Superfund Program Proposed Plan for Operable Unit 3

Pohatcong Valley Groundwater Contamination Site

Warren County, New Jersey

June 2016

EPA ANNOUNCES PROPOSED PLAN

This Proposed Plan identifies the Preferred Alternative to address soil contamination at the Pohatcong Valley Groundwater Contamination Site (PVGWCS) Operable Unit (OU) 3 located in Warren County, New Jersey (the Site), and provides the rationale for this preference. Alternatives have been developed to address soil contaminated with the volatile organic compound (VOC) trichloroethene (TCE).

The U.S. Environmental Protection Agency's (EPA's) Preferred Alternative to address soil contamination in OU3 is Alternative 4: the construction of a deep Soil Vapor Extraction (SVE) system, with optional *in-situ* thermal hot-spot treatment to enhance mass removal.

This Proposed Plan includes a summary of all cleanup alternatives evaluated for OU3. This document is issued by EPA, the lead agency for Site activities, and New Jersey Department of Environmental Protection (NJDEP), the support agency. EPA, in consultation with NJDEP, will select the final remedy for OU3 after reviewing and considering all information submitted during a 30-day public comment period. EPA, in consultation with NJDEP, may modify the preferred alternative or select another response action presented in this Proposed Plan based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives presented in this document.

EPA is issuing this Proposed Plan for OU3 as part of its public participation responsibilities under Section 117(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA, or Superfund). This Proposed Plan summarizes information that can be found in greater detail in the OU3 Remedial Investigation (RI) and Feasibility Study (FS) reports and other documents contained in the Administrative Record for the Site.

Mark Your Calendar

June 15, 2016 – July 15, 2016: Public Comment Period on the Proposed Plan.

June 21, 2016, at 6:30p.m.: The EPA will hold a Public Meeting to explain the Proposed Plan, at the Washington Borough Municipal building, 100 Belvidere Avenue, Washington, NJ 07882
Telephone: (908) 689-3600

For more information, see the Administrative Record file (which includes the Proposed Plan and supporting documents), available at the following locations:

Warren County Health Department
700 Oxford Road
Oxford New Jersey, 07863
Telephone: (908) 475-7960
Fax: (908) 475-7964
Website: http://www.co.warren.nj.us/healthdept/
Hours: Monday-Friday: 8:30 am – 4:30 pm

And USEPA-Region II
Superfund Records Center
290 Broadway, 18th Floor
New York, New York 10007-1866
(212) 637-4308 Monday-Friday, 9:00 a.m. - 5:00 p.m.

EPA's website for the Pohatcong Valley Groundwater Contamination Site:
https://www.epa.gov/superfund/pohatcong-valley-groundwater

Written comments on this Proposed Plan should be addressed to:

Michelle Granger
Remedial Project Manager
Southern New Jersey Remediation Section
U.S. Environmental Protection Agency
290 Broadway, 19th Floor
New York, New York 10007-1866
Telephone: (212) 637-4975
Email address: granger.michelle@epa.gov

or

Pat Seppi,
Community Involvement Coordinator
290 Broadway, 26th Floor
New York, New York 10007-1866
Telephone: 212-637-3679
Email address: seppi.pat@epa.gov

SITE DESCRIPTION

The PVGWCS is located in parts of Washington Borough, Washington Township, Franklin Township, and Greenwich Township in Warren County, New Jersey (see **Figure 1**). The PVGWCS includes a groundwater contaminant plume that is approximately 8.5 miles long and 1.5 miles wide. Groundwater contamination primarily consists of TCE and perchloroethylene (PCE). The TCE and PCE plumes join into a combined plume. Pohatcong Valley is a northeast-southwest trending valley that is part of the Delaware River watershed and is drained by Pohatcong Creek and associated tributaries.

Due to its size and complexity, EPA has divided the PVGWCS cleanup into three OUs, referred to as the OU1, OU2, and OU3 Study Areas.

The OU1 Study Area extends approximately 4.5 miles southward from the former American National Can (ANC) facility. It includes TCE and PCE contaminated groundwater within Washington Borough and parts of Washington and Franklin Townships.

The OU2 Study Area is immediately downgradient of OU1 and extends approximately 4 miles southward from there (*i.e.*, extending from approximately 4.5 to 8.5 miles from the former ANC facility). OU2 includes TCE and PCE groundwater contamination located downgradient of OU1 within portions of Franklin and Greenwich Townships.

The OU3 Study Area is located in Washington Borough near Route 31 and includes the former ANC property and several adjacent downgradient properties: Area of Concern 1 (AC1), Warren Lumber Yard (WLY), and Vikon Tile Corporation (VTC)**.** The former ANC property is currently an active industrial facility. Land use for the properties of the OU3 Study Area are mainly commercial and industrial. These properties were identified in the OU1 RI as potentially contributing TCE to the Site-wide groundwater plume. See **Figure 2** for a layout of the ANC, AC1, WLY, and VTC properties.

This Proposed Plan addresses OU3 of the PVGWCS. The OU3 Study Area includes the four properties identified in the OU1 RI that have potentially contributed TCE to the groundwater contamination associated with OU1 and OU2. See **Figure 1** for a layout of the three OU Study Areas.

The OU1 RI indicated that there were elevated TCE concentrations in soil and groundwater in the OU3 Study Area requiring further delineation. PCE was not identified as a contaminant of concern for OU3. TCE-contaminated soil in the OU3 Study Area provides a continuing source of contaminants to groundwater and indoor air. Soils contaminated with TCE were grouped into three areas related to TCE contamination in the OU3 Study Area. These potential TCE contamination source areas have been designated during the OU3 RI as Areas A, B and C described below:

- **Area A**: This area includes the soils beneath the southwestern portion of the ANC building. Drain Lines (DL) DL-9 and DL-10, which connect to discharge structures on the down slope portions of the ANC property, originate in this area of the ANC building.

- **Area B:** This area is located at the DL-9 discharge point. Area B also includes areas down slope of DL-9, including a small portion of the ANC property (west of the railroad spur) and the Warren Lumber Yard (WLY) ponded area that primarily lie in the railroad Right-of-Way (ROW).

- **Area C**: This area is located at the DL-10 discharge point and includes areas down slope of this discharge on the ANC slope drainage area.

RI sampling focused on, but was not limited to these 3 areas. See **Figure 2** for a layout of Areas A, B, and C.

SITE HISTORY

VOCs, specifically TCE and PCE, were detected in groundwater from two public potable-water supply wells in Washington Borough in the late 1970s. The two potable-water supply wells, the Vannatta Street Well and the Dale Avenue Well, are owned and operated by New Jersey American Water Company.

After subsequent investigations conducted by the Warren County Department of Health and NJDEP, NJDEP installed public water-supply connections to homes and businesses within contaminated areas of Washington Township in 1989. Wellhead treatment systems were added to the public wells so groundwater is treated to meet drinking-water standards prior to distribution. EPA included the PVGWCS on the National Priorities List (NPL) of Superfund sites in March 1989.

Regarding the OU1 Study Area, EPA initiated RI/FS activities to delineate the nature and extent of contaminated groundwater and to evaluate potential human health and ecological risks. The OU1 RI documented levels of TCE and PCE in groundwater above drinking water standards. OU1 was subdivided into the OU1-TCE plume (groundwater primarily contaminated with TCE from the former ANC facility) and the OU1-PCE plume (groundwater primarily contaminated with PCE from the former Tung-Sol Tubing facility). The entire OU1 area covers Washington Borough, Washington Township, and the northern portion of Franklin Township. The OU1 PCE plume is significantly smaller than the OU1 TCE plume, and is encompassed solely within Washington Borough. The OU1 TCE plume extends from the former ANC facility approximately 4.5 miles southward to Asbury-Broadway Road. EPA completed the OU1 RI in 2005.

EPA selected a remedy for OU1 in 2006 that includes: 1) the extraction, treatment and reinjection of TCE and PCE contaminated water in the most contaminated areas; 2) monitored natural attenuation for the remediation of contaminated groundwater until cleanup goals are met; and 3) establishing a Classification Exception Area (CEA), to minimize the potential for exposure to contaminated groundwater until the groundwater meets cleanup goals. The groundwater treatment plants have been constructed and are anticipated to be operational in 2016. For further information regarding the OU1 remedy, refer to the July 2006 Record of Decision (ROD). This document can be found in the Administrative Record for the OU3 Study Area and at https://www.epa.gov/superfund/pohatcong-valley-groundwater. See Figure 1 for a layout of the OU1 Study Area.

Regarding the OU2 Study Area, between 2006 and 2009, EPA conducted an RI to determine the nature and extent of contamination beyond the OU1 Study Area. The RI also included an assessment of the hydraulic gradient and hydrogeologic connection between the OU1 and the OU2 Study Areas, and an evaluation of potential human health and ecological risks based on the occurrence and distribution of Site-related contamination in sediment, surface water, residential wells, indoor air, and groundwater. OU2 includes TCE-contaminated groundwater resulting from the OU1-TCE Plume and is located downgradient of the OU1 Study Area in portions of Franklin and Greenwich Townships. EPA selected a remedy for OU2 in September 2010. The OU2 remedy includes the following: 1) providing potable water to impacted and threatened properties through the construction of water mains and service connections; 2) monitored natural attenuation for the remediation of contaminated groundwater until cleanup goals are met; 3) establishing a CEA, to minimize the potential for exposure to contaminated groundwater until cleanup goals are met; and 4) abandoning private potable wells. The engineering design of the OU2 remedy is anticipated to be completed in 2017. For further information, regarding the OU2 remedy refer to the September 2010 ROD. This document can be found in the Administrative Record for the OU3 Study Area at https://www.epa.gov/superfund/pohatcong-valley-groundwater. See Figure 1 for a layout of the OU2 Study Area.

Regarding the OU3 Study Area, in 2011, EPA initiated RI/FS activities to determine the nature and extent of contamination. The RI included an evaluation of potential human health and ecological risks based on Site-related contamination in soil, sediment, surface water and indoor air.

SITE CHARACTERISTICS

Geology/ Hydrology

The PVGWCS is located in the Highlands physiographic province of western New Jersey. The Pohatcong Valley trends northeast-southwest and is underlain by carbonate rocks. Glacial moraine deposits overlay the carbonate bedrock. The glacial deposits are comprised of a mix of glacio-fluvial deposits and till and are characterized as a poorly

sorted mixture of sand, silt, and clay with larger clasts ranging from gravel to boulders. The moraine deposits range from 95 feet to greater than 140 feet thick at the OU3 Study Area. In general the permeability of the glacial deposits is low.

The groundwater occurs in the carbonate bedrock aquifer below the overburden. This group of fractured carbonate rocks is part of the Leithsville Formation and is often referred to as the Kittatiny Aquifer System. Near the OU3 Study Area, the depth to groundwater is approximately 100 to 120 feet below ground surface (bgs). Groundwater flow is from the northeast to the southwest, down the axis of the valley.

Investigations

The results of the OU1 RI performed by EPA, as well as investigations performed by other parties, indicated that there were elevated TCE concentrations in soil and groundwater in the OU3 Study Area requiring further delineation. Several investigations were completed between 2012 and 2015 to determine the nature and extent of contamination at the OU3 Study Area. These investigations included: soil investigations, a drainage pathway investigation, groundwater investigations, indoor and sub-slab air sampling investigations, and an ecological characterization.

Soil Investigations

Based on historical soil sampling results, EPA targeted soil investigations throughout the OU3 Study Area, including Areas A, B, and C. From 2012 to 2015, 71 borings were advanced to collect a total of 470 soil samples for chemical analysis to determine the extent of soil contamination. Sample locations are presented on **Figure 3**.

The highest concentrations and most frequent detections of TCE were beneath the southwestern corner of the ANC building (Area A), where TCE degreasers are believed to have been located. Below the ANC building, a total of 165 samples from 30 borings were collected between 2012 and 2015 to determine the extent of soil contamination directly below the ANC building. Out of 28 soil samples collected in shallow soils (< 2 feet bgs) beneath the building slab, TCE was detected in 6 samples at levels ranging from .008 parts per million (ppm) to 2.8 ppm. The maximum concentration was detected under the southwestern corner of the building (Area A). Soil samples from the subsurface soils (soils > 2 feet bgs) showed TCE at levels ranging from non-detect to 120 ppm, with the maximum concentration again detected under the southwestern corner of the building (Area A).

Vertically, TCE is present above 1 ppm throughout the overburden beneath the ANC building and into the weathered bedrock zone to a depth of approximately 100 feet (bgs). Area A has the highest concentrations of TCE in soil at the OU3 Study Area (as high as 120 ppm at a depth of 80 feet bgs). Throughout the vadose zone soils under the building, levels of TCE were above 1 ppm, however a hotspot was identified within Area A at depths between 70 and 100 feet bgs. TCE detections in the groundwater directly under the ANC building (Area A) ranged from 74 parts per billion (ppb) to as high as 120 ppb. The New Jersey Groundwater Quality Standard (NJGWQS) for TCE is 1 ppb. TCE detections were as high as 4,600 ppb in the groundwater 100 feet downgradient from this area, confirming that TCE beneath the ANC building has migrated through the unsaturated overburden into the regional groundwater. The TCE remaining in the soils in Area A is an ongoing source of groundwater and indoor air contamination.

A total of 123 samples from 15 borings were collected outside the ANC building footprint on the ANC property during the OU3 RI, including in Areas B and C. Out of 123 soil samples, TCE was detected in 28 samples as high as 0.74 ppm. The maximum concentration was detected in deep soils downgradient of the DL-10 discharge point (Area C).

Soil samples were also taken on adjacent properties downgradient of the ANC property, AC1, WLY, and VTC. On the WLY property, 58 samples were collected from 9 borings. TCE was found in 36 samples at a range of non-detect to 6.7 ppm, with the maximum concentration found 7 feet bgs in the WLY ponded area, near the DL-9 discharge (Area B). On the AC1 property, 92 soil samples were collected from 12 borings. The maximum TCE detection was 2 ppm in the surface soil downgradient from the DL-10 discharge (Area C). On the VTC property, 32 samples were collected

from 5 borings and no TCE contamination was detected.

Soil samples were also analyzed for semivolatile organic compounds (SVOCs), pesticides, polychlorinated biphenyls (PCBs), and metals within the OU3 Study Area. SVOCs, PCBs, pesticides, and metals were detected in soil throughout the OU3 Study Area. These detections were isolated occurrences, not found in widespread areas of the OU3 Study Area associated with the TCE contamination. The limited presence of SVOCs, PCBs, pesticides, and metals above guidance values are not Site-related because they are not associated with the TCE-contaminated groundwater. These results will be forwarded to the facility property owner as well as state and local authorities to address under other cleanup authorities, as appropriate.

Drainage Pathway Investigation

Surface water and sediment samples were obtained to determine the nature and extent of contamination in outfall areas, drainage pathways, and ponded water areas. A total of 13 surface water samples and 14 sediment samples were collected throughout the OU3 Study Area including in Areas B and C. It was not possible to collect surface water and sediment samples from Area A, since that area is under the ANC building. Sample locations are presented on **Figure 4**.

Since there are no permanent surface-water features in the OU3 Study Area, samples were collected following a rain event to examine the impact of recharge at areas with soil contamination (*i.e.*, Areas B and C). Surface water and sediment samples were analyzed for VOCs, SVOCs, pesticides, PCBs and metals.

The data suggest that TCE entered the wastewater drainage network inside the Area A portion of the ANC building and that TCE-contaminated water either infiltrated into the ground through cracked drain pipes under the facility or was directed through effluent pipes that then discharged to drainage areas on the eastern (DL-9) and western (DL-10) side of the ANC railroad spur (Areas B and C, respectively).

Compared to the high TCE concentrations in soil underneath Area A of the ANC building (Area A), substantially lower concentrations of TCE were identified throughout Areas B and C of the OU3 Study Area. Area C includes the ANC slope drainage area east of the railroad spur down slope from the DL-10 outfall, which extends into the AC1 drainage basin through an eroded channel, and Area B in the WLY ponded area down slope from the DL-9 outfall on the western side of the ANC property railroad spur. TCE was detected in 103 of 305 samples collected from the four OU3 Study Area properties (not including samples from below the ANC building). TCE in Area C was observed in the surface water (up to 0.11 ppb) and sediment (up to .002 ppm). TCE in Area B was observed in surface water (up to 21 ppb) and sediment (up to .008 ppm).

Residual levels of TCE in subsurface soil throughout the drainage areas indicate likely disposal and transfer of TCE at the ANC facility during historical operations. The data suggests that TCE migrated through overland flow and then infiltration in the drainage areas provided a mechanism for TCE in the surface water and sediment to mobilize from the discharge areas (DL-9 and DL-10), redistribute to the lower portions of the drainage areas, and either migrate into groundwater and/or volatize into the air.

Surface water and sediment samples were also analyzed for SVOCs, pesticides, PCBs, and metals. SVOCs, PCBs, pesticides and metals were detected in surface water and sediment within the OU3 Study Area. The detections were isolated occurrences, not found in widespread areas of the OU3 Study Area associated with the TCE contamination. The limited presence of SVOCs, PCBs, pesticides, and metals above the guidance values are not Site-related and are not associated with the TCE-contaminated groundwater.

Groundwater Investigations

Based on EPA's OU1 and OU2 comprehensive RI studies, it has been concluded that TCE forms a continuous 8.5 mile groundwater contaminant plume originating in the OU3 Study Area. The extensive OU1 groundwater investigation concluded that TCE is by far the main groundwater contaminant throughout the PVGWCS and the ANC property constitutes the primary source of that TCE. Groundwater samples collected throughout the OU1 Study Area indicate that TCE has migrated down

through unconsolidated soils from the ANC property (Area A) into the regional aquifer.

The highest TCE concentration detected in groundwater sampled during the OU1 RI (2,100 ppb) was located immediately downgradient of the ANC facility. Sampling results in the regional aquifer revealed that groundwater underlying the ANC facility is consistently highly contaminated with TCE, with concentrations as high as 4,600 ppb. In addition, a groundwater sample (PPP-SBD-40) collected during the OU3 RI detected TCE at 540 ppb in the southern portion of the ANC property.

A total of 11 perched groundwater samples were collected in both deep and shallow soil borings in perched zones throughout the drainage areas of the OU3 Study Area. Perched water samples were analyzed for VOCs to determine the presence of TCE contamination. TCE levels in perched groundwater ranged from .4 ppb to 820 ppb with the maximum concentration detected in Area C near the base of the AC1 slope, downgradient from the DL-10 discharge point. Sample locations are presented on Figure **3**.

Indoor and Sub-Slab Air Sampling Investigations

Buildings throughout the OU3 Study Area were screened for potential vapor intrusion during the OU3 RI. The only building that had the potential for vapor intrusion was the ANC building. In March 2013, a vapor intrusion investigation was completed within and under the ANC building. Ten sub-slab and ten indoor air samples were collected. Significantly elevated levels of VOC vapors were detected in both sub-slab and indoor air samples. The results indicated that concentrations of TCE in the sub-slab air were significantly above the NJDEP Non-Residential Soil Gas Screening Level (150 micrograms per cubic meter, or $\mu g/m^3$) and indoor air concentrations were well above the Site-specific indoor air health goal of 7 $\mu g/m^3$ developed by EPA and the Agency for Toxic Substances and Disease Registry (ATSDR). The highest level of TCE in the sub-slab was found to be 480,000 ug/m^3. This concentration was detected under Area A. Indoor air TCE concentrations up to 180 ug/m^3 were also detected in Area A.

During the summer of 2013, soil vapor extraction (SVE) and sub-slab depressurization (SSD) systems to mitigate exposure to TCE inside the building were installed. The systems treat the soils to a depth of approximately 5 feet below the building slab. Results of subsequent sampling show the systems have reduced concentrations in the indoor and sub-slab air significantly and indoor air levels are below the Site-specific indoor air health goal of 7 $\mu g/m^3$.

Ecological Characterization

OU3 Study Area habitats were characterized for the ANC, AC1, VTC, and WLY properties. It was determined that no endangered, threatened or sensitive species were present within ¼ mile of the Site and that investigation and cleanup of the OU3 Study Area would have no effect on any federally listed threatened or endangered species or critical habitats.

SCOPE AND ROLE OF THE ACTION

EPA has addressed the cleanup of this Site by implementing both immediate and long-term cleanup actions.

With respect to immediate actions taken in the OU3 Study Area, in 2013 an action was performed which included the installation of SVE and SSD systems to mitigate exposure to TCE in the indoor air of the building. As noted above, results of subsequent sampling show the systems have reduced concentrations in the indoor air below levels of concern. The SVE/SSD systems continue to operate at the ANC building.

The long-term cleanup at the Site is being conducted in three phases, or operable units.

- OU1, which was the subject of a 2006 ROD, provides for the implementation of a remedy to address groundwater contamination, including: 1) the extraction, treatment and reinjection of TCE and PCE contaminated water in the most contaminated areas; 2) monitored natural attenuation for the remediation of contaminated groundwater until cleanup goals are met; and 3) establishing a CEA, to minimize the potential for exposure to contaminated groundwater until the groundwater meets cleanup goals.

- OU2, which was the subject of a 2010 ROD, provides for the implementation of a remedy to address groundwater contamination, including: 1) providing potable water through the construction of water mains and service connections; 2) monitored natural attenuation for the remediation of contaminated groundwater until cleanup goals are met; 3) establishing a CEA, to minimize the potential for exposure to contaminated groundwater until the groundwater meets cleanup goals; and 4) abandoning private potable wells.

- OU3, which is the subject of this Proposed Plan, will address the TCE contaminated soils that constitute a source of contamination to groundwater and indoor air at the Site. The OU3 ROD is expected to be the final remedy selected for this Site.

Principal Threats

Soils with elevated levels of TCE in the vadose zone underlying the ANC building are considered principal threat wastes. Addressing these contaminated soils will have a positive impact on the planned groundwater remediation, as they are an ongoing source of contamination to groundwater and indoor air at this Site (see inset box).

WHAT IS A "PRINCIPAL THREAT"?

The NCP establishes an expectation that EPA will use treatment to address the principal threats posed by a site wherever practicable (NCP Section 300.430(a)(1)(iii)(A)). The "principal threat" concept is applied to the characterization of "source materials" at a Superfund site. A source material is material that includes or contains hazardous substances, pollutants or contaminants that act as a reservoir for migration of contamination to groundwater, surface water or air, or acts as a source for direct exposure. Contaminated groundwater generally is not considered to be a source material; however, Non-Aqueous Phase Liquids (NAPLs) in groundwater may be viewed as source material. Principal threat wastes are those source materials considered to be highly toxic or highly mobile that generally cannot be reliably contained, or would present a significant risk to human health or the environment should exposure occur. The decision to treat these wastes is made on a site-specific basis through a detailed analysis of the alternatives using the nine remedy selection criteria This analysis provides a basis for making a statutory finding that the remedy employs treatment as a principal element.

WHAT IS RISK AND HOW IS IT CALCULATED?

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

Hazard Identification: In this step, the chemicals of potential concern (COPCs) at a site in various media (*i.e.*, soil, groundwater, surface water, and air) are identified based on such factors as toxicity, frequency of occurrence, and fate and transport of the contaminants in the environment, concentrations of the contaminants in specific media, mobility, persistence, and bioaccumulation.

Exposure Assessment: In this step, the different exposure pathways through which people might be exposed to the contaminants identified in the previous step are evaluated. Examples of exposure pathways include incidental ingestion of contaminated groundwater. Factors relating to the exposure assessment include, but are not limited to, the concentrations that people might be exposed to and the potential frequency and duration of exposure. Using these factors, a reasonable maximum exposure scenario, which portrays the highest level of human exposure that could reasonably be expected to occur, is calculated.

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

Risk Characterization: This step summarizes and combines outputs of the exposure and toxicity assessments to provide a quantitative assessment of site risks. Exposures are evaluated based on the potential risk of developing cancer and the potential for non-cancer health hazards. The likelihood of an individual developing cancer is expressed as a probability. For example, a 10^{-4} cancer risk means a one-in-ten-thousand excess cancer risk; or one additional cancer may be seen in a population of 10,000 people as a result of exposure to site contaminants under the conditions explained in the Exposure Assessment. Current guidelines for acceptable exposures are an individual lifetime excess cancer risk in the range of 10^{-4} to 10^{-6} (corresponding to a one-in-ten-thousand to a one-in-a-million excess cancer risk) with 10^{-6} being the point of departure. For noncancer health effects, a hazard index (HI) is calculated. An HI represents the sum of the individual exposure levels compared to their corresponding reference doses. The key concept for a non-cancer HI is that a threshold level (measured as an HI of less than 1) exists below which non-cancer health effects are not expected to occur.

RISK SUMMARY

The purpose of the risk assessment is to identify potential cancer risks and noncancer health hazards at the Site assuming that no further remedial action is taken. A baseline human-health risk assessment was performed to evaluate current and future cancer risks and noncancer health hazards based on the results of the RI. A screening-level ecological risk assessment was also conducted to assess the risk posed to ecological receptors due to Site-related contamination.

Human-Health Risk Assessment

As part of the RI/FS, a baseline human-health risk assessment (BHHRA) was conducted to estimate the risks and hazards associated with the current and future effects of contaminants on human health and the environment. A baseline human-health risk assessment is an analysis of the potential adverse human-health effects caused by hazardous-substance exposure in the absence of any actions to control or mitigate these under current and future land uses.

A four-step human-health risk assessment process was used for assessing Site-related cancer risks and noncancer health hazards (see inset box "What is Risk and How is it Calculated"). The four-step process is comprised of: Hazard Identification of Chemicals of Potential Concern (COPCs), Exposure Assessment, Toxicity Assessment, and Risk Characterization.

The BHHRA began with selecting COPCs in the various media (*i.e.*, soil, subsurface soil, etc.) that could potentially cause adverse health effects in exposed populations. The current and future land use scenarios included the following exposure pathways and populations:

- Site Workers (adult): current/future ingestion, dermal contact and inhalation of soil particles and vapors related to surface soil from the ANC and WLY properties. In addition, the AC1/VTC/railroad property was evaluated for future exposures.
- Trespassers (adolescent): current ingestion, dermal contact and inhalation of soil particles and vapors related to surface soil and ingestion and dermal contact from surface water and sediment from the AC1/VTC/railroad property.
- Construction Workers (adult): future ingestion, dermal contact and inhalation of soil particles and vapors from both surface and subsurface soil related to ANC, WLY, and AC1/VTC/railroad properties.
- Residents (child/adult): future hypothetical ingestion, dermal contact and inhalation of soil particles and vapors related to surface soil from the ANC, WLY and AC1/VTC/railroad properties.

In this assessment, exposure point concentrations were estimated using either the maximum detected concentration of a contaminant or the 95 percent upper-confidence limit (UCL) of the average concentration. Chronic daily intakes were calculated based on the reasonable maximum exposure (RME), which is the highest exposure reasonably anticipated to occur at the Site. The RME is intended to estimate a conservative exposure scenario that is still within the range of possible exposures. Central tendency exposure (CTE) assumptions, which represent typical average exposures, were also developed. A complete summary of all exposure scenarios can be found in the baseline human-health risk assessment.

In addition, indoor air and groundwater are also considered as part of assessing risk at the OU3 Study Area.

Surface Soil

Risks and hazards were evaluated for current and future exposure to surface soil. The populations of interest included adult Site workers, adolescent trespassers and adult/child residents. The cancer risks for all of the receptor populations evaluated were within or below the acceptable EPA risk range of 1×10^{-6} to 1×10^{-4} with the exception of the adult/child resident for ANC and AC1/VTC/Railroad properties, which were above the acceptable cancer risk range. The hazard indexes for all of the receptor populations evaluated were below the EPA acceptable value of 1 with the exception of the adult/child resident for all properties. The primary contaminants associated with the elevated risks and hazards were arsenic, chromium, vanadium, and PCBs. The risks and hazards for TCE and the breakdown products, all

which are Site-related contaminants, were all below or within EPA acceptable ranges.

Since the contaminants that are associated with the cancer risk and noncancer hazards above acceptable EPA criteria are not considered to be Site-related contaminants, there were no contaminants of concern (COCs) identified for surface soil.

Surface and Subsurface Soil

Risks and hazards were evaluated for the potential future exposure to surface and subsurface soil. The population of interest included adult construction workers. The cancer risks were below or within the EPA acceptable ranges. The non-cancer hazards were below the EPA acceptable value of 1, with the exception of the construction worker for the AC1/VTC/Railroad property. There were no Site-related COCs identified in the surface/subsurface soil.

Since the contaminants that are associated with the cancer risk and noncancer hazards above acceptable EPA criteria are not considered to be Site-related contaminants, there were no COCs identified for surface and subsurface soil.

Sediment and Surface Water

Risks and hazards were evaluated for the potential current exposure to sediment and surface water. The population of interest included adolescent trespassers at the AC1/VTC/Railroad property. The surface water is intermittent as it is associated with rainfall and standing water in low lying areas. Due to the lack of a consistent surface water body, the surface water was not evaluated quantitatively in the risk assessment. The cancer risks calculated for sediment exposure exceeded the EPA acceptable ranges. The non-cancer hazards for sediment exposure also exceeded the EPA acceptable value of 1. The primary contaminants associated with the elevated sediment risks are PCBs. There were no Site-related COCs identified in the sediment or surface water.

Since the contaminants that are associated with the cancer risk and noncancer hazards above acceptable EPA criteria are not considered to be Site-related contaminants, there were no COCs identified for surface soil.

Vapor Intrusion

Risks and hazards were evaluated for the potential exposure of workers at the ANC building to TCE by the intrusion of vapors from contaminated soils and groundwater. Sub-slab soil vapor concentrations of TCE beneath the ANC building continue to exceed the 10^{-6} screening criteria. Indoor air vapor concentrations of TCE exceeded the 10^{-6} screening criteria by several orders of magnitude. Indoor air vapor concentrations are currently below the screening criteria due to the ongoing operation of the SVE and SSD systems, which were installed in 2013. With the vapor mitigation systems operational, the vapor intrusion exposure pathway is incomplete.

Groundwater

As noted above, TCE is the main OU1 groundwater contaminant and the ANC property (OU3) constitutes the primary source of that TCE. With TCE as the primary COC in the groundwater, and since groundwater in the regional aquifer within the OU1 Study Area is used as a potable water supply, the OU1 risk assessment evaluated the risks associated with exposures to the groundwater in the OU1 Study Area for industrial/commercial and residential use. The results of the OU1 baseline risk assessment indicate that the TCE-contaminated groundwater within OU1 poses an unacceptable risk to human health. The hazards and risks associated with exposure to the regional groundwater within the OU1 Study Area, which begins in the OU3 Study Area, result in risks above EPA's target risk levels for both industrial and residential scenarios.

Although other contaminants were detected in groundwater and contribute to risk, TCE by far presents the most concern. In contrast to the TCE groundwater contamination, other contaminants identified are limited in extent, and are localized inside and outside the TCE plume. As noted above, the TCE plume extends approximately 8.5 miles from the OU3 Study Area.

Human Health Risk Assessment Summary

Based on the results of the OU1 and OU3 human-health risk assessments, there are unacceptable risks associated with Site-related contamination in indoor air and groundwater.

Ecological Risk Assessment

A screening-level ecological risk assessment (SLERA) was conducted to evaluate the potential for ecological risks from the presence of contaminants in surface soil, sediments and surface water. The SLERA focused on evaluating the potential for impacts to sensitive ecological receptors to Site-related constituents of concern through exposure to soil, sediments and surface water on the combined properties (ANC, WLY and ACI/VTC/Railroad). Surface soil, sediment and surface water concentrations were compared to ecological screening values as an indicator of the potential for adverse effects to ecological receptors. A complete summary of all exposure scenarios can be found in the SLERA.

Surface Soil

The surface soil screening criteria were exceeded for metals (antimony, barium, cadmium, chromium, cobalt, copper, lead, manganese, mercury, selenium, vanadium, and zinc), pesticides (aldrin and dieldrin), SVOCs, (benzo[a]anthracene, fluoranthene, and pyrene), and PCBs (*i.e*., Aroclor 1248), which resulted in HIs greater than the acceptable value of 1. None of these compounds are considered to be Site-related.

Sediment

The sediment screening criteria were exceeded for metals (antimony, arsenic, cadmium, chromium, copper, cyanide, iron, lead, manganese, mercury, nickel, and zinc), pesticides (4,4'-DDE, 4,4'-DDT, aldrin, dieldrin, endosulfan, endosulfan sulfate, endrin, gamma-chlordane, and heptachlor), SVOCs (2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[g,h,i]perylene, benzo[k] fluoranthene, chrysene, dibenzo[a,h]anthracene, fluoranthene, hexachlorobenzene, indeno[1,2,3-cd] pyrene, phenanthrene, and pyrene), and PCBs (*i.e.*, Aroclor 1248), which resulted in HIs greater than the acceptable value of 1. None of these compounds are considered to be Site-related.

Surface Water

The surface water screening criteria were exceeded for metals (aluminum, cadmium, chromium, copper, iron, lead, manganese, nickel, and zine) and PCBs (*i.e*., Aroclor 1248), which resulted in HIs greater than the acceptable value of 1. None of these compounds are considered to be Site-related.

Ecological Risk Assessment Summary

No concentrations of Site-related chemicals (*i.e*., TCE) were detected at concentrations above ecological screening criteria, therefore there were no ecological COCs identified for the Site. In addition, there is limited habitat present on the Site for ecological receptors. Based on the results of the SLERA there are no unacceptable risks or hazards associated with Site-related contamination.

Conclusion of the Risk Assessment

While evaluated as part of the OU3 investigations, no OU3-related risks were found on the adjacent AC1, VTC, Railroad or WLY properties; please refer to the OU3 RI Report and OU3 BHHRA for further detail on the results of these investigations. Further, based on the results of the OU3 human-health and ecological risk assessments it has been concluded that no Site-related risks are attributable to Areas B & C. Based on the results of the OU1 and OU3 human-health risk assessments, there are unacceptable risks associated with Site-related contamination in indoor air and groundwater. TCE in soils beneath the ANC building (Area A) will need to be addressed in order to ensure continued protection of human health and the environment. In addition, TCE contamination in soil under the ANC building poses a risk to the groundwater as it acts as a continuing source of contamination.

REMEDIAL ACTION OBJECTIVES

Remedial Action Objectives (RAOs) are specific goals to protect human health and the environment. These objectives are based on available information and standards, such as applicable or relevant and appropriate requirements (ARARs), to-be-considered (TBC) guidance, and Site-specific risk-based levels.

RAOs have been developed to focus on reducing the impact from the contaminated vadose zone soils

(unsaturated zone of soil and rock above the water table) to the groundwater quality and the indoor air. The RAOs for the OU3 Study Area are:

For contaminated soil:

- Reduce contaminant mass in the vadose-zone soil to minimize the impact to groundwater quality.
- Reduce contaminant mass in the vadose-zone soil to minimize the potential human-health risks from vapor intrusion.

For soil vapor:

- Mitigate impacts to public health resulting from existing, or the potential for, soil vapor intrusion into buildings.

To achieve these RAOs, remediation goals for contaminated soil and soil vapor at the Site were identified.

Modeled calculations demonstrate that a TCE soil concentration of 1 ppm would result in minimal impact to TCE concentrations in groundwater at the OU1 groundwater treatment plant extraction wells, thus, would be protective of groundwater at this Site. Therefore, a Site-specific remediation goal of 1 ppm has been established for TCE in the vadose-zone soil.

The Site-specific indoor air health goal of 7 $\mu g/m^3$ developed by EPA and ATSDR is a TBC criterion. Using collected sub-slab and indoor air concentrations, a Site-specific attenuation factor from sub-slab vapor to indoor air was developed. Using the Johnson & Ettinger Model for Subsurface Vapor Intrusion into Building, a soil cleanup value of 1 ppm for TCE was determined to be protective of human-health.

SUMMARY OF REMEDIAL ALTERNATIVES

CERCLA Section 121(b)(1), 42 U.S.C. Section 9621(b)(1), mandates that remedial actions must be protective of human health and the environment, cost-effective, comply with ARARs, and utilize permanent solutions and alternative treatment technologies and resource recovery alternatives to the maximum extent practicable. Section 121(b)(1) also establishes a preference for remedial actions which employ, as a principal element, treatment to permanently and significantly reduce the volume, toxicity, or mobility of the hazardous substances, pollutants, and contaminants at a Site.

Potential applicable technologies were identified and screened in the FS using effectiveness, implementability, and cost as the criteria, with emphasis on the effectiveness of the remedial action. The retained technologies were combined into four remedial alternatives. A brief summary of the remedial alternatives for the Site is provided below.

The timeframes for implementation of alternatives do not include the time for designing the remedy or the time to procure necessary contracts. Because each of the action alternatives are expected to take longer than five years to reach cleanup criteria, a Site review will be conducted every five years (five-year reviews) until remedial goals are achieved.

With the exception of the No Action alternative, all alternatives would include the following common elements: a deed notice which will assure the implementation of all aspects of the OU3 remedy; operation, maintenance and monitoring of the existing shallow soil vapor extraction (SVE) and sub-slab depressurization (SSD) systems; and five-year reviews.

Detailed descriptions of the remedial alternatives for the OU3 Study Area can be found in the FS report.

Alternative 1 – No Action

The No Action Alternative was retained, as required by the National Oil and Hazardous Substances Contingency Plan (NCP), and provides a baseline for comparison with other Site remedial alternatives. No remedial actions would be implemented to address the TCE-contaminated soil as part of the No Action Alternative.

Under the No Action alternative, the ANC building acts as an impermeable cap, which reduces the infiltration beneath the ANC building; significantly slows down contaminant migration into groundwater; and prolongs the existence of contamination in the vadose zone.

Under this alternative, the shallow SVE and SSD systems, which are currently operating in order to address indoor air TCE contamination, are assumed to be not in operation. No remedial action or monitoring would be performed.

Capital Cost:	$0
Annual O&M Cost:	$0
Present-Worth Cost	$0
Construction Timeframe:	0 years
Timeframe to reach RAOs	> 100 years

Alternative 2 – Limited Action

Under this alternative, the existing shallow SVE and SSD systems would be operated and maintained. The shallow SVE and SSD systems create a negative pressure through a series of extraction wells. The extraction wells are used to collect the contaminated air, which is then treated to remove contaminants through the use of granular activated carbon. The operation of the shallow SVE and SSD systems provides protection of human health from vapor intrusion. The shallow SVE and SSD systems treat contaminated soil vapor in the sub-slab down to approximately 5 feet under the slab. TCE concentrations in the most recent indoor air sampling event ranged from non-detect to 1 $\mu g/m^3$, which meet the Site-specific indoor air health goal and demonstrate that the system is effective.

Capital Cost:	$0
Annual O&M Cost:	$185,000
Present-Worth Cost:	$2,370,000
Construction Timeframe:	0 years
Timeframe to reach RAOs	>100 years

Alternative 3 – *In-Situ* Chemical Oxidation

Under this alternative, *in-situ* chemical oxidation (ISCO), in conjunction with the shallow SVE and SSD systems, would be implemented to remediate the contaminated area beneath the ANC building. The shallow SVE and the SSD systems would be operated as described in Alternative 2. The ISCO treatment would involve injecting an oxidant or oxidant releasing compounds into the target treatment zone containing TCE at levels of greater than 1 ppm in the soil. The oxidant would mix with the contaminants and cause them to decompose. When the process is complete, only water and innocuous breakdown products would be left in the treated area. Monitoring would be required to determine the effectiveness of the treatment. For the ISCO treatment, the chemical distribution would require enhancement by environmental hydraulic fracturing, which involves the injection of an amendment under a moderate pressure to create flow paths to enhance oxidant distribution. For this alternative, permanganate is assumed as the representative oxidant for alternative development and estimating costs. During the remedial design (RD), other process options would be evaluated based on bench-study and pilot study results to select the most effective oxidant to treat the Site.

For the remedial action, environmental hydraulic fracturing would be conducted followed by the delivery of chemicals (*e.g.*, permanganate solution) using a network of injection wells. Multiple applications of treatment agents are anticipated as the injected chemical would infiltrate into a deeper depth by gravity. A monitoring well screened at the groundwater table would be installed at the downgradient edge of the injection area to monitor the migration of contaminants and /or oxidant into the aquifer.

After completion of multiple rounds of ISCO treatment, soil borings would be installed within the treatment zone to evaluate the effectiveness of treatment. Data from soil sampling and analysis and groundwater samples below the treatment zone could also be used to evaluate the mass reduction. Due to the challenges in adequate distribution of oxidant in vadose zone soils, it is estimated that approximately 50 percent mass removal could be achieved within the treatment zone based on prior experience. The remaining soil contamination left in place would migrate to the building sub-slab as soil gas and be extracted by the shallow SVE and SSD systems or migrate to groundwater and be addressed under the OU1 remedy.

Capital Cost:	$10,300,000
Annual O&M Cost:	$185,000
Present-Worth Cost:	$12,600,000
Construction Timeframe:	3 years
Timeframe to reach RAOs	> 30 years

Alternative 4 – Deep SVE with Optional *In-Situ* Thermal Hot-Spot Treatment

Under this alternative, the shallow SVE and the SSD systems would be operated as described in Alternative 2. A deep SVE system would be installed from 30 to 100 feet bgs to remediate the deep vadose zone contamination beneath the ANC building to meet the Site-specific remediation goal. The deep SVE would operate by the same principles as the shallow SVE, except it would be located in a deeper interval. The shallow SVE system has been successfully remediating the shallow soil. The lithology in the deeper soils is similar to the shallow soils, indicating that it is likely that the deep SVE would be effective in treating the deeper soils. During the RD, a pilot study would be performed to obtain additional design parameters and also to determine the full effectiveness of a deep SVE system. If, due to Site specific conditions (such as excess moisture in the deep zone), the deep SVE could not effectively achieve the remediation goal in a reasonable timeframe, this alternative includes the option to implement *in-situ* thermal treatment. *In-situ* thermal treatment would be used if necessary to remediate the most contaminated zone (hot-spot) where contamination would likely persist, in addition to the deep SVE system. EPA would evaluate the necessity of implementing *in-situ* thermal treatment during the remedial design and/or during the operation of the deep SVE system. *In-situ* thermal treatment entails heating the treatment zone soils to a high temperature that can volatilize TCE into soil gas, which would then be captured by the deep SVE system.

After the first few years (approximately 3 to 5 years) of operation of the deep SVE system, as TCE concentrations in the extracted vapor reach the asymptotic level, the operation of the SVE system would likely become intermittent. The mass removal rate and the TCE concentration rebound (especially at the hot-spot) during the deep SVE system shutdown period would be evaluated. Options for optimizing the system would be evaluated. Soil samples may also be collected and compared to the Site-specific remediation goal for TCE. The option of implementing *in-situ* thermal hot-spot treatment would be evaluated as one of the optimization options for the deep SVE system in order to meet the remediation goal in a reasonable timeframe.

If *in-situ* thermal treatment is implemented, it is anticipated to be conducted between 60 and 100 feet bgs at the hot-spot under the ANC building. *In-situ* thermal hot-spot treatment is estimated to operate for 6 months. After the completion of *in-situ* thermal treatment, soil samples would be collected from the treatment zone to evaluate the treatment effectiveness. More than 90 percent mass removal of TCE is anticipated for this alternative.

Deep SVE without *in-situ* Thermal Treatment:

Capital Cost:	$3,500,000
Annual O&M Cost:	$609,000
Present-Worth Cost:	$7,800,000
Construction Timeframe:	2.5 years
Timeframe to reach RAOs	10 years

Deep SVE with *In-Situ* Thermal Treatment

Capital Cost:	$9,200,000
Annual O&M Cost:	$410,000
Present-Worth Cost:	$12,700,000
Construction Timeframe:	4 years
Timeframe to reach RAOs	10 years

EVALUATION OF ALTERNATIVES

Nine criteria are used to evaluate the different remedial alternatives individually and against each other in order to select the best alternative. This section of the Proposed Plan profiles the relative performance of each alternative against the nine criteria, noting how it compares to the other alternatives under consideration. The nine evaluation criteria are discussed below. A more detailed analysis of the presented alternatives can be found in the FS.

Overall Protection of Human Health and the Environment

With the exception of Alternative 1, all the alternatives provide protection to human health. For the OU3 Study Area, human health risks and ecological risks associated with Site-related contaminants from direct contact with soils are within EPA's acceptable range. However, human health risks from exposure to elevated levels of TCE in the indoor air are above the EPA's acceptable range. Under Alternative 1, human health would not be protected, since the shallow SVE and SSD systems would not be in place to

mitigate vapor intrusion. Under Alternatives 2, 3 and 4, vapor intrusion at the ANC building would be effectively mitigated by the operation of the shallow SVE and SSD systems and human health would be protected from vapor intrusion. Therefore, Alternatives 2, 3 and 4 would meet the RAO for soil vapor.

THE NINE SUPERFUND EVALUATION CRITERIA

1. Overall Protectiveness of Human Health and the Environment evaluates whether and how an alternative eliminates, reduces, or controls threats to public health and the environment through institutional controls, engineering controls, or treatment.

2. Compliance with Applicable or Relevant and Appropriate Requirements (ARARs) evaluates whether the alternative meets federal and state environmental statutes, regulations, and other requirements that pertain to the site, or whether a waiver is justified.

3. Long-term Effectiveness and Permanence considers the ability of an alternative to maintain protection of human health and the environment over time.

4. Reduction of Toxicity, Mobility, or Volume (TMV) of Contaminants through Treatment evaluates an alternative's use of treatment to reduce the harmful effects of principal contaminants, their ability to move in the environment, and the amount of contamination present.

5. Short-term Effectiveness considers the length of time needed to implement an alternative and the risks the alternative poses to workers, the community, and the environment during implementation.

6. Implementability considers the technical and administrative feasibility of implementing the alternative, including factors such as the relative availability of goods and services.

7. Cost includes estimated capital and annual operations and maintenance costs, as well as present worth cost. Present worth cost is the total cost of an alternative over time in terms of today's dollar value. Cost estimates are expected to be accurate within a range of +50 to -30 percent.

8. State/Support Agency Acceptance considers whether the State agrees with the EPA's analyses and recommendations, as described in the RI/FS and Proposed Plan.

***9.* Community Acceptance** considers whether the local community agrees with EPA's analyses and preferred alternative. Comments received on the Proposed Plan are an important indicator of community acceptance.

Under both Alternatives 1 and 2, no or very limited reduction of deep vadose zone TCE soil contamination would occur. Contamination beneath the ANC building would serve as a continuous source for vapor intrusion and groundwater contamination. The RAOs for soil would not be met. Alternative 3 would remove some contaminants in deep vadose zone soils, which would shorten the operation of the shallow SVE and SSD systems and groundwater pump and treat system under OU1 compared to Alternatives 1 and 2. Therefore Alternative 3 provides some protection of the environment. Alternative 4 would have the highest removal of contamination underneath the ANC building and offer the highest degree of protectiveness of all of the alternatives. The vadose zone soil would no longer serve as a source for groundwater contamination. Alternatives 3 and 4 would achieve the RAOs.

Compliance with ARARs

There are no promulgated federal chemical-specific ARARs which apply to Site soils and indoor air, the two media of concern for this operable unit. Site contaminant concentrations of TCE in surface and shallow subsurface soil did not exceed the promulgated state chemical-specific ARARs for direct contact with soils, the NJDEP Non-Residential Direct Contact Soil Remediation Standard (NRDCSRS). For TCE, a Site-specific impact to groundwater soil remediation goal and a Site-specific health goal for vapor intrusion were developed for this Site. Alternative 1 would not meet the soil Site-specific remediation goal (1 ppm) and the Site-specific indoor air health goal (7 ug/m^3). Alternatives 2, 3, and 4 would be in compliance with the Site-specific indoor air health goal due to the effective operation of the existing shallow SVE and SSD systems. Alternatives 2 and 3 would not meet the soil remediation goal for TCE. Alternative 4 is expected to meet the soil Site-specific remediation goal for TCE.

Long-Term Effectiveness and Permanence

The highest degree of permanence and long term effectiveness is achieved for those alternatives that result in the greatest removal of contaminants from the Site.

Under Alternative 1, soil contamination would not be remediated and would continue to serve as the source for groundwater contamination and for vapor

intrusion. Human health would be at risk from vapor intrusion. Therefore, Alternative 1 does not provide long-term effectiveness and permanence. For Alternative 2, contamination would be removed from the shallow depth, to a depth of about 5 feet below the ANC building. However, the removal of contamination from the deep vadose zone would be minimal. The deep soil contamination would continue to serve as the source for groundwater contamination and for potential vapor intrusion. Alternative 2 would result in the operation of the existing shallow SVE and SSD systems and the OU1 pump and treat system for a long time, possibly hundreds of years. Alternative 3 is expected to remove approximately 50 percent of deep soil contamination and would result in the operation of the existing shallow SVE and SSD systems and the OU1 pump and treat system for more than 30 years. The remaining contamination in the deep vadose zone would continue serving as the source for groundwater contamination and for potential vapor intrusion. The required duration for the operation of the existing shallow SVE and SSD systems and the OU1 pump and treat system would be shortened compared to Alternatives 1 and 2. Alternative 4 would remove approximately 90 percent or more of the contaminant mass within the treatment zone, and the contamination beneath the ANC building would no longer serve as a significant source for groundwater contamination or vapor intrusion. The operation of the existing shallow SVE and SSD system would also be significantly shortened (to 10 years) compared to Alternatives 1, 2, and 3. A few years after the completion of Alternative 4 remediation, the possibility of shutting down the shallow SVE system may be evaluated and the SSDS may be sufficient to mitigate the remaining potential of vapor intrusion.

Residual soil contamination remaining after implementation of Alternatives 2 or 3 would be addressed by the OU1 groundwater remedy. While the OU1 groundwater remedy is considered an adequate and reliable control measure for residual groundwater contaminant sources, it will do little to address the remaining soil contamination. Alternative 4 would be protective of groundwater by removing the source of contamination.

Reduction in Toxicity, Mobility or Volume

Alternative 1 would provide no reduction of toxicity, mobility and volume (T/M/V). Alternative 2 is expected to have very limited reduction of T/M/V since the soil contamination deeper than 5 feet below the ANC building would not be directly targeted for treatment. Alternative 4 would have the highest reduction (more than 90 percent) of contaminant mass from the treatment zone, followed by Alternative 3 (estimated at 50 percent mass reduction). Under Alternative 4, the deep SVE system would extract soil gas, which would contain TCE, from the subsurface soil. The extracted soil gas would then be treated prior to discharge to the atmosphere using vapor phase carbon which would remove TCE from the soil gas through a process called adsorption. Periodically, the carbon would need to be regenerated as the TCE adsorption capacity is exhausted. The adsorbed TCE would then be treated (destroyed) during the carbon regeneration process. Therefore, Alternative 4 would have the highest degree of reduction of T/M/V. Alternative 3 would destroy (oxidize) the contaminants in situ, but results in less reduction of T/M/V than Alternative 4 because only approximately 50 percent of the contaminant would be treated due to the limitations in distributing oxidant in soils under Alternative 3 versus more than 90 percent treatment under Alternative 4.

Short-Term Effectiveness

Alternative 1 would have no short-term impact to the workers, communities, and the environment since no additional remedial action would be conducted. Alternative 2 would have minimal short-term impact to workers, communities, and the environment, since the installation has been completed and the routine operation and maintenance of the shallow SVE and SSD systems is established.

Alternatives 3 and 4 would have greater short-term impacts to the current operation of the facility as compared to Alternatives 1 or 2. The potential impacts may include physical hazards, noise, dust, heavy equipment construction and operations, and emissions Noise and dust control measures could be implemented to minimize the impacts.

Additional significant short-term risks would be present under Alternative 3, as this alternative would involve the handling and temporary storage of a large quantity of high concentration oxidants, which present potential health and fire hazards in

an active facility. Special health and safety measures would need to be developed and followed to prevent direct contact to the oxidant by Site workers and to prevent fire and explosion. Environmental hydraulic fracturing would be required to facilitate the delivery of the oxidant to the contaminated soil, likely resulting in the release of some oxidants into the fractured bedrock aquifer. Additional measures would need to be taken to prevent the oxidants from reaching the OU1 groundwater treatment system, which is not equipped to treat the oxidant and would possibly need to be shut down.

Alternative 4 involves the installation of deep SVE wells and piping inside the facility. However, this would be manageable as demonstrated by the shallow SVE system. The carbon treatment system would be located outside of the building. If *in-situ* thermal treatment is implemented, additional closely spaced wells and monitoring points would need to be installed. Additionally, high voltage and current electrical cables would be connected to the heating wells. Electrical safety measures would need to be developed and implemented for in-situ thermal treatment. Access to the treatment area would need to be restricted for the protection and safety of Site workers.

Both Alternatives 3 and 4 would pose significant short-term impact to the current facility operation. Alternative 3 has much higher short-term impact to the current facility operation and the OU1 remedy than Alternative 4 because of the concerns about:

- Storage and handling of a large quantity of oxidants;
- Hydraulic fracturing; and
- Potential impact to OU1 operations.

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The construction period for Alternative 3 is expected to be 3 years. However, it would take more than 30 years to reach the Site-specific remediation goal (1 ppm). The time frame to reach the Site-specific remediation goal for Alternative 4 with or without *in-situ* thermal treatment is expected to be 10 years.

Implementability

Alternative 1 is the easiest to implement since no action would be taken. Alternative 2 would be the second easiest to implement since the shallow SVE and SSD systems are already in operation. Alternatives 3 and 4 are both implementable, but with both logistic and technical challenges. The implementation of Alternatives 3 and 4 would take up space in the building and would generate dust and noise that would affect the operation of the facility to different degrees. This is manageable since the remediation would be conducted outside the main production area and engineering controls are available to mitigate these challenges. Impacts to the current operations can be minimized through coordination with facility representatives.

Implementing Alternative 3 is technically more challenging than Alternative 4. Distributing oxidants through the heterogeneous, low-permeability formation via flow pathways created by environmental hydraulic fracturing would be much more challenging and less effective than drawing air through the formation under Alternative 4. The shallow SVE system has been successfully distributing air similar to the deep stratigraphy. Additionally, both environmental hydraulic fracturing and *in-situ* chemical treatment in a vadose zone are innovative technologies with less well-established track records of performance. Environmental hydraulic fracturing would need to be properly planned and executed by an experienced vendor to prevent potential adverse impacts to the building. The extent of improvement using hydraulic fracturing to enhance chemical distribution within the vadose zone soil is uncertain. As treatment will only occur in the aqueous phase, the ability to keep the vadose zone soil flooded with oxidant solution for treatment while minimizing oxidant migration into the bedrock aquifer is also uncertain.

Implementing Alternative 4 without *in-situ* thermal treatment would be much easier than Alternative 3. No significant installation and operation issues would be anticipated for the deep SVE system, as the shallow SVE system has been installed without issue and is successfully operating. The addition of *in-situ* thermal treatment into Alternative 4 would increase the implementability issues, but these issues are manageable and would be comparatively easier to manage than Alternative 3. Implementing *in-situ* thermal treatment would likely require additional power supply, would require the establishment of an exclusion zone to handle the electrical hazard, and would require more space

both inside and outside of the ANC building for the large quantity of wells, piping, and the above ground treatment system.

Cost

Table 1: Cost Comparison for Alternatives

Remedial Alternative	Capital Cost	Annual Cost	Present Worth
1	0	0	0
2	0	185,000	2.4 million
3	10.3 million	185,000	12.6 million
4 no thermal	3.5 million	185,000 to 609,000	7.8 million
4 w/ thermal	9.8 million	185,000 to 410,000	12.7 million

The estimated capital, annual O&M, and present-worth costs for each of the alternatives are presented in Table 1. The present-worth costs for each alternative were calculated for a period of 30 years based on EPA guidance.

State Acceptance

EPA's Preferred Alternative as presented in this Proposed Plan is under review by the State of New Jersey.

Community Acceptance

Community acceptance of the Preferred Alternative will be evaluated after the public comment period ends and will be described in the Record of Decision. Based on public comment, the preferred alternative could be modified from the version presented in this proposed plan. The Record of Decision is the document that formalizes the selection of the remedy for a Site.

PREFERRED ALTERNATIVE

The Preferred Alternative for achieving remedial action objectives for the soils impacted by Site-related contamination is Alternative 4, Deep Soil Vapor Extraction with Optional *In-Situ* Thermal Hot-Spot Treatment.

Alternative 4 includes the long-term operation and maintenance of the existing shallow SVE/SSD systems, which are successfully remediating shallow soils under the building and protecting indoor air within the ANC building, as well as the installation of a deep SVE system. The deep SVE system will be installed to a depth of approximately 100 feet bgs beneath the ANC building in Area A, to remediate the deep vadose zone contamination. If it is determined by EPA during remedial design or remedial action that the deep SVE system alone will not be sufficient to meet RAOs in a reasonable timeframe, then *in-situ* thermal treatment to remediate the hot-spot area, located within Area A approximately 70 to 100 feet below the building will be implemented. The determination as to whether to implement the *in-situ* thermal treatment in the hot-spot area would be made by EPA either during the remedial design or during the operation of the deep SVE system based on data collected. Groundwater monitoring in the OU3 Study Area will be performed over time to assess the remedy's effectiveness in protecting groundwater.

No significant installation and/or operation issues are anticipated for the deep SVE system, as the currently operating shallow SVE system was installed in 2013 and is currently successfully operating at the Site in Area A. The lithology in the deep zone is similar to that of the shallow zone, and therefore it is believed that SVE alone may be sufficient to meet cleanup goals. However, as stated above, hot-spot remediation by thermal treatment will be employed if needed. After treatment, post-remediation sampling will be performed to confirm that remediation goals have been met. SVE is an established technology, widely employed to treat soils contaminated with volatile organic contaminants, such as this Site.

The Preferred Alternative, Alternative 4, provides the best balance of trade-offs among the alternatives with respect to the evaluation criteria. The Preferred Alternative will be protective of human health and the environment, comply with ARARs, and is expected to meet the RAOs for the Site.

Consistent with EPA policy, five-year reviews will

be conducted until remediation goals are achieved. In addition, the existing deed notice will be modified, as appropriate, to include any additional restrictions in order to assure the implementation of all aspects of the OU3 remedy.

Consistent with EPA Region 2's Clean and Green policy, EPA will evaluate the use of sustainable technologies and practices with respect to implementation of the selected remedy.

Based on information currently available, EPA believes that Alternative 4 will achieve RAOs by reducing the impact from the contaminated vadose zone soils to the groundwater and indoor air.

COMMUNITY PARTICIPATION

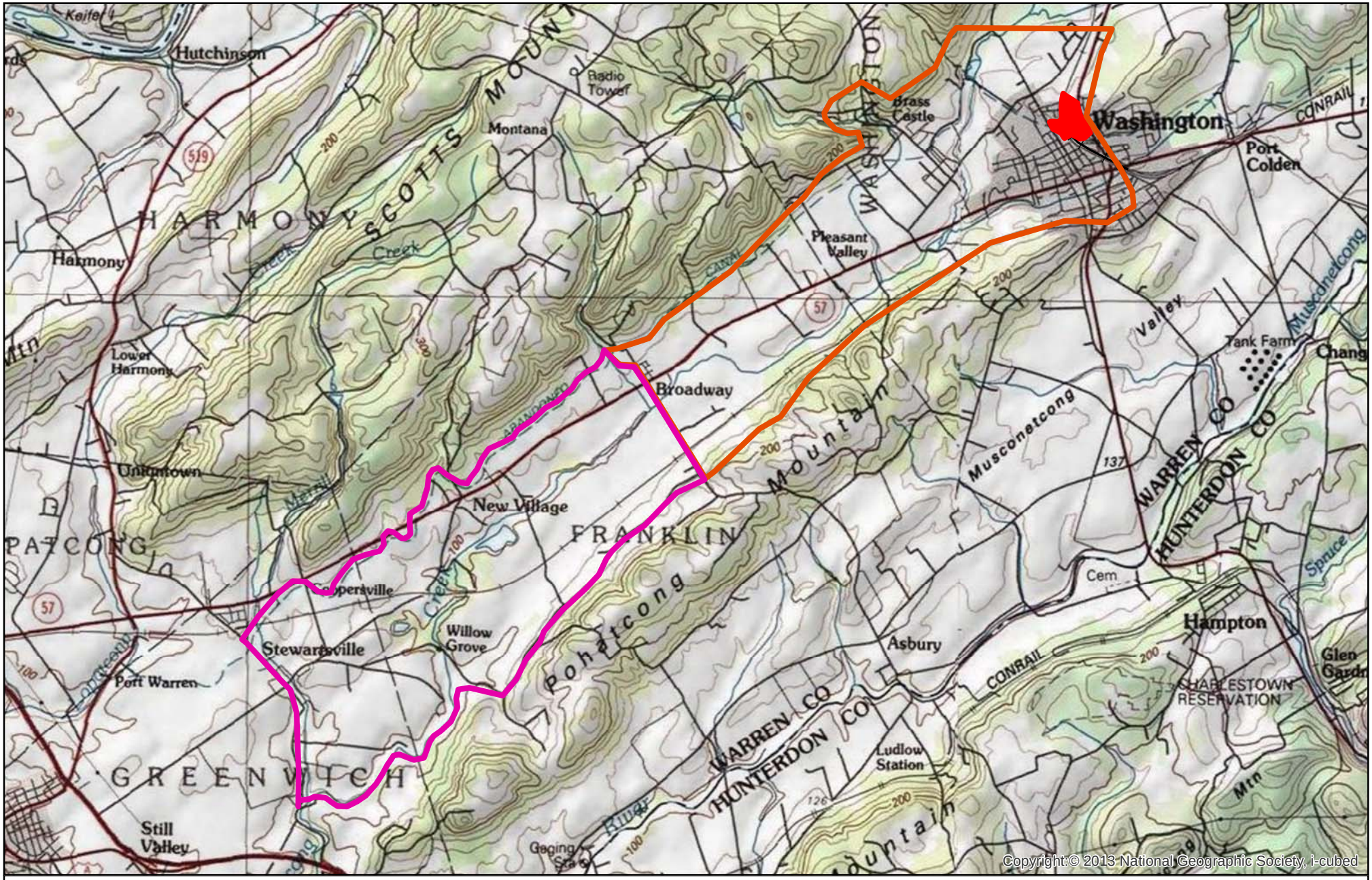
EPA provided information to the public regarding the cleanup of the OU3 portion of the Pohatcong Valley Groundwater Contamination Superfund Site through public meetings, the Administrative Record file for the Site and announcements published in the Express Times. EPA encourages the public to gain a more comprehensive understanding of the Site and the Superfund activities.

The dates for the public comment period, the date, the locations and time of the public meeting, and the locations of the Administrative Record files, are provided on the front page of this Proposed Plan.

For further information on EPA's Preferred Alternative for the OU3 portion of the Pohatcong Valley Groundwater Contamination Superfund Site, please contact:

Michelle Granger	Patricia Seppi
Remedial Project Manager	Community Relations
(212) 637-4975	(212) 637-3679

U.S. EPA
290 Broadway, 19th Floor
New York, New York 10007-1866



OU1 Study Area (approximate)

OU2 Study Area (approximate)

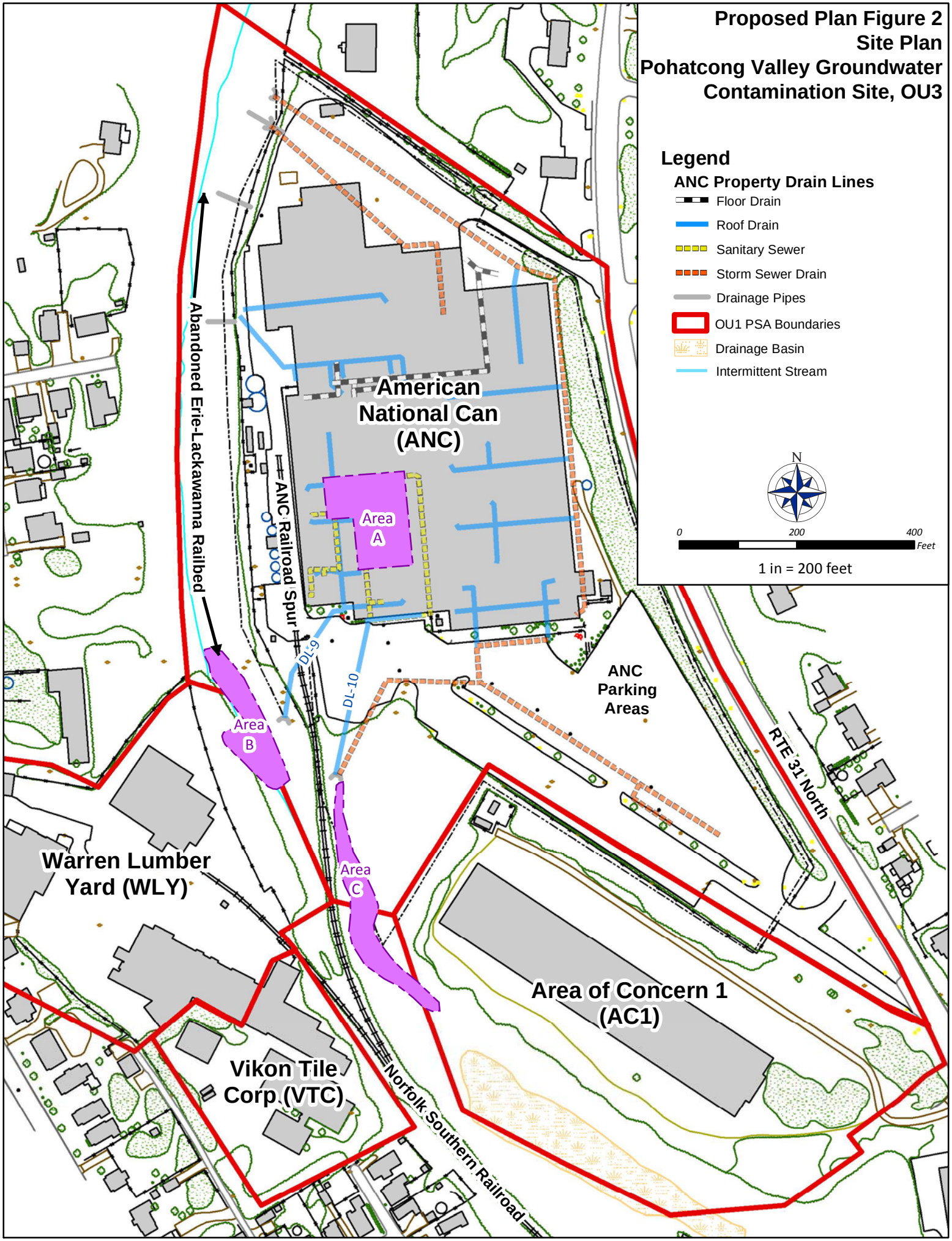
OU3 Study Area (approximate)

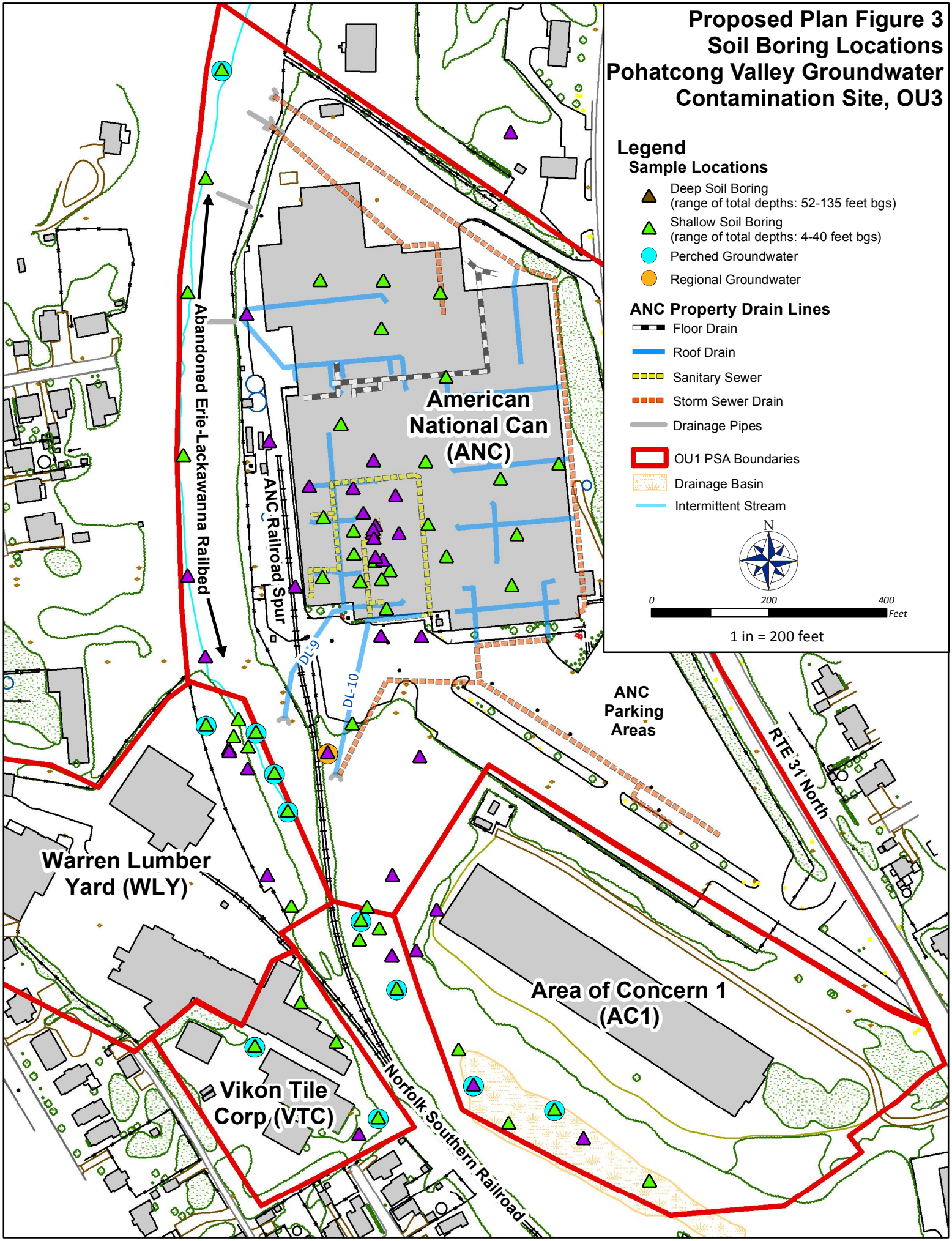
N

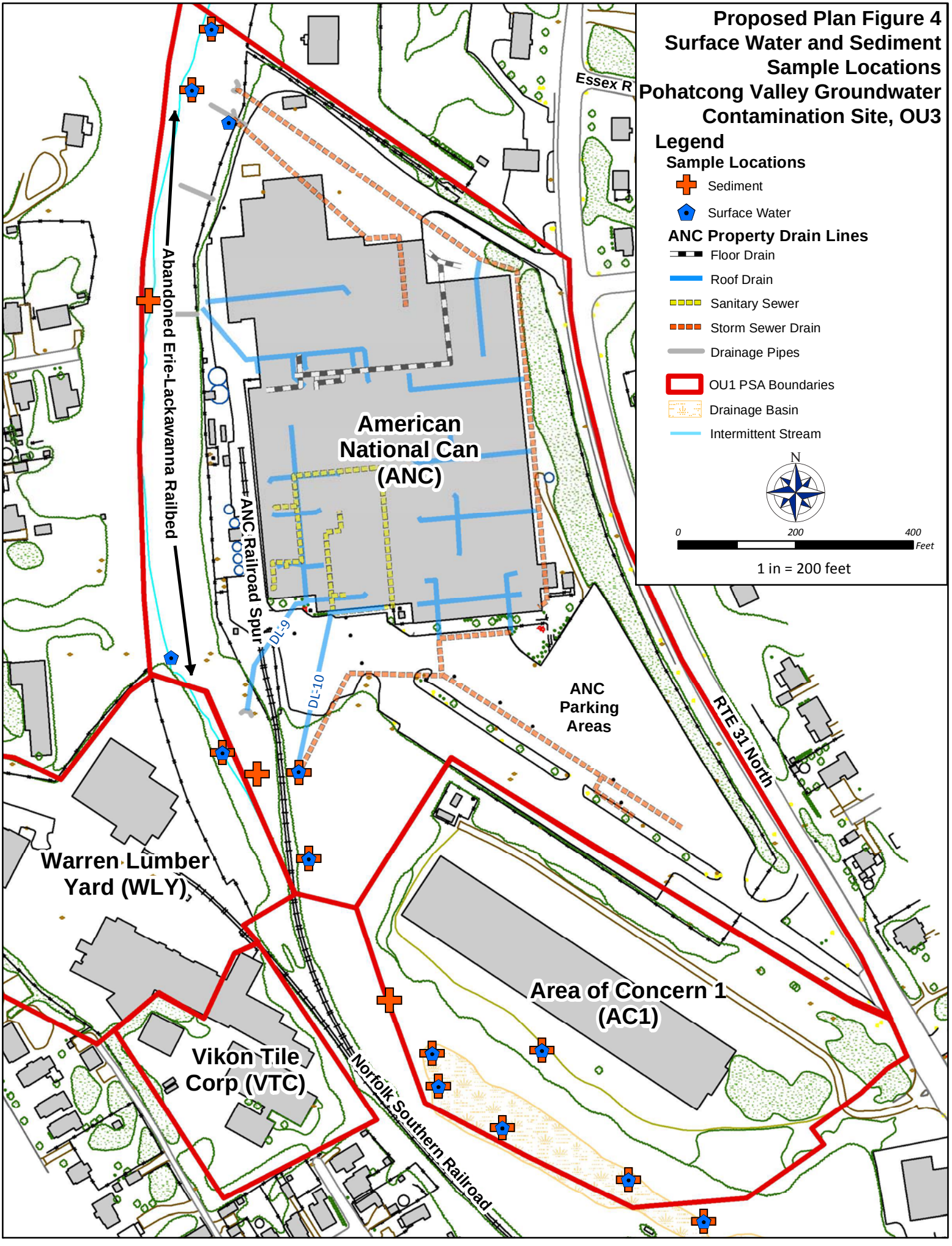
0 6,000 12,000 Feet

1 in = 6,000 feet

Proposed Plan Figure 1
Site Location Map
Pohatcong Valley Groundwater Contamination Site, OU3


Proposed Plan Figure 2
Site Plan
Pohatcong Valley Groundwater
Contamination Site, OU3
Legend
ANC Property Drain Lines
Floor Drain
Roof Drain
Sanitary Sewer
Storm Sewer Drain
Drainage Pipes
OU1 PSA Boundaries
Drainage Basin
Intermittent Stream
N
0
200
400
Feet
1 in = 200 feet
American National Can (ANC)
Abandoned Erie-Lackawanna Railbed
ANC Railroad Spur
DL-9
DL-10
Area A
Area B
Area C
ANC Parking Areas
RTE 31 North
Warren Lumber Yard (WLY)
Vikon Tile Corp (VTC)
Area of Concern 1 (AC1)
Norfolk Southern Railroad


Proposed Plan Figure 3
Soil Boring Locations
Pohatcong Valley Groundwater
Contamination Site, OU3
Legend
Sample Locations
Deep Soil Boring
(range of total depths: 52-135 feet bgs)
Shallow Soil Boring
(range of total depths: 4-40 feet bgs)
Perched Groundwater
Regional Groundwater
ANC Property Drain Lines
Floor Drain
Roof Drain
Sanitary Sewer
Storm Sewer Drain
Drainage Pipes
OU1 PSA Boundaries
Drainage Basin
Intermittent Stream
N
0
200
400
Feet
1 in = 200 feet
American National Can (ANC)
Abandoned Erie-Lackawanna Railbed
ANC Railroad Spur
DL-9
DL-10
ANC Parking Areas
RTE 31 North
Warren Lumber Yard (WLY)
Area of Concern 1 (AC1)
Vikon Tile Corp (VTC)
Norfolk Southern Railroad


Proposed Plan Figure 4
Surface Water and Sediment Sample Locations
Pohatcong Valley Groundwater Contamination Site, OU3
Legend
Sample Locations
Sediment
Surface Water
ANC Property Drain Lines
Floor Drain
Roof Drain
Sanitary Sewer
Storm Sewer Drain
Drainage Pipes
OU1 PSA Boundaries
Drainage Basin
Intermittent Stream
N
0
200
400
Feet
1 in = 200 feet
Essex R
Abandoned Erie-Lackawanna Railbed
American National Can (ANC)
ANC Railroad Spur
DL-9
DL-10
ANC Parking Areas
RTE 31 North
Warren Lumber Yard (WLY)
Area of Concern 1 (AC1)
Vikon Tile Corp (VTC)
Norfolk Southern Railroad