely to provide the habitat necessary for a sustaining population of small mammals or birds, though both may forage in the area at times.

Nonetheless, both Lots 67 and 69 will be considered for remediation with the objective of reducing the exposure of ecological receptors in shallow soil/fill to constituent concentrations above the ecological screening values. No further risk assessment is proposed.

3.7.2 Preliminary Remediation Goals for Groundwater

Groundwater is not currently used as a source of potable water, and future groundwater use at the Site is unlikely because site-specific conductivity readings of the shallow groundwater indicate brackish conditions due to tidal influence of the adjacent Passaic River. Additionally, the Site and surrounding area are served by the City of Newark's potable water system. Potable use of groundwater should be avoided to prevent potential mobilization of the soluble fraction of COPCs in fill that has been identified at the Site.

For drinking water use, NJDEP GWQS are chemical-specific ARARs. Based on the default groundwater categorization, Federal and NJDEP drinking water standards are also relevant and appropriate requirements. For site-related contaminants, NJDEP GWQS are the most stringent promulgated standards and were used as the PRGs.

Groundwater in some wells contains contamination above ARARs (Section 3.4.2). Site-related COPCs that exceed ARARs as described in Section 3.4.2 are identified as COCs and are the focus of the remedial alternatives. The groundwater COCs and the respective PRGs are as follows:

VOCs	PRG (µg/L)
Acetone	6,000
Benzene	1
Ethylbenzene	700
Tetrachloroethane, 1,1,2,2-	1
Tetrachloroethylene	1
Toluene	600
Trichloroethane, 1,1,2-	3
Trichloroethylene	1
Xylene, m,p	1,000
Xylene, o-	1,000

SVOCs	PRG (µg/L)
Cresol, p-	50
Benzo(a)anthracene	0.1
Benzo[a]pyrene	0.1
Dioxane, 1,4-	0.4
Indeno(1,2,3-cd)pyrene	0.2
Pentachlorophenol	0.3

Metals	PRG (µg/L)
Antimony	6
Arsenic	3
Cadmium	4
Lead	5

3.7.3 Preliminary Remediation Goals for Soil Gas

Soil gas concentrations attributed to COCs in soil/fill present unacceptable human health risks to future indoor workers. The BHHRA identified potential unacceptable risks to future indoor workers on Lots 58, 62 from soil gas. Soil/fill concentrations of naphthalene, TCE, and total xylenes will be compared to the respective soil/fill PRGs to evaluate the need for potential response actions in remaining Site areas (Section 5.5). PRGs for soil gas are as listed for TCE, total xylenes, and naphthalene in Section 3.7.2 for soil/fill.

3.7.4 Preliminary Remediation Goals for Sewer Water

The remediation goal for sewer water at an inactive portion of the northern sewer line (Manhole 8) on Lot 1 is removal followed by reduction of TMV. Remedial alternatives (Section 5.4) address the contents of Manhole 8 (water and solids) and the accessible pipe with the wastes.

4. IDENTIFICATION AND SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS

4.1 Identification and Screening of Technologies

Technologies and process options were compiled for the GRA categories that could potentially satisfy RAOs for each medium of interest. Technology types are general categories of remedial technologies, while process options refer to specific processes within each remedial technology type. Representative remedial technologies and process options that are retained are used to develop remedial action alternatives in Section 5, either alone or in combination with other technologies.

Screening tables identifying remedial technology types, process options, and screening results are presented for waste, soil/fill, groundwater, soil gas, and sewer water (Tables 4-1, 4-2, 4-3, 4-4, and 4-5, respectively). Assembled process options were subjected to a preliminary technology screening to verify their applicability to Site contaminants and physical setting. The technology screening approach is based on the procedures outlined in the Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (USEPA, 1988). Potential candidate technologies were initially presented in the ICT Memorandum (Woodard & Curran, 2019) approved by USEPA on July 17, 2019. Since that time, more recent data from the final RI and BHHRA have been used to update screening results.

The technology screening evaluation process uses three criteria: effectiveness, implementability, and relative cost. Among these three, the effectiveness criterion outweighs the implementability and relative cost criteria. These criteria are described below.

Effectiveness: This evaluation criterion focuses on the effectiveness of process options to reduce the TMV of contamination for long-term protection and to meet the RAOs and PRGs. It also evaluates the potential impacts to human health and the environment during construction and implementation and how proven and reliable the process is with respect to site-specific conditions. Technologies and process options that are not effective are eliminated using this criterion.

Implementability: This evaluation criterion encompasses both the technical and administrative feasibility of the technology or process option. It includes an evaluation of pretreatment requirements, remedial construction requirements, residuals management, the relative ease or difficulty of operation and maintenance (O&M), and the availability of qualified vendors. Technologies and process options that are clearly not implementable at the Site are eliminated using this criterion.

Relative Cost: Cost plays a limited role in the screening process. Both capital and O&M costs are considered. The cost analysis is based on engineering judgment, and each process is evaluated as to whether costs are low, medium, or high relative to the other options within the same GRA category.

4.2 Evaluation of Technologies and Selection of Representative Technologies

Following the preliminary technology screening, the GRAs, remedial technologies, and process options retained as potential components of a comprehensive site remedy for further evaluation are summarized by medium of concern below.

4.2.1 Waste

Retained GRAs for waste are no action, removal, and off-site disposal. Process options for each GRA are proven and readily implemented as wastes at the Site have been identified.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Removal	Mechanical transfer	Containerization or transport vehicle
Disposal	Disposal (off-site)	Solid waste landfill, used oil recycling, or treatment and disposal

4.2.2 Soil/Fill

Retained GRAs, remedial technologies, and process options for soil/fill are listed below:

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls/access restrictions	Land use restrictions	Deed notice
		Zoning/ordinances
	Barriers	Fencing/signs
Engineering controls	Cover systems	Single-layer cap
		Combination cap
	Vertical barriers	Shoreline revetment
		Sheet piling
		Soil berm
Removal	Excavation	Mechanical
Treatment	In-situ treatment (biological)	Bioventing
	In-situ treatment (physical)	Soil vapor extraction (SVE)
		Air stripping and air sparging
	In-situ treatment (chemical)	Chemical oxidation
	In-situ treatment (immobilization)	Stabilization/solidification
	Ex-situ treatment (immobilization)	Stabilization/solidification
	Ex-situ treatment (thermal)	Thermal desorption
	Ex-situ treatment (chemical)	Chemical oxidation
Beneficial reuse	Beneficial reuse	On-site fill
Disposal	Disposal (off-site)	Solid waste and hazardous waste landfills

Soil/fill with elevated concentrations of lead that is excavated may classify as RCRA characteristic waste (Waste Code D-008) if the leachate concentration of lead exceeds the Toxicity Characteristics Leaching Procedure (TCLP) regulatory limit of 5 mg/L. As a result, off-site disposal would need to comply with RCRA LDR requirements via treatment to eliminate the RCRA characteristic or alternative LDR treatment standards under 40 CFR 268.49 (Phase IV LDR). For this Site, TCLP data are not available.

Lead-contaminated soil/fill identified for potential response actions, including some that may classify as characteristic waste, may be co-located with PCBs (Lot 70). The Toxic Substances Control Act (TSCA) provides the Federal PCB remediation policy. Excavated soil/fill containing PCBs would classify as bulk remediation waste. Bulk PCB remediation wastes at concentrations of less than 50 ppm may be disposed of at an approved PCB disposal facility; or when disposed pursuant to Section 761.61(a) or (c), a permitted municipal solid waste or non-municipal non-hazardous waste facility; or a RCRA Section 3004 or Section 3006 permitted hazardous waste landfill. Bulk PCB remediation waste at concentrations of 50 ppm or greater must be disposed of in a RCRA Section 3004 or 3006 permitted hazardous waste landfill or an approved PCB disposal facility (e.g., incinerator, chemical waste landfill) via an approved alternate disposal method (USEPA, 2005). TSCA is an action-specific ARAR.

Under NJDEP SRP policy, soils with PCB concentrations above 0.2 ppm require a deed notice and, when above 1 ppm, require a deed notice and cap. NJDEP policy allows for contaminants with appropriate institutional and engineering controls to be non-permanently remediated if the remedy is found to be protective of human health and the environment. NJDEP SRP policy is a TBC.

The process options retained for further consideration could be implemented on a site-wide basis or an individual lot basis. SVE is retained for possible application under buildings to mitigate vapor intrusion by treating soil/fill containing COPCs, if necessary. Given the relatively thin vadose zone, SVE, air stripping, and air sparging efficiency may be poor due to the potential for short-circuiting to the atmosphere in the absence of a cover system. New deed notices, capping, and a vertical barrier would require landowner consent to maintain these controls. Capping, vertical barrier, stabilization/solidification, and removal/disposal could be disruptive of current commercial activities.

During ebb tide and precipitation/flooding events, soil/fill may be susceptible to erosion, sloughing, and transport off-site. Surface water may infiltrate through the bulkhead and exposed shoreline due to tidal effects. When tidal current is flowing inland (i.e., flood tide) and during river flooding events, the soil/fill along with the exposed shoreline may be susceptible to infiltration of surface water and river sediment deposition. The existing bulkhead could be extended along the riverbank and raised higher. Vertical barriers such as sheet piling could be installed inland and either independent of or connected to the bulkhead to prevent or minimize off-site transport of soil/fill containing COCs. A barrier along the river could be implemented on an individual lot basis to enhance the barrier provided by the existing bulkhead. Berms along the river could be a component of the vertical barrier to control surface water movement. Vertical containment and flood protection measures could be coordinated with property redevelopment.

4.2.3 Groundwater

Retained GRAs, remedial technologies, and process options for groundwater as listed below have been updated from the approved ICT Memorandum based on more recent groundwater data:

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls/access	Use restrictions	CEA
		Well restriction area (WRA)
Restrictions	Barriers	Fencing/signs
Engineering controls	Subsurface barriers	Slurry walls
		Sheet piling
Removal	Collection Systems	Pumping Wells
Treatment	Ex-situ (physical)	Filtration
		Granular activated carbon
	Ex-situ (chemical)	Chemical oxidation
		Chemical precipitation
	In-situ (biological)	Bioremediation
		Biosparging
	In-situ (physical)	Immobilization
		Air sparging
	In-situ (chemical)	In-situ chemical oxidation
		In-situ chemical reduction
		In-situ chemical precipitation
MNA	Monitoring	Not applicable
Disposal	Disposal (off-site)	Discharge to local POTW
	Disposal (on-site)	Discharge to surface water

Groundwater use restrictions under NJDEP regulations require property owner notification but not owner permission. Groundwater concentrations of some COPCs were lower for the last event than prior events. The improvement could be due to several factors including source removal (illegal activities reduced or stopped) and natural degradation. Extraction via pumping would induce infiltration of surface water from the river. Furthermore, while pump and treat options may reduce TMV of organic COCs, no pump and treat option would eliminate dissolution of residual recalcitrant inorganic COC in urban fill that remains in contact with groundwater. Pump and treat may offer marginal improvement of groundwater quality and would have more negative environmental impact than in-situ treatment options. The options retained for further consideration could be implemented on a site-wide basis or an individual lot/area basis.

4.2.4 Soil Gas

Retained GRAs, remedial technologies, and process options for soil gas are listed below. Retained GRAs, remedial technologies, and process options for soil containing COCs (potential source of soil gas) are listed in Section 4.2.2.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Institutional controls	Use restrictions	Deed notice
		CEA
Engineering controls	Subsurface barriers	Vapor barrier
Removal	Subsurface depressurization system (SSDS)	Active SSDS
Treatment	Ex-situ treatment (physical)	Immobilization/adsorption
		Photocatalytic oxidation

Based on indoor air sample results, health risks posed by indoor vapors in currently occupied buildings are below acceptable risk thresholds. Risk assessment results indicate that response actions may be required for future indoor workers at Lots 58, 62, and 68. As discussed in Section 5.5, response actions may also be appropriate for areas in addition to the lots identified from the BHHRA where concentrations of naphthalene, total xylenes, and TCE exceed PRGs for soil/fill. Retained process options are proven and readily implemented and would be implemented on an individual lot basis.

4.2.5 Sewer Water

Retained GRAs for sewer water and solids are no action and removal with off-site disposal. Retained process options are proven and readily implemented and would likely be implemented on a lot by lot basis, and the sewer water medium is found on Lot 1.

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Removal	Mechanical transfer	Containerization or transport vehicle
		Pumped
Disposal	Disposal (off-site)	Discharge to local POTW
		Disposal to off-site treatment, storage, and disposal (TSD) facility

5. DEVELOPMENT AND SCREENING OF ALTERNATIVES

In this section, remedial alternatives for wastes, surface and subsurface soil/fill, groundwater, sewer materials, and soil gas at the Site are formed to address the RAOs. The technologies and process options retained in the screening procedures described in Section 4.0 are developed into medium-specific remedial alternatives. These assembled alternatives are then subjected to further screening in Section 6. Consideration of the No Action Alternative is required by the NCP.

The remedial alternatives were initially presented in the DASRAT Memorandum (August 28, 2019) conditionally approved by USEPA on February 27, 2020 (Section 1). Since that time, more recent data from the Final RIR, BHHRA, and SLERA and USEPA comments have been used to update remedial alternatives.

To develop remedial alternatives for the Site, representative process options were selected across alternatives from the same groups of remedial technologies, as appropriate. However, other process options may still be applicable and should be considered during the remedial design stage of the project. Similarly, quantities of affected materials described in this section are preliminary estimates based on currently available data. It is anticipated that, where appropriate, additional delineation data may be obtained during remedial design activities as needed to more accurately define the extent of materials subject to remedial action.

5.1 Wastes

Wastes at the Site include containerized waste and LNAPL in the USTs and Building #15A, as described in Section 3.8.1. Contaminated soil/fill or groundwater encountered during UST closure is managed under Wastes. Wastes present in other site media are addressed with those media: Manhole 8 is addressed in Section 5.4 (Sewer), and LNAPL in soil/fill not directly associated with USTs is addressed in Section 5.2 (Soil/Fill).

As noted in Section 4.2, the remaining technologies and process options for source materials include the following:

GRA	Remedial Technology	Process Options
No action	Not applicable	Not applicable
Removal	Mechanical transfer	Containerization or transport vehicle
Disposal	Disposal (off-site)	Solid waste landfill, used oil recycling, or treatment and disposal

Based on the remaining GRAs and process options, there are two decisions to be made for wastes at the Site in certain remaining process equipment and containers:

- whether or not to take action; and
- if action occurs, what means should be used to remove and dispose of the materials.

Approximately 39,000 gallons of liquid and solid wastes remain at the Site in the various containers, six USTs, and Building #15. Although the risks associated with these materials have not been quantified, RAOs include securing or removing the materials to the extent practicable, preventing uncontrolled movement of the materials, and addressing human and ecological exposure to the materials. Note that wastes which may be present in other site media (soil/fill or groundwater) are addressed with those media.

5.1.1 Waste Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, remaining source materials at the Site would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented.

5.1.2 Waste Alternative 2 – Removal and Off-Site Disposal

Waste, including NAPLs and LNAPLs, has been identified in certain remaining process equipment, a UST, Building #15A, and miscellaneous containers. Based on RI laboratory results, the LNAPL is identified as diesel fuel/heating oil and is classified as non-hazardous.

This alternative consists of the transfer of wastes into appropriate containers or transport vehicles for off-site recycling or disposal, along with proper closure of USTs by removal. The means for disposal of the various wastes would be determined during the remedial design; however, for the purposes of this FS, certain assumptions can be made, pending disposal characterization. Solid wastes such as the hopper in Building #7 would most likely be disposed of in an appropriate solid waste landfill. Oils and other NAPLs contained within process equipment and USTs would either be sent to a recycling facility or for treatment and disposal. Water contained in the USTs would be transferred to an appropriate facility for treatment and disposal.

Within Building #7, a white chalky talc-looking substance remains in an approximately 5-foot diameter hopper that measures approximately 20 feet in height between the first and the second floors. The top of the hopper is accessible from the second floor, and the chalky contents are visible approximately 5 feet below the top. The estimated volume of non-hazardous solid waste in the hopper is approximately 11 CY. In Building #12, a plastic 55-gallon drum contains approximately 50 gallons of non-hazardous liquid waste. In Building #17, a five-gallon bucket labeled as a filler contains a solid non-hazardous waste.

A portion of Building #15A (pump house) contains a petroleum-based liquid (NAPL) beneath pooled water under a steel grated floor. The NAPL is approximately 0.5-foot to 0.65-foot thick and very viscous. Assuming that the grate and liquid covers the entire floor plan (approximately 650 SF), and assuming an average thickness of 0.6-foot, the volume of NAPL in Building #15A is estimated at 2,900 gallons.

There are six USTs located north of Building #12, each measuring approximately 30 feet long by 8 feet in diameter. One of these USTs (UST-5) contains approximately 1,600 gallons of LNAPL (0.9-foot thick) along with approximately 4,100 gallons of water. Based on the depth measurements from the top of the tanks and the approximate dimensions of the tanks, the following table provides estimated volumes as well.

Sample Location	Depth to LNAPL (feet)	Depth to Liquid (feet)	Estimated Liquid Elevation (feet AMSL)	Approximate Volume (gallons)
UST-1	NA[1]	4.62	1.8	4,500 (water)
UST-2/3	NA	3.10 / 3.93	3.3 / 2.5	7,200 (water)
UST-4	NA	6.6	-0.2	1,300 (water)
UST-5	3.95	4.85		4,100 (water)
			2.5	1,600 (LNAPL)
UST-6	NA	2.6	3.8	8,100 (water)
UST-7	NA	0.55	5.9	9,500 (water)

1. NA – not applicable.

Upon removal of contents, the USTs would be removed and confirmation soil/fill (including underneath the tank) and groundwater sampling will occur in consideration of New Jersey tank closure regulations. Contaminated soil/fill/groundwater observed in the excavation after tank removal would be addressed in accordance with New Jersey tank closure regulations. It is assumed that approximately 3,173 CY of impacted soil/fill adjacent to the USTs will require excavation and off-site disposal as part of the UST removal.

5.2 Soil/Fill

As discussed in Section 3.4.1, soil/fill with COC concentrations associated with ARAR non-compliance are delineated in Appendix A and are subject to remedial alternative development. Soil/fill areas exceeding PRGs for naphthalene, total xylenes, and TCE are delineated on Figures A-15 through A-17 in Appendix A and addressed by soil gas alternatives in Section 5.5. Additionally, two areas of LNAPL-containing soil/fill on Lot 64 and Lot 63 which contain concentrations of certain COCs above ARAR-based criteria were also determined to require further assessment in the FS. Finally, SLERA results indicate unacceptable risks to ecological receptors at Lots 67 and 69 due to chemicals of ecological concern (COECs) in surface soil/fill.

There is an estimated 37,000 CY of soil/fill at the Site that is impacted with benzo(a)pyrene, arsenic, lead, PCB Aroclor-1260, and/or benzene at the Site at concentrations exceeding respective PRGs. In addition, there is approximately 380 CY of surface soil/fill on Lot 68 with concentrations of copper that exceed the PRG. An estimated 3,170 CY of LNAPL-impacted surface and subsurface soil//fill is present on Lot 64, and an estimated 275 CY of LNAPL-impacted surface soil/fill (with copper exceeding the PRG) and subsurface soil/fill is present on Lot 63 (Boring B-33). LNAPL-impacted soil/fill on Lot 64 is addressed with UST removal in Section 5.1.

Estimated soil/fill areas and volumes with concentrations exceeding PRGs are listed by major constituents and area as follows:

COPC	Areas	Area (SF)	Depth (FT)	Volume (CY)	Comments
Copper	Lot 68	5,160	2	380	
Benzo(a)pyrene	Lots 60, 61, 64, 65, and 67	91,160	2	3,375 CY	
Benzo(a)pyrene	Lots 57, 60, 63, 65, 66, and 67	452,340	0-10.5	16,750 CY	
Lead	Lots 69/70	266,600	0-10	9,875 CY	Collocated with PCB Aroclor 1260 on Lot 70
Lead	Lots 63/64	208,840	0-10	7,735 CY	Collocated with arsenic (Lot 63), benzene (Lot 64), and benzo(a)pyrene (Lot 63)

Subsurface soil/fill volumes were estimated assuming the depth of ARAR exceedances corresponding to the estimated depth of soil/fill (i.e., approximately 10-foot depth on Lot 60 and north, and approximately 11-foot depth to the south of Lot 60).

Based on the remaining GRAs and process options (Section 4.2), there are four decisions to be made for soil/fill at the Site:

- whether or not to take action;

- if action occurs, whether to leave the soil/fill in place or to excavate for off-site disposal;
- if the soil/fill is left in place, whether to cover/isolate or treat; and
- what, if any, institutional controls are needed in combination with the selected alternatives.

RAOs include addressing human exposure pathways, ecological pathways, the potential off-site transport, and the potential leaching to groundwater and surface water.

For alternatives which involve excavation or treatment, estimates of soil/fill quantities exceeding a PRG are used, such that remaining soil/fill concentrations would comply with health-based or ARAR-based criteria. Achievement of cleanup levels may be based on these criteria or as otherwise determined during the remedy selection process.

For alternatives involving a surface action such as containment or access restrictions, the entire area of interest was considered due to the small incremental cost associated with increasing the extent of the action for these areas. Actual quantities and extents of affected soil/fill handled during remedial activities may differ, depending on conditions at the time of the remedial action and the target cleanup concentrations. Depending on the remedy selected, sampling and analysis for specific COCs during remedial design and/or remedial action may be used to more accurately define quantities and plan remediation.

5.2.1 Soil/Fill Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, new deed restrictions and other institutional controls would not be implemented, and future use of the subject areas would be unrestricted except that existing NJDEP-approved institutional and engineering controls would remain intact although they are not enforceable by USEPA.

5.2.2 Soil/Fill Alternative 2 – Institutional Controls and LNAPL Removal

For this alternative, deed notices would be recorded on all 15 lots. Existing deed notices would be revised to reflect RI results and existing engineering controls for applicable lots. Fencing would be maintained and enhanced as appropriate in order to limit unauthorized access to the area and prohibit future use of the area in a manner which may expose human receptors to unacceptable risk. Deed restrictions are to ensure future use of the Site remains commercial or industrial. Regular Site inspections would be performed to ensure compliance with the deed restrictions. Other institutional controls include existing zoning and local ordinances associated with use of the Site which would also be reviewed and modified as appropriate to ensure compliance with the objectives of this alternative. Institutional controls are typical components of a NJDEP-approved remedy for historic fill (NJDEP, 2013).

Soil/fill with LNAPL on Lot 63 will be excavated and disposed off-site under this alternative. LNAPL in soil/fill adjacent to the USTs is addressed under waste alternatives (Section 5.1). A predesign investigation will be completed to further refine the extent of LNAPL in soil/fill on the Lot 63 area shown on Figure 5-1. NJDEP guidance on LNAPL will be considered in determining the extent of remedial action during remedial design and documentation of meeting applicable RAOs by the removal action. Specific information on the type of petroleum hydrocarbons could be collected during remedial design for application of NJDEP guidance. For the purposes of the FS, it is assumed approximately 275 CY of soil/fill with LNAPL will be removed adjacent to Building #7.

Institutional controls and access restrictions (to be determined during remedial design) and will reflect the ongoing business operations at the Site. Access restriction could include fencing, concrete barriers, and guard rail. Figure 5-1 displays the areas subjected to remedial actions under this alternative.

5.2.3 Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls and NAPL Removal

Under Alternative 3, soil/fill containing COCs would be left in place and would be addressed by engineering controls (cover system) and institutional controls (deed notice), for the potential unacceptable risk. In addition, the bulkhead would be reinforced or reconstructed, as appropriate, with new sheet piling or shoreline revetment in order to minimize the potential for interaction between the Site and surface water. Figure 5-2 displays the areas subjected to remedial actions under this alternative. Removal of 275 CY of soil/fill contaminated with LNAPL under this alternative is as described in Soil/Fill Alternative 2.

Capping of contaminated areas consists of the construction of a barrier over/around the contaminated areas. The cap is intended to prevent access to and contact with the contaminated media and/or to control its migration. Impermeable caps like asphalt caps also address the soil-to-groundwater pathway by reducing vertical infiltration. Existing building floor slabs in contact with soil/fill are incorporated into the cap. If a building is demolished in the future and its floor slab removed, a new surface barrier could be warranted at that location.

An existing deed notice with engineering control (concrete slab) presently exists within portions of the building footprint on Lot 63. Asphalt pavement is the engineering control in the existing Lots 68 and 70 deed notice. Other lots at the Site have concrete or asphalt surface pavement, although not part of a deed notice. During the remedial design, these surfaces would be inspected to determine their suitability to be used as a cover. Some existing pavement may need to be repaired to be used as an engineering control if the pavement otherwise meets the specifications of the cap design.

The use of existing pavement as surface cap would reduce the amount of material resources as encouraged under Region 2 Clean & Green Policy. Using existing asphalt or concrete pavement reduces the environmental footprint of the remedial action. The listing of concrete as a surface material in this alternative is intended to allow the reuse of existing concrete pavement. It is envisioned that new pavement under this alternative would be asphalt but concrete is an acceptable substitute as it provides the same protection of human health and environment as asphalt.

Two other capping options were retained in the DASRAT Memorandum, including a single-layer cap (such as a soil or asphalt cover) and a combination cap. While both types of cap accomplish the objective of preventing exposure to impacted soil/fill, a single-layer asphalt or concrete cap is judged to be more compatible with the likely long-term future use of the Site. NJDEP technical guidance concerning caps will be considered during design of a cap. Other surface barriers such as soil or geo-membrane layer have been screened out because the Site is an active industrial park and its future use is anticipated to be the same. These other surface caps are less suitable for roadways, parking, and material storage occurring at the Site, and also require more maintenance like vegetation control.

Asphalt capping as an engineering control is a typical component of an NJDEP-approved remedy for historic fill (NJDEP, 2013, NJDEP, 2014). Accordingly, a 6-inch asphalt cap is proposed in this alternative over exterior unpaved portions of the lots to prevent direct exposure to those soil/fill. In areas to be capped that have existing surface pavement, the thickness of new asphalt pavement can be adjusted to include the existing pavement as long as the combined system of existing and new cap are protective of the environment and human health. The estimated extent of the asphalt cap, including Lots 67 and 69, is approximately 28,400 square yards (SY) (see Appendix A-18), some of which is currently covered by concrete or asphalt. Surface water management is a capping component to reduce potential off-site transport of soil/fill with COCs. A cover consisting of soil, recycled concrete aggregate and/or alternate fill may be an appropriate substitution for asphalt based on reasonable future use during remedial design. Different covers may be appropriate for different lots. Use of alternative covers are to be approved by USEPA and be in compliance with state regulations.

The existing bulkhead along the riverfront consists of various materials (steel, wood, concrete), and varies in condition from poor/failing to good, with the wood bulkhead sections generally in the worst condition and the steel and concrete sections generally in the best condition. A geotechnical investigation would be required for both bulkhead enhancement

process options. For the purposes of this FS, one process option is that wood sections would be replaced with new sheet piling tied into the adjacent steel and concrete sections of the wall. Additionally, steel sheeting would be installed along Lots 67 and 63 where a bulkhead is not currently present. Approximately 810 feet of new bulkhead walls would be constructed, and the old sections of bulkhead would be removed and properly disposed of.

The second bulkhead enhancement process option is shoreline revetment which would require sloping the shoreline back and placement of an impermeable liner and R-6 or larger riprap. Approximately 800 feet of shoreline revetment would be constructed.

Design and installation of either bulkhead enhancement will incorporate active stormwater discharge pipes as appropriate, and existing inactive river wall pipes would be sealed. In either bulkhead enhancement scenario, the effective height of the bulkhead wall could be increased with soil/fill berms for surface water management. Both bulkhead enhancement options reduce the potential interaction between the Site and the Passaic River. Both options are also compatible with, and will take into account as necessary, remedial action being designed in the lower 8.3 miles of the Lower Passaic River. Currently, the OU2 remedial design anticipates bank-to-bank sediment dredging with dredging offsets and placement of a cap over remaining river sediment. The installation of the shoreline revetment option would disturb less river sediment than the sheet pile wall.

This alternative would also include access restrictions and institutional controls of Soil/fill Alternative 2. Under this alternative, engineering and institutional controls would be coordinated with existing NJDEP-approved controls.

5.2.4 Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls, Focused Removal with Off-Site Disposal of Lead, and NAPL Removal

This alternative combines focused excavation and off-site disposal for lead-impacted soil/fill in the vicinity of Building #7 with capping and bulkhead enhancements as described for Soil/Fill Alternative 3 for the remaining affected soil/fill. As with the other alternatives, institutional controls such as deed restrictions would be implemented to ensure that the future use of the Site is consistent with the assumptions of the BHHRA. Figure 5-3 provides the major components of this alternative.

The extent of focused excavation will be determined during the remedial design. The limits of focused excavation will be based on assessment of soil/fill COCs to be removed or managed to achieve cumulative cancer risk estimates below or within the NCP risk range (10^{-4} to 10^{-6}), and the non-cancer HI estimates are at or below the protection goal of 1 or to achieve ARAR compliance. The assessment would include RI soil/fill samples along with remedial design samples and/or confirmation samples if necessary.

Areas to be remediated in this alternative include soil/fill containing benzo(a)pyrene. Benzo(a)pyrene and other PAHs are ubiquitous in urban and industrialized areas especially properties with historic fill or asphalt pavement. The Site has both sources present. Many of the soil/fill areas being subjected to remedial action are due to the presence of benzo(a)pyrene above its ARAR (2 mg/kg). As shown on Figure 3-4, benzo(a)pyrene concentrations are fairly consistent site wide with no clear source area(s) based on soil/fill concentrations. The soil samples with observed LNAPL do not contain benzo(a)pyrene concentrations above the ARARs (RIR, Appendix D). As explained in the RIR (Section 4.2.5), a source of benzo(a)pyrene in soil/fill has been identified as historic fill in NJDEP-led remediation. The narrow range of concentrations are consistent with this finding. Capping these areas without excavation/off-site disposal is consistent with NJDEP guidance for historic fill (NJDEP, 2013; NJDEP 2014).

The focused excavation is for soil/fill above the water table (up to six feet) in the vicinity of Buildings #7 and #12 with lead concentrations above the PRG. Excavated soil/fill is estimated to be approximately 2,870 CY (see Appendix A-18) and LNAPL-impacted soil/fill is approximately 275 CY. Actual volumes of soil/fill to be disposed of will be dependent

on the results of further delineation during remedial design, and post-excavation sampling. Soil/fill located beneath existing buildings is not be excavated with the concrete floor slab being a cap.

The excavated areas would be backfilled with fill material selected considering the NJDEP "Fill Material Guidance for SRP Sites" dated April 2015.

Removal of soil/fill reduces and/or eliminates potential impact-to-groundwater sources, primarily localized lead. Because of the extent of soil/fill, some of which has been identified as historic fill, excavation under this alternative does not reduce the extent of capping. The remaining affected soil/fill (Figure 5-3) would be capped to address the associated potential unacceptable human health or ecological risks. Capping under this alternative would be as described in Soil/Fill Alternative 3 for a 6-inch asphalt cap with an assessment of existing surface pavement. Existing building concrete bottom floors are considered part of cap system in this alternative. If a building is demolished in the future and its floor slab removed, a new surface barrier could be warranted at that location.

Excavation adjacent to existing buildings raises building stability considerations. Additional measures would be undertaken to address building stability. Because foundation and other building details are not known, building stability measures would have to be more conservative than if these details were known.

Removal of soil/fill contaminated with NAPL (275 CY) under this alternative is as described in Soil/Fill Alternative 2.

Institutional controls and access restrictions as described in Soil/Fill Alternative 2 would be implemented under this alternative. Engineering and institutional controls under this alternative would be coordinated with existing NJDEP-approved controls.

5.2.5 Soil/Fill Alternative 5 – Institutional Controls, In-Situ Remediation, Engineering Controls, and LNAPL Removal

Under this alternative, the affected soil/fill would be subject to institutional and engineering controls, LNAPL removal, and one or more of several readily implementable and well developed in-situ treatment methods. The specific in-situ methods to be implemented for each lot will depend on the nature of the contaminants to be treated. Figure 5-4 presents the major components and areas for Soil/Fill Alternative 5.

For the soil/fill where the primary COC is metals, stabilization/solidification would be the most applicable means of treatment. This process would involve the injection and mixing of an appropriate binding agent (such as cement, lime, or kiln dust) using a backhoe or large-diameter auger. Alternatively, an iron sulfide amendment could be used to immobilize the metals as insoluble metal sulfides incorporated into secondary metal precipitates. After completion of stabilization activities, the treated areas would be capped as described under Soil/Fill Alternative 3. Untreated areas of Lots 67 and 69 would be capped also. Note that due to the increase in soil/fill volume inherent with this approach, along with the need to cap treated soils, it may be necessary to remove and properly dispose of the top 12 to 18 inches of soil/fill prior to treatment, so that the elevation of the final surface does not change. Treatability studies and/or pilot test(s) are warranted to determine the most effective binding agent and mixing ratio to treat site soil/fill. Approximately 18,000 CY (see Appendix A-18) of soil/fill would be treated in this manner.

Areas to be remediated in this alternative include soil/fill containing benzo(a)pyrene. Benzo(a)pyrene and other PAHs are ubiquitous in urban and industrialized areas especially properties with historic fill or asphalt pavement. The Site has both sources present. Many of soil/fill areas being subjected to remedial action are due to the presence of benzo(a)pyrene above its ARAR (2 mg/kg). As shown on Figure 3-4, benzo(a)pyrene concentrations are fairly consistent site wide with no clear source area(s) based on soil/fill concentrations. The soil samples with observed LNAPL do not contain benzo(a)pyrene concentrations above the ARARs (RIR, Appendix D). As explained in the RIR

(Section 4.2.5) a source of benzo(a)pyrene in soil/fill has been identified as historic fill in NJDEP-led remediation. The narrow range of concentrations are consistent with this finding.

For the soils where organics are COCs (approximately 19,400 CY, see Appendix A-18), soil/fill mixing with a chemical oxidant, such as a persulfate or hydrogen peroxide, would be considered the most applicable in-situ treatment approach. For this option, a slurry of the selected oxidant would be mixed with impacted soils using large-diameter augers or a backhoe, depending on the area and depth of treatment required. Treatability studies and/or pilot tests(s) would be included as part of the remedial design to evaluate the most effective oxidant for soil/fill. For areas where lead and organics are both present above target concentrations (approximately 6,300 CY, see Appendix A-18), chemical oxidation could be followed by stabilization.

As described above, this alternative includes treatment consistent with the CERCLA preference for treatment to reduce contaminant TMV. However, site-specific conditions at the Site suggest in general that treatment may be impractical, infeasible or not implementable for the following reasons:

- Some soil/fill contaminants for the Site based on Sections 3.1 and 3.4 are copper, arsenic, lead, VOCs, and select PAHs. Metals treatment methods include stabilization/solidification. However, these methods would not significantly reduce the metals concentration in soils (except possibly a minor reduction due to the dilution effect of the stabilization/solidification reagents) and would not reduce the mass of contaminants at the Site. Therefore, stabilization/solidification methods would not meet ARARs for placement on Site of treated soil/fill.
- Technologies for extraction of metals from soil/fill are likely to require treatability/pilot testing. In addition, the time for treatment would likely delay backfill and restoration of the treated areas or require interim institutional controls (deed restrictions) if in-situ treatment was used.
- In-situ treatment on Site may be impractical or inefficient because of the space constraints at the active industrial park, the likely length of time required to meet RAOs for certain in-situ treatment technologies (and the long-term implication on the businesses of protracted treatment), and access limitations for treatment equipment. If the vacant southern portion of the Site is redeveloped prior to remedial action, the lack of available space negatively impacts implementability of this alternative.

Institutional controls and access restrictions would be implemented, as described in Soil/Fill Alternative 2. Bulkhead engineering controls as described in Soil/Fill Alternative 3 are a component of this alternative.

5.2.6 Soil/Fill Alternative 6 – Institutional Controls, Removal with Off-Site Disposal, and LNAPL Removal

Under this alternative, COC-impacted soil/fill is excavated and transported to a permitted off-site facility for subsequent treatment (if needed) and disposal (Figure 5-5). The excavated areas would be backfilled with fill material selected considering NJDEP "Fill Material Guidance for SRP Sites" dated April 2015, and finished in a manner consistent with current conditions (i.e., asphalt paving, grass, etc.), with appropriate erosion and surface drainage controls implemented. Off-site disposal would likely occur at an appropriately licensed solid waste or hazardous waste landfill, depending on the results of disposal characterization sampling which would be conducted as part of the remedial design. Figure 5-5 presents the major components and areas for Soil/Fill Alternative 6.

The extent of excavation will be determined during the remedial design phase. The limits of excavation will be based on assessment of soil/fill COCs to be removed or managed to achieve cumulative cancer risk estimates below or within the NCP risk range (10^{-4} to 10^{-6}), and the non-cancer HI estimates are at or below the protection goal of 1 or to achieve ARAR compliance. The assessment would include RI samples along with remedial design samples and/or confirmation samples if necessary.

Excavation adjacent to existing buildings at depths below the water table, which raises building stability considerations. Additional measures would be undertaken to address building stability. Because foundation and other building details are not known, building stability measures would have to be more conservative than if these details were known.

These measures may include offsetting excavation which leaves soil/fill in place. Based on building layout and the proximity to each other in excavation areas, this could result in a substantial portion of the to-be-excavated soil/fill remaining in-place due to building stability and safety considerations.

Areas to be remediated in this alternative include soil/fill containing benzo(a)pyrene. Benzo(a)pyrene and other PAHs are ubiquitous in urban and industrialized areas especially properties with historic fill or asphalt pavement. The Site has both sources present. Many of soil/fill areas being subjected to remedial action are due to the presence of benzo(a)pyrene above its ARAR (2 mg/kg). As shown on Figure 3-4, benzo(a)pyrene concentrations are fairly consistent site wide with no clear source area(s) based on soil/fill concentrations. The soil samples with observed LNAPL do not contain benzo(a)pyrene concentrations above the ARARs (RIR, Appendix D). As explained in the RIR (Section 4.2.5) a source of benzo(a)pyrene in soil/fill has been identified as historic fill in NJDEP led remediation. The narrow range of concentrations are consistent with this finding.

For the purposes of this document, it is assumed that select soil/fill with COC concentrations above the PRGs (approximately 37,600 CY, see Appendix A-18), including LNAPL-impacted soil/fill, would be excavated and disposed, such that remaining soils would be in compliance with cleanup goals. Actual volumes of soil/fill to be disposed of will be dependent on the determined cleanup levels, results of further delineation during remedial design, and post-excavation sampling. Excavation could extend across lot boundary lines as needed to meet remedial goals. It is assumed that soil/fill located beneath existing buildings would not be excavated.

Removal of soil/fill contaminated with LNAPL under this alternative is as described in Soil/Fill Alternative 2.

As the scope of this alternative is based on future use of the Site consistent with current industrial use, institutional controls as described in Soil/Fill Alternative 2 would be implemented. Engineering and institutional controls under this alternative would be coordinated with existing NJDEP-approved controls. Access restrictions as described in Soil/Fill Alternative 2 are included in this alternative.

5.2.7 Soil/Fill Alternative 7 – Institutional Controls, Ex-Situ Treatment and On-Site Placement, Engineering Controls, and NAPL Removal

Under this alternative, the affected soil/fills would be subject to institutional and engineering controls, removal, and one or more of several readily implementable and well developed ex-situ treatment methods. The specific methods to be implemented for each lot depends on the nature of the contaminants to be treated. Soil/fill would be excavated and treated on-site with the treated material being placed in the excavation(s). Figure 5-6 displays the areas subjected to remedial actions under this alternative.

For the soil/fills where the primary COC is metals (approximately 18,000 CY, see Appendix A-18), stabilization/solidification would be the most applicable means of treatment. This process would involve the injection and mixing of an appropriate binding agent (such as cement, lime, or kiln dust) within a constructed aboveground treatment cell or pugmill. After completion of stabilization activities, the treated soil/fill would be placed in the excavation. Note that due to the increase in soil/fill volume inherent with this approach, it may be necessary to remove and properly dispose of the top 12 to 18 inches of soil/fill prior to treatment, so that the elevation of the final surface does not change. Treatability studies and/or pilot test(s) during remedial design are appropriate to determine the most effective binding agent and mixing ratio to treat soil/fill.

Areas to be remediated in this alternative include soil/fill containing benzo(a)pyrene. Benzo(a)pyrene and other PAHs are ubiquitous in urban and industrialized areas especially properties with historic fill or asphalt pavement. The Site has both sources present. Many of soil/fill areas being subjected to remedial action are due to the presence of benzo(a)pyrene above its ARAR (2 mg/kg). As shown on Figure 3-4, benzo(a)pyrene concentrations are fairly consistent site-wide with no clear source area(s) based on soil/fill concentrations. The soil samples with observed LNAPL do not contain benzo(a)pyrene concentrations above the ARARs (RIR, Appendix D). As explained in the RIR (Section 4.2.5), a source of benzo(a)pyrene in soil/fill has been identified as historic fill in NJDEP-led remediation. The narrow range of concentrations are consistent with this finding.

For the soil/fill where organics are COCs (approximately 19,400 CY, see Appendix A-18), soil/fill mixing with a chemical oxidant, such as a persulfate, would be considered the most applicable ex-situ treatment approach. For this option, excavated soil/fill a slurry of the selected oxidant would be mixed with organic-impacted soil/fill within a constructed aboveground treatment cell. Upon confirmation of meeting treatment goals, the soil/fill would be placed back in the excavation. Treatability studies and/or pilot test(s) would be included as part of the remedial design to evaluate the most effective oxidant for soil/fill in each lot. Where metals and organics are both present above target concentrations (approximately 6,300 CY), chemical oxidation could be followed by stabilization.

- As described above, this alternative includes treatment consistent with the CERCLA preference for treatment to reduce contaminant mobility, toxicity, and volume. However, site-specific conditions at the Site suggest in general that treatment may be impractical, infeasible or not implementable for the following reasons: Some soil/fill contaminants for the Site based on Sections 3.1 and 3.4 are copper, arsenic, lead, VOCs, and select PAHs. Metals treatment methods include stabilization/ solidification. However, these methods would not significantly reduce the metals concentration in soils (except possibly a minor reduction due to the dilution effect of the stabilization/solidification reagents) and would not reduce the mass of contaminants at the Site. Therefore, stabilization/solidification methods would not meet ARARs for placement on-site of treated soil/fill.
- Technologies for extraction of metals from soil/fill are likely to require treatability/ pilot testing. In addition, the time for treatment would likely delay backfill and restoration of the treated areas or require interim Institutional Controls (Deed Restrictions) if in-situ treatment was used.
- Ex-situ treatment on Site may be impractical or inefficient because of the space constraints at the active industrial park, the likely length of time required to meet RAOs for certain in-situ treatment technologies (and the long-term implication on the businesses of protracted treatment), and access limitations for treatment equipment. If the vacant southern portion of the site is redeveloped prior to remedial action, the lack of available space negatively impacts implementability of this alternative.

Institutional controls and access restrictions would be implemented as described in Soil/Fill Alternative 2.

Removal of soil/fill contaminated with NAPL (275 CY) under this alternative is as described in Soil/Fill Alternative 2.

5.3 Groundwater

As discussed in Section 3.4.2, shallow and deep groundwater concentrations exceed ARAR at some lots on Site. Potable and non-potable use of site groundwater, if it were to occur in the future, would pose unacceptable risk to human health. Groundwater use at the Site is unlikely because shallow groundwater is brackish, and the Site and surrounding area are served by the City of Newark's potable water system. Currently, Lots 67, 68, 69, and 70 already have restrictions in place under NJDEP regulations to prevent groundwater use.

As noted in Section 3.7.3, groundwater in some wells contain COC concentrations above ARAR-based PRGs, including several VOCs, SVOCs, and lead.

Based on the remaining GRAs and process options (Section 4.3), there are two decisions to be made for groundwater at the Site:

- whether or not to take action; and
- if action occurs, whether to pursue passive remedies or active remedies.

Secondary decisions must also be made regarding the specific types of limited actions and treatment/disposal methods. Where multiple process options are available within a class of response actions (such as in-situ treatment) and the options are expected to have similar effectiveness and protectiveness, the more common and/or less costly method was selected for inclusion as part of a remedial alternative. Should such an alternative be selected for the site remedy, site-specific bench and/or pilot studies may be appropriate to determine the most cost-effective process option. These choices are considered in developing the alternatives and are based on the magnitude of COC concentrations above human health-based and ARAR-based cleanup levels, the quantity of affected material, and the potential for additional aquifer degradation due to cross-media effects from soil/fill. RAOs include reduction of contaminant concentrations and restoration of groundwater quality, mitigating exposure to and migration of groundwater containing COCs, and preventing or minimizing discharge of groundwater containing COCs to surface water. As previously discussed, hypothetical future potable and non-potable use of shallow and deep groundwater site-wide has been determined to present unacceptable health risks. Groundwater use at the Site is unlikely because shallow groundwater is brackish, and the Site and surrounding area are served by the City of Newark's potable water system. Furthermore, Lots 67, 68, 69 and 70 have restrictions in place to prevent groundwater use. CEAs are proposed for two additional areas (Section 2.3.16).

It is noted that LNAPL has not been observed in groundwater wells at the Site. LNAPLs observed in site soil/fill are addressed by the soil/fill alternatives.

5.3.1 Groundwater Alternative 1 – No Action

Under this alternative, no action would be taken to reduce the potential for unacceptable exposures of humans to impacted groundwater or minimize further aquifer degradation. Existing NJDEP-approved institutional would remain intact although they are not enforceable by USEPA. This alternative is retained for comparison with the other alternatives as required by the NCP.

5.3.2 Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge and Monitored Natural Attenuation

Groundwater Alternative 2 includes placement of institutional controls on the entire Site with the natural degradation of COCs in the aquifer by natural biological, chemical, and/or physical processes. Interaction with the existing CEAs and WRAs would be coordinated with NJDEP along with LSRPs and responsible parties for these controls. USEPA cannot enforce existing NJDEP CEAs and WRAs. The CEAs provide notice that groundwater in the area does not meet designated use requirements, and the WRAs prohibit the installation and use of wells for potable and other uses within the designated area. During remedial design, groundwater samples will be collected, analyzed, and reported to update shallow fill and deep groundwater quality. Updated results will be used for institutional controls. Periodic monitoring and reporting to demonstrate compliance with the restrictions is part of this alternative. Figure 5-7 presents the major components and areas for Groundwater Alternative 2.

A vertical sheet pile barrier would be constructed along the river's edge as a means of reducing the potential for interaction between groundwater and the river. Sheet piling would be constructed to the top of an underlying confining layer, most likely the glacial lake bottom silt deposits, with a depth to be determined during remedial design. The barrier would have a total length of approximately 1,300 feet. The sheet piling is not intended to address geotechnical issues

related to property redevelopment or to enhance the structural stability of the current bulkhead. A geotechnical investigation will occur during remedial design to determine wall alignment, depth and specifications.

An assessment of the potential occurrence of MNA processes was not conducted as part of the RI. However, as indicated by RI results, benzene, ethylbenzene, TCE, toluene, vinyl chloride, m,p-xylene, 1,4-dioxane, and selenium concentrations were lower for the February 2019 event than prior events. Decreasing organic concentrations would be consistent with the occurrence of natural attenuation processes. Additionally, dissolved oxygen and redox potential field measurements and the presence of abundant iron and manganese represent conditions that are favorable for natural anaerobic biodegradation of BTEX compounds.

Groundwater monitoring focused on MNA processes during the remedial design is included in this alternative. Other alternatives with source control measures (i.e., UST removal) would remove potential groundwater sources allowing MNA to achieve RAOs within a reasonable timeframe as compared to other alternatives. Natural attenuation reduces the potential risk posed by groundwater contaminants in three ways:

1. Transformation of contaminant(s) to a less toxic form through destructive processes such as biodegradation or abiotic transformations;
2. Reduction of contaminant concentrations whereby potential exposure levels may be reduced; and
3. Reduction of contaminant mobility and bioavailability through sorption onto the soil/fill.

Ongoing groundwater monitoring would be performed to confirm that these natural processes are occurring, and that this alternative continues to be protective of human health and the environment. As part of the monitoring program, the installation of additional groundwater monitoring wells may be appropriate.

5.3.3 Groundwater Alternative 3 – Institutional Controls, Site Containment at River Edge, and Pump and Treat

Alternative 3 combines the institutional controls and vertical barrier wall along the river's edge described for Groundwater Alternative 2, and active remediating groundwater to achieve ARARs. Additionally, between 15 and 20 extraction wells would be installed throughout the Site in order to recover both shallow and deep groundwater impacted by organics and metals. Extracted groundwater would be pumped to a new groundwater treatment facility, likely at least 5,000 SF in floor area, to be constructed at an appropriate location on the property.

The number of extraction wells, pumping rate, and individual processes to be utilized for treatment will be determined during the remedial design. For the purposes of this FS, a 200-gallon per minute (GPM) system (i.e., 10 GPM per extraction well) including chemical oxidation, filtration, metals precipitation (chemical), and carbon polishing is assumed. Approval and/or permit equivalency would be sought for discharge of treated water to the local POTW or surface water. Figure 5-8 presents the major components and areas for Groundwater Alternative 3.

The treatment of relatively low concentrations away from higher concentration areas, including deep unit groundwater, would be extremely inefficient. As shown on Figure 5-8, deep groundwater is addressed by this alternative.

5.3.4 Groundwater Alternative 4 – Institutional Controls and In-Situ Remediation

Alternative 4 includes the institutional controls described for Groundwater Alternative 2. Additionally, impacted groundwater would be subject to in-situ remediation. The objective of this alternative is to reduce COC concentrations in groundwater, eventually restoring groundwater quality. Figure 5-9 presents the major components and areas for Groundwater Alternative 4.

The lateral extent of the remedial effort would depend on the cleanup goals for the aquifer and whether the effort would be a "hot-spot" treatment (including the UST excavation water and areas if measurable LNAPLs in groundwater are observed) or a broader effort to treat groundwater containing COCs above PRGs. Although COCs include inorganic constituents which are largely associated with soil/fill and tend to be less amenable to in-situ remediation efforts, and that treatment of relatively low concentrations away from the hot-spot areas would be extremely inefficient, this alternative assumes a broader effort to treat all groundwater containing COCs above PRGs. USTs and associated LNAPL-impacted soil/fill are addressed in waste alternatives, and other LNAPL-impacted soil/fill are addressed in soil/fill alternatives.

For organic COCs, the most likely in-situ treatment methods include in-situ chemical treatment, biosparging, and air sparging. Pilot- and bench-scale testing would be required as part of the remedial design to determine the most appropriate treatment approach and reagents for site groundwater. However, tidal influences and brackish water quality effects on in-situ treatment may limit effectiveness and may need to be assessed.

Metal COCs in groundwater are less amenable for in-situ remediation because of their ubiquitous presence in historic fill, and because they cannot be destroyed, but only changed in form or become attached to particles. As described in the RIR (Section 7), fill material is present in surface and subsurface soil/fill throughout the Site. This material is considered "historic fill" as it complies with the NJDEP definition of historic fill. Defining the fraction of impacts associated with natural conditions, pre-placement of contaminated fill, or a release(s) was not an RI objective. For the purposes of this FS, injection of an iron sulfide amendment to form metal sulfide complexes in the soil/fill is assumed.

Additional groundwater sampling and performance of treatability studies would be required as part of the remedial design to evaluate and select the most cost-effective means for addressing both organic and inorganic constituents in groundwater, including means of reagent delivery to the subsurface and evaluation of tidal influences on that delivery. Chemical oxidation is generally preferred over reductive dechlorination due to the presence of arsenic and the likely decrease of arsenic mobility with increasing oxidation state. This alternative does not eliminate the need for institutional controls or reduce their expected duration.

The treatment of relatively low concentrations away from higher concentration areas, including deep unit groundwater, would be extremely inefficient. As shown on Figure 5-9 deep groundwater is addressed by this alternative.

5.3.5 Groundwater Alternative 5 – Institutional Controls, In-Situ Remediation, and Targeted Pump and Treat

This alternative combines the institutional controls of Groundwater Alternative 2 with the in-situ treatment aspects of Groundwater Alternative 5 for upgradient portions of the Site and the pump and treat aspects of Groundwater Alternative 4 for downgradient portions of the Site. Figure 5-10 presents the major components and areas for Groundwater Alternative 5.

As with Groundwater Alternatives 3 and 4, the extent of groundwater to be addressed and the specific means for addressing would be determined during the remedial design, including additional groundwater sampling and the performance of treatability studies. Under this currently envisioned hybrid approach, in-situ remediation would be focused on the upgradient portion of the Site, targeting metals in the shallow unit and organics in both the shallow and deep units. As above, a means of chemical oxidation for organics and fixation of metals is assumed. Chemical oxidation is generally preferred over reductive dechlorination due to the presence of arsenic and the likely decrease of arsenic mobility with increasing oxidation state.

The treatment of relatively low concentrations away from higher concentration areas, including deep unit groundwater, would be extremely inefficient. As shown on Figure 5-10, deep groundwater is addressed by this alternative.

The location of injection wells would be located based on groundwater concentration compared to ARARs. For downgradient portions of the Site, 8 to 10 extraction wells would be installed to address shallow and deep units, and a 100-GPM groundwater treatment system would be constructed, likely using similar technologies as described under Groundwater Alternative 3. To prevent uncontrolled release of injection fluids into the river, injection wells along the river may not be a viable option. Tidal influence of groundwater levels especially near the river could reduce injection volumes because of less free space in a well for injection during high tides.

5.3.6 Groundwater Alternative 6 – Institutional Controls, Site Containment at River Edge and Focused In-Situ Remediation

This alternative combines the designation of CEAs and WRAs Site wide for groundwater ARARs exceedances and focused in-situ remediation implemented in higher VOC concentration areas. Installation of a vertical barrier along the river edge is to reduce the potential interaction between groundwater and the river (Figure 5-11) and is part of this alternative. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

The extent of focused in-situ remediation (Figure 5-11) will be determined during the remedial design, with the intent being to address those portions of groundwater that are most amenable to in-situ treatment, i.e,, highest concentrations of organic constituents. The remaining groundwater would be subject to the restrictions of the CEAs/WRAs. For the purposes of this FS, the remediation is assumed to be targeted to areas with VOCs at concentrations approximately one order of magnitude or greater than the PRGs, specifically focused on the vicinity of shallow Monitoring Wells MW-106, MW-107, MW-108, MW-124, and deep Monitoring Well MW-202. In-situ treatment methods for the VOCs would be as described under Groundwater Alternative 4, including the need for treatability studies to evaluate the most effective approach.

5.3.7 Groundwater Alternative 7 – Institutional Controls and Site Containment

This alternative combines the institutional controls of Groundwater Alternative 2 with engineering controls to isolate contaminated groundwater from the environment and reduce potential hydraulic communication with off-site surface water. As noted in the RI, groundwater may migrate in the direction of shallow groundwater flow which, for this Site, is primarily toward the Passaic River. Tidal fluctuations affect the rate of shallow groundwater migration toward the river, as during high tide river water migrates into the shallow groundwater. Figure 5-12 presents the major components and areas for Groundwater Alternative 7.

Slurry walls and grout curtains have been screened out from this alternative because of implementability complexities, substantial preparation work that would be undertaken and disruption of existing business. Slurry walls and grout curtains would be offset from river edge by 10 feet, maybe more based upon remedial design geotechnical investigation findings and to prevent uncontrolled slurry or grout movement due to void spaces along the bulkhead. This 10-foot offset alignment would require at least another 10 feet of working space for installation. This working space from river would necessitate the demolition of vacant (Building #7) and occupied buildings (Buildings #15 and #17). In addition, subsurface utility lines exist along the bulkhead that would need to be relocated. Because the slurry wall/grout curtain is offset from the river, soil/fill will be outside of slurry wall/grout curtain.

Sheet piling surrounding the entire Site would be constructed to the top of an underlying confining layer, most likely the glacial lake bottom silt deposits starting between 20 and 40 feet below grade. The wall depth, design and alignment will be determined during remedial design. A geotechnical investigation would be conducted during remedial design also. The purpose of the vertical barrier wall is to reduce lateral groundwater migration and river water infiltration and isolate contaminated groundwater from the environment. The mitigation/infiltration would be addressed for both shallow fill and deep groundwater. The sheet piling is not intended to address geotechnical issues related to property

redevelopment or to enhance the structural stability of the current bulkhead. The alignment of the sheet piling is shown on Figure 5-12.

Additionally, unpaved portions of the Site would be covered with a low-permeability cap considering NJDEP guidance to reduce infiltration of precipitation and address the soil/fill to groundwater pathway. Where existing paved areas meet the to be developed specifications for a containment cap, they would remain intact and would be incorporated into the cap system. Appropriate deed restrictions would be implemented to prevent disturbance of the cap and vertical barrier. This alternative would be implemented for the entire Site.

5.4 Sewer Water

As discussed in Sections 3.5 and 3.7, sewer water and solids in an inactive portion of the northern sewer line (Manhole 8) on Lot 1 are wastes. Manhole 8 measures approximately 4 feet by 4 feet in plan and approximately 6 feet deep. Nine 4-inch diameter steel pipe terminations were identified in Manhole 8, only one of which was not blocked. Approximately 1.2 feet of sewer water and sediment were present within the base of the manhole during sampling events in March and December 2018, or approximately 0.75 CY of combined water and solids. The water sample had methylene chloride and TCE above groundwater PALs. Methylene chloride and toluene concentrations were above 1 mg/kg, and TCE was reported at a concentration of 26 µg/kg in the solids sample.

Retained GRAs for sewer water and solids are no action and removal with off-site disposal and are listed in Section 4.4. Based on the remaining GRAs and process options, there are two decisions to be made for sewer water and solids:

- whether or not to take action; and
- if action occurs, what means should be used to remove and dispose of the materials.

VOC-impacted sewer water and solids in an inactive portion of the northern sewer line at Manhole 8 on Lot 1 are potential source materials. Although the risks associated with these materials have not been quantified, the RAOs include preventing exposure to a release of the materials, reducing COC concentrations in the water, and preventing or minimizing the discharge of sewer water COCs to surface water. Note that the solids are considered a waste, but for the purposes of this FS, those solids are addressed with the sewer water, as they are co-located.

5.4.1 Sewer Water Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, the water and solids in the designated section of sewer and associated line would be left in place, and no means of securing the materials to prevent future release to the environment would be implemented.

5.4.2 Sewer Water Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of the water and solids into appropriate containers or transport vehicles for off-site treatment and/or disposal. The means for disposal of the various wastes would be determined during the remedial design; however, for the purposes of this FS, certain assumptions can be made, pending disposal characterization. Liquid materials would be pumped into drums and transferred to an appropriate facility for treatment and disposal. Remaining solids in the manhole would be vacuumed into a drum and disposed of in an appropriate solid waste landfill.

Upon removal of the contents, the interior of the manhole and associated line would be water-jetted, and then closed in place by plugging/filling to prevent future buildup of water and solids in the manhole. Cleaning of the manhole and the one unplugged pipe would generate an estimated 300 gallons (approximately 1.5 CY) of liquids, for a total of approximately 2 CY of water.

Solids currently contained within the inactive sewer at Manhole 8 are also potential source material. Manhole 8 measures approximately 4 feet by 4 feet in plan and approximately 6 feet deep. Approximately 1.2 feet of sewer water and sediment were present within the base of the manhole during sampling events in March and December 2018, or approximately 0.75 CY of combined water and solids. Of this volume, approximately 50 percent or 0.4 CY is estimated to consist of solids.

5.5 Soil Gas

As indicated in the BHHRA, risks to future indoor workers from soil gas intrusion are unacceptable at Lots 58 (TCE and xylenes), 62 (naphthalene), and 68 (TCE and xylenes). It is assumed that soil gas concentrations are relatively consistent within each of the areas delineated for soil vapor COCs as provided in Section 3.8. Accordingly, the areas identified for Lots 58, 62, and 68 VOCs in soil/fill are the same for soil gas delineation.

Retained GRAs, remedial technologies, and process options for soil gas are in Section 4.5. Based on indoor air sample results, health risks posed by indoor vapors in currently occupied buildings are below applicable risk thresholds. Risk assessment results indicate that vapor barriers and/or passive depressurization systems may be required for future indoor workers at Lots 58, 62, and 68, should structures be occupied or built on those lots. Additionally, shallow groundwater results at four monitoring wells exceed NJDEP VISLs. Retained process options are proven and readily implemented and would be implemented on an individual lot or site-wide basis as appropriate. The RAO for soil gas is to reduce COC levels in soil/fill to reduce the potential for vapor intrusion.

Based on the remaining GRAs and process options, there are two decisions to be made for soil gas:

- whether or not to take action; and
- if action occurs, whether to pursue limited action, passive remedies or active remedies.

As discussed in Section 2.15, risks to future indoor workers from soil gas intrusion are unacceptable at Lots 58 (TCE and xylenes), 62 (naphthalene), and 68 (TCE and xylenes). Areas where soil/fill concentrations of naphthalene, TCE and total xylenes exceed the respective PRGs, including the aforementioned lots, are delineated as shown on Figures A-15 through A-17, respectively, of Appendix A. Alternatives to directly address the sources of the soil gas, such as through soil/fill excavation or in-situ remediation, are discussed in Section 5.2. The treatment alternatives described in this section relate to the treatment of soil gas COCs after removal from the ground, if such treatment is required to meet ARARs with respect to off-gas emissions.

It is noted that soil/fill associated with potential vapor intrusion risks are also directly addressed as part of Soil/Fill Alternatives 5, 6, and 7. Should any of those alternatives be selected, the selection of an alternative to actively address soil/fill associated with potential soil gas risk may not be necessary.

5.5.1 Soil Gas Alternative 1 – No Action

Under this alternative, no action would be taken. This alternative is retained for comparison with the other alternatives as required by the NCP. Under no action, no measures would be taken to protect future indoor workers from exposure to organic soil vapors.

5.5.2 Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings) and Site-Wide Engineering Controls (future buildings)

This alternative consists of establishing or enhancing deed notices and/or CEAs site-wide to provide certain restrictions upon the use of the property. Such restrictions (institutional controls) would require that prior to existing buildings being occupied in the future, a building-specific assessment of sub-slab soil gas and/or indoor air quality would be performed,

and if needed, some means of protecting the future occupants of such existing buildings from vapor intrusion risks would be implemented. Additional restrictions would require that future new construction include a vapor barrier or other appropriate means of sealing the ground surface underneath the new building slab or installation of a SSDS.

Ongoing indoor air monitoring or engineering controls (such as a SSDS) would be required in certain occupied buildings to confirm previous assessment results and/or to ensure the indoor workers are protected, due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells.

Figure 5-13 presents the major components and areas for Soil Gas Alternative 2.

5.5.3 Soil Gas Alternative 3 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and In-Situ Remediation of Soil/Fill (existing occupied buildings)

This alternative includes the site-wide institutional controls and continued air monitoring or engineering controls for existing occupied and future buildings associated with VOCs in groundwater above NJDEP VISLs, as described for Soil Gas Alternative 2. Additionally, certain soil/fill adjacent to existing occupied buildings would be subject to in-situ remediation. Figure 5-14 presents the major components and areas for Soil Gas Alternative 3.

In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative includes in-situ remediation of 7,500 CY (see Appendix A-19) of soil/fill containing TCE, total xylenes and naphthalene above target remediation goals (Figure 5-14) within 100 feet of those buildings. In-situ remediation of the designated soil/fill would be performed as described under Soil/Fill Alternative 7. Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) is addressed by the site-wide institutional controls requiring assessment and if needed mitigation prior to occupancy of existing buildings and engineering controls for future construction.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells.

5.5.4 Soil Gas Alternative 4 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Removal/Off-Site Disposal of Soils (existing occupied buildings)

This alternative includes establishing or enhancing institutional controls as described for Soil Gas Alternative 2. In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative includes removal and off-site disposal of 7,500 CY (see Appendix A-19) of soils containing TCE, total xylenes and naphthalene above target remediation goals (Figure 5-15) within 100 feet of those buildings. Removal of the designated soils would be performed as described under Soil/Fill Alternative 5. Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) are addressed by the site-wide institutional controls requiring assessment and if needed mitigation prior to occupancy of existing buildings and engineering controls for future construction.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells.

Figure 5-15 presents the major components and areas for Soil Gas Alternative 4.

5.5.5 Soil Gas Alternative 5 – Institutional Controls, Site-Wide Engineering Controls (future buildings), and Air Monitoring or Engineering Controls and Ex-Situ Treatment and On-Site Placement of Soil/Fill (existing occupied buildings)

This alternative consists of establishing or enhancing institutional controls as described for Soil Gas Alternative 2. In lieu of air monitoring and engineering controls (SSDS) for existing occupied buildings, this alternative includes ex-situ treatment and on-site placement (i.e., beneficial reuse) of approximately 7,500 CY (see Appendix A-19) of soil/fill containing TCE, total xylenes and naphthalene (Figure 5- 15) within 100 feet of those buildings. Removal, treatment, and replacement of the designated soil/fill would be performed as described under Soil/Fill Alternative 6. Remaining soil/fill with VOCs above the associated PRGs (i.e., not within 100 feet of existing occupied buildings) are addressed by the site-wide institutional controls requiring assessment and if needed mitigation prior to occupancy of existing buildings and engineering controls for future construction.

Ongoing indoor air monitoring or mitigation actions would be required in certain occupied buildings to ensure the indoor workers are protected due to the presence of VOCs in groundwater above NJDEP VISLs in certain shallow monitoring wells.

Figure 5-16 presents the major components and areas for Soil Gas Alternative 5.

5.6 Screening of Alternatives

In an FS, a preliminary screening evaluation of assembled alternatives can be performed to reduce the number of alternatives that will undergo a more thorough and extensive analysis. This screening was performed and included a general evaluation of effectiveness, implementability and cost for each alternative, and alternatives would be screened out if judged to be either not effective, not implementable, or with costs far out of line with respect to the apparent benefits of the alternative, relative to the other alternatives. A summary of this screening evaluation is included in Table 5-1 and is briefly described below. Note that the No Action alternatives are required to be carried forward to the detailed analysis, even though in most cases such alternatives are considered not effective.

5.6.1 Waste

Both waste alternatives are retained for detailed analysis.

5.6.2 Soil/Fill

Seven alternatives were assembled for consideration in addressing risks associated with soil/fill. Among them, Soil/Fill Alternatives 6 (Institutional Controls, Removal with Off-Site Disposal, and NAPL Removal) and 7 (Institutional Controls, Ex-Situ Treatment and On-Site Placement, Engineering Controls, and NAPL Removal) are judged to be not implementable and having costs not commensurate with the expected benefit. Both of these alternatives require the excavation of substantial volumes of soil/fill at depths of up to 11 feet, which is well below the water table and the adjacent river level and would require significant dewatering and water handling and treatment, particularly for the approximately 800 linear feet of excavations that would be performed immediately adjacent to the river.

Additionally, the impact of such remedial actions to the operating businesses at the Site during the implementation of these alternatives would be considerable. The excavation/treatment areas and associated work areas are where active business operations occur. Because of shared access and parking, all current business would be disrupted, not only lots with excavations/treatment. To implement these alternatives, businesses would be shut down during the work.

Excavation adjacent to existing buildings resulting in building stability considerations. Additional measures would be undertaken to address building stability. Because foundation and other building details are not known, building stability

measures would have to be more conservative than if these details were known. Building stability issues would result in soil/fill designated for removal next to a building under Alternatives 6 and 7 to remain in place.

Accordingly, Soil/Fill Alternatives 6 and 7 are removed from further consideration.

5.6.3 Groundwater

Seven alternatives were assembled for consideration in addressing risks associated with groundwater at the Site. While none of the alternatives involving treatment have a demonstrated ability to restore groundwater quality given the nature of the soil/fill at the Site, Groundwater Alternative 7 (Institutional Controls and Site Containment) is judged to be not implementable, given the need to construct an impermeable vertical barrier around the entire Site, which may require building(s) demolition depending on wall alignment. Given the numerous underground utilities at the Site and the proximity of several buildings to the property line and roadways to the west, it is uncertain whether an effective barrier can be constructed along much of the western boundary of the Site, and access from adjacent property owners may be needed. This alternative would also require construction of an impermeable cap over the entire Site, which would cause considerable business disruption. Accordingly, Groundwater Alternative 7 is removed from further consideration.

5.6.4 Sewer Water

Both sewer water alternatives are retained for detailed analysis.

5.6.5 Soil Gas

Five alternatives were assembled for consideration in addressing risks associated with soil gas at the Site. While Soil Gas Alternatives 4 and 5 are similar in nature to Soil/Fill Alternatives 6 and 7 in that they include excavation of impacted soil/fill, the excavations for the soil gas alternatives would have a smaller footprint and would be limited to the vadose zone, and thus water handling would not be required. Accordingly, all five soil gas alternatives are retained for detailed analysis.

6. DETAILED ANALYSIS OF ALTERNATIVES

6.1 Evaluation Criteria

In this section, the alternatives developed in Section 5 for various media at the Site are described and evaluated in detail. The detailed analysis of alternatives provides information to aid in the comparison among alternatives and the selection of the final recommended alternative. This analysis is performed in accordance with the USEPA RI/FS Guidance Document (USEPA, 1988) and the NCP, as revised by 55 Federal Register 8813 (March 8, 1990). In conformance with the NCP, the following nine criteria are used in the final analysis:

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Long-term effectiveness and permanence;
- Reduction of TMV by treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State (support agency) acceptance; and
- Community acceptance.

These criteria are described below, before performing the detailed analysis of the alternatives.

6.1.1 Overall Protection of Human Health and the Environment

Each alternative is assessed to determine whether it can provide adequate protection of human health and the environment (short- and long-term) from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the Site. Evaluation of this criterion focuses on how site risks are eliminated, reduced, or controlled through treatment, engineered controls, or institutional controls and whether an alternative poses any unacceptable cross-media impacts.

6.1.2 Compliance with ARARs

Section 121(d) of CERCLA, 42 U.S. Code § 9621(d), the NCP, 40 CFR Part 300 (1990), and guidance and policy issued by USEPA require that remedial actions under CERCLA comply with substantive provisions of ARARs from the state and federal environmental laws and State facility siting laws during and at the completion of the remedial action, unless such ARARs are waived. The definition and identification of ARARs have been described and discussed in detail in Section 3.2. Three classifications of requirements are defined by USEPA in the ARAR determination process. ARARs are defined as chemical-, location-, or action-specific. An ARAR can be one or a combination of all three types. Each alternative is evaluated to determine how ARARs would be met.

6.1.3 Long-Term Effectiveness and Permanence

Long-term effectiveness evaluates the likelihood that the remedy would be successful and the permanence it affords. Factors TBC, as appropriate, are discussed below.

- Magnitude of residual risk remaining from untreated waste or treatment residuals remaining at the end of the remedial activities. The characteristics of the residuals are considered to the degree that they remain hazardous, taking into account their TMV and, where relevant, propensity to bioaccumulate.
- Adequacy and reliability of controls used to manage treatment residuals and untreated waste remaining at the Site. This factor includes an assessment of containment systems and institutional controls to determine if they are sufficient to ensure any exposure to human and ecological receptors is within protective levels. This factor also addresses the long-term reliability of management controls for providing continued protection from residuals, the assessment of the potential need to replace technical components of the alternative, and the potential exposure pathways and risks posed should the remedial action need replacement.

6.1.4 Reduction of Toxicity, Mobility, or Volume by Treatment

CERCLA expresses a preference for remedial alternatives employing treatment technologies that permanently or significantly reduce the TMV of hazardous substances. Each alternative is assessed for the degree to which it employs a technology to permanently and significantly reduce TMV, including how treatment is used to address the principal threats posed by the site. Factors TBC, as appropriate, include the items below.

- The treatment processes the alternatives employ and materials they would treat
- The amount of hazardous substances, pollutants, or contaminants that would be destroyed or treated, including how the principal threat(s) would be addressed
- The degree of expected reduction in TMV of the waste due to treatment
- The degree to which the treatment is irreversible
- The type and quantity of residuals that would remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate such hazardous substances and their constituents
- Whether the alternative would satisfy the statutory preference for treatment as a principal element of the remedial action

6.1.5 Short-Term Effectiveness

This criterion reviews the effects of each alternative during the construction and implementation phase of the remedial action until remedial response objectives are met. The short-term impacts of each alternative are assessed, considering the following factors, as appropriate.

- Short-term risks that might be posed to the community during implementation of an alternative
- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures

- Potential adverse environmental impacts resulting from construction and implementation of an alternative and the reliability of the available mitigation measures during implementation in preventing or reducing the potential impacts
- Ability to provide controls to minimize potential exposures during remedial actions
- Time until protection is achieved for either the entire site or individual elements associated with specific site areas or threats

6.1.6 Implementability

The technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation is evaluated under this criterion. The ease or difficulty of implementing each alternative is assessed by considering the following factors:

Technical Feasibility

- Technical difficulties and unknowns associated with the construction and operation of a technology
- Reliability of the technology, focusing on technical problems that will lead to schedule delays
- Ease of undertaking additional remedial actions, including what, if any, future remedial actions would be needed and the difficulty to implement additional remedial actions

Administrative Feasibility

- Activities needed to coordinate with other offices and agencies and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions)

Availability of Services and Materials

- Availability of adequate off-site treatment, storage capacity, and disposal capacity and services
- Availability of necessary equipment and specialists and provisions to ensure any necessary additional resources

6.1.7 Cost

Detailed cost estimates for each alternative were developed for the FS according to A Guide to Developing and Documenting Cost Estimates during the Feasibility Study (USEPA, 2000), with an expected accuracy of -30 to +50 percent. Costs are based on published unit rates, such as R.S. Means, recent actual cost data and supplier quotes for other projects of a similar nature, and professional judgement. A contingency of 25 percent is added to the cost estimates to account for possible variations in scope and quantities. Detailed cost estimates for the alternatives are included in Appendix B and include the following:

- Capital costs
- Annual O&M costs
- Periodic costs
- Present value of capital and annual O&M costs, based on a 7 percent annual discount rate for future costs

6.1.8 State (Support Agency) Acceptance

State (support agency) acceptance is a modifying criterion under the NCP. Assessment of state acceptance will not be completed until comments on the final FS report are submitted to USEPA. State acceptance is assessed by USEPA following public comment on the Proposed Plan, and thus, state acceptance is not considered in the detailed analysis of alternatives presented in the FS.

6.1.9 Community Acceptance

Community acceptance is also a modifying criterion under the NCP. Assessment of community acceptance will include responses to questions that any interested person in the community may have regarding any component of the remedial alternatives presented in the final FS report. This assessment will be completed by USEPA after receipt of public comments on the Proposed Plan during the public comment period, and thus, community acceptance is not considered in the detailed analysis of alternatives presented in the FS.

6.2 Individual Analysis of Alternatives

This section provides the detailed analysis for each remedial alternative developed in Section 5 and is summarized in Table 6-1. Detailed cost estimates were generated for each alternative and are summarized in Table 6-2, and projected durations of each of the alternatives are provided in Table 6-3. The cost estimates encompass the capital, construction, and long-term maintenance costs incurred over the life of the remedy (30 years) expressed as the net present value of these costs. Detailed estimated cost tables are included in Appendix B.

6.2.1 Wastes

6.2.1.1 Waste Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to remove the containerized waste and LNAPLs in USTs and Building #15A. This alternative would not meet the RAOs.

Compliance with ARARs

This alternative would not comply with New Jersey UST regulations.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the contaminated wastes would not be addressed. There would be no change to the magnitude of potential impacts since no action would be taken to reduce or remove the materials. The No Action alternative provides no controls of the materials nor any measures to control potential human health risks and ecological risks. The No Action alternative would not provide any mechanism to monitor the potential release of the materials.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to remove waste.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life, and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $15,500, as detailed in Appendix B.

6.2.1.2 Waste Alternative 2 – Removal and Off-Site Disposal

This alternative includes the removal and appropriate disposal of waste from containers, Building #15A and the USTs, as well as the removal and disposal of the USTs. Refer to Soil/Fill Alternatives for removal of LNAPL-impacted soil/fill not associated with USTs.

Overall Protection of Human Health and the Environment

This alternative would provide protection of human health and the environment, as the wastes would be removed from the Site, thereby eliminating the potential for exposure of human and ecological receptors and release of the materials to environmental media. LNAPL-impacted soil/fill not immediately adjacent to the USTs is not addressed by this alternative.

Compliance with ARARs

This alternative would comply with New Jersey UST regulations. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with necessary regulations and permits, including disposal of removed wastes at an authorized off-site TSD facility. This alternative would meet chemical-specific ARARs (PRGs) since the wastes would be removed from the Site.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by removal of the waste. The magnitude of the residual risk of the waste would be minimal. No wastes requiring continuing controls would remain. LNAPL-impacted soil/fill not immediately adjacent to the USTs is addressed by the soil/fill alternatives.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the waste, including NAPL-impacted soil/fills immediately adjacent to the USTs, through removal and appropriate off-Site disposal. The toxicity and volume of the waste would not be affected by treatment.

Short-Term Effectiveness

This alternative would involve approximately 2 to 4 weeks of on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, shipment of waste containers, and importing of backfill materials. Protection of the workers and the surrounding environment and

community during implementation of this remedy can be achieved by adhering to Occupational Safety and Health Administration (OSHA) standards for construction and hazardous waste work.

Implementability

Removal of the wastes and USTs is readily implementable, as equipment and experienced vendors for this type of work are available. Groundwater in excavation area will be managed during UST removal.

Cost

The capital cost for this alternative is $1,563,000. The annual O&M cost, which is primarily related to performance of five-year reviews, is $3,100. The present worth cost of this alternative is $1,602,000 for 30 years.

6.2.2 Soil/Fill

6.2.2.1 Soil/Fill Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to reduce contaminant mass and to restore the impacted areas. Potential risks to workers, visitors, and trespassers, as identified in the BHHRA, would remain. This alternative would not address the RAOs.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address soil/fills with COC concentrations above relevant standards.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the contaminated soil/fill, including LNAPL where present, would not be addressed. There would be no change to the magnitude of residual contamination since no action would be taken to reduce or remove the contaminants. The No Action alternative provides no controls nor any measures to control potential human health risks and ecological risks associated with the impacted soil/fill, and would not provide any mechanism to monitor the potential migration of the impacted soil/fill.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address impacted soil/fill. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs, although not as quickly as a treatment option.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action alternative has no capital costs over the 30-year project life and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $49,000, as detailed in Appendix B.

6.2.2.2 Soil/Fill Alternative 2 – Institutional Controls and NAPL Removal

For this alternative, deed notices would be recorded on all 15 lots. Existing deed notices would be revised to reflect RI results and implemented engineering controls for applicable lots. Fencing would be maintained and enhanced as appropriate in order to limit unauthorized access to the area and prohibit future use of the area in a manner which may expose human receptors to unacceptable risk. Other institutional controls include existing zoning and local ordinances associated with use of the Site which would also be reviewed and modified as appropriate to ensure compliance with the objectives of this alternative. NAPL-impacted soil/fill not associated with the USTs would be removed as part of this alternative (UST-associated NAPL-impacted soil/fill is addressed by the waste alternatives).

Overall Protection of Human Health and the Environment

Through the recording and maintenance of deed notices, zoning ordinances, and access restrictions as described in Section 5.2.2, including fencing, this alternative would be protective of human health by addressing human exposure pathways, but would not address ecological exposure pathways, nor would it prevent or minimize potential off-site transport of soil/fill containing COCs or the potential leaching of COCs to groundwater and surface water. Removal of NAPL-impacted soil/fill will eliminate the potential for exposure of human and ecological receptors to these materials.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address soil/fill with COC concentrations above relevant standards. This alternative would not be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7.

Long-Term Effectiveness and Permanence

Deed restrictions effectively prevent unauthorized land use and development by future owners of the property in a manner inconsistent with use assumptions of the BHHRA. Fencing reduces unauthorized on-site activities and human exposure to COPCs in soil/fill and fill material. Removal of NAPL-impacted soil/fill will effectively and permanently eliminate the potential for exposure of human and ecological receptors to these materials.

Regular site inspections would be required to confirm and document continued compliance with the deed and access restrictions. This alternative provides no controls nor any measures to control potential and ecological risks associated with COCs in soil/fill, and would not provide any mechanism to monitor the potential migration of the COPCs in soil/fill.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address COCs in soil/fill beyond the removal of NAPL-impacted soil/fill adjacent to Building #7. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs, although not as quickly as an active treatment option.

Short-Term Effectiveness

This alternative would pose limited short-term impact to on-site workers or the local community, as on-site remedial activities would be limited to fencing installation and an area of NAPL removal adjacent to Building #7.

Implementability

This alternative would be easily implemented. Property owners would need to record their deed notice. Regular inspections would be required to verify continued integrity of the fencing and compliance with deed restrictions.

Cost

The capital cost for this alternative is $279,000. The annual O&M cost, which is primarily related to performance of routine site inspections and five-year reviews, is $4,400. The present worth cost of this alternative is $333,000 for 30 years.

6.2.2.3 Soil/Fill Alternative 3 – Institutional Controls, Engineering Controls (containment and bulkhead), and LNAPL Removal

For this alternative, in addition to the institutional controls (deed restriction, zoning, and fencing) and NAPL removal described for Soil/Fill Alternative 2, a 6-inch asphalt cap would be installed over soil/fill over the majority of the Site (Figure 5-2). Capping of contaminated areas consists of the construction of a barrier over/around the contaminated areas. The cap is intended to prevent access to and contact with the contaminated media and/or to control its migration. Impermeable caps like asphalt caps also address the soil to groundwater pathway by reducing vertical infiltration.

Portions of the river shoreline with either no bulkhead or an existing failing bulkhead would be addressed by the installation of either new steel sheet piling or installation of a liner and riprap to reduce the potential interaction between surface water and the Site.

Overall Protection of Human Health and the Environment

Through the recording and maintenance of deed notices and access restrictions as described in Section 5.2.2, fencing and the installation of a surface cap and enhancement of the existing bulkhead along the river, this alternative would be protective of human health and the environment. Removal of NAPL-impacted soil/fill will eliminate the potential for exposure of human and ecological receptors to these materials. These actions would address human exposure and ecological pathways to COCs and COECs, minimize the potential for interaction between the Site and the surface water, and reduce the potential for leaching of COCs to groundwater and surface water.

Compliance with ARARs

This alternative would meet PRGs (chemical-specific ARARs) because contaminated soil/fill exceeding PRGs would be capped.

This alternative would be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

Deed restrictions, fencing, and appropriate risk management practices would effectively prevent unauthorized activities and development by future owners of the property in a manner inconsistent with use assumptions of the BHHRA, and the asphalt cap would effectively reduce human and ecological exposures. Removal of NAPL-impacted soil/fill will effectively and permanently eliminate the potential for exposure of human and ecological receptors to these materials. The bulkhead enhancements would reduce off-site soil/fill movement. Inactive wall pipes would be sealed, eliminating

this potential pathway. Some lots have existing asphalt caps via deed notices or concrete/asphalt pavement that could provide comparable long-term effectiveness and permanence as a new cap. During remedial design, these existing features will be assessed. Regular site inspections would be required to confirm and document continued compliance with the deed and access restrictions. Regular inspections and as-needed maintenance of the cap and enhanced bulkhead would be required to ensure those controls continue to be protective.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative, as there is no provision in this alternative to directly address COCs in soil/fill, beyond the removal of NAPL-impacted soil/fill adjacent to Building #7. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs. Mobility of soil/fill COCs would be reduced through installation of the cap and bulkhead enhancement.

Short-Term Effectiveness

This alternative would involve approximately 6 to 10 months of on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of large construction equipment, and importing of materials. Construction would generate noise during the day, particularly with respect to installation of the steel bulkhead sections. Bulkhead enhancement and capping of soil/fill at the Site will require coordination with existing operations on certain lots.

Implementability

This alternative is implementable. Equipment and experienced contractors for cap installation are readily available. Construction of the cap would require coordination with existing businesses and anticipated redevelopment plans, if available at the time of remedial design. For the bulkhead enhancement, administrative coordination with the U.S. Corps of Engineers, NJDEP, and USEPA would be required, and the limited space between the shoreline and existing site buildings may present a technical challenge. A geotechnical investigation during design of bulkhead enhancement would likely be required. The northern portion of the Site is congested with ongoing business activities and also provides the only vehicle access point. This alternative will cause disturbances to current businesses. Deed notices would be recorded by each property owner.

A specialty contractor would be required for installation of the enhanced bulkhead sections, using either land-based or water-based equipment. Regular inspections would be required to verify continued integrity of the fencing and compliance with deed restrictions, and to verify integrity of the cap and bulkhead. Inspection and maintenance of the bulkhead, in particular, may be challenging. Coordination with implementation of remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River may be required.

Excavation adjacent to existing buildings resulting in building stability considerations. Additional measures would be undertaken to address building stability. Because foundation and other building details are not known, building stability measures would have to be more conservative than if these details were known.

Cost

The capital cost for this alternative is $5,681,000 if the bulkhead is enhanced with new sheet piling, and $4,115,000 if a liner and riprap is used to anchor portions of the shoreline. The annual O&M cost, which is primarily related to performance of routine site inspections and maintenance, including occasional cap resurfacing, is $71,200 to $77,500. The present worth cost of this alternative is $6,565,000 (sheet pile) or $5,077,000 (geomembrane/riprap) for 30 years.

6.2.2.4 Soil/Fill Alternative 4 – Institutional Controls, Engineering Controls (containment and bulkhead), Focused Removal with Off-Site Disposal of Lead, and LNAPL Removal

For this alternative, select soil/fill with lead concentrations above PRGs would be excavated and disposed off Site, such that compliance with ARARs for lead could be achieved in that area (Figure 5-3). Other metals and COCs that are co-located with lead would also be removed. Remedial design sampling will refine excavation areas and depths. Excavated areas would be backfilled and finished in a manner consistent with current conditions or as otherwise appropriate for subsequent site redevelopment. Additionally, the institutional controls and NAPL removal described for Soil/Fill Alternative 2 and the engineering controls (capping and bulkhead improvements) and access restrictions described for Soil/Fill Alternative 3 would also be implemented.

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment through the implementation of institutional controls and focused removal of lead and LNAPL-impacted soil/fill, capping of soils, and bulkhead improvements. These activities will prevent potential off-site transport of soil/fill containing COCs and reduce the exposure pathways to human and ecological receptors associated with soil/fill with COCs and COECs. Removal of LNAPL-impacted soil/fill will eliminate the potential for exposure of human and ecological receptors to these materials.

Compliance with ARARs

By removal and appropriate off-site disposal of soil/fill exceeding the established PRGs, this alternative may comply with chemical-specific ARARs for lead in soil/fill in that area, but would require a waiver of ARARs for COCs remaining in soil/fill. Safety concerns related to excavation adjacent to a building will result in offset excavation from building foundation resulting in soil/fill designated for removal to remain in place.

Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. Based on backfill used, this alternative may not be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by targeted removal of soil/fill containing lead and NAPLs. The residual risk is reduced but remains as soil/fill with other COCs above PRGs. Routine inspections of backfilled areas and the bulkhead, and correction of erosion or other issues would be performed.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the lead and NAPL in soil/fill through removal and appropriate off-site disposal, most likely by landfilling, although not by treatment unless removed soil/fill is determined to be hazardous and requires treatment prior to disposal. The toxicity and volume of the waste would not be reduced.

Short-Term Effectiveness

This alternative would involve approximately five to eight months of on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, shipment of waste containers, and importing of backfill materials. Protection of the workers and the surrounding environment and community during excavation of impacted soil/fill can be achieved by adhering to OSHA standards for construction and hazardous waste work, including air monitoring and dust control measures.

Implementability

Soil/fill excavation, loading, and hauling are readily implemented with common earthmoving equipment, and other requisite services, including backfill material and disposal facilities, are anticipated to be readily available. The ability to conduct deeper excavations may be limited by the proximity to building foundations. Remedial activities would be coordinated with ongoing commercial activities at the Site. Excavation and associated soil/fill management would disrupt existing business. The northern portion of the Site is congested with ongoing business activities and also provides the only vehicle access point. This alternative will cause disturbances to current businesses. Implementability issues associated with bulkhead construction are described in Section 6.2.2.3. Owner would record deed notices.

Cost

The capital cost for this alternative is $6,694,000 (sheet pile) or $5,173,000 (geomembrane/riprap). The annual O&M cost, which is primarily related to performance of routine inspections and maintenance of the cap and bulkhead, is $71,200 to $77,500. The present worth cost of this alternative is $7,578,000 (sheet pile) or $6,135,000 (geomembrane/riprap) for 30 years.

6.2.2.5 Soil/Fill Alternative 5 – Institutional Controls, In-Situ Remediation, Engineering Controls (bulkhead), and LNAPL Removal

For this alternative, selected soil/fill with metals above PRGs would be subject to in-situ stabilization in order to bind the metals to the soil/fill matrix. Selected soil/fill with organics above PRGs would be subject to soil/fill mixing with a chemical oxidant to destroy the organics. A single-layer asphalt cap and bulkhead improvements (as described or Soil/Fill Alternative 3) would be installed over the treated areas as well as Lots 67 and 69, and the institutional controls and LNAPL removal described for Soil/Fill Alternative 2 would also be implemented.

Overall Protection of Human Health and the Environment

This alternative would be protective of human health and the environment. Treatment of surface soil/fill from Lots 63 and 64 would minimize potential off-site transport of soil/fill containing COCs. The exposure pathways to human and ecological receptors would be eliminated by capping and treatment of soil/fill with COCs exceeding the PRGs from the Site. Potential transport of COCs in soil/fill off Site and potential leaching of COCs to groundwater and surface water would also be reduced by capping and bulkhead improvements.

Compliance with ARARs

By treatment of COCs in soil/fill exceeding the established PRGs, this alternative would comply with some chemical-specific ARARs for COCs in soil/fill through destruction of organics. Areas capped under this alternative would meet PRGs (chemical-specific ARARs). Metals concentrations exceeding PRGs would remain, but the metals would be immobilized and capped. As described in Section 5.2.5, stabilization/solidification methods for metals would not meet ARARs for on-site placement of treated soil/fill.

Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including erosion and sedimentation regulations and storm water management. This alternative may not be in compliance with required remedial action related to historic fill pursuant to N.J.A.C. 7:26E-5.4 and to N.J.A.C. 7:26C-7. Institutional controls would need to be implemented and monitored.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by treatment of the COCs in soil/fill to destroy organics and immobilize metals. The magnitude of the residual risk would be minimal, although COCs would remain in soil/fills. Routine inspections of treated and capped areas and the bulkhead, and correction of erosion or other issues would be performed.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the metals COCs and the toxicity and volume of PAHs and VOCs through treatment.

Short-Term Effectiveness

This alternative would involve approximately 8 to 12 months of initial on-site construction operations, which would increase local traffic due to the commute of construction workers, transportation of construction equipment, importing of treatment reagents, and hauling of excess soil/fill. If injections are used for reagent delivery, additional rounds of treatment may be required to achieve treatment goals, which may extend the duration of the project for an additional one to two years. Protection of the workers and the surrounding environment and community during treatment of impacted soil/fill can be achieved by adhering to OSHA standards for construction and hazardous waste work, including handling of treatment reagents, air monitoring and dust control measures.

Implementability

This alternative is implementable but challenging, requiring owner/tenant cooperation. Equipment, reagents, and experienced vendors for in-situ stabilization and treatment of impacted soil/fill are commercially available. Pilot studies would be required during remedial design to determine the appropriate reagents and mixing ratios to meet PRGs and required leachability treatment criteria. Remedial activities would be coordinated with ongoing commercial activities at the Site. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Treatment in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, or closely spaced injection points, due to the relatively shallow depth of impacts. Implementability issues associated with bulkhead construction are described in Section 6.2.2.3. If additional injections are warranted, business disruption would occur again.

Cost

Chemical oxidation treatment is generally applied in several rounds with several months between treatments. Three rounds of treatment have been assumed in FS costs, with each round assuming a reduction in the area required for treatment. Any disturbed surface would need to be restored to allow business operations. The capital cost for this alternative is $9,517,000 (sheet pile) or $7,997,000 (geomembrane/riprap), assuming in-situ stabilization for metals and soil/fill mixing/chemical oxidation for organics. Alternate treatment methods are expected to have similar implementation costs. The annual O&M cost, which is primarily related to performance of routine inspections, bulkhead maintenance, and five-year reviews, is $65,000 to $71,200. The present worth cost of this alternative is $10,324,000 (sheet pile) or $8,881,000 (geomembrane/riprap) for 30 years.

6.2.3 Groundwater

6.2.3.1 Groundwater Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to prevent exposure to groundwater at the Site or to prevent or minimize potential discharge to surface water, although at the present time there are no users of groundwater. This alternative would not address the RAOs. Natural processes such as dispersion and degradation may gradually reduce COC concentrations in the aqueous phase; however, no monitoring would be performed to confirm this reduction.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs, as no action would be taken to address groundwater with COC concentrations above relevant standards.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since COCs in groundwater would not be addressed. There would be no change to the magnitude of residual contamination since no action would be taken to reduce or remove the contaminants. The No Action alternative provides no controls nor any measures to control potential human health risks and ecological risks associated with the impacted groundwater, and would not provide any mechanism to monitor its potential migration.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to address impacted groundwater. However, natural biological, chemical, and physical processes may continue to gradually reduce concentrations of certain COCs, although not as quickly as a treatment option.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action alternative is not applicable, as no action is taken.

Cost

The No Action alternative has no capital costs over the 30-year project life, and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $38,800 as detailed in Appendix B.

6.2.3.2 Groundwater Alternative 2 – Institutional Controls, Site Containment at River Edge and Monitored Natural Attenuation

This alternative combines the designation of CEAs and WRAs for the entire Site, installation of a vertical barrier along the river edge to reduce the potential for interaction between groundwater and the river, and the degradation of COCs in the aquifer by natural biological, chemical, and/or physical processes. Groundwater monitoring would be performed

to demonstrate that these natural processes are occurring, and that the selected remedy continues to be protective of human health and the environment.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater, and reduce COC concentrations and migration of COCs in groundwater associated with biodegradation. This on-site attenuation in combination with a vertical barrier reduces potential for discharges of groundwater containing COCs to surface water. Metal COC attenuation in groundwater is primarily due to retardation and adsorption. Groundwater monitoring would be conducted to support the demonstration of the occurrence of natural attenuation processes such to gradually reduce COC concentrations in the aqueous phase.

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater; however, over time, natural attenuation processes may eventually reduce COC concentrations to meet certain chemical-specific ARARs. Groundwater results during the RI indicated some COC concentrations decreased resulting in ARAR compliance for some COCs in the most recent samples. The timeframe for achieving compliance with these ARARs has not been estimated at this time. Metal COC concentrations in groundwater may not be reduced to below PRGs for a long period because of their presence in saturated soil/fill and tidal influences on groundwater quality. Other alternatives including waste removal and capping or excavation of contaminated soil/fill will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and the barrier wall would effectively reduce the potential for interaction between site groundwater and the river. As the natural recovery of the impacted areas would be slow, it is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed to confirm that natural attenuation is occurring.

Reduction of TMV through Treatment

Implementation of institutional controls, construction of a vertical barrier wall, and MNA would not reduce the TMV of COCs through active treatment. However, natural biological, chemical, and physical processes may continue to gradually reduce concentrations of certain substances. An MNA study would be required as MNA was not elevated in the RI. It is noted that, in general, VOC concentrations decreased during the RI resulting in some VOCs being in compliance with ARARs.

Short-Term Effectiveness

Lower COC concentrations were observed over an 11-month period in the RI, indicating potential short-term effectiveness likely due to natural biological, chemical, and physical processes. The implementation of this alternative would entail minimal risk of human exposure to COCs in groundwater, with the greatest contribution to this risk resulting from occasional groundwater sampling and the installation of additional monitoring wells as needed. Risks would also be associated with use of heavy equipment and handling of sheet piles for installation of the vertical barrier wall along the river. Such risks would be minimized by following appropriate health and safety requirements.

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for installation of the vertical barrier wall along the river. Installation of the barrier wall may need to be coordinated with implementation of the remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River. Regular inspections would be performed to verify compliance with the applicable provisions of the CEAs and WRAs, and routine groundwater monitoring would be performed. Moderate disruption to industrial park's businesses would occur during vertical barrier wall installation.

Cost

The capital cost for this alternative is $3,743,000. The annual O&M cost, which is primarily related to performance of routine site inspections and groundwater monitoring, is $87,000 The present worth cost of this alternative is $4,821,000 for 30 years.

6.2.3.3 Groundwater Alternative 3 – Institutional Controls, Site Containment at River Edge, and Pump and Treat

This alternative combines the designation of CEAs and WRAs for the entire Site, installation of a vertical barrier along the river edge to reduce the potential for interaction between groundwater and the river, and the installation of an extraction and treatment system for shallow and deep groundwater. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater, and the extraction and treatment system may reduce concentrations of COCs in groundwater over time, although the timeframe for such reduction is indefinite, particularly with respect to metals. Additionally, installation of the vertical barrier would reduce the discharge of groundwater containing COCs to surface water.

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater, however, over time the extraction of impacted groundwater along with the occurrence of natural attenuation processes may eventually reduce COC concentrations to meet certain chemical-specific ARARs. The timeframe for achieving compliance with these ARARs has not been estimated at this time. Metal COC concentrations in groundwater may not be reduced to below PRGs for a long period. Other alternatives including waste removal and capping or excavation of contaminated soil/fill will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and the barrier wall would effectively reduce the potential for interaction between site groundwater and the river. It is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed until PRGs are met.

Reduction of TMV through Treatment

Installation and operation of a groundwater extraction and treatment system would effectively reduce the TMV of COCs captured by the extraction system.

Short-Term Effectiveness

The implementation of this alternative would entail limited risk of human exposure to COCs in groundwater, with the greatest contribution to this risk resulting from the installation of extraction wells and O&M of the extraction and treatment system. Risks would also be associated with use of heavy equipment and handling of sheet piles for installation of the vertical barrier wall along the river. Such risks would be minimized by following appropriate health and safety requirements.

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for installation of the extraction and treatment system as well as the vertical barrier wall along the river. For the treatment system, a portion of the Site would have to be designated for construction of a significantly sized treatment building (at least 5,000 SF), limiting the future use of that portion of the Site. Installation of conveyance lines between the extraction wells and the treatment system may also be challenging given the presence of underground utilities throughout the Site. Installation of the barrier wall may need to be coordinated with implementation of remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed. Moderate disruption to the industrial park's businesses would occur during vertical barrier wall installation. Installation and operation of an extraction and treatment system will be moderate during construction and low during treatment operations.

Cost

The capital cost for this alternative is $7,973,000. The annual O&M cost, which is primarily related to O&M of the extraction and treatment system, is $613,000. The present worth cost of this alternative is $15,575,000 for 30 years.

6.2.3.4 Groundwater Alternative 4 – Institutional Controls and In-Situ Remediation

Alternative 4 includes the CEA and WRA components described for Groundwater Alternative 2. A focused in-situ remediation of potential source area(s) (i.e., UST area) in combination with MNA (Groundwater Alternative 3) are other components of this alternative. The most appropriate in-situ treatment approach/reagent(s) will be selected as part of the remedial design, which will consider performance of treatability and/or pilot studies and evaluation of tidal influences on reagent delivery. Based on RI findings, LNAPL has not been observed in groundwater wells, and thus remedial measures are not warranted at this time. If LNAPL is observed in groundwater (outside of the UST area), this alternative would include remedial measures to address the LNAPL depending the nature and extent of the LNAPL, and could include excavation and removal, passive absorption, or dual-phase extraction, among other potential approaches.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site, designation of additional CEAs and WRAs for the remainder of the Site, and in-situ treatment of organics and inorganics, this alternative would prevent exposure to COCs and may reduce potential discharge of groundwater with COCs to surface water (if and when PRGs are attained).

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, along with treatment to reduce the migration of organic COCs in groundwater, compliance with action-specific ARARs may be achieved. This alternative could comply with chemical-specific ARARs for COCs amenable to in-situ treatment (VOCs), however, compliance with ARARs for other COCs (metals) is uncertain at this time.

Because soil/fill below the water table contains metal COCs, their sources in addition to a natural source are likely historic fill which may have been impacted by current or past releases(s). This may result in some COC concentrations in groundwater not being reduced to below PRGs for a long period. Other alternatives including waste removal, capping, or excavation of contaminated soil/fill may reduce lead infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to impacted groundwater. As the impacted groundwater may not be remediated for all COCs by this alternative, it is possible that the use restrictions would be required to remain in effect for an indefinite period.

Reduction of TMV through Treatment

Performance of in-situ remediation would reduce the TMV of certain COCs (organics) in groundwater by treatment. The mobility of other metals in groundwater would be reduced, but not the toxicity or volume.

Short-Term Effectiveness

This alternative would initially involve approximately 4 to 8 weeks of on-site construction operations, including injection or sparging and monitoring well installation. Follow-up injections or operation of sparging systems and regular groundwater monitoring may continue for an additional 6 months to 5 years, with continued groundwater monitoring beyond that timeframe. If soil/fill mixing is utilized for reagent delivery, this alternative will likely take 18 to 24 months to implement, not including potential delays associated with minimizing business disruptions. Protection of the workers and the surrounding environment and community during these activities can be achieved by adhering to OSHA standards for construction and hazardous waste work. Design of an injection remedy should address the potential for loss of reagents to the river.

Implementability

Implementation of this alternative is feasible, as providers of these services are available. Operations would have to be coordinated with ongoing business operations at the Site. Implementability of an in-situ remedy may be affected by on-site hydrogeological conditions with respect to ability to deliver reagents to the aquifer or the radius of influence of injection or sparging wells, which may be limited particularly for shallow groundwater. Tidal fluctuations would also need to be accounted for in designing the remedy. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed. Based on current site businesses and depending on the work areas and means of reagent delivery, disruption of businesses ranges from moderate to severe.

Cost

The capital cost for this alternative is $44,109,000, assuming in-situ chemical oxidation and stabilization. The 30-year O&M cost, which includes routine groundwater monitoring, is $87,000. The present worth cost of this alternative is $45,187,000 for 30 years. Alternate treatment methods are expected to have similar present worth costs.

6.2.3.5 Groundwater Alternative 5 – Institutional Controls, In-Situ Remediation, and Targeted Pump and Treat

This alternative combines the designation of CEAs and WRAs for the entire Site, with in-situ remediation methods in upgradient portions of the Site and the installation of an extraction and treatment system for downgradient portions of the Site. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater, and the in-situ treatment and extraction/treatment system may reduce concentrations of COCs in groundwater over time, although the timeframe for such reduction is indefinite, particularly with respect to metals. The extraction system along the downgradient portion of the Site would reduce the discharge of groundwater containing COCs to surface water. To prevent uncontrolled release of injection fluids into the river, injection wells along the river may not be a viable option.

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater, however, over time, in-situ treatment and the extraction of impacted groundwater along with the occurrence of natural attenuation processes may eventually reduce COC concentrations to meet certain chemical-specific ARARs. The timeframe for achieving compliance with these ARARs has not been estimated at this time. Metal COC concentrations in groundwater may not be reduced to below PRGs for a long period. Other alternatives including waste removal and capping or excavation of contaminated soil/fill will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and extraction system along the river would reduce discharge of site groundwater to the river. As demonstrated by the tidal influences along the river, river water will be captured by the extraction wells. The volume of river water captured by pump and treat will be significantly more than captured groundwater, thus reducing this alternative's effectiveness. This excessive capture and treatment of river water is not an environmentally sustainable practice. Additional treatment processes of brackish water not related to Site would be added. It is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed until PRGs are met.

Reduction of TMV through Treatment

Installation and operation of a groundwater extraction and treatment system would effectively reduce the TMV of COCs captured by the extraction system. In upgradient portions of the Site, in-situ remediation would reduce TMV of organic COCs, but would only reduce the mobility of inorganic COCs.

Short-Term Effectiveness

The implementation of this alternative would entail moderate risk of human exposure to COCs in groundwater, with the greatest contribution to this risk resulting from the handling of treatment reagents and operation of equipment needed

for reagent delivery to the subsurface, along with the installation of extraction wells and O&M of the extraction and treatment system. Such risks would be minimized by following appropriate health and safety requirements.

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for installation of the extraction and treatment system as well as in-situ treatment. For the treatment system, a portion of the Site would have to be designated for construction of a significantly sized treatment building (at least 3,200 SF), limiting the future use of that portion of the Site. Installation of conveyance lines between the extraction wells and the treatment system may also be challenging given the presence of underground utilities throughout the Site. Implementing an in-situ treatment remedy may cause significant business disruptions in the upgradient portion of the Site. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed.

Cost

The capital cost for this alternative is $12,334,000. The annual O&M cost, which is primarily related to O&M of the extraction and treatment system, is $574,000. The present worth cost of this alternative is $19,453,000 for 30 years.

6.2.3.6 Groundwater Alternative 6 – Institutional Controls, Site Containment at River Edge and Focused In-Situ Remediation

This alternative combines the designation of CEAs and WRAs for the entire Site with focused in-situ remediation on higher VOC concentration areas. Installation of a vertical barrier along the river edge to reduce the potential interaction between groundwater and the river as shown on Figure 5-11 is part of this alternative. Ongoing groundwater monitoring would be performed to demonstrate that the selected remedy continues to be protective of human health and the environment.

Overall Protection of Human Health and the Environment

Through the maintenance of existing CEAs and WRAs at the Site and designation of additional CEAs and WRAs for the remainder of the Site, this alternative would prevent exposure to COCs in groundwater. In-situ treatment of targeted areas of higher VOC concentrations may likely reduce concentrations of those COCs in groundwater. Inorganic COCs are not directly remediated by this alternative. This focused treatment in combination with a vertical barrier reduces the potential for discharges of groundwater containing COCs to surface water.

Compliance with ARARs

By providing institutional controls restricting the use of groundwater and thereby eliminating the exposure pathway, compliance with action-specific ARARs may be achieved. In the short-term, this alternative would not comply with chemical-specific ARARs (PRGs) associated with the restoration of groundwater, however, over time, in-situ treatment along with the occurrence of natural attenuation processes may reduce COC concentrations to meet certain chemical-specific ARARs. The timeframe for achieving compliance with these ARARs has not been estimated at this time. Metal COC concentrations in groundwater may not be reduced to below PRGs for a longer period than for VOCs. Establishment of a CEA for metals is consistent with NJDEP policy for historic fill remedies. Other alternatives including waste removal and capping or excavation of contaminated soil/fill will reduce potential COC infiltration into groundwater from unsaturated soil/fill. Groundwater would be monitored under institutional controls until PRGs for COCs are met.

Long-Term Effectiveness and Permanence

If complied with, groundwater use restrictions in combination with the existing reliable supply of public water available throughout the area would effectively prevent unacceptable human exposure to COCs in groundwater, and in-situ treatment of groundwater with the highest VOC concentrations would reduce potential off-site groundwater mitigation. The vertical barrier wall will reduce influence of tidal river water, increasing in-situ treatment effectiveness. It is likely that the use restrictions would be required to remain in effect for an indefinite period. Groundwater monitoring would be performed until PRGs are met.

Reduction of TMV through Treatment

In targeted portions of the Site, in-situ remediation would reduce TMV of organic COCs. The TMV for inorganic COCs would not be addressed by this alternative.

Short-Term Effectiveness

The implementation of this alternative would entail moderate risk of human exposure to COCs in groundwater, with the greatest contribution to this risk resulting from the handling of treatment reagents and operation of equipment needed for reagent delivery to the subsurface. Additional risks are associated with construction activities for the vertical barrier wall along the river, including operation of large equipment and handling of steel sheeting. Such risks would be minimized by following appropriate health and safety requirements.

Implementability

This alternative is implementable, as certain lots/areas already have the indicated institutional controls, and services and equipment are readily available for performance of in-situ treatment. The areas presently targeted for the focused in-situ remediation are adjacent to currently vacant buildings and, therefore, would lead to limited business disruptions. Regular inspections would be performed to verify compliance with the CEAs and WRAs, and routine groundwater monitoring would be performed. Installation of the barrier wall may need to be coordinated with implementation of the remedial action currently being designed for the lower 8.3 miles of the Lower Passaic River. Business disruption related to vertical barrier wall is the same as other alternatives with this component.

Cost

The capital cost for this alternative is $5,719,800. The annual O&M cost, which is primarily related to groundwater monitoring and five-year reviews, is $86,900. The present worth cost of this alternative is $6,798,000 for 30 years.

6.2.4 Sewer Water

6.2.4.1 Sewer Water Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health and the environment since no action would be taken to remove impacted water and solids from Manhole 8 and associated piping. This alternative would not meet the RAOs.

Compliance with ARARs

This alternative would not comply with chemical-specific ARARs.

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since the water and solids in the sewer would not be addressed. There would be no change to the magnitude of potential impacts since no action would be taken to reduce or remove the materials. The No Action alternative provides no controls of the materials nor any measures to control potential human health risks. The No Action alternative would not provide any mechanism to monitor the potential release of the materials.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative. There is no provision in this alternative to remove the sewer materials.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life, and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $15,500, as detailed in Appendix B.

6.2.4.2 Sewer Water Alternative 2 – Removal and Off-Site Disposal

This alternative consists of the transfer of the water and solids into appropriate containers or transport vehicles for off-site treatment and/or disposal.

Overall Protection of Human Health and the Environment

This alternative would provide protection of human health and the environment, as the sewer materials would be removed from the Site, thereby eliminating the potential exposure to the waste, release of the materials to the environment, or potential discharge of sewer water COCs to surface water.

Compliance with ARARs

This alternative would comply with ARARs. Location- and action-specific ARARs would be met by following appropriate health and safety requirements and complying with applicable provisions of regulations and permits, including disposal of removed materials at an authorized off-site TSD facility.

Long-Term Effectiveness and Permanence

This alternative would provide long-term effectiveness and permanence by removal of the sewer material and filling of the manhole and associated line. The magnitude of the residual risk would be minimal, and no wastes requiring continuing controls would remain.

Reduction of TMV through Treatment

This alternative would reduce the mobility of the sewer material through removal and appropriate off-Site disposal. The toxicity and volume of the material would not be affected by treatment.

Short-Term Effectiveness

This alternative would involve approximately 1 week of on-site construction operations. Protection of the workers and the surrounding environment and community during removal and filling can be achieved by adhering to OSHA standards for construction and hazardous waste work.

Implementability

Removal of the sewer materials and filling of the manhole and piping is readily implementable, as equipment and experienced vendors for this type of work are available. Disruption of current business would be minimal.

Cost

The capital cost for this alternative is $29,700. The annual O&M cost, which is primarily related to performance of five-year reviews, is $2,500. The present worth cost of this alternative is $60,800 for 30 years.

6.2.5 Soil Gas

6.2.5.1 Soil Gas Alternative 1 – No Action

Overall Protection of Human Health and the Environment

The No Action alternative would not provide protection of human health since no action would be taken to prevent COCs in soil gas from migrating to indoor air (assuming the No Action alternative for Soil/Fill is also selected), although at the present time, the detected concentrations do not pose unacceptable cancer risks or non-cancer hazards, as determined in the BHHRA. Natural processes may gradually reduce COC concentrations in soil/fill; however, no monitoring of soil/fill would be performed to confirm this reduction.

Compliance with ARARs

This alternative would not comply with ARARs, as no action would be taken to address COCs in soil gas (assuming no action is taken under the soil/fill alternatives to address impacted soils).

Long-Term Effectiveness and Permanence

The No Action alternative does not provide long-term effectiveness and permanence since COCs in soil gas would not be addressed (assuming no action is taken under the soil/fill alternatives to address impacted soils). The No Action alternative provides no measures to control or monitor for the potential migration of soil gas to indoor air.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative (assuming no action is taken under the soil/fill alternatives to address impacted soils). There is no provision in this alternative to address soil gas. However, natural biological, chemical, and physical processes may gradually reduce concentrations of certain COCs.

Short-Term Effectiveness

Since no remedial action would be implemented, this alternative would not pose a short-term impact to on-site workers or the local community.

Implementability

An evaluation of the implementability of the No Action Alternative is not applicable, as no action is taken.

Cost

The No Action Alternative has no capital costs over the 30-year project life, and would incur only costs related to the five-year reviews required by the NCP, estimated to have a net present value of $23,300, as detailed in Appendix B.

6.2.5.2 Soil Gas Alternative 2 – Institutional Controls, Air Monitoring or Engineering Controls (existing occupied buildings), and Site-Wide Engineering Controls (future buildings)

This alternative consists of establishing or enhancing deed notices and/or CEAs across the entire Site to provide certain restrictions upon the use of the property, requiring assessing and if necessary, addressing the potential for vapor intrusion prior to occupying existing vacant buildings or constructing new buildings on those lots. The assessment will determine if engineering controls, such as sub-slab vapor barriers or SSDS, are required. Additional air monitoring of existing occupied buildings is also included to confirm there are no unacceptable risks to current indoor workers associated with VOCs in groundwater.

Overall Protection of Human Health and the Environment

Through the recording and maintenance deed restrictions and CEAs on the affected lots, this alternative would be protective of human health, as it would require assessing and, if needed, mitigating vapor intrusion risks in existing buildings prior to occupancy, and establishing required protective measures for new construction. Natural processes may gradually reduce COC concentrations in soil/fill; however, no monitoring of soil/fill would be performed to confirm this reduction.

Compliance with ARARs

This alternative would comply with ARARs for addressing potential vapor intrusion.

Long-Term Effectiveness and Permanence

Requirements for assessing and mitigating vapor intrusion risks for existing and future buildings on the affected lots would be effective. Regular site inspections would be required to confirm and document continued compliance with the requirements and operation of engineering controls, if installed.

Reduction of TMV through Treatment

No reductions of contaminant TMV through treatment would be achieved under this alternative, except where active (electro-mechanical) mitigation of vapor intrusion is determined to be necessary and treatment of vapors performed.

Short-Term Effectiveness

Short-term risks for this alternative would be limited to those associated with the collection of vapor samples and, if needed, installation of engineering controls. These risks are readily controlled by following appropriate health and safety practices.

Implementability

This alternative is implementable and requires owner/tenant cooperation. If engineering controls are required for an existing building, design testing may be required. Regular inspections would be required to verify continued compliance with the requirements of this alternative. Disruption to businesses ranges from minimal to moderate.

Cost

The capital cost for this alternative is $122,000. The annual O&M cost, which is primarily related to performance of routine site inspections, is $17,500. The present worth cost of this alternative is $339,000 for 30 years.

6.2.5.3 Soil Gas Alternative 3 – Institutional Controls, Air Monitoring or Engineering Controls (future buildings), and In-Situ Remediation of Soil/fill (existing occupied buildings)

This alternative combines the site-wide institutional controls and engineering controls for future construction as described for Soil Gas Alternative 2 with the in-situ remediation of soil/fill in the vicinity of existing occupied buildings which exceed PRGs associated with vapor-intrusion risks. Additional air monitoring of existing occupied buildings is also included to confirm there are no unacceptable risks to current indoor workers associated with VOCs in groundwater.

Overall Protection of Human Health and the Environment

Through the maintenance and enhancement of existing deed restrictions and CEAs and certain requirements for future construction, along with the in-situ treatment of soil/fill associated with potential vapor intrusion risks, this alternative would be protective of human health.

Compliance with ARARs

This alternative would comply with ARARs for addressing potential vapor intrusion.

Long-Term Effectiveness and Permanence

Treatment of soils presenting potential vapor intrusion risks for existing buildings and implementing requirements for assessing and mitigating vapor intrusion risks for future buildings would be effective. Regular site inspections would be required to confirm and document continued compliance with the requirements and proper operation of SSDS if installed.

Reduction of TMV through Treatment

Reductions of contaminant TMV through treatment would be achieved under this alternative for VOCs in soil/fill in the vicinity of existing occupied buildings.

Short-Term Effectiveness

Short-term risks for this alternative would be limited to those associated with the handling of treatment reagents and operation of equipment for reagent delivery, and the collection of vapor samples and installation of SSDSs if required. These risks are readily controlled by following appropriate health and safety practices.

Implementability

This alternative is implementable and requires owner/tenant cooperation. For the existing buildings, treatability testing during the remedial design may be appropriate to determine the most effective treatment reagent, and multiple

applications of the reagent may be necessary. Business disruption would be minimal to moderate, depending on the reagent delivery method selected.

Cost

The capital cost for this alternative is $1,678,000. The annual O&M cost, which is primarily related to performance of routine site inspections and SSDS operation/monitoring, is $17,500. The present worth cost of this alternative is $1,895,000 for 30 years.

6.2.5.4 Soil Gas Alternative 4 – Institutional Controls, Air Monitoring or Engineering Controls (future buildings), and Removal and Off-Site Disposal of Soil/fill (existing occupied buildings)

This alternative is similar to Soil Gas Alternative 3, except soil/fill in the vicinity of existing occupied buildings which exceed PRGs associated with vapor-intrusion risks would be removed and disposed of off-site. Additional air monitoring of existing occupied buildings is also included to confirm there are no unacceptable risks to current indoor workers associated with VOCs in groundwater.

Overall Protection of Human Health and the Environment

Through the maintenance and enhancement of existing deed restrictions and CEAs and certain requirements for future construction, along with the removal of soil/fill associated with potential vapor intrusion risks, this alternative would be protective of human health.

Compliance with ARARs

This alternative would comply with ARARs for addressing potential vapor intrusion.

Long-Term Effectiveness and Permanence

Removal of soils presenting potential vapor intrusion risks for existing buildings and implementing requirements for assessing and mitigating vapor intrusion risks for future buildings would be effective. Regular site inspections would be required to confirm and document continued compliance with the requirements and proper operation of SSDS if installed.

Reduction of TMV through Treatment

This alternative does not reduce TMV of VOCs through treatment, unless removed soil/fill is determined to be hazardous and require treatment prior to disposal. Proper landfilling of excavated soil/fill would reduce the mobility of the VOCs.

Short-Term Effectiveness

Short-term risks for this alternative would be associated with excavation activities and increased truck traffic, and the collection of vapor samples and installation of SSDSs if required. These risks are readily controlled by following appropriate health and safety practices.

Implementability

This alternative is implementable and requires owner/tenant cooperation. Excavation activities may cause moderate business disruption.

Cost

The capital cost for this alternative is $3,463,000. The annual O&M cost, which is primarily related to performance of routine site inspections and SSDS operation/monitoring, is $17,500. The present worth cost of this alternative is $3,680,000 for 30 years.

6.2.5.5 Soil Gas Alternative 5 – Institutional Controls, Air Monitoring or Engineering Controls (future buildings), and Ex-Situ Treatment and On-Site Placement of Soil/fill (existing occupied buildings)

This alternative is similar to Soil Gas Alternative 3, except the targeted soil/fill in the vicinity of existing occupied buildings which exceed PRGs associated with vapor-intrusion risks would be treated ex-situ and then replaced back in the excavation. Additional air monitoring of existing occupied buildings is also included to confirm there are no unacceptable risks to current indoor workers associated with VOCs in groundwater.

Overall Protection of Human Health and the Environment

Through the maintenance and enhancement of existing deed restrictions and CEAs and certain requirements for future construction, along with the ex-situ treatment and replacement of soil/fill associated with potential vapor intrusion risks, this alternative would be protective of human health.

Compliance with ARARs

This alternative would comply with ARARs for addressing potential vapor intrusion.

Long-Term Effectiveness and Permanence

Treatment of soils presenting potential vapor intrusion risks for existing buildings and implementing requirements for assessing and mitigating vapor intrusion risks for future buildings would be effective. Regular site inspections would be required to confirm and document continued compliance with the requirements and proper operation of SSDS if installed.

Reduction of TMV through Treatment

Reductions of contaminant TMV through treatment would be achieved under this alternative for VOCs in soil/fill in the vicinity of existing occupied buildings.

Short-Term Effectiveness

Short-term risks for this alternative would be limited to those associated with the handling of treatment reagents and operation of excavation and treatment equipment, and the collection of vapor samples and installation of SSDSs. These risks are readily controlled by following appropriate health and safety practices.

Implementability

This alternative is implementable and requires owner/tenant cooperation. For the soil/fill at existing occupied buildings, treatability testing during the remedial design may be appropriate to determine the most effective treatment reagent. Business disruption would be moderate, due to the required excavation and need to designate an adjacent area for treatment processes.

Cost

The capital cost for this alternative is $1,715,000. The annual O&M cost, which is primarily related to performance of routine site inspections and SSDS operation/monitoring, is $17,500. The present worth cost of this alternative is $1,933,000 for 30 years.

6.3 Comparative Analysis of Alternatives

This comparative analysis section evaluates how each of the remedial alternatives achieves the evaluation criteria relative to one another. To compare the alternatives, ratings of poor, fair, good, or excellent (low, medium, or high for costs) were assigned to each of the evaluation criteria used in the analysis of the alternatives.

6.3.1 Waste

In terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, Alternative 2 (removal and off-site disposal) is rated better than Alternative 1 (no action), which rates poorly in each of those categories. In terms of short-term effectiveness, implementability, and cost, Alternative 1 rates better as no action is taken. Alternative 2 would need to be combined with a soil/fill alternative addressing LNAPL-impacted soil/fill not associated with the USTs.

6.3.2 Soil/Fill

Compliance with chemical-specific ARARs for some COCs may not be feasible due to the nature of the soil/fill. Up to 15 feet of NJDEP defined historic fill exists beneath the Site. The sources of fill are unknown. As fill placement occurred over a more than 30-year period, the sources and thus physical and chemical properties could be different. The fill material consists predominantly of sands, silts, and gravel along with man-made materials such as brick, pieces of concrete block, wood, glass, and cinders. The fraction of each material in the fill varies across the Site.

In terms of protectiveness, compliance with ARARs, and long-term effectiveness, Alternatives 3 (cap and bulkhead enhancement), 4 (focused excavation/disposal with capping) and 5 (in-situ remediation) rate better compared to the remaining alternatives, with Alternative 5 rating the best among these criteria. Alternative 5 also rating best for reduction of TMV by treatment. However, Alternative 5 rates the worst for implementability and short-term effectiveness. Alternatives 2 through 5 will be disruptive to the industrial park's businesses. The northern portion of the Site is extremely congested with ongoing business activities and also provides the only vehicle access point. Alternative 5 treatment areas in the northern portion will cause significant disturbances to businesses, as reagent delivery to the subsurface will require the use of either large diameter augers, which may not be feasible due to underground utilities, and closely spaced injection points, due to the relatively shallow depth of impacts. If additional injections under Alternative 5 are warranted, business disruption would occur again.

Alternative 1 (no action) would not meet the chemical-specific ARARs since no action would be taken. Alternative 2 (institutional controls and LNAPL removal) would not meet chemical-specific ARARs other than as provided by institutional controls. Alternative 3 would comply with chemical-specific ARARs through capping of soil/fill, and Alternative 4 would offer better compliance with the chemical-specific ARARs than the other alternatives since some contaminated soil/fill would be removed from the Site. Stabilization/solidification methods for metals (Alternative 5) would not meet ARARs.

Location- and action-specific ARARs are met by Alternatives 2 through 5. None of the Alternatives eliminate the need for institutional controls.

Alternatives 3 through 5 rate the best for minimizing human and ecological exposure to soil/fill and preventing off-site transport of soil/fill containing COCs. Not including the No Action alternative, Alternative 2 (limited action) rates best

for short-term effectiveness, implementability, and cost. Alternatives 3 through 5 provide similar long-term effectiveness with Alternatives 4 and 5 providing better permanence due to excavation/disposal or in-situ treatment.

Alternatives 2 through 5 have similar long-term O&M obligations through institutional controls. Other than the No Action alternative, none of the soil/fill alternatives reduce these obligations to less than 30 years assumed in the FS process.

Two options are presented for the engineering controls along the river, i.e., bulkhead enhancements, including either sheet pile or geomembrane/riprap to replace approximately 800 feet of missing or failing bulkheads along the river. Both approaches would meet the RAO of minimizing off-site transport of soil/fill containing COPCs to minimize the potential for interaction between the Site and the Passaic River. The two approaches would have similar implementability, with the geomembrane/riprap approach having a lower cost.

6.3.3 Groundwater

Groundwater Alternative 4 (in-situ remediation) rates the best in terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, with Alternatives 3 (pump and treat) and 5 (targeted in-situ and pump/treat) rating slightly lower in these criteria largely due to their reliance on pump and treat as a significant remedy component, which will likely extend the timeframe to achieve the goal of groundwater restoration, particularly with respect to metals in groundwater within soil/fill. Alternative 6 offers compliance with ARARs with in-situ treatment and institutional controls. Alternatives 2 and 6 rank highest for implementability. Three alternatives (Alternatives 3 through 5) rate lower for implementability due to the challenge of addressing metals in groundwater, potential business disruptions, and/or the need to designate a significant portion of the property for construction of a new treatment facility. The handling of treatment reagents also lowers the short-term effectiveness rating for Alternatives 4 and 5. The vertical barrier wall alternatives address potential off-site movement of groundwater better than other alternatives which depend on active controls (i.e., pump and treat).

Alternative 2 (barrier wall and MNA) and Alternative 6 (barrier wall and focused in-situ) rate well for short-term effectiveness (implementation risks are primarily associated with construction hazards of installing the barrier wall along the river) and implementability. Alternative 1 would not meet the chemical-specific ARARs since no action would be taken. Location- and action-specific ARARs are met by Alternatives 3 through 6.

Alternatives 4 and 5 rate the lowest for environmental sustainability because of the resources expended to manage river water which is not site-related media.

In terms of cost, Alternative 2 rates the best, followed by Alternative 6, while Alternatives 3 through 5 rate the worst. Alternatives 2, 4 and 6 have similar long-term O&M obligations through institutional controls and long-term groundwater monitoring, whereas Alternatives 3 and 5 have substantial long-term costs associated with O&M of pump and treat systems. None of these five groundwater alternatives eliminate O&M obligations to less than 30 years assumed in the FS process, although it is possible that the source (LNAPL) removal activities included in the waste and soil/fill alternatives may reduce certain O&M obligations related to organic COCs over time.

6.3.4 Sewer Water

In terms of overall protectiveness, compliance with ARARs, long-term effectiveness, and reduction of TMV, Alternative 2 (removal and off-site disposal) is rated better than Alternative 1 (no action), which rates poorly in each of those categories. In terms of short-term effectiveness, implementability, and cost, Alternative 1 rates better as no action is taken.

6.3.5 Soil Gas

All soil gas alternatives (except No Action) rate well for compliance with ARARs, as potential risks associated with soil gas are directly addressed through air monitoring and engineering controls for both existing occupied buildings and future construction. Alternatives 3 through 5 rate highest for protectiveness and long-term effectiveness, as they include provisions to directly address soil/fill associated with potential vapor intrusion risks at occupied buildings. Only Alternatives 3 and 5 provide reduction of TMV through treatment, although Alternative 4 may provide treatment if removed soil/fill is determined to be hazardous. Alternative 2 (institutional and engineering controls) rates best in terms of short-term effectiveness, implementability, and cost.

6.4 Cross-Media Effects

It is noted that although alternatives for each site medium were evaluated independently of alternatives for other media, the selection and implementation of specific alternatives for certain media may enhance, overlap, or otherwise render irrelevant specific alternatives or portions thereof for other media. Overlapping components of alternatives from different media may also present cost benefits by increasing the effectiveness of a treatment, reducing duration of treatment. Specific examples of these cross-media effects include the following:

- Waste Alternative 2's removal of USTs and their contents along with directly associated LNAPL- and VOC-impacted soils removes a potential groundwater source. This action is expected to result in improved groundwater quality with respect to VOCs, and may reduce the scope/footprint and time needed to achieve certain chemical-specific ARARs, as well as increase the effectiveness of the Groundwater Alternatives with respect to organics.

- Likewise, the removal of other NAPL-impacted soil/fill included in Soil/Fill Alternatives 2 through 5 may have a similar impact on the effectiveness and scope of the Groundwater Alternatives with respect to organic COCs. As well, the limited soil/fill removal of Soil/Fill Alternative 4 and the in-situ remediation included in Soil/Fill Alternative 5 would be expected to have a positive impact on groundwater quality, which could also reduce the scope of groundwater remediation required.

- Implementation of access restrictions under institutional controls for five soil/fill alternatives is expected to reduce illegal dumping. The reduction of illegal dumping reduces sources to impact soil/fill and groundwater. The elimination of this potential source to groundwater could reduce the time needed to achieve groundwater RAOs under Groundwater Alternatives 2 through 6, particularly with respect to organic COCs.

- Capping of the Site under Soil/Fill Alternatives 3 and 4 reduce infiltration through the soil/fill. The cap would reduce the scope/footprint and time needed to achieve groundwater RAOs by eliminating the soil/fill to groundwater pathway.

- Soil/Fill Alternative 5 could include the treatment of VOC-impacted soil/fill adjacent to existing occupied buildings, which could effectively address the potential risks associated with soil gas migration to indoor air at those locations, thereby eliminating the need for Soil Gas Alternatives 3 through 5, and may also reduce or eliminate the need for air monitoring or engineering controls at the existing buildings under Soil Gas Alternative 2.

- Treatment or removal of contaminated soil/fill could increase the effectiveness of groundwater alternatives, potentially decreasing the time needed to achieve ARARs, and potentially reducing the scope of the groundwater alternatives.

- Soil/Fill Alternatives 3 through 5 include the upgrading of the river bulkhead through the installation of approximately 800 feet of sheet piling or riprap to reduce the potential transport of soil/fill containing COCs to surface water. Groundwater Alternatives 2, 3 and 6 each include the installation of a vertical barrier wall, most likely sheet piling, across the entire river edge so as to reduce the potential migration of shallow fill and deep groundwater to surface water. If the selected remedy includes a vertical barrier wall as part of the groundwater alternative, there would be no need for the bulkhead enhancements described for the soil/fill alternatives, and the overall cost would be reduced accordingly.

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