RECORD OF DECISION

LANDFILL & RESOURCE RECOVERY, INC. (L&RR) SUPERFUND SITE

OPERABLE UNIT 02

NORTH SMITHFIELD, RHODE ISLAND

EPA SITE ID: RID093212439

PREPARED BY:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 1 - NEW ENGLAND

APRIL 2020

PART 1: THE DECLARATION FOR THE RECORD OF DECISION

A. SITE NAME AND LOCATION

Landfill & Resource Recovery, Inc. (L&RR) Superfund Site OU2
North Smithfield, Providence County, Rhode Island
CERLCIS ID#: RID093212439

B. STATEMENT OF BASIS AND PURPOSE

This decision document presents the selected remedial action for the Landfill and Resource Recovery, Inc. (L&RR) Superfund Site, Operable Unit 02 (OU2), in North Smithfield, Rhode Island (the Site), which was chosen in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 as amended (CERCLA, also commonly referred to as "Superfund"), 42 U.S.C. § 9601 *et seq.,* and, to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) as amended, 40 C.F.R. Part 300. The Region 1 Director of the Superfund and Emergency Management Division (SEMD) has been delegated the authority to approve this Record of Decision (ROD).

This decision was based on the Administrative Record for the Site, which has been developed in accordance with Section 113(k) of CERCLA, 42 U.S.C. § 9613(k). The Administrative Record is available for review online at www.epa.gov/superfund/lrr, and via computer at the Municipal Annex Building located at 575 Smithfield Road in North Smithfield, Rhode Island, and at the U.S. Environmental Protection Agency (EPA) Region 1 Records Center located at 5 Post Office Square, Boston, Massachusetts. The Administrative Record Index **(Appendix G** of this ROD) identifies each of the items comprising the Administrative Record upon which the selection of the remedial action is based.

The State of Rhode Island, as the support agency, concurs with the selected remedy (see **Appendix A** of this ROD for a copy of the concurrence letter).

C. ASSESSMENT OF SITE

The remedial action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances, pollutants, or contaminants into the environment. The April 2020 Remedial Investigation (RI) Report for the Site summarizes the nature and extent of the contamination and was used to prepare the June 2020 Feasibility Study (FS) Report that identified all the remedial alternatives considered for cleanup of the Site.

D. DESCRIPTION OF SELECTED REMEDY

This ROD sets forth the selected remedy for OU2 of the Site, which is a comprehensive cleanup approach and is based on a combination of remedial alternatives set out in a Proposed Plan issued for public comment in July 2020. The selected remedy addresses groundwater outside the boundary of the waste management area (WMA) associated with the closed landfill (OUl). The selected remedy utilizes *in-situ* treatment and sequestration and institutional controls to prevent the migration of COCs from OUl and to restore groundwater outside of the waste management area to its beneficial use as a source of drinking water.

The remedial measures selected in this ROD include the following:

Groundwater

EPA's selected remedy for Groundwater is **Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring** which includes the following components:

- **Treatability/Pilot Testing:** Treatability testing is underway and will be completed to determine the effectiveness of the innovative technologies selected to treat Site-specific conditions.
- **Pre-Design Investigations:** Pre-design investigations will be used to refine the horizontal and vertical extents of the plume and to identify target treatment zones.
- ***In-situ* Chemical Oxidation (ISCO) Treatment Zone:** The remedy uses a combination of potassium persulfate and sodium persulfate injections to treat the contaminant mass.
- **ISCO Injections:** The remedy includes targeted ISCO injections in areas downgradient of the ISCO treatment zone.
- **Activated Carbon (AC) Injections:** The remedy includes an activated carbon barrier extending approximately 5 to 60 feet below ground surface and 750 feet across.
- **Wetland Restoration:** Wetlands that are disturbed as part of construction will be restored and impacts to any floodplain are expected to be temporary.
- **Monitoring:** Monitoring includes groundwater and surface water monitoring.
- **Institutional Controls:** Institutional controls (ICs) would be implemented for groundwater use in all areas necessary to prevent exposure.
- **Five-Year Reviews:** The Site will be reviewed at a minimum of every five years to assess protectiveness of the remedy.

If EPA, after consultation with RIDEM, determines that the selected remedy will not meet performance standards, the contingency remedy will be implemented. EPA's contingency remedy for Groundwater is **Alternative 3: Groundwater Extraction with Ex Situ Treatment, Institutional Controls, and Monitoring,** which includes the following components:

- **Pre-Design Investigation:** Pre-design investigations would include an additional groundwater investigation to determine optimal extraction well placement.
- **Treatability/Pilot Testing:** Treatability and pilot testing would be used to optimize treatment components and finalize treatment design based on the results from pre-design studies.
- **Extraction and Injection System:** The groundwater extraction system would consist of a series of extraction wells that would capture contaminated portions of the aquifer.
- **Treatment Plant:** Extracted groundwater would be treated by a series of processes including advanced oxidation (AO) and granular activated carbon (GAC) treatment.
- **Operation and Maintenance of the Treatment System:** Operation and Maintenance (O&M) would include monitoring to evaluate that all parts of the extraction and treatment system are operating properly.
- **Wetland Restoration:** Wetlands that are disturbed as part of construction will be restored, and any impacts to floodplains are expected to be temporary.
- **Monitoring:** Monitoring would include groundwater and surface water monitoring.
- **Institutional Controls:** Institutional controls (ICs) would be implemented for groundwater use in all areas necessary to prevent exposure.
- **Five-Year Reviews:** The Site will be reviewed at a minimum of every five years to assess protectiveness of the remedy.

E. STATUTORY DETERMINATIONS

The selected remedy and contingency remedy are consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy and contingency remedy are protective of human health and the environment; comply with federal and State requirements that are applicable or relevant and appropriate to the remedial action; are cost-effective; and utilize permanent solutions and alternative treatment technologies to the maximum extent practicable. The selected remedy and contingency remedy satisfy the statutory preference for treatment as a principal element of the remedy.

Because this remedy will result in Site contaminants remaining in groundwater above levels that would allow for unlimited use and unrestricted exposure, the remedial actions for OU2 will be incorporated into the existing Five Year review cycle for the Site, to ensure all Site remedial actions provide adequate protection of human health and the environment. Five-year reviews for the Site will continue as long as waste remains at the Site above levels that would allow for unlimited use and unrestricted exposure.

F. SPECIAL FINDINGS

Issuance of this ROD embodies the following specific determinations:

Wetlands Impacts

Pursuant to Section 404 of the Clean Water Act (CWA), 44 C.F.R. Part 9, and Executive Order 11990 (Protection of Wetlands), EPA has determined that because of the existence of wetlands at the Site and the levels of Site-related contamination that exist in these wetlands and underlying groundwater there is no practicable alternative to conducting work in these areas. EPA has also determined that the selected remedy and contingency remedy which impact wetland areas are the least environmentally damaging practicable alternatives for protecting wetland resources. EPA will minimize potential harm and avoid adverse impacts to wetlands by using best management practices to minimize harmful impacts on the wetlands, wildlife or their habitat, and by restoring or replicating, if necessary, these areas consistent with federal and state wetlands protection laws. Any wetlands affected by remedial work will be restored or replicated, if necessary, with native vegetation as a wetland area and such restoration will be monitored until the wetland vegetation becomes re-established. Other mitigation measures will be used to protect wildlife and aquatic life during remediation and restoration, as necessary. As required under applicable federal wetlands regulations, EPA solicited public comment regarding the remedies' potential impacts on wetland resources and received no negative comments (see Part 3 of this ROD).

Floodplain Impacts

Pursuant to Executive Order 11988 (Floodplain Management) and federal regulations at 44 C.F.R. Part 9, EPA has determined that there is no practicable alternative to activities that affect or result in the occupancy and modification of the 100-and 500-year floodplain. EPA has also determined that the selected remedy and contingency remedy will cause temporary impacts to 100-year and 500-year floodplains but will not result in the occupancy and modification of floodplains. Best management practices will be used to minimize temporary impacts to floodplains and excavated areas will be returned to original grade to avoid diminishing flood storage capacity. Restoration and monitoring activities are included in the selected remedy. As required under applicable federal floodplains regulations, EPA solicited public comment regarding the remedies' potential impacts on floodplain resources and received no negative comments (see Part 3 of this ROD).

G. DATA CERTIFICATION CHECKLIST

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

	ROD DATA	LOCATION
☑	Chemicals of concern (COCs), also known as contaminants of concern, and their respective concentrations.	Tables G1 – G2
☑	Baseline risk represented by the COCs.	Tables G5 – G10
☑	Cleanup levels established for COCs and the basis for these levels.	Table L-2
☑	Current and reasonably anticipated future groundwater use assumptions used in baseline human health risk assessment.	Section F
☑	Current and potential future groundwater uses as a result of the selected remedy.	Section L
☑	Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected.	Tables L2 – L3
☑	Decisive factors that led to selecting the remedy.	Section K

H. AUTHORIZING SIGNATURES

This ROD documents the selected remedy for groundwater associated with the Landfill and Resource Recovery, Inc. (L&RR) Superfund Site – Operable Unit 02. This remedy was selected by EPA with concurrence of the Rhode Island Department of Environmental Management. A copy of the State's concurrence letter is attached to this ROD (**Appendix A**).

By: BRYAN OLSON Digitally signed by BRYAN OLSON Date: 2021.04.15 16:40:50 -04'00' _____ Date: _____

Bryan Olson, Director
Superfund and Emergency Management Division

PART 2: THE DECISION SUMMARY

A. SITE NAME, LOCATION, AND DESCRIPTION

The L&RR Superfund Site (CERCLIS ID#: RID093212439) or ñSiteò is located in North Smithfield, Rhode Island. EPA is the lead agency and RIDEM is the support agency.

The L&RR Site includes a 28-acre closed/capped landfill that is part of an undeveloped portion of North Smithfield, Rhode Island. The landfill is bounded to the west by a gravel road referred to as Old Oxford Turnpike, which is part of a network of gravel roads maintained for truck use by the Holliston Sand Corporation located farther to the north. An extensive wetland complex associated with Trout Brook is located east of the landfill. Trout Brook flows north toward Trout Brook Pond located farther to the north and east of the landfill. The north, south, and eastern edges of the landfill are bounded by high voltage electric transmission lines. A photovoltaic solar array was recently constructed on a large undeveloped land parcel south of the landfill. Another solar developer has obtained construction permits for a solar array to be located on the parcels to the northwest of the landfill. A series of single-family residential homes and two-unit single-floor condominiums are located approximately one quarter mile to the east along Pound Hill Road. These residences include private drinking water wells for household consumption and use. A Site Locus Map is provided as **Figure 1-1** in **Appendix C** and a Site Plan is provided as **Figure 1-2** in **Appendix C**.

B. SITE HISTORY AND ENFORCEMENT ACTIVITIES

History of Site Use

The L&RR Superfund Site was initially used as a sand and gravel pit given the extensive glacially derived materials within this portion of Rhode Island. The volume of sand and gravel mined remains unknown. It is estimated that most of the sand and gravel was excavated to the elevation at which groundwater was encountered. According to the NUS Corporationôs Remedial Action Master Plan, acceptance of waste for disposal began in 1927 and continued until 1969 when the facility became a solid waste disposal area. In 1974, the waste management area was sold to L&RR, Inc. and operations expanded to include acceptance of commercial, domestic, and industrial waste, in addition to solid waste.

L&RR, Inc. obtained a solid waste management facility license issued by RIDEM in December 1976. Acceptance of hazardous waste began in November 1977 and ceased by September 1979. Hazardous wastes were thought to have been disposed of in the north-central area. Between December 1980 and December 1981, operations at the Site were in a state of flux following expiration of the solid waste management facility license on December 1, 1980. This led to a series of court appeals that eventually ruled in the landfill ownerôs favor and allowed operations to resume. In January 1985, a Rhode Island State Superior Court issued a determination that landfill operations were to permanently cease. The landfill ceased accepting waste materials in 1985.

History of Investigations, Remedial Actions and Enforcement Activities

Operable Unit 1

Efforts to reduce landfill leachate generation began in 1979 when, under the direction of RIDEM, an area referred to as a ñhazardous waste areaò was covered with a 20-mil PVC liner by L&RR, Inc. to reduce the

potential for hazardous waste leachate generation. In 1986, under the direction of RIDEM, additional areas of the landfill were covered with 20-mil PVC geomembrane and soil and supplemented with shaping and grading to enhance landfill drainage.

Numerous subsurface investigations were undertaken for OU1 beginning in 1977 when RIDEM required the past owner of the landfill to submit copies of waste manifests.

Between 1980 and 1981, EPA conducted a preliminary site assessment of the L&RR Site which resulted in the Site being added to the National Priorities List (NPL) in 1982 (47 Fed. Reg. 58476, December 30, 1982). A Remedial Action Master Plan (RAMP) was completed for the Site in 1983. The RAMP evaluated existing data sources, identified data needs and recommended remedial action activities. In 1985, L&RR, Inc., began to close the landfill under a Court Order and Consent Order and Agreement with RIDEM. EPA was not a party to that Court Order and began a federally funded RI/FS in May 1986.

The RI included extensive subsurface investigations to characterize the nature and extent of past landfill-related activities along with a landfill closure assessment. The RI and FS were completed in 1988. Data obtained during the RI were used to support screening and selection of a remedial alternative for OU1 as part of the ROD.

EPA issued the OU1 ROD on September 29, 1988 which was subsequently modified by two Explanation of Significant Differences (ESDs) on March 8, 1991 and September 16, 1996. The selected remedy included the following components:

- Landfill closure upgrades including installation of a perimeter fence, developing a post-closure monitoring plan, surface water management improvements, slope stability improvements, covering the uncovered northeast portion of the landfill, and soil cover/vegetation establishment;
- Installation of a landfill gas collection (using 18 gas extraction wells) and thermal destruction system;
- Remediation of nearby wetlands (modified in 1991 via ESD); and
- Periodic environmental monitoring for a period of at least 30 years.

Implementation of institutional controls for land and water use at the landfill and adjacent areas was required by a 1997 Settlement Agreement and Consent Decree.

On June 5, 1986, EPA notified L&RR, Inc., of its potential liability with respect to the Site. On July 29, 1988, EPA sent a notice letter to L&RR, Inc. which formally demanded reimbursement for past costs, requested information regarding activities at the Site, and requested voluntary participation in undertaking forthcoming remedial activities. On July 29, 1988, EPA also notified additional parties who either generated wastes that were shipped to the facility, arranged for the disposal of wastes at the facility, or transported wastes to the facility, of their potential liability with respect to the Site.

On January 30, 1992, EPA entered into a de minimis settlement pursuant to Section 122(g) of CERCLA, 42 U.S.C. Ä9622(g), with 46 potentially responsible parties each of which, according to EPA, disposed of less than 1% of the hazardous substances at the Site.

In February and March 1990, EPA issued special notice letters to potentially responsible parties to engage in settlement negotiations for the performance of the remedial actions and recovery of response costs at the Site; the negotiations did not result in a settlement between any of the parties. EPA issued a Unilateral Administrative Order (ñUAOò), pursuant to Sections 104(e) and 106(a) of CERCLA, on June 29, 1990, for performance of response actions at the Site. Certain of the respondents subject to the UAO performed

remedial activities pursuant to the UAO, including construction of the remedy set forth in the final 100% Design for the remedy at the Site approved by EPA pursuant to the UAO.

Following a remedial design period from March 1993 to September 1993, implementation of Remedial Action activities began in May 1994. These activities included placing a new PVC cover system over previously uncovered areas, extending the eastern slope, and constructing a gas collection system. The 18 gas extraction wells were connected using a series of pipes (headers) for conveyance of landfill gas to a 40-foot high enclosed flare unit for treatment via thermal destruction. The gas collection system began operation in February 1995. The Post-Closure/O&M Plan was submitted in 1996.

The gas collection and treatment system has successfully operated to reduce landfill gas emissions and control methane levels since 1996. The flare currently operates on a part-time basis due to low methane concentrations typical of aging landfills. The OU1 remedy remains subject to the ARARs set forth in the OU1 ROD, including Rhode Islandôs solid waste regulations.

The ESD issued on September 16, 1996 clarified that the groundwater standards referenced in the ROD (Maximum Contaminant Levels, or MCLs) are to be used to judge the performance of the landfill cap and closure and are not, by themselves, cleanup or performance standards for groundwater. At the time of the initial ROD, air quality emissions were the primary risk driver for which remedial actions were implemented. EPA stated in the ROD (and restated in the 1996 ESD) its reservation of the right to address groundwater in the future if EPA determined that groundwater poses a threat to human health or the environment.

In 1997, the United States and certain settling defendants entered into a Settlement Agreement and Consent Decree that resolved certain claims of the United States and required the settling defendants to perform the work described in the Consent Decree, including: the remaining components of the remedial action not completed pursuant to the UAO; surface water monitoring and institutional controls for land and water use; and all activities required to maintain the effectiveness of the remedial action as required under the Operation and Maintenance Plan and/or Post Closure Operation and Maintenance Plan approved or developed by EPA pursuant to the UAO or modified and approved pursuant to the Consent Decree.

Operable Unit 2

Following closure of the landfill, annual environmental monitoring was performed, which included collection of groundwater and surface water samples to evaluate water quality as part of Post-Closure Site Monitoring (PCSM) requirements. Review of groundwater data indicated detections of select VOCs and metals above regulatory standards at select locations along the perimeter of the landfill. These standard comparisons took into consideration the 1996 ESD which clarified that MCLs were specific to evaluating changes in water quality as part of post-closure monitoring activities.

To support institutional control efforts, field investigation activities involving Lot 23 (**Figure 1-2** in **Appendix C**) began in July and August 2013. The initial approach involved advancement of three groundwater profile locations (WL-1, WL-2, WL-3) to obtain high-resolution vertical profiling data. Select VOCs and arsenic had been historically detected above MCLs at the CW-5 and MW-102 well nests near the landfill boundaries upgradient of the respective lots. The results from the 2013 groundwater profiling confirmed the presence of a limited subset of VOCs (including 1,4-dioxane) and metals, in the overburden aquifer at concentrations that in some cases were above MCLs.

As a result of these detections, a second phase of investigation was initiated in March and April 2014 to further evaluate groundwater and surface water hydraulics and bedrock aquifer conditions. Groundwater-surface water interactions were evaluated using a network of piezometers installed in Trout Brook Pond. Bedrock assessment occurred using a borehole (BH14-1) east of the landfill on Lot 23 followed by geophysical logging to identify potential water-bearing zones. Groundwater samples were collected from the borehole on two separate occasions using packer isolation techniques. Potentiometric data obtained from the network of piezometers on May 15, 2014 were used to develop vertical flow gradients within the wetland complex surrounding Trout Brook. At four of the five piezometers (PZ-1, PZ-3, PZ-4, and PZ-5), the surface water elevation was higher than the groundwater elevation and supported downward groundwater flow and discharge of surface water to groundwater for the time of year. At only one piezometer (PZ-2), the surface water elevation was lower than the groundwater elevation. This piezometer was installed furthest in the wetland complex and the calculated vertical gradient indicates upward groundwater flow consistent with historic observations. Borehole BH14-1 was drilled and logged using standard geophysical methods in March 2014. Bedrock was encountered at 36.5 feet below grade; permanent casing was installed to facilitate air rotary drilling, and the boring was advanced 96.5 feet into rock (corresponding with an elevation of 142.9 feet above mean sea level [AMSL]). The geophysical results identified two possible transmissive fracture zones in the borehole, located from approximately 44 to 49 feet below the top of casing and at approximately 73 feet and 86 feet below the top of casing. Heat-pulse flow meter (HPFM) measurements recorded under ambient conditions and while stressing the borehole confirmed that the primary transmissive zone was between 44 and 49 feet, where water enters the borehole through a nearly vertical fracture located just below the casing. A small amount of water also enters the borehole through the fracture zone located at 73 feet. A packer system was subsequently used to isolate these zones and collect groundwater samples during two mobilizations in March and April 2014. Two sampling events were completed primarily due to diverse laboratory results between EPAôs Chelmsford, Massachusetts lab and the Respondentôs lab.

Multiple VOCs (including 1,4-dioxane) and metals were detected in samples from these events with only concentrations of tetrachloroethene (PCE) and trichloroethene (TCE) detected above MCLs.

Following a review of analytical data for groundwater samples from BH14-1, residential drinking water samples were initially collected from 10 residences to the east and south of the Site along Pound Hill Road in April 2014. These samples were used to evaluate current drinking water conditions based on the bedrock groundwater results obtained from BH14-1. Concentrations of VOCs including 1,4-dioxane were not detected above the laboratoryôs minimum reporting limit, with the following exceptions: naphthalene was detected at one residence and chloroform was detected at another address. Naphthalene detection was a one-time occurrence, while chloroform detection is attributed to use of chlorine bleach by the homeowner to disinfect the well. These residences continue to be sampled on a semi-annual basis and Site-related constituents remain undetected. Recent analysis of per- and polyfluorinated alkyl substances (PFAS) from residential samples identified very low detection of a subset of PFAS, well below EPA guidelines and RIDEMôs standards. Monitoring activities will continue to include PFAS, along with VOCs and 1,4-dioxane, on a semi-annual basis.

EPAôs Fourth Five-Year Review (2014) determined that the OU1 remedy currently remains protective of human health and the environment. However, to support long-term protectiveness requirements, EPA concluded that (i) institutional controls are still required, and (ii) on-going assessments of groundwater quality need to continue to determine the nature and extent of subsurface impacts and evaluate the need for response actions.

EPA issued Special Notice Letters to potentially responsible parties on April 8, 2015. These Special Notice Letters were followed by a response and Good Faith Offer correspondence on June 8, 2015, which outlined the Respondentôs willingness to conduct RI/FS activities. EPA and the Respondents entered into an Administrative Order on Consent for the RI/FS for OU2 on August 17, 2015.

The Settling Defendants elected to perform an electrical resistivity survey in November 2015. The electrical survey involved an area significantly beyond the extent of the landfill footprint. Results and interpretations from the resistivity survey were used to refine bedrock borehole locations based on indicators of potential water-bearing bedrock zones.

Implementation of RI/FS activities began in June 2016. The RI report was completed in April 2020 and the FS report was completed in June 2020.

A summary of the work conducted during previous investigations, including the dates and contractor/agency that performed the work can be found in Table 1-1 of the April 2020 RI Report.

C. COMMUNITY PARTICIPATION

The RI/FS Reports and Proposed Plan for the L&RR Superfund Site OU2 were made available to the public in July 2020. They can be found in the Administrative Record file and the information repository accessible via computer at the Municipal Annex Building 575 Smithfield Road North Smithfield, RI 02896 or online at www.epa.gov/superfund/lrr. The notice of the availability of these documents was published in The Valley Breeze on July 30, 2020. EPA also provided notice to the Town of North Smithfield and nearby residents via a postcard mailing. A public comment period was held from July 29, 2020 to August 28, 2020 during which EPA accepted public comments by e-mail, fax, mail, and telephone. A virtual public meeting was held on August 12, 2020 to present the Proposed Plan to the community. At this meeting, representatives from EPA presented information and answered questions about OU2 and the remedial alternatives. This meeting was followed by a Virtual Formal Public Hearing at which community members could provide oral comments. EPAôs response to the comments received during this public comment period is included in the Responsiveness Summary, which is part of this Record of Decision.

D. SCOPE AND ROLE OF OPERABLE UNIT OR RESPONSE ACTION

EPA selected the remedy for Operable Unit 1 (OU1) in a ROD signed in September 1988, which addressed the closure of the landfill at the Site. Operable Unit 2 (OU2), the subject of this ROD, addresses the groundwater outside the boundary of the waste management area that has been impacted by the closed landfill. EPA has determined that there are future potential threats to human health at the Site due to uncontrolled migration of contaminated groundwater from the landfill. The presence of VOCs (including 1,4-dioxane), metals, PFAS and other contaminants have been identified throughout groundwater at the Site at levels that present an unacceptable risk to human health and the environment. The OU2 remedy will address the unacceptable risks and meet the cleanup objectives for OU2. Groundwater outside the boundary of the waste management area will be restored to beneficial reuse and will no longer act as a source for surface water contamination in Trout Brook, Trout Brook Pond, or the associated tributaries. OU1 and OU2 together comprise the L&RR Superfund Site.

E. SITE CHARACTERISTICS

The most recent significant Site findings can be found in the April 2020 RI Report and the June 2020 FS Report and are summarized below.

Physical Setting

The Site is bound to the west by a gravel road referred to as Old Oxford Turnpike. The area surrounding the Site is predominantly conifer forest to the north, west, and south. A large wetland complex to the east of the landfill includes a mixture of open emergent swamp and forested swamp. Trout Brook flows within this wetland complex before connecting with Trout Brook Pond farther to the north (see **Figure 1-3** in **Appendix C**). More information about the land uses at and around the Site can be found in **Section F**.

Site Geology

Surficial overburden deposits near the Site consist of glacial stratified drift that are part of a regional kame delta further categorized into two sub-units consisting of an upper kame delta sequence, which includes well-sorted fine sand and silt, and a lower unit including variable sequences of coarse sand and gravel associated with ice contact deposits and high-energy meltwater resulting from deglaciation.

Bedrock beneath the Site consists of a quartz-biotite gneiss. Logging of select cores indicated minor amounts of ferromagnesian minerals and foliation. Bedrock was encountered at depths ranging from approximately 30 to 130 feet below ground surface (bgs), with corresponding elevations ranging from approximately 250 feet above mean sea level (AMSL) at the western end of the landfill, to approximately 180 feet AMSL at the eastern toe of the landfill, to approximately 220 feet AMSL near Pound Hill Road, east of the landfill.

The bedrock surface generally slopes north/northeast towards the edge of the landfill and aligns with a buried bedrock valley that was infilled with post-glacial sand and gravel deposits. This bedrock valley forms a basin-like depression in the vicinity of the CW-5 clusters (northwest), BH16-1 (northeast), CW-1 (southwest), and BH16-3 (southeast). The morphology of the bedrock surface is generally aligned with the channel reach of Trout Brook before it enters Trout Brook Pond.

A series of geologic cross-sections were developed based on overburden interpretations and bedrock drilling during the OU2 RI (see **Figure 1-4** in **Appendix C** for cross-section locations). These cross-sections are ordered as D-Dô(**Figure 1-5**), E-Eô(**Figure 1-6**), and F-Fô(**Figure 1-7**). These cross-sections highlight the contrast in bedrock depth from deeper elevations near the eastern edge of the landfill to shallower depths east of Trout Brook and near Pound Hill Road. These cross-sections also include the elevation of potential and likely water-bearing fractures identified during borehole logging. The degree, distribution, and aperture of fractures varies at each borehole. Only one shallow fracture beneath the overburden interface was identified at BH14-1, adjacent to Trout Brook with the remaining boreholes supporting competent upper bedrock surface.

Hydrogeology

Groundwater flow is generally from the landfill east toward Trout Brook and the associated wetland complex. Flow in the shallow overburden deposits is strongly influenced by surface water and groundwater exchange effects. This hydraulic dynamic is evident between the Brook and the wetland, where overburden shallow groundwater flow likely deviates further within floodplain areas when seasonal precipitation levels are elevated. During low flow periods, horizontal flow is presumably less as the wetlands adapt to groundwater losses. Flow during seasonally elevated precipitation levels leads to

gaining conditions. These alternating hydraulic periods likely contribute to a scenario where Trout Brook may function as a hydraulic boundary or divide, consistent with U.S. Geological Survey (USGS) observations and model results. **Figure 1-8** in **Appendix C** presents interpretive overburden shallow and intermediate groundwater contours from gauging in March 2017.

Groundwater flow in the deep overburden and bedrock zones also maintains a consistent west to east flow pattern, but there are likely zones along the edge of the wetlands where depositional heterogeneities result in localized anisotropic flow. This is presumably based on the distribution of the deeper ice contact deposits and finer-grained seams. Flow in bedrock also maintains the west to east configuration, before reaching Trout Brook, where flow shifts northward consistent with regional flow. **Figure 1-9** in **Appendix C** presents interpretative contours from deep overburden and bedrock gauging in March 2017.

Hydraulic conductivity estimates obtained during the OU1 RI using a variety of test methods indicated that the ice contact sand and gravel (2.2×10^{-2} centimeters per second [cm/sec]) is more than two orders of magnitude as permeable as the kame delta (4.4×10^{-4} cm/sec). Similarly, vertical gradient estimates using data from May and October 1987 for the network of OU1 RI wells confirmed a downward direction of flow from the finer-grained upper kame unit to the lower ice contact deposits. More recent groundwater elevation measurements obtained during the OU2 RI were consistent with these estimates, with a few exceptions notably occurring further to the east and beyond the network of wells installed as part of OU1.

Surface Water and Wetlands

Extensive freshwater wetlands associated with Trout Brook and its tributaries are located east of the landfill. The wetland complex likely plays a significant role in mediating surface water flow (gaining conditions) and groundwater recharge (losing conditions) based on the time of year. Trout Brook flows northward, widening into Trout Brook Pond, and ultimately joins the Slatersville Reservoir, part of the Branch River and located less than a mile to the north of the Site.

Surface water from the landfill surface is conveyed into detention basins by a series of drainage swales and ditches. These channels flow east toward the wetland complex east of the landfill via two predominant tributary features that are aligned with the southeastern boundary of the landfill and a broad southwestern oriented channel that originates near the northeastern portion of the landfill. These tributaries ultimately connect with Trout Brook, which flows north and drains into Trout Brook Pond.

Slatersville Reservoir, Trout Brook, Trout Brook Pond, and the associated tributaries are designated as Class B water bodies by RIDEM, which indicates that they are suitable for fishing, swimming, and other recreational activities.

Conceptual Site Model

A conceptual site model (CSM) is a three-dimensional picture of site conditions that illustrates contaminant sources, release mechanisms, exposure pathways, migration routes, and potential human and ecological receptors. The CSM documents current and potential future site conditions and is supported by maps, cross sections, and site diagrams that illustrate what is known about human and environmental exposure through contaminant release and migration to potential receptors.

The text in this section is also supported by a flowchart based CSM (see **Figure 1-14** in **Appendix C**).

Known and Suspected Sources of Contamination

The source of OU2 groundwater contamination is the hazardous waste disposed of within the landfill on OU1. These wastes include, but are not limited to:

> waste oil containing metals, asbestos, calcium fluoride sludge with lead, scrap paints containing volatile organic compounds (ñVOCsò) and alcohols, chemical compounds containing VOCs, batteries containing mercury, metal hydroxide sludge containing copper and nickel, lime sludge containing iron and copper, paint sludge containing VOCs, waste sludge containing hydroxide, calcium and zinc sludge, HPR 106 containing butyl acetate and xylene, filtrate waste containing methanol and organic byproducts, tank rinse containing sodium hydroxide and organic byproducts, rinse water containing ammonia and ethylene diamine tetracetic acid (EDTA), sodium oxylate sludge containing metals, organic latex and organic latex wash containing copper, nickel, chromium, silver and VOCs, waste oil and solvents containing VOCs, water soluble dye and fibers containing acids and VOCs, solvents and alcohol containing acetone, toluene, methyl ethyl ketone, isopropanol, isobutyl acetate and cyclohexanone, waste coating material containing methyl ethyl ketone, isobutyl acetate, cyclohexanone and ethylene vinyl acetate, waste oil containing arsenic, cadmium, chromium, mercury, lead, selenium and silver, organic latex waste containing styrene and ammonia, waste solvents containing 1,1,1-trichloroethane, grinding swarf containing selenium, mercury and arsenic, fine wire tank waste water containing metals, and adhesives and solvents containing methylene chloride, ketones and esters.

Hazardous substances, including liquid wastes, were either poured directly into the landfill at the Site or deposited in drums into the landfill.

The primary source of surface water and sediment contamination is groundwater discharge. Other sources, such as stormwater runoff, may also contribute to contamination in the water bodies.

There is no Principal Threat Waste identified at OU2.

Nature & Extent of Contamination

Investigation data have been divided into a series of sub-areas generally oriented from the landfill to hydraulically downgradient zones. Refer to **Figure 1-4** in **Appendix C** for the areal extent of each sub-area and corresponding sample locations.

Landfill Area ï Includes the landfill perimeter and upgradient locations.

Downgradient of Landfill ï Located beyond the landfill perimeter and within the transitional zone upgradient of the wetland complex.

Wetland Area ï The centrally-located wetland complex east of the landfill which also confines the floodplain and channel features of Trout Brook.

Near Receptor ï The area containing nearby residences along Pound Hill Road, as well as upgradient wetland locations east of Pound Hill Road.

The following subsections summarize the nature and extent of contamination at OU2.

Groundwater

Groundwater is the primary impacted media at the Site. **Figure 1-10** in **Appendix C** provides the extent of preliminary remediation goal (PRG) exceedances in groundwater.

Of the constituents, 1,4-dioxane was detected the most frequently. These concentrations extend from the Landfill area to the Downgradient of Landfill area consistent with groundwater flow patterns toward the wetlands and Trout Brook. Concentrations of 1,4-dioxane are approximately one to two orders of

magnitude greater in overburden than in shallow bedrock. Detections of 1,4-dioxane in bedrock were limited to shallow bedrock depths and results generally indicate decreasing concentrations with depth. Levels of 1,4-dioxane decrease significantly further to the east across the Wetland sub-area with low level detections in overburden and bedrock adjacent to Trout Brook. This trend continues eastward with no detections of 1,4-dioxane in bedrock groundwater in Near-Receptor Area nor in the Residential Wells, along with non-detect levels at the northern borehole location (BH18-1).

The distribution of CVOCs in groundwater was less extensive than that of 1,4-dioxane. Higher detections were associated with intermediate breakdown products from PCE and TCE degradation, including cis-1,2-dichloroethene (cis-1,2-DCE) and vinyl chloride. PCE and TCE were detected less frequently and at significantly lower levels which confirms the prevalence and sustainability of naturally occurring breakdown processes. Vinyl chloride was the only CVOC detected above regulatory standards. The distribution of CVOCs in groundwater was also less extensive compared with the network of monitoring locations where 1,4-dioxane was detected.

Various metals were also detected in groundwater. Arsenic was one of the more frequently detected metals and often at concentrations above standards/guidelines at monitoring locations in proximity to the landfill perimeter.

A limited subset of PFAS, primarily perfluorooctanoic acid (PFOA), were detected in groundwater samples collected in 2018. Elevated concentrations of PFOA were identified in samples collected at wells along the eastern edge of the landfill and slightly downgradient of the landfill. The distribution of PFOA in groundwater in these areas was generally consistent with 1,4-dioxane with respect to horizontal nature and extent as well as vertically, where overburden concentrations were nearly two times greater than bedrock locations. PFOA was the primary compound detected above Site-specific standards used for comparison. Low levels of perfluorooctane sulfonate (PFOS) were also detected and contributed to exceedances of standards based on the summation of PFOA and PFOS.

Surface Water

Surface water detections within each of the sub-areas were used to assess nature and extent of contamination. Contaminants detected included VOCs (both CVOCs and non-chlorinated VOCs), 1,4-dioxane, metals, and pesticides. In general, more frequently detected VOCs included acetone, chlorobenzene, and dichlorobenzene isomers along with 1,4-dioxane. Frequently detected metals included arsenic, cadmium, lead, and zinc. This subset of metals also included more frequent detections above water quality criteria. Higher concentrations of VOCs, semi-volatile organic compounds (SVOCs), and metals were associated with the area of groundwater discharge near the transition between the Downgradient of the Landfill and Wetland sub-areas. **Figure 1-12** in **Appendix C** provides a summary of the distribution of impacts to surface water.

Pore Water

Co-located pore water samples were collected concurrently with surface water during the wetland and ecological sample collection programs in 2016 and 2017. Based on groundwater-surface water hydraulics in the transitional area aligned with the Downgradient of the Landfill and Wetland sub-areas, there are notable consistencies with the distribution of compounds detected in pore water and both groundwater and surface water detections. More frequently detected VOCs, along with 1,4-dioxane, included benzene, chlorobenzene, and 1,4-dichlorobenzene. Consistent with surface water results, arsenic was the most frequently detected metal.

Sediment

Sediment samples were collected from two depth profiles, 0-6 inches and 6-12 inches to support nature and extent objectives and evaluate ecological risk. VOCs detected in sediment generally included 1,4-dichlorobenzene, 1,4-dioxane, acetone, benzene, isopropylbenzene, methyl ethyl ketone (MEK), and toluene. Acetone and MEK were the most frequently detected VOCs. Lesser concentrations of SVOCs, metals, and pesticides were also detected and, in some cases, exceeded ecological benchmarks. Multiple metals exceeded ecological benchmarks, with arsenic and selenium being the more frequently detected constituents above benchmarks. While arsenic was more widely distributed in sediment, selenium exceedances occurred more frequently in the Downgradient of the Landfill and Wetland sub-areas, with fewer exceedances at Landfill sub-area locations. **Figures 1-13a** and **1-13b** in **Appendix C** provide a summary of the distribution of impacts to sediment.

Contaminant Fate and Transport

Groundwater

Groundwater is the primary impacted media at the Site, as a result of various transport mechanisms, including advection, dispersion, diffusion, and desorption. Transportation of dissolved-phase contaminants downgradient of the landfill has occurred due to prevailing groundwater flow gradients and hydrogeologic properties of aquifer materials.

Prior waste disposal practices contributed to leaching of contaminants from vadose zone soils, adsorption of contaminants to soils, and seepage into bedrock from limited shallow bedrock fractures, along with primary groundwater flow conditions from west to east and prevailing downward vertical flow, particularly on the western side of Trout Brook and the wetland complex where overburden deposits were proportionally greater. Conditions in this key transitional area were associated with the following observations and interpretations:

- Shallow overburden groundwater flow gradients become upward, as the hydraulics in this area alternate towards predominantly gaining as groundwater discharge occurs to sustain wetland conditions and functionality. This change is supported by higher concentrations of dissolved-phase contaminants in pore water and surface water.
- Intermediate and deeper overburden impacts generally decrease with depth, while residual levels of COCs from these deeper units remain in deeper groundwater with the potential to flow beneath the Wetland sub-area.
- The slope of the bedrock surface decreases laterally across the interpreted buried channel adjacent to the landfill. As this transition occurs, the upper surface appears to be less fractured and there are fewer detections of COCs in bedrock, particularly at the deeper depths associated with residential drinking water wells.

The evaluation of results from prior to and as part of the RI to assess the nature and extent of contamination, showed that Site-related COCs in bedrock groundwater and residential drinking water wells beyond Pound Hill Road are extremely limited. In addition to having few instances of COC detections, groundwater flow in bedrock suggests an overall lack of connectivity from upper zones to lower zones, especially in proximity to the adjacent residences. This may be due to the topographic profile of the upper bedrock surface which is limited to depths approximately 35 feet bgs in the vicinity of the residences along Pound Hill Road, compared with more than 70 feet bgs closer to the landfill. From the wetlands towards the Pound Hill Road residences, overburden thickness decreases significantly and

few, if any, detections of COCs persist in overburden in the vicinity of the residences. The lack of detections in these areas remains consistent with regional groundwater flow in this area which is predominantly northward and conforms with Trout Brook flow.

Routes of Exposure and Potential Receptors

Exposure occurs when humans or other living organisms eat, drink, breathe or have direct skin contact with a hazardous substance or waste material. There must be a current or potential exposure to a hazardous substance for there to be a risk to human health. EPA develops various exposure scenarios to determine potential risks, appropriate cleanup levels for contaminants, and potential cleanup approaches. Exposure scenarios for OU2 were developed considering the nature and extent of contamination, the location of the site, current and future potential use of the Site, and potential receptors and exposure pathways.

Receptors that may come in contact with impacted media include the following:

(i) current/future recreational users who may come in contact with Site contaminants in sediment, surface water, or fish (if present) in the brook, tributaries, and pond;
(ii) nearby current residents who may be exposed to Site contaminants through potable use of groundwater wells and indoor air (via vapor intrusion);
(iii) future residents who may be exposed to Site contaminants through potable use of groundwater wells and indoor air (via vapor intrusion);
(iv) ecological receptors within the Trout Brook area and the adjacent streams/tributaries.

The following table is a summary of human health exposure pathways evaluated for OU2:

Receptor Population	Scenario Timeframe	Exposure Medium	Exposure Point	Exposure Route
Resident	Current	Groundwater	Overburden Groundwater	Ingestion Dermal Contact Inhalation Vapor Intrusion (Inhalation)
			Bedrock Groundwater	Ingestion Dermal Contact Inhalation
Resident	Future	Groundwater	Overburden Groundwater	Ingestion Dermal Contact Inhalation Vapor Intrusion (Inhalation)
			Bedrock Groundwater	Ingestion Dermal Contact Inhalation
Recreator	Current/ Future	Surface Water	Trout Brook Pond Trout Brook Associated Tributaries	Incidental Ingestion Dermal Contact Fish Ingestion
Recreator	Current/ Future	Sediment	Trout Brook Pond Trout Brook Associated Tributaries	Incidental Ingestion Dermal Contact

Results of the Screening Level Ecological Risk Assessment (SLERA) and Refinement and of the Baseline Human Health Risk Assessment (BHHRA) can be found in **Section G** of this ROD.

F. CURRENT AND POTENTIAL FUTURE SITE AND RESOURCE USES

Land Uses

Current land use within OU2 consists of industrial/commercial, recreational, and residential. The following land features and uses are present in the vicinity of OU2:

- Old Oxford Road ï Primarily commercial, with an equestrian center located north of the site;
- Old Oxford Turnpike - Part of a network of gravel roads maintained for truck use by the Holliston Sand Corporation located further to the north ï Industrial use;
- Solar developments located to the south and currently being developed to the northeast ï Industrial use;
- Pound Hill Road ï Mixed low-density residential neighborhood and commercial use; and
- The north, south, and eastern edges of the landfill are bounded by high voltage electric transmission lines ï Commercial use.

Ground and Surface Water Uses

Groundwater in the vicinity of the Site is part of the Branch River watershed, which includes the Slatersville Aquifer, which has been designated as a drinking water source by the State of Rhode Island. In 1963, the Town of North Smithfield constructed a public water supply well to the north of the Site, referred to as the Tifft Road Well (see **Figure 1-3** in **Appendix C**), which ceased operating in 2006 following an agreement to purchase water from neighboring Woonsocket.

Residences around the Site, including Pound Hill Road, Black Plain Road, and other nearby roads, use private wells for water supply. As noted in Section E, Trout Brook Trout Brook Pond, and the associated tributaries are designated as Class B water bodies by RIDEM, which indicates that they are suitable for fishing, swimming, and other recreational activities. While Trout Brook and its tributaries are generally not large enough for these activities, Trout Brook Pond is known to be used for these activities.

G. SUMMARY OF SITE RISKS

Basis for Action

The remedial action selected in this Record of Decision is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances from this Site which may present an imminent and substantial endangerment to public health or welfare.

Baseline Risk Assessment

The baseline risk assessment estimates what risks the site poses if no action were taken. It provides the basis for taking action and identifies the contaminants and exposure pathways that need to be addressed by the remedial action. This section of the ROD summarizes the results of the baseline risk assessment for this Site. The summary of the relevant aspects of the human health risk assessment and ecological risk assessments, discussed below, support the need for remedial action.

Human Health Risk Assessment

A baseline human health risk assessment (BHHRA) was conducted pursuant to EPA Risk Assessment Guidance for Superfund (RAGS). The BHHRA followed a four-step process:

1) hazard identification, which identified those hazardous substances which, given the specifics of the Site, were of significant concern;

2) exposure assessment, which identified actual or potential exposure pathways, characterized the potentially exposed populations, and determined the extent of possible exposure;

3) toxicity assessment, which considered the types and magnitude of adverse health effects associated with exposure to hazardous substances, and

4) risk characterization and uncertainty analysis, which integrated the three earlier steps to summarize the potential and actual risks posed by hazardous substances at the Site, including carcinogenic and non-carcinogenic risks and a discussion of the uncertainty in the risk estimates.

These evaluations are discussed below.

Hazard Identification

Thirty-seven of the approximately 115 chemicals detected at the Site were selected for evaluation in the HHRA as chemicals of potential concern (COPCs). The COPCs were selected based on toxicity, concentration, frequency of detection, and mobility and persistence in the environment, and can be found in Tables 2.1 through 2.7 of the baseline HHRA. From this, a subset of the chemicals was identified in the HHRA as presenting a significant current or future risk and/or were identified at the Site in excess of the appropriate chemical-specific ARAR value; these chemicals are referred to as the COCs in this ROD. The COCs are listed in **Tables G-1** and **G-2** of **Appendix B** along with the exposure point concentrations used to evaluate the reasonable maximum exposure (RME) scenario in the baseline HHRA. Estimates of average or central tendency exposure concentrations for the COCs and all COPCs can be found in Tables 3.1 through 3.9 of the baseline HHRA.

All of the COCs in **Tables G-1** and **G-2** were identified as presenting a significant risk in the baseline HHRA except for cis-1,2-dichloroethene, bis(2-ethylhexyl)phthalate, perfluorooctanoic acid (PFOA), perfluorooctane sulfonic acid (PFOS), and antimony in groundwater; these analytes are included because their maximum detected concentrations in groundwater exceed a chemical specific-ARAR value (e.g., MCLs).

The COCs identified for OU2 of the Site are:

Overburden Groundwater	
1,4-dichlorobenzene	vinyl chloride
1,1-dichloroethane	bis-2-ethylhexylphthalate
1,2-dichloroethane	PFOA (and total PFOA+PFOS)
cis-1,2-dichloroethene	Antimony
1,2-dichloropropane	Arsenic
1,4-dioxane	chromium (VI)
Benzene	Iron
Naphthalene	Manganese
trichloroethene	

Bedrock Groundwater
1,1-dichloroethane
1,2-dichloroethane
1,4-dioxane
Benzene
cis-1,2-dichloroethene
Tetrachloroethene
Trichloroethene
vinyl chloride
PFOA (and total PFOA+PFOS)
Arsenic
chromium (VI)

Exposure Assessment

Exposures to COPCs were estimated quantitatively or qualitatively through the development of several different exposure scenarios. Exposure scenarios were developed based on the nature and extent of contamination, the location of the Site, current and future potential use of the Site, and identification of potential receptors and exposure pathways. Potentially exposed populations include recreational users of Trout Brook Pond and associated tributaries and brook, as well as current and future residents living near or downgradient of the landfill.

Groundwater data from shallow overburden within areas that could potentially be developed were compared to EPA Vapor Intrusion Screening Levels (VISLs) to assess whether a vapor intrusion pathway could present a potential risk to human health if new residences are constructed. Maximum detected concentrations of benzene, cis-1,2-dichlorethene, TCE and vinyl chloride exceeded the groundwater VISLs. The area of the Site evaluated for vapor intrusion remains undeveloped, therefore a complete vapor intrusion pathway currently does not exist; however, the presence of elevated concentrations of VOCs in groundwater at the Site indicates there may be a need for further evaluation of the future vapor intrusion pathway if any new buildings are constructed at the Site that may increase the potential for vapor intrusion to occur.

Potential risk from fish consumption by recreational users was evaluated by comparing detected surface water concentrations of COPCs against National Recommended Water Quality Criteria and RIDEM Water Quality Criteria, which are human health-based criteria protective of fish and water ingestion. Results indicate the following:

- Arsenic, lead, and 1,4-dioxane concentrations exceeded criteria at multiple locations across Trout Brook, Trout Brook Pond and the Tributaries Area.
- Concentrations of PAHs (such as benzo(a)pyrene) exceeded criteria in two locations in the Tributaries Area (TRIB-04, TRIB-08), and one location in Trout Brook (TB-08).
- Several other contaminants had concentrations above the criteria, but exceedances were not widespread and appeared limited to specific locations (TRIB-01, TRIB-04-pesticides; TRIB-01-thallium; TRIB-09-cadmium)

Based on exceedances of the criteria in surface water, fish populations will be evaluated as part of the pre-design investigation. Sampling of fish may be conducted if it is determined that sufficient populations of fish suitable for consumption are present in Trout Brook Pond, in order to further evaluate whether there is human health risk from fish consumption.

Exposure point concentrations (EPCs) are the COPC concentrations that a receptor is assumed to encounter during exposure to Site contaminated media. In general, the 95% UCL of the arithmetic mean concentration was used as the EPC for both central tendency exposure (CTE) and reasonable maximum exposure (RME) scenarios, where an adequate sample size existed. In cases where a COPC within an exposure point had a small sample size (<10) or a small number of detected concentrations (<3), the maximum concentration was selected as the EPC.

Exposure doses are dependent upon the magnitude, frequency, and duration of exposure. They are estimated by combining the COPC concentration (i.e., the EPC) and the exposure parameters. The exposure doses are expressed as intakes in milligrams of COPC per kilogram of body weight per day (mg/kg-day). The lifetime average daily dose (LADD) or the lifetime average daily exposure (for inhalation pathways), which is averaged over a 70-year lifetime, was used to estimate exposure dose for carcinogens. The average daily dose (ADD) or average daily exposure (for inhalation pathways), which is

averaged over the actual exposure duration for each receptor, was used to estimate exposure dose for non-cancer compounds.

More information about the exposure scenarios developed for this Site can be found in **Section E**. A more thorough description of all exposure pathways evaluated in the risk assessment including estimates for an average exposure scenario, can be found in Section 3 and in Tables 4.1 through 4.8 of the baseline HHRA.

Toxicity Assessment

Carcinogenic Effects

For cancer effects, the toxicity values are expressed as oral cancer slope factors (CSFs) in units of per milligrams of COPC per kilogram of body weight per day $(mg/kg\text{-}day)^{-1}$ or as inhalation unit risk (IUR) factors in units of per micrograms of COPC per cubic meter $(\varepsilon g/m^3)^{-1}$. EPA has assigned each contaminant a ñweight-of-evidenceò category that represents the likelihood of it being a human carcinogen. **Table G-3** of **Appendix B** presents these cancer toxicity values and cancer classifications for the COCs which showed significant risk at the Site. EPAôs Cancer Guidelines and Supplemental Guidance (March 2005) have been used as the basis for analysis of carcinogenicity risk assessment.

Non-Carcinogenic Effects

Non-carcinogens refer to contaminants that cause toxic effects other than cancer. Non-cancer effects can include central nervous system damage, reproductive effects, and other systemic effects. For addressing non-carcinogenic effects, it is EPAôs policy to assume that a threshold level exists, below which adverse effects are not expected to occur. This threshold level is described by the reference dose (RfD) or reference concentration (RfC) for inhalation exposures. RfDs and RfCs have been developed by EPA as an estimate of a daily exposure that is likely to be without an appreciable risk of an adverse health effect during a lifetime. RfDs and RfCs are derived from epidemiological and/or animal studies and incorporate uncertainty factors to help ensure that adverse health effects will not occur. The RfDs and RfCs relevant to the Site are presented in **Table G-4** of **Appendix B**.

Risk Characterization

The risk characterization combines the exposure estimate with the toxicity information to estimate the probability or potential that adverse health effects may occur if no action were to be taken at a site. Carcinogenic risks were calculated for those COPCs with evidence of carcinogenicity and for which cancer toxicity values are available. Non-cancer health effects were evaluated for all COPCs (i.e., including carcinogens) for which non-cancer toxicity values are available.

Cancer Health Effects

Potential cancer risk from the ingestion and dermal contact pathways was calculated by multiplying the estimated LADD for each COPC by the chemical-specific CSF. The LADD (or lifetime average daily dose) is expressed as intake averaged over a 70-year lifetime as mg COPC/kg-body weight per day. The CSF is the COPC- and route-specific cancer slope factor $(mg/kg\text{-}day)^{-1}$. CSFs are upper-bound estimates of the excess risk of developing cancer as a result of a period of continuous exposure to a chemical, averaged throughout the course of a 70-year lifetime and are developed based on the assumption that there is no threshold level of exposure below which adverse effects will not be seen.

Potential cancer risk from the inhalation pathway was calculated by multiplying the estimated lifetime average daily exposure (LADE) for each COPC by the chemical-specific IUR. The LADE is expressed as intake averaged over a 70-year lifetime as mg of COPC/mį of air. The IUR is the COPC-specific inhalation unit risk factor ($\varepsilon g/m^3)^{-1}$. The IUR is the 95 percent UCL of the mean incremental lifetime cancer risk estimated to result from lifetime exposure to an agent if it is in the air at a concentration of 1 microgram per cubic meter (risk per ε g/mį).

As described in EPAôs *Supplemental Guidance for Assessing Susceptibility from Early Life Exposure to Carcinogens*, evidence suggests that chemicals with a mutagenic mode of action, which would be expected to cause irreversible changes to DNA, would exhibit a greater effect in early-life versus later-life exposures. EPAôs guidance on cancer risks recommend the use of age-dependent adjustment factors (ADAFs) for carcinogens that act via a mutagenic model. The ADAF accounts for susceptibility differences between early- and later-life exposures and is applied to the cancer slope factor or inhalation unit risk. ADAFs are combined with age-specific exposure estimates when assessing cancer risks.

Cancer risk estimates can be expressed in scientific notation or as a probability (e.g., 1×10^{-6} or 1E-06 for 1/1,000,000) and indicate (using this example), that an average individual is not likely to have greater than a one in a million chance of developing cancer over 70 years as a result of site-related exposure (as defined) to the contaminant at the stated concentration.

All risks estimated represent an incremental risk of cancer from exposures to contamination originating from the Site, which go beyond an individualôs baseline risk of developing cancer. The chance of an individual developing cancer from all other (unrelated to the Site) causes has been estimated to be as high as one in three. EPA generally views site related cancer risks in excess of 10^{-4} (1 in 10,000) as unacceptable. Current EPA practice considers carcinogenic risks to be additive when assessing exposure to a mixture of hazardous substances.

Non-Cancer Health Effects

The potential for non-cancer risks is characterized by the hazard quotient (HQ). The HQ is a ratio of the estimated average daily dose (ADD) (or the average daily exposure (ADE) in the case of air exposures) and a threshold value below which adverse health effects would not be expected to occur (RfD or RfC). A HQ $\leq$ 1 indicates that adverse effects are unlikely. Conversely, a HQ > 1 indicates that adverse effects as a result of exposure to the contaminant are possible. To account for additive effects resulting from exposure to more than one compound, a hazard index (HI) is generated by adding the HQs for all chemicals of concern that have the same or a similar mechanism or mode of action. As a conservative measure and a common practice, HQs are often added for all contaminants of concern that affect the same organ or system (i.e., liver, nervous system) since the mechanism or mode of action is not always known, which results in a hazard index (HI). A HI < 1 indicates that adverse effects are unlikely whereas a HI > 1 indicates adverse effects are possible. Generally, EPA views HI values based on site-related exposure above 1 as unacceptable. It should be noted that the magnitude of the HQ or HI is not proportional to the likelihood that an adverse effect will be observed.

The following is a summary of the media and exposure pathways that were found to present a risk exceeding EPAôs cancer risk range or non-cancer risk threshold at the Site. Only those exposure pathways that will be addressed by the selected remedy are presented in this ROD. See Section 6.5 and Appendix A, Tables 7, 9 and 10 of the baseline HHRA for a more comprehensive risk summary of all exposure pathways evaluated for all COPCs, and for estimates of central tendency risk.

Current Resident - Groundwater

Tables G-5 and **G-6** of **Appendix B** depict the carcinogenic and non-carcinogenic risk summaries for the COCs in residential groundwater evaluated to reflect current residential potable water exposure corresponding to the RME scenario. For a current resident using untreated groundwater as household water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable cancer risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for groundwater. The exceedances were due to the presence of naphthalene (in one occurrence) in one residential well and chloroform in another (related to the homeownerôs well disinfection activities).

Future Resident ï Groundwater

Tables G-7 through **G-10** of **Appendix B** depict the carcinogenic and non-carcinogenic risk summaries for the COCs in overburden and bedrock groundwater evaluated to reflect potential future residential potable water exposure corresponding to the RME scenario (under the assumption that groundwater associated with the Site is used as a source of potable water in the future). For a future resident using untreated groundwater as household water, carcinogenic and non-carcinogenic risks exceeded the EPA acceptable cancer risk range of 10^{-4} to 10^{-6} and/or a target organ HI of 1 for groundwater. The exceedances were due primarily to the presence of 1,4-dioxane, naphthalene, trichloroethene, vinyl chloride, hexavalent chromium, arsenic, and manganese in Site groundwater. Though not listed on **Tables G-7** through **G-10**, cis-1,2-dichloroethene, bis(2-ethylhexyl)phthalate, PFOA, PFOS, and antimony are also Site groundwater COCs because their maximum detected concentrations exceed ARARs, even though the baseline HHRA did not identify them as primary risk contributors.

Uncertainties

The groundwater dataset for target analytes (except for polyfluorinated alkyl substances [PFAS]) was based on five years of monitoring data, and thus reflects long-term temporal variability in contaminant concentrations, and provides confidence in characterizing exposure. PFAS, an emergent class of contaminants, were analyzed in only a subset of wells for up to three sampling events. There is some uncertainty on whether these data adequately represent temporal and spatial changes in conditions. The observed concentrations of PFOA+PFOS (combined) in groundwater are higher (up to four times) than both the EPA Health Advisory and the State of Rhode Island regulatory standard of 70 ng/L. Accordingly, PFAS concentrations represent an unacceptable risk at the Site.

Overburden and bedrock groundwater were evaluated as future potable water sources. While this is possible, since the Site is located in an area zoned for drinking water, the probability of use of the overburden aquifer as a future water supply is expected to be low, since potable wells are more often drilled bedrock wells.

Groundwater data from shallow overburden within areas that could potentially be developed were compared to EPA Vapor Intrusion Screening Levels (VISLs) to assess whether a vapor intrusion pathway could occur if new residences are constructed. Uncertainties in calculating the EPA Vapor Intrusion Screening Levels (VISLs) include certain generic assumptions about the building dimensions, the amount of attenuation that occurs, and potential contribution of indoor sources (indoor chemical use). Additionally, VISLs were based on residential use and assume that exposure to COPCs in indoor air occurs 24 hours per day, 350 days per year, for the full residential tenure. In all likelihood, this assumption may overestimate risks for the majority of the population, since a significant portion of time each day may be spent at school, work, or other locations.

The area of the Site evaluated for vapor intrusion is undeveloped (and will likely remain undeveloped for the foreseeable future), therefore a complete vapor intrusion pathway currently does not exist.

Exceedances of VISLs suggest that a complete vapor intrusion pathway may potentially exist in the future, should this portion of the Site be developed, and that the vapor intrusion pathway should be evaluated further if buildings are considered for this portion of the Site.

Hexavalent chromium was identified as a cancer risk driver for receptors. Because samples were analyzed for total chromium, rather than speciated chromium (trivalent and hexavalent), there is considerable uncertainty as to whether hexavalent chromium is present at the Site. In the absence of site-specific data, the HHRA conservatively assumed that the entire fraction of total chromium consisted of hexavalent chromium (the most toxic form) to estimate hazard and risk.

Fish tissue data were not collected at the Site, and so the potential for health risks related to fish consumption was evaluated by comparing detected surface water concentrations of COPCs against National Recommended Water Quality Criteria and RIDEM Water Quality Criteria, which are human health-based criteria protective of fish and water ingestion.

Based on exceedances of the criteria in surface water, fish populations will be evaluated as part of the pre-design investigation. Sampling of fish may be conducted if it is determined that sufficient populations of fish suitable for consumption are present in Trout Brook Pond, in order to further evaluate whether there is human health risk from fish consumption. Risks related to the fish consumption pathway were not included in the cumulative estimates of hazard/risk for the recreational user scenarios, which may potentially underpredict risks. However, the water quality criteria for fish ingestion are conservative and assume that both fishing and ingestion of water in surface water bodies occurs on a regular basis. This scenario is unlikely for Trout Brook, Trout Brook Pond, and the Tributaries, none of which are significant recreational fishing or swimming areas (particularly in the Tributaries and Trout Brook areas).

The recreational user (surface water and sediment pathways) and the residential receptors (groundwater pathways) were evaluated as separate exposure scenarios. It is possible that a local resident (particularly for future use scenarios where development within the plume core could hypothetically occur) who contacts Site groundwater could also fish, wade and/or swim in Trout Brook, Trout Brook Pond and/or appurtenant tributaries, and thus have a resultant higher cumulative risk from Site COPCs than those risks predicted by each of the separate exposure scenarios.

The complete baseline human health risk assessment can be found in the November 2019 Baseline Human Health Risk Assessment.

Ecological Risks

A Screening Level Ecological Risk Assessment (SLERA) and Refinement was performed in two phases to evaluate the risk to ecological receptors potentially affected by the Site. Chemicals originally identified as chemicals of potential ecological concern (COPECs) potentially related to the Site included metals (primarily arsenic and lead), DDT, and cVOCs. The habitats potentially affected by the Site include downgradient Trout Brook and its associated wetlands (east of the landfill), tributaries to Trout Brook, and Trout Brook Pond. In addition, upgradient areas were investigated for comparison purposes.

Data to support the analyses in the SLERA were collected during two rounds of wetland and ecological sampling events in June/July 2016 and May 2017 to reflect seasonal diversity. Samples were collected from pore water, surface water, and sediment. Analyses included VOCs, 1,4-dioxane, metals, PCBs, pesticides, and SVOCs in each medium, as well as simultaneously extracted metals (SEM), acid volatile sulfides (AVS), and total organic carbon (TOC) in sediment.

Two ecologically relevant Exposure Areas (EAs) were established for the purposes of the risk assessment based on habitat types, contaminant fate and transport pathways, and hydrogeology. These exposure areas were:

- Trout Brook Area (including downgradient Trout Brook Pond); and
- Tributary Area.

In addition, sample locations in upgradient areas were identified to represent reference locations for each habitat and media type (surface water, sediment, and soil).

Maximum concentrations of surface water, sediment (both shallow [0-6ò] and deep [6-12ò]), and pore water collected in June/July 2016 were screened against ecological benchmarks in the 2017 SLERA to identify initial COPECs. COPEC refinement, which included benchmark adjustments based on hardness and TOC, as well as comparison to upgradient results, was performed in the 2017 SLERA, along with determination of potential data gaps. COPECs resulting from this refinement included:

- Pore water - CVOCs and lead
- Surface water ï DDT
- Sediment ï Acetone and arsenic.

The SLERA and Refinement concluded the following:

- Concentrations of metals, VOCs, SVOCs, and pesticides exceeded the most conservative screening-level ecological benchmarks; however, the number of locations where exceedances occurred is limited and the magnitude of the exceedances was relatively small for most constituents.
- A comparison to alternative, less-conservative benchmarks indicated that most COPECs are below effects level concentrations.
- Upgradient Area sample results demonstrate that acetone, metals, and PAHs are present; however, overall, the Upgradient Area concentrations of most constituents were lower than those detected in the Tributary and/or Trout Brook Areas.

Based on this evaluation, the SLERA indicated that there is minimal likelihood for adverse ecological impacts to the majority of the Site as a result of releases from the landfill. However, there are certain locations in Trout Brook and the Tributary Areas where elevated concentrations of constituents, namely chlorinated benzene compounds and arsenic, are present at concentrations that may pose a potential risk to ecological receptors.

Further evaluation of ecological risk through a Baseline Ecological Risk Assessment (BERA) was not recommended. Presumably, groundwater from the landfill, which was initially capped in 1979 and underwent a series of upgrades between 1994 and 1996, is upwelling into the wetlands to cause elevated concentrations of CVOCs and arsenic. An additional round of data collection was recommended to verify contaminant presence and concentration and evaluate seasonal variability.

Sampling performed in May 2017 was evaluated in the 2018 Interim Final SLERA. This report included:

- A comparison of the June 2016 and the May 2017 wetland/ecological sampling results;
- A review of 2017 results with respect to the findings of the SLERA and Refinement; and
- A determination of whether compounds referred to as ñUncertainò COPECs in the Interim Final SLERA and Refinement are Site-related and may pose a potential risk to ecological receptors.

The 2018 Interim Final SLERA concluded the following:

- In general, the types of contaminants and magnitude of concentrations detected in Site media in 2017 are similar to those observed in 2016.
- Exceedances of ecological benchmarks in 2017 are typically in sample locations where corresponding exceedances were identified in 2016.
- Pore water COPECs include 1,4-dichlorobenzene and lead.
- No COPECs were identified for surface water.
- Sediment COPECs include arsenic and selenium.

In summary, the 2017 analytical results support the conclusions of the 2017 SLERA and Refinement, with minor exceptions, including the addition of selenium as a COPEC in sediment, and the exclusion of DDT in surface water and acetone in sediment as COPECs.

Following review of the SLERA and Refinement, EPA concluded that there was no clear indication of ecological risk for which remedial action would be required, and therefore a BERA was not performed for OU2 of the Site.

The complete ecological risk assessment can be found in the September 2018 Screening Level Ecological Risk Assessment and Refinement.

H. REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are media-specific cleanup goals that define the objective of remedial actions to protect human health and the environment. RAOs specify the COCs, potential exposure routes and receptors and provide a general description of what the cleanup will accomplish. The RAOs are based on available information and standards, such as ARARs, To Be Considered (TBC) guidance, and site-specific risk-based levels. These RAOs were developed to mitigate, restore, and/or prevent existing and future potential threats to human health and the environment and to attain ARARs. The COCs and associated groundwater cleanup levels are presented in **Table L-1** in **Appendix B** of this ROD. The RAOs for the selected remedy for the Site are:

- Prevent exposure by current and future area residents to groundwater containing site COCs that exceed ARARs or would result in a total excess lifetime cancer risk greater than the target risk range of 10 to 10 , and/or a non-cancer hazard index greater than 1.
- Prevent exposure by future building occupants to indoor air vapors emanating from shallow groundwater containing site COCs that would result in a total excess lifetime cancer risk greater than the target risk range of 10 to 10 , and/or a non-cancer hazard index greater than 1.
- Restore groundwater containing site COCs to its beneficial use as a potential future drinking water source by reducing concentrations of contaminants so that they do not exceed ARARs or result in a total excess lifetime cancer risk greater than the target risk range of 10^{-4} to 10^{-6}, and/or a noncancer hazard index greater than 1.
- Prevent or minimize migration of site COCs in groundwater in excess of cleanup levels to Trout Brook, Trout Brook Pond, and related wetlands and tributaries.
- Prevent or minimize migration of site COCs in groundwater in excess of cleanup levels to the residential drinking water wells along Pound Hill Road.

I. DEVELOPMENT AND SCREENING OF ALTERNATIVES

Statutory Requirements/Response Objectives

Under its legal authorities, EPAôs primary responsibility at Superfund sites is to undertake remedial actions that are protective of human health and the environment. The goal of the Superfund program as stated in the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) at 40 C.F.R. Ä300.430(a)(1)(i) is to select remedies that are protective of human health and the environment, that maintain protection over time, and that minimize untreated waste. In addition, Section 121 of CERCLA establishes several other statutory requirements and preferences, including: 1) a requirement that EPAôs remedial action, when complete, must comply with all federal environmental and more stringent state environmental and facility siting standards, requirements, criteria, or limitations, unless a waiver is invoked; 2) a requirement that EPA select a remedial action that is cost-effective and that utilizes permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and 3) a preference for remedies in which treatment permanently and significantly reduces the toxicity, mobility, or volume of the hazardous substances is a principal element over remedies not involving such treatment. Remedial alternatives were developed to be consistent with these statutory requirements and preferences.

Technology and Alternative Development and Screening

CERCLA and the NCP set forth the process by which remedial actions are evaluated and selected. In accordance with these requirements, a range of remedial alternatives were developed for the Site. As discussed in Section 3 of the June 2020 FS report, groundwater treatment technology options were identified, assessed, and screened based on implementability, effectiveness, and cost.

Section 4 of the June 2020 FS report presents a limited number of remedial alternatives that attain site specific cleanup levels within different time frames using different technologies, including an innovative treatment technology; an alternative that involves little or no treatment but provides protection through institutional controls; and a no action alternative. Each alternative was then evaluated in detail in Section 5 of the June 2020 FS report.

J. DESCRIPTION OF ALTERNATIVES

This section provides a narrative summary of each remedial alternative retained following screening and evaluated in the detailed analyses (Section 4.0) of the June 2020 FS report. These alternatives were developed by combining response actions and technologies to address the estimated exposure risks to human health and the environment. The alternatives were also developed, to the extent practicable, to represent a range of effectiveness, duration of time required to achieve the RAOs, and cost to implement.

The specific details of each remedial alternative are conceptual and are used for costing purposes. The specific design details and costs for the selected remedy will be re-evaluated during the remedial design. The costs are intended to be within the target accuracy of -30 to +50% of the actual cost. All present worth costs associated with O&M and periodic expenditures are based on a 7% discount rate over 30 years.

The remedial action alternatives for OU2 are presented below. They are numbered to correspond with the FS. More complete, detailed presentations of each alternative can be found in Section 4.0 of the June 2020 FS report.

Alternative 1: No Action

Alternative 1 was developed as a baseline case, as required by the NCP, to which all other alternatives may be compared. Under this alternative, no action would be taken to address exposure to groundwater or to reduce the toxicity, mobility, or volume of contaminated groundwater at the Site. As required by CERCLA, a review of Site conditions and risks would be conducted every five years since contamination would remain on the Site above levels that allow for unlimited use and unrestricted exposure.

The estimated present worth cost associated with Alternative 1 is $430,000. The range of costs based on a -30 to +50 range of accuracy is $301,000 to $645,000.

Alternative 2: Limited Action: Institutional Controls and Monitoring

Alternative 2 was developed as a limited action alternative. Under this alternative, no action would be taken to reduce the toxicity, mobility, or volume of contaminated groundwater at the Site, however, institutional controls would be implemented to protect human health by preventing or controlling potential exposures to contaminated groundwater. As required by CERCLA, a review of Site conditions and risks would be conducted every five years since contamination would remain on the Site above levels that allow for unlimited use and unrestricted exposure.

The estimated present worth cost associated with Alternative 2 is $2,300,000. The range of costs based on a -30 to +50 range of accuracy is $1,610,000 to $3,450,000.

Alternative 3: Groundwater Extraction with Ex Situ Treatment, Institutional Controls, and Monitoring (This is EPA's contingency remedy)

Alternative 3 includes the implementation of active groundwater extraction and *ex situ* treatment, institutional controls, and monitoring. This alternative consists of installation of a groundwater extraction system to intercept, collect, and treat contaminated groundwater across a three-dimensional target capture zone. Treated water would be injected in rapid infiltration basins. **Figure 4-1** in **Appendix C** of this ROD depicts the general components and target treatment areas of Alternative 3.

Alternative 3 includes the following components:

- **Pre-Design Investigation:** Pre-design investigations would include an additional groundwater investigation to determine optimal extraction well placement. Pumping tests and other studies would be conducted to assist in determining pumping rates, locations, and depths of extraction wells. Sampling and analysis of extracted groundwater would be used to assist in the development of the groundwater treatment system design. Infiltration tests and hydraulic modeling would be needed to support the infiltration of treated groundwater.
- **Treatability/Pilot Testing:** Treatability and pilot testing would be used to optimize treatment components and finalize treatment design based on the results from pre-design studies.
- **Extraction and Injection System:** The groundwater extraction system would consist of a series of extraction wells that would capture contaminated portions of the aquifer while minimizing extraction of uncontaminated groundwater and impacts to the wetlands. The extraction system would also include pumps, electronic controls, and a network of underground piping that would convey extracted groundwater to a central treatment location. Treated water would be conveyed to infiltration basins constructed outside the treatment area. The infiltration basins allow the treated groundwater to slowly seep into the ground.

- **Treatment Plant:** The treatment system would occupy an approximate 60 by 60 square foot footprint on the landfill property. Extracted groundwater would be treated by a series of processes. The pre-treatment elements would focus on metals and suspended solids removal. These pre-treatment processes would be followed by contaminant-specific treatment processes including advanced oxidation (AO) for 1,4-dioxane treatment and granular activated carbon (GAC) treatment for PFAS removal.
- **Operation and Maintenance of the Treatment System:** Operation and Maintenance (O&M) would include monitoring to evaluate that all parts of the extraction and treatment system are operating properly. Equipment replacement and repair would be completed in accordance with an O&M plan approved by EPA.
- **Wetland Restoration:** Treatment system piping will likely be constructed within a wetland because groundwater impacts extend below the wetlands adjacent to Trout Brook. The remedy will be designed to minimize wetland and floodplain impacts. Wetlands that are disturbed as part of construction will be restored, and any impacts to floodplains are expected to be temporary.
- **Monitoring:** Monitoring would include groundwater and surface water monitoring. The monitoring program includes the current OU1 Post Closure Site Monitoring (PCSM) program, monitoring of wells installed as part of OU2 Remedial Investigation activities, and monitoring of new wells intended to enhance the Site-wide network to evaluate if contaminant concentrations are decreasing by natural processes. Surface water monitoring is included in the PCSM and Long-Term Monitoring (LTM) programs. Monitoring of residential drinking water wells is also included in this alternative. Remedy performance monitoring would include the installation and sampling of additional performance monitoring wells and extraction wells to evaluate remedy performance.
- **Institutional Controls:** Institutional controls (ICs) would be implemented to restrict groundwater use in all areas necessary to control exposure. ICs may also be necessary for the protection of the selected remedy including limitations on uses and activities that interfere with or disturb components of the remedy. ICs are also necessary to require a vapor intrusion assessment and/or a vapor barrier for new building construction in areas where Site related groundwater contamination is present.
- **Five-Year Reviews:** The Site will be reviewed at a minimum of every five years to assess protectiveness of the remedy.

The estimated timeframe for cleanup for groundwater hydraulically upgradient of the extraction well network ranges from 40 to 92 years. For the downgradient aquifer zones located beyond the extraction well network, cleanup levels are expected to be achieved between 11 and 19 years following implementation of the remedy.

The estimated present worth cost associated with Alternative 3 is $14,600,000. The range of costs based on a -30 to +50 range of accuracy is $10,220,000 to $21,900,000.

Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring (This is EPA's selected remedy)

Alternative 4 includes *in situ* treatment and sequestration, institutional controls, and monitoring. The *in situ* groundwater treatment strategy includes two technologies that would be used together in a two-stage reactive treatment zone to address Site COCs. The two technologies include: (i) ISCO with potassium persulfate, a slow-release form of chemical oxidant, to address CVOCs, 1,4-dioxane, and some PFAS (notably perfluorinated carboxylic acids (PFCAs); and (ii) sequestration/stabilization with injectable activated carbon for PFAS that are not susceptible to ISCO, primarily PFSAs associated with the sulfonic

acid/sulfonate sub-group. Metals are not specifically addressed by these technologies; however, metals are expected to become less mobile in the subsurface as groundwater shifts towards prevailing oxidizing conditions following persulfate injections. Performance monitoring will be conducted to evaluate whether the treatment of VOCs has resulted in conditions which will reduce the mobility and associated concentrations of metals in groundwater. **Figure 4-2** in **Appendix C** of this ROD depicts the general components and target treatment areas of Alternative 4.

Alternative 4 includes the following components:

- **Treatability/Pilot Testing:** Treatability testing is underway and will be completed to determine the effectiveness of the innovative technologies to treat Site-specific conditions. Treatability testing provides information to design the pilot test and the full-scale remedy. Pilot testing will be performed to provide additional information for implementation (such as, injection volumes, radius of influence, field-scale solubility/longevity of the reagents, and the Site-specific method(s) for injection).
- **Pre-Design Investigations:** Pre-design investigations will likely include steps to refine the extent of horizontal and vertical impacts in the vicinity of the proposed footprint of the two-stage reactive zone, understand contrasts in overburden permeabilities, and identify target treatment zones.
- ***In-situ* Chemical Oxidation (ISCO) Treatment Zone:** This alternative uses a combination of potassium persulfate and sodium persulfate injections as the first step to treat the contaminant mass and non-target oxidant demand, respectively. An iron activator may also be used to facilitate the oxidative processes.
- **ISCO Injections:** In addition to the ISCO treatment zone, the remedy includes targeted ISCO injections in areas downgradient of the ISCO treatment zone in areas of elevated 1,4-dioxane concentrations.
- **Activated Carbon (AC) Injections:** The remedy includes a second step consisting of an activated carbon barrier extending approximately 5 to 60 feet below ground surface and 750 feet across.
- **Wetland Restoration:** *In-situ* treatment zones may need to be constructed within a wetland or floodplain because groundwater impacts extend below the wetlands adjacent to Trout Brook. The remedy will be designed to minimize wetland and floodplain impacts. Wetlands that are disturbed as part of construction will be restored and impacts to any floodplain are expected to be temporary.
- **Monitoring:** Monitoring includes groundwater and surface water monitoring. The monitoring program includes the current OU1 Post Closure Site Monitoring (PCSM) program, monitoring of wells installed as part of OU2 Remedial Investigation activities, and monitoring of new wells intended to enhance the Site-wide network to evaluate if contaminant concentrations are decreasing by natural processes. Surface water monitoring is included in the PCSM and LTM programs. Monitoring of residential drinking water wells is also included in this alternative. Remedy performance monitoring will also include the installation and sampling of additional performance monitoring wells upgradient of the ISCO injections, between the two stages, and downgradient of the AC zone to monitor remedy performance.
- **Institutional Controls:** Institutional controls (ICs) would be implemented to restrict groundwater use in all areas necessary to control exposure. ICs may also be necessary for the protection of the selected remedy including limitations on uses and activities that interfere with or disturb components of the remedy. ICs are also necessary to require a vapor intrusion assessment and/or a vapor barrier for new building construction in areas where Site related groundwater contamination is present.

- **Five-Year Reviews:** The Site will be reviewed at a minimum of every five years to assess protectiveness of the remedy.

The estimated timeframe for cleanup for groundwater hydraulically upgradient of the treatment zones ranges from 55 to 119 years. For the downgradient aquifer zones located beyond the two treatment zones, cleanup levels are expected to be achieved between 8 and 19 years following implementation of the remedy.

The estimated present worth cost associated with Alternative 4 is $11,700,000. The range of costs based on a -30 to +50 range of accuracy is $8,190,000 to $17,550,000.

K. COMPARATIVE ANALYSIS OF ALTERNATIVES

Section 121(b)(1) of CERCLA presents several factors that, at a minimum, EPA is required to consider in its assessment of remedial alternatives. Building upon these specific statutory mandates, the NCP articulates nine evaluation criteria to be used in assessing the individual remedial alternatives.

A detailed analysis was performed on the remedial alternatives for OU2 using the nine evaluation criteria in order to select a Site remedy. The comparative analysis of alternatives was presented in Section 6 of the June 2020 FS report. The following is a summary of the comparison of each alternativeôs strength and weakness with respect to the nine evaluation criteria. These criteria are summarized as follows:

Threshold Criteria

The two threshold criteria described below must be met for the alternatives to be eligible for selection in accordance with the NCP.

1. **Overall protection of human health and the environment** addresses whether a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.
2. **Compliance with applicable or relevant and appropriate requirements (ARARs)** addresses whether a remedy will meet all Federal environmental and more stringent State environmental and facility siting standards, requirements, criteria, or limitations, unless a waiver is invoked.

Primary Balancing Criteria

The following five criteria are utilized to compare and evaluate the elements of one alternative to another that meet the threshold criteria:

3. **Long-term effectiveness and permanence** address the criteria that are utilized to assess alternatives for the long-term effectiveness and permanence they afford, along with the degree of certainty that they will prove successful.
4. **Reduction of toxicity, mobility, or volume through treatment** addresses the degree to which alternatives employ recycling or treatment that reduces toxicity, mobility, or volume, including how treatment is used to address the principal threats posed by the site.
5. **Short term effectiveness** addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period, until cleanup goals are achieved.
6. **Implementability** addresses the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

7. **Cost** includes estimated capital and O&M costs, as well as present value costs.

Modifying Criteria

The modifying criteria are used as the final evaluation of remedial alternatives, generally after EPA has received public comments on the Proposed Plan:

8. **State acceptance** addresses the Stateôs position and key concerns related to the preferred alternative and the other alternatives described in the Proposed Plan and FS, and the Stateôs comments on ARARs or the proposed use of waivers.
9. **Community acceptance** addresses the publicôs general response to the alternatives described in the Proposed Plan and FS.

Following the detailed analysis of each individual alternative, a comparative analysis was conducted focusing on the relative performance of each alternative against the nine criteria. This comparative analysis can be found in Section 6 of the June 2020 FS report and **Table K-1** of **Appendix B** of this ROD.

Comparative Analysis of Groundwater Alternatives

1. Overall Protection of Human Health and the Environment

Alternative 1 fails to meet the threshold criteria for overall protection of human health and the environment because the unacceptable future risks to human health are not reduced, controlled, or eliminated. COCs would remain in groundwater at levels exceeding the cleanup levels and potential human health risks would exist during this time.

Alternative 2 meets the threshold criteria for overall protection of human health and the environment because institutional controls will protect against human contact with contaminated groundwater by prohibiting certain uses (e.g., drinking water) or requiring pre-treatment of water prior to use.

Alternative 3, which is EPAôs contingency remedy, meets the threshold criteria for overall protection of human health and the environment because groundwater extraction and treatment is an effective and well-proven means of containment and treatment of impacted groundwater. This alternative would reduce contaminant mass downgradient of the hydraulic containment zone, and institutional controls would be used to protect human health during the remedial action.

Alternative 4, which is EPAôs selected remedy, meets the threshold criteria for overall protection of human health and the environment because most of the dissolved-phase contaminant mass would be destroyed *in situ* through ISCO and any untreated residual fractions would be sequestered *in situ* through adsorption using AC. This alternative would reduce contaminant mass downgradient of the treatment zone, and institutional controls would be used to protect human health during the remedial action.

2. Compliance with ARARs

Alternative 1 and Alternative 2 do not comply with chemical-specific ARARs within a reasonable timeframe. The expected timeframe to achieve compliance with RAOs under these alternatives, based on site-specific hydrogeologic parameters and the extent of groundwater impacts, is 123 to 233 years.

Alternative 3 and Alternative 4 were developed to comply with ARARs within a reasonable timeframe. Chemical-specific, action-specific, and location-specific ARARs are judged to be attainable with proper

implementation for both of these alternatives. The ARARs and TBCs for these alternatives are outlined in **Appendix D** of this ROD.

3. Long-term Effectiveness and Permanence

Alternative 1 does not address the unacceptable future risks due to the Site and provides no long-term effectiveness or permanence. Alternatives 2, 3, and 4 protect human health through the use of institutional controls, which are effective over the long-term if adequately monitored and enforced. Additionally, Alternative 3 and Alternative 4 are expected to reduce COCs in groundwater to below cleanup levels within approximately 20 years downgradient of the remedy, permanently eliminating the potential risk to human health and the environment. The time to conservatively achieve RAOs throughout the entire OU2 portion of the Site is estimated to take 40 to 92 years under Alternative 3 and 55 to 119 years under Alternative 4. Alternatives 3 and 4 have similar clean up timeframes, and similar long-term effectiveness.

Under Alternative 3, long-term management of the treatment system components would be required to maintain effectiveness. O&M would include process control activities, maintenance of extraction wells and treatment equipment, periodic inspections to perform preventative maintenance, change-out or regeneration of treatment media, and process water sampling to verify treatment system effectiveness. Long term monitoring of groundwater would be required to evaluate COC levels in the aquifer and to assess containment and the effectiveness of the treatment system.

Under Alternative 4, long term monitoring would be required to evaluate performance over time and additional ISCO injections would likely be required to maintain effectiveness. The timeframe between additional injections would be determined based on monitoring. The AC treatment zone has a predicted life span of over 25 years, which is expected to be adequate to address PFSAs at the Site.

Based on these expectations, Alternatives 3 and 4 have similar long-term effectiveness and permanence; however Alternative 4 has fewer long-term operation and maintenance requirements. Results from the Treatability Study will assist in the determination of overall long-term effectiveness of Alternative 4.

4. Reduction of Contaminant Toxicity, Mobility, or Volume through Treatment

Alternatives 1 and 2 provide no reduction in toxicity, mobility, or volume through treatment. Alternative 3 would reduce mobility of all COCs through containment by extraction wells and would also reduce contaminant toxicity through *ex situ* treatment. Alternative 4 would reduce toxicity of some COCs (CVOCs, 1,4-dioxane, and some PFAS) through ISCO treatment, and would reduce the mobility of the remaining organic COCs through sequestration to *in situ* activated carbon. Mobility of inorganic COCs is also expected to be reduced following persulfate injections as groundwater shifts towards oxidizing conditions. Both Alternative 3 and Alternative 4 are expected to provide similar overall reduction in toxicity, mobility, and volume.

5. Short-term Effectiveness

Alternative 1 does not address the unacceptable future risks due to the Site, and thus it provides no short-term effectiveness. Alternatives 2, 3, and 4 protect human health through the use of institutional controls, which could be implemented shortly after remedy selection.

Alternatives 1 and 2 do not involve any activities that would create any additional short-term risks to workers, the community, or the environment.

During implementation of Alternative 3, risks to the community are expected to be low. Risks to the environment include temporary disturbance to approximately 1,600 square feet of forested wetland (0.1% of the total wetlands at the Site) caused by construction of conveyance piping for the treatment system. Temporary impacts to the 100-year floodplain are similar in scale and involve an approximate 1,800 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. These risks would be mitigated by using best management practices and all work would be done in accordance with ARARs. Impacted wetlands would be fully restored after construction. Impacts to workers involved in construction and implementation of the groundwater extraction and treatment are minimal and are anticipated to be manageable through use of personal protective equipment (PPE), implementation of an appropriate health and safety program, and the use of qualified contractors. Treatment chemicals will need continual management and secondary containment. Treated water would infiltrate into the ground and would need to be monitored to evaluate potential impacts to the environment; there is a risk of adverse effects on sensitive biotic receptors in the wetlands or Trout Brook due to alteration of the local water balance by the groundwater extraction system. There would be minimal disruption to neighboring land parcels during extraction well construction, trenching, treatment building construction, and connection to a power supply source for system operation. These construction-related activities will require some degree of coordination with surrounding landowners and utility companies.

During implementation of Alternative 4, risks to the community are expected to be low. Risks to the environment include temporary disturbance to approximately 2600 square feet of forested wetland (0.2% of the total wetlands at the Site) caused by injections for the ISCO treatment zone. Temporary impacts to the 100-year floodplain involve an approximate 8,600 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. These risks would be mitigated by using temporary mats to minimize impacts from the equipment, best management practices, and all work would be done in accordance with ARARs. Impacted wetlands would be fully restored after construction. Impacts to the workers implementing the remedy include physical hazards from the equipment required for injections and the potential exposure to the materials being injected. The selected chemicals for the ISCO injections are corrosive. AC can form a combustible dust and can be an eye or respiratory irritant. These risks are anticipated to be manageable through use of PPE, implementation of an appropriate health and safety program, decontamination procedures, and the use of qualified contractors. There would be minimal disruption to neighboring land parcels during implementation of the remedy. Design and implementation of the alternative may require some degree of coordination with surrounding landowners and utility companies.

Based on these expectations, Alternatives 3 and 4 have similar short-term effectiveness as well as similar-short term risks.

6. Implementability

Alternative 1 is the most implementable as it requires no activities. Alternative 2 follows, as the only activities required are implementation of institutional controls and monitoring.

Alternative 3, groundwater extraction and treatment, is a well-developed technology and is expected to be readily implementable under current conditions. Significant delays to schedule are not likely to result from technical concerns; however, bench or pilot testing would be required to optimize treatment design. Treatment system operation is subject to intermittent shutdowns from power failures, treatment complication, media changeouts, and well rehabilitation due to fouling. These shutdowns are anticipated to be short-lived and would not result in extended periods of insufficient hydraulic control. Offsite

treatment and/or disposal would be required for sludges that accumulate. Spent carbon from PFAS treatment would require incineration. It is anticipated that there would be capacity for these materials at an appropriate facility. The technologies proposed in the treatment system should be readily available. Construction of the groundwater extraction and treatment system could be completed within 6 to 12 months of a final design.

Alternative 4 utilizes two technologies that have both been implemented individually at the full-scale level and are available through commercial vendors. Amendments would be injected using readily available technologies. Bench and pilot scale testing will be conducted to confirm effectiveness and optimize design. A treatability study is currently underway to further refine this alternative and evaluate the effectiveness of the innovative technologies to treat Site-specific conditions; refer to the Treatability Study Work Plan for ISCO and AC in Appendix E of the FS. Application of the oxidants and AC to the subsurface in a manner that promotes adequate contact time with contaminated groundwater will also be confirmed through pilot testing. Injection methods are flexible and supplementary injections, if required, would also use readily available and minimally disruptive injection methods. Implementation of the treatment zone could be completed within 6 to 9 months of final design.

Based on these expectations, Alternatives 4 is somewhat more easily implementable than Alternative 3 as it does not require building construction or connection to power; however, neither Alternative is prohibitively difficult to implement.

7. Costs

There is no cost associated with Alternative 1 other than the cost of five-year reviews. The cost for Alternative 2 is estimated to be $2.3 million; the cost for Alternative 3 is estimated to be $14.6 million; and the cost for Alternative 4 is estimated to be $11.7 million.

8. State Acceptance

The State of Rhode Island, through its lead agency, RIDEM, has expressed its support for EPA's preferred alternative presented in the July 2020 Proposed Plan, and concurs with the selected remedy, including the contingency remedy, outlined in this ROD (see **Appendix A** of this ROD for the State concurrence letter).

9. Community Acceptance

EPA's community engagement efforts at the Site included the publication of a Proposed Plan in July 2020; a virtual public informational meeting held on August 12, 2020; and a virtual public hearing which immediately followed the public informational meeting. A transcript was created for this hearing and has been included in the Responsiveness Summary located in Part 3 of this ROD. In addition to the one oral comment received at the hearing, one written comment was also received. The comments were supportive of the selected remedy but questioned the timing of it and the extent of well testing and monitoring to be performed to evaluate potential impacts off-site. A summary of the comments and EPA's responses to these comments are included in **Part 3: The Responsiveness Summary** of this ROD.

L. THE SELECTED REMEDY

EPA's selected remedy, **Alternative 4**, provides both short-term and long-term protection of human health and the environment, attains applicable federal environmental and more stringent state

environmental laws and regulations, reduces the toxicity, mobility, and volume of contaminants through treatment to the extent practicable, and utilizes permanent solutions. In addition, the selected remedy uses proven cleanup technologies including ISCO treatment of groundwater and sequestration of contaminants using activated carbon. The selected remedy is also generally cost effective while achieving the site-specific remedial action objectives and cleanup levels in a reasonable timeframe and has fewer impacts to the community.

For these reasons, EPA believes that the selected remedy for OU2, Alternative 4, achieves the best overall balance among the nine evaluation criteria required by the NCP. However, although the technologies in Alternative 4 have been demonstrated to be effective at the full-scale level individually, a treatability study is underway to determine if they are likely to be effective for *in situ* sequential treatment of COCs in groundwater at the L&RR Site. Because additional bench and pilot testing of this approach is still required, EPA has also identified a contingency remedy, Alternative 3, which best meets the NCP criteria if it is determined that Alternative 4 will not be able to reduce COC levels downgradient of the treatment area and throughout the Site to below cleanup levels within a reasonable timeframe.

If, after reviewing the treatability study results, pilot test results, or other data collected during the design phase, EPA, after consultation with RIDEM, determines that the selected remedy will not be effective in attaining cleanup levels identified for the Site, and no longer achieves the best balance among EPAôs required evaluation criteria, EPA will provide notice to the public of its intention to implement its contingency remedy. Specific performance criteria that will be used to assess the results of the treatability study can be found in the July 2020 Treatability Study Specific Aims and Performance Goals Memorandum.

EPAôs contingency remedy, **Alternative 3**, also provides both short-term and long-term protection of human health and the environment, attains applicable federal environmental and more stringent state environmental laws and regulations, reduces the toxicity, mobility, and volume of contaminants through treatment to the extent practicable, and utilizes permanent solutions. In addition, the contingency remedy uses proven cleanup technologies including groundwater extraction and treatment. The contingency remedy is also generally cost effective while achieving the site-specific remedial action objectives and cleanup levels in a reasonable timeframe.

Description of Remedial Components

The Selected Remedy: Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring

The selected remedy for OU2 is consistent with EPAôs preferred alternatives outlined in the July 2020 Proposed Plan. **Figure 4-2** in **Appendix C** of this ROD depicts the general components and target treatment areas of the selected remedy.

The selected remedy is an *in situ* groundwater treatment strategy which includes two technologies that will be used together in a two-stage reactive treatment zone to address Site COCs. The two technologies include: (i) ISCO with a combination of sodium persulfate and potassium persulfate, a slow-release form of chemical oxidant, to address CVOCs, 1,4-dioxane, and some PFAS (notably PFCAs); and (ii) sequestration/stabilization with injectable AC for PFAS that are not susceptible to ISCO, primarily PFSAs associated with the sulfonic acid/sulfonate sub-group. If appropriate, other oxidants or amendments may also be considered. The application of these two technologies in succession has not been performed at other sites; however, both technologies have been successfully implemented at the full-

scale level independently. A treatability study is currently underway to evaluate the viability of this alternative for Site specific conditions and to optimize system design. Refer to the Treatability Study Work Plan for ISCO and AC in Appendix E of the June 2020 FS for more information on the Treatability Study.

The components of the selected remedy include pre-design investigations; bench and pilot testing; *in situ* treatment and sequestration via ISCO and AC injections; institutional controls; long term monitoring of groundwater and surface water to evaluate contaminant status and migration; and a review of Site conditions and risks every five years. The following is a detailed description of the components of the selected remedy.

Pre-Design Investigation (PDI):

Pre-design investigations (PDI) will be conducted to refine the extent of horizontal and vertical impacts in the vicinity of the proposed footprint of the two-stage reactive zone, as well as to better understand contrasts in overburden permeabilities. PDIs will also include additional studies to further evaluate potential human health risks through the fish consumption pathway. Additionally, the potential for metals mobilization will be evaluated as part of pre-design bench- and pilot-scale activities and the remedial design will include measures to reduce or eliminate the potential for mobilization of metals beyond the treatment zones.

Treatability/Pilot Testing

Treatability testing is currently under way and results will be used to determine the effectiveness of the proposed technologies to treat Site-specific conditions. Treatability testing results will be used to design the pilot test and for the full-scale remedial design. Pilot testing will be performed to provide additional information on injection volumes, radius of influence, field-scale solubility/longevity of the reagents, and the Site-specific method(s) for injection. The work plan for the treatability study is provided in Appendix E of the June 2020 FS.

ISCO Treatment Zone:

It is expected that a combination of potassium persulfate and sodium persulfate will be used to treat the contaminant mass and non-target oxidant demand, respectively. An iron activator will also be used to facilitate oxidative processes. The conceptual design includes approximately 100 injection points spaced on 15-foot centers in two rows in an approximately 920-linear foot array. While the specifics will be determined during remedial design, it is anticipated that injections will be completed using direct push technology (DPT) in 1-foot intervals from 5 feet to up to approximately 80 feet bgs, depending on the depth to the top of bedrock. Potassium persulfate will be injected at a rate of approximately 50 pounds per linear foot in a 20 to 35 percent solid slurry by weight. Sodium persulfate and the iron activator will be injected in an amount equal to approximately 10 percent by weight of the potassium persulfate injected.

Full-scale amendment delivery will be designed to distribute additional reagent at the deep overburden and upper bedrock interface for treatment of contaminants in bedrock using prevailing vertical flow gradients. It has been assumed that to target the bedrock interval, two-times the potassium persulfate volume will be injected in the last 5-feet at each location. Amendment distribution will occur via downward groundwater flow gradients from the upper kame delta deposits to the lower ice contact unit. Low levels of contaminants in groundwater at the overburden-bedrock interface will benefit from enhanced reagent contact times as delivered reagents will persist for longer periods due to reduced vertical flow gradients within these zones.

Approximately 225,000 pounds of potassium persulfate will be injected during the first year. Additional injections will be completed based on performance monitoring results and the frequency of reinjection will be a function of field-scale solubility (that is, based on depletion) of the reagents and groundwater flux. The conceptual design conservatively includes three additional injections in the first 10 years, two additional injections in years 10 through 20, and one additional injection in years 20 through 30.

Metals are not specifically addressed by these technologies; however, metals are expected to become less mobile in the subsurface as groundwater shifts towards prevailing oxidizing conditions following persulfate injections.

Concentrations of the remaining COCs (1,4-dioxane, chlorinated VOCs, and metals) beyond the treatment zones are expected to continue to decrease following implementation of the remedial activities through natural processes including biodegradation (CVOCs), advection, dispersion, sorption, and groundwater recharge.

ISCO Injections:

Additional targeted ISCO injections will be done in areas downgradient of the persulfate barrier where concentrations of 1,4-dioxane remain elevated above cleanup levels. It has been assumed that injections would be done in a grid pattern using a 7.5-foot radius of influence.

AC Injections:

The AC barrier would be installed downgradient from locations where PFAS concentrations exceed cleanup levels. The conceptual design includes a 750-foot activated carbon barrier extending 5 to 60 feet bgs. The AC is expected to be injected at 150 locations using direct push technology (DPT). A higher volume of AC will be injected at the deep overburden/bedrock interface to allow for additional sequestration of COCs in bedrock. Approximately 100,000 pounds of media or 350,000 gallons of slurry would be injected. The barrier is expected to be effective for an extended period of time and should not need to be replaced.

Wetland Restoration:

In situ treatment zones are likely to be constructed within a small portion of floodplain or wetland because groundwater impacts extend below the wetlands adjacent to Trout Brook. The estimated temporary disturbance to the forested wetland is approximately 2,600 square feet. Temporary impacts to the 100-year floodplain involve an approximate 8,600 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. Alternatives to avoid wetland disturbance were considered, such as abrupt termination of the ISCO treatment zone south of the wetland, however this would result in incomplete treatment of groundwater east of the MW-102 well cluster. The remedy will be designed to minimize wetland impacts consistent with ARARs and will use best management practices for working in the vicinity of wetlands (e.g., haybales/silt fencing, temporary mats, and low-ground pressure construction equipment). A wetlands mitigation and restoration plan will be developed for the selected remedy as part of pre-design activities.

Monitoring:

Long-term monitoring will include:

- Ongoing monitoring conducted under the Post-Closure Site Monitoring (PCSM) Program, which consists of annual monitoring activities at seven existing monitoring wells and six surface water locations;
- Continued semi-annual monitoring of nearby residential wells on Pound Hill Road;
- Continued monitoring wells recently installed as part of OU 2 RI activities;
- Installation and sampling additional wells intended to enhance the Site-wide network for the potential future evaluation of natural attenuation processes; and
- Installation and sampling of three transects of monitoring wells to evaluate remedy performance, including a transect upgradient of the ISCO injections, between the two stages, and downgradient of the AC zone.

Long-term performance monitoring will include monitoring the COCs, degradation byproducts, and general physical and chemical parameters that may impact treatment performance. Additionally, during the injection process, water levels and oxidant dispersion will be monitored from surrounding new and existing wells. The specific monitoring program will be outlined in project plans to be developed during remedial design. Monitoring locations, frequency, and analyses may be adjusted over time.

Institutional Controls:

Institutional controls will be implemented to restrict groundwater use in all areas necessary to control exposure to Site related contaminants including areas described in the 1997 Settlement Agreement and Consent Decree that require groundwater use restrictions outside the landfill boundary. Institutional controls may also be necessary for the protection of the selected remedy including limitations on uses and activities that could interfere with or disturb components of the remedy. Institutional controls to restrict fish consumption may also be implemented if determined to be warranted based on future evaluation of potential human health risk from fish consumption. The details of the institutional controls will be resolved during the pre-design and remedial design phase in coordination with the parties performing the Remedial Action, impacted landowners, local officials, and RIDEM. Institutional controls are expected to be in the form of Environmental Land Use Restrictions (ELURs) but may also be implemented through measures that include, but are not limited to, other proprietary controls or a local town ordinance. Institutional controls may also include a prohibition of certain uses (e.g., future drinking water wells) or require pre-treatment of water (engineering control) prior to use. Institutional controls are also necessary to require vapor intrusion assessment and/or vapor barrier for new building construction in areas where Site related groundwater contamination is present.

Five-Year Reviews

At the conclusion of remedy construction, hazardous substances, pollutants, or contaminants associated with OU2 will remain in place. Therefore, as required by law, EPA will review the OU2 remedy/remedies to ensure that the remedial action(s) are protective of human health and the environment at least once every five years. These five-year reviews will evaluate the components of the remedy for as long as contaminated media remain in place above levels that would allow for unlimited use and unrestricted exposure. The purpose of the five-year review is to evaluate the implementation and performance of a Site remedy or remedies to determine if the remedy is, or the remedies are, protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of a remedy, or to bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions,

improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls, and/or conducting additional studies and investigations.

The Contingency Remedy: Alternative 3: Groundwater Extraction with Ex Situ Treatment, Institutional Controls, and Monitoring

The contingency remedy for OU2 is consistent with EPAôs contingency alternative outlined in the July 2020 Proposed Plan. **Figure 4-1** in **Appendix C** of this ROD depicts the general components and target treatment areas of the contingency remedy.

The components of the contingency remedy include pre-design investigations; pilot testing; treatment system design, construction, and operation and maintenance; institutional controls; long-term monitoring of groundwater and surface water to evaluate contaminant status and migration; and a review of Site conditions and risks every five years. The following is a detailed description of the components of the contingency remedy.

Pre-Design Investigation (PDI):

Pre-design investigations will include additional groundwater investigations to determine optimal well placement, as well as pumping tests to determine necessary pumping rates and extraction wells depths. Additionally, infiltration tests and hydraulic modeling will be utilized to support the design of the infiltration basin. PDIs will also include additional studies to further evaluate potential human health risks through the fish consumption pathway.

Treatability/Pilot Testing:

Treatability and pilot testing will be used to optimize treatment components and finalize treatment design based on the results from pre-design studies.

Extraction System:

The groundwater extraction system will consist of a series of extraction wells designed and located (based on pre-design studies) to hydraulically capture impacted portions of the aquifer while minimizing extraction of uncontaminated groundwater and pumping-induced impacts to the wetlands. Large diameter extraction wells (i.e., greater than 6-inches) will be constructed with long screens throughout the overburden unit. Extraction wells will be located such that areas where exceedances of PFAS cleanup levels were reported in the shallow fracture zone, will be within the radius of influence. Dissolved PFAS in overburden will be removed by extraction wells which will reduce the potential for flux into bedrock. PFAS exceeding cleanup levels in shallow bedrock will be contained, and bedrock impacts will be reduced as a result of strengthened upward flow gradients. The extraction system would also include pumps, electronic controls, and a network of underground pipes that would convey extracted groundwater to a central treatment location (the treatment plant).

Infiltration Basins:

After extracted groundwater goes through the treatment system, the water will be piped to infiltration basins. The infiltration basins allow the treated groundwater to slowly seep into the subsurface. The proposed infiltration basin location is upgradient of the landfill. The location was selected based on site constraints including available space, proximity to the wetlands, and land ownership. Groundwater modeling will be used during the design phase to evaluate optimal basin location and confirm that the extraction well network and treatment system are capable of managing additional contaminant loading

resulting from groundwater recirculation and flushing. If it is determined that the use of an infiltration basin is not implementable, other treated water discharge methods may be considered and used.

Treatment Plant:

The treatment system is expected to occupy an approximate 60 by 60 square foot footprint on the property. The proposed treatment plant location was selected based on proximity to the existing landfill gas treatment system, proximity to power, and minimal land preparation requirements. Contaminated groundwater that is extracted will be treated by a treatment train that consists of a series of processes that are applicable to the target contaminants that are being removed. The specific treatment unit operations will be determined if/when such a contingency remedy is designed. Conceptually, the pre-treatment elements will focus on metals and suspended solids removal and will consist of an equalization tank to control flow into the treatment system, followed by flocculation and separation steps, a particle filtration system, and neutralization. These pre-treatment processes will be followed by contaminant-specific treatment processes including advanced oxidation (AO) for 1,4-dioxane treatment and granular activated carbon (GAC) treatment for PFAS removal.

Operation and Maintenance of the Treatment System:

O&M will include monitoring to evaluate extraction pump operational rates, in-well drawdown and overall hydraulic capture, and extraction well and treatment components operation and performance. Equipment replacement and repair will be completed in accordance with an O&M plan.

Wetland Restoration:

The construction of the conveyance piping for the treatment system will likely occur within a small portion of floodplain and wetland because groundwater impacts extend below the wetlands adjacent to Trout Brook. The estimated temporary disturbance to the forested wetland is approximately 1,600 square feet. Temporary impacts to the 100-year floodplain are similar in scale and involve an approximate 1,800 square foot area, with no permanent compensatory storage loss or impacts to the 500-year floodplain. Alternatives to avoid wetland disturbance were considered, such as trenching on the western side of the electric and natural gas lines and horizontal drilling, however the equipment, costs, and necessary approvals for these options were deemed disproportional relative to the small extent of wetland to be disturbed. The remedy will be designed to minimize wetland impacts consistent with ARARs and use best management practices for working in the vicinity of wetlands (e.g., haybales/silt fencing, temporary mats, and low-ground pressure construction equipment). A wetlands mitigation and restoration plan will be developed for the selected remedy as part of pre-design activities.

Monitoring:

Long-term monitoring will include:

- Ongoing monitoring conducted under the Post-Closure Site Monitoring (PCSM) Program, which consists of annual monitoring activities at seven existing monitoring wells and six surface water locations;
- Continued semi-annual monitoring of nearby residential wells on Pound Hill Road;
- Continued monitoring wells recently installed as part of OU 2 RI activities;
- Installation and sampling additional wells intended to enhance the Site-wide network for the potential future evaluation of natural attenuation processes; and
- Installation and sampling additional performance monitoring wells and the extraction wells.

Long-term performance monitoring would include monitoring the COCs, degradation byproducts, and general physical and chemical parameters that may impact treatment performance. Additionally, treatment system influent and effluent will be monitored monthly to evaluate system performance. The specific monitoring program will be outlined in project plans to be developed during remedial design. Monitoring locations, frequency, and analyses may be adjusted over time.

Institutional Controls:

Institutional controls will be implemented to restrict groundwater use in all areas necessary to control exposure to Site related contaminants including areas described in the 1997 Settlement Agreement and Consent Decree that require groundwater use restrictions outside the landfill boundary. Institutional controls may also be necessary for the protection of the selected remedy including limitations on uses and activities that could interfere with or disturb components of the remedy. Institutional controls to restrict fish consumption may also be implemented if determined to be warranted based on future evaluation of potential human health risk from fish consumption. The details of the institutional controls will be resolved during the pre-design and remedial design phase in coordination with the parties performing the Remedial Action, impacted landowners, local officials, and RIDEM. Institutional controls are expected to be in the form of Environmental Land Use Restrictions (ELURs) but may also be implemented through measures that include, but are not limited to, other proprietary controls or a local town ordinance. Institutional controls may also include a prohibition of certain uses (e.g., future drinking water wells) or require pre-treatment of water (engineering control) prior to use. Institutional controls are also necessary to require vapor intrusion assessment and/or vapor barrier for new building construction in areas where Site related groundwater contamination is present.

Five-Year Reviews

At the conclusion of remedy construction, hazardous substances, pollutants, or contaminants associated with OU2 will remain in place. Therefore, as required by law, EPA will review the OU2 remedy/remedies to ensure that the remedial action(s) are protective of human health and the environment at least once every five years. These five-year reviews will evaluate the components of the remedy for as long as contaminated media remain in place above levels that would allow for unlimited use and unrestricted exposure. The purpose of the five-year review is to evaluate the implementation and performance of a Site remedy or remedies to determine if the remedy is, or the remedies are, protective of human health and the environment. The five-year review will document recommendations and follow-up actions as necessary to ensure long-term protectiveness of a remedy, or to bring about protectiveness of a remedy that is not protective. These recommendations could include providing additional response actions, improving O&M activities, optimizing the remedy, enforcing access controls and institutional controls, and/or conducting additional studies and investigations.

Remedy Modifications

The selected remedy may change somewhat as a result of the remedial design, results of the PDIs, additional groundwater monitoring, and/or construction processes. Any changes to the remedy described in this ROD would be documented using a technical memorandum in the Administrative Record, an Explanation of Significant Differences (ESD), or ROD amendment, as appropriate.

Summary of the Estimated Remedy Costs

The estimated total cost of the selected remedy is approximately $11.7 million. The estimated total cost of the contingency remedy is approximately $14.6 million. A summary table of the major capital construction and annual O&M cost elements for the selected remedy and the contingency remedy are shown on the following pages. Detailed tables for the selected remedy and the contingency remedy are presented in **Tables L-2** and **L-3** of **Appendix B**. The discount rate used for calculating total present worth costs was 7%. The timeframe, estimated in the June 2020 FS report, over which cost expenditures are calculated is 30 years.

Changes in the cost elements may occur as a result of new information and data collected during the remedial design or PDIs. Changes may be documented in the form of a memorandum in the Administrative Record file, an ESD, or a ROD amendment, as appropriate. This is an order-of-magnitude engineering cost estimate that is expected to be within -30 to +50 percent of the actual project cost.

Selected Remedy Cost Table
Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring

CAPITAL COSTS			
Construction Activities			
Pre-Design Investigation		$	140,000
Pilot Testing		$	300,000
Two-Stage Reactive Barrier		$	3,462,000
New Well Installation		$	301,000
Institutional Controls		$	65,000
	SUBTOTAL - TWO-STAGE TREATMENT ZONE, ICs	$	4,268,000
	Contingency (20%)	$	853,600
	TOTAL TWO-STAGE TREATMENT ZONE + ICs	**$**	**5,122,000**
Professional/ Technical Services			
Project Management		$	256,100
Remedial Design		$	409,800
Construction Management		$	307,400
Health and Safety		$	76,900
Legal		$	50,000
Permitting		$	25,000
	TOTAL PROFESSIONAL/ TECHNICAL SERVICES	**$**	**1,126,000**
TOTAL CAPITAL COSTS		**$**	**6,250,000**
ANNUAL OPERATION, MAINTENANCE, AND MONITORING COSTS			
Monitoring (Years 1-10) SUBTOTAL:		$	175,100
	Contingency (20%)	$	35,000
	TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)	**$**	**1,476,000**
Monitoring (Years 11-30) SUBTOTAL:		$	131,100
	Contingency (20%)	$	26,200
	TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)	**$**	**848,000**
TOTAL PRESENT VALUE OM&M (PV 7%)		**$**	**2,330,000**
PERIODIC COSTS			
Five Year Site Reviews		$	44,000
Persulfate Reinjections		$	3,044,000
Well Decommissioning		$	16,000
Update LTM Program		$	2,000
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)		**$**	**3,110,000**
TOTAL PRESENT VALUE (7%)		**$**	**11,700,000**
	Total Present Value Range (-30 %)	$	8,190,000
	Total Present Value Range (+50 %)	$	17,550,000

Contingency Remedy (Alternative 3) Cost Table
Groundwater Extraction with Ex Situ Treatment, Institutional Controls, and Monitoring

CAPITAL COSTS		
Equipment Procurement	$	1,422,400
Construction Activities		
Pre-Design Investigation	$	125,000
Bench and Pilot Testing	$	370,000
Site Civil/Structural	$	645,500
Mechanical	$	747,200
Electrical/I&C	$	897,000
Start Up and Commissioning	$	59,000
Indirects and O&P	$	618,300
New Monitoring Well Installation	$	228,000
Institutional Controls	$	65,000
SUBTOTAL - GROUNDWATER EXTRACTION AND TREATMENT, ICs	$	5,177,400
Contingency (20%)	$	1,035,500
TOTAL GROUNDWATER EXTRACTION AND TREATMENT + ICs	**$**	**6,213,000**
Professional/Technical Services		
Project Management	$	310,700
Remedial Design	$	497,100
Construction Management	$	372,800
Health and Safety	$	93,200
Permitting/Legal	$	93,200
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	**$**	**1,367,000**
TOTAL CAPITAL COSTS	**$**	**7,580,000**
ANNUAL OPERATION, MAINTENANCE, AND MONITORING COSTS		
Performance Monitoring (Years 1-10)	$	224,100
Contingency (20%)	$	44,800
TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)	**$**	**1,888,700**
Performance Monitoring (Years 11-30)	$	156,100
Contingency (20%)	$	31,200
TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)	**$**	**1,008,700**
Groundwater Treatment - Operations and Maintenance	$	253,000
Contingency (20%)	$	50,600
TOTAL PV - GWTP O&M COSTS (30 Years, Year 1 through 30)	**$**	**3,767,400**
General Site Maintenance	$	13,500
Contingency (20%)	$	2,700
TOTAL PV - SITE MAINTENANCE COSTS (30 Years, Year 1 through 30)	**$**	**201,100**
TOTAL PRESENT VALUE OM&M (7%)	**$**	**6,870,000**
PERIODIC COSTS		
Five Year Site Reviews	$	44,000
Groundwater Performance and Optimization Study	$	23,000
Demobilization of On-site Treatment System	$	33,000
Well Decommissioning	$	16,000
Update Institutional Controls Plan	$	2,000
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)	**$**	**118,000**
TOTAL PRESENT VALUE (7% OM&M, 30 Years)	**$**	**14,600,000**
Total Present Value Range (-30 %)	$	10,220,000
Total Present Value Range (+50 %)	$	21,900,000

Expected Outcomes of the Selected Remedy

Following implementation, it is expected that both the selected remedy and the contingency remedy (if implemented) will reduce downgradient COC concentrations to levels that are protective of human health and the environment within 20 years. After completion of the remedy, groundwater (outside the boundary of the landfill) will be restored to beneficial reuse and will no longer pose a potential risk to future residents nor act as a source for surface water contamination in Trout Brook, Trout Brook Pond, or the associated tributaries.

The effectiveness of the remedy will be determined based upon attainment of the groundwater cleanup levels (performance standards) outlined in **Table L-1** in **Appendix B** of this ROD as well as any additional site-related COCs added through subsequent decision documents. A monitoring program will be implemented in order to evaluate remedy performance and progress towards attainment of cleanup levels. The details of the monitoring program will be established during the remedial design phase and will include preparation of a long-term monitoring plan. Monitoring scope and frequency could change over time based on technical analysis of the remedy, optimization studies, revised conceptual site model, or other information, as determined by EPA after reasonable opportunity for review and comment by RIDEM.

The determination that all cleanup levels have been met will consider historical and current monitoring data, contaminant distribution, trend analysis, and the appropriateness of the compliance monitoring program (*i.e.*, locations, frequency of monitoring, sampling parameter). After all groundwater cleanup levels outlined in **Table L-1** in **Appendix B** have been met, as determined by EPA after reasonable opportunity for review and comment by RIDEM, consistent with Agency guidance and State regulatory requirements, EPA will perform a risk evaluation which considers additive risk from remaining COCs considering all potential routes of exposure to document the residual risk based on exposure to groundwater at the Site. The residual risk evaluation will document the potential risk associated with the concentrations of the COCs remaining in groundwater at the Site (if detected).

Cleanup Levels

Cleanup levels were developed for the COCs identified in the human health risk assessment. COCs are the chemicals found at the Site that, based on the results of the risk assessment, were determined to pose an incremental lifetime cancer risk (ILCR) greater than 1 in 1 million (10^{-6}) or an HI greater than 1. COCs were identified for exposure areas that posed a cancer risk in excess of an ILCR of 10^{-4}, or an HI greater than 1.

Groundwater Cleanup Levels

Cleanup levels have been established for groundwater for all COCs identified in the baseline HHRA (for groundwater used as residential potable water) found to pose an unacceptable risk to human health. These cleanup levels can be found in **Table L-1.** For the residential potable water scenarios, the cleanup levels were selected based on federal Maximum Contaminant Levels (MCLs), RIDEM Groundwater Quality Rules (RIDEM-GQR), health advisories, or risk-based cleanup goals. For those COCs that do not have a federal or state ARAR at the time this ROD was developed, a risk-based cleanup level was calculated. (see Section 2.3, Table 2-4, and Appendix A of the June 2020 FS for cleanup level development). Risk-based cleanup levels are based on the residential potable water scenarios evaluated in the baseline HHRA with potential future cumulative cancer risks greater than 10^{-4} or target organ HIs greater than 1 considering the ingestion, dermal contact, and inhalation exposure pathways. Cleanup level development included each chemical with an individual cancer risk above 10^{-6} or with an HQ above 1. For each of the

contaminants, risk-based cleanup levels were calculated using equations and exposure assumptions presented in the baseline HHRA. Toxicity values used in the calculation of the risk-based cleanup levels are presented in **Section G** of this ROD.

M. STATUTORY DETERMINATIONS

The remedial action selected for implementation at the Landfill and Resource Recovery, Inc. (L&RR) Superfund Site ï OU2 is consistent with CERCLA and, to the extent practicable, the NCP. The selected remedy and the contingency remedy are protective of human health and the environment, will comply with ARARs, and are cost-effective. In addition, the selected remedy and the contingency remedy utilize permanent solutions and alternate treatment technologies or resource recovery technologies to the maximum extent practicable and satisfy the statutory preference for treatment that permanently and significantly reduces the mobility, toxicity, or volume of hazardous substances as a principal element to the maximum extent practicable.

1. The Selected and Contingency Remedies are Protective of Human Health and the Environment

The selected and contingency remedies for OU2 will adequately protect human health and the environment by eliminating, reducing, or controlling exposures to human receptors through *in situ* treatment and sequestration, extraction and *ex situ* treatment, engineering controls, long-term monitoring, and institutional controls. The selected and contingency remedies will reduce potential human health risk levels such that they do not exceed protective ARAR levels, or in the absence of protective ARAR levels, EPAôs target risk range of a total excess lifetime cancer risk of 10^{-6} to 10^{-4} and/or a non-cancer Hazard greater than 1.0.

Implementation of Alternative 4 would prevent continued migration of the majority of the groundwater contaminant mass to residential receptors through *in situ* treatment and sequestration. If the contingency remedy is implemented, Alternative 3 would prevent the flow of contaminated groundwater from the landfill perimeter into the wetlands and Trout Brook and protect downgradient residential receptors through hydraulic containment and *ex situ* treatment of groundwater.

Under either remedy, concentrations of the COCs beyond the hydraulic control or treatment capture zone are expected to continue to decrease following implementation of upgradient remedial actions through on-going natural processes including biodegradation (CVOCs), advection, dispersion, sorption, and groundwater recharge. Both remedies utilize ICs, which will provide further protection from exposure to contaminated groundwater emanating from the Site until groundwater cleanup levels are achieved. It should be noted that the groundwater remediation at this Site addresses contaminants related to the Site only.

2. The Selected and Contingency Remedies Comply with ARARs

Both the selected remedy and the contingency remedy will comply with federal and more stringent state ARARs identified for OU2. (The OU1 remedy remains subject to the ARARs set forth in the OU1 ROD.) The selected remedy and the contingency remedy will also incorporate procedures and processes identified by policies, advisories, criteria, and guidance documents (TBCs). Detailed lists of ARARs/TBCs for the selected remedy and contingency remedy are included in **Appendix D** of this ROD. A discussion of the more significant ARAR issues is included below.

Wetlands Impacts

Issuance of the ROD embodies specific ARARs determinations made by EPA, pursuant to federal regulatory standards. More specifically, as defined by Section 404(b) of the Clean Water Act and regulations promulgated under the Act at 40 C.F.R. Parts 230, 231, and 33 C.F.R. Parts 320-323, EPA has determined, with issuance of this ROD, that the selected remedy and contingency remedy are the least environmentally damaging practicable alternatives for protecting wetland resources. EPA will minimize potential harm and avoid adverse impacts to wetlands by using best management practices to minimize harmful impacts on the wetlands, wildlife or their habitat, and by restoring these areas consistent with federal and state wetlands protection laws. Any wetlands affected by remedial work will be restored with native vegetation as a wetland area and such restoration will be monitored until the wetland vegetation becomes re-established. Other mitigation measures will be used to protect wildlife and aquatic life during remediation and restoration, as necessary. More detail regarding wetland management can be found in the FS.

In compliance with standards with relevant and appropriate Wetland Protection and Floodplain Management regulations (44 C.F.R. Part 9), EPA solicited public comment through the Proposed Plan on the proposed cleanupôs impacts on wetland resources within the Proposed Plan. EPA did not receive any comments regarding wetland issues.

Floodplain Impacts

EPA has also determined that there is no practicable alternative to activities that affect or result in the occupancy and modification of the 100- and 500-year floodplain, and that the proposed and contingency cleanups will cause temporary impacts but will not result in the occupancy and modification of floodplains.

While injections (under the preferred Alternative 4) or trenching for treatment system piping (under contingency Alternative 3) are proposed for areas of the Site located in the floodplain, only temporary impacts to the floodplains are anticipated. Best management practices will be used during injections, which will include erosion control measures, proper regrading, and restoration and monitoring of impacted areas. More detail regarding floodplain management can be found in the FS.

In compliance with standards with relevant and appropriate Wetland Protection and Floodplain Management regulations (44 C.F.R. Part 9), EPA solicited public comment through the Proposed Plan on the proposed cleanupôs impacts on floodplains within the Proposed Plan. EPA did not receive any comments regarding floodplain issues.

3. The Selected and Continency Remedies are Cost-Effective

The estimated present worth cost of the selected remedy is approximately $11.7 million and the estimated present worth cost of the contingency remedy is approximately $14.6 million.

EPA believes that both the selected remedy and the contingency remedy are cost-effective because each remedyôs costs are proportional to its overall effectiveness (see 40 C.F.R. Ä300.430(f)(1)(ii)(D)). This determination was made by evaluating the overall effectiveness of those alternatives that satisfied the threshold criteria by assessing three of the five balancing criteria: long-term effectiveness and permanence; reduction in toxicity, mobility, or volume through treatment; and short-term effectiveness; in combination. The overall effectiveness of each alternative then was compared to the alternativeôs cost to determine cost-effectiveness. The relationship of the overall effectiveness of each of these remedial

alternatives was determined to be proportional to its costs and hence represents a reasonable value for the money to be spent.

4. The Selected and Contingency Remedies Utilize Permanent Solutions and Alternative Treatment (or Resource Recovery) Technologies to the Maximum Extent Practicable

EPA believes that the selected remedy provides the best balance of trade-offs with respect to the balancing criteria set out in NCP Ä300.430(f)(1)(i)(B), such that it represents the maximum extent to which permanence and treatment can be practicably utilized at this site. This determination was made by evaluating trade-offs among alternatives with an emphasis on two of the five balancing criteria: long-term effectiveness and permanence; and the reduction of toxicity, mobility, or volume through treatment. The preference for source area treatment as a principal element was also considered. The selected remedy provides the best balance of trade-offs among the alternatives because it utilizes *in situ* treatment of contaminated groundwater, permanent *in situ* sequestration of contaminants, and does not result in any off-site disposal.

If EPA, after consultation with RIDEM, determines that the selected remedy will not meet performance standards, then EPA believes that the contingency remedy provides the next best balance of trade-offs among the alternatives because it utilizes *ex situ treatment* of contaminated groundwater to achieve a permanent reduction in the toxicity, mobility, and volume of contaminated groundwater at the Site.

5. The Selected and Contingency Remedies Satisfy the Preference for Treatment as a Principal Element

The principal element of both the selected and contingency remedies is management of migration. The selected remedy utilizes *in situ* groundwater treatment to intercept and treat contaminated groundwater before it reaches residential receptors and Trout Brook. If implemented, the contingency remedy utilizes various methods of *ex situ* treatment to treat groundwater prior to re-infiltration.

6. Five-Year Reviews of the Selected and Continency Remedies are Required

At the conclusion of the OU2 Site remedy implementation, hazardous contaminants will remain at the Site. Therefore, as required by law, EPA will review the Site remedies to ensure that the remedial actions continue to protect human health and the environment at least once every five years, as part of the EPAôs five-year reviews for the entire L&RR Site for as long as waste remains above levels that would allow for unlimited use and unrestricted exposure. These five-year reviews will evaluate the components of the OU2 Site remedy for as long as contaminated media (i.e., groundwater) remain in place above groundwater cleanup levels.

N. DOCUMENTATION OF NO SIGNIFICANT CHANGES

EPA issued the L&RR OU2 Proposed Plan for remediation of the Site to the public for review and comment on July 29, 2020. The Proposed Plan described the alternatives considered and EPAôs preferred alternative for the selected remedy and contingency remedy.

EPA reviewed all written and verbal comments submitted during the public comment period, which began on July 29, 2020, and ended on August 28, 2020. Based upon a review of the submitted comments, EPA determined that no significant changes to the selected remedy or contingency remedy, as originally identified in the July 2020 Proposed Plan, were necessary.

O. STATE ROLE

The Rhode Island Department of Environmental Management has reviewed the various alternatives and has indicated its support for the selected remedy and contingency remedy. The State has also reviewed the Remedial Investigation, Risk Assessments, and Feasibility Study to determine if the selected remedy and contingency remedies are in compliance with applicable or relevant and appropriate state environmental and facility siting laws and regulations. The State of Rhode Island concurs with the selected remedy for the L&RR Superfund Site. A copy of the declaration of concurrence is attached as **Appendix A** of this ROD.

PART 3: THE RESPONSIVENESS SUMMARY

PUBLIC COMMENTS AND EPA RESPONSES

EPA published the notice of availability of the Proposed Plan and Administrative Record through a news release on July 29, 2020 and released the Proposed Plan to the public on July 29, 2020 by posting a publicly accessible link on EPAôs website at www.epa.gov/superfund/lrr. In addition, postcard notifications were mailed to residents and businesses located within a one-mile radius of the Site, and notification letters were sent to potentially responsible parties that participated in previous settlements related to the Site.

From July 29, 2020 through August 28, 2020, EPA held a thirty-day public comment period to accept public comments on the alternatives presented in the Feasibility Study and Proposed Plan.

On August 12, 2020, EPA held a virtual public informational meeting, immediately followed by a virtual Public Hearing, to describe EPAôs Proposed Plan and to accept any oral comments. A transcript of this hearing and the comments received at the hearing are included in the Responsiveness Summary.

One public comment was received during the Public Hearing, and one comment was received in writing during the public comment period. Comments have been paraphrased below. The full text of the written and oral comments received during the comment period has been included in the ROD Administrative Record.

Comments Received at the July 29, 2020 Public Hearing

COMMENT 1:

During the July 29, 2020 Public Hearing, the North Smithfield Town Administrator expressed concern about the timeline of the remedy due to the lack of other drinking water options for residents near the Site. The commenter also wants to ensure that if EPA moves forward with Alternative 4 and it does not prove effective within an appropriate time, that Alternative 3 will be pursued in a reasonable timeline.

> **EPA RESPONSE 1:** EPA understands the need for a timely response to address migration of contaminated groundwater, and the need to move forward swiftly in order to avoid potential contamination of existing groundwater drinking wells downgradient of the Site. Following issuance of this ROD, EPA will issue Special Notice letters inviting potentially responsible parties identified for the Site to engage in settlement negotiations for the performance of the remedial actions described in this ROD. Additionally, once available, EPA will review treatability study results for the selected remedy (Alternative 4) to evaluate its ability to meet performance standards. If EPA determines that the selected remedy is expected to meet performance standards, EPA will promptly move forward with the selected remedy. If EPA determines that the selected remedy will not meet performance standards, EPA will notify the public before promptly moving forward with the contingency remedy.

Comments Received in Writing during the Public Comment Period

COMMENT 2:

One town resident commented that he and other adults in his household were suffering from neurological issues that he believes may be related to toluene that he believes may be leaching from the L&RR Site to his residential well.

The commenter recommended more well testing beyond what has been done already, and asked what EPA is doing to ensure that development beyond a one-mile radius does not cause contamination to be drawn off Site into areas that are not being monitored.

EPA RESPONSE 2:

Toluene is not a Contaminant of Concern at the L&RR Superfund Site. During the OU2 Remedial Investigation, toluene was not detected in overburden groundwater samples; toluene was detected in 14 out of 40 bedrock groundwater samples with detections ranging from 0.9 ug/L to 4.8 ug/L, well below ARARs including US EPA MCL of 1000 Õg/L, RIDEM Groundwater Quality Rule of 1000 Õg/L, and below the EPA risk-based screening level for drinking water which is 110 Õg/L.

Additionally, the address provided by the resident is southwest of the Site and looks to be associated with the Tarkiln Brook watershed that flows into the Upper Slatersville Reservoir from the southeast. The USGS Study for the Cumberland, North Smithfield, and Westerly public-supply well recharge study included a model which supported the belief that groundwater flow in the vicinity of the L&RR landfill is distinctly east towards Trout Brook, and Ridge Hill may function as a localized divide ï with groundwater to the east flowing toward Trout Brook and west towards the Brook and Upper Slatersville Reservoir. Therefore, there is no monitoring to the southwest of the landfill as part of the L&RR Superfund Site Monitoring Program. There are monitoring wells associated with the Western Sand and Gravel Site (WS&G Site) that are located southwest of the L&RR Site surrounding the WS&G Site. Review of site documents for the WS&G Site indicate that groundwater flow in the area of that Site is distinctly to the northwest, and also away from the residence of the commenter.

Regarding the concern of the plume being drawn off-Site due to development beyond a one-mile radius: Impacted groundwater exists only on a few parcels in the direct vicinity of the Site. The extent of this contamination was determined through analysis of groundwater data from a network of wells throughout the Site, including those both within and beyond the plume, and is continually updated to reflect the most recent data. The extent of contaminated groundwater at the Site is well defined and extends only several hundred feet downgradient of the landfill boundary.

Additionally, to mitigate further migration of impacted groundwater due to off-Site groundwater usage, institutional controls (ICs) will be implemented as part of the remedy to restrict groundwater use in all areas necessary to control exposure.

Regarding the need for expanded monitoring beyond what has been done: Wells associated with the OU1 remedy continue to be sampled annually. The monitoring program for the OU2 remedy will also include monitoring of wells installed as part of OU2 Remedial Investigation activities, monitoring of new wells intended to enhance the Site-wide network, and monitoring of selected residential drinking water wells downgradient of the plume. Locations are identified for monitoring wells based upon continually updated information including recent and historic groundwater data, existing and potential exposure pathways resulting from known or anticipated development, and groundwater flow characteristics.

UNITED STATES OF AMERICA

ENVIRONMENTAL PROTECTION AGENCY

BOSTON REGION

In the Matter of:

PUBLIC HEARING:

RE: PROPOSED REMEDY FOR L&RR SUPERFUND SITE

IN NORTH SMITHFIELD, RHODE ISLAND

Via Skype

Wednesday
August 12, 2020

The above entitled matter came on for hearing, pursuant to Notice at 8:15 p.m.

BEFORE:

MELISSA TAYLOR, EPA Section Chief
New Hampshire and Rhode Island Superfund Section
HOSHAIAH BARCZYNSKI, Project Manager
SARAH WHITE, Community Involvement Coordinator
EPA, Region 1
5 Post Office Square, Suite 100
Boston, MA 02109

I N D E X

P R O C E E D I N G S

(7:53 p.m.)

MS. TAYLOR: Good evening. My name is Melissa Taylor. I am the Chief of the New Hampshire and Rhode Island Superfund Section in EPA's Region 1 office. I will be the hearing officer for tonight's hearing on the proposed remedy for the L&RR Superfund site located in North Smithfield, Rhode Island.

The purpose of this hearing is to formally accept oral comments on the proposed plan released to the public on July 29, 2020. We will not be accepting written comments during the hearing. You may submit written comments via fax, e-mail or postal mail to Hoshaiah Barczynski. This information will be on the how to submit comments slide which will be provided at the closure of the hearing.

We will not be responding to comments today, but will respond to them in writing after August 28, 2020, which is the close of the comment period.

A public information meeting on the plan was held immediately before the hearing via Skype and telephone. During that meeting, information concerning the plan was presented and EPA was available to respond to questions about the site.

Now, let me describe the format for the hearing. You just heard Hoshaiah Barczynski, EPA's project manager

for the site, give a brief overview of the site, various cleanup alternatives that were evaluated, and EPA's proposed cleanup plan for the site. And for the record, that proposal includes in situ treatment of groundwater contaminants using a two stage reactive treatment zone, land use restrictions called institutional controls or IC's that prohibit use of contaminated groundwater until cleanup levels are met, and also required evaluation of the vapor intrusion pathway if any construction of buildings is planned over contaminated groundwater plume in the future.

It also includes a contingency remedy consisting of groundwater extraction and treatment and an on-site treatment system that will be implemented if the ongoing treatability study results show that the proposed remedy will not be effective in obtaining the desired cleanup levels of the site. It will include restoration of any wetland, flood plain habitat altered by the remedial action, long term groundwater surface water and residential well monitoring, and periodic reviews, at least every five years, to assess the protectiveness of the remedy.

The total estimated cost of this proposed remedy is approximately 11.7 million.

Copies of the proposed plan have been made available on EPA's L&RR website at www.EPA.gov/Superfund/LRR, and the link is listed in the

chat box. Hard copies remain available by request to Sarah White, EPA's Community Involvement Coordinator.

Those of you on Skype wishing to comment should indicate your desire to do so by entering I have a comment in the Skype chat box. Sarah will call on those wishing to make a comment in the order in which you signed up to speak.

When called on, please un-mute your Skype line, state your name and address or your affiliation.

After Sarah has gone through the Skype oral comments, we will take any comments from the phone line. Please follow the same process for identifying yourself.

Please limit your oral comments to five minutes. If the extent of your comments will take longer than five minutes, I ask that you summarize your major points and provide EPA with a copy of the full text of your comments. The text, in its entirety, will become part of the hearing record.

If you have any comments that you wish to add via telephone at a later date, but before August 28th, EPA has provided a dedicated voice mailbox you may reach at 617-918-1910.

After all comments have been heard, I will close the formal hearing. If you wish to submit comments, you can e-mail or fax them to Hoshaiah, or you can mail them to our Boston office at the address in the proposed plan and on the

how to submit comment slide which will be provided at the closure of the hearing. If you have any questions on how to submit comments after the hearing, please either call or e-mail Hoshaiah or Sarah.

All oral comments that we receive tonight, and the comments that we receive during the comment period, will be addressed in the responsiveness summary and become part of the administrative record for the site and will be included with the decision on the remedy for the site.

We will now accept your oral comments. Sarah will moderate the queue for the oral comments.

MS. WHITE: Thank you, Melissa. Just to reiterate what Melissa said, if you would like to speak for the record, please post I have a comment in the chat box. Starting with those participating via Skype, I will call on each person in the order received. Please remember to state your name and affiliation. I will then ask those on the phone line if they would like to provide comments. Please remember to un-mute and then re-mute your line after you have provided comments.

Thank you.

(Pause.)

MS. WHITE: All right. Thus far, no one has indicated that they would like to comment -- okay. I did get one person that I'm going to call on that would like to

comment.

Gary Ezovski. Please un-mute your line to comment.

MR. EZOVSKI: Yes. Thank you. I am the Town Administrator. My address is 88 North Main Street in North Smithfield as well.

Sarah, Hoshaiah, Melissa, I want to say thank you on behalf of myself and the town for the work that EPA continues to provide to mitigate the issues that emanate from this landfill. Your work is impressive and appreciated in so many ways.

And I thank you also for the meeting that you arranged for us yesterday to be able to understand what it was that was going to be presented tonight. It certainly helped to anticipate the meeting and be ready.

But all of that just puts me back to the same place I was back in 2018. And as much as we appreciate what is happening, we also need to recognize the cumbersome circumstance that you have in managing this process. It obviously requires a lot of time to pass.

It's my understanding, from reading the documents, that the first telltale signs of migration of the landfill for these specific compounds was identified on or about 2012. And it is taken this long to be able to go through the process, to get buy in by all of the PRP's and to get a

plan together which still will take time to get in place to ultimately protect the water resources, the drinking water resources, for the down gradient residents.

So, my concern, I guess, that I want for the record is simply to state again how, while we appreciate the effort, there is concern about the time it takes to be able to put things in place and the anticipation that, if you go forward with option 4 and find that it isn't providing a response in the appropriate time, that option 3 be pursued in again, a reasonable time line.

It is also abstract, I know, and I'm not trying to ask for absolute deadlines. I just have to emphasize that we don't have options for these folks that are near by the landfill in terms of public water supply. So, the timing of these responses is of strong concern. And we just hope you feel that message and it carries on into your work.

The bottom line, thank you. Please keep doing what you're doing as quickly and efficiently as you possibly can. Thank you.

MS. WHITE: Thank you, Gary. If anyone else would like to make a comment, please again, indicate, again, in the chat feature, I have a comment.

(Pause.)

MS. WHITE: Okay. Seeing no more requests in the chat, I'm going to turn it over to the phone lines. If

anyone would like to make a comment, please un-mute your phone and I will call your number in the order that I see it un-muted.

Again, please state your name and your affiliation if you would like to comment.

(Pause.)

MS. WHITE: No one is indicating that they would like to comment on the phone lines. I'm not seeing any indication on the chat feature that people would like to comment.

So, I'm going to turn the hearing back over to Melissa. Thank you everyone.

MS. TAYLOR: Thank you, Sarah. And thank you to everybody who participated this evening. Remember that the public comment period for making comments closes on August 28th.

And then, as you see here, we have a slide for your information on how to submit comments for any additional written or oral comments you may have. You can send your comments via mail to Hoshaiah Barczynski, US EPA Region 1, 5 Post Office Square, mail code SEMD0701, Boston, Mass, 02109, or to Hoshaiah's direct fax line at 617-918-0336, or e-mail at barczynski.hoshaiah@EPA.gov. Lastly, you can leave an oral comment on EPA's voice mailbox at 617-918-1910.

MS. WHITE: Melissa, I'm sorry to interrupt, but

the fax number I heard you say is different than what is on the screen. 918-0275.

MS. TAYLOR: I'm sorry. You are right. The fax -- oh, you're right. Sorry. Yeah. The fax number 617-918-0275. Apologies for that.

You may stop the recording, Rosa.

If you have not viewed the proposed plan already, you can find it and other information regarding the L&RR Superfund site at www.EPA.gov/Superfund/LRR. Hoshaiah has also prepared a narrated version of the presentation that is also posted on the L&RR website if you didn't catch everything in her presentation tonight.

Again, if you have questions on how to make comments, please contact Hoshaiah or Sarah via e-mail or phone. If you don't feel like jotting own this information, or missed anything on the slide, their contact information is listed on the L&RR website and where to submit comments is listed in the proposed plan.

Thank you for joining us this evening. This concludes the public meeting and hearing. Have a nice night. Thank you.

(Whereupon, the public hearing was concluded at 8:06 p.m.)

CERTIFICATE OF REPORTER AND TRANSCRIBER

This is to certify that the attached proceedings in the Matter of:

RE: PROPOSED REMEDY FOR L&RR SUPERFUND SITE

IN NORTH SMITHFIELD, RHODE ISLAND

Place: Via Skype

Date: August 18, 2020

were held as herein appears, and that this is the true, accurate and complete transcript prepared from the notes and/or recordings taken of the above entitled proceeding.

Maryann Rooney	08/12/20
Reporter	Date
Maryann Rooney	09/22/20
Transcriber	Date

APPENDICES

Appendix A: RIDEM Letter of Concurrence

Appendix B: Tables

Appendix C: Figures

Appendix D: ARARs Tables

Appendix E: Acronyms and Abbreviations

Appendix F: Treatability Study Specific Aims and Performance Goals Memorandum (Remedy Contingency Criteria)

Appendix G Administrative Record Index and Guidance Documents

Appendix A - Rhode Island Department of Environmental Management Letter of Concurrence

RHODE ISLAND
DEPARTMENT OF ENVIRONMENTAL MANAGEMENT
DIVISION OF THE DIRECTOR
235 Promenade Street, Room 425
Providence, Rhode Island 02908

April 12, 2021

Bryan Olson, Director
U.S. EPA Region 1- New England
Office of Site Remediation and Restoration
5 Post Office Square
Suite 100
Boston, MA 02109

RE: Record of Decision for OU2, Landfill and Resource Recovery, Inc. Superfund Site, RI

Dear Mr. Olson,

The Office of Land Revitalization and Sustainable Materials Management has conducted a review of the Record of Decision (ROD), dated February 2021, for the Operable Unit 2 of the Landfill and Resource Recovery, Inc. Superfund Site (OU2) located in North Smithfield, Rhode Island. The selected remedial action the United States Environmental Protection Agency (USEPA) has put forth addresses contaminated groundwater and other environmental media within OU2.

The selected remedy consists of a two-stage reactive treatment zone, institutional controls, and monitoring. This remedy is currently undergoing a treatability study to determine its effectiveness as a remedy at this site. If the results of the treatability study determine this is not an effective remedy, then the contingency remedy of groundwater extraction with ex situ treatment, institutional controls, and monitoring will be implemented.

The Department of Environmental Management (the Department) has worked with your Agency, other federal and municipal agencies, and various stakeholders, from the early investigatory stages up through this current important decision milestone. Based upon this Department's review of this ROD and the results of the remedial investigation activities conducted to date, we offer our concurrence on this decision. This concurrence is based upon all aspects of the aforementioned ROD being implemented during design, construction, and operation of the remedy in a timely manner.

The Department wishes to emphasize the following aspects of the ROD:

- One component of the selected remedy encompasses and innovative approach of a two-stage reactive zone to treat VOCs, 1,4 dioxane and PFAS at the site, with a contingent remedy of traditional groundwater extraction and ex situ treatment. RIDEM will be involved in this evaluation process;

- We agree with the institutional controls to restrict groundwater use at the site and the additional evaluation of the adjacent streams and ponds;

- We agree with the continued monitoring program including the adjacent residents for site related contaminants, including PFAS; and

- It is recognized by the Department that the health and environmental concerns associated with the emerging contaminant PFAS are dynamic. RIDEM encourages the EPA to be cognizant of any changes, including, but not limited to, regulatory changes associated with this group of contaminants in order to ensure that the remedy remains protective of human health and the environment.

The Department also would like to thank you and your staff for coming together and working with us and the stakeholders to make the necessary enhancements to this ROD. We look forward to continued cooperation between our agencies throughout this project and appreciate the opportunity to review and concur with this important ROD.

Sincerely,

Janet Coit Director

cc: Terrence Gray, RIDEM
Leo Hellested, RIDEM
Matthew DeStefano, RIDEM
Paul Kulpa, RIDEM
Kathryn Sarsfield, RIDEM
Hoshaiah Barczynski, USEPA Region I

Appendix B - Tables

Table K-1: Comparative Analysis of Alternatives

Table L-1: Groundwater Cleanup Levels – Residential Potable Water Scenario

Table L-2: Selected Remedy Detailed Cost Estimate

Table L-3: Contingency Remedy Detailed Cost Estimate

Table G-1: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration – Current Resident

Table G-2: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration – Future Resident

Table G-3: Cancer Toxicity Data Summary

Table G-4: Non-Cancer Toxicity Data Summary

Table G-5: Risk Characterization Summary – Carcinogens – Current Resident – Residential Groundwater

Table G-6: Risk Characterization Summary - Non-Carcinogens – Current Resident – Residential Groundwater

Table G-7: Risk Characterization Summary – Carcinogens – Future Resident – Overburden Groundwater

Table G-8: Risk Characterization Summary - Non-Carcinogens – Future Resident – Overburden Groundwater

Table G-9: Risk Characterization Summary – Carcinogens – Future Resident – Bedrock Groundwater

Table G-10: Risk Characterization Summary - Non-Carcinogens – Future Resident – Bedrock Groundwater

Table K-1 – Comparative Analysis of Alternatives

Evaluation Criteria	Alternative 1: No Action	Alternative 2: Limited Action – Institutional Controls and Monitoring	Alternative 3: Groundwater Extraction with *Ex Situ* Treatment and Institutional Controls	Alternative 4: Two-Stage Reactive Treatment Zone and Institutional Controls
Overall Protection of Human Health and the Environment				
Overall Protection of Human Health	Fails	Passes	Passes	Passes
Overall Protection of the Environment	NA[1]	NA(1)	NA(1)	NA[1]
Compliance with ARARs				
Chemical-Specific ARARs	Fails	Fails	Passes	Passes
Location-Specific ARARs	NA	Passes	Passes	Passes
Action-Specific ARARs	NA	Passes	Passes	Passes
Other Criteria, Advisories, and Guidance	Uncertain	Uncertain	Passes	Passes
Long-Term Effectiveness and Permanence				
Long-Term Effectiveness and Permanence	●	●●	●●●	●●●
Reduction of Toxicity, Mobility, or Volume through Treatment				
Reduction of Toxicity, Mobility, or Volume through Treatment	●	●	●●●	●●●
Short-Term Effectiveness				
Short-Term Effectiveness	●	●●	●●	●●
Implementability				
Implementability	●●●	●●●	●●	●●●
Cost				
Capital	$0	$315,000	$7,580,000	$6,250,000
Total NPV	$430,000	$2,300,000	$14,600,000	$11,700,000
Overall Cost Rating	●●●	●●●	●	●●

Notes:

(1) The results of the SLERA and Refinement did not identify unacceptable risks to ecological receptors from exposure to groundwater.

NA – Not applicable

● Low rating in comparison to other alternatives for specified criterion (less favorable outcome for criteria)

●● Mid-range rating in comparison to other alternatives for specified criterion

●●● High rating in comparison to other alternatives for specified criterion (most favorable outcome for criteria

Table L-1: Groundwater Cleanup Levels – Residential Potable Water Scenario

Table L-1: Groundwater Cleanup Levels - Residential Potable Water Scenario			
Carcinogenic Chemical of Concern	Cancer Classification	Site-Wide Cleanup Level	
		µg/L	Basis
1,1-Dichloroethane	C	2.8	ILCR = 10^{-6}
1,2-Dichloroethane	B2	5	MCL
1,2-Dichloropropane	Likely	5	MCL
1,4-Dichlorobenzene	Likely	75	MCL
1,4-Dioxane	Likely	0.46	ILCR = 10^{-6}
Benzene	A	5	MCL
Naphthalene	C	0.17	ILCR = 10^{-6}
Tetrachloroethene	Likely	5	MCL
Trichloroethene	Carcinogenic to humans	5	MCL
Vinyl Chloride	A	2	MCL (1)
bis(2-Ethylhexyl)phthalate	B2	6	MCL
Perfluorooctanoic acid (PFOA)	Suggestive Evidence	0.070	RIDEM-GQR
Arsenic	A	10	MCL (1)
Chromium, Hexavalent	Likely	0.035	ILCR = 10^{-6}
Non-Carcinogenic Chemical of Concern	Target Endpoint	Site-Wide Cleanup Level	
		µg/L	Basis
1,1-Dichloroethane	Kidney	2.8	ILCR = 10^{-6}
1,2-Dichloroethane	Kidney/Nervous System	5	MCL
1,2-Dichloropropane	Developmental/Respiratory	5	MCL
1,4-Dichlorobenzene	Liver	75	MCL
1,4-Dioxane	Kidney/Liver/Nervous System/Respiratory	0.46	ILCR = 10^{-6}
Benzene	Immune System	5	MCL
cis-1,2-Dichloroethene	Kidney	70	MCL
Naphthalene	Whole Body/Nervous System/Respiratory	0.17	ILCR = 10^{-6}
Tetrachloroethene	Nervous System	5	MCL
Trichloroethene	Developmental/Immune System	5	MCL
Vinyl Chloride	Liver	2	MCL
bis(2-Ethylhexyl)phthalate	Liver	6	MCL
Perfluorooctanoic acid (PFOA)	Developmental	0.070	RIDEM-GQR
Perfluorooctane sulfonic acid (PFOS)	Developmental	0.070	RIDEM-GQR
Total PFOA + PFOS	Developmental	0.070	RIDEM-GQR
Antimony	Blood	6	MCL
Arsenic	Skin/Developmental/Cardiovascular/ Nervous System/Respiratory	10	MCL
Chromium, Hexavalent	Respiratory	0.035	ILCR = 10^{-6}
Iron	Gastrointestinal	14000	HQ = 1
Manganese	Nervous System	300	Health Advisory

Key:

(1) The risk associated with the MCLs for arsenic and vinyl chloride fall outside (above) the Superfund risk range; however, EPA has determined that MCLs are protective values for drinking water.

Health Advisory - Health Advisory on Manganese (EPA-822-R-04-003; January 2004)
HI - Hazard Index
MCL – federal Maximum Contaminant Level (The Rhode Island MCLs are equal to the federal MCLs for the applicable Site COCs)
ILCR - Incremental Lifetime Cancer Risk; 10-6 = 1 in 1,000,000
NA - Not available or not applicable
RIDEM-GQR - Groundwater Quality Rules, RIDEM Office of Water Resources (250-RICR-150-05-3, effective 1/09/2019)

Cancer Classification:

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

Table L-2: Selected Remedy Detailed Cost Estimate

Alternative 4: Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring

COST SUMMARY

CAPITAL COSTS		
Construction Activities		
Pre-Design Investigation	$	140,000
Pilot Testing	$	300,000
Two-Stage Reactive Barrier	$	3,462,000
New Well Installation	$	301,000
Institutional Controls	$	65,000
SUBTOTAL - TWO-STAGE TREATMENT ZONE, ICs	$	4,268,000
Contingency (20%)	$	853,600
TOTAL TWO-STAGE TREATMENT ZONE + ICs	$	5,122,000
Professional/ Technical Services		
Project Management	$	256,100
Remedial Design	$	409,800
Construction Management	$	307,400
Health and Safety	$	76,900
Legal	$	50,000
Permitting	$	25,000
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	$	1,126,000
TOTAL CAPITAL COSTS	**$**	**6,250,000**
ANNUAL OPERATION, MAINTENANCE, AND MONITORING COSTS		
Monitoring (Yrs 1-10) SUBTOTAL:	$	175,100
Contingency (20%)	$	35,000
TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)	**$**	**1,476,000**
Monitoring (Yrs 11-30) SUBTOTAL:	$	131,100
Contingency (20%)	$	26,200
TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)	**$**	**848,000**
TOTAL PRESENT VALUE OM&M (PV 7%)	**$**	**2,330,000**
PERIODIC COSTS		
Five Year Site Reviews	$	44,000
Persulfate Reinjections	$	3,044,000
Well Decommissioning	$	16,000
Update LTM Program	$	2,000
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)	**$**	**3,110,000**
TOTAL PRESENT VALUE (7%)	**$**	**11,700,000**
Total Present Value Range (-30 %)	$	8,190,000
Total Present Value Range (+50 %)	$	17,550,000

Table L-2: Selected Remedy Detailed Cost Estimate *(continued)*

CAPITAL COSTS

	QTY	UNIT	UNIT COST	TOTAL	NOTES
Construction Activities					
Pre-Design Investigation					
HPT Investigation	1	LS	$ 73,000	$ 73,000	Cascade Quote - 4 locations to 70 feet
Analytical Costs	16	EA	$ 408	$ 7,000	1,4-dioxane, VOCs, PFAS
Oversight	1	LS	$ 25,000	$ 25,000	
Groundwater Model	1	LS	$ 35,000	$ 35,000	
SUBTOTAL:				**$ 140,000**	
Pilot Testing					
Pilot Study	1	LS	$ 300,000	$ 300,000	
SUBTOTAL:				**$ 300,000**	
Two-Stage Reactive Barrier					
Potassium Persulfate	210,164	lb	$ 1.50	$ 315,300	PeroxyChem quote (scaled to 920 feet, additional ammedments at bedrock interface)
Sodium Persulfate	76,038	lb	$ 1.41	$ 107,300	PeroxyChem quote (scaled to 920 feet)
Pyrite Activator	21,016	lb	$ 1.00	$ 22,000	10% of potassium persulfate
Amendment Shipping	1	LS	$ 5,000	$ 5,000	
DPT Injections	1	LS	$ 371,500	$ 371,500	Cascade Quote (scaled to 920 feet)
ISCO Injections at MW-303 and MW-302	2,160	LF	$ 446	$ 963,900	Calculated cost/ linear foot
Powdered Activated Carbon Injections	1	LS	$ 1,577,200	$ 1,577,200	Regenesis Quote (750 feet, additional ammedments at bedrock interface)
Oversight Labor	40	day	$ 1,500	$ 60,000	40 days of oversight
Wetland Restoration	1	LS	$ 40,000	$ 40,000	Allowance for wetland restoration
SUBTOTAL:				**$ 3,462,000**	
New Well Installation					
Bedrock Drilling and Geophysical Logging	3	EA	$31,600	$ 94,800	previous project costs
Packer Sampling & Analysis	3	EA	$14,700	$ 44,100	previous project costs
Bedrock Monitoring Well/System Installation	3	EA	$16,200	$ 48,600	previous project costs
Overburden Monitoring Well Installation/Development	6	EA	$17,600	$ 105,600	previous project costs
Survey	1	LS	$2,100	$ 2,100	previous project costs
Residuals Management	1	LS	$5,400	$ 5,400	previous project costs
SUBTOTAL:				**$ 301,000**	
Institutional Controls					
Institutional Controls Plan	1	LS	$ 15,000	$ 15,000	
Legal Fees, Deed Restrictions, Property Surveys	2	EA	$ 25,000	$ 50,000	2 properties adj. to landfill (Lots 23 and 24)
SUBTOTAL:				**$ 65,000**	
SUBTOTAL - TWO-STAGE TREATMENT ZONE, ICs				$ 4,268,000	
Contingency			20%	$ 853,600	
TOTAL TWO-STAGE TREATMENT ZONE + ICs				**$ 5,122,000**	
Professional/ Technical Services					
Project Management	5%			$ 256,100	per USACE and USEPA, 2000
Remedial Design	8%			$ 409,800	
Construction Management	6%			$ 307,400	
Health and Safety	1.5%			$ 76,900	
Legal				$ 50,000	Access Agreements
Permitting				$ 25,000	
TOTAL PROFESSIONAL/ TECHNICAL SERVICES				**$ 1,126,000**	
TOTAL - CAPITAL COSTS				**$ 6,250,000**	

Table L-2: Selected Remedy Detailed Cost Estimate *(continued)*

OPERATION, MAINTENANCE, AND MONITORING COSTS

	QTY	UNIT	UNIT COST	TOTAL	NOTES
Performance Monitoring (Years 1-10)					see backup for monitoring program assumptions
PCSM Program	1	LS	$ 13,100	$ 13,100	
LTM Program	1	LS	$ 36,000	$ 36,000	
Performance Monitoring	2	LS	$ 44,000	$ 88,000	2 events/year
Residential Monitoring	1	LS	$ 23,000	$ 23,000	
Reporting	1	LS	$ 15,000	$ 15,000	
SUBTOTAL:				$ 175,100	
Performance Monitoring (Years 11-30)					see backup for monitoring program assumptions
PCSM Program	1	LS	$ 13,100	$ 13,100	
LTM Program	1	LS	$ 36,000	$ 36,000	
Performance Monitoring	1	LS	$ 44,000	$ 44,000	1 event/year
Residential Monitoring	1	LS	$ 23,000	$ 23,000	
Reporting	1	LS	$ 15,000	$ 15,000	
SUBTOTAL:				$ 131,100	
Monitoring (Yrs 1-10) SUBTOTAL:				$ 175,100	
Contingency (20%)				$ 35,000	
Monitoring (Yrs 1-10) TOTAL:				$ 210,100	
Monitoring (Yrs 11-30) SUBTOTAL:				$ 131,100	
Contingency (20%)				$ 26,200	
Monitoring (Yrs 10-20) TOTAL:				$ 157,300	
TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)				**$ 1,476,000**	
TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)				**$ 848,000**	
TOTAL PRESENT VALUE OM&M (PV 7%)				**$ 2,330,000**	

Table L-2: Selected Remedy Detailed Cost Estimate *(continued)*

PERIODIC COSTS

	YEAR	QTY	UNIT	UNIT COST	TOTAL	PRESENT VALUE (7%)	NOTES
Persulfate Reinjections							
Potassium Persulfate	3,6,9,14,19,25	6	LS	$ 315,300	$ 1,892,000	$ 907,000	PeroxyChem quote
Sodium Persulfate	3,6,9,14,19,25	6	LS	$ 107,300	$ 644,000	$ 309,000	PeroxyChem quote
Pyrite Activator	3,6,9,14,19,25	6	LS	$ 22,000	$ 132,000	$ 64,000	10% of potassium persulfate
Amendment Shipping	3,6,9,14,19,25	6	LS	$ 5,000	$ 30,000	$ 15,000	
DPT Injections	3,6,9,14,19,25	6	LS	$ 371,500	$ 2,229,000	$ 1,069,000	Cascade Quote
Oversight Labor	3,6,9,14,19,25	6	LS	$ 60,000	$ 360,000	$ 173,000	40 days of oversight
Contingency	3,6,9,14,19,25	6	%	$ 176,220	$ 1,057,400	$ 507,000	20% contingency
Five Year Site Reviews	5, 10, 15, 20, 25,30	6	LS	$ 20,000	$ 120,000	$ 44,000	
Well Decommissioning	30	1	LS	$ 120,000	$ 120,000	$ 16,000	
Update LTM Program	30	1	LS	$ 15,000	$ 15,000	$ 2,000	
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)					**$6,599,400**	**$3,110,000**	

Table L-3: Contingency Remedy Detailed Cost Estimate

Alternative 3: Groundwater Extraction with Ex Situ Treatment, Institutional Controls, and Monitoring

COST SUMMARY

CAPITAL COSTS		
Equipment Procurement	$	1,422,400
Construction Activities		
Pre-Design Investigation	$	125,000
Bench and Pilot Testing	$	370,000
Site Civil/Structural	$	645,500
Mechanical	$	747,200
Electrical/I&C	$	897,000
Start Up and Commissioning	$	59,000
Indirects and O&P	$	618,300
New Monitoring Well Installation	$	228,000
Institutional Controls	$	65,000
SUBTOTAL - GROUNDWATER EXTRACTION AND TREATMENT, ICs	$	5,177,400
Contingency (20%)	$	1,035,500
TOTAL GROUNDWATER EXTRACTION AND TREATMENT + ICs	**$**	**6,213,000**
Professional/Technical Services		
Project Management	$	310,700
Remedial Design	$	497,100
Construction Management	$	372,800
Health and Safety	$	93,200
Permitting/Legal	$	93,200
TOTAL PROFESSIONAL/ TECHNICAL SERVICES	**$**	**1,367,000**
TOTAL CAPITAL COSTS	**$**	**7,580,000**
ANNUAL OPERATION, MAINTENANCE, AND MONITORING COSTS		
Performance Monitoring (Years 1-10)	$	224,100
Contingency (20%)	$	44,800
TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)	**$**	**1,888,700**
Performance Monitoring (Years 11-30)	$	156,100
Contingency (20%)	$	31,200
TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)	**$**	**1,008,700**
Groundwater Treatment - Operations and Maintenance	$	253,000
Contingency (20%)	$	50,600
TOTAL PV - GWTP O&M COSTS (30 Years, Year 1 through 30)	**$**	**3,767,400**
General Site Maintenance	$	13,500
Contingency (20%)	$	2,700
TOTAL PV - SITE MAINTENANCE COSTS (30 Years, Year 1 through 30)	**$**	**201,100**
TOTAL PRESENT VALUE OM&M (7%)	**$**	**6,870,000**
PERIODIC COSTS		
Five Year Site Reviews	$	44,000
Groundwater Performance and Optimization Study	$	23,000
Demobilization of On-site Treatment System	$	33,000
Well Decommissioning	$	16,000
Update Institutional Controls Plan	$	2,000
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)	**$**	**118,000**
TOTAL PRESENT VALUE (7% OM&M, 30 Years)	**$**	**14,600,000**
Total Present Value Range (-30 %)	$	10,220,000
Total Present Value Range (+50 %)	$	21,900,000

Table L-3: Contingency Remedy Detailed Cost Estimate *(continued)*

CAPITAL COSTS

	QTY	UNIT	UNIT COST	TOTAL	NOTES
Equipment Procurement					
Extraction Well Pumps	4	EACH	$ 2,296	$ 9,184	Grundfos 25S05 quote
Equalization Tank (5,000 gal HDPE Tank)	1	EACH	$ 15,000	$ 15,000	HDPE Tank quotes
Equalization Pumps (90 gpm, centrifugal pumps)	2	EACH	$ 6,500	$ 13,000	
Aeration Blowers (20 scfm)	2	EACH	$ 5,000	$ 10,000	
Reaction Tank (1500 gal, HDPE Tank)	2	EACH	$ 5,300	$ 10,600	HDPE Tank quotes
Reaction Tank Mixer	2	EACH	$ 5,660	$ 11,320	2 HP Mixer Quote
Metals Removal (Inclined Plate Clarifier)	1	EACH	$ 81,100	$ 81,100	Vendor Quote - Parkson
Metals Removal (Continuous Backwash Sand Filter)	1	EACH	$ 132,000	$ 132,000	Vendor Quote - Dynasand
Extraction Well Pumps	1	EACH	$ 5,300	$ 5,300	HDPE Tank quotes
Neutralization Tank Mixer	1	EACH	$ 5,660	$ 5,660	2 HP Mixer Quote
Transfer Tank (3000 gal, HDPE Tank)	1	EACH	$ 7,500	$ 7,500	HDPE Tank quotes
Transfer Pumps (90 gpm, centrifugal pumps)	2	EACH	$ 6,500	$ 13,000	
Advanced Oxidation Process (Hydrogen Peroxide/UV)	1	LS	$ 650,000	$ 650,000	Vendor Quote - Trojan
PFAS Treatment System (Two LGAC Adsorbers)	1	LS	$ 102,000	$ 102,000	Vendor Quote - Evoqua
Effluent Tank (10,000 gal FRP Tank)	1	EACH	$ 46,450	$ 46,450	Vendor Quote - ECS
Effluent Pumps (90 gpm, centrifugal pumps)	2	EACH	$ 6,500	$ 13,000	
Backwash Pumps (400 gpm, centrifugal pumps)	2	EACH	$ 10,000	$ 20,000	
Sludge Holding Tank (10,000 gal, FRP Tank)	1	EACH	$ 46,450	$ 46,450	Vendor Quote - ECS
Filter Press Feed Pumps	2	EACH	$ 5,985	$ 11,970	Vendor Quote - Micronics
Filter Press	1	LS	$ 63,785	$ 63,785	Vendor Quote - Micronics, 20 cubic foot press with 800mm x 800mm plates
Air Compressor	1	EACH	$ 15,000	$ 15,000	
Chemical Feed Tanks (500 gal, HDPE Tanks with HPDE Containment Basin)	3	EACH	$ 8,000	$ 24,000	Caustic, Acid, and Hydrogen Peroxide (other chemicals supplied in totes)
Duplex Chemical Feed Systems	6	EACH	$ 17,000	$ 102,000	Caustic, Acid, Ferric Chloride, Polymer, Hydrogen Peroxide, and Sodium Bisulfite
Building Sump Pumps (Submersible)	2	EACH	$ 7,000	$ 14,000	
SUBTOTAL EQUIPMENT PROCUREMENT COST				**$ 1,422,400**	
Construction Activities					
Pre-Design Investigation					
HPT Investigation	1	LS	$ 73,000	$ 73,000	Cascade Quote - 4 locations to 70 feet
Analytical Costs	16	EA	$ 408	$ 7,000	1,4-dioxane, VOCs, PFAS
Oversight	1	LS	$ 10,000	$ 10,000	
Groundwater Model	1	LS	$ 35,000	$ 35,000	
SUBTOTAL:				**$ 125,000**	
Bench and Pilot Testing					
Treatability Testing	1	LS	$ 20,000	$ 20,000	
Pump Test	1	LS	$ 150,000	$ 150,000	
Pilot Study	1	LS	$ 200,000	$ 200,000	
SUBTOTAL:				**$ 370,000**	
Site Civil/Structural					
Mob/ Demobe	1	EACH	$ 5,000	$ 5,000	Allowance
Extraction Wells - Install and Develop	4	EACH	$ 30,000	$ 120,000	>6" Diameter PVC with SS Screens drilled via sonic
Infiltration Gallery - Site work and fencing	1	LS	$ 50,000	$ 50,000	
Excavation - Trenching	2400	CY	$ 4.68	$ 11,232	RS Means 31 23 16-13
Excavation - for new building	626	CY	$ 17	$ 10,852	RS Means 31 23 16-16
Backfill & Compaction	3026	CY	$ 23	$ 69,705	RS Means 31 23 23-13-1900 and 31 23 23-13 0300
Underground Piping (Extraction Lines)	7600	LF	$ 2.35	$ 17,863	RS Means 22 11 13-78
Underground Piping (Injection Line)	1900	LF	$ 3.58	$ 6,797	RS Means 22 11 13-78
Underground Piping (Allowance for Utilities)	1	LS	$ 10,000	$ 10,000	
Grading	2000	SF	$ 4.21	$ 8,420	RS Means 31 22 16-10; Finish grading around new building
Paving	1200	SF	$ 5.38	$ 6,452	RS Means 32 12 16-14; Paving parking area adjacent to new building
Reinforced Concrete (in place; equipment pads)	67	CY	$ 195	$ 12,991	RS Means 03 31 13-70
Forms for equipment pads	1800	SF	$ 25	$ 45,059	RS Means 03 11 13-40
Reinforced Concrete (in place; building slab)	133	CY	$ 195	$ 25,982	RS Means 03 31 13-70 1550 and 03 31 13-35 0520
Structural Steel	10	TON	$ 3,500	$ 35,000	Allowance for access platforms, pipe rack
Miscellaneous Metals	1	LS	$ 15,000	$ 15,000	Allowance
Pre-Engineered Bldg.	3600	SF	$ 37	$ 134,964	RS Means 13 34 19-50
Overhead Door	2	EACH	$ 5,071	$ 10,142	RS Means 08 33 23-10
Final Clean-up / Housekeeping	1	LS	$ 10,000	$ 10,000	Allowance to clean-up site
Wetland Restoration	1	LS	$ 40,000	$ 40,000	Allowance for wetland restoration
SUBTOTAL:				**$ 645,500**	

Table L-3: Contingency Remedy Detailed Cost Estimate *(continued)*

CAPITAL COSTS *(CONTINUED)*

	QTY	UNIT	UNIT COST	TOTAL	NOTES
Mechanical					
Process Piping and Valve Allowance for Materials and Installation	25%			$ 355,600	percent of equipment costs
Bldg. HVAC	3600	SF	$ 20	$ 72,000	
Bldg. Plumbing	3600	SF	$ 24	$ 86,400	
Fire protection	3600	SF	$ 6	$ 19,800	
Equipment installation	15%			$ 213,360	percent of equipment costs
SUBTOTAL:				**$ 747,200**	
Electrical/I&C					
New Electrical Service	1	LS	$ 30,000	$ 30,000	allowance based on similar projects
Motor Control Center (MCC)	1	EA	$ 75,000	$ 75,000	allowance based on similar projects
Emergency Generator	1	EA	$ 40,000	$ 40,000	allowance based on similar projects
Transformer	1	EA	$ 15,000	$ 15,000	allowance based on similar projects
Interior Facility Lighting	1	EA	$ 20,000	$ 20,000	allowance based on similar projects
Yard Lighting	1	EA	$ 7,500	$ 7,500	allowance based on similar projects
Grounding / Lightning Protection	1	EA	$ 12,500	$ 12,500	allowance based on similar projects
Building Power	1	EA	$ 15,000	$ 15,000	allowance based on similar projects
Main Control Panel	1	EA	$ 60,000	$ 60,000	allowance based on similar projects
Extraction Well Control Panel	2	EA	$ 20,000	$ 40,000	allowance based on similar projects
Control Systems Integration	1	EA	$ 125,000	$ 125,000	allowance based on similar projects
SCADA System Hardware/Software	1	EA	$ 70,000	$ 70,000	allowance based on similar projects
Instruments (analog - FIT)	10	EA	$ 4,000	$ 40,000	allowance based on similar projects
Instruments (analog - LIT, pH, Temp, PIT, FIT)	25	EA	$ 1,500	$ 37,500	allowance based on similar projects
Instruments (digital switches - LS, XS, SS, PS)	14	EA	$ 500	$ 7,000	allowance based on similar projects
Instruments (control valves)	15	EA	$ 3,500	$ 52,500	allowance based on similar projects
Instruments (non I/O, PI, TI)	25	EA	$ 700	$ 17,500	allowance based on similar projects
Instrumentation Installation	89	EA	$ 2,500	$ 222,500	Wiring, calibration, and loop check
Miscellaneous	1	LS	$ 10,000	$ 10,000	Allowance for fire alarm system, security alarm system, communications
SUBTOTAL:				**$ 897,000**	
Start Up and Commissioning					
Hydrostatic pressure testing of piping	1	LS	$ 25,000	$ 25,000	
Commisioning	1	LS	$ 9,000	$ 9,000	assumes 1 week
Start up	1	LS	$ 24,400	$ 24,400	assumes 3 days/week for first month, 1 day/week for months 2 and 3, and start up analytical
SUBTOTAL:				**$ 59,000**	
Indirects and O&P					
Indirect Project Costs	10%			$ 229,000	% of civil, mechanical, and electrical
Contractors Overhead	10%			$ 229,000	% of civil, mechanical, and electrical
Contractors Profit	7%			$ 160,300	% of civil, mechanical, and electrical
SUBTOTAL:				**$ 618,300**	
New Monitoring Well Installation					
Bedrock Drilling and Geophysical Logging	3	EA	$ 31,600	$ 94,800	previous project costs
Packer Sampling & Analysis	3	EA	$ 14,700	$ 44,100	previous project costs
Bedrock Monitoring Well/System Installation	3	EA	$ 16,200	$ 48,600	previous project costs
Overburden Monitoring Well Installation & Development	4	EA	$ 8,800	$ 35,200	previous project costs
Survey	1	LS	$ 2,100	$ 2,100	previous project costs
Residuals Management	1	LS	$ 2,700	$ 2,700	previous project costs
SUBTOTAL:				**$ 228,000**	
Institutional Controls					
Institutional Controls Plan	1	LS	$ 15,000	$ 15,000	
Legal Fees, Deed Restrictions, Property Surveys	2	EA	$ 25,000	$ 50,000	2 properties adj. to landfill (Lots 23 and 24)
SUBTOTAL:				**$ 65,000**	
SUBTOTAL CONSTRUCTION COST				**$ 3,755,000**	
SUBTOTAL - GROUNDWATER EXTRACTION AND TREATMENT, ICs				$ 5,177,400	
Contingency			20%	$ 1,035,500	
TOTAL GROUNDWATER EXTRACTION AND TREATMENT + ICs				**$ 6,213,000**	
Professional/ Technical Services					
Project Management	5%			$ 310,700	
Remedial Design	8%			$ 497,100	
Construction Management	6%			$ 372,800	
Health and Safety	1.5%			$ 93,200	
Permitting/Legal	1.5%			$ 93,200	
TOTAL PROFESSIONAL/ TECHNICAL SERVICES				**$ 1,367,000**	
TOTAL - CAPITAL COSTS				**$ 7,580,000**	

Table L-3: Contingency Remedy Detailed Cost Estimate *(continued)*

OPERATION, MAINTENANCE, AND MONITORING COSTS

	QTY	UNIT	UNIT COST	TOTAL	NOTES
Performance Monitoring (Years 1-10)					see backup for monitoring program assumptions
PCSM Program	1	LS	$ 13,100	$ 13,100	
LTM Program	1	LS	$ 37,000	$ 37,000	includes data validation and management
Performance Monitoring	2	LS	$ 43,000	$ 86,000	2 events per year
Residential Monitoring	1	LS	$ 23,000	$ 23,000	includes data validation and management
System Influent and Effluent Monitoring	1	LS	$ 50,000	$ 50,000	monthly monitoring
Reporting	1	LS	$ 15,000	$ 15,000	
SUBTOTAL:				**$ 224,100**	
Performance Monitoring (Years 11-30)					see backup for monitoring program assumptions
PCSM Program	1	LS	$ 13,100	$ 13,100	
LTM Program	1	LS	$ 37,000	$ 37,000	includes data validation and management
Performance Monitoring	1	LS	$ 43,000	$ 43,000	annual
Residential Monitoring	1	LS	$ 23,000	$ 23,000	includes data validation and management
System Influent and Effluent Monitoring	1	LS	$ 25,000	$ 25,000	monthly monitoring
Reporting	1	LS	$ 15,000	$ 15,000	
SUBTOTAL:				**$ 156,100**	
Groundwater Treatment - Operations and Maintenance					
Operations Labor	624	mh	$ 85	$ 53,040	operator for 12 hours per week
Equipment Repair/Replacement	1	LS	$ 24,000	$ 24,000	allowance, includes replacing the UV lamps every 5 years
Power	621,332	kWh	$ 0.11	$ 68,347	
Utilities	1	LS	$ 10,000	$ 10,000	allowance for plant water, sewer etc.
Chemicals	1	LS	$ 17,000	$ 17,000	allowance for caustic, acid, ferric chloride, polymer, and bisulfite
Hydrogen Peroxide	1265	gal	$ 4.10	$ 5,186	based on peroxide dose of 10 ppm
Liquid Phase Carbon Changeouts	12,000	lb	$ 2.50	$ 30,000	assume each carbon vessel is changed out once per year
Sludge Disposal	173	CY	$ 200	$ 34,667	30% dry filter cake to landfill
Laboratory Costs	1	LS	$ 10,000	$ 10,000	analytical costs + lab supplies allowance
SUBTOTAL:				**$ 253,000**	
General Site Maintenance					
Misc. Site Work	1	LS	$ 10,000	$ 10,000	includes RIB maintenance
Snow plowing events	10	EA	$ 350	$ 3,500	
SUBTOTAL:				**$ 13,500**	
Monitoring (Yrs 1-10) SUBTOTAL:				$ 224,100	
Contingency (20%)				$ 44,800	
Monitoring (Yrs 1-10) TOTAL:				**$ 268,900**	
Monitoring (Yrs 11-30) SUBTOTAL:				$ 156,100	
Contingency (20%)				$ 31,200	
Monitoring (Yrs 10-20) TOTAL:				**$ 187,300**	
Groundwater Treatment O&M SUBTOTAL:				$ 253,000	
Contingency (20%)				$ 50,600	
GWTP O&M TOTAL:				**$ 303,600**	
General Site Maintenance SUBTOTAL:				$ 13,500	
Contingency (20%)				$ 2,700	
Site Maintenance TOTAL:				**$ 16,200**	
TOTAL PRESENT VALUE - MONITORING COSTS (10 Years, Years 1-10)				**$ 1,888,700**	
TOTAL PRESENT VALUE - MONITORING COSTS (20 Years, Years 11-30)				**$ 1,008,700**	
TOTAL PV - GWTP O&M COSTS (30 Years, Year 1 through 30)				**$ 3,767,400**	
TOTAL PV - SITE MAINTENANCE COSTS (30 Years, Year 1 through 30)				**$ 201,100**	
TOTAL PRESENT VALUE OM&M (7%)				**$ 6,870,000**	

Table L-3: Contingency Remedy Detailed Cost Estimate *(continued)*

PERIODIC COSTS

	YEAR	QTY	UNIT	UNIT COST	TOTAL	PRESENT VALUE (7%)	NOTES
Five Year Site Reviews	5, 10, 15, 20, 25,30	6	LS	$ 20,000	$ 120,000	$ 44,000	
Groundwater Performance and Optimization Study	10 and 20	2	LS	$ 30,000	$ 60,000	$ 23,000	
Demobilization of On-site Treatment System	30	1	LS	$ 250,000	$ 250,000	$ 33,000	
Well Decommissioning	30	1	LS	$ 120,000	$ 120,000	$ 16,000	
Update Institutional Controls Plan	30	1	LS	$ 15,000	$ 15,000	$ 2,000	
TOTAL PRESENT VALUE PERIODIC COSTS (PV 7%)					**$565,000**	**$118,000**	

Table G-1: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration – Current Resident

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration								
Scenario Timeframe: Current Medium: Groundwater Exposure Medium: Residential Groundwater								
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Units	Statistical Measure (1)
		Minimum	Maximum					
1309 Pound Hill	Naphthalene	8.7E-01	8.7E-01	µg/L	1 / 84	8.7E-01	µg/L	Max
1431 Pound Hill	Chloroform	5.6E-01	6.3E+00	µg/L	7 / 84	3.7E+00	µg/L	95% UCL

Key:

(1) Statistics: Maximum Detected Value (Max); 95% UCL (95% UCL); Arithmetic Mean (Mean)

ug/L - microgram per liter

The table represents the current/future chemical of concern (COC) and exposure point concentration (EPC) for the COCs detected in residential groundwater wells (i.e., the concentration that will be used to estimate the exposure and risk for the COC in surface water). The table includes the range of concentrations detected for the COCs, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected at the site), the EPC, and how the EPC was derived. This table indicates that naphthalene is the only COC in the 1309 Pound Hill residential well and chloroform is the only COC in the 1431 Pound Hill residential well. The 95% UCL on the arithmetic mean was used as the EPC for chloroform, while the maximum detected concentration was used as the EPC for naphthalene. Note that the minimum and maximum detections and frequency of detection was determined for all residential wells sampled, while the EPC was calculated specific to the individual residential well

Table G-2: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration – Future Resident

Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration								
Scenario Timeframe: Future Medium: Groundwater Exposure Medium: Groundwater								
Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Unit	Statistical Measure (1)
		Minimum	Maximum					
Overburden Groundwater	1,1-Dichloroethane	8.4E-01	1.0E+01	µg/L	22 / 99	3.4E+00	µg/L	95% UCL
	1,2-Dichloroethane	2.5E-01	2.6E-01	µg/L	2 / 99	2.6E-01	µg/L	Max
	1,2-Dichloropropane	9.3E-01	1.1E+00	µg/L	2 / 99	1.1E+00	µg/L	Max
	1,4-Dichlorobenzene	4.5E-01	5.6E+00	µg/L	26 / 98	1.7E+00	µg/L	95% UCL
	1,4-Dioxane	3.3E-01	4.8E+02	µg/L	50 / 99	9.7E+01	µg/L	95% UCL
	Benzene	3.8E-01	2.3E+00	µg/L	29 / 99	7.2E-01	µg/L	95% UCL
	cis-1,2-Dichloroethene [3]	5.1E-01	7.2E+01	µg/L	15 / 99	1.1E+01	µg/L	95% UCL
	Naphthalene	2.4E-01	2.1E+01	µg/L	5 / 97	1.3E+00	µg/L	95% UCL
	Trichloroethene	2.3E-01	2.6E+00	µg/L	16 / 99	6.0E-01	µg/L	95% UCL
	Vinyl chloride	2.0E-01	1.0E+01	µg/L	16 / 99	1.8E+00	µg/L	95% UCL
	bis(2-Ethylhexyl)phthalate [3]	6.5E-01	1.2E+01	µg/L	3 / 15	3.0E+00	µg/L	95% UCL
	Perfluorooctanoic acid (PFOA) [3]	1.9E-03	3.1E-01	µg/L	27 / 33	1.1E-01	µg/L	95% UCL
	Perfluorooctane sulfonic acid (PFOS) [3,4]	1.9E-03	1.0E-02	µg/L	15 / 33	N/A	N/A	N/A
	Antimony [3]	1.1E+01	1.1E+01	µg/L	1 / 58	1.1E+01	µg/L	Max
	Arsenic	2.5E-01	2.0E+03	µg/L	51 / 95	1.6E+02	µg/L	95% UCL
	Chromium, Hexavalent [2]	5.9E-01	2.0E+01	µg/L	28 / 58	4.7E+00	µg/L	95% UCL
	Iron	6.5E+00	1.8E+05	µg/L	35 / 38	3.7E+04	µg/L	95% UCL
	Manganese	2.0E+00	9.1E+03	µg/L	27 / 38	3.5E+03	µg/L	95% UCL

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Table G-2: Summary of Chemical of Concern and Medium-Specific Exposure Point Concentration – Future Resident *(continued)*

Exposure Point	Chemical of Concern	Concentration Detected		Units	Frequency of Detection	Exposure Point Concentration	Exposure Point Concentration Unit	Statistical Measure (1)
		Minimum	Maximum					
Bedrock Groundwater	1,1-Dichloroethane	9.5E-01	8.4E+00	µg/L	18 / 40	3.8E+00	µg/L	95% UCL
	1,2-Dichloroethane	5.3E-01	1.4E+00	µg/L	5 / 40	6.7E-01	µg/L	95% UCL
	1,4-Dioxane	4.1E+00	7.3E+01	µg/L	18 / 40	4.4E+01	µg/L	95% UCL
	Benzene	2.3E-01	5.5E-01	µg/L	9 / 40	3.0E-01	µg/L	95% UCL
	Tetrachloroethene	5.4E-01	8.6E+00	µg/L	4 / 40	1.5E+00	µg/L	95% UCL
	Trichloroethene	2.6E-01	4.9E+00	µg/L	6 / 40	1.2E+00	µg/L	95% UCL
	Vinyl chloride	2.1E-01	1.6E+00	µg/L	5 / 40	4.8E-01	µg/L	95% UCL
	Perfluorooctanoic acid (PFOA) [3]	2.0E-03	1.1E-01	µg/L	10 / 17	5.7E-02	µg/L	95% UCL
	Perfluorooctane sulfonic acid (PFOS) [3,4]	2.6E-03	9.5E-03	µg/L	6 / 17	N/A	N/A	N/A
	Arsenic	6.1E-01	1.1E+02	µg/L	28 / 40	2.5E+01	µg/L	95% UCL
	Chromium, Hexavalent [2]	7.0E-01	1.2E+01	µg/L	24 / 40	2.4E+00	µg/L	95% UCL

Key:

(1) Statistics: Maximum Detected Value (Max); 95% UCL (95% UCL); Arithmetic Mean (Mean)
Multiple results from each on-site monitoring well were treated as discrete samples.

(2) Samples were analyzed for total chromium. As no speciation has yet been performed, all chromium results were assumed to consist of 100% hexavalent chromium

(3) Though not determined to show an actionable risk in the baseline HHRA, this analyte was identified as a potential future risk due to ARAR exceedances

(4) PFOS did not exceed a screening level to become a COPC (and therefore did not have an EPC calculated). However, the ARAR criteria is for a combined sum of PFOA and PFOS. Therefore, PFOS has been included in this table for completeness

ug/L - microgram per liter

N/A - Not Applicable

COPC - Chemical of Potential Concern

The table represents the future chemicals of concern (COCs) and exposure point concentrations (EPCs) for each of the COCs detected in overburden and bedrock groundwater (i.e., the concentrations that will be used to estimate the exposure and risk for each COC in overburden and bedrock groundwater). The table includes the range of concentrations detected for each COC, as well as the frequency of detection (i.e., the number of times the chemical was detected in the samples collected), the EPC, and how the EPC was derived. This table indicates that the inorganic chemicals, arsenic, iron, manganese, and hexavalent chromium, and the organic chemicals, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,4-dioxane, PFOA, and benzene are the most frequently detected COCs in overburden and bedrock groundwater. The 95% UCL concentration, identified assuming multiple results from each monitoring well were treated as discrete samples, was used as the EPC for each of the COCs detected in groundwater, except for 1,2-dichloroethane, 1,2-dichloropropane, and antimony in overburden groundwater, for which the maximum detected concentration was used. Note that the minimum and maximum detections and frequency of detection was determined for all overburden/bedrock results, while the EPC was calculated on a subset of wells within the core of the plume

Table G-3: Cancer Toxicity Data Summary

Cancer Toxicity Data Summary						
Pathway: Ingestion, Dermal						
Chemical of Concern	Oral Cancer Slope Factor	Dermal Cancer Slope Factor	Slope Factor Units	Weight of Evidence/Cancer Guideline Description	Source	Date (1) (MM/DD/YYYY)
1,1-Dichloroethane	5.7E-03	5.7E-03	$(mg/kg\text{-}day)^{-1}$	C	CalEPA	12/13/19
1,2-Dichloroethane	9.1E-02	9.1E-02	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/13/19
1,2-Dichloropropane	3.7E-02	3.7E-02	$(mg/kg\text{-}day)^{-1}$	Likely	PPRTV	12/13/19
1,4-Dichlorobenzene	5.4E-03	5.4E-03	$(mg/kg\text{-}day)^{-1}$	Likely	CalEPA	12/13/19
1,4-Dioxane	1.0E-01	1.0E-01	$(mg/kg\text{-}day)^{-1}$	Likely	IRIS	12/13/19
Benzene	5.5E-02	5.5E-02	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Chloroform	3.1E-02	3.1E-02	$(mg/kg\text{-}day)^{-1}$	Likely	CalEPA	12/13/19
Naphthalene	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	C	IRIS	12/13/19
Tetrachloroethene	2.1E-03	2.1E-03	$(mg/kg\text{-}day)^{-1}$	Likely	IRIS	12/13/19
Trichloroethene	4.6E-02	4.6E-02	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	12/13/19
Vinyl chloride	7.2E-01	7.2E-01	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Arsenic	1.5E+00	1.5E+00	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Chromium, Hexavalent	5.0E-01	2.0E+01	$(mg/kg\text{-}day)^{-1}$	Likely	CalEPA	12/13/19
Iron	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	Inadequate Evidence	N/A	12/13/19
Manganese	N/A	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/13/19

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Table G-3: Cancer Toxicity Data Summary *(continued)*

Pathway: Inhalation							
Chemical of Concern	Unit Risk	Units	Inhalation Cancer Slope Factor	Units	Weight of Evidence/Cancer Guideline Description	Source	Date (1) (MM/DD/YYYY)
1,1-Dichloroethane	1.6E-06	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	C	CalEPA	12/13/19
1,2-Dichloroethane	2.6E-05	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS	12/13/19
1,2-Dichloropropane	3.7E-06	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Likely	PPRTV	12/13/19
1,4-Dichlorobenzene	1.1E-05	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Likely	CalEPA	12/13/19
1,4-Dioxane	5.0E-06	$(\mu g/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Likely	IRIS	12/13/19
Benzene	7.8E-06	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Chloroform	2.3E-05	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	B2	IRIS: CalEPA	12/13/19
Naphthalene	3.4E-05	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	C	CalEPA	12/13/19
Tetrachloroethene	2.6E-07	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Likely	IRIS	12/13/19
Trichloroethene	4.1E-06	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Carcinogenic to humans	IRIS	12/13/19
Vinyl chloride	4.4E-06	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Arsenic	4.3E-03	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	A	IRIS	12/13/19
Chromium, Hexavalent	8.4E-02	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Likely	IRIS	12/13/19
Iron	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	Inadequate Evidence	N/A	12/13/19
Manganese	N/A	$(ug/m^3)^{-1}$	N/A	$(mg/kg\text{-}day)^{-1}$	D	IRIS	12/13/19

Key:

(1) Date indicates when source was last reviewed.

(2) The slope factor presented for trichloroethene is the adult-based value. For early-life exposures, tumor-specific slope factor values of 9.3E-03 (mg/kg-day)-1 for kidney tumors and 3.7E-02 (mg/kg-day)-1 for combined liver tumors and non-Hodgkins lymphoma (NHL) are used in conjunction with age-dependent adjustment factors, as appropriate.

The unit risk presented for trichloroethene is the adult-based value. For early-life exposures, tumor-specific unit risk values of 1E-06 (µg/m3)-1 for kidney tumors and 3.1E-06 (µg/m3)-1 for combined liver tumors and non-Hodgkins lymphoma (NHL) are used in conjunction with age-dependent adjustment factors, as appropriate.

Age-dependent adjustment factors are used in conjunction with toxicity values, as appropriate, for hexavalent chromium, trichloroethene, and vinyl chloride.

N/A - No information available

IRIS - Integrated Risk Information System, U.S. EPA

PPRTV - Provisional Peer Reviewed Toxicity Value developed by STSC

NJDEP - New Jersey Department of Environmental Protection

CalEPA - California Environmental Protection Agency, Office of Environmental Health Hazard Assessment

Cancer Classification:

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

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Table G-3: Cancer Toxicity Data Summary *(continued)*

This table provides the carcinogenic risk information which is relevant to the contaminants of concern in groundwater. At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in this assessment have been extrapolated from oral values. An adjustment factor is sometimes applied, and is dependent upon how well the chemical is absorbed via the oral route. Adjustments are particularly important for chemicals with less than 50% absorption via the ingestion route. However, adjustment is not necessary for the chemicals evaluated at this site, except for hexavalent chromium which has an adjustment factor of 0.025. For the remaining chemicals, the same oral slope factors as presented above were used as the dermal carcinogenic slope factors for these contaminants. Thirteen of the COCs considered carcinogenic via the inhalation route were determined to be primary risk drivers for at least one exposure pathway evaluated at the site.

Table G-4: Non-Cancer Toxicity Data Summary

Non-Cancer Toxicity Data Summary									
Pathway: Ingestion, Dermal									
Chemical of Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Dermal RfD	Dermal RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfD: Target Organ	Dates of RfD: Target Organ(1) (MM/DD/YYYY)
1,1-Dichloroethane	Chronic	2.0E-01	mg/kg-day	2.0E-01	mg/kg-day	Kidney	3000	PPRTV	12/13/19
1,2-Dichloroethane	Chronic	6.0E-03	mg/kg-day	6.0E-03	mg/kg-day	Kidney	10000	PPRTV	12/13/19
1,2-Dichloropropane	Chronic	4.0E-02	mg/kg-day	4.0E-02	mg/kg-day	Developmental	30	PPRTV	12/13/19
1,4-Dichlorobenzene	Chronic	7.0E-02	mg/kg-day	7.0E-02	mg/kg-day	Liver	100	ATSDR	12/13/19
1,4-Dioxane	Chronic	3.0E-02	mg/kg-day	3.0E-02	mg/kg-day	Kidney/Liver	300	IRIS	12/13/19
Benzene	Chronic	4.0E-03	mg/kg-day	4.0E-03	mg/kg-day	Immune System	300	IRIS	12/13/19
Chloroform	Chronic	1.0E-02	mg/kg-day	1.0E-02	mg/kg-day	Liver	1000 / 1	IRIS	12/13/19
Naphthalene	Chronic	2.0E-02	mg/kg-day	2.0E-02	mg/kg-day	Whole Body	3000	IRIS	12/13/19
Tetrachloroethene	Chronic	6.0E-03	mg/kg-day	6.0E-03	mg/kg-day	Nervous System	1000	IRIS	12/13/19
Trichloroethene	Chronic	5.0E-04	mg/kg-day	5.0E-04	mg/kg-day	Developmental/ Immune System	10 to 1000	IRIS	12/13/19
Vinyl chloride	Chronic	3.0E-03	mg/kg-day	3.0E-03	mg/kg-day	Liver	30	IRIS	12/13/19
Arsenic	Chronic	3.0E-04	mg/kg-day	3.0E-04	mg/kg-day	Cardiovascular/ Skin	3	IRIS	12/13/19
Chromium, Hexavalent	Chronic	3.0E-03	mg/kg-day	7.5E-05	mg/kg-day	None	300	IRIS	12/13/19
Iron	Chronic	7.0E-01	mg/kg-day	7.0E-01	mg/kg-day	Gastrointestinal	2	PPRTV	12/13/19
Manganese	Chronic	2.4E-02	mg/kg-day	9.6E-04	mg/kg-day	Nervous System	1	IRIS	12/13/19

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Table G-4: Non-Cancer Toxicity Data Summary *(continued)*

Pathway: Inhalation									
Chemical of Concern	Chronic/ Subchronic	Inhalation RfC	Inhalation RfC Units	Inhalation RfD	Inhalation RfD Units	Primary Target Organ	Combined Uncertainty/ Modifying Factors	Sources of RfC: RfD: Target Organ	Dates (MM/DD/YYYY)
1,1-Dichloroethane	Chronic	N/A	mg/m^3	N/A	N/A	N/A	N/A	N/A	12/13/19
1,2-Dichloroethane	Chronic	7.0E-03	mg/m^3	N/A	N/A	Nervous System	3000	PPRTV	12/13/19
1,2-Dichloropropane	Chronic	4.0E-03	mg/m^3	N/A	N/A	Respiratory	300	IRIS	12/13/19
1,4-Dichlorobenzene	Chronic	8.0E-01	mg/m^3	N/A	N/A	Liver	100	IRIS	12/13/19
1,4-Dioxane	Chronic	3.0E-02	mg/m^3	N/A	N/A	Nervous System/ Respiratory	1000	IRIS	12/13/19
Benzene	Chronic	3.0E-02	mg/m^3	N/A	N/A	Immune System	300	IRIS	12/13/19
Chloroform	Chronic	9.8E-02	mg/m^3	N/A	N/A	Liver	100	ATSDR	12/13/19
Naphthalene	Chronic	3.0E-03	mg/m^3	N/A	N/A	Nervous System/ Respiratory	3000	IRIS	12/13/19
Tetrachloroethene	Chronic	4.0E-02	mg/m^3	N/A	N/A	Nervous System	1000	IRIS	12/13/19
Trichloroethene	Chronic	2.0E-03	mg/m^3	N/A	N/A	Immune System/ Developmental	10 to 1000	IRIS	12/13/19
Vinyl chloride	Chronic	1.0E-01	mg/m^3	N/A	N/A	Liver	30	IRIS	12/13/19
Arsenic	Chronic	1.5E-05	mg/m^3	N/A	N/A	Developmental/ Cardiovascular/ Nervous System/ Respiratory	30	CalEPA	12/13/19
Chromium, Hexavalent	Chronic	1.0E-04	mg/m^3	N/A	N/A	Respiratory	300	IRIS	12/13/19
Iron	Chronic	N/A	mg/m^3	N/A	N/A	N/A	N/A	N/A	12/13/19
Manganese	Chronic	5.0E-05	mg/m^3	N/A	N/A	Nervous System	1000	IRIS	12/13/19

Key:

(1) Date indicates when source was last reviewed.

N/A - No information available
IRIS - Integrated Risk Information System, U.S. EPA
PPRTV - Provisional Peer Reviewed Toxicity Value developed by STSC
HEAST = Health Effects Assessment Summary Tables
CalEPA - California Environmental Protection Agency, Office of Environmental Health Hazard Assessment
ATSDR = Agency for Toxic Substances and Disease Registry

This table provides non-carcinogenic risk information which is relevant to the contaminants of concern in groundwater. Fifteen of the COCs have oral toxicity data (or surrogate toxicity data) indicating their potential for adverse non-carcinogenic health effects in humans. Chronic toxicity data available for the fifteen COCs for oral exposures have been used to develop chronic oral reference doses (RfDs), provided in this table. The available chronic toxicity data indicate that benzene and trichloroethene affect the immune system, 1,4-dichlorobenzene, 1,4-dioxane, chloroform, and vinyl chloride affect the liver, 1,1-dichloroethane, 1,2-dichloroethane, and 1,4-dioxane affect the kidney, 1,2-dichloroethane, 1,4-dioxane, naphthalene, tetrachloroethene, arsenic, and manganese affect the central nervous system, 1,2-dichloropropane, trichloroethene, and arsenic are developmental toxicants, iron affects the gastrointestinal system, naphthalene affects the whole body, 1,2-dichloropropane, 1,4-dioxane, naphthalene, arsenic, and hexavalent chromium affect the respiratory system, arsenic affects the cardiovascular system, and arsenic affects the skin. Dermal RfDs are not available for any of the COCs. As was the case for the carcinogenic data, dermal RfDs can be extrapolated from oral RfDs by applying an adjustment factor as appropriate. Oral RfDs were adjusted for COCs with less than 50% absorption via the ingestion route (hexavalent chromium and manganese) to derive dermal RfDs for these COCs. Inhalation reference concentrations (RfCs) are available for thirteen COCs evaluated for the inhalation pathway.

Table G-5: Risk Characterization Summary – Carcinogens – Current Resident – Residential Groundwater

Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Residential Groundwater	1431 Pound Hill	Chloroform	1E-06	4E-04	1E-07	- -	4E-04
							Groundwater Risk Total =	4E-04
							Total Risk =	4E-04

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the current young child and adult resident exposed to groundwater used as tap (household) water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a young child's and adult's exposure to groundwater, as well as the toxicity of the COC (chloroform). The total risk from direct exposure to contaminated groundwater to a current resident is estimated to be 4 x 10-4. This risk level indicates that if no clean-up action is taken, a current child/adult resident would have an increased probability of 4 in 10,000 of developing cancer as a result of site-related exposure to the COCs in groundwater. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Table G-6: Risk Characterization Summary - Non-Carcinogens – Current Resident – Residential Groundwater

Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Current Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Residential Groundwater	1309 Pound Hill	Naphthalene	Whole Body	2E-03	3E+00	1E-03	3E+00
							Groundwater Hazard Index Total =	3E+00
							Whole Body Hazard Index =	3E+00

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the current young child and adult resident exposed to groundwater used as tap (household) water. The Risk Assessment Guidance for Superfund (RAGS) states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HI of 3 indicates that the potential for adverse effects could occur from exposure to contaminated groundwater containing naphthalene. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Table G-7: Risk Characterization Summary – Carcinogens – Future Resident – Overburden Groundwater

Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Future Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Overburden Groundwater						
			1,1-Dichloroethane	3E-07	3E-05	2E-08	- -	3E-05
			1,2-Dichloroethane	3E-07	3E-05	1E-08	- -	3E-05
			1,2-Dichloropropane	5E-07	2E-05	5E-08	- -	2E-05
			1,4-Dichlorobenzene	1E-07	7E-05	7E-08	- -	7E-05
			1,4-Dioxane	1E-04	N/A	4E-07	- -	1E-04
			Benzene	5E-07	3E-05	7E-08	- -	3E-05
			Naphthalene	N/A	1E-04	N/A	- -	1E-04
			Trichloroethene	5E-07	2E-05	7E-08	- -	2E-05
			Vinyl chloride	3E-05	9E-05	2E-06	- -	1E-04
			Arsenic	3E-03	N/A	2E-05	- -	3E-03
			Chromium, Hexavalent	9E-05	N/A	4E-05	- -	1E-04
							Groundwater Risk Total =	4E-03
							Total Risk =	4E-03

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future young child and adult resident exposed to groundwater used as tap (household) water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a young child's and adult's exposure to groundwater, as well as the toxicity of the COCs (1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, 1,2-dichloropropane, 1,4-dioxane, benzene, naphthalene, trichloroethene, vinyl chloride, arsenic, and hexavalent chromium). The total risk from direct exposure to contaminated groundwater to a future resident, in the event that groundwater is used as a potable source, is estimated to be 4 x 10-3. The COCs contributing most to these risk levels are 1,4-dioxane, naphthalene, vinyl chloride, and hexavalent chromium in groundwater. This risk level indicates that if no clean-up action is taken, a future child/adult resident would have an increased probability of 4 in 1,000 of developing cancer as a result of site-related exposure to the COCs in groundwater. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Table G-8: Risk Characterization Summary - Non-Carcinogens – Future Resident – Overburden Groundwater

Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Future Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Overburden Groundwater	1,2-Dichloropropane	Developmental	1E-03	3E+00	1E-04	3E+00
			Naphthalene	Whole Body	3E-03	4E+00	2E-03	4E+00
			Trichloroethene	Developmental/Immune System	6E-02	4E+00	9E-03	4E+00
			Arsenic	Cardiovascular/Skin	3E+01	N/A	1E-01	3E+01
			Iron	Gastrointestinal	3E+00	N/A	1E-02	3E+00
			Manganese	Nervous System	7E+00	N/A	8E-01	8E+00
							Groundwater Hazard Index Total =	5E+01
							Immune System Hazard Index =	4E+00
							Developmental Hazard Index =	7E+00
							Skin Hazard Index =	3E+01
							Whole Body Hazard Index =	4E+00
							Cardiovascular Hazard Index =	3E+01
							Gastrointestinal Hazard Index =	3E+00
							Nervous System Hazard Index =	8E+00

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future young child and adult resident exposed to groundwater used as tap (household) water. The Risk Assessment Guidance for Superfund (RAGS) states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 3 and 30 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing 1,2-dichloropropane, naphthalene, trichloroethene, arsenic, iron, and manganese. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Table G-9: Risk Characterization Summary – Carcinogens – Future Resident – Bedrock Groundwater

Risk Characterization Summary - Carcinogens								
Scenario Timeframe: Future Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Carcinogenic Risk				
				Ingestion	Inhalation	Dermal	External (Radiation)	Exposure Routes Total
Groundwater	Groundwater	Bedrock Groundwater						
			1,1-Dichloroethane	3E-07	3E-05	2E-08	- -	3E-05
			1,2-Dichloroethane	8E-07	8E-05	4E-08	- -	8E-05
			1,4-Dioxane	6E-05	N/A	2E-07	- -	6E-05
			Benzene	2E-07	1E-05	3E-08	- -	1E-05
			Tetrachloroethene	4E-08	2E-06	2E-08	- -	2E-06
			Trichloroethene	1E-06	3E-05	2E-07	- -	3E-05
			Vinyl chloride	9E-06	3E-05	4E-07	- -	4E-05
			Arsenic	5E-04	N/A	3E-06	- -	5E-04
			Chromium, Hexavalent	5E-05	N/A	2E-05	- -	7E-05
							Groundwater Risk Total =	8E-04
							Total Risk =	8E-04

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides risk estimates for the significant routes of exposure for the future young child and adult resident exposed to groundwater used as tap (household) water. These risk estimates are based on a reasonable maximum exposure and were developed by taking into account various conservative assumptions about the frequency and duration of a young child's and adult's exposure to groundwater, as well as the toxicity of the COCs (1,1-dichloroethane, 1,2-dichloroethane, 1,4-dioxane, benzene, tetrachloroethene, trichloroethene, vinyl chloride, arsenic, and hexavalent chromium). The total risk from direct exposure to contaminated groundwater to a future resident, in the event that groundwater is used as a potable source, is estimated to be 8 x 10-4. The COCs contributing most to these risk levels are arsenic, 1,2-dichloroethane, 1,4-dioxane, and hexavalent chromium in groundwater. This risk level indicates that if no clean-up action is taken, a future child/adult resident would have an increased probability of 8 in 10,000 of developing cancer as a result of site-related exposure to the COCs in groundwater. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Table G-10: Risk Characterization Summary - Non-Carcinogens – Future Resident – Bedrock Groundwater

Risk Characterization Summary - Non-Carcinogens								
Scenario Timeframe: Future Receptor Population: Resident Receptor Age: Young Child/Adult								
Medium	Exposure Medium	Exposure Point	Chemical of Concern	Primary Target Organ	Non-Carcinogenic Hazard Quotient			
					Ingestion	Inhalation	Dermal	Exposure Routes Total
Groundwater	Groundwater	Bedrock Groundwater	Trichloroethene Arsenic	Developmental/Immune System Cardiovascular/Skin	1E-01 4E+00	7E+00 N/A	2E-02 2E-02	7E+00 4E+00
							Groundwater Hazard Index Total =	1E+01
							Immune System Hazard Index =	7E+00
							Developmental Hazard Index =	7E+00
							Skin Hazard Index =	4E+00
							Cardiovascular Hazard Index =	4E+00

Key:

N/A - Toxicity criteria are not available to quantitatively address this route of exposure.
-- Route of exposure is not applicable to this medium.

This table provides hazard quotients (HQs) for each route of exposure and the hazard index (sum of the hazard quotients) for all routes of exposure for the future young child and adult resident exposed to groundwater used as tap (household) water. The Risk Assessment Guidance for Superfund (RAGS) states that, generally, a hazard index (HI) of greater than 1 indicates the potential for adverse noncancer effects. The estimated target organ HIs between 4 and 7 indicate that the potential for adverse effects could occur from exposure to contaminated groundwater containing trichloroethene and arsenic. Results presented use current toxicity values along with site-specific exposure parameters from the baseline HHRA.

Appendix C - Figures

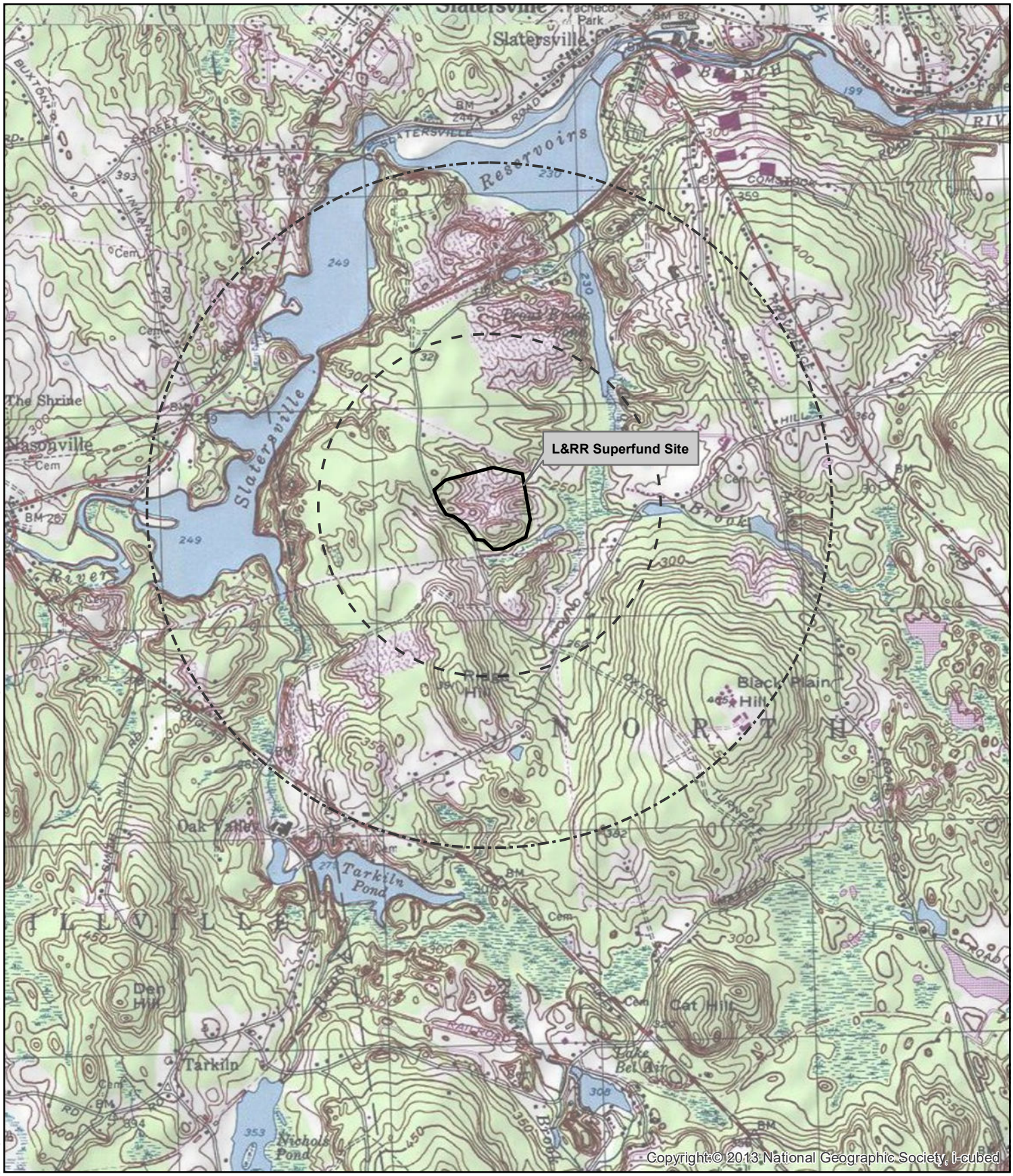

Figure 1-1

Site Locus

L&RR Superfund Site
OU 2 Remedial Investigation
/Feasibility Study

Legend

- 1 Mile
- 1/2 Mile
- Landfill

N

1 inch = 2,000 feet

0 500 1,000 2,000 Feet

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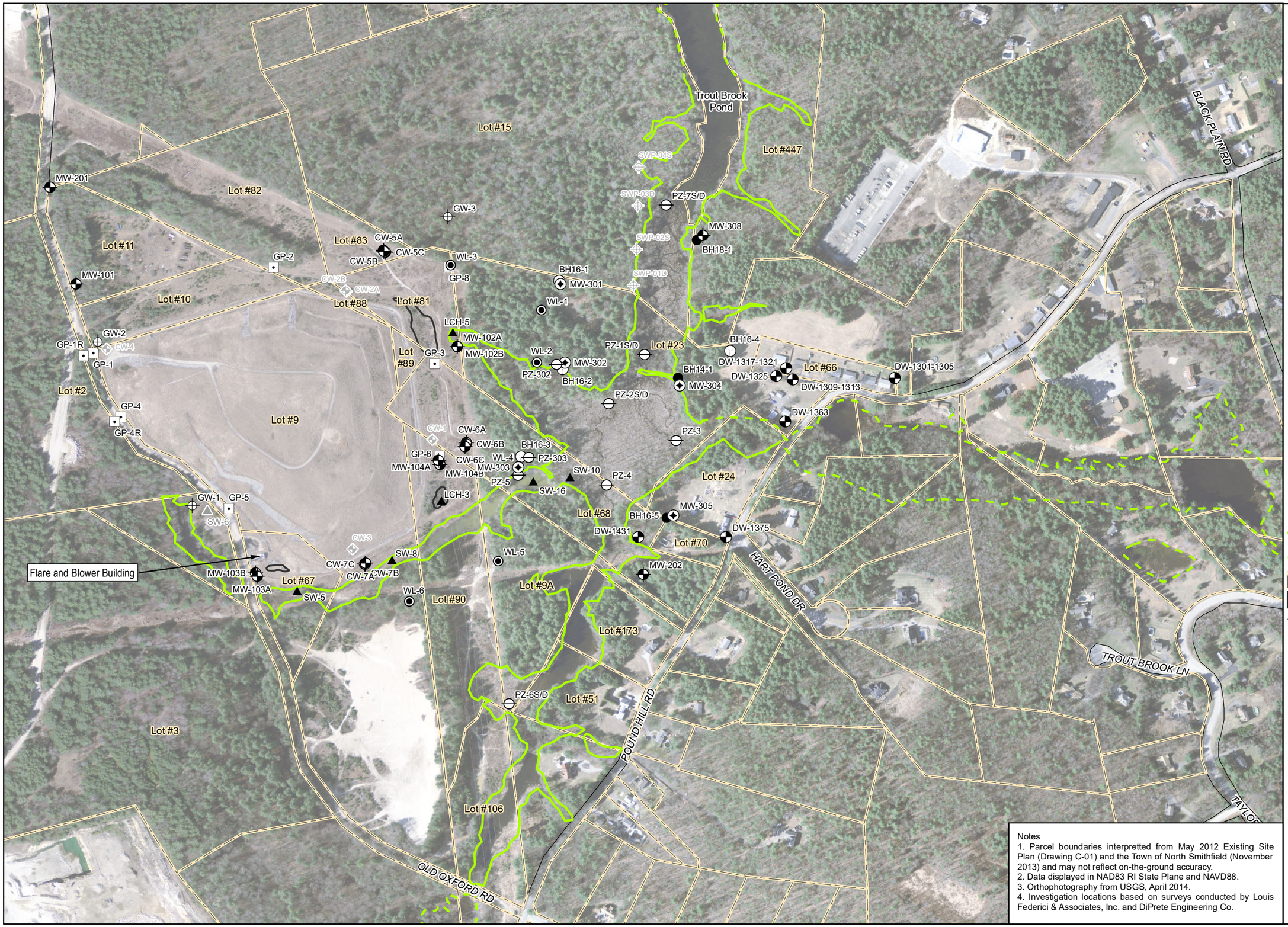
Figure Exported: 6/11/2020 By: solney Using: \\woodardcurran.net\shared\Projects\229620 L&RR PRP Group - OU2 RI\FS\wip\GIS\MXD\2020.05 Final FS\Figure 1-1 Site Locus.mxd



N

Figure 1-2

Site Plan

L&RR Superfund Site
OU 2 Remedial Investigation
/Feasibility Study

Legend

- Monitoring Well
- Overburden CMT
- Piezometer
- Residential Well
- Annual PCSM Surface Water Sample Location
- Waterloo Profile Location
- Discrete Groundwater Location
- Bedrock CMT
- Bedrock Borehole
- Gas Probe
- Abandoned Monitoring Well
- Geoprobe Groundwater (2006)
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries
- Surface Water Detention Basins
- Roads

1 inch = 400 feet

0 100 200 400 Feet

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Project #: 229620
Map Created: June 2020

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Notes
1. Parcel boundaries interpretted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
2. Data displayed in NAD83 RI State Plane and NAVD88.
3. Orthophotography from USGS, April 2014.
4. Investigation locations based on surveys conducted by Louis Federici & Associates, Inc. and DiPrete Engineering Co.

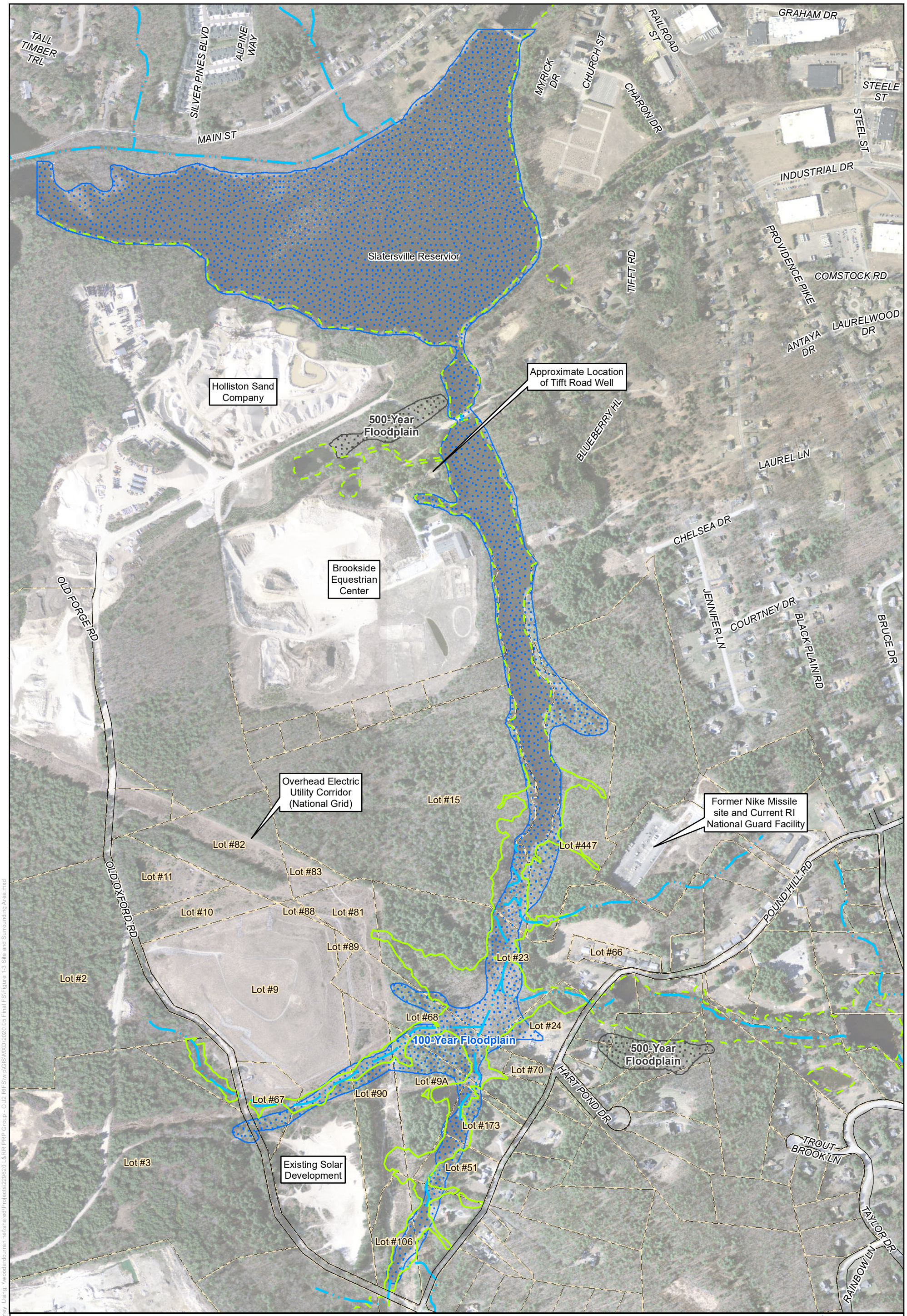

Figure 1-3

Site and Surrounding Area

L&RR Superfund Site
OU 2 Remedial Investigation
/Feasibility Study

Legend

- Stream Channel
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features

FEMA Floodplains

Zone

- 100-year floodplain
- 500-year floodplain
- Interpreted Parcel Boundaries

Notes:
1. Parcel boundaries interpretted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
2. Data displayed in NAD83 RI State Plane and NAVD88.
3. Orthophotography from USGS, April 2014.
4. Extent of wetland features surveyed in July 2016 by DiPrete Engineering. Wetlands east of Pound Hill Road and near the Slatersville Reservoir are based upon the National Wetlands Inventory.
5. FEMA Floodplains from National Flood Insurance Program Flood Insurance Rate Map (FIRM) Panel 0152G, Providence County,

N

1 inch = 600 feet

0 150 300 600 Feet

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Project #: 229620
Map Created: June 2020

Figure Exported: 6/11/2020 By: soliney Using: \\woodardcurran.net\shared\Projects\229620 L&RR PRP Group - OU2 RI\FS\wip\GIS\MXD\2020.05 Final FS\Figure 1-3 Site and Surrounding Area.mxd

Data Sources: USGS, Town of North Smithfield, RI

Figure 1-4

Hydrogeological Investigation Locations & Investigation Sub-Areas

L&RR Superfund Site
OU 2 Remedial Investigation/ Feasibility Study

N

Legend

- Monitoring Well
- Bedrock CMT
- Overburden CMT
- Bedrock Borehole
- Piezometer
- Residential Well
- Annual PCSM Surface Water Sample Location
- Waterloo Profile Location
- Discrete Groundwater Location
- Roads
- Geological Cross-Sections
- Transects
- Interpreted Parcel Boundaries

Investigation Subareas

- Downgradient of Landfill
- Downgradient of Wetland
- Landfill Area
- Near Receptor
- Upgradient of Landfill
- Upgradient of Wetland
- Wetland

D Cross-Section Profile

1 inch = 400 feet

0 100 200 400 Feet

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Notes:
1. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
2. Data displayed in NAD83 RI State Plane and NAVD88.
3. Orthophotography from USGS, April 2014.
4. Overburden Multi-Level System identifier to correspond with A/B/C - deep / intermediate / shallow designation.

Lithology

- Silty Fine Sand
- Fine to Medium Sand
- Coarse to Fine Sand
- Sand and Gravel
- Sand and Clay
- Clay
- Bedrock
- Estimated Landfill Waste Depth (Offset)

Hydrology

- Surface Water/Wetland
- Groundwater Elevation (March 2017)

Well Construction

- CMT Screen
- Open Borehole
- Well Screen

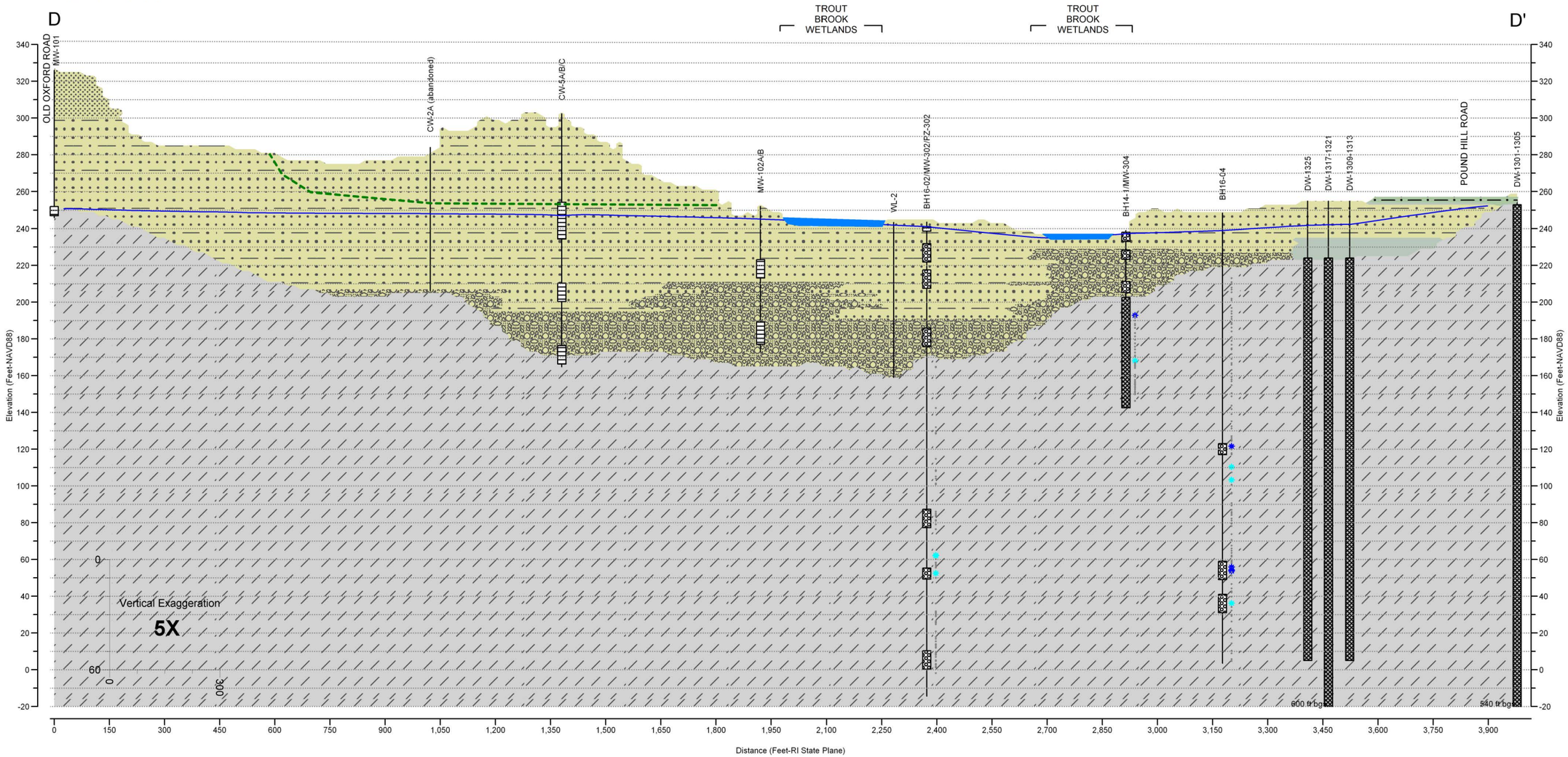
Bedrock Geophysics

- Likely Transmissive Fracture
- Possibly Transmissive Fracture

Notes

1. Monitoring wells, borings, and groundwater profile locations are approximate.
2. Vertical elevations along cross-section derived from Rhode Island 2011 state-wide LiDAR dataset obtained from RIGIS.
3. Geologic units were interpreted from E.C. Jordan and Wehran Engineering borings and well installations during previous site investigation activities. Units and contacts are interpretational and may vary from actual field conditions.
4. Lithology interpolated using "Lateral Blending" algorithm in RockWorks 17. Lateral blending extends boring lithology data horizontally and randomizes correlations at the middle zone between borings.
5. Private well data for wells along Pound Hill Road (DW-XXXX) based on well logs on file at Rhode Island Department of Public Health.
6. Water table is inferred from depth to groundwater measurements in shallow overburden wells recorded in the field by Woodard & Curran on March 6, 2017. Overburden groundwater elevations near private wells along Pound Hill Road were estimated based upon topography.
7. The location of Trout Brook and associated wetlands have been interpreted from existing orthophotos. These limits likely vary with stage of the brook.
8. Refer to Figue 1-4 for the location of Cross-Section D-D'.

Orthophotography from Google Earth, 2018. Not to Scale.



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COMMITMENT & INTEGRITY DRIVE RESULTS

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CROSS-SECTION D-D'

DESIGNED BY: BLG
DRAWN BY: BLG
CHECKED BY: MAA
CrossSectionD-D' RwRpt

L&RR SUPERFUND SITE
NORTH SMITHFIELD, RHODE ISLAND

REMEDIAL INVESTIGATION & FEASIBILITY STUDY

JOB NO: 229620
NOVEMBER 2019

FIGURE 1-5

Lithology

- Silty Fine Sand
- Fine to Medium Sand
- Coarse to Fine Sand
- Sand and Gravel
- Bedrock

Hydrology

- Surface Water/Wetland
- Groundwater Elevation (March 2017)

Well Construction

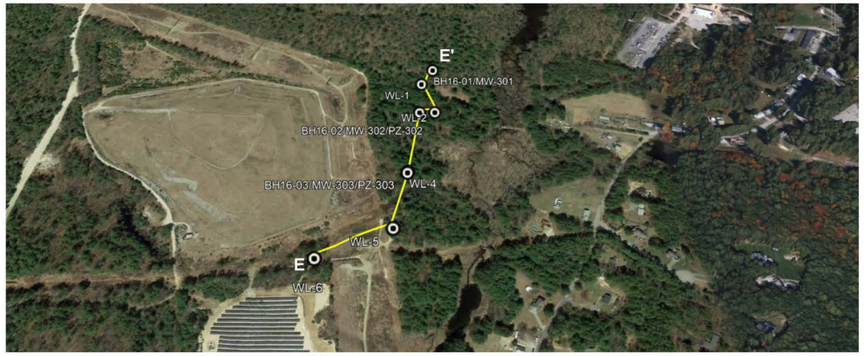
- CMT Screen
- Open Borehole
- Well Screen

Bedrock Geophysics

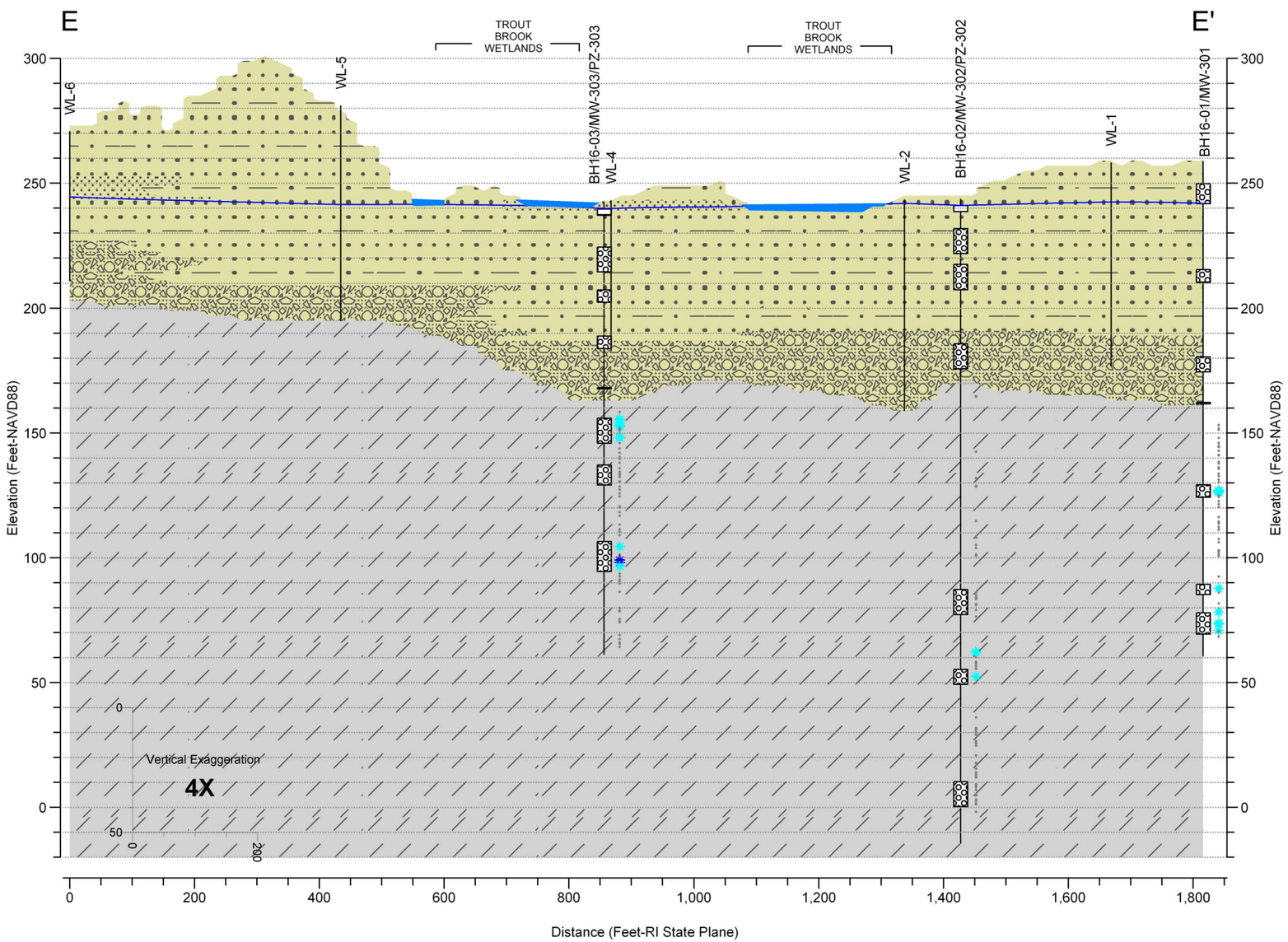
- Likely Transmissive Fracture
- Possibly Transmissive Fracture

Notes

1. Monitoring wells, borings, and groundwater profile locations are approximate.
2. Vertical elevations along cross-section derived from Rhode Island 2011 state-wide LiDAR dataset obtained from RIGIS.
3. Geologic units were interpreted from E.C. Jordan and Wehran Engineering borings and well installations during previous site investigation activities. Units and contacts are interpretational and may vary from actual field conditions.
4. Lithology interpolated using "Lateral Blending" algorithm in RockWorks 17. Lateral blending extends boring lithology data horizontally and randomizes correlations at the middle zone between borings.
5. Water table is inferred from depth to groundwater measurements in shallow overburden wells recorded in the field by Woodard & Curran on March 6, 2017.
6. The location of Trout Brook and associated wetlands have been interpreted from existing orthophotos. These limits likely vary with stage of the brook.
7. Refer to Figure 1-4 for the location of Cross-Section E-E'.



Orthophotography from Google Earth, 2018. Not to Scale.



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COMMITMENT & INTEGRITY DRIVE RESULTS

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CROSS-SECTION E-E'

DESIGNED BY: BLG
DRAWN BY: BLG
CHECKED BY: MAA
CrossSectionE-E' RwRpt

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NORTH SMITHFIELD, RHODE ISLAND

REMEDIAL INVESTIGATION & FEASIBILITY STUDY

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NOVEMBER 2019

FIGURE 1-6

Lithology

- Silty Fine Sand
- Coarse to Fine Sand
- Bedrock
- Fine to Medium Sand
- Sand and Gravel
- Estimated Landfill Waste Depth (Offset)

Hydrology

- Surface Water/Wetland
- Groundwater Elevation (March 2017)

Well Construction

- CMT Screen
- Open Borehole
- Well Screen

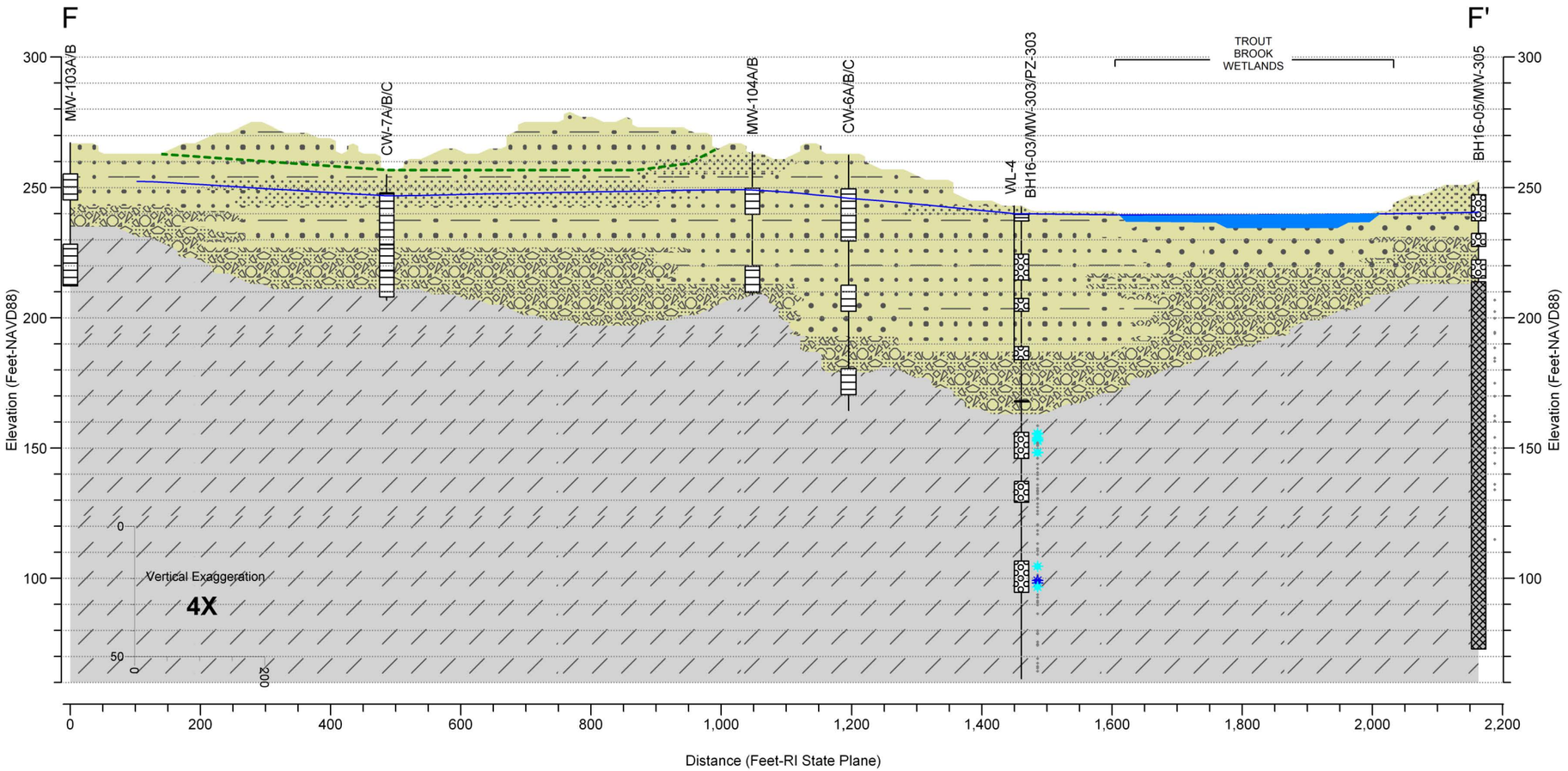
Bedrock Geophysics

- Likely Transmissive Fracture
- Possibly Transmissive Fracture

Notes

1. Monitoring wells, borings, and groundwater profile locations are approximate.
2. Vertical elevations along cross-section derived from Rhode Island 2011 state-wide LiDAR dataset obtained from RIGIS.
3. Geologic units were interpreted from E.C. Jordan and Wehran Engineering borings and well installations during previous site investigation activities. Units and contacts are interpretational and may vary from actual field conditions.
4. Lithology interpolated using "Lateral Blending" algorithm in RockWorks 17. Lateral blending extends boring lithology data horizontally and randomizes correlations at the middle zone between borings.
5. Water table is inferred from depth to groundwater measurements in shallow overburden wells recorded in the field by Woodard & Curran on March 6, 2017.
6. The location of Trout Brook and associated wetlands have been interpreted from existing orthophotos. These limits likely vary with stage of the brook.
7. Refer to Figure 1-4 for the location of Cross-Section F-F'.

Orthophotography from Google Earth, 2018. Not to Scale.



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COMMITMENT & INTEGRITY DRIVE RESULTS

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CROSS-SECTION F-F'

CHECKED BY: MAA
CrossSectionF-F'.RwRpt
DESIGNED BY: BLG
DRAWN BY: BLG

L&RR SUPERFUND SITE
NORTH SMITHFIELD, RHODE ISLAND

REMEDIAL INVESTIGATION & FEASIBILITY STUDY

JOB NO: 229620
NOVEMBER 2019

FIGURE 1-7

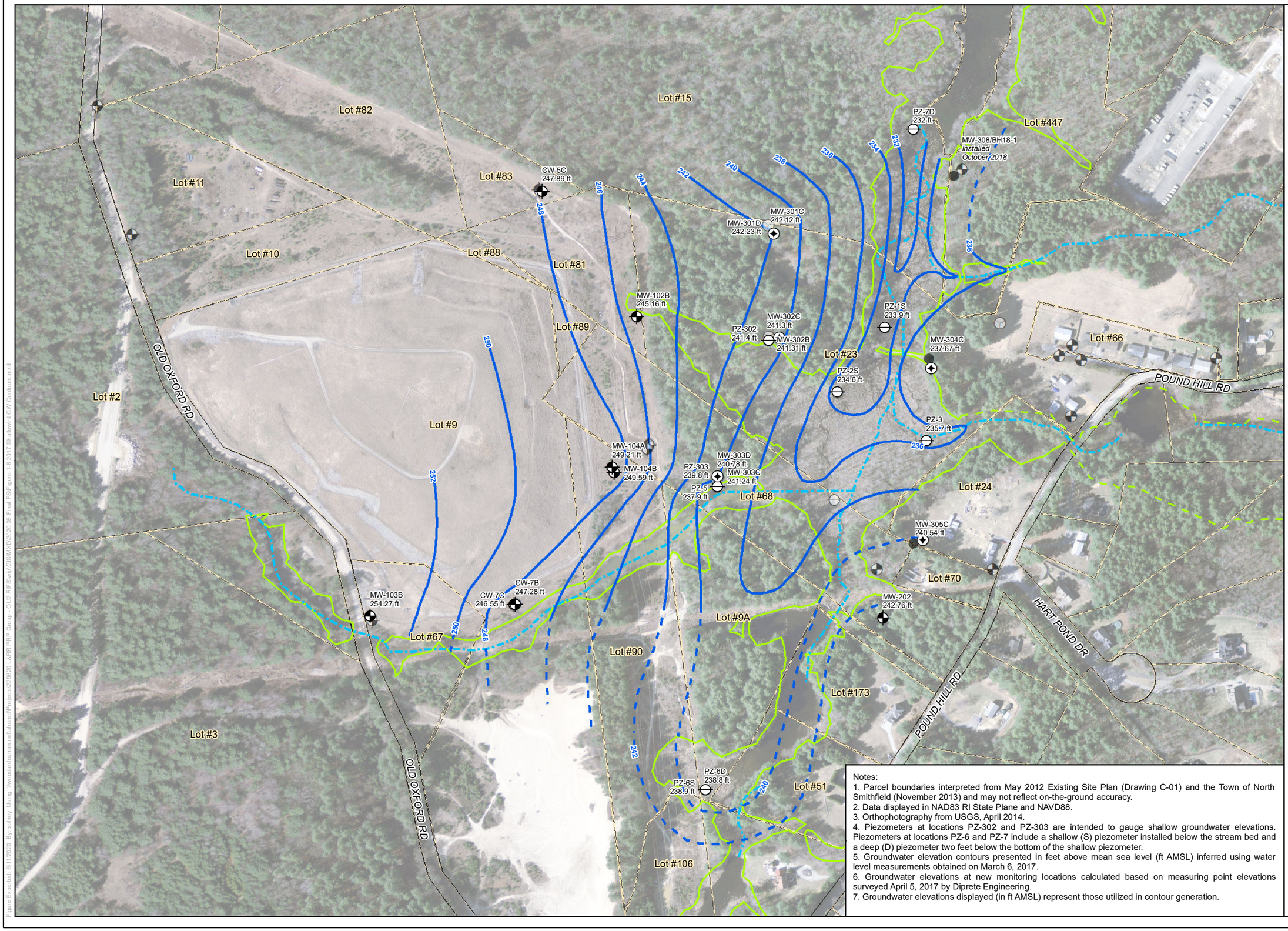

Figure 1-8

Shallow and Intermediate Overburden Groundwater Elevation Contours March 2017

L&RR Superfund Site
OU 2 Remedial Investigation /Feasibility Study

N

Legend

- Bedrock CMT
- Bedrock Borehole
- Monitoring Well
- Overburden CMT
- Piezometer
- Residential Well
- Groundwater Elevation Contours (ft AMSL)
- Roads
- Streams
- Interpreted Parcel Boundaries

1 inch = 300 feet

0 75 150 300 Feet

Notes:
1. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
2. Data displayed in NAD83 RI State Plane and NAVD88.
3. Orthophotography from USGS, April 2014.
4. Piezometers at locations PZ-302 and PZ-303 are intended to gauge shallow groundwater elevations. Piezometers at locations PZ-6 and PZ-7 include a shallow (S) piezometer installed below the stream bed and a deep (D) piezometer two feet below the bottom of the shallow piezometer.
5. Groundwater elevation contours presented in feet above mean sea level (ft AMSL) inferred using water level measurements obtained on March 6, 2017.
6. Groundwater elevations at new monitoring locations calculated based on measuring point elevations surveyed April 5, 2017 by Diprete Engineering.
7. Groundwater elevations displayed (in ft AMSL) represent those utilized in contour generation.

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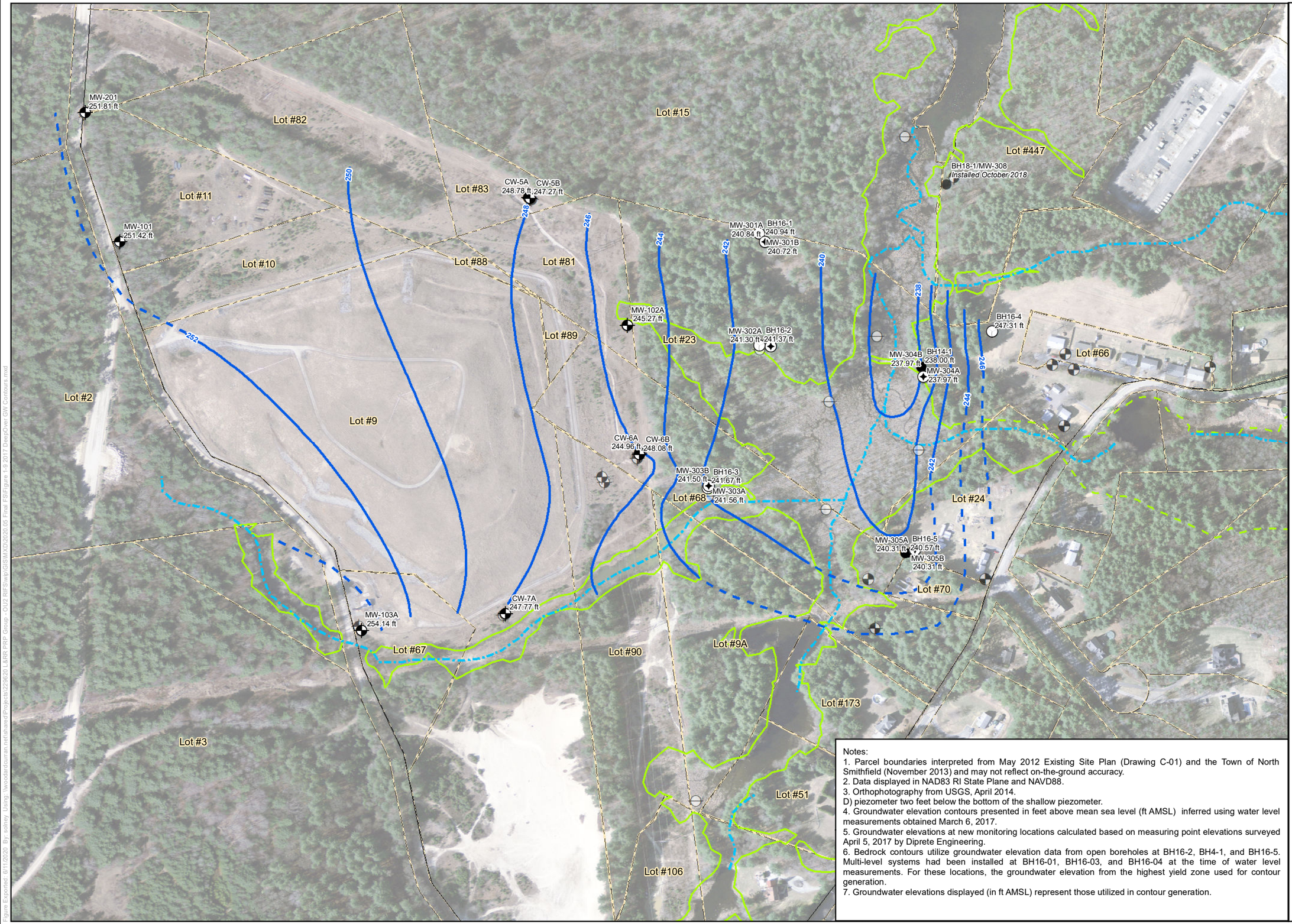


Figure 1-9

Deep Overburden and Bedrock Groundwater Elevation Contours March 2017

L&RR Superfund Site
OU 2 Remedial Investigation
/Feasibility Study

N

Legend

- Bedrock CMT
- Bedrock Borehole
- Monitoring Well
- Overburden CMT
- Piezometer
- Residential Well
- Groundwater Elevation Contours (ft AMSL)
- Streams
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries
- Roads

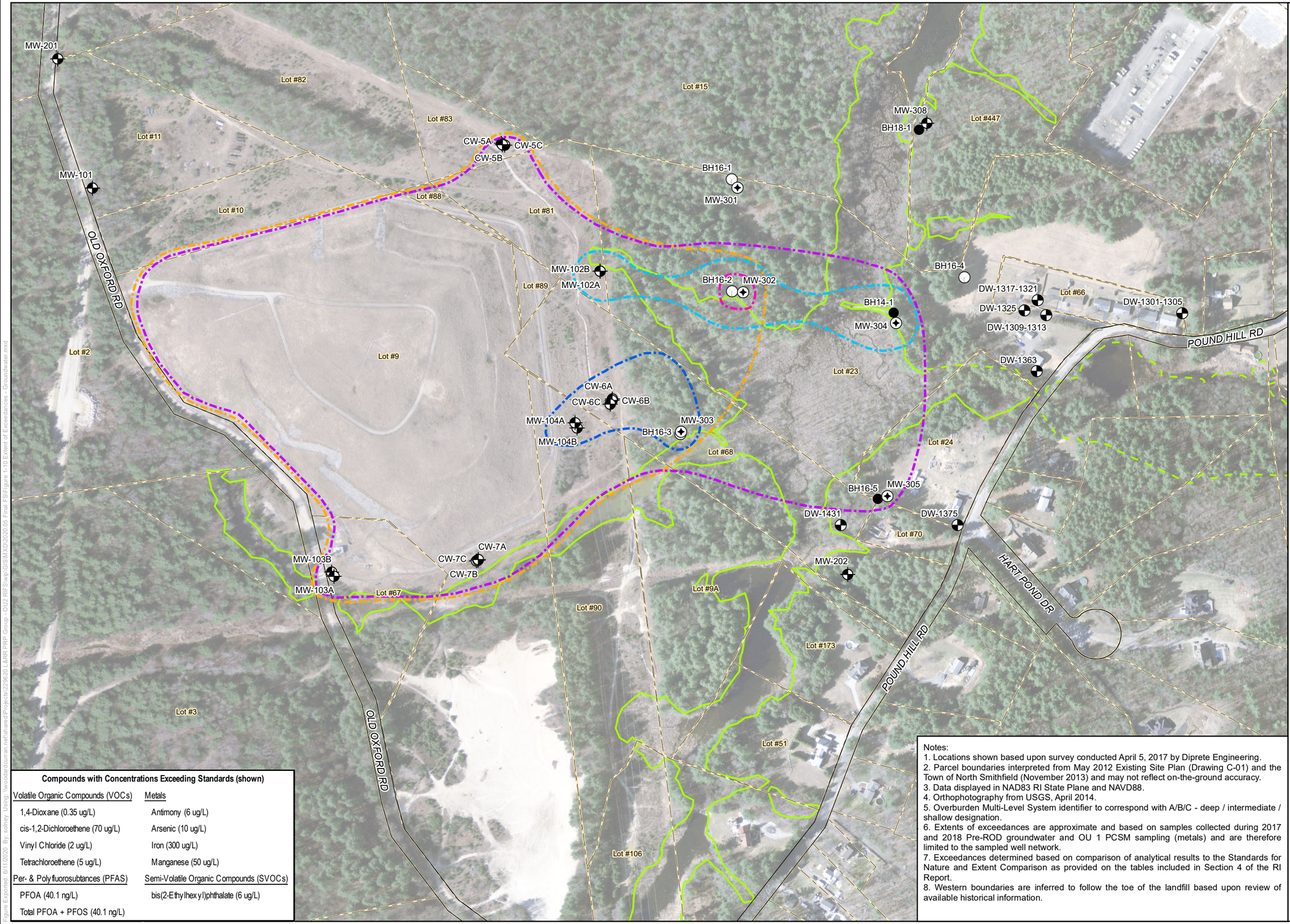
1 inch = 300 feet

0 75 150 300 Feet

Notes:
1. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
2. Data displayed in NAD83 RI State Plane and NAVD88.
3. Orthophotography from USGS, April 2014.
D) piezometer two feet below the bottom of the shallow piezometer.
4. Groundwater elevation contours presented in feet above mean sea level (ft AMSL) inferred using water level measurements obtained March 6, 2017.
5. Groundwater elevations at new monitoring locations calculated based on measuring point elevations surveyed April 5, 2017 by Diprete Engineering.
6. Bedrock contours utilize groundwater elevation data from open boreholes at BH16-2, BH4-1, and BH16-5. Multi-level systems had been installed at BH16-01, BH16-03, and BH16-04 at the time of water level measurements. For these locations, the groundwater elevation from the highest yield zone used for contour generation.
7. Groundwater elevations displayed (in ft AMSL) represent those utilized in contour generation.

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020



Compounds with Concentrations Exceeding Standards (shown)

Volatile Organic Compounds (VOCs)	Metals
1,4-Dioxane (0.35 ug/L)	Antimony (6 ug/L)
cis-1,2-Dichloroethene (70 ug/L)	Arsenic (10 ug/L)
Vinyl Chloride (2 ug/L)	Iron (300 ug/L)
Tetrachloroethene (5 ug/L)	Manganese (50 ug/L)
Per- & Polyfluorosubtances (PFAS)	**Semi-Volatile Organic Compounds (SVOCs)**
PFOA (40.1 ng/L)	bis(2-Ethylhexyl)phthalate (6 ug/L)
Total PFOA + PFOS (40.1 ng/L)	

Notes:
1. Locations shown based upon survey conducted April 5, 2017 by Diprete Engineering.
2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Overburden Multi-Level System identifier to correspond with A/B/C - deep / intermediate / shallow designation.
6. Extents of exceedances are approximate and based on samples collected during 2017 and 2018 Pre-ROD groundwater and OU 1 PCSM sampling (metals) and are therefore limited to the sampled well network.
7. Exceedances determined based on comparison of analytical results to the Standards for Nature and Extent Comparison as provided on the tables included in Section 4 of the RI Report.
8. Western boundaries are inferred to follow the toe of the landfill based upon review of available historical information.

N

Figure 1-10

Approximate Extents of Exceedances in Groundwater

L&RR Superfund Site
OU 2 Remedial Investigation/
Feasibility Study
North Smithfield, Rhode Island

Legend

- Bedrock Multi-Level System
- Bedrock Borehole
- Monitoring Well
- Overburden Multi-Level System
- Residential Well
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries

Approximate Extent of Exceedances in Groundwater

- 1,4-Dioxane
- Other VOCs
- PFAS
- Metals
- SVOCs

1 inch = 300 feet

0 75 150 300 Feet

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020

Lithology

- Silty Fine Sand
- Fine to Medium Sand
- Coarse to Fine Sand
- Sand and Gravel
- Bedrock

Hydrology

- Surface Water/Wetland
- Groundwater Elevation (March 2017)

Well Construction

- CMT Screen
- Open Borehole
- Well Screen

Bedrock Geophysics

- Likely Transmissive Fracture
- Possibly Transmissive Fracture

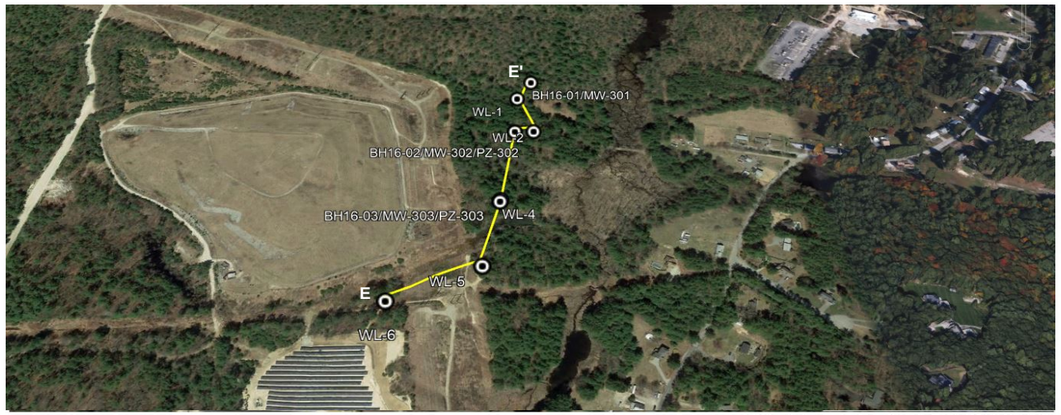
- Result Below Minimum Laboratory Reporting Limit
- 2.93 — 1,4-Dioxane [µg/L]
- 1.85 — Other VOCs [µg/L]

Total VOC Concentration (µg/L)

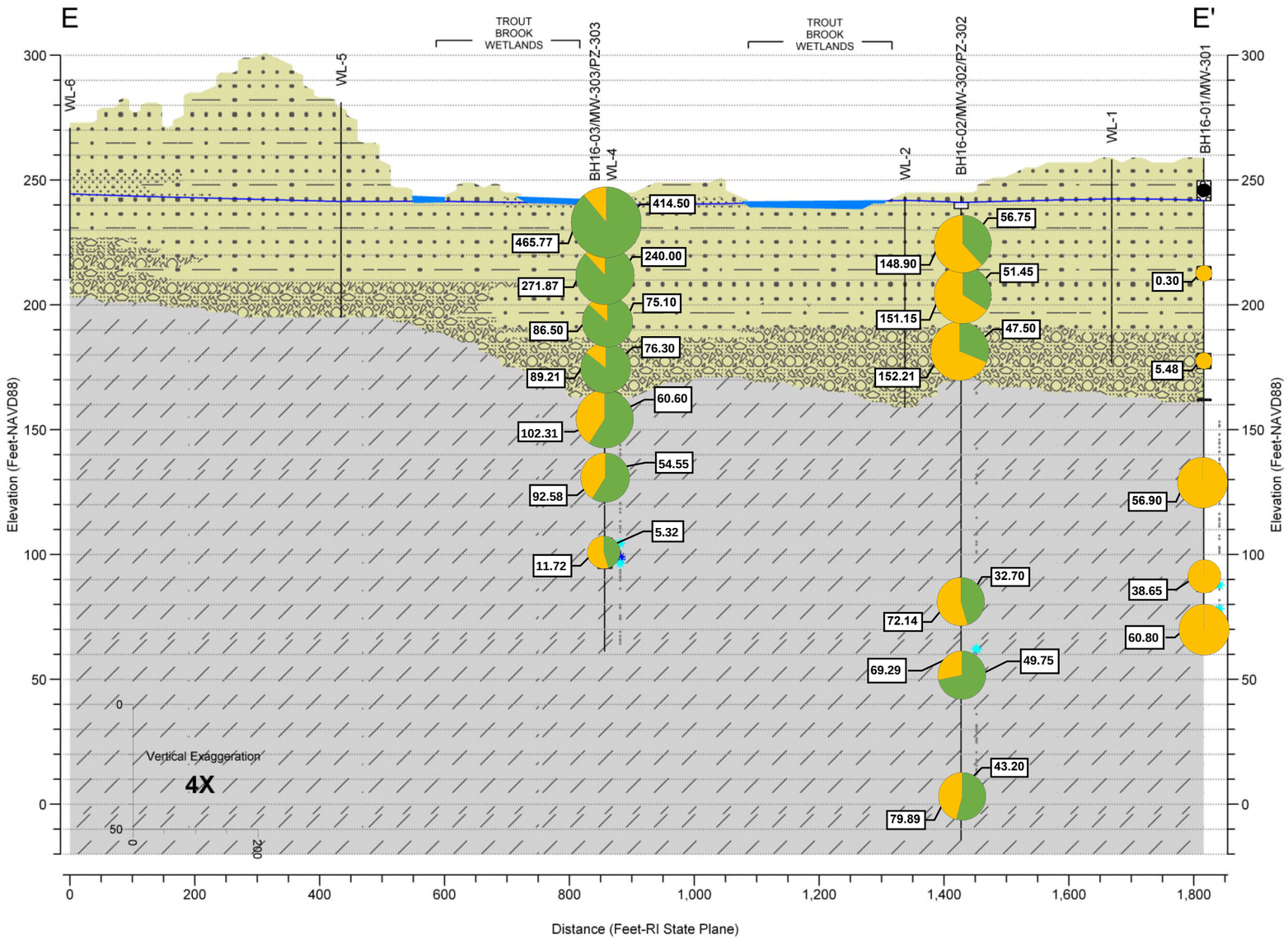
ND - 10 | 10 - 50 | 50 - 100 | 100 - 400 | > 400

Notes

1. Monitoring wells, borings, and groundwater profile locations are approximate.
2. Vertical elevations along cross-section derived from Rhode Island 2011 state-wide LiDAR dataset obtained from RIGIS.
3. Geologic units were interpreted from E.C. Jordan and Wehran Engineering borings and well installations during previous site investigation activities. Units and contacts are interpretational and may vary from actual field conditions.
4. Lithology interpolated using "Lateral Blending" algorithm in RockWorks 17. Lateral blending extends boring lithology data horizontally and randomizes correlations at the middle zone between borings.
5. Water table is inferred from depth to groundwater measurements in shallow overburden wells recorded in the field by Woodard & Curran on March 6, 2017.
6. The location of Trout Brook and associated wetlands have been interpreted from existing orthophotos. These limits likely vary with stage of the brook.
7. Groundwater concentrations displayed are the average concentration of 1,4-dioxane and all other VOCs across Spring 2017 and Summer 2018 Pre-ROD sampling events and April and October 2018 Residential drinking water sampling events. The size of the chart represents the average total VOC concentration.
8. Refer to Figure 1-4 for the location of Cross-Section E-E'.



Orthophotography from Google Earth, 2018. Not to Scale.



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COMMITMENT & INTEGRITY DRIVE RESULTS

WOODARD & CURRAN

VERTICAL EXTENT OF IMPACTS CROSS-SECTION E-E'

DESIGNED BY: BLG
DRAWN BY: BLG
CHECKED BY: MAA
CrossSectionE-E' RwRpt

L&RR SUPERFUND SITE
NORTH SMITHFIELD, RHODE ISLAND

REMEDIAL INVESTIGATION & FEASIBILITY STUDY

JOB NO: 229620

JUNE 2020

FIGURE 1-11

Figure 1-12

Summary of Surface Water Impacts

L&RR Superfund Site
OU 2 Remedial Investigation/
Feasibility Study
North Smithfield, Rhode Island

N

Legend

- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries
- SVOCs / Metals / VOCs / Pesticides
- Concentration of specified constituent detected above the applicable standard
- Concentration of specified constituent not detected above the applicable standard
- Sample not analyzed for specified constituent

1 inch = 400 feet

0 100 200 400 Feet

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: USGS, Town of North Smithfield, RI**

Notes:
1. Locations shown based upon survey conducted April 5, 2017 by Diprete Engineering.
2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Results shown are from wetland and ecological sampling conducted in June/July 2016 and May 2017, Pre-ROD surface water sampling conducted in July/August 2018, and PCSM sampling conducted between 2013 and 2018.
6. Exceedances are based on sample results exceeding the Standards for Nature

INSET: Northern Extent of Trout Brook Pond (TB-16 and TB-17)

Figure 1-13a

Summary of Sediment Impacts (0-6 in)

L&RR Superfund Site
OU 2 Remedial Investigation/
Feasibility Study
North Smithfield, Rhode Island

N

Legend

- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries
- SVOCs / Metals / VOCs / Pesticides
- Concentration of specified constituent detected above the applicable benchmark
- Concentration of specified constituent not detected above the applicable benchmark
- Sample not analyzed for specified constituent

1 inch = 400 feet

0 100 200 400 Feet

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020

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2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Results shown are from wetland and ecological sampling conducted in June/July 2016 and May 2017.
6. Exceedances are based on sample results exceeding the sediment-specific ecological benchmarks presented in the SLERA and Refinement.

INSET: Northern Extent of Trout Brook Pond (TB-16 and TB-17)

Figure 1-13b

Summary of Sediment Impacts (6-12 in)

L&RR Superfund Site
OU 2 Remedial Investigation/
Feasibility Study
North Smithfield, Rhode Island

N

Legend

- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries
- SVOCs / Metals / VOCs / Pesticides
- Concentration of specified constituent detected above the applicable benchmark
- Concentration of specified constituent not detected above the applicable benchmark
- Sample not analyzed for specified constituent

1 inch = 400 feet

0 100 200 400 Feet

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020

Third Party GIS Disclaimer: This map is for reference and graphical purposes only and should not be relied upon by third parties for any legal decisions. Any reliance upon the map or data contained herein shall be at the users' sole risk. **Data Sources: USGS, Town of North Smithfield, RI**

Notes:
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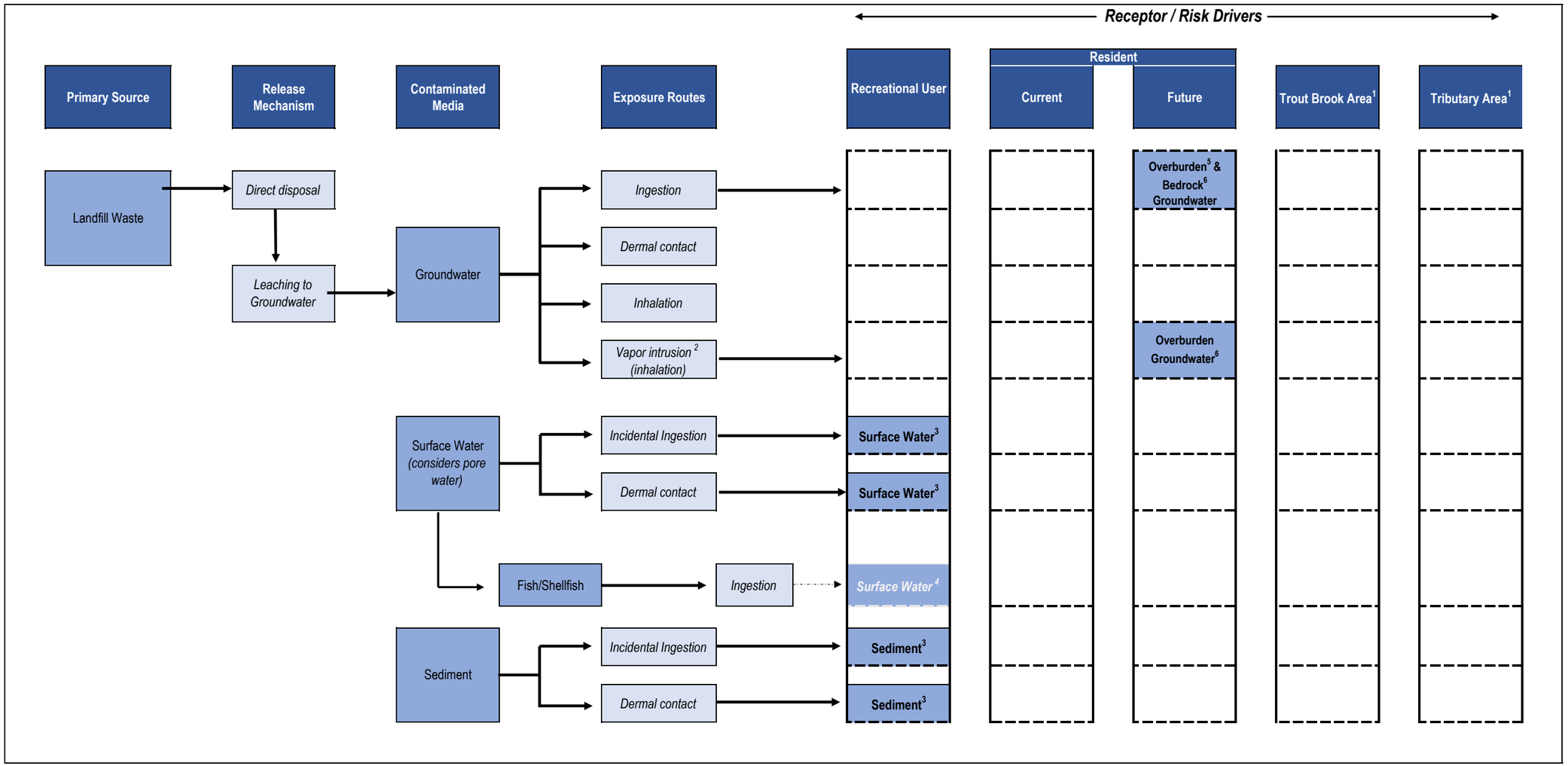
2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Results shown are from wetland and ecological sampling conducted in June/July 2016 and May 2017.
6. Exceedances are based on sample results exceeding the sediment-specific ecological benchmarks presented in the SLERA and Refinement.

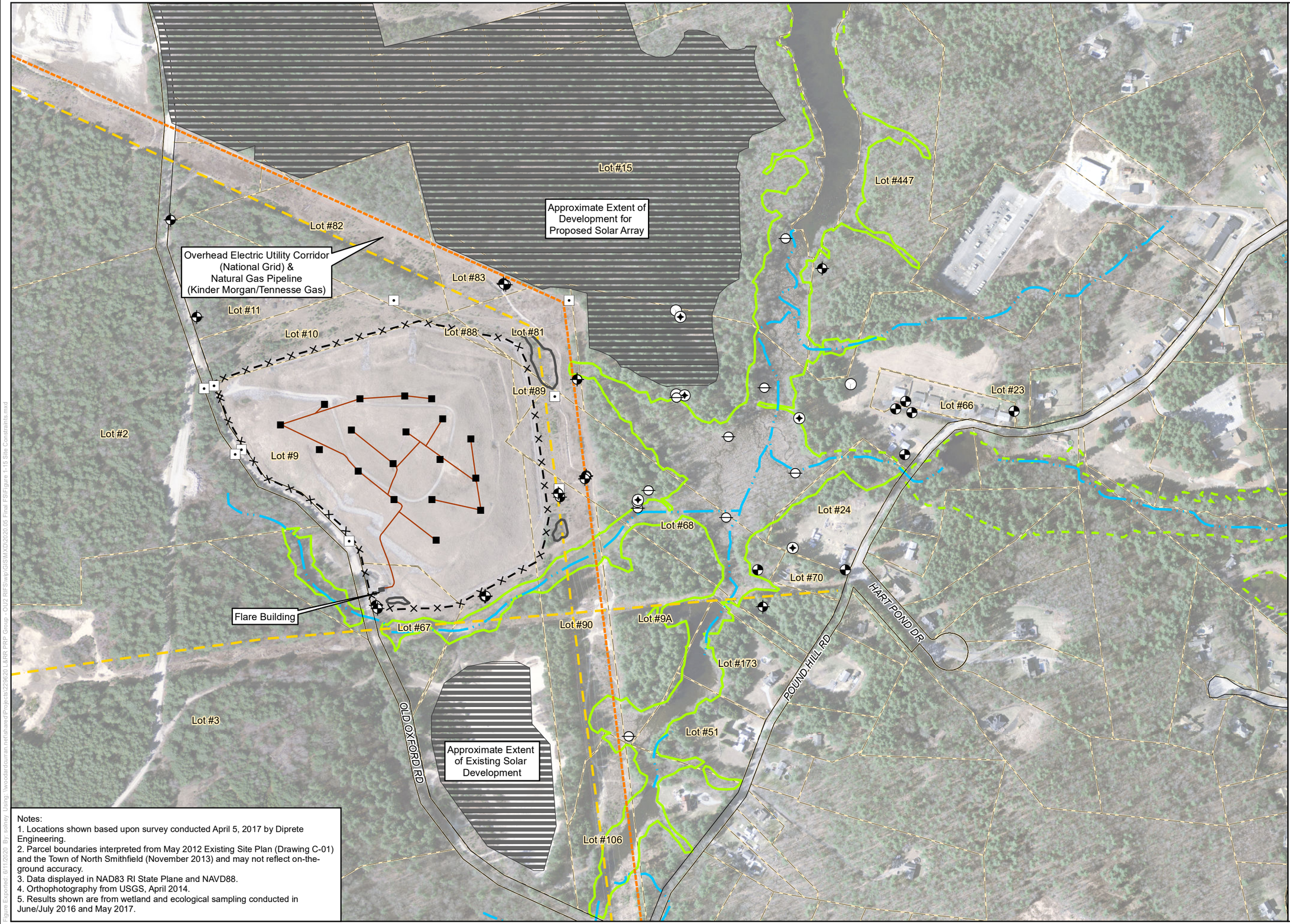
INSET: Northern Extent of Trout Brook Pond (TB-16 and TB-17)

Figure 1-14 Conceptual Site Model
L&RR Landfill Superfund Site
OU 2 Remedial Investigation/Feasibility Study
North Smithfield, Rhode Island



NOTES:

1. USEPA provided a memorandum, dated September 12, 2018, which provided concurrence on the conclusions of the September 2018 version of the SLERA and Refinement along with acknowledgement that a BERA was not required. This memorandum also indicated there was no clear indication of ecological risk for which remedial action would be required. No Receptor/Risk Drivers are indicated in this CSM based on USEPA's concurrence in this memorandum.
2. Evaluated qualitatively in HHRA through comparison to vapor intrusion screening levels.
3. Recreational users of the Trout Brook, Tributaries and Trout Brook Pond Areas may encounter COPCs in surface water and shallow sediment driven by risks associated with arsenic and hexavalent chromium (if present).
4. Evaluated qualitatively in the HHRA through comparison to surface water quality standards.
5. Overburden groundwater COCs include:
   VOCs: 1,4-dichlorobenzene, 1,1-DCA, 1,2-DCA, 1,2-dichloropropane, 1,4-dioxane, cis-1,2-DCE, benzene, naphthalene, TCE, vinyl chloride,
   SVOCs: bis-2-ethylhexylphthalate
   Metals: antimony, arsenic, chromium (hexavalent), iron, manganese
   PFAS: PFOA (incl. total PFOA/PFOS)
6. Bedrock groundwater COCs include:
   VOCs: 1,1-DCA, 1,2-DCA, 1,4-dioxane, 2-hexanone, benzene, TCE, PCE, vinyl chloride
   Metals: arsenic, chromium (hexavalent)
   PFAS: PFOA (incl. total PFOA and PFOS)



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2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Results shown are from wetland and ecological sampling conducted in June/July 2016 and May 2017.

N

Figure 1-15

Site and Remedial Design Considerations

L&RR Superfund Site
OU 2 Remedial Investigation/ Feasibility Study
North Smithfield, Rhode Island

Legend

- Monitoring Well
- Overburden CMT
- Bedrock CMT
- Piezometer
- Residential Well
- Gas Probe
- Gas Well
- Gas Collection Pipe
- Fence Line
- Surface Water Detention Basins
- Approximate location of Natural Gas Pipeline
- Approximate location of Electric Transmission Lines

Wetlands

- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Stream Channel
- Interpreted Parcel Boundaries
- Roads

0 100 200 400 Feet

WOODARD &CURRAN

Project #: 229620
Map Created: June 2020

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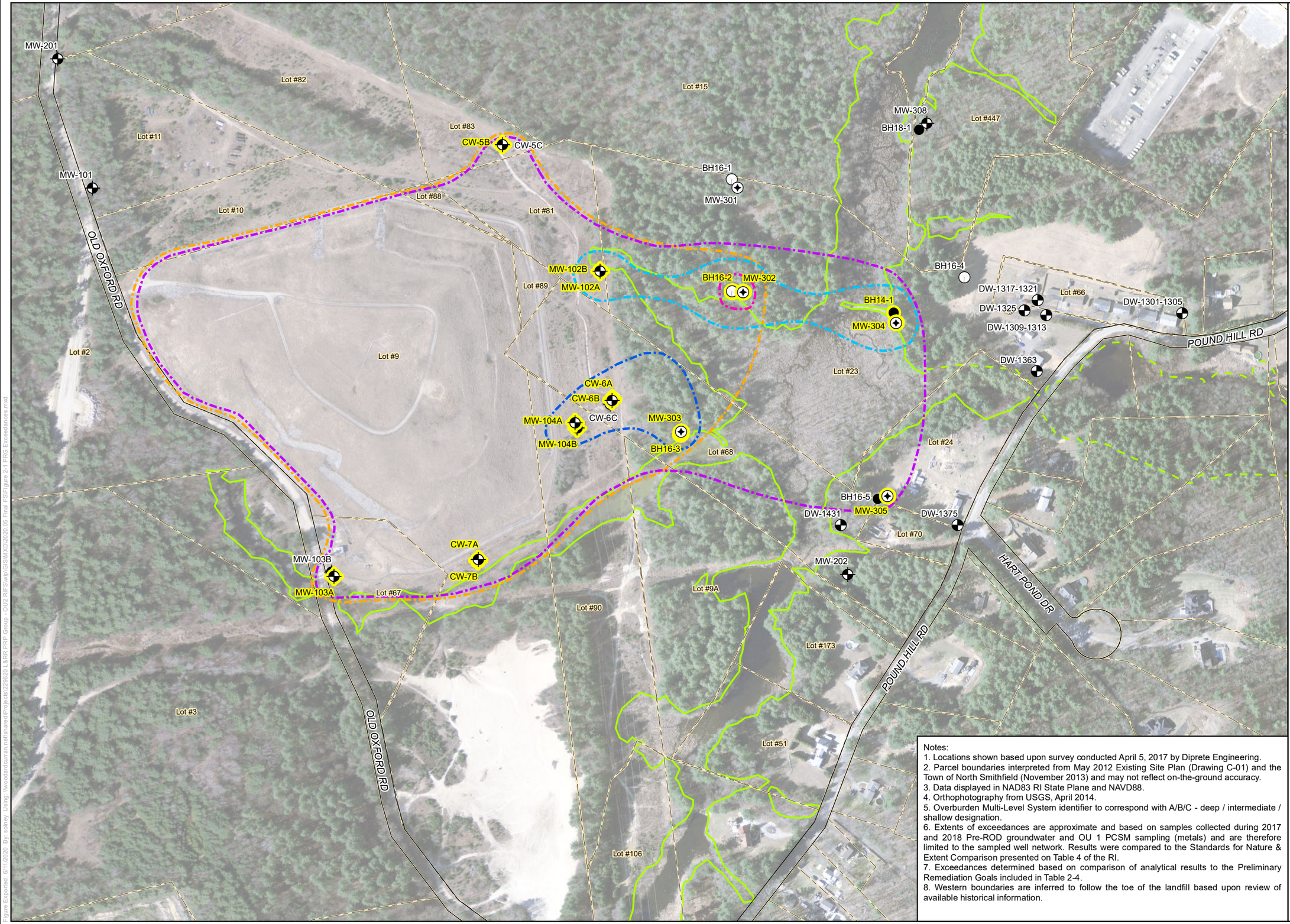

N

Figure 2-1

Exceedances of Preliminary Remediation Goals in Groundwater

L&RR Superfund Site
OU 2 Remedial Investigation/ Feasibility Study
North Smithfield, Rhode Island

Legend

- Bedrock Multi-Level System
- Bedrock Borehole
- Monitoring Well
- Overburden Multi-Level System
- Residential Well
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries

Approximate Extent of Exceedances in Groundwater

- 1,4-Dioxane
- Other VOCs
- PFAS
- Metals
- SVOCs
- Sampling location with a PRG exceedance

1 inch = 300 feet

0 75 150 300 Feet

Notes:
1. Locations shown based upon survey conducted April 5, 2017 by Diprete Engineering.
2. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
3. Data displayed in NAD83 RI State Plane and NAVD88.
4. Orthophotography from USGS, April 2014.
5. Overburden Multi-Level System identifier to correspond with A/B/C - deep / intermediate / shallow designation.
6. Extents of exceedances are approximate and based on samples collected during 2017 and 2018 Pre-ROD groundwater and OU 1 PCSM sampling (metals) and are therefore limited to the sampled well network. Results were compared to the Standards for Nature & Extent Comparison presented on Table 4 of the RI.
7. Exceedances determined based on comparison of analytical results to the Preliminary Remediation Goals included in Table 2-4.
8. Western boundaries are inferred to follow the toe of the landfill based upon review of available historical information.

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Project #: 229620
Map Created: June 2020

Figure Exported: 6/11/2020 By: soliney Using: \\woodardcurran.net\shared\Projects\229620 L&RR PRP Group - OU2 RI\FS\wip\GIS\MXD\2020.05 Final FS\Figure 2-1 PRG Exceedances.mxd

Figure 4-1

Conceptual Plan for Alternative 3 Groundwater Extraction, Ex Situ Treatment, and Infiltration of Treated Groundwater

L&RR Superfund Site
OU 2 Remedial Investigation/
Feasibility Study
North Smithfield, Rhode Island

N

Legend

- Bedrock Multi-Level System
- Bedrock Borehole
- Monitoring Well
- Overburden Multi-Level System
- Residential Well
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries

Approximate Extent of Exceedances in Groundwater

- 1,4-Dioxane
- Other VOCs
- PFAS
- Metals
- SVOCs
- Proposed Extraction Well Locations
- Proposed Groundwater Treatment Plant Location
- Proposed Location of Infiltration Basins
- Proposed Conveyance Piping
- Approximate Area of Potential Wetland Disturbance

1 inch = 300 feet

0 75 150 300 Feet

Compounds with Concentrations Exceeding Standards (shown)

Volatile Organic Compounds (VOCs)	Metals
1,4-Dioxane (0.35 ug/L)	Antimony (6 ug/L)
cis-1,2-Dichloroethene (70 ug/L)	Arsenic (10 ug/L)
Vinyl Chloride (2 ug/L)	Iron (300 ug/L)
Tetrachloroethene (5 ug/L)	Manganese (50 ug/L)
Per- & Polyfluorosubtances (PFAS)	**Semi-Volatile Organic Compounds (SVOCs)**
PFOA (40.1 ng/L)	bis(2-Ethylhexyl)phthalate (6 ug/L)
Total PFOA + PFOS (40.1 ng/L)	

Notes:
1. Figure intended to be a conceptual representation of the proposed layout for Alternative 3.
2. Locations shown based upon survey conducted April 5, 2017 by Diprete Engineering.
3. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
4. Data displayed in NAD83 RI State Plane and NAVD88.
5. Orthophotography from USGS, April 2014.
6. Overburden Multi-Level System identifier to correspond with A/B/C - deep / intermediate / shallow designation.
7. Extents of exceedances are approximate and based on samples collected during 2017 and 2018 Pre-ROD groundwater and OU 1 PCSM sampling (metals) and are therefore limited to the sampled well network.
8. Exceedances determined based on comparison of analytical results to the Standards for Nature and Extent Comparison as provided on the tables included in Section 4 of the RI Report.
9. Western boundaries are inferred to follow the toe of the landfill based upon review of available historical information.

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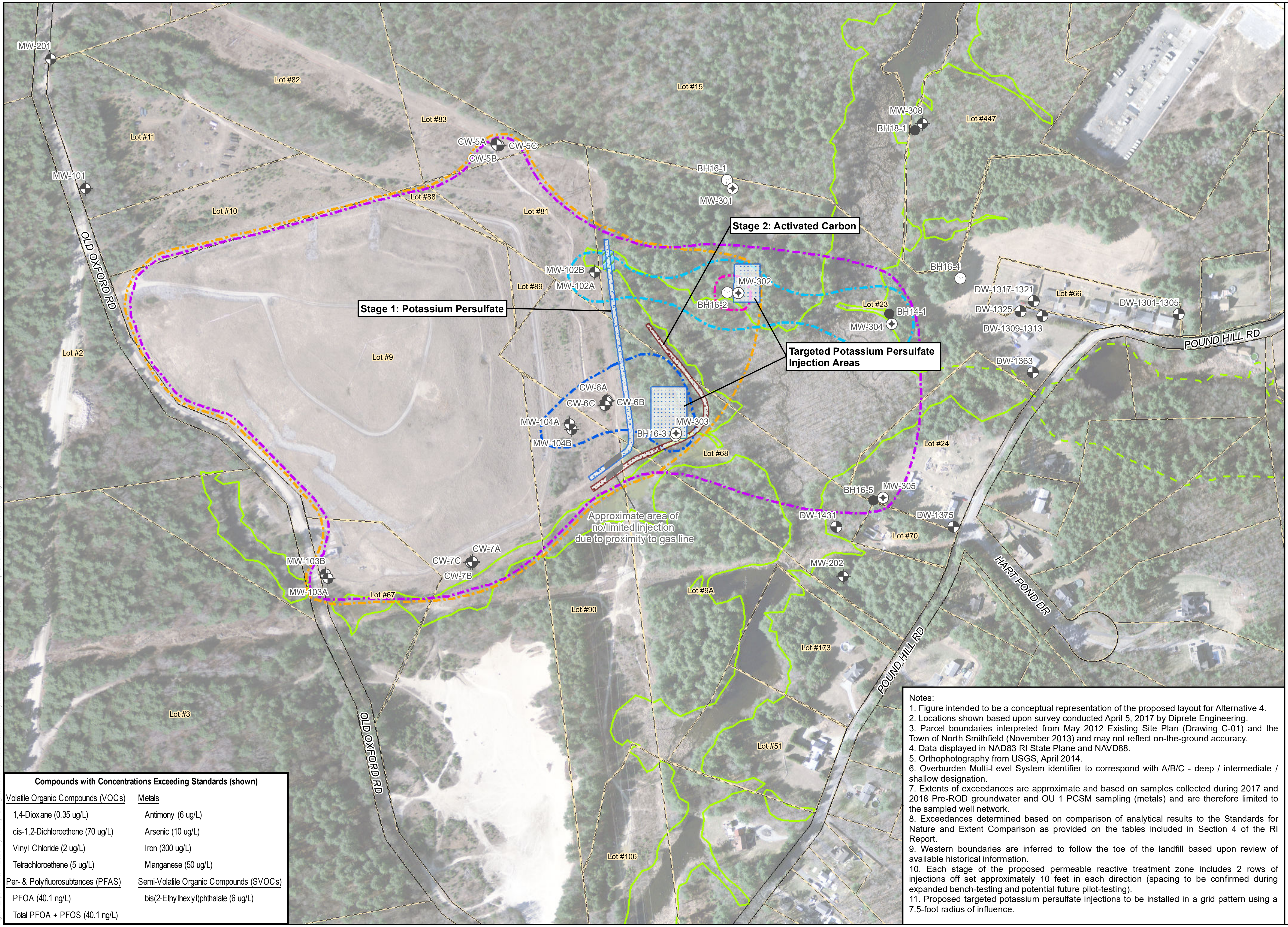
Project #: 229620
Map Created: June 2020

 Data Sources: USGS, Town of North Smithfield, RI



Compounds with Concentrations Exceeding Standards (shown)

Volatile Organic Compounds (VOCs)	Metals
1,4-Dioxane (0.35 ug/L)	Antimony (6 ug/L)
cis-1,2-Dichloroethene (70 ug/L)	Arsenic (10 ug/L)
Vinyl Chloride (2 ug/L)	Iron (300 ug/L)
Tetrachloroethene (5 ug/L)	Manganese (50 ug/L)
Per- & Polyfluorosubtances (PFAS)	**Semi-Volatile Organic Compounds (SVOCs)**
PFOA (40.1 ng/L)	bis(2-Ethylhexyl)phthalate (6 ug/L)
Total PFOA + PFOS (40.1 ng/L)	

Notes:
1. Figure intended to be a conceptual representation of the proposed layout for Alternative 4.
2. Locations shown based upon survey conducted April 5, 2017 by Diprete Engineering.
3. Parcel boundaries interpreted from May 2012 Existing Site Plan (Drawing C-01) and the Town of North Smithfield (November 2013) and may not reflect on-the-ground accuracy.
4. Data displayed in NAD83 RI State Plane and NAVD88.
5. Orthophotography from USGS, April 2014.
6. Overburden Multi-Level System identifier to correspond with A/B/C - deep / intermediate / shallow designation.
7. Extents of exceedances are approximate and based on samples collected during 2017 and 2018 Pre-ROD groundwater and OU 1 PCSM sampling (metals) and are therefore limited to the sampled well network.
8. Exceedances determined based on comparison of analytical results to the Standards for Nature and Extent Comparison as provided on the tables included in Section 4 of the RI Report.
9. Western boundaries are inferred to follow the toe of the landfill based upon review of available historical information.
10. Each stage of the proposed permeable reactive treatment zone includes 2 rows of injections off set approximately 10 feet in each direction (spacing to be confirmed during expanded bench-testing and potential future pilot-testing).
11. Proposed targeted potassium persulfate injections to be installed in a grid pattern using a 7.5-foot radius of influence.

N

Figure 4-2

Conceptual Plan for Alternative 4 Two-Stage Reactive Treatment Zone

L&RR Superfund Site
OU 2 Remedial Investigation/ Feasibility Study
North Smithfield, Rhode Island

Legend

- Bedrock Multi-Level System
- Bedrock Borehole
- Monitoring Well
- Overburden Multi-Level System
- Residential Well
- Surveyed Extent of Wetland Features (July 2016)
- Approximate Extent of Wetland Features
- Interpreted Parcel Boundaries

Approximate Extent of Exceedances in Groundwater

- 1,4-Dioxane
- Other VOCs
- PFAS
- Metals
- SVOCs

Proposed Two-Stage Permeable Reactive Treatment Zone

- Stage 1: Potassium Persulfate
- Stage 2: Activated Carbon
- Potassium Persulfate Targeted Injection Areas
- Approximate Area of Potential Wetland Disturbance

1 inch = 300 feet

0 75 150 300 Feet

WOODARD & CURRAN

Project #: 229620
Map Created: June 2020

Appendix D - ARARs Tables

Alternative 3: Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 3: Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 3: Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 4: Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 4: Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 4: Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

Alternative 3:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Groundwater	Safe Drinking Water Act (SDWA) – National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs) (40 CFR Part 141, Subparts B and G)[1]	Relevant and Appropriate	Establishes MCLs for a number of common organic and inorganic contaminants applicable to public drinking water supply systems. MCLs are relevant and appropriate for Site groundwater because groundwater in the vicinity is used as a drinking water supply.	MCLs were considered in the development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. Institutional controls (ICs) will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	SDWA - National Primary Drinking Water Regulations, MCLGs (40 CFR Part 141, Subpart F)	Relevant and Appropriate for non-zero MCLGs only	Establishes Maximum Contaminant Level Goals (MCLGs) for public drinking water supply. MCLGs are health goals for drinking water sources. Non-zero MCLGs are relevant and appropriate.	Non-zero MCLGs were considered in development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	Health Advisories (EPA Office of Drinking Water)	To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water.	These health advisories were considered in the development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk- based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	USEPA Risk Reference Doses (RfDs)	To Be Considered	Risk RfDs are estimates of daily exposure levels that are unlikely to cause significant adverse non-carcinogenic health effects over a lifetime.	RfDs were used to characterize human health risks due to non-carcinogens. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.

[1] For any COCs with Rhode Island MCLs set forth in Section 1.6 of the Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1) and Section 2.11 of the Rhode Island Private Drinking Water Systems Regulations (216-RICR-50-05-2), the Rhode Island MCLs are the same as the SDWA federal MCLs.

Alternative 3:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Groundwater	USEPA Carcinogenic Assessment Group (CAG) Potency Factors	To Be Considered	Used to calculate the incremental cancer risk from contaminant exposures.	These factors were used to calculate incremental cancer risk from exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	These factors were used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk- based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Guidelines for Carcinogenic Risk Assessment (RPA/630/P-03/001F)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	These guidelines were used to calculate potential carcinogenic risks caused by exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (RPA/630/R-03/001F)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	This guidance was used to evaluate potential carcinogenic risks to children caused by exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.

Alternative 3:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Groundwater	Rhode Island Rules and Regulations Pertaining to Water Resources and Water Quality, Groundwater Quality Rules (250 RICR-1450-05-3)	Applicable	Sets requirements to protect and restore groundwater quality to drinking water uses. Provides classification of groundwater throughout the state. Sets groundwater remediation standards for drinking water and non-drinking water groundwater classes.	These standards were used to develop groundwater cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	Rhode Island Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations) (250-RICR-140-30-1)	Applicable	These regulations set remediation standards for contaminated media resulting from the unpermitted release of hazardous material.	These standards were used to develop groundwater cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through groundwater extraction and treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.

Alternative 3:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Floodplains	Protection of Floodplains: FEMA Regulations (44 CFR Part 9) Floodplains Executive Order (EO 11988 and 13690)	Relevant and Appropriate	FEMA regulations that set forth the policy, procedure, and responsibilities to implement and enforce Executive Order 11988 and 13690 (Floodplain Management). Requires the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain and to avoid development within floodplain wherever there is a practicable alternative, and to improve resilience to current and future flood risks. An assessment of impacts to 500-year floodplain is required for critical actions – which includes siting waste facilities in a floodplain. Requires public notice when proposing any action in or affecting floodplain or wetlands.	There is no practicable alternative method to work in federal jurisdictional floodplains while installing and sampling monitoring wells. All practicable measures will be taken to minimize and mitigate any adverse impacts within the regulated 500-year floodplain. After completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood stage or velocities. Floodplain habitat will be restored, to the extent practicable. Public comment was solicited as part of the Proposed Plan concerning any proposed alteration to floodplain.
Wetlands	Protection of Wetlands: FEMA Regulations (44 CFR Part 9) Wetlands Executive Order (EO 11990)	Relevant and Appropriate	FEMA regulations that set forth the policy, procedure, and responsibilities to implement and enforceExecutive Order 11990 (Protection of Wetlands). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	There is no practicable alternative method to work in federal jurisdictional wetlands while installing and sampling monitoring wells. All practicable measures will be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures will be adopted during installation and management activities to protect federal jurisdictional wetlands. Public comment was solicited as part of the Proposed Plan concerning any proposed alteration to wetlands.

Alternative 3:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Wetlands	Clean Water Act Section 404 (33 U.S.C. § 1344); Section 404(b)(1) Guidelines for discharge of dredged or fill material into waters of the U.S. (40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320- 323 and 332)	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity. Sets standards for restoration and mitigation required as a result of unavoidable impacts to aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	Under this alternative installation and management of monitoring wells/extraction, access ways, and treatment systems may possibly impact federal jurisdictional wetlands. Activities affecting wetlands will be conducted in accordance with these requirements including, but not limited to, mitigation and/or restoration. Public comment was solicited on EPA's LEDPA finding in the Proposed Plan.
Other Natural Resources	Archaeological and Historical Preservation Act of 1974 Public Law 93-291	Applicable	When a Federal agency finds, or is notified, that its activities in connection with a Federal construction project may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data, such agency shall notify DOI. Such agency may request DOI to undertake the preservation of such data or it may undertake such activities.	If during remedial design or remedial action it is determined that this alternative may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data, DOI will be notified and these requirements will be complied with.
Other Natural Resources	National Historic Preservation Act (16 USC 470, 36 CFR Part 800)	Applicable	A federal agency must take into account the project's effect on properties included or eligible for inclusion in the National Register of Historic Places	If the project affects any properties included or eligible for inclusion in the National Register of Historic Places, these requirements will be complied with.

Alternative 3:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Floodplains	RIDEM Rules for Regulations of Hazardous Waste Management – Location Standards for Hazardous Waste Facilities (250-RICR-140-10-1, Section 1.10.2(18))	Applicable	Rhode Island is delegated to administer the federal RCRA program through its state regulations. The standards of 40 CFR 264.18(b) are incorporated by reference. A facility located in 100-year floodplain must be designed, constructed, operated and maintained to prevent washout of any hazardous waste by 100-year flood, unless demonstrate no adverse effects on human health or the environment will result from washout.	Standards for installing and sampling monitoring/extraction wells, access ways, and treatment systems within the regulated 100-year floodplain will be attained to prevent washout of hazardous wastes by a 100-year flood.
Wetlands	Rules and Regulations for Governing the Administration and Enforcement of the Freshwater Wetlands Act, RIDEM, (RIGL Chapters 2-1-20.1, 42-17.1, and 42- 17.6, as amended, 250-RICR-150-15-1)	Applicable	Sets requirements to prevent the undesirable drainage, excavation, filling, alteration, encroachment, or any other form of disturbance or destruction to a wetland.	Activities involving monitoring and extraction wells, access ways and treatment systems will be conducted to minimize the disturbance of state jurisdictional wetland.
Other Natural Resources	Rhode Island Historic Preservation Act – Rhode Island General Laws 42-45 et seq.	Applicable	Regulations that address the project's effect on properties included or eligible for inclusion in the State/National Registers of Historic Places.	If the project affects any properties included or eligible for inclusion in the State/National Register of Historic Places, these requirementswill be complied with.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Discharges to Surface Waters/ Stormwater Controls	Clean Water Act; National Pollutant Discharge Elimination System (NPDES); 40 C.F.R. Parts 122 and 125	Applicable	Establishes the specifications for discharging pollutants from any point source into the waters of the U.S. Also, includes stormwater standards for activities disturbing more than one acre.	If the implementation of Alternative 3 will impact more than one acre of land, then the groundwater treatment system will be constructed, operated, and maintained to comply with applicable provisions of these regulations. Any water generated from the treatment system and during installation and management of monitoring/extraction wells will be treated to meet substantive discharge standards if the water is to be discharged to surface waters.
Hazardous Waste – Air Emissions	National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)	Applicable	These regulations apply to any stationary source of substances designated as hazardous air pollutants or that have serious health effects from ambient exposure to the substance.	Remedial activities, including the groundwater treatment system will be operated and maintained to comply with applicable provisions of these regulations.
Hazardous Waste – Air Emissions	RCRA, Air Emission Standards for 40 C.F.R. Part 264, Subpart AA Process Vents	Applicable	RCRA emissions standards not delegated to the State. Standards for process vents for systems that treat RCRA wastes that have total organic concentrations of 10 ppm or greater.	If the threshold limit is exceeded, the groundwater treatment system will be operated and maintained to comply with applicable provisions of these regulations. If air treatment of VOCs is required, emission standards for any process vents, if present, will be achieved.
Hazardous Waste – Air Emissions	RCRA, Air Emission Standards for 40 C.F.R. Part 264, Subpart BB Equipment Leaks	Applicable, if VOC emissions over 10 ppm or greater; Relevant and Appropriate, if less than 10 ppm	RCRA emissions standards not delegated to the State. Standards for air equipment leaks for systems that treat RCRA wastes that have total organic concentrations of at least 10% by weight.	If the threshold limit is exceeded, the groundwater treatment system will be operated and maintained to comply with applicable provisions of these regulations. Standards for preventing air emission leaks from treatment systems for VOCs will be achieved.
Surface Water Quality/Sediment Monitoring	Clean Water Act, National Recommended Water Quality Criteria (NRWQC) (33 U.S.C. § 1314, 40 CFR Part 131)	Relevant and Appropriate	NRWQC are provided by USEPA for chemicals for both the protection of human health and the protection of aquatic life.	Will be used as performance standards to monitor the impact of groundwater to surface water.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Air Emissions	Clean Air Act (CAA), Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants (NESHAPS) (42 USC §112(b)(1); 40 CFR Part 61)	Applicable	The regulations establish emissions standards for hazardous air pollutants. Standards set for dust and other release sources.	Remedial activities, including air discharges from treatment system and installation and management of monitoring/extraction wells, will be implemented in accordance with these rules. No air emissions from remedial activities will cause air quality standards to be exceeded. Dust standards will be complied with during construction and management of the treatment system and monitoring/extraction wells.
Groundwater Monitoring	Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels (42 U.S.C. § 300f et seq.; 40 C.F.R. 141, Subparts B and G)[2]	Relevant and Appropriate	Establishes MCLs for a number of common organic and inorganic contaminants applicable to drinking water supply systems. MCLs are relevant and appropriate for Site groundwater because groundwater in the vicinity is used as a drinking water supply.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved.
Groundwater Monitoring	Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (42 U.S.C. § 300f et seq.; 40 C.F.R. 141, Subpart F)	Relevant and Appropriate for non-zero MCLGs only	Establishes MCLGs for public drinking water supply. MCLGs are health goals for drinking water sources. MCLGs are relevant and appropriate.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved.
Groundwater Monitoring	EPA Health Advisories	To Be Considered	Federal risk-based standards for groundwater used as groundwater monitoring standards.	Risk-based standards developed using these advisories will be used as groundwater monitoring standards until groundwater cleanup is achieved.
Investigation-Derived Waste	Management of investigation-derived waste (IDW) from sampling of monitoring wells USEPA (OSWER Publication 9345.3-03 FS, January 1992)	To Be Considered	Management of IDW must ensure protectiveness of human health and the environment.	IDW produced from well installation and sampling will be managed to comply with these requirements.

[2] For the COCs, the Rhode Island MCLs set forth in Section 1.6 of the Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1) and Section 2.11 of the Rhode Island Private Drinking Water Systems Regulations (216-RICR-50-05-2) are the same as the SDWA federal MCLs.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Groundwater Remediation	Summary of Key Existing EPA Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Policies for Groundwater Restoration (OSWER Directive 9283.1-33, June 26, 2009)	To Be Considered	Guidance on developing groundwater remedies at CERCLA sites.	Groundwater remediation standards called for in this guidance will be satisfied through the installation, operation, and maintenance of the groundwater extraction and treatment system. Institutional controls (ICs) will be established that will prevent exposure to contaminated groundwater until cleanup standards are achieved.
Vapor Intrusion	Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (OSWER Publication 9200.2-154, June 2015)	To Be Considered	USEPA guidance for addressing vapor intrusion issues at CERCLA sites.	This guidance will be considered if future building construction is planned. ICs will require future construction to evaluate vapor intrusion risk.
Other Natural Resources	Invasive Species (Executive Order 13112)	To Be Considered	Federal agencies are directed to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause when requiring actions that impact the environment.	If wetland or other restoration is required, invasive species will not be introduced. Restoration will be conducted to comply with this Executive Order.
Underground Injection	Underground Injection Control Program (40 CFR 144, 146, 147)	Applicable	Regulation of construction, operation, permitting, and closure of injection wells used for emplacement of subsurface fluids. These regulations are used to prevent contamination of underground drinking water resources.	Groundwater extraction and treatment will be implemented and maintained in compliance with these standards.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Definitions and Standards for Generators (250-RICR-140-10- 1, Sections 1.5 and 1.7)	Applicable	These rules include relevant definitions and outline requirements for generators, including probations, hazardous waste determination, generator notification and identification, fees, generator quantity determination, manifest, inspections, pre-transport requirements and other applicable aspects associated with the generation of hazardous waste	Hazardous waste generated during the implementation of this alternative, if any, will be managed in accordance with these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Transporters (250-RICR-140-10-1, Section 1.8)	Applicable	Outlines requirements for transporters of hazardous waste.	Any transportation of hazardous waste on-site shall be managed in accordance with the substantive provisions of these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Issuance, Renewal and Conditions of Facility Permits (250-RICR- 140-10-1, Section 1.9)	Applicable	Outlines requirements for treatment, storage, and disposal facilities.	Any treatment, storage or disposal of hazardous waste shall be managed in accordance with the substantive provisions of these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Operational Requirements for Treatment, Storage and Disposal Facilities (250-RICR-140-10-1, Section 1.10)	Applicable	Outlines requirements for treatment, storage, and disposal facilities.	Any treatment, storage or disposal of hazardous waste shall be managed in accordance with these regulations.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards (continued)				
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Requirements for Temporary Transfer and Storage Facilities (250-RICR-140-10-1, Section 1.11)	Applicable	Outlines requirements for temporary transfer and storage facilities.	Hazardous waste generated during the implementation of this alternative, if any, will be managed in accordance with these regulations.
Underground Injection and Groundwater Monitoring	Rules for the Discharge of Non-Sanitary Wastewater and Other Fluid to or Below the Ground Surface (including Underground Injection Control Program Rules), RIDEM Groundwater Discharge Rules (RIGL, Chapters 42-35, 46-12, 46-13.1, 42-17.1, and 42-17.6, 250-RICR-150-05-4)	Applicable	Protection and preservation of groundwater quality of the State of Rhode Island and prevention of contamination of groundwater resources from the discharge of non-sanitary wastewater or other fluid to or below the ground surface.	Groundwater extraction and treatment will be implemented and maintained in compliance with these standards. The discharge of non- sanitary wastewater or other fluid and the associated groundwater discharge system shall be located, designed, constructed, installed, operated, monitored and closed in a manner to prevent such contamination and to protect public health and groundwater quality for current or potential beneficial uses, including use as an underground source of drinking water.
Groundwater Monitoring	Rhode Island Rules and Regulations Pertaining to Water Resources and Water Quality, Groundwater Quality Rules (250 RICR-1450-05-3)	Applicable	Sets requirements to protect and restore groundwater quality to drinking water uses. Provides classification of groundwater throughout the state. Sets groundwater remediation standards for drinking water and non-drinking water groundwater classes.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved.
Groundwater	Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1, Section 1.4(B)(3) and (C))	Relevant and Appropriate	Establishes requirements for buffer zones around new public water supply wells.	This regulation will be used to support implementation of ICs to prevent exposure to contaminated groundwater.
Stormwater	Stormwater Management, Design and Installation Rules (250-RICR-150-10-8)	Applicable	Provides standards for planning, designing, and installing effective stormwater best management practices to effectively manage impacts of stormwater and prevent adverse impacts to water quality, habitat and flood storage capacity.	The groundwater treatment system will be constructed, operated, and maintained to comply with the applicable provisions of these regulations.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards (continued)				
Surface Water Quality/Sediment Monitoring	Rhode Island Water Quality Regulations (250 RICR-150-05-1)	Relevant and Appropriate	Provides water classification for surface waters in the state and sets ambient water quality criteria for toxic substances and governs water quality impacts associated with site activities.	Will be used as performance standards to monitor surface water and sediments during the remedial action.
Air Emissions	Air Pollution Control Regulation No. 7 – Emission of Air Contaminants Detrimental to Person or Property (250- RICR-120-05-7)	Applicable	Prohibits emissions of contaminants that may be injurious to humans, plant, or animal life or cause damage to property or that reasonably interferes with the enjoyment of life and property.	The groundwater treatment system will be constructed, operated, and maintained to comply with the applicable provisions of these regulations.
Air Emissions	Air Pollution Control Regulation No. 9 – Air Pollution Control Permits (250- RICR-120-05-9)	Applicable	Establishes a preconstruction permitting program for stationary sources of air pollution and air pollution control systems.	The groundwater treatment system will be constructed, operated, and maintained to comply with the substantive provisions of these regulations.
Air Emissions	Air Pollution Control Regulation No. 15 – Control of Organic Solvent Emissions (250-RICR-120-05-15)	Applicable	Establishes limits of emissions of volatile organic compounds from stationary sources.	The groundwater treatment system will be constructed, operated, and maintained to comply with the applicable provisions of these regulations.
Air Emissions	Air Pollution Control Regulation No. 17 – Odors (250-RICR-120-05-17)	Applicable	Prohibits the release of air contaminants which may create an objectional odor beyond the source's property line.	The groundwater treatment system will be constructed, operated, and maintained to comply with the applicable provisions of these regulations.
Air Emissions	Air Pollution Control Regulation No. 22 – Air Toxics (250-RICR-120-05-22)	Applicable	Establishes air emission limits for any stationary source using or generating a listed toxic substance.	The groundwater treatment system will be constructed, operated, and maintained to comply with the applicable provisions of these regulations.
Solid Waste	Rules and Regulations for Solid Waste Management Facilities (250-RICR-140-05-1, Section 1.6(B)(2))	Relevant and Appropriate	Prohibits a solid waste management facility from causing groundwater pollution beyond the operational area of the facility.	The groundwater treatment system will be constructed, operated, and maintained, and the groundwater will be monitored, until the groundwater cleanup is achieved.

Alternative 3:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIA	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards (continued)				
Solid Waste	Solid Waste Regulations No. 2 Solid Waste Landfills (250-RICR-140-05-2, Sections 2.1.8(F)(1)(a) and (h) and 2.3.5(c)(2))	Relevant and Appropriate	Establishes requirements for detection monitoring and provides a buffer around sanitary landfills with respect to public water supply wells.	Groundwater monitoring will be conducted in accordance with the substantive requirements of Sections 2.1.8(F)(1)(a) and (h) for the purpose of monitoring environmental conditions outside the landfill. Section 2.3.5(c)(2) will be used to support implementation of ICs to prevent exposure to contaminated groundwater.

Alternative 4:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Groundwater	Safe Drinking Water Act (SDWA) – National Primary Drinking Water Regulations, Maximum Contaminant Levels (MCLs) (40 CFR Part 141, Subparts B and G)[3]	Relevant and Appropriate	Establishes MCLs for a number of common organic and inorganic contaminants applicable drinking water supply systems. MCLs are relevant and appropriate for Site groundwater because groundwater in the vicinity is used as a drinking water supply.	MCLs were considered in the development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. Institutional controls (ICs) will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	SDWA – National Primary Drinking Water Regulations, MCLGs (40 CFR Part 141, Subpart F)	Relevant and Appropriate for non-zero MCLGs only	Establishes Maximum Contaminant Level Goals (MCLGs) for public drinking water supply. MCLGs are health goals for drinking water sources. Non-zero MCLGs are relevant and appropriate.	Non-zero MCLGs were considered in development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	Health Advisories (EPA Office of Drinking Water)	To Be Considered	Health Advisories are estimates of risk due to consumption of contaminated drinking water; they consider non-carcinogenic effects only. To be considered for contaminants in groundwater that may be used for drinking water.	These health advisories were considered in the development of cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in- situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	USEPA Risk Reference Doses (RfDs)	To Be Considered	Risk RfDs are estimates of daily exposure levels that are unlikely to cause significant adverse non-carcinogenic health effects over a lifetime.	RfDs were used to characterize human health risks due to non-carcinogens. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in- situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.

[3] For the COCs, the Rhode Island MCLs set forth in Section 1.6 of the Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1) and Section 2.11 of the Rhode Island Private Drinking Water Systems Regulations (216-RICR-50-05-2) are the same as the SDWA federal MCLs.

Alternative 4:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Groundwater	USEPA Carcinogenic Assessment Group (CAG) Potency Factors	To Be Considered	Used to calculate the incremental cancer risk from contaminant exposures.	These factors were used to calculate incremental cancer risk from exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Human Health Assessment Cancer Slope Factors (CSFs)	To Be Considered	CSFs are estimates of the upper-bound probability of an individual developing cancer as a result of a lifetime exposure to a particular concentration of a potential carcinogen.	These factors were used to compute the individual incremental cancer risk resulting from exposure to carcinogenic contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in- situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Guidelines for Carcinogenic Risk Assessment (RPA/630/P-03/001F)	To Be Considered	These guidelines provide guidance on conducting risk assessments involving carcinogens.	These guidelines were used to calculate potential carcinogenic risks caused by exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.
Groundwater	Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens (RPA/630/R-03/001F)	To Be Considered	This provides guidance on assessing risk to children from carcinogens.	This guidance was used to evaluate potential carcinogenic risks to children caused by exposure to contaminants. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds calculated risk-based standards developed using this guidance until groundwater cleanup standards are achieved.

Alternative 4:
Chemical-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Groundwater	Rhode Island Rules and Regulations Pertaining to Water Resources and Water Quality, Groundwater Quality Rules (250 RICR-1450-05-3)	Applicable	Sets requirements to protect and restore groundwater quality to drinking water uses. Provides classification of groundwater throughout the state. Sets groundwater remediation standards for drinking water and non-drinking water groundwater classes.	These standards were used to develop groundwater cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.
Groundwater	Rhode Island Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases (Remediation Regulations) (250-RICR-140-30-1)	Applicable	These regulations set remediation standards for contaminated media resulting from the unpermitted release of hazardous material.	These standards were used to develop groundwater cleanup levels. Outside of the compliance boundary of the landfill, cleanup levels will be met through *in-situ* treatment. ICs will prevent exposure to groundwater that exceeds these standards until groundwater cleanup standards are achieved.

Alternative 4:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Floodplains	Protection of Floodplains: FEMA Regulations (44 CFR Part 9) Floodplains Executive Order (EO 11988 and 13690)	Relevant and Appropriate	FEMA regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11988 and 13690 (Floodplain Management). Requires the avoidance of impacts associated with the occupancy and modification of federally-designated 100-year and 500-year floodplain and to avoid development within floodplain wherever there is a practicable alternative, and to improve resilience to current and future flood risks. An assessment of impacts to 500-year floodplain is required for critical actions – which includes siting waste facilities in a floodplain. Requires public notice when proposing any action in or affecting floodplains or wetlands.	There is no practicable alternative method to work in federal jurisdictional floodplains while installing and sampling monitoring wells. All practicable measures will be taken to minimize and mitigate any adverse impacts within the regulated 500-year floodplain. After completion of the work, there will be no significant net loss of flood storage capacity and no significant net increase in flood stage or velocities. Floodplain habitat will be restored, to the extent practicable. Public comment was solicited as part of the Proposed Plan concerning any proposed alteration to floodplain.
Wetlands	Protection of Wetlands: FEMA Regulations (44 CFR Part 9) Wetlands Executive Order (EO 11990)	Relevant and Appropriate	FEMA regulations that set forth the policy, procedure and responsibilities to implement and enforce Executive Order 11990 (Protection of Wetlands). Prohibits activities that adversely affect a federally-regulated wetland unless there is no practicable alternative and the proposed action includes all practicable measures to minimize harm to wetlands that may result from such use.	There is no practicable alternative method to work in federal jurisdictional wetlands while installing and sampling monitoring wells. All practicable measures will be taken to minimize and mitigate any adverse impacts. Erosion and sedimentation control measures will be adopted during installation and management activities to protect federal jurisdictional wetlands. Public comment was solicited as part of the Proposed Plan concerning any proposed alteration to wetlands.

Alternative 4:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Wetlands	Clean Water Act Section 404 (33 U.S.C. § 1344); Section 404(b)(1) Guidelines for discharge of dredged or fill material into waters of the U.S. (40 C.F.R. Part 230, 231 and 33 C.F.R. Parts 320- 323 and 332)	Applicable	For discharge of dredged or fill material into water bodies or wetlands, there must be no practical alternative with less adverse impact on aquatic ecosystem; discharge cannot cause or contribute to violation of state water quality standard or toxic effluent standard or jeopardize threatened or endangered (T&E) species; discharge cannot significantly degrade waters of U.S.; must take practicable steps to minimize and mitigate adverse impacts; must evaluate impacts on flood level, flood velocity, and flood storage capacity. Sets standards for restoration and mitigation required as a result of unavoidable impacts to aquatic resources. EPA must determine which alternative is the "Least Environmentally Damaging Practicable Alternative" (LEDPA) to protect wetland and aquatic resources.	Under this alternative installation and management of monitoring wells, access ways, and injection/re-injection of remedial amendments may possibly impact federal jurisdictional wetlands. Activities effecting wetlands will be conducted in accordance with these requirements including, but not limited to, mitigation and/or restoration. Public comment was solicited on EPA's LEDPA finding in the proposed Plan.
Other Natural Resources	Archaeological and Historical Preservation Act of 1974 Public Law 93-291	Applicable	When a Federal agency finds, or is notified, that its activities in connection with a Federal construction project may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data, such agency shall notify DOI. Such agency may request DOI to undertake the preservation of such data or it may undertake such activities.	If during remedial design or remedial action it is determined that this alternative may cause irreparable loss or destruction of significant scientific, prehistoric, historical, or archeological data, DOI will be notified and these requirements will be complied with.
Other Natural Resources	National Historic Preservation Act (16 USC 470, 36 CFR Part 800)	Applicable	A federal agency must take into account the project's effect on properties included or eligible for inclusion in the National Register of Historic Places	If the project affects any properties included or eligible for inclusion in the National Register of Historic Places, these requirements will be complied with.

Alternative 4:
Location-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Floodplains	RIDEM Rules for Regulations of Hazardous Waste Management – Location Standards for Hazardous Waste Facilities (250- RICR-140-10-1, Section 1.10.2(18))	Applicable	Rhode Island is delegated to administer the federal RCRA program through its state regulations. The standards of 40 CFR 264.18(b) are incorporated by reference. A facility located in 100-year floodplain must be designed, constructed, operated and maintained to prevent washout of any hazardous waste by 100-year flood, unless demonstrate no adverse effects on human health or the environment will result from washout.	Standards for installing and sampling monitoring wells, access ways, and injection/re-injection of remedial amendments within the regulated 100-year floodplain will be attained to prevent washout of hazardous wastes by a 100-year flood.
Wetlands	Rules and Regulations for Governing the Administration and Enforcement of the Freshwater Wetlands Act, RIDEM, (RIGL Chapters 2-1-20.1, 42-17.1, and 42- 17.6, as amended, 250-RICR-150-15- 1)	Applicable	Sets requirements to prevent the undesirable drainage, excavation, filling, alteration, encroachment, or any other form of disturbance or destruction to a wetland.	Activities involving monitoring and extraction wells, access ways and treatment systems will be conducted to minimize the disturbance of state jurisdictional wetland.
Other Natural Resources	Rhode Island Historic Preservation Act – Rhode Island General Laws 42-45 et seq.	Applicable	Regulations that address the project's effect on properties included or eligible for inclusion in the State/National Registers of Historic Places.	If the project affects any properties included or eligible for inclusion in the State/National Register of Historic Places, these requirements will be complied with.

Alternative 4:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards				
Underground Injection	Underground Injection Control Program (40 CFR 144, 146, 147	Applicable	Regulation of construction, operation, permitting, and closure of injection wells used for emplacement of subsurface fluids. These regulations are used to prevent contamination of underground drinking water resources.	*In situ* treatment will be implemented and maintained in compliance with these standards.
Surface Water Quality/Sediment Monitoring	Clean Water Act, National Recommended Water Quality Criteria (NRWQC) (33 U.S.C. § 1314, 40 CFR Part 131)	Relevant and Appropriate	NRWQC are provided by USEPA for chemicals for both the protection of human health and the protection of aquatic life.	Will be used as performance standards to monitor the impact of groundwater to surface water.
Chemical, Physical, and Biological Treatment	RCRA, Interim Status Treatment, Storage, and Disposal Facility Standards, Chemical, Physical and Biological Treatment (40 CFR Part 265 Subpart Q)	Relevant and Appropriate	Standards for operating chemical, physical and biological treatment systems, including the proper handling of reagents, system maintenance, and closure procedures.	*In situ* treatment will be implemented and maintained in compliance with these standards.
Groundwater Monitoring	Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Levels (42 U.S.C. § 300f et seq.; 40 C.F.R. 141, Subparts B and G)[4]	Relevant and Appropriate	Establishes MCLs for a number of common organic and inorganic contaminants applicable to drinking water supply systems. MCLs are relevant and appropriate for Site groundwater because groundwater in the vicinity is used as a drinking water supply.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved through *in situ* treatment.
Groundwater Monitoring	Safe Drinking Water Act; National Primary Drinking Water Regulations, Maximum Contaminant Level Goals (42 U.S.C. § 300f et seq.; 40 C.F.R. 141, Subpart F)	Relevant and Appropriate for non-zero MCLGs only	Establishes MCLGs for public drinking water supply. MCLGs are health goals for drinking water sources. MCLGs are relevant and appropriate.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved through *in situ* treatment.

[4] For any COCs with Rhode Island MCLs set forth in Section 1.6 of the Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1) and Section 2.11 of the Rhode Island Private Drinking Water Systems Regulations (216-RICR-50-05-2), the Rhode Island MCLs are the same as the SDWA federal MCLs.

Alternative 4:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
Federal Standards (continued)				
Groundwater Monitoring	EPA Health Advisories	To Be Considered	Federal risk-based standards for groundwater used as groundwater monitoring standards.	Risk-based standards developed using these advisories will be used as groundwater monitoring standards until groundwater cleanup is achieved through *in situ* treatment.
Investigation-Derived Waste	Management of investigation-derived waste (IDW) from sampling of monitoring wells USEPA (OSWER Publication 9345.3-03 FS, January 1992)	To Be Considered	Management of IDW must ensure protectiveness of human health and the environment.	IDW produced from well installation and sampling and *in situ* treatment will be managed to comply withthese requirements.
Groundwater Remediation	Summary of Key Existing EPA Comprehensive Environmental Response Compensation and Liability Act (CERCLA) Policies for Groundwater Restoration (OSWER Directive 9283.1-33, June 26, 2009)	To Be Considered	Guidance on developing groundwater remedies at CERCLA sites.	Groundwater remediation standards called for in this guidance will be satisfied through *in situ* treatment. Institutional controls (ICs) will be established that will prevent exposure to contaminated groundwater until cleanup standards are achieved.
Vapor Intrusion	Technical Guide for Assessing and Mitigating the Vapor Intrusion Pathway from Subsurface Vapor Sources to Indoor Air (OSWER Publication 9200.2-154, June 2015)	To Be Considered	USEPA guidance for addressing vapor intrusion issues at CERCLA sites.	This guidance will be considered if future building construction is planned. ICs will require future construction to evaluate vapor intrusion risk.
Other Natural Resources	Invasive Species (Executive Order 13112)	To Be Considered	Federal agencies are directed to prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause when requiring actions that impact the environment.	If wetland or other restoration is required, invasive species will not be introduced. Restoration will be conducted to comply with this Executive Order.

Alternative 4:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards				
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management Definitions and Standards for Generators (250-RICR-140-10- 1, Sections 1.5 and 1.7)	Applicable	These rules include relevant definitions and outline requirements for generators, including probations, hazardous waste determination, generator notification and identification, fees, generator quantity determination, manifest, inspections, pre-transport requirements and other applicable aspects associated with the generation of hazardous waste.	Hazardous waste generated during the implementation of this alternative, if any, will be managed in accordance with these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Transporters (250-RICR-140-10-1, Section 1.8)	Applicable	Outlines requirements for transporters of hazardous waste.	Any transportation of hazardous waste on-site shall be managed in accordance with the substantive provisions of these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Issuance, Renewal and Conditions of Facility Permits (250-RICR- 140-10-1, Section 1.9)	Applicable	Outlines requirements for treatment, storage, and disposal facilities.	Any treatment, storage or disposal of hazardous waste shall be managed in accordance with the substantive provisions of these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management, Operational Requirements for Treatment, Storage and Disposal Facilities (250-RICR- 140-10-1, Section 1.10)	Applicable	Outlines requirements for treatment, storage, and disposal facilities.	Any treatment, storage or disposal of hazardous waste shall be managed in accordance with these regulations.
Hazardous Waste	Rhode Island Rules and Regulations for Hazardous Waste Management Requirements for Temporary Transfer and Storage Facilities (250-RICR-140-10-1, Section 1.11)	Applicable	Outlines requirements for temporary transfer and storage facilities.	Hazardous waste generated during the implementation of this alternative, if any, will be managed in accordance with these regulations.

Alternative 4:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards (continued)				
Underground Injection and Groundwater Monitoring	Rules for the Discharge of Non-Sanitary Wastewater and Other Fluid to or Below the Ground Surface (including Underground Injection Control Program Rules), RIDEM Groundwater Discharge Rules (RIGL, Chapters 42-35, 46-12, 46-13.1, 42-17.1, and 42-17.6, 250-RICR-150-05-4)	Applicable	Protection and preservation of groundwater quality of the State of Rhode Island and prevention of contamination of groundwater resources from the discharge of non-sanitary wastewater or other fluid to or below the ground surface.	*In situ* treatment will be implemented and maintained in compliance with these standards. The discharge of non-sanitary wastewater or other fluid and the associated groundwater discharge system shall be located, designed, constructed, installed, operated, monitored and closed in a manner to prevent such contamination and to protect public health and groundwater quality for current or potential beneficial uses, including use as an underground source of drinking water.
Groundwater Monitoring	Rhode Island Rules and Regulations Pertaining to Water Resources and Water Quality, Groundwater Quality Rules (250 RICR-1450-05-3)	Applicable	Sets requirements to protect and restore groundwater quality to drinking water uses. Provides classification of groundwater throughout the state. Sets groundwater remediation standards for drinking water and non-drinking water groundwater classes.	Standards used as groundwater monitoring standards until groundwater cleanup is achieved through *in situ* treatment.
Groundwater	Rhode Island Public Drinking Water Regulations (216-RICR-50-05-1, Sections 1.4(B)(3) and (C))	Relevant and Appropriate	Establishes requirements for buffer zones around new public water supply wells.	This regulation will be used to support implementation of ICs to prevent exposure to contaminated groundwater.
Stormwater	Stormwater Management, Design and Installation Rules (250-RICR-150-10-8)	Applicable	Provides standards for planning, designing and installing effective stormwater best management practices to effectively manage impacts of stormwater and prevent adverse impacts to water quality, habitat and flood storage capacity.	The groundwater treatment system will be constructed, operated and maintained to comply with the applicable provisions of these regulations.
Surface Water Quality/Sediment Monitoring	Rhode Island Water Quality Regulations (250 RICR-150-05-1)	Relevant and Appropriate	Provides water classification for surface waters in the state and sets ambient water quality criteria for toxic substances and governs water quality impacts associated with site activities.	Will be used as performance standards to monitor surface water and sediments during the remedial action.

Alternative 4:
Action-Specific Applicable or Relevant and Appropriate Requirements and To Be Considered Criteria

MEDIUM	REQUIREMENT	STATUS	REQUIREMENT SYNOPSIS	ACTION TO BE TAKEN TO ATTAIN REQUIREMENT
State Standards (continued)				
Solid Waste	Rules and Regulations for Solid Waste Management Facilities (250-RICR-140-05-1, Section 1.6(B)(2))	Relevant and Appropriate	Prohibits a solid waste management facility from causing groundwater pollution beyond the operational area of the facility.	The groundwater treatment system will be constructed, operated and maintained, and the groundwater will be monitored, until the groundwater cleanup is achieved.
Solid Waste	Solid Waste Regulations No. 2 Solid Waste Landfills (250-RICR-140-05-2, Sections 2.1.8(F)(1)(a) and (h) and 2.3.5(c)(2))	Relevant and Appropriate	Establishes requirements for detection monitoring and provides a buffer around sanitary landfills with respect to public water supply wells.	Groundwater monitoring will be conducted in accordance with the substantive requirements of Sections 2.1.8(F)(1)(a) and (h) of these regulations for the purpose of monitoring environmental conditions outside the landfill. Section 2.3.5(c)(2) will be used to support implementation of ICs to prevent exposure to contaminated groundwater.

Appendix E - Acronyms and Abbreviations

AC	activated carbon
ADAF	age-dependent adjustment factors
ADD	average daily dose
AO	advanced oxidation
AMSL	above mean sea level
AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
AVS	acid volatile sulfides
BERA	Baseline Ecological Risk Assessment
bgs	below ground surface
BHHRA	Baseline Human Health Risk Assessment
CAA	Clean Air Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
C.F.R.	Code of Federal Regulations
cm/sec	centimeters per second
COC	contaminant of concern / chemical of concern
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
CSM	conceptual site model
CSF	cancer slope factor
CTE	central tendency exposure
CVOC	chlorinated volatile organic compound
CWA	Clean Water Act
DCE	cis 1,2-dichloroethene
DPT	direct-push technology
ELUR	Environmental Land Use Restriction
EPA	United States Environmental Protection Agency
EPC	exposure point concentration
ESD	Explanation of Significant Differences
FEMA	Federal Emergency Management Agency
FS	Feasibility Study
GAC	granular activated carbon
GQR	Groundwater Quality Rules
GW	groundwater
HHRA	Human Health Risk Assessment
HI	hazard index
HPFM	heat pulse flow meter
HQ	hazard quotient
ICs	institutional controls
ILCR	incremental lifetime cancer risk
IUR	inhalation unit risk
IDW	investigation-derived waste
ISCO	*in-situ* chemical oxidation
LADD	lifetime average daily dose
LTM	long-term monitoring
MCL	Maximum Contaminant Level

MEK	methyl ethyl ketone
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
NPL	National Priorities List
NRWQC	National Recommended Water Quality Criteria
O&M	operations and maintenance
OSWER	Office of Solid Waste and Emergency Response
OU	Operable Unit
PCE	tetrachloroethene
PCSM	post-closure site monitoring
PDI	pre-design investigation(s)
PFAS	per- and polyfluorinated alkyl substances
PFCA	perfluorinated carboxylic acids
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonate
PFSA	perfluorinated sulfonates
PPE	Personal Protective Equipment
ppm	part per million
PRG	preliminary remediation goal
PRP	potentially responsible party
RAGS	EPA Risk Assessment Guidance for Superfund
RAO	remedial action objective
RCRA	Resource Conservation and Recovery Act
RfC	reference concentration
RfD	reference dose
RI	Remedial Investigation
RIDEM	Rhode Island Department of Environmental Management
RME	reasonable maximum exposure
ROD	Record of Decision
SEM	simultaneously extracted metals
SEMD	Superfund and Emergency Management Division
SLERA	Screening Level Ecological Risk Assessment
SVOC	semi-volatile organic compound
TBC	To-Be-Considered
TCE	trichloroethene
TOC	total organic carbon
UCL	upper concentration limit
U.S.C.	United States Code
USEPA	United States Environmental Protection Agency
USGS	U.S. Geological Survey
VISL	EPA Vapor Intrusion Screening Level
VOC	volatile organic compound
WMA	waste management area
WS&G	Western Sand and Gravel Superfund Site

Appendix F - Treatability Study Specific Aims and Performance Goals Memorandum (Remedy Contingency Criteria)

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MEMORANDUM

WOODARD &CURRAN

TO: Hoshaiah Barczynski (USEPA)

CC: Kathryn Sarsfield (RIDEM)

FROM: Mike Apfelbaum and Alan Benevides

DATE: July 20, 2020

RE: Treatability Study Specific Aims and Performance Goals
Addendum to the Treatability Study Work Plan
L&RR Superfund Site OU 2, North Smithfield, RI

A *Revised* Treatability Study Work Plan (TSWP) was submitted on February 12, 2020 that presented the scope of a bench-scale treatability study to evaluate potential treatment technologies for 1,4-dioxane and per- and polyfluoroalkyl substances (PFAS) in groundwater at the Landfill & Resource Recovery (L&RR) Superfund Site (Site). Treatability activities are being performed by the L&RR PRP Group as part of the Remedial Investigation/Feasibility Study (RI/FS) for Operable Unit 2 (OU 2) in accordance with the Subpart C.II.H. *Treatability and Pilot Studies* to the Administrative Settlement Agreement and Order on Consent executed on August 17, 2015. This memorandum is intended to serve as an addendum to the TSWP, by outlining how treatability data and results will be evaluated to demonstrate proof of concept for the proposed remedial technologies. Based on a request from the U.S. Environmental Protection Agency (USEPA) to receive updates on interim test results and participate in working discussions regarding test procedures, this memorandum also includes a projected schedule (Table 1) developed based on various treatability study components, and preliminary recommendations for discussions with USEPA representatives.

Treatability Study Basis and Two-Stage Treatment Zone Remedial Alternative Overview

The basis for this treatability study involves a focused bench-scale evaluation of the treatment technologies for Remedial Alternative 4 (*Two-Stage Reactive Treatment Zone, Institutional Controls, and Monitoring*), which is the preferred alternative presented in the FS Report. The two technologies used as the basis for this alternative (and the treatability study) are *in situ* chemical oxidation (ISCO) using potassium persulfate (KP) and activated carbon (AC) to be injected into the subsurface in a barrier configuration for treatment of groundwater impacted by volatile organic compounds(VOCs)[1], 1,4-dioxane (primary constituent), and PFAS. The staged configuration of the proposed barrier utilizes an ISCO-KP array (*Stage* 1) for primary treatment of target VOCs, 1,4-dioxane, and select PFAS (primarily the perfluoroalkyl carboxylic acids [PFCAs] subgroup), followed by the downgradient AC barrier (*Stage* 2) to

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[1] The susceptibility of other VOCs present in Site groundwater (benzene, 1,4-dichlorobenzene, 1,1-dichloroethane, 1,2-dichloroethane, cis-1,2-dichloroethene, 1,2-dichloropropane, naphthalene, tetrachloroethene, trichloroethene, and vinyl chloride) to destruction via ISCO processes and sorption (using AC) is well understood and not proposed for specific evaluation during the treatability study. The treatability study is focused exclusively on treatment of 1,4-dioxane and PFAS. Concentrations of VOCs will be measured during the pre-test baseline analytical program to understand occurrence and concentration for comparison with prior results.

sequester remaining VOCs and PFAS that are not treated via ISCO, notably the perfluorosulfonic acids (PFSAs) subgroup of PFAS.

Treatability studies involving the ISCO-KP and AC remedial technologies are currently being administered at Brown University (Brown), under the direction of Dr. Kurt Pennell. This laboratory based study will be evaluated relative to the performance goals presented in this memorandum and more importantly, will be used to recommend and guide the design and implementation of field-scale pilot studies, if the treatability study results are favorable, as part of pre-design investigation (PDI) activities following Record of Decision (ROD) issuance. It is also important to note that a subset of treatability activities have already been completed while others remain in progress, concurrent with finalization of the FS Report. The treatability program is anticipated to require an additional six months to complete. Based on this duration and overall test complexity, USEPA previously agreed for treatability activities to proceed in parallel with the FS to support selection of the two-stage treatment zone remedial alternative and its incorporation into the *Draft* Proposed Plan.

Specific Aims of the Treatability Study

Treatability studies involving ISCO and AC are sub-divided into a multi-phase evaluation program intended to elicit technology performance results and incorporate test data into future pre-design and design submittals. The two phases of the treatability studies include:

- Phase 1 is a series of batch reactor studies to understand site-specific dosing and reaction chemistry for the KP oxidant.
- Phase 2 is a series of column tests with multiple KP-AC amendment formulations and Site soil to simulate the flow of groundwater and testing of key parameters to assess treatment efficacy.

The columns will be operated "in series" with a "lead" KP column followed by a "lag" AC column to simulate the conceptual two-stage barrier design, configured with the upgradient ISCO-KP barrier (*Stage* 1) to intercept and treat 1,4-dioxane, VOCs, and select PFAS (primarily PFCAs) in groundwater, followed by the downgradient AC barrier (*Stage* 2) to sequester remaining VOCs and PFAS that are not treated via ISCO, notably the PFSAs.

The ISCO and AC treatability study will be used to evaluate the effectiveness of these amendments towards treating 1,4-dioxane and PFAS in groundwater, in support of optimization of future pre-design activities that notably will involve moving forward with field pilot-testing. Specific aims include:

- Determining effective KP oxidant dosages using Site media that consider important factors such as contaminant concentration, groundwater temperature and pH, buffering capacity of soils, and soil and groundwater oxidant demand.
- Selecting the optimal iron activator and dose for KP and evaluating the rate of activation and residence time in the presence of Site media. Testing involves evaluation of three iron activators: pyrite, ferrihydrite, and mackinawite. Observations from KP activation and residence will also be used to preliminarily assess the degree to which additional injections may be required to sustain on-going oxidation and sorption processes under field conditions during pilot-testing. This information will also be evaluated from an overall scalability standpoint, that considers amendment costs and logistical factors during remedy implementation.
- Quantifying contaminant degradation rates following KP oxidation based on interim and end-of-test chemical analysis and measured column detention times.

- Measuring the sorption capacity of the AC provided for testing followed by directly measuring the retention capacity of AC on soil at the conclusion of the column studies as an indicator of persistence in the Site subsurface.
- Evaluating the potential for reduced hydraulic conductivities and porosity of overburden deposits that could affect groundwater velocities and flow trajectories in the vicinity of the KP and AC barrier zones during full-scale implementation. Mechanisms potentially affecting hydraulic conductivity and porosity include: (i) use of a solid-phase iron activator which may be subject to dissolution and re-precipitation over time, potentially occupying pore space; and (ii) potential occupation of pore space in overburden deposits with injectable AC.
- Identifying contaminants that are recalcitrant to ISCO (specifically PFSAs) and AC treatment, as well as transformation of longer-chained PFAS to shorter-chained PFAS following KP oxidation that are potentially less effectively treated. Test outcomes regarding these potential effects will be used to optimize future pre-design activities.
- Measuring the potential for low pH effects, sulfate migration, and metals mobilization, and their effect on both short- and long-term groundwater geochemistry. These results will also be used to plan and mitigate conditions during the design and implementation of the remedial alternative.

In addition to the test methods and procedures outlined in the TSWP, the study maintains a holistic approach that considers measures to expand various test steps and pursue alternative tests and analyses intended to strengthen the overall viability of this remedial alternative. Results obtained during the study will be evaluated and discussed with Brown to determine if supporting analyses and/or modifications to in-test procedures are required. These supplementary activities, if recommended, will be discussed with USEPA and the Rhode Island Department of Environmental Management (RIDEM) during the proposed status check-ins as outlined in Table 1.

Performance Goals for the Treatability Study

The ISCO and AC treatability study will be used to demonstrate the potential for the two-stage reactive barrier remedy alternative to effectively reduce concentrations of 1,4-dioxane and PFAS via oxidation and sorption processes, respectively, during the 6-month study period. A converging lines of evidence approach will be used to evaluate observations, interim test data, and analytical results. Specific performance goals involving the aims of the ISCO and AC treatability study include:

1. Determine if concentrations of 1,4-dioxane and oxidizable PFAS compounds can be treated using KP treatment. Pre-test baseline concentrations will be compared with interim test analyses of 1,4-dioxane and PFAS on an approximate four pore volume basis, followed by end of test data. Quantified mass reduction estimates will also be verified using a control column (no KP or iron activator) to evaluate extraneous contaminant losses for the duration of the study. Contaminant reduction specific performance goals include the following criteria:
    - If ***at least 80%*** of 1,4-dioxane and oxidizable PFAS concentrations are reduced or levels are below preliminary remediation goals (PRGs), within the estimated 60-day column study, then the ISCO remedy component will be considered effective. Further optimization of the treatment may be evaluated in the future to further reduce concentrations.
    - If concentrations were ***not reduced by 80%, but demonstrate reductions greater than 60%***, the results will be considered "positive" towards supporting overall proof of concept objectives. Steps to optimize the KP technology for

re-evaluation during future treatability studies will be presented in pre-design investigation work plans as part of the RD phase.

2. Evaluate if un-oxidizable PFAS fractions (specifically PFSAs) and/or incompletely oxidized non-target PFAS compounds[2] remain following KP treatment and assess sorption potential in the presence of the AC amendment columns. Pre-test baseline concentrations and incremental pore volume samples will be used to determine which amendment (PlumeStop™ or S-PAC) provides the optimal sorption properties. Quantified sorption estimates will also be verified using a control column with no AC to evaluate potential changes in contaminant concentrations as Site groundwater is pumped through the columns.

   - If COC concentrations are reduced by ***at least 80%*** or are below PRGs within the estimated 60-day column study, then the AC remedy component will be considered effective. Further optimization of the treatment may be evaluated in the future to further reduce concentrations.
   - If concentrations were ***not reduced by 80%, but demonstrate reductions greater than 60%***, the results will be considered "positive" towards supporting overall proof of concept objectives. Steps to optimize the AC technology for re-evaluation during future treatability studies will be presented in pre-design investigation work plans as part of the RD phase.

3. Assess KP, iron activator, and AC amendment stability and longevity using columns to simulate short-term persistence and provide information on scale-up potential for the individual reactive zones. These amendments will be assessed under variable residence times associated with corresponding flow rates in the shallow and deep aquifer zones for the respective columns. Similar to the above performance indicators, persistent or incomplete treatment of 1,4-dioxane and PFAS in accordance with the above criteria, may require refinement of supplemental column studies performed as part of future pre-design activities. Information used to evaluate stability and longevity for these amendments will include:

   KP Amendment and Iron Activator

   - Demonstrating that KP remains "activated" by iron throughout the duration of the test based on Oxidation-Reduction Potential (ORP) and pH test data that yield strongly oxidizing ORP levels (greater than 225 mV measured by a platinum electrode) and sustained low pH levels (less than 4.0 pH standard units).
   - Comparing end of test KP residuals using sulfate to assess the amount of KP expected to be exhausted based on known KP solubility and the number of pore volumes flushed through the columns.

[2] A total oxidizable precursor (TOP) assay will be performed on column influent and effluent groundwater to assess for the presence of oxidizable precursors that can undergo transformation to PFAS using heat and activated persulfate based on the methods presented in Houtz and Sedlak (2012).

- Measuring the retention of iron remaining in the column based on the measurement of iron leaving the column compared to the amount of iron anticipated to be exhausted based on the solubility of the iron activator[3] and the number of pore volumes flushed through the columns.

AC Amendments

- The sorption capacity of the PlumeStop™ and the S-PAC will be assessed at the end of test by comparing retained PFAS with expected retention capacities predicted by the sorption isotherm experiments (Phase 1). Modeled versus actual sorption capacities greater than 80% will be considered effective, while concentrations not reduced by 80%, but greater than 60% will be considered "positive" towards supporting overall proof of concept.

4. To assess potential changes in hydraulic conductivity and porosity:
   - The differential pressure between the inlet and outlet of the columns will be measured with a differential pressure transducer. The differential pressure transducer will be used to monitor for changes in pressure, which, combined with the flow rate through the columns, will be used to estimate permeability.
   - A conservative sodium bromide tracer mixed with Site groundwater will be pumped through each of the column test configurations at the start of the test and again at the end. Bromide will be measured using an ion-selective electrode. The resulting time and electrode response data will be used to construct tracer breakthrough curves. Bromide ion concentrations will be fit using a one-dimensional transport model to obtain the pore volume.

   If less than a 30% difference is calculated between the baseline and end of test pore volume estimates, then any changes involving inferred porosity and hydraulic conductivity will be considered negligible that will also be considered within a factor of safety for pre-design activities (i.e. field-scale pilot study). The 30% criteria was selected based on the range of variability resulting from the set-up of the columns and potential changes in grain size sorting effects that may occur as the number of pore volumes introduced to the columns increases during the column tests.
5. Identify potential secondary impacts to groundwater quality that may result from incomplete treatment, undesirable contaminant transformations, and accumulation of treatment residuals and assess if these impacts are short-lived and transient. These potential adverse impacts may include sustained low pH conditions from KP oxidation that overwhelms the buffering capacity of the soils, accumulation of shorter-chain PFAS compounds (supported by TOP assays), potential for iron mobilization, and excess sulfate residuals. Potential secondary impacts will be evaluated on an individual basis to recommend potential mitigation/minimization measures to be considered during future pilot studies performed during pre-design investigations as part of the RD phase.

[3] Quantification of residual iron levels may be challenging due to catalytic processes involving soluble (Fe^{2+}) and insoluble (Fe^{3+}) states.

A comparison of test results and outcomes with these performance goals will be included in the treatability study summary report.

Treatability Study Schedule

Refer to Table 1 (*Treatability Study Summary and Schedule*) for a summary of the two primary study phases. Since the study was initiated following approval of the TSWP, a subset of the Phase 1 batch reactor studies has been completed by Brown in advance of this addendum. This table includes a synopsis of key test results and preliminary interpretations from completed tests. The status of on-going test components is included with a preliminary schedule based on Brown's input and current laboratory access restrictions.

As a follow-up to USEPA's request for involvement during the treatability study, Table 1 includes a column with proposed status check-in opportunities with USEPA representatives to review interim test results and participate in working discussions. The proposed future status check-ins are at specific intervals considering the duration of study procedures, Brown's current laboratory accessibility, and the availability of interim test results.

Table 1
Treatability Study Summary and Schedule
L&RR Superfund Site OU 2 Remedial Investigation/Feasibility Study
North Smithfield, Rhode Island

	Test Overview / Purpose	Status	Anticipated Start	Anticipated Completion	Results Synopsis	Notes/Other	Tentative Check-in with USEPA & RIDEM
Phase 1 - Batch Reactor Studies							
Baseline / Pre-Study Analytical Testing	Establish baseline analytical results for 1,4-dioxane and PFAS.	Complete	--	--	Generally consistent with results from pre-ROD sampling events	Brown University carboy results approximately 30% lower than low-flow field sample results	Interim Batch Reactor Check-In = **Early June** (*Discussed during the June 4th meeting with EPA and RIDEM*)
Soil Oxidant Demand (SOD)	Quantify the oxidant that can react with Site soil. Measured by exposing soils to varying amounts of persulfate until the persulfate no longer reacts with the soils.	Complete	--	--	SOD evaluated using KP at concentrations of 0.5, 1, and 2 grams (g). SOD in upper zone was <0.884 g/kg of soil and <0.334 g/kg for lower zone soils. Results < 1 g/kg, notably below PeroxyChem's default SOD assumption of 1 g persulfate per kg of Site soil.		
Chemical Oxidant Demand (COD)	Quantify the oxidant that can react with Site groundwater.	Complete	--	--	COD ranged from 0.100 (upper) to 0.035 g/L (lower).		
Buffering Capacity	Measure the ability of Site soils to neutralize acidity by calculating the cation exchange capacity (CEC) of soil.	Complete	--	--	Lime buffering capacity (LBC) ranged from 194 ppm CaCO3 in lower zone soils to 227 ppm CaCO3 in upper zone soils. CEC ranged from 4.13 meg/100g in lower unit soils to 4.60 meg/100g in upper unit soils.	Addition of buffering agent to moderate pH in future tests may be needed based on the results of the activation testing described below.	
Activation of Potassium Persulfate (KP) using Iron	Measure the amount and type of iron source necessary to activate the KP.	*In progress*	Week of April 20th	Week of August 10th	--	Initial testing of the three activators (pyrite, Mackinawite[1], and ferrihydrite) with deionized (DI) water performed. Testing currently underway using the three activators with Site groundwater. Future testing will be expanded to include a mixture of Site soil and groundwater.	Pre-Column Study Check-in = **Late July** (Results and next steps for iron activation of KP; scheduled for July 22)
Sorption Isotherms	Evaluate the adsorption capacity of PlumeStop™ and S-PAC on a mass basis using multiple concentrations of PFOA and PFOS.	*In progress*	Week of April 6th	Week of August 10th	--	Initial isotherm tests performed using DI water. Testing to begin using Site groundwater, supplemented by COC spiking, as necessary.	
Phase 2 - Column Studies							
Shallow (Run #1)	Evaluate 1,4-Dioxane and PFAS oxidation (KP + selected iron activator) and residuals/secondary treatment using two AC amendments. Columns run in series. Retention capacity of AC also measured.	*Pending Phase 1*	Early August	Early October (~60 days[2])	--	Start of columns to occur as remaining KP activation batch tests are completed. Initial column tests will involve iron activators that have been subject to each phase of activation (i.e., DI water, Site groundwater, and Site soil and groundwater).	Interim Column Study Check-In #1 = **Mid-September**
Control							
KP + [Fe] + PlumeStop							
KP + [Fe] + S-PAC							
Deep (Run #1)	see above	*Pending Phase 1*	Late October	Late December (~60 days[2])	--		Interim Column Study Check-In #2 = **Early December**
Control							
KP + [Fe] + PlumeStop							
KP + [Fe] + S-PAC							
Shallow & Deep Duplicate Runs[3]	Preferred amendment configuration from initial runs, re-performed to assess run #1 results.	*Pending Phase 1*	Mid-January	Mid-March (~60 days[2])			Interim Column Study Check-In #3 = **Late January**

Notes:
1. Supplier of commercially available ferrous sulfide reagent has requested that their product be referred to as "Mackinawite".
2. Brown Univertity's current capabilities include columns and pumps to run three tests at a time (i.e., Control, KP-PlumeStop™, and KP-S-PAC) for one aquifer zone. It is assumed that the Phase 2 - Column Studies will begin with the shallow zone. Column testing takes approximately 60-days based on groundwater detention times. At the conclusion of the first suite of column tests, labware will be cleaned prior to adding amendments and Site soil and starting the next series of tests.

Appendix G - Administrative Record Index and Guidance Documents

Landfill & Resource Recovery, Inc. (L&RR)
NPL Site Administrative Record
Record of Decision (ROD)

Index

ROD Dated: April 2021
Released: April 2021

Prepared by
EPA New England
Superfund & Emergency Management Division

Introduction to the Collection

This is the administrative record for the Landfill & Resource Recovery, Inc. (L&RR) Superfund Site, North Smithfield, Rhode Island, Operable Unit 2 (OU2) Record of Decision (ROD), dated April 2021. The file contains site-specific documents and a list of guidance documents used by EPA staff in selecting a response action at the site.

This record replaces the administrative record file for the OU 2 ROD Proposed Plan dated July 2020. This record includes, by reference, administrative records for the OU1 ROD, issued September 1988; and the OU1 Explanation of Significant Differences (ESD), issued March 1991. Documents listed as bibliographic sources in individual reports might not be listed separately in the index.

The administrative record file is available for review at:

Online: https://go.usa.gov/xfQbz

Additional information about the site is also available at www.epa.gov/superfund/lrr.

The EPA is temporarily suspending its Regional Records Centers for public visitors to reduce the risk of transmitting COVID-19. In addition, many site information repositories are closed and information in these repositories, including the administrative record file, has not been updated.

The EPA continues to carefully and continuously monitor information from the Centers for Disease Control and Prevention (CDC), local area health departments, and our Federal partners so that we can respond rapidly as conditions change regarding COVID-19.

For assistance with access or for questions, contact (note that because of government COVID-19 restrictions EPA's Offices may not be open to the public during the comment period):

SEMS Records & Information Center
U.S. EPA Region 1 - New England
5 Post Office Square, Suite 100 (mail code: 02-3)
Boston, MA 02109-3912
(617) 918-1440 (phone)
R1.Records-SEMS@epa.gov (email)

An administrative record is required by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA).

Questions about this administrative record should be directed to the EPA New England site manager, Hoshaiah Barczynski (617) 918-1275, barczynski.hoshaiah@epa.gov.

AR 66499
Record of Decision (ROD), Operable Unit 2
April 2021

Doc. ID	Title	Document Date	Page Count	Author	Addressee	Resource Type	Program Information	Access Control	Region	URL
657100	RECORD OF DECISION (ROD)	4/15/2021	175	R01: (US EPA REGION 1)		RPT	053-REMEDIAL/0531-Remedy Characterization/05.04-RECORD OF DECISION (ROD)	UCTL	1	https://semspub.epa.gov/src/document/01/657100
653736	RESPONSIVENESS SUMMARY	4/15/2021	13	R01: (US EPA REGION 1)		RPT	053-REMEDIAL/0531-Remedy Characterization/05.03-RESPONSIVENESS SUMMARIES	UCTL	1	https://semspub.epa.gov/src/document/01/653736
653737	LETTER REGARDING CONCURRENCE WITH RECORD OF DECISION (ROD)	4/12/2021	2	R01: Coit, Janet (RI DEPT OF ENVIRONMENTAL MGMT)	R01: Olson, Bryan (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/05.01-CORRESPONDENCE (ROD)	UCTL	1	https://semspub.epa.gov/src/document/01/653737
650458	PUBLIC HEARING TRANSCRIPT FOR 08/12/2020 MEETING	9/22/2020	11	(APEX REPORTING)		MTG	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.04-PUBLIC MEETINGS/HEARINGS	UCTL	1	https://semspub.epa.gov/src/document/01/650458
650460	EMAIL REGARDING PUBLIC COMMENT ON THE PROPOSED PLAN (WELL TESTING RESULT AND TOLUENE INTOXICATION INFORMATION ATTACHED)	8/26/2020	4	Richer. Jason (NORTH SMITHFIELD (RI) RESIDENT)	Barczynski, Hoshaiah (US EPA REGION 1)	EML	053-REMEDIAL/0531-Remedy Characterization/05.03-RESPONSIVENESS SUMMARIES	UCTL	1	https://semspub.epa.gov/src/document/01/650460
100014361	EPA PROPOSED PLAN PUBLIC MEETING PRESENTATION	8/12/2020	26	(US EPA REGION 1)		PUB	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.04-PUBLIC MEETINGS/HEARINGS	UCTL	1	https://semspub.epa.gov/src/document/01/100014361
649272	2020 POST-CLOSURE SITE MONITORING REPORT	8/1/2020	384	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/649272
647591	NEWS RELEASE: EPA PROPOSES GROUNDWATER CLEANUP PLAN FOR LANDFILL AND RESOURCE RECOVERY, INC. SUPERFUND SITE IN N. SMITHFIELD, RI	7/29/2020	3	(US EPA REGION 1)		PUB	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.03-NEWS CLIPPINGS/PRESS RELEASES	UCTL	1	https://semspub.epa.gov/src/document/01/647591

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647589	MEMO REGARDING PROPOSED PLAN PUBLIC COMMENT PERIOD - VIRTUAL PUBLIC PARTICIPATION MEASURES	7/20/2020	2	Meeks, Sarah (US EPA REGION 1)		MEMO	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.01-CORRESPONDENCE (COMMUNITY RELATIONS)	UCTL	1	https://semspub.epa.gov/src/document/01/647589
647559	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 04/01/2020 - 06/30/2019	7/13/2020	3	Benevides, Alan (WOODWARD & CURRAN)	Barczynski, Hoshaiah (US EPA REGION 1), Sarsfield, Kathryn (RIDEM)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647559
647545	PROPOSED PLAN	7/1/2020	33	(US EPA REGION 1)		RPT	053-REMEDIAL/0531-Remedy Characterization/04.09-PROPOSED PLANS FOR SELECTED REMEDIAL ACTION	UCTL	1	https://semspub.epa.gov/src/document/01/647545
647596	FEASIBILITY STUDY (FS), REVISED	6/12/2020	416	(WOODARD & CURRAN)	(L&RR PERFORMING PRP GROUP REPRESENTATIVES)	RPT	053-REMEDIAL/0531-Remedy Characterization/04.06-FEASIBILITY STUDY REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/647596
647808	EMAIL REGARDING APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARAR) (EMAIL HISTORY ATTACHED)	5/28/2020	4	Sarsfield, Kathryn (RIDEM)	Barczynski, Hoshaiah (US EPA REGION 1)	EML	053-REMEDIAL/0531-Remedy Characterization/04.05-ARARS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647808
100002469	For Regional Superfund Site Teams: CERCLA Interim Guidance on Public Engagement During COVID-19	4/28/2020	2	R11: (U.S. EPA)		LAWS	058-PROGRAM SUPPORT/0583-Regulatory Development/B8.4-Directives and Policy Guidance Documents	UCTL	11	https://semspub.epa.gov/src/document/11/100002469
100002476	Memorandum on Virtual Public Hearings and Meetings	4/16/2020	2	R11: (Office of General Counsel)		LAWS	058-PROGRAM SUPPORT/0583-Regulatory Development/B8.4-Directives and Policy Guidance Documents	UCTL	11	https://semspub.epa.gov/src/document/11/100002476
647558	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 01/01/2020 - 03/31/2019	4/7/2020	3	Benevides, Alan (WOODWARD & CURRAN)	Barczynski, Hoshaiah (US EPA REGION 1), Sarsfield, Kathryn (RIDEM)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647558
646140	REMEDIAL INVESTIGATION (RI) REPORT	4/1/2020	11143	(WOODARD & CURRAN)	(THE L&RR SITE GROUP)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.06-REMEDIAL INVESTIGATION REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/646140

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647568	REVISED TREATABILITY STUDY WORK PLAN, SEQUENTIAL TREATMENT USING IN SITU CHEMICAL OXIDATION AND SEQUESTRATION	2/1/2020	153	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647568
647557	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 10/01/2019 - 12/31/2019	1/7/2020	3	Benevides, Alan (WOODWARD & CURRAN)	Barczynski, Hoshaiah (US EPA REGION 1), Sarsfield, Kathryn (RIDEM)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647557
642582	NEWS RELEASE: EPA COMPLETES REVIEW OF L&RR SUPERFUND SITE IN N. SMITHFIELD, RI	12/20/2019	2	(US EPA REGION 1)		PUB	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.03-NEWS CLIPPINGS/PRESS RELEASES	UCTL	1	https://semspub.epa.gov/src/document/01/642582
647556	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 07/01/2019 - 09/30/2019	11/6/2019	2	Benevides, Alan (WOODWARD & CURRAN)	Barczynski, Hoshaiah (US EPA REGION 1), Sarsfield, Kathryn (RIDEM)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647556
647567	HUMAN HEALTH RISK ASSESSMENT	11/1/2019	449	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0531-Remedy Characterization/03.09-HEALTH ASSESSMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/647567
100012177	FIFTH FIVE-YEAR REVIEW REPORT	9/6/2019	50	(US EPA REGION 1)		RPT	053-REMEDIAL, 053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/100012177
647566	2019 POST-CLOSURE SITE MONITORING REPORT	8/1/2019	331	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/647566
647555	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 04/01/2019 - 06/30/2019	7/26/2019	3	Benevides, Alan (WOODWARD & CURRAN)	Brown, James (US EPA REGION 1), Kulpa, Paul (RIDEM), Barczynski, Hoshaiah (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647555
647554	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 01/01/2019 - 03/31/2019	4/22/2019	3	Benevides, Alan (WOODWARD & CURRAN)	Brown, James (US EPA REGION 1), Kulpa, Paul (RIDEM), Barczynski, Hoshaiah (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647554

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647562	FLYER FOR DROP-IN INFORMATION SESSIONS 03/20/2019 AND 03/25/2019	3/20/2019	1	(US EPA REGION 1)		MTG / Meeting Document	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.04-PUBLIC MEETINGS/HEARINGS	UCTL	1	https://semspub.epa.gov/src/document/01/647562
632576	NEWS RELEASE: EPA BEGINS REVIEWS OF THREE RHODE ISLAND SUPERFUND SITE CLEANUPS THIS YEAR	2/21/2019	2	(US EPA REGION 1)		PUB	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.03-NEWS CLIPPINGS/PRESS RELEASES	UCTL	1	https://semspub.epa.gov/src/document/01/632576
647553	QUARTERLY PROGRESS REPORT, REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 10/01/2018 - 12/31/2018	1/8/2019	4	Benevides, Alan (WOODWARD & CURRAN)	Brown, James (US EPA REGION 1), Kulpa, Paul (RIDEM), Barczynski, Hoshaiah (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/04.07-WORK PLANS & PROGRESS REPORTS (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647553
647560	FINAL WATER QUALITY REGULATION	12/20/2018	46	Coit, Janet (RI DEPT OF ENVIRONMENTAL MGMT)		LAWS	056-SITE SUPPORT/0563-State/Tribal Involvement/09.10-STATE TECHNICAL AND HISTORICAL RECORDS	UCTL	1	https://semspub.epa.gov/src/document/01/647560
631406	LETTER REGARDING QUARTERLY REPORT FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, 07/01/2018 - 09/30/2018	10/24/2018	4	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0533-Remedial Action/07.06-WORK PLANS & PROGRESS REPORTS (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/631406
100010284	EPA'S MEMO ON ECOLOGICAL RISK DETERMINATIONS FOR L&RR OU 2	9/12/2018	2	Hoskins, Bart (US EPA REGION 1)	Krasko, Anna (US EPA REGION 1)	MEMO	053-REMEDIAL/0531-Remedy Characterization/03.10-ENDANGERMENT/BASELINE RISK ASSESSMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/100010284
100010285	INTERIM FINAL SCREENING LEVEL ECOLOGICAL RISK ASSESSMENT (SLERA) AND REFINEMENT	9/7/2018	6232	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0531-Remedy Characterization/03.10-ENDANGERMENT/BASELINE RISK ASSESSMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/100010285
100010165	2018 POST-CLOSURE SITE MONITORING (PCSM) REPORT	8/1/2018	294	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/100010165

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100009905	QUARTERLY PROGRESS REPORT FOR OPERABLE UNIT (OU) 2 REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, REPORTING PERIOD 04/01/2018 TO 06/30/2018	7/13/2018	4	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0533-Remedial Action/07.06-WORK PLANS & PROGRESS REPORTS (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100009905
100009785	RESPONSES TO COMMENTS REGARDING WORK PLAN FOR ADDITIONAL SAMPLING OF PFAS ADDENDUM	6/22/2018	6	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0533-Remedial Action/07.01-CORRESPONDENCE (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100009785
100009702	REVISED REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) WORK PLAN REGARDING 2018 PRE-ROD SAMPLING	6/7/2018	19	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100009702
100009352	WORK PLAN FOR ADDITIONAL NORTHERN BOREHOLE/MONITORING WELLS, OPERABLE UNIT (OU) 2, REMEDIAL IINVESTIGATION/FEASIBILITY STUDY (RI/FS)	5/14/2018	5	Benevides, Alan (WOODWARD & CURRAN), Apfelbaum, Mike (WOODARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100009352
100009353	WORK PLAN FOR ADDITIONAL SAMPLING OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)	5/14/2018	10	Benevides, Alan (WOODWARD & CURRAN), Apfelbaum, Mike (WOODARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100009353
100009012	QUARTERLY PROGRESS REPORT FOR OPERABLE UNIT (OU) 2 REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) IMPLEMENTATION, REPORTING PERIOD 01/01/2018 TO 03/31/2018	4/13/2018	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100009012
100003702	PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) ANALYICAL RESULTS, OPERABLE UNIT (OU) 2, REMEDIAL INVESTIGATION/FEASIBLILTY STUDY (RI/FS)	3/29/2018	76	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/03.02-SAMPLING & ANALYSIS DATA (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100003702
100002462	LETTER REGARDING RECOMMENDATIONS FOR 2018 PRE-RECORD OF DECISION (ROD) SAMPLING	3/13/2018	12	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100002462

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100002112	EMAIL REGARDING CONCERNS OF IMPACT OF CONTAMINATED GROUNDWATER ON RESIDENTIAL WELLS	2/16/2018	1	Ezovski, Gary (NORTH SMITHFIELD (RI), TOWN OF)	Krasko, Anna (US EPA REGION 1)	EML	053-REMEDIAL/0533-Remedial Action/07.01-CORRESPONDENCE (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100002112
100001622	SAMPLING AND ANALYSIS PLAN FOR PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)	1/17/2018	48	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	WP	053-REMEDIAL/0533-Remedial Action/07.02-SAMPLING & ANALYSIS DATA (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100001622
100001522	QUARTERLY STATUS REPORT QS7	1/10/2018	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0533-Remedial Action/07.06-WORK PLANS & PROGRESS REPORTS (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100001522
100000652	LETTER REGARDING COMMENT RESPONSE NO. 2 TO TREATABILITY STUDY WORK PLAN	11/2/2017	3	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/100000652
623313	QUARTERLY PROGRESS REPORT FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) IMPLEMENTATIONS	10/19/2017	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/623313
100001501	PFAS GROUNDWATER QUALITY STANDARD	10/18/2017	7	Coit, Janet (RI DEPT OF ENVIRONMENTAL MGMT)		LAWS	053-REMEDIAL/0533-Remedial Action/07.01-CORRESPONDENCE (RA)	UCTL	1	https://semspub.epa.gov/src/document/01/100001501
622917	REVISED TREATABILITY STUDY WORK PLAN (10/02/2017 TRANSMITTAL EMAIL ATTACHED)	9/26/2017	1	Benevides, Alan (WOODWARD & CURRAN), Apfelbaum, Mike (WOODARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/622917
605883	2017 POST CLOSURE SITE MONITORING REPORT - 05/01/2016 TO 04/30/2017	8/1/2017	303	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/605883
605828	QUARTERLY SUMMARY REPORT - 04/01/2017 – 06/30/2017	7/18/2017	6	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/605828
599059	LETTER REGARDING SPRING 2017 SAMPLING RECOMMENDATIONS COMMENT RESPONSES	6/2/2017	11	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	ADD	053-REMEDIAL/0531-Remedy Characterization/03.02-SAMPLING & ANALYSIS DATA (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/599059

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597444	FOURTH QUARTERLY PROGRESS REPORT FOR REMEDIAL INVESTIGATION/FEASABILITY (RI/FS) IMPLEMENTATIONS	4/12/2017	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/597444
597453	MEMO REGARDING RECOMMENDATIONS FOR SPRING WETLAND SAMPLING EVENT	3/10/2017	8	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	ADD	053-REMEDIAL/0531-Remedy Characterization/03.02-SAMPLING & ANALYSIS DATA (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/597453
597448	RECOMMENDATIONS FOR PRE-ROD GROUNDWATER SAMPLING COMMENT RESPONSES (WITH ATTACHMENTS)	3/3/2017	32	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/597448
595069	QUARTERLY SUMMARY REPORT - 11/01/2016 – 12/31/2016	1/11/2017	8	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/595069
595045	QUARTERLY STATUS REPORT # 2 FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) IMPLEMENTATION - 07/01/2016 TO 10/31/2016	11/18/2016	9	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/595045
592094	INTERIM FINAL SAMPLING AND ANALYSIS PLAN (SAP), QUALITY ASSURANCE PROJECT PLAN (QAPP) AND FIELD SAMPLING PLAN (FSP)	10/11/2016	1411	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.02-SAMPLING & ANALYSIS DATA (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/592094
592093	2016 ANNUAL POST CLOSURE SITE MONITORING REPORT - MAY 2015 THROUGH APRIL 2016	10/1/2016	308	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/592093
587395	QUARTERLY PROGRESS REPORT FOR REMEDIAL INVESTIGATION/FEASABILITY (RI/FS) IMPLEMENTATIONS	7/19/2016	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1), Kulpa, Paul (RIDEM)	RPT	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/587395
587350	INTERIM FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN	5/23/2016	124	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/587350

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587351	LETTER PROVIDING RESPONSE TO EPA AND RIDEM COMMENTS REGARDING INTERIM FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN	5/23/2016	206	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/587351
587353	INTERIM FINAL SAMPLING AND ANALYSIS PLAN (SAP), QUALITY ASSURANCE PROJECT PLAN (QAPP) AND FIELD SAMPLING PLAN (FSP)	5/23/2016	1363	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.02-SAMPLING & ANALYSIS DATA (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/587353
587352	LETTER REGARDING EPA'S APPROVAL OF INTERIM FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN (WP) (REVIEW OF COMMENTS ATTACHED)	4/8/2016	14	Krasko, Anna (US EPA REGION 1)	Benevides, Alan (WOODWARD & CURRAN)	CORR	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/587352
583583	INTERIM FINAL SITE MANAGEMENT PLAN (SMP)	2/25/2016	29	(WOODARD & CURRAN)		WP	056-SITE SUPPORT/0561-Administrative Support/17.06-SITE MANAGEMENT PLANS & REVIEWS	UCTL	1	https://semspub.epa.gov/src/document/01/583583
583584	INTERIM FINAL SAMPLING AND ANALYSIS PLAN (SAP)	2/25/2016	1359	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/583584
583587	INTERIM FINAL REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN (WP)	2/25/2016	124	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/583587
583588	DRAFT REMEDIAL INVESTIGATION AND FEASIBILITY STUDY (RI/FS) WORK PLAN (WP) - COMMENT RESPONSE ON ADMINISTRATIVE SETTLEMENT AND ORDER ON CONSENT	2/25/2016	34	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0531-Remedy Characterization/03.01-CORRESPONDENCE (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/583588
583589	INTERIM FINAL HEALTH AND SAFETY PLAN (HSP)	2/25/2016	187	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/583589
583599	INTERIM FINAL COMMUNITY RELATIONS SUPPORT PLAN (CRSP)	2/25/2016	12	(WOODARD & CURRAN)		WP	053-REMEDIAL/0531-Remedy Characterization/03.07-WORK PLANS & PROGRESS REPORTS (RI)	UCTL	1	https://semspub.epa.gov/src/document/01/583599

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647569	ANALYTICAL REPORT, LAB NUMBER: L1525461	10/16/2015	59	(ALPHA ANALYTICAL LABS)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0531-Remedy Characterization/04.02-SAMPLING & ANALYSIS DATA (FS)	UCTL	1	https://semspub.epa.gov/src/document/01/647569
581173	NEWS RELEASE: AGREEMENT ENSURES GROUNDWATER STUDY AT NORTH SMITHFIELD, RI SUPERFUND SITE	8/19/2015	2	(US EPA REGION 1)		PUB	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.03-NEWS CLIPPINGS/PRESS RELEASES	UCTL	1	https://semspub.epa.gov/src/document/01/581173
581886	ADMINISTRATIVE SETTLEMENT, AGREEMENT AND ORDER ON CONSENT (AOC) FOR OPRABLE UNIT (OU) 02, REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS) - US EPA REGION 1 CERCLA DOCKET NO.01-2015-0066	8/10/2015	115	(US EPA REGION 1)		LGL	052-ENFORCEMENT/0522-Negotiations/10.07-EPA ADMINISTRATIVE ORDERS	UCTL	1	https://semspub.epa.gov/src/document/01/581886
647565	2015 POST-CLOSURE SITE MONITORING REPORT	7/1/2015	301	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/647565
574353	LETTER REGARDING STATE TRUSTEE NOTIFICATION OF IMPENDING NEGOTIATIONS WITH POTENTIALLY RESPONSIBLE PARTIES (PRP) FOR REMEDIAL INVESTIGATION/FEASIBILITY STUDY (RI/FS)	4/8/2015	2	Barmakian, Nancy (US EPA REGION 1)	Gray, Terry (RHODE ISLAND DEPARTMENT OF ENVIRONMENTAL MANAGEMENT)	LTR	053-REMEDIAL/0531-Remedy Characterization/16.01-CORRESPONDENCE (NATURAL RESOURCE TRUSTEE)	UCTL	1	https://semspub.epa.gov/src/document/01/574353
574354	LETTER REGARDING NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION TRUSTEE NOTIFICATION OF IMPENDING NEGOTIATIONS WITH POTENTIALLY RESPONSIBLE PARTIES (PRP) FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS)	4/8/2015	2	Krasko, Anna (US EPA REGION 1)	Finkelstein, Kenneth (US NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION)	LTR	053-REMEDIAL/0531-Remedy Characterization/16.01-CORRESPONDENCE (NATURAL RESOURCE TRUSTEE)	UCTL	1	https://semspub.epa.gov/src/document/01/574354
574355	LETTER REGARDING US FISH AND WILDLIFE TRUSTEE NOTIFICATION OF IMPENDING NEGOTIATIONS WITH POTENTIALLY RESPONSIBLE PARTIES (PRP) FOR REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS)	4/8/2015	2	Krasko, Anna (US EPA REGION 1)	Munney, Kenneth (US DOI/US FISH & WILDLIFE SERVICE)	LTR	053-REMEDIAL/0531-Remedy Characterization/16.01-CORRESPONDENCE (NATURAL RESOURCE TRUSTEE)	UCTL	1	https://semspub.epa.gov/src/document/01/574355

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572038	LETTER REGARDING RECOMMENDATIONS FOR NEXT STEPS WORK PLAN – RETRACTION LOT 23 ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION	12/22/2014	1	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572038
572037	LETTER REGARDING SUMMARY OF EXISTING INFORMATION REGARDING LOT 15 ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION	12/9/2014	26	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572037
572009	ANALYTICAL REPORT	11/5/2014	41	(TEST AMERICA)	(WOODARD & CURRAN INC)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572009
572039	LETTER SUMMARIZING FIELD INVESTIGATION ACTIVITIES INVOLVING POTENTIAL DELINEATION OF ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) (10/18/2013 ANALYTICAL REPORT ATTACHED)	11/4/2014	194	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572039
565428	FOURTH FIVE-YEAR REVIEW REPORT	9/25/2014	44	(US EPA REGION 1)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/565428
572963	LETTER REGARDING RECOMMENDATIONS FOR NEXT STEPS LOT 23 ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION	9/16/2014	7	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572963
572964	LETTER REGARDING SUMMARY OF FINDINGS LOT 23 ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION (WITHOUT ATTACHMENTS)	7/2/2014	11	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572964
647564	POST-CLOSURE SITE MONITORING REPORT	7/1/2014	305	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/647564
565899	TRANSMITTAL LETTER PROVIDING CD REGARDING ANNUAL MONITORING REPORTS ISSUED 2010-2013 [CD NOT ATTACHED)	5/8/2014	2	Krasko, Anna (US EPA REGION 1)	Hamilton, Paulette (NORTH SMITHFIELD (RI), TOWN OF)	LTR	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.01-	UCTL	1	https://semspub.epa.gov/src/document/01/565899

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							CORRESPONDENCE (COMMUNITY RELATIONS)			
572011	ANALYTICAL REPORT, DIOXANE VOLATILE ORGANIC COMPOUNDS (VOC)	4/30/2014	35	(TEST AMERICA)	(WOODARD & CURRAN INC)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572011
572070	PROJECT SUMMARY: TIER 1 PLUS DATA VALIDATION	4/30/2014	3	Switalski, Gloria (DATA CHECK INC)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572070
572004	LABORATORY REPORT, 1,4 DIOXANE IN WATER	4/29/2014	13	(US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572004
572063	REVISION 1 LEVEL 2 FINAL REPORT FOR GROUNDWATER	4/29/2014	23	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572063
572065	EPA LABORATORY VOLATILE ORGANIC ANALYSIS (VOA) IN WATER	4/29/2014	23	(US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572065
572008	GROUNDWATER DATA ANALYSIS	4/28/2014	199	(TEST AMERICA)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572008
572007	REVISION 1, UDS LEVEL 2 FINAL REPORT FOR GROUNDWATER METALS	4/16/2014	58	(TEST AMERICA)	(WOODARD & CURRAN INC)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572007
572001	ANNUAL DATA VALIDATION SUMMARY, TEST AMERICA LABORATORIES	4/14/2014	6	Switalski, Gloria (DATA CHECK INC)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572001

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572061	LEVEL 2 FINAL REPORT FOR GROUNDWATER GENERAL CHEMISTRY	4/9/2014	26	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572061
572005	UDS LEVEL 2 FINAL REPORT FOR GROUNDWATER METALS	4/1/2014	26	(TEST AMERICA)	(WOODARD & CURRAN INC)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572005
572060	LEVEL 2 FINAL REPORT FOR SURFACE WATER METALS	4/1/2014	18	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572060
572002	LEVEL 2 REPORT FOR GROUNDWATER	3/31/2014	59	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572002
572031	EPA LABORATORY REPORT REGARDING VOLATILE ORGANIC ANALYSIS (VOA) IN WATER	3/31/2014	21	Boudreau, Dan (US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572031
572034	EPA LABORATORY DATA ANALYSIS, 1,4 DIOXANE IN WATER	3/31/2014	12	Boudreau, Dan (US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572034
572062	LEVEL 2 FINAL REPORT FOR SURFACE WATER, VOLATILE ORGANIC COMPOUNDS (VOC)	3/31/2014	33	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572062
572033	EPA LABORATORY VOLATILE ORGANIC ANALYSIS (VOA) DATA	3/27/2014	1	(US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572033
572036	EPA LABORATORY DIOXANE DATA	3/27/2014	1	(US EPA REGION 1)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572036

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572046	SAMPLING AND ANALYSIS PLAN, LOT 23 ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION	3/7/2014	65	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.05-WORK PLANS & PROGRESS REPORTS (POST REMEDIAL)	UCTL	1	https://semspub.epa.gov/src/document/01/572046
572041	TRANSMITTAL LETTER REGARDING FOLLOW-UP TO RECOMMENDED NEXT STEPS ON LETTER 11/26/2013 FOR DELINEATION OF ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION	12/5/2013	2	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572041
647588	LETTER REGARDING RECOMMENDED NEXT STEPS FOR ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION (LAB REPORT OMITTED)	11/26/2013	11	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/647588
554641	2013 ANNUAL POST CLOSURE SITE MONITORING REPORT, PERFORMING SETTLING DEFENDANTS - MAY 2012 THROUGH APRIL 2013 (11/08/2013 TRANSMITTAL LETTER ATTACHED)	11/1/2013	342	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/554641
572003	REVISION 1, LOT 81 (N GRID) ANALYTICAL RESULTS	10/18/2013	69	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572003
572006	LOT 23 (CARON) ANALYTICAL RESULTS	10/18/2013	139	(TEST AMERICA)	(WOODARD & CURRAN INC)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572006
572044	LEVEL 2 FINAL REPORT FOR GROUNDWATER	10/18/2013	147	(TEST AMERICA)	(WOODARD & CURRAN)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572044
572045	TABLE 2: WATERLOO ANALYTICAL DATA, SAMPLE 7/29/2013 - 08/01/2013	8/1/2013	13			ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572045

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572069	TABLE 1: HYDRAULIC GEOCHEMISTRY DATA	7/29/2013	2	(LOUIS FEDERICI ASSOCIATES)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572069
572042	RESPONSE TO AGENCY'S COMMENTS REGARDING RECOMMENDED NEXT STEPS ENVIRONMENTAL LAND USAGE RESTRICTIONS (ELUR) INVESTIGATION DATED 11/26/2013 AND UPDATED 12/5/2013	2/25/2013	5	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572042
572059	LETTER REGARDING REVISED APPROACH FROM PREVIOUS VERSION SUBMITTED ON 08/23/2012 WHICH INCORPORATES COMMENTS RECEIVED FROM EPA AND RIDEM ON NOVEMBER 26, 2012	12/3/2012	12	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572059
572054	LETTER REGARDING RIDEM (RIDEM) COMMENTS ON APPROACH FOR LOTS 15 AND 23 DRAFTED BY WOODARD AND CURRAN ON 08/23/2012	11/20/2012	3	Jablonski, Gary (RIDEM)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572054
572057	LETTER REGARDING REVISED APPROACH FROM PREVIOUS VERSION SUBMITTED ON 08/17/2011, WHICH INCORPORATES COMMENTS RECEIVED FROM NOBIS AND EPA ON 12/6/2011	8/23/2012	12	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572057
572058	LETTER REGARDING UPDATED INFORMATION ON LANDFILL GAS ISSUE IDENTIFIED IN THIRD FIVE-YEAR REVIEW	8/17/2012	3	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572058
554640	2012 ANNUAL POST CLOSURE SITE MONITORING REPORT, PERFORMING SETTLING DEFENDANTS - MAY 2011 THROUGH APRIL 2012	8/1/2012	338	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/554640
577629	LETTER REGARDING APPROACH FOR DELINEATING EXTENT OF ENVIRONMENTAL LAND USAGE RESTRICTIONS ON LOT 15 (KING PROPERTY) AND 23 (CARON PROPERTY)	11/29/2011	3	Austin, Shelley (RIDEM)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577629

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554639	2011 ANNUAL POST CLOSURE SITE MONITORING REPORT, PERFORMING SETTLING DEFENDANTS - MAY 2010 THROUGH APRIL 2011 (09/28/2011 TRANSMITTAL LETTER ATTACHED)	9/1/2011	272	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/554639
572056	LETTER REGARDING REVISED APPROACH FROM PREVIOUS VERSION SUBMITTED ON 03/04/2010 TO DETERMINE NEED FOR AND, IF NECESSARY, EXTENTS OF ENVIRONMENTAL LAND USE RESTRICTIONS (ELUR) ON LOTS 15 AND 23	8/17/2011	166	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572056
471119	2010 ANNUAL POST CLOSURE SITE MONITORING REPORT, PERFORMING SETTLING DEFENDANTS - MAY 2009 THROUGH APRIL 2010	8/1/2010	520	(WOODARD & CURRAN)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/471119
572048	LETTER PROVIDING RESPONSE TO COMMENTS REGARDING APPROACH FOR LOTS 15 AND 23	7/2/2010	3	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction	UCTL	1	https://semspub.epa.gov/src/document/01/572048
572055	LETTER REGARDING REVISED APPROACH FROM PREVIOUS VERSION SUBMITTED ON 12/21/2009 TO DELINEATE EXTENT OF ENVIRONMENTAL LAND USE RESTRICTIONS (ELUR) ON LOTS 15 AND 23	3/4/2010	3	Benevides, Alan (WOODWARD & CURRAN)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572055
572053	LETTER REGARDING L&RR (L&RR) GROUP'S APPROACH TO DELINEATE EXTENT OF ENVIRONMENTAL LAND USE RESTRICTIONS (ELUR) ON LOTS 15 AND 23 (12/22/2009 TRANSMITTAL LETTER ATTACHED)	12/21/2009	4	Benevides, Alan (WOODWARD & CURRAN)	Mcburney, John P (DE MAXIMIS INC.)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572053
457538	THIRD FIVE-YEAR REVIEW REPORT	9/2/2009	84	(US EPA REGION 1 - OFFICE OF SITE REMEDIATION & RESTORATION)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/457538
565873	2009 ANNUAL POST CLOSURE SITE MONITORING REPORT, 05/2008 - 04/2009 (08/06/2009 TRANSMITTAL LETTER ATTACHED)	8/1/2009	239	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565873

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565872	2008 ANNUAL POST CLOSURE SITE MONITORING REPORT, 09/2007 - 08/2008 (09/19/2008 TRANSMITTAL LETTER ATTACHED)	9/1/2008	219	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565872
565896	ANALYTICAL DATA REPORT (11/26/2007 AND 11/14/2007 TRANSMITTAL LETTERS ATTACHED)	10/30/2007	9	(PREMIER LABORATORY LLC)	(RIDEM)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565896
565876	2007 ANNUAL POST CLOSURE SITE MONITORING REPORT (08/14/2007 TRANSMITTAL LETTER ATTACHED)	8/1/2007	206	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565876
577630	LETTER REGARDING PROPOSED SENTINEL WELLS	1/23/2007	2	Destefano, Matthew D (RIDEM)	Jasinski, Michael (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/577630
572968	LETTERS REGARDING SENTINEL WELL ACTIVITIES	1/12/2007	3	Fuerst, David (O & M INC), Mcburney, Jack (O & M INC)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/572968
565870	POST CLOSURE SITE MONITORING REPORT, 07/2006 - 12/2006 (01/10/2007 TRANSMITTAL LETTER ATTACHED)	1/1/2007	204	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565870
572969	LETTER IN RESPONSE TO EPA REGARDING RESULTS FOR GROUNDWATER GEOPROBE SAMPLING RESULTS, DATED ON 06/12/2006	10/5/2006	9	Fuerst, David (O & M INC)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/572969
577625	LETTER REGARDING REVIEW OF RESULTS FOR GROUNDWATER GEOPROBE SAMPLING RESULTS - 06/12/2006 (COMMENTS ATTACHED)	8/7/2006	3	Krasko, Anna (US EPA REGION 1)	Mcburney, John P (DE MAXIMIS INC.)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577625
577626	LETTER REGARIDNG GROUNDWATER GEOPROBE SAMPLING POINTS (COMMENTS ATTACHED)	7/31/2006	3	Ducharme, Shelley (RIDEM)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577626

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577628	REVISED RESPONSE TO 06/15/2006 LETTER OF POST-CLOSURE SITE MONITORING REPORT, DATED JULY THROUGH DEMCEMBER 2005	7/26/2006	2	Fuerst, David (O & M INC)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577628
577627	RESPONSE TO 06/15/2006 LETTER OF POST-CLOSURE SITE MONITORING REPORT, DATED JULY THROUGH DEMCEMBER 2005	7/19/2006	4	Fuerst, David (O & M INC)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577627
572066	ANALYTICAL DATA REPORT, RESIDENTIAL WELLS	7/12/2006	34	(PREMIER LABORATORY LLC)	(RIDEM)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572066
565869	POST CLOSURE SITE MONITORING REPORT, 01/2006 - 06/2006 (07/14/2006 TRANSMITTAL LETTER ATTACHED)	7/1/2006	245	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565869
572052	FIELD SAMPLING PLAN FOR RESIDENTIAL DRINKING WATER WELL SAMPLING	6/26/2006	3	Destefano, Sarah R (RIDEM), Ducharme, Shelley (RIDEM)		WP	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572052
565884	RESULTS FOR GROUNDWATER GEOPROBE SAMPLING POINTS (TRANSMITTAL LETTER ATTACHED)	6/12/2006	12	(O & M INC)	(US EPA)	ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565884
259321	POST-CLOSURE SITE MONITORING REPORT - JULY THROUGH DECEMBER 2005 (03/06/2005 TRANSMITTAL IS ATTACHED)	3/1/2006	301	(O & M INC)	(L&RR PERFORMING PRP GROUP REPRESENTATIVES)	RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/259321
572946	LETTER REGARDING INSTALLATION OF SENTINEL WELLS	11/29/2005	2	Fuerst, David (O & M INC)	(NARRAGANSETT ELECTRIC CO)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/572946
565877	REVISED TECHNICAL MEMO FOR INSTALLATION OF GROUNDWATER GEOPROBE SAMPLING POINTS (TRANSMITTAL LETTER ATTACHED)	10/3/2005	34	(O & M INC)	(US EPA)	MEMO	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565877

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565885	LETTER REGARDING NORTH SMITHFIELD PUBLIC WATER SUPPLY WELL AT TIFFT ROAD (05/16/2000 LETTER AND 07/11/2000 WATER AUTHORITY MEETING MINUTES ATTACHED)	2/25/2005	8	Cournoyer, James (SLATERSVILLE (RI) RESIDENT)	Krasko, Anna (US EPA REGION 1)	LTR	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.01-CORRESPONDENCE (COMMUNITY RELATIONS)	UCTL	1	https://semspub.epa.gov/src/document/01/565885
554636	APPROVAL OF SOURCE WELL LOCATION - TIFFT ROAD REPLACEMENT WELL (03/30/2005 TRANSMITTAL AND 04/01/2005 FAX COVER SHEET ATTACHED)	1/6/2005	5	Aschman, Doris P (STATE OF RHODE ISLAND)	Lowe, Robert (TOWN OF NORTH SMITHFIELD - TOWN PLANNER)	RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/445636
204878	SECOND FIVE-YEAR REVIEW REPORT	9/28/2004	71	(US EPA REGION 1)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/204878
572064	WELL COMPLETION REPORT, RESIDENTIAL WELL LOG	8/18/2004	1	(RIDEM)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572064
572068	WELL COMPLETION REPORT, RESIDENTIAL WELL LOGS - (08/16/1996, 09/03/1998 AND 08/18/2004)	8/18/2004	4	(RIDEM)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572068
259320	POST-CLOSURE SITE MONITORING REPORT - JANUARY THROUGH JUNE 2004 (09/10/04 TRANSMITTAL AND 09/14/04 RIDEM COMMENT ARE ATTACHED)	8/1/2004	297	(O & M INC)	(L&RR PERFORMING PRP GROUP REPRESENTATIVES)	RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/259320
565883	LETTER REGARDING HOLLISTON SAND AND GRAVEL TEST WELL EXPLORATION WITH WELL COMPLITION LOG, 2004 (06/13/2006 TRANSMITTAL EMAIL AND 06/09/2006 FAX COVER ATTACHED)	6/15/2004	13	Morino, Theodore J (MAHER DRILLING & PUMP SERVICES)	Baillargeon, Paul P (METCALF & EDDY)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565883
582526	POST-CLOSURE SITE MONITORING REPORT - 07/2003 TO 12/2003 (02/25/2004 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	2/1/2004	208	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/582526

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554635	DELINEATION OF AREAS CONTRIBUTING RECHARGE TO SELECTED PUBLIC-SUPPLY WELLS IN GLACIAL VALLEY-FILL AND WETLAND SETTINGS (TRANSMITTAL LETTERS ATTACHED)	1/1/2004	68	(US DEPT OF INTERIOR), (US GEOLOGICAL SURVEY)		RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/554635
565871	POST CLOSURE SITE MONITORING REPORT, 01/2003 - 06/2003 (10/31/2003 TRANSMITTAL LETTER ATTACHED)	10/1/2003	222	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565871
582527	POST-CLOSURE SITE MONITORING REPORT - 09/2002 TO 12/2002 (04/21/2003 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	4/1/2003	253	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/582527
577610	RESPONSE TO REQUEST FOR MEETING WITH EPA STAFF ON ISSUES OF REPLACING TIFFT ROAD WELL AND POTENTIAL IMPACT OF SITE	9/27/2002	1	Mendoza, Robert E (US EPA REGION 1)	Yazbak, Edward F (NORTH SMITHFIELD (RI), TOWN OF)	LTR	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/577610
572979	POST CLOSURE SITE MONITORING REPORT (09/04/2002 TRANSMITTAL LETTER ATTACHED)	9/1/2002	263	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572979
572980	POST CLOSURE SITE MONITORING REPORT (05/17/2002 TRANSMITTAL LETTER ATTACHED)	5/1/2002	283	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572980
577608	LETTER REGARDING INDECK GROUNDWATER MODEL AND PROBLEMS GENERATED FROM SELECTIVE USE OF MODEL RESULTS AND MISINTERPRETATIONS	4/30/2002	2	Ingari, Joseph C (HYDROSOURCE ASSOCIATES INC)	Krasko, Anna (US EPA REGION 1)	LTR	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/577608
572974	RESPONSE TO EPA COMMENTS ON DECEMBER, 2001 POST CLOSURE SITE MONITORING REPORT	3/29/2002	73	Mcburney, Jack (O & M INC)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572974
565881	MEMO REGARDING CLARIFICATION STATEMENT FOR FIVE-YEAR REVIEW PREPARED SEPTEMBER 1999	12/18/2001	1	Krasko, Anna (US EPA REGION 1)	Duwart, Roger F (US EPA REGION 1)	MEMO	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565881

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572973	POST CLOSURE SITE MONITORING REPORT (12/31/2001 TRANSMITTAL LETTER ATTACHED)	12/1/2001	278	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572973
572976	RESPONSE TO EPA COMMENTS ON JUNE, 2001 POST CLOSURE SITE MONITORING REPORT	10/4/2001	35	Helgason, Thor (DE MAXIMIS INC)	Krasko, Anna (US EPA REGION 1)	CORR	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572976
572975	POST CLOSURE SITE MONITORING REPORT (06/27/2001 TRANSMITTAL LETTER ATTACHED)	6/1/2001	245	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572975
572955	LETTER REGARDING TIFFT ROAD WELL AND IMPACT OF INCREASED PUMPING RATES, INDECK GROUNDWATER MODEL	5/29/2001	1	Destefano, Matthew D (RIDEM)	Andrews, Daniel J (NORTH SMITHFIELD (RI), TOWN OF)	LTR	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/572955
572990	POST CLOSURE SITE MONITORING REPORT (12/11/2000 TRANSMITTAL LETTER ATTACHED)	12/1/2000	339	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572990
554633	SIMULATIONS DUPLICATING GROUNDWATER MODELING CONTAINING IN GZA MODFLOW REPORT (05/01/2000 AND 05/16/2000 TRANSMITTAL LETTERS ATTACHED)	4/28/2000	22	(METCALF & EDDY INC)		RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/554633
565889	SURFACE WATER QUALITY DATA (05/31/2000 FAX TRANSMITTAL ATTACHED)	4/11/2000	22	(STS CHICAGO)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565889
565895	APRIL 200 SURFACE WATER DATA (07/20/2000 TRANSMITTAL LETTER AND 06/13/200 DATA PACKAGE REVIEWS ATTACHED)	4/1/2000	67	(DE MAXIMIS INC)		ADD	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565895
565887	EPA SURFACE WATER QUALITY DATA SUMMARY FOR JANUARY 2000 SAMPLING (02/22/2000 and 02/17/2000 MEMOS ATTACHED)	2/25/2000	48	(US EPA REGION 1)		MEMO	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/565887

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565892	LETTER CONFIRMING DISCUSSIONS BETWEEN EPA AND L&RR PERFORMING PARTIES REGARDING SURFACE WATER QUALITY TESTING	2/4/2000	1	Muench, Gretchen (US EPA REGION 1)	Cherney, Colburn T (ROPES & GRAY)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565892
572989	POST CLOSURE SITE MONITORING REPORT (02/08/2000 TRANSMITTAL LETTER ATTACHED)	2/1/2000	227	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572989
565894	LETTER IN RESPONSE TO EPA AND RIDEM (RI DEM) AND L&RR PERFORMING PARTIES REGARDING SURFACE WATER SAMPLING	1/24/2000	3	Helgason, Thor (DE MAXIMIS INC.)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565894
565893	LETTER REGARDING POSITION OF L&RR PERFORMING PARTIES REGARDING OILY STAINING	1/18/2000	2	Cherney, Colburn T (ROPES & GRAY)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565893
577399	INTERVENOR, TOWN OF NORTH SMITHFIELD'S MEMONRANDUM OF LAW PERTAINING TO CERTAIN ZONING AND LAND USE ISSUES (10/14/1999 TRANSMITTAL LETTER ATTACHED)	10/18/1999	14	(RHODE ISLAND ENERGY FACILITY SITTING BOARD)		MEMO	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/577399
577606	TRANSMITTAL LETTER FOR SUMMARY RESULTS OF GROUNDWATER SAMPLING DATA THROUGH MARCH 1999	9/24/1999	1	Krasko, Anna (US EPA REGION 1)	Cournoyer, George (SLATERSVILLE (RI) RESIDENT)	LTR	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/577606
565882	LETTER REGARDING RIDEM (RIDEM) REVIEW OF FIVE-YEAR REVIEW DATED ON 09/1999	9/17/1999	1	Grandchamp, Laurie (RIDEM)	Krasko, Anna (US EPA REGION 1)	LTR	053-REMEDIAL/0534-Post Construction/08.01-CORRESPONDENCE (POST REMEDIAL ACTION)	UCTL	1	https://semspub.epa.gov/src/document/01/565882
34977	FIRST FIVE-YEAR REVIEW REPORT	9/10/1999	30	(US EPA REGION 1)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/34977
554632	GROUNDWATER FLOW MODEL, PROPOSED INDECK - NORTH SMITHFIELD, LLC POWER PLANT [MARGINALIA]	8/1/1999	40	(GZA GEO ENVIRONMENTAL INC)	(INDECK - NORTH SMITHFIELD LLC)	RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/554632

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582517	POST-CLOSURE SITE MONITORING REPORT, 02/1999 TO 05/1999 (06/22/1999 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	6/1/1999	239	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/582517
577603	FOLLOW-UP LETTER TO TELEPHONE CONVERSATION ON 05/10/1999 REGARDING RESIDENT CONCERN WITH REGARDS TO FUTURE POTENTIAL DEVELOPMENT PLANS NEAR SLATERSVILLE RESERVOIR	5/12/1999	2	Krasko, Anna (US EPA REGION 1)	Zisiades, George (NORTH SMITHFIELD (RI) RESIDENT)	LTR	056-SITE SUPPORT/0561-Administrative Support/17.01-CORRESPONDENCE (SITE MANAGEMENT)	UCTL	1	https://semspub.epa.gov/src/document/01/577603
582518	POST-CLOSURE SITE MONITORING REPORT, 10/1998 TO 01/1999 (02/18/1999 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	2/1/1999	266	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/582518
582519	POST-CLOSURE SITE MONITORING REPORT, 06/1998 TO 09/1998 (11/02/1998 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	11/1/1998	204	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/582519
554631	BRIEF SUMMARY OF SITE HYDROGEOLOGICAL AND ANALYTICAL INFORMATION	10/7/1998	115			RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/554631
572959	POST CLOSURE SITE MONITORING REPORT - FEBRUARY TO MAY 1998 (06/12/1998 TRANSMITTAL LETTER ATTACHED)	6/1/1998	151	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572959
572961	POST CLOSURE SITE MONITORING REPORT - OCTOBER 1997 TO JANUARY 1998 (02/06/1998 TRANSMITTAL LETTER ATTACHED)	2/1/1998	184	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572961
582525	SUBSIDENCE REPAIR REPORT (11/141/997 TRANSMITTAL LETTER AND 11/07/1997 MONTHLY PROGRESS REPORT ATTACHED)	11/1/1997	81	(DE MAXIMIS INC)		RPT	053-REMEDIAL/0533-Remedial Action/07.05-REMEDIAL ACTION DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/582525
259361	CONSENT DECREE WITH SETTLEMENT AGREEMENT - CA NO 97-0078T	10/3/1997	382	(US DISTRICT COURT/DISTRICT OF RI)		LGL	052-ENFORCEMENT/0522-Negotiations/10.08-EPA CONSENT DECREES	UCTL	1	https://semspub.epa.gov/src/document/01/259361

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582516	POST-CLOSURE SITE MONITORING REPORT, 05/1997 TO 07/1997 (10/21/1997 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	10/1/1997	368	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/582516
444734	FINAL INTERIM REMEDIAL ACTION (RA) REPORT, OPERABLE UNIT (OU) 1 (TRANSMITTAL MEMO ATTACHED)	9/4/1997	28	(DE MAXIMIS INC)	(US EPA REGION 1)	MEMO	053-REMEDIAL/0533-Remedial Action/07.05-REMEDIAL ACTION DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/444734
582515	POST-CLOSURE SITE MONITORING REPORT, 01/1997 TO 04/1997 (05/16/1997 TRANSMITTAL LETTER ATTACHED) [MARGINALIA]	5/1/1997	146	(O & M INC)		RPT	053-REMEDIAL/0534-Post Construction/08.03-LONG-TERM RESPONSE REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/582515
551269	FINAL AS-BUILT DRAWINGS - SYNTHETIC COVER / SLOPE STABILIZATION REMEDIAL DESIGN (RD) CONSTRUCTION DRAWINGS, REVISION 5	3/25/1997	35	(SMITH)	(THE L&RR SITE GROUP)	FIG	053-REMEDIAL/0532-Remedial Design/06.04-REMEDIAL DESIGN REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/551269
271398	EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD)	9/16/1996	8	(US EPA REGION 1)		RPT	053-REMEDIAL/0531-Remedy Characterization/05.04-RECORD OF DECISION (ROD)	UCTL	1	https://semspub.epa.gov/src/document/01/271398
572957	POST CLOSURE SITE MONITORING REPORT - APRIL TO JUNE 1996	9/1/1996	253	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572957
647563	POST-CLOSURE OPERATION AND MAINTENANCE (O&M) PLAN	9/1/1996	244	(DE MAXIMIS INC)		WP	053-REMEDIAL/0534-Post Construction/08.05-WORK PLANS & PROGRESS REPORTS (POST REMEDIAL)	UCTL	1	https://semspub.epa.gov/src/document/01/647563
572962	POST CLOSURE SITE MONITORING REPORT - JANUARY TO MARCH 1996 (06/11/1996 REVISIONS ATTACHED)	5/1/1996	284	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/572962
577634	POST CLOSURE SITE MONITORING REPORT - OCTOBER TO DECEMBER 1995	2/1/1996	246	(O & M INC)	(L&RR SITE GROUP)	RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577634
577633	POST CLOSURE SITE MONITORING REPORT - JULY TO SEPTEMBER 1995 (11/06/1995 TRANSMITTAL LETTER AND 02/08/1996 MEMO ATTACHED)	10/1/1995	348	(DE MAXIMIS INC)		RPT	053-REMEDIAL/0534-Post Construction/08.04-LONG TERM RESPONSE MONITORING	UCTL	1	https://semspub.epa.gov/src/document/01/577633

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647561	CERTIFICATE OF PROMULGATION, RULES AND REGULATIONS FOR GROUNDWATER QUALITY	5/29/1992	1	(STATE OF RHODE ISLAND)		LAWS	056-SITE SUPPORT/0563-State/Tribal Involvement/09.10-STATE TECHNICAL AND HISTORICAL RECORDS	UCTL	1	https://semspub.epa.gov/src/document/01/647561
572965	LETTER REGARDING ADMINISTRATIVE ORDER (10/18/1990 REVISED MAILING LIST ATTACHED)	2/7/1992	6	Hohman, Merrill S (Mel) (US EPA REGION 1)		LTR	052-ENFORCEMENT/0522-Negotiations/10.01-CORRESPONDENCE (ENFORCEMENT/NEGOTIATION)	UCTL	1	https://semspub.epa.gov/src/document/01/572965
259375	EXPLANATION OF SIGNIFICANT DIFFERENCES (ESD)	3/8/1991	8	(US EPA REGION 1)		RPT	053-REMEDIAL/0531-Remedy Characterization/05.04-RECORD OF DECISION (ROD)	UCTL	1	https://semspub.epa.gov/src/document/01/259375
444694	REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) VOLUME 1 OF 2	6/1/1988	519	(EBASCO SERVICE INC)		RPT	053-REMEDIAL/0531-Remedy Characterization/04.06-FEASIBILITY STUDY REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/444694
444695	REMEDIAL INVESTIGATION / FEASIBILITY STUDY (RI/FS) VOLUME 2 OF 2 - APPENDICES	6/1/1988	613	(EBASCO SERVICE INC)		RPT	053-REMEDIAL/0531-Remedy Characterization/04.06-FEASIBILITY STUDY REPORTS	UCTL	1	https://semspub.epa.gov/src/document/01/444695
561476	REVISED COMMUNITY RELATIONS PLAN	10/1/1986	27	(EBASCO SERVICES INC)	(US EPA REGION 1)	RPT	051-COMMUNITY INVOLVEMENT/0511-Community Involvement Activities/13.02-COMMUNITY RELATIONS PLANS	UCTL	1	https://semspub.epa.gov/src/document/01/561476
554634	AVAILABILITY OF GROUNDWATER IN BRANCH RIVER BASIN, PROVIDENCE COUNTY, RHODE ISLAND (10/15/1998 LETTERS ATTACHED)	12/1/1974	48	(US GEOLOGICAL SURVEY)		RPT	056-SITE SUPPORT/0561-Administrative Support/17.07-REFERENCE DOCUMENTS	UCTL	1	https://semspub.epa.gov/src/document/01/554634

Key:

ADD – Analytical Data Document
CORR – Correspondence
EML – Email
FIG – Figure/Map/ Drawing
LAWS – Laws/Regulations/Guidance
LGL – Legal Instrument
LTR – Letter
MEMO – Memorandum
MTG - Meeting Document
PUB – Publication
RIDEM – Rhode Island Department of Environmental Management
RPT – Report
UCTL – Uncontrolled
WP – Work Plan