Proposed Plan

Site 16 – Creosote Dip Tank Area, Fire-Fighting Training Area, and Former Building 41 Area (OU 9)

Former Naval Construction Battalion Center, Davisville, Rhode Island

The Proposed Plan

This Proposed Plan has been prepared in accordance with federal laws to present the Navy's proposed cleanup approach (remedy) for Site 16 (**Creosote** Dip Tank Area, Fire-Fighting Training Area, and Former Building 41 [known as Operable Unit (OU) 9]) at the former Naval Construction Battalion Center, Davisville, Rhode Island. This plan describes the Navy's proposed remedy for the site, which consists of the following:

- Excavation of surface soils where necessary in the north-central portion of the Site including surface soils by Building E-107;
- Focused treatment of groundwater at the eastern end of the former Building 41;
- **Natural attenuation** and long-term monitoring of groundwater after the active groundwater treatment until groundwater standards are achieved, and
- Implementation of **land use controls** to prevent exposure to contaminants in soil and **groundwater**.

This plan provides information on the remedial alternatives evaluated, public comment period, informational open house and public hearing, and also describes how the final remedy for Site 16 will ultimately be selected.

LET US KNOW WHAT YOU THINK

Mark Your Calendar!

Public Comment Period:
October 15 through November 14, 2013

The Navy will accept written comments on the **Proposed Plan** for Site 16 during this comment period. Comments can be sent by mail, e-mail, or fax. Oral or written comments can also be offered at the public hearing (see page 26 for details).

Informational Open House and Public Hearing October 24, 2013

The Navy invites you to attend an informational open house to be held from 7:00 p.m. to 9:00 p.m., to learn about the Site 16 proposed remedy. The informational session will include a presentation describing the **Proposed Plan**. A public hearing will follow, during which the Navy will receive public comments on the **Proposed Plan**. It is at this hearing that an official transcript of the comments will be recorded. The above activities will be held at the:
QDC Conference Center
95 Cripe Street
North Kngstown, Rhode Island

For more information, visit the Information Repository at the location provided on page 27 of this Proposed Plan.

*Federal and state environmental laws govern cleanup activities at federal facilities. A federal law called the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)**, better known as **Superfund**, provides procedures for investigation and cleanup of environmental problems. Under this law, the Navy is investigating and pursuing cleanup, as necessary, of sites at the Former Naval Construction Battalion Center (NCBC) to ensure the property is protective of the community, workers, and the environment. The Navy is issuing this **Proposed Plan** as part of its public participation responsibilities under Section 300.430(f)(2) of the **National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.*

Introduction

This **Proposed Plan** provides information to the public on the preferred approach for the cleanup of Site 16 [**Creosote** Dip Tank Area, Fire-Fighting Training Area (FFTA), and Former Building 41] at the former NCBC Davisville, and provides the rationale for this preference. This document is issued by the Navy, as the lead agency for all investigation and cleanup programs ongoing at the former NCBC Davisville, with concurrence from the Environmental Protection Agency (EPA) and the Rhode Island Department of Environmental Management (RIDEM). The Navy and EPA, with the concurrence of RIDEM, will select a final remedy for Site

Bolded Terms Throughout This Proposed Plan are Explained in the Glossary of Terms on Pages 27 through 29.

16 after reviewing and considering all information submitted during the 30-day public comment period. The Navy and EPA, with the concurrence of RIDEM, may modify the proposed remedy or select another response action, based on new information or public comments. Therefore, the public is encouraged to review and comment on this **Proposed Plan**.

More detailed information about Site 16 can be found in key documents such as the **Remedial Investigation and Feasibility Study (RI/FS)** Reports, the related regulatory agency correspondence, and other documents that form the Administrative Record for this Proposed Plan, and are available for review at the Public Information Repository, which is located at the Annex Building, Quonset Development Corporation, 95 Cripe Street, North Kingstown, Rhode Island, 02852 (see Exhibit 1 for a partial list of investigations and removal actions conducted at Site 16).

The Navy, EPA, and RIDEM encourage the public to review these documents to gain a more comprehensive understanding of the Site and associated environmental activities.

The purpose of this **Proposed Plan** is to:

- Provide the public with basic background information about the former NCBC Davisville, including Site 16, which is also known as Operable Unit 09. This information includes a description of the Site, developed by reviewing previous documents including the Site history, and summary of environmental investigations.
- Describe cleanup alternatives (Remedial Action Alternatives) that have been considered for the Site.
- Identify and explain the Navy's preferred remedy for the Site.
- Provide information to the public on how they can be involved in the remedy selection process.
- Encourage public review and comment on the proposed remedy for the Site.

After the public has had the opportunity to review and comment on this **Proposed Plan**, the Navy will summarize and respond to all comments received during the comment period and public hearing in a document called the **Responsiveness Summary**. The Navy will carefully consider all comments received and could even select a remedial action different from that which has been proposed. Ultimately, the selected remedy for Site 16 will be documented in a **Record of Decision (ROD)** for the Site. The **Responsiveness Summary** will be issued with the **ROD**.

Site Background

The former NCBC Davisville facility is located in the Town of North Kingstown, Rhode Island, and is approximately 18 miles south of Providence (Figures 1 and 2). The NCBC Davisville mission was to provide mobilization support to the active Naval Construction force; to act as a mobilization base for the rapid assembly, outfitting, and readying of Reserve Construction Battalions; to store, preserve, and ship advance base and mobilization stocks; and to procure, receive, pack, and ship equipment for Atlantic, European, and Caribbean military construction projects. Much of NCBC Davisville was comprised primarily of warehouse space and freight yards, most of which have been demolished or redeveloped. The base was **decommissioned** in March 1994, and closed on April 1, 1994, under the Base Realignment and Closure (BRAC) program.

Exhibit 1: Summary of Environmental Investigations and Removal Actions

1992 Removal Action: Soil with elevated concentrations of **polycyclic aromatic hydrocarbons (PAHs)** in a spill area around an upended creosote dip tank located in the North Central Area (NCA) was excavated and disposed of off-site. (The **creosote** dip tank was part of the Navy's past **creosote** wood-treatment operations in the northwestern portion of the NCA.)

1995-1998 Environmental Baseline Survey (EBS) and Follow-On Investigations: The 1995 Basewide EBS identified Site 16 as requiring additional investigation. From 1996 to 1998, samples (including soil, **groundwater**, and/or **seep water**) were collected in various areas of the site. Contaminated soils in the Building E-107 area were excavated and disposed of off-site. Based on the results of the EBS investigations, the Navy concluded that additional investigation of Site 16 was required.

1999-2008 Remedial Investigation (RI): **RI** activities included soil, **groundwater, seep,** surface water, and sediment sampling, and an Allen Harbor tidal study to evaluate site physical characteristics and to determine the sources, nature, and extent of contamination at the **site**. An extended area of **groundwater** contaminated with **volatile organic compounds (VOCs)** (known as a **VOC plume**) was identified. This **VOC plume** also underlies Allen Harbor. The RI evaluation concluded that Site 16 source areas were not the primary sources of the **PAHs** detected in the sediments underlying Allen Harbor.

2010 Feasibility Study (FS) Support Field Investigation: Supplemental sampling was conducted to further determine the nature and extent of contamination.

2012 – FS: Conducted to develop and evaluate potential cleanup alternatives for contaminated soil and **groundwater** at Site 16. The 2013 FS Addendum was developed to include additional alternatives.

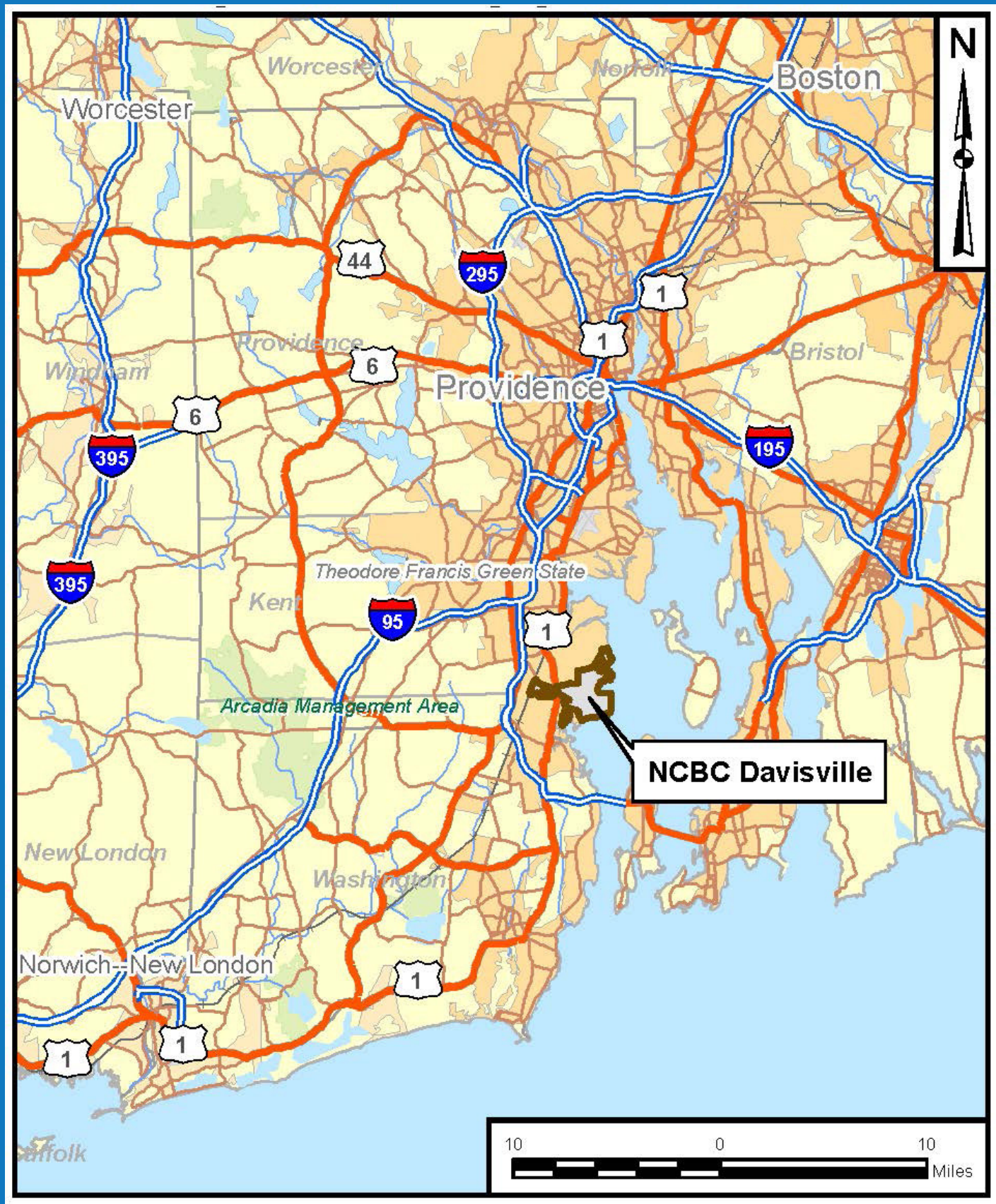


Figure 1: NCBC Davisville, North Kingstown, Rhode Island

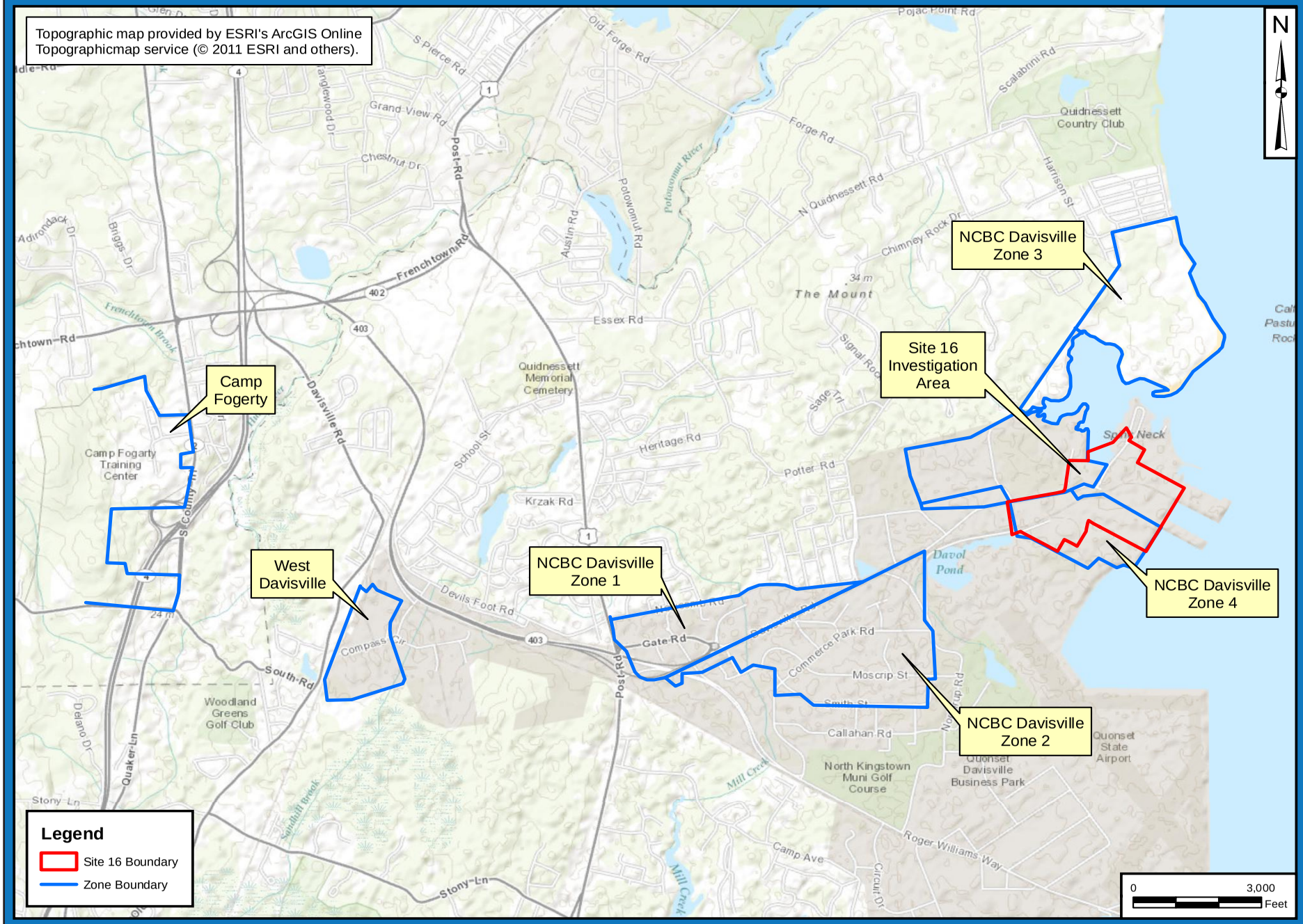


Figure 2: Site 16 Location Map

Where is Site 16 within the former NCBC facility?

Site 16 is an irregularly shaped area (Figure 3) bounded on the west by Thompson Road, to the south by the rail tracks; and extending north to Allen Harbor and east to Narragansett Bay. Most of the Site consists of parking area and buildings. The North Central Area (NCA) of Site 16 was the location of the former creosote dip tanks and fire training area. The NCA is bounded by Allen Harbor to the north, Westcott Road to the west, Davisville Road to the south, and Allen Harbor Road to the east. The Site also includes the area between former Building 41 and Narragansett Bay because a volatile organic compound (VOC) **plume** (an area of VOC contaminated groundwater) extends eastward to Narragansett Bay. Some of this property was transferred prior to the BRAC program under the Shore Establishment Realignment announcement in 1973. VOCs (e.g., trichloroethene [TCE]) are present in both groundwater and soils (soils primarily within the **saturated zone**) underlying the Site.

What was Site 16 used for?

Creosote dipping operations (for preserving wood pilings) occurred in the northwestern portion of the NCA. In the north-central portion of the NCA, structures were built, doused with flammable materials, set on fire, and the fires extinguished as part of fire-fighting training exercises.

NCBC training exercises involving large construction and transport vehicles also occurred in the NCA. **Fill materials** and **subsurface** debris exist throughout a significant portion of the NCA, indicating that much of this area received fill material. This portion of the NCA has been designated a **waste management area** for many of the soil alternatives described in this Proposed Plan.

Former Building 41 was used as an equipment preservation/ packing shop and an automotive parts storage building. A solvent recovery tank was located in the westernmost portion of this building. The solvent recovery tank reclaimed TCE, used as a degreaser for equipment. Buildings 318, E-319, 39, and E-107 were used as warehouses or for operations support. Aboveground and/or underground fuel storage tanks and septic tanks were associated with all of these buildings.

The environmental contamination detected in soils and groundwater at the Site is a consequence of releases which occurred during these operations.

What are the current and future land uses at the site?

The NCA portion of Site 16 is currently forested and shrub land. The portion of Site 16 immediately north of the NCA is within the area leased to the Allen Harbor Boating Association. The remainder of Site 16 includes mostly paved areas that are primarily used for the storage of cars delivered by ships and trains, pending delivery to automotive dealers. The anticipated future land use for most of Site 16 is **industrial/ commercial**. However, it is anticipated that the area that is in the immediate vicinity of Building E-107 (the Marina Building) will continue to be used for marina purposes and exposure to subsurface soils in that area will be prohibited by land-use controls (LUCs) and soil management plans (SMPs). For example, future residential land use will be prohibited.

What are the results of the environmental investigations?

A partial list of the environmental investigations and removal actions that have been conducted at Site 16 is presented in Exhibit 1 of this Proposed Plan.

The principal contaminants associated with Site 16 **groundwater** are **VOCs** such as TCE, tetrachloroethene (PCE), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride, and benzene. TCE is the primary **VOC** found in the **groundwater**, and the associated maximum concentration in **groundwater** exceeds 5,000 parts per billion (ppb). As a point of comparison, the current Safe Drinking Water Act maximum contaminant level for TCE is 5 ppb

VOC Results

Several **VOC** releases have occurred in the past. These releases have resulted in an elongated **VOC** plume (an area of **VOC**-contaminated **groundwater**) in the deeper **groundwater**, extending towards both Allen Harbor (to the north/northeast) and Narragansett Bay (to the east). The **VOCs** (e.g., TCE) detected in the **groundwater** underlying Site 16 are not detected in the surface waters or sediments of Allen Harbor at concentrations exceeding conservative, risk-based screening levels.

In soil, limited **VOC** contamination has been detected in the upper 10 feet (0 to 10 feet below ground surface), with the exception of one area in the northwestern portion of the NCA. In this area, elevated levels of benzene were detected in soil approximately 8 feet below ground surface. Most **VOC** soil contamination has migrated downward into deeper soils and **groundwater**.

PAH Results

Elevated levels of **polycyclic aromatic hydrocarbons** or **PAHs** (e.g., naphthalene, benzo(a)pyrene) were detected in **surface** and shallow **subsurface soil** within the NCA, and, to a much lesser extent, in **shallow groundwater** in the NCA. These chemicals are often associated with industrial operations such as those conducted in the **Creosote** Dip Tank area or with the combustion of fuels, wood, coal, etc. PAHs were also detected in soils outside the NCA (e.g., in the former Building 41 area) and in sediments; however, the **environmental forensics** investigation conducted for Site 16 concluded the Site 16 source areas were not the primary sources of the PAHs detected in the sediments underlying Allen Harbor or in the soils outside the NCA.

Dioxins/Furans Results

Dioxins/furans were detected in **surface** and shallow **subsurface** soil samples collected from the NCA**.** The maximum detected concentrations exceed EPA clean-up levels for residential soil but not the clean-up levels for commercial/industrial soils.

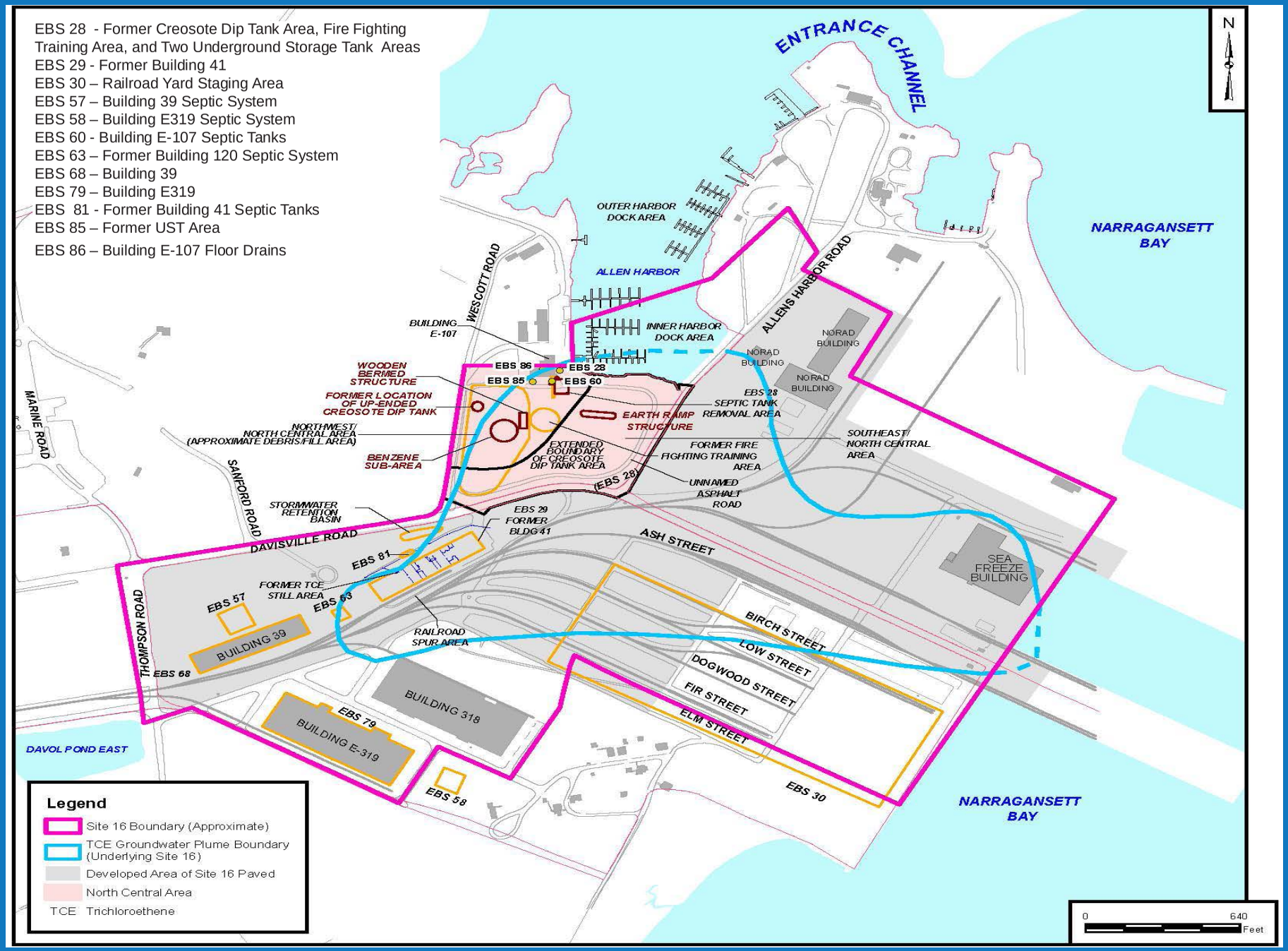


Figure 3: Site 16 Area of Investigation

Metals

Most locations with elevated levels of arsenic or lead levels are within the northwestern portion of the NCA. Metals were also detected in the groundwater and sediments at Site 16; however, the detected concentrations reflect, in large part, **background** conditions, or are considered unlikely to be related to historical operations at the Site 16 source areas. Some metals (e.g., arsenic and lead) detected in soils were present at levels higher than those detected in **background** soil samples (collected during the NCBC Davisville base-wide **background** study).

Scope and Role of the Site 16 Response Action

Site 16 is one of the sixteen sites identified at the former NCBC Davisville for cleanup under CERCLA. Most sites undergoing cleanup under CERCLA progress through the cleanup process independently of each other. The response action for Site 16 is not expected to affect the strategy or progress of environmental investigations at other Davisville NCBC sites at the former Base. As these sites advance through the cleanup process, separate **Proposed Plans** are issued accordingly.

RODs (i.e., decision documents) for "no further action" have been signed for Sites 05, 06, 08, 10, 11, 12, 13, 14, and 15. To meet the requirements of the **RODs** for Sites 07 and 09, periodic **monitoring** is being conducted in accordance with the Long-Term **Monitoring** Program for each site. A nine million dollar cap was a component of the remedial action for Site 09.

Study Areas 01 and 04 and Sites 02 and 03 are in the **RI/FS** process and no remedial decisions have been made to date. These sites are acknowledged in this **Proposed Plan** because they are located immediately west of the Site 16 area. Contamination detected at these and other sites has not impacted the Site 16 area.

Summary of Results for Site 16 Human Health and Ecological Risk Assessments

As part of Site 16 investigation activities, the Navy completed **human health and ecological risk assessments** to evaluate potential current and future effects of the chemicals detected at Site 16 on human health and the environment. The results of the **risk assessments, prepared per standard EPA risk assessment protocol**, are described below. Sediments (although evaluated in the risk assessments) are not a medium of concern for Site 16 because the Site 16 source areas were not determined to be the primary sources of the sediment contamination within Allen Harbor.

HUMAN HEALTH RISKS - The human health **risk assessment** estimates the baseline risk to humans, which is the likelihood of health problems occurring if no cleanup actions were taken at Site 16. To estimate this baseline risk, a four-step process was used.

Step 1 - Identify Chemicals of Potential Concern: Chemicals of potential concern (**COPCs**) are chemicals found at Site 16 at concentrations that exceed federal and state risk screening levels. Chemicals with concentrations greater than these benchmarks are further evaluated in Step 2.

Step 2 – Conduct an Exposure Assessment: The ways in which humans come into contact with soil, sediment, surface water, air and/or **groundwater** at Site 16 are considered. Both current and reasonably foreseeable future exposure scenarios were considered as part of this process. For Site 16, it is anticipated that construction workers, industrial workers, trespassers, recreational users, and, in the future, hypothetical potential residents may come in contact with these environmental media. (While residential development of the Site 16 area is not anticipated, the Navy did evaluate the most restrictive possible use of the Site, which is a resident living on the Site.)

Individuals could potentially contact soil through touch or ingestion, or could inhale soil particulates, such as dust. Individuals visiting the Site could also potentially contact the surface water and sediments along the southern shoreline of Allen Harbor, through touch or ingestion. Construction workers could potentially contact chemicals in **groundwater** through touching **groundwater** or inhaling **VOCs** vaporizing from the **groundwater** (e.g., if **groundwater** pooled in the bottom of an excavation or ditch). Future residents could contact chemicals in **groundwater** beneath the Site if it were to be used as a drinking water source. Finally, indoor workers or residents could contact **VOC** vapors in indoor air if the vapors seeped into a building constructed over the VOC **plume**.

Step 3 – Complete a Toxicity Assessment: Possible harmful effects from exposure to the individual chemicals of potential concern are evaluated. Generally, these chemicals are separated into two groups: **carcinogens** (chemicals that may cause cancer) and **non-carcinogens** (chemicals that may cause adverse health effects other than cancer).

Step 4 - Characterize the Risk: The results of Steps 2 and 3 are combined to estimate overall risks from exposure to chemicals present at the Site. The terms used to define the estimated risks are explained in the text box, *"Expressing Estimated Human Health Risks"* (Exhibit 2).

The results of the **risk assessment** evaluating health effects to persons utilizing the Site show that:

- For surface soil located primarily in the northwestern portion of the NCA, potential risks for future residents exceed EPA and/or RIDEM acceptable exposure levels (see text box Exhibit 2 entitled "Expressing Estimated Human Health Risks"). The risks are associated with **PAHs**, dioxins/furans, lead and arsenic in the soils. There are no unacceptable risks to construction workers, industrial workers, recreational users, or trespassers.

Exhibit 2: Expressing Estimated Human Health Risks

Human Health Risk Assessment: When evaluating the health risk to humans, the risk estimates for **carcinogens** (chemicals that may cause cancer) and **non-carcinogens** (chemicals that may cause adverse health effects other than cancer) are expressed differently.

Carcinogens: For cancer-causing chemicals, risk estimates are expressed in terms of probability. For example, exposure to a particular carcinogenic chemical may present a 1 additional case of cancer above normal background rates in 10,000 which would be expressed as $1x10^{-4}$. The EPA risk range for carcinogens is $1x10^{-6}$ (1 additional case of cancer above normal background rates in 1,000,000) to $1x10^{-4}$ (a 1 additional case of cancer above normal background rates in 10,000). In general, calculated risks higher than this range would require consideration of the development and implementation of cleanup alternatives. The State of Rhode Island target cancer risk level is $1x10^{-5}$ (a 1 additional case of cancer above normal background rates in 100,000).

Non-Carcinogens: For non-cancer-causing chemicals, exposures are first estimated and then compared to a reference dose (RfD). The reference dose is developed by EPA scientists to estimate the amount of a chemical a person (including the most sensitive person) could be exposed to over a lifetime without developing adverse (non-cancer) health effects. This measure is known as a hazard index. A hazard index greater than 1 suggests that adverse health effects are possible.

- For subsurface soil (2 to 10 feet below the ground surface) located primarily in the northwestern portion of the NCA, potential risks for industrial workers, construction workers, recreational users, and hypothetical future residents exceed EPA and/or RIDEM acceptable levels. As noted for the surface soils, the risks are associated with PAHs, dioxins/furans, lead and arsenic. There are no unacceptable risks to trespassers.

- For **groundwater**, potential risks for future residents using the **groundwater** as a drinking water source exceed EPA and RIDEM acceptable levels. The potential risks are primarily associated with **VOCs** (e.g., TCE, PCE, benzene, 1,2-dichloroethane, and vinyl chloride). Potential risk is also associated with other chemicals and metals found in the **groundwater**, including **PAHs** (e.g., dibenzo(a,h)anthracene, 2-methylnaphthalene and naphthalene), hexachlorobenzene, and the metals arsenic, aluminum, antimony, chromium, lead, iron, manganese, silver and thallium). However, most of these chemicals/metals were found very infrequently or at levels similar to background levels in **groundwater**. There are no unacceptable risks to construction workers.

- Individual contact with surface waters (e.g., seeps [groundwater seeping into Allen Harbor]) along the southern shore of Allen Harbor does not pose a CERCLA risk.

- Potential risks for individuals touching the sediments of Allen Harbor would exceed EPA and RIDEM acceptable levels only if these sediments were to be routinely exposed (i.e., not covered with Allen Harbor surface water). (The risks are attributable to the carcinogenic PAHs and arsenic.) The vast majority of Allen Harbor sediments are under water; the potential for human contact (and thus, risk) is very limited. Also, as noted above, the RI concluded that the Site 16 source areas were not the primary sources of PAHs detected in the sediments underlying Allen Harbor. Thus, the sediments do not pose a CERCLA risk.

- Potential risks for industrial workers or hypothetical future residents exposed to **VOCs** in the indoor air of a building constructed over the **VOC groundwater plume** do exceed EPA and RIDEM acceptable levels. The potential risks are primarily associated with TCE in the **groundwater**.

These risk results were used to develop the list of **chemicals of concern** (**COCs**) further evaluated in the **Feasibility Study** for Site 16.

ECOLOGICAL RISKS - The ecological **risk assessment** is comprised of three steps, as discussed below.

Step 1 – Problem Formulation: The primary objective of an ecological **risk assessment** is to evaluate whether or not ecological **receptors** are potentially at risk when exposed to chemicals at Site 16. More specifically, the ecological assessment for Site 16 was completed to determine whether ecological receptors are able to exist and grow in ways similar to those same **receptors** in the surrounding area. The ecological **receptors** evaluated for this assessment include:

- **Terrestrial vertebrates** (small mammals or birds, such as the Eastern cottontail, meadow vole, bobwhite quail, short-tail shrew, red fox, and American Robin) coming in contact with or eating food items that have been in contact with surface soil, sediments, and surface water.

- **Terrestrial invertebrates** (e.g., earthworms) coming in contact with surface soils.

- **Terrestrial** plants in contact with surface soils.

- Fish and **aquatic invertebrates** in contact with surface water and sediment, and aquatic birds (e.g., the herring gull) that consume contaminated fish or aquatic invertebrates.

Similar to the human health **risk assessment**, chemicals found at the Site at concentrations above federal or state risk–screening levels are identified as **COPCs**. The initial list of **COPCs** evaluated in the ecological **risk assessment**

included metals (e.g., lead), pesticides, dioxins/furans, and **PAHs**. (The predominant COPCs in the Site 16 **surface soils** and in Allen Harbor sediments are the PAHs.) These chemicals and metals are further evaluated in the **risk assessment**. (As a point of clarification, pesticides were also selected as COPCs for the human health risk, however, based on the results of the human health risk assessment pesticides were not selected as COCs to be further addressed in the Feasibility Study.)

Step 2 - Risk Analysis: In this step, possible harmful effects from being exposed to individual **COPCs** are evaluated. This step includes measuring or estimating the amount of a chemical in soils, **seeps**, surface water, sediments, plant and animal tissue, and then evaluating ecological **receptor** exposure to these chemical concentrations.

Step 3 – Risk Characterization: The results of the risk analysis are evaluated to determine the likelihood of harmful effects to ecological **receptors** at Site 16. The ecological **risk assessment** completed for Site 16 concluded that the presence of **COPCs** in the **surface soils** and in **seeps**/ surface water pose limited site-related risks to mammals, birds, invertebrates (e.g., earthworms), terrestrial plants, or aquatic organisms (e.g., fish, **benthic organisms** living in the sediments of Allen Harbor). For example, regarding the surface soils in the undeveloped portion of the NCA, the initial soil COPCs were further evaluated using a more refined analysis about how chemicals may adversely impact ecological receptors. Based on this refined analysis, no chemicals were retained as soil COPCs for plants or soil invertebrates or wildlife. Regarding sediments, the RI concluded there was a slight potential of risk from exposure to PAHs and pesticides.

The risk characterization for Allen Harbor considered two important **RI** results:

- As noted above, the extensive environmental investigation conducted at Site 16 concluded that the Site 16 source areas were not the primary sources of the PAHs (or other chemicals initially selected as sediment COPCs [e.g., pesticides]) detected in the Allen Harbor sediments.
- The **VOCs** (e.g., TCE) detected in the **groundwater** underlying Site 16 are not detected in the surface waters or sediments of Allen Harbor at concentrations exceeding conservative, risk-based screening levels for ecological **receptors**.

Thus, based on the analyses presented in the RI, no CERCLA COCs were identified for the surface waters/sediments of Allen Harbor.

Remedial Action Objectives

Remedial Action Objectives (RAOs) are the goals that a cleanup plan should achieve. They are established to protect human health (see Exhibit 2) and the environment, and to comply with all pertinent federal and state regulations. Based on the current and reasonably anticipated future use of Site 16, the following **RAOs** were developed for soil and for **groundwater**.

SOIL RAOs FOR THE NORTHWESTERN PORTION OF THE NCA, EXCLUDING THE BENZENE SUB-AREA:

Soil RAO No. 1 - Prevent industrial worker (including construction worker) exposure to subsurface soil containing concentrations of **COCs** (**PAHs**, arsenic, and lead) that cause unacceptable risk.

Soil RAO No. 2 - Ensure/verify that surface and subsurface soil contaminants (e.g., naphthalene) do not migrate to **groundwater** causing the **groundwater,** sediment**, and surface water** to have associated unacceptable risk.

Soil RAO No. 3 - Prevent future resident exposure to surface and subsurface soil contaminants (**PAHs**, arsenic, lead, and dioxins/ furans) that cause unacceptable risk.

SOIL RAOs FOR THE BENZENE SUB-AREA:

Soil RAO No. 4 - Prevent industrial worker (including construction worker) exposure to subsurface soil (in the benzene sub-area) containing concentrations of **COCs** (**PAHs**, arsenic and lead) that cause unacceptable risk.

Soil RAO No. 5 - Ensure/verify that surface and subsurface soil contaminants (e.g., benzene and naphthalene in the benzene sub-area) do not migrate to **groundwater** causing the **groundwater,** sediment**, and surface water** to have associated unacceptable risk.

Soil RAO No. 6 - Prevent future resident exposure to surface and subsurface soil (in the benzene sub-area) containing concentrations of **COCs** (**PAHs**, arsenic, lead and dioxins/ furans) that cause unacceptable risk.

SOIL RAO SPECIFIC TO THE SOILS IN THE VICINITY OF THE MARINA BUILDING:

Soil RAO No. 7 - Prevent **recreational user** exposure to soil in the vicinity of the Marina Building containing concentrations of COCs (e.g., PAHs) that cause unacceptable risk.

RAOs FOR GROUNDWATER:

Groundwater RAO No. 1: Prevent human exposure (including drinking, showering, and irrigation) to **groundwater** containing concentrations of **COCs** that cause unacceptable risk and that does not meet the selected clean-up levels. (Note: This RAO is a permanent RAO for NCA **waste management area** and a temporary RAO for those areas outside the NCA **waste management area**.)

Groundwater RAO No. 2: Verify that **groundwater** discharging to Allen Harbor and Narragansett Bay continues to pose no unacceptable risks.

Groundwater RAO No. 3: Prevent unacceptable risks to industrial workers/future residents that could result from exposure to **VOC** vapors migrating into buildings.

Groundwater RAO No. 4: Restore **groundwater** quality to its **beneficial use**.

In the **FS**, **cleanup levels** were developed for the soil **COCs**, including **PAHs** [evaluated collectively as **benzo(a)pyrene equivalents** (**BaPEqs**)], arsenic, lead, dioxins/furans, naphthalene, and benzene. These soil **cleanup levels** are provided in Table 1 (in units of milligram per kilogram [mg/kg]).

Similarly, **cleanup levels** were developed in the FS for the **groundwater COCs**, including PCE, TCE, cis-1,2-DCE, vinyl chloride, naphthalene, and benzene. These **groundwater cleanup levels** are provided in Table 2 (in units of microgram per liter [µg/L]).

Summary of Remedial Alternatives

A number of remedial alternatives were identified and evaluated in the Site 16 **FS** and **FS Addendum**. These alternatives are different combinations of methods or procedures to restrict access and to contain, remove, or treat contamination to protect human health and the environment. The remedial alternatives that were developed for soil and **groundwater** at Site 16 are listed below. There are 7 remedial alternatives for soil and 8 remedial alternatives for groundwater.

SOIL ALTERNATIVES:

- Alternative S-1: No Action
- Alternative S-2: Soil Cover and/or Cap, **Monitoring**, and **Land Use Controls (LUCs)**
- Alternative S-3: Excavation, Off-Site Disposal, and **LUCs**
- Soil Alternative S-3A: Excavation, Off-Site Disposal, Cover, and **LUCs**
- Alternative S-4: Soil Cover, Selected Excavation and Disposal, and **LUCs**
- Alternative S-5: Excavation and Off-Site Disposal – Unrestricted Use
- Alternative S-6: Full Soil Cover, Monitoring, and **LUCs**

GROUNDWATER ALTERNATIVES:

- Alternative G-1: No Action
- Alternative G-2: Monitored **Natural Attenuation (MNA)** and **LUCs**
- Alternative G-3: In-Situ Chemical Oxidation (High-Concentration Areas), MNA, and **LUCs**
- Alternative G-3A: In-Situ Chemical Oxidation (Source Area), MNA, and **LUCs**
- Groundwater Alternative G-3B: In-Situ Chemical Oxidation (East End of Former Building 41), **MNA**, and **LUCs**
- Alternative G-4: Enhanced **Bioremediation** (High-Concentration Areas), MNA, and **LUCs**
- Alternative G-5: **Groundwater** Extraction and Treatment (High-Concentration Areas), MNA, and **LUCs**
- Alternative G-6: Enhanced Bioremediation, MNA, and **LUCs** (Reduced Remediation Time)

DESCRIPTION OF SOIL ALTERNATIVES

As noted above, **fill materials** and **subsurface** debris exist throughout a significant portion of the NCA indicating that much of this area received fill material. Thus, for purposes of the soils alternatives evaluations, the area has been designated a **waste management area** (i.e., an area where waste is “managed in place”). LUCs described below are considered permanent for the **waste management area**.

Alternative S-1: No Action, Five-Year Review

Evaluation of the “no action” alternative is required under **CERCLA** in order to serve as a baseline for comparison with the other alternatives. Under this alternative, no further cleanup or monitoring would be implemented at the site. Only administrative reviews of the site status would be conducted every 5 years, in accordance with **CERCLA**.

Alternative S-2: Soil Cover and/or Cap, Monitoring, LUCs, and Five-Year Reviews (Including Limited Excavation and Off-Site Disposal)

Alternative S-2 applies to selected areas in the NCA where contaminant concentrations exceed industrial clean-up levels. The alternative involves covering these areas with a 2-foot-thick cover of clean soil obtained from an off-site location. This will prevent unacceptable exposure to underlying contaminated surface and subsurface soil. A cap (a low-permeability cover such as clay or a liner) would be added to some areas of the NCA to prevent migration of contaminants to **groundwater**. LUCs would be implemented to prevent residential use of all areas exceeding residential risk levels, outside of an area around Building E-107, discussed below. The LUCs would also prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils. No excavation would be permitted without an approved soil management plan. Long-term monitoring and maintenance would also be required that includes inspections and any required maintenance of the cover, as well as groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels. At least yearly compliance monitoring would ensure that LUCs were being complied with.

A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to permit the continued use of the area as a marina or other recreational use, while preventing

TABLE 1. SOIL CLEANUP LEVELS		
Chemical of Concern	**Industrial User[4] (mg/kg, unless specified otherwise)**	**Residential/Recreational User[4] (mg/kg, unless specified otherwise)**
BaP Eqs [(1)(2)(6)]	**0.8**	0.150/**0.400**
Arsenic[(2)]	**7**	**7**
Lead[(2)]	**500**	**150**
Naphthalene[(2)]	**0.8 (Leach[5])**	**0.8 (Leach[5])**
Dioxins/Furans[(2)]	600 parts per trillion	50 parts per trillion
Benzene[(2)]	**0.2 (Leach[5])**	**0.2 (Leach[5])**
Antimony[(3)]	**820** (220)	**10**
Manganese[(3)]	**10,000**	**390**
Benzo(g,h,i)Perylene[(3)]	**10,000** (9,500)	**0.8**
Fluoranthene[(3)]	**10,000**	**20**
Fluorene[(3)]	**1,000**	**28**
2-Methylnaphthalene[(3)]	**10,000** (2,200)	**123**
1,1-Dichloroethene (DCE)[(3)]	**9.5**	**0.2/0.7 (Leach[5])**
1,1-Biphenyl[(3)]	**10,000**	**0.8**
Pyrene[(3)]	**10,000** (9,500)	**13**
Vinyl Chloride (VC)[(3)]	**3** (0.1)	**0.02/0.3 (Leach[5])**
Trichloroethene (TCE)[(3)]	**520** (3.6)**/0.2 (Leach[5])**	**13/0.2 (Leach[5])**
Tetrachloroethene (PCE)[(3)]	**110** (86)**/0.1(Leach[5])**	**12/0.1 (Leach[5])**

Notes:

1 - Benzo(a)pyrene (BaP) criterion was used for BaP Equivalent concentrations (BaP Eqs). The following carcinogenic PAHs are considered in the calculation of the BaPEqs (the RIDEM chemical-specific residential/industrial Direct Exposure Criteria are displayed in mg/kg)

Benzo(a)pyrene (0.4/0.8) Benz(a)anthracene (0.9/7.8)
Benzo(b)fluoranthene(0.9/7.8) Benzo(k)fluoranthene (0.9/78)
Chrysene (0.4/780) Dibenz(ah)anthracene (0.4/0.8)
In deno(1 ,2, 3-cd)pyrene (0.9/7.8)

The RIDEM and risk-based residential remedial goals are presented for the BaP equivalents.

2 - Chemicals of concern based on Human Health Risk Assessment.

3 - Additional chemicals of concern based on exceedances of State of Rhode Island Residential Direct Exposure Criteria. For these chemicals, there are no exceedances of State of Rhode Island Industrial/Commercial Direct Exposure Criteria. (Unbolded values in parentheses are risk-based levels calculated using the risk assessment protocol for Site 16. **State criteria have been bolded**).

4 - Remedial goals are presented for the chemicals of concern identified in the Human Health Risk Assessment for Site 16. The remedial goals for the carcinogenic PAHs in soil for the hypothetical future residential land use will be 0.15 mg/kg for the carcinogenic PAHs (as a group) calculated in terms of BaPEqs and the RIDEM residential DECs for each individual carcinogenic PAH. All goals presented are *direct contact exposure goals* unless otherwise noted by the application of footnote 5.

5 - Criterion based on chemical migration from soil to groundwater (e.g., RIDEM GA leachability concern). All other cleanup levels presented in the table are based on direct contact risk with the chemical of concern. (**RIDEM criteria have been bolded**.)

6 - TPH was also detected in Site 16 soils. The observed contamination is generally collocated with BaP Eqs contamination. The Direct Contact/Leachability Residential Soil/GA and Industrial Soil/GB RIDEM criteria are 500 mg/kg and 2,500 mg/kg, respectively.

TABLE 2. GROUNDWATER CLEANUP LEVELS[1]		
Chemical of Concern	**Groundwater Criteria (µg/L)**	**Basis**
1,1-Dichloroethene (DCE)	7	MCL
cis-1,2-DCE[2]	70	MCL
1,1,2-Trichloroethane (TCA)	5	MCL
Benzene[2]	5	MCL
Bis(2 ethylhexyl)phthalate (BEHP)	6	MCL
Methylene Chloride	5	MCL
Naphthalene[1,3]	0.14	RSL
Tetrachloroethene (PCE)[2]	5	MCL
Trichloroethene (TCE)[2]	5	MCL
Vinyl chloride[2]	2	MCL
Antimony	6	MCL
Arsenic	10	MCL
Barium	2,000	MCL
Beryllium	4	MCL
Cadmium	5	MCL
Chromium	To be determined.	MCL or Facility-Wide Background whichever is higher
Lead[3]	15	SDWA Action Level
Nickel	To be determined.	RIDEM or Facility-Wide Background whichever is higher
Nitrate	10,000	MCL
Nitrite	1,000	MCL
Selenium	50	MCL
Thallium	To be determined.	MCL or Facility-Wide Background whichever is higher

Notes:
1 - These clean-up levels apply outside the waste management area; inside the waste management area they are "Performance Standards".
2 - COCs selected based on results of human health risk assessment. Other chemicals are included in table because of exceedances of EPA MCLs or RIDEM criteria.
3 – The goal for naphthalene is a calculated risk-based concentration based on EPA toxicity criteria. The goal for lead is from the SDWA regulations (40 CFR 141 Subpart G).
SDWA — Safe Drinking Water Act
MCL — Maximum Contaminant Level
RSL — EPA Regional Screening Level
RIDEM — Rhode Island Department of Environmental Management

disturbance of the cover and preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. Long-term monitoring would be required that includes at least yearly inspections to determine whether LUCs were being complied with and that components of the remedy, particularly the cover, were not disturbed. Groundwater and/or sediment/surface water monitoring would be conducted, as necessary, to insure underlying contamination is not migrating from the waste management area to Allen Harbor at unacceptable levels. Long-term maintenance would be implemented to maintain the 2-foot of clean soil cover and other components of the remedy.

Alternative S-3: Excavation, Off-Site Disposal, LUCs, and Five-Year Reviews

Alternative S-3 consists of excavation and off-site disposal of shallow soil (to a depth of 2 feet) containing contaminant concentrations greater than industrial exposure-based soil clean-up levels to prevent unacceptable human exposure. Soil with contaminant concentrations greater than **leachability**-based soil clean-up levels would also be excavated to the depth of the water table and would be disposed of offsite. The excavated areas would be backfilled with a clean soil cover to restore the pre-existing grade and to prevent exposure to deeper (i.e., at a depth greater than 2 feet) contaminated soil. LUCs would be implemented to prevent residential use of all areas exceeding residential risk levels, outside of an area around Building E-107, discussed below. The LUCs would also prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils. No excavation would be permitted without an approved soil management plan. Long-term monitoring and maintenance would also be required that includes inspections and any required maintenance of the cover, as well as groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels. At least yearly compliance monitoring would ensure that LUCs were being complied with.

A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to permit the continued use of the area as a marina or other recreational use, while preventing disturbance of the cover and preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. Long-term monitoring would be required that includes at least yearly inspections to determine whether LUCs were being complied with and that components of the remedy, particularly the cover, were not disturbed. Groundwater and/or sediment/surface water monitoring would be conducted, as necessary, to insure underlying contamination is not migrating from the waste management area to Allen Harbor at unacceptable levels. Long-term maintenance would be implemented to maintain the 2-foot of clean soil cover and other components of the remedy.

Soil Alternative S-3A: Shallow Excavation, Off-Site Disposal, Cover, LUCs, and Five-Year Reviews (See Figures 4 and 5)

Alternative S-3A consists of excavation and off-site disposal of shallow soil (to a depth of 2 feet) containing contaminant concentrations greater than industrial exposure-based soil clean-up levels to prevent unacceptable human exposure. The excavated areas would be backfilled with a clean soil cover to restore the pre-existing grade and to prevent exposure to deeper contaminated soil. LUCs would be implemented to prevent residential use of all areas exceeding residential risk levels, outside of an area around Building E-107, discussed below. The LUCs would also prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. No excavation would be permitted without an approved soil management plan. Long-term monitoring and maintenance would also be required that includes inspections and any required maintenance of the cover, as well as groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels. At least yearly compliance monitoring would ensure that LUCs were being complied with.

A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to permit the continued use of the area as a marina or other recreational use, while preventing disturbance of the cover and preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. Long-term monitoring would be required that includes at least yearly inspections to determine whether LUCs were being complied with and that components of the remedy, particularly the cover, were not disturbed. Groundwater and/or sediment/surface water monitoring would be conducted, as necessary, to insure underlying contamination is not migrating from the waste management area to Allen Harbor at unacceptable levels. Long-term maintenance would be implemented to maintain the 2-foot of clean soil cover and other components of the remedy.

Alternative S-4: Soil Cover, Selected Excavation and Disposal, LUCs, and Five-Year Reviews

Alternative S-4 consists of excavation of soil with contaminant concentrations greater than leachability-based soil clean-up levels to the depth of the water table, and off-site disposal. A soil cover would be placed over the remainder of the NCA, where contaminant concentrations are greater than industrial exposure-based clean-up levels, to prevent unacceptable human exposure to contaminated

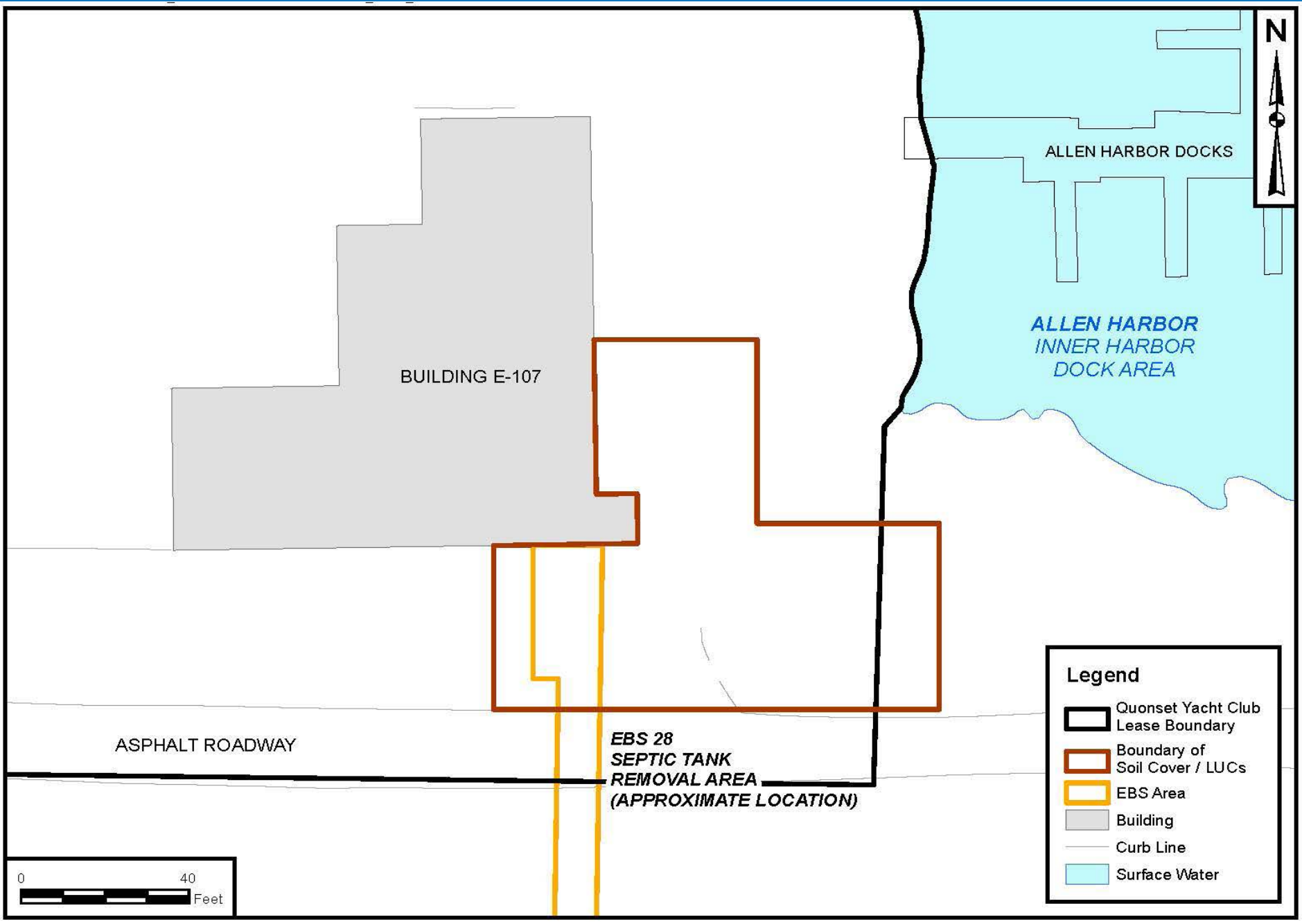


Figure 4: Marina Building (E-107) Area

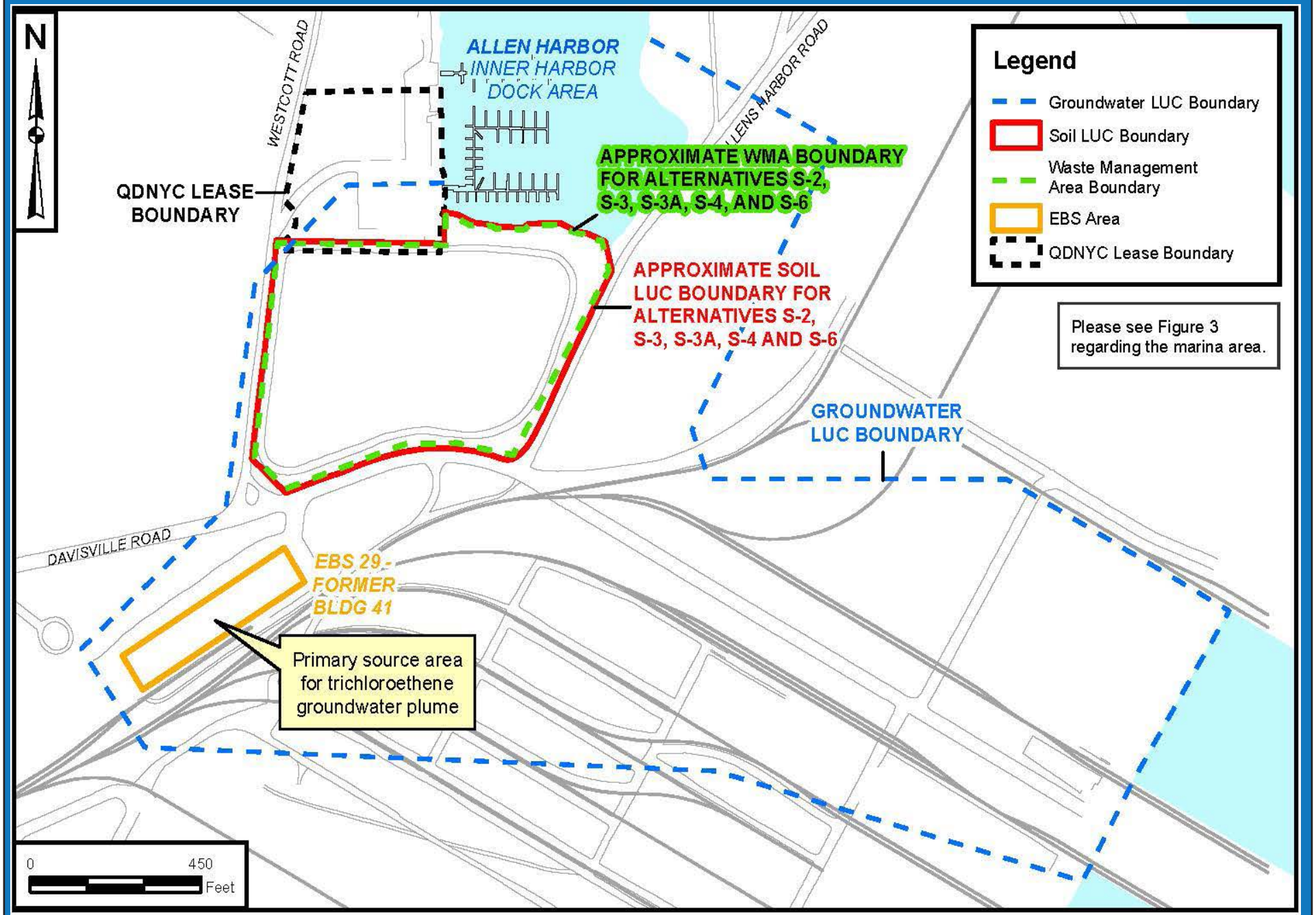


Figure 5: Relevant Site 16 Boundary

surface and subsurface soil. LUCs would be implemented to prevent residential use of all areas exceeding residential risk levels, outside of an area around Building E-107, discussed below. The LUCs would also prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils. No excavation would be permitted without an approved soil management plan. Long-term monitoring and maintenance would also be required that includes inspections and any required maintenance of the cover, as well as groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels. At least yearly compliance monitoring would ensure that LUCs were being complied with.

A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to permit the continued use of the area as a marina or other recreational use, while preventing disturbance of the cover and preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. Long-term monitoring would be required that includes at least yearly inspections to determine whether LUCs were being complied with and that components of the remedy, particularly the cover, were not disturbed. Groundwater and/or sediment/surface water monitoring would be conducted, as necessary, to insure underlying contamination is not migrating from the waste management area to Allen Harbor at unacceptable levels. Long-term maintenance would be implemented to maintain the 2-foot of clean soil cover and other components of the remedy.

Alternative S-5: Excavation and Off-Site Disposal – Unrestricted Use

Soil with contaminant concentrations greater than residential-exposure-based and leachability-based soil clean-up levels would be excavated to achieve residential-exposure-based and leachability-based soil clean-up levels, to the depth of the water table. A small area of soil near the Building E-107 would also be excavated, disposed of off-site, and backfilled with clean soil to the pre-existing grade. Soils would be disposed offsite and replaced with clean backfill to restore existing grades. No LUCs would be required.

Alternative S-6: Limited Excavation, Full Soil Cover, Monitoring, LUCs, and Five-Year Reviews

Alternative S-6 consists of placing a geotextile membrane followed by a 1-foot-thick soil cover over the entire NCA to prevent unacceptable human exposure to contaminated surface and subsurface soil. Although areas of soil with contaminant concentrations greater than leachability-based screening levels would remain, it has been shown that contaminants are unlikely to migrate to Allen Harbor at unacceptable concentrations. LUCs would be implemented to prevent residential use of all areas exceeding residential risk levels, outside of an area around Building E-107, discussed below. The LUCs would also prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils. No excavation would be permitted without an approved soil management plan. Long-term monitoring and maintenance would also be required that includes inspections and any required maintenance of the cover, as well as groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels. At least yearly compliance monitoring would ensure that LUCs were being complied with.

A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to permit the continued use of the area as a marina or other recreational use, while preventing disturbance of the cover and preventing the unauthorized excavation and/or disposal of contaminated soils below 2 feet bgs. Long-term monitoring would be required that includes at least yearly inspections to determine whether LUCs were being complied with and that components of the remedy, particularly the cover, were not disturbed. Groundwater and/or sediment/surface water monitoring would be conducted, as necessary, to insure underlying contamination is not migrating from the waste management area to Allen Harbor at unacceptable levels. Long-term maintenance would be implemented to maintain the 2-foot of clean soil cover and other components of the remedy.

Description of Groundwater Alternatives

The **waste management area** designated for the NCA is considered in the groundwater alternatives presented below. The boundary of the waste management area is referred to as the "**compliance boundary**" with regards to attainment of the groundwater cleanup levels presented in Table 2. Specifically, groundwater outside the **compliance boundary** must eventually meet these levels. In contrast, the Table 2 levels are considered "performance standards" only (not cleanup levels) for groundwater within the compliance boundary.

The designation of the **waste management area** for the NCA impacts the LUCs for groundwater and the determination of which soil alternatives (described above) may be combined with (i.e., "paired with") which groundwater alternatives (described below) for purposes of selecting the preferred alternative for Site 16. LUCs are permanent for groundwater **within the compliance boundary**, and temporary for groundwater outside the **compliance boundary** and for the entire Site if Soil Alternative S-5 is selected as the preferred alternative (until remedial levels are achieved). A groundwater remedial alternative that assumes that a **waste management area** has been designated must be paired with a soil remedial alternative that also assumes a **waste management area** has been designated.

Alternative G-1: No Action, Five-Year Reviews

Evaluation of the "no action" alternative is required under **CERCLA** to serve as a baseline for comparison with the other alternatives. Under this alternative, no cleanup or monitoring remedy would be implemented at the Site. Only administrative reviews of the site status would be conducted every 5 years, in accordance with **CERCLA**.

Alternative G-2: MNA, LUCs, and Five-Year Reviews

Alternative G-2 consists of monitoring the progress of the degradation of contaminants by **natural attenuation**. A **waste management area** (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prohibit all uses of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger levels** based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the **plume** along the shore of Allen Harbor.

Alternative G-3: In-Situ Chemical Oxidation (High-Concentration Areas), MNA, LUCs, and Five-Year Reviews

Alternative G-3 consists of the injection of an oxidant such as **sodium permanganate** into the **groundwater** in the high-concentration areas (Figure 6) to destroy approximately 324 pounds of **VOC** contaminants through oxidation. The high-concentration areas are the areas within the 1,000 µg/L TCE concentration contour. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. A **waste management area** (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prevent the use of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger levels** based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the **plume** along the shore of Allen Harbor.

Alternative G-3A: In-Situ Chemical Oxidation (Source Area), MNA, LUCs, and Five-Year Reviews

Alternative G-3A consists of the injection of an oxidant such as **sodium permanganate** into the **groundwater** in the source areas near former Building 41 to destroy approximately 117 pounds of **VOC** contaminants through oxidation. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. Groundwater beneath the NCA would not be treated. A **waste management area** (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prevent the use of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion. (See Figure 5).

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger** levels based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the **plume** along the shore of Allen Harbor.

Groundwater Alternative G-3B: Focused In-Situ Chemical Oxidation (East End of Former Building 41 Source Area Only), MNA, LUCs, and Five-Year Reviews

Alternative G-3B consists of the injection of an oxidant such as **sodium permanganate** into the **groundwater** through existing injection wells at the eastern end of the former Building 41 to destroy approximately 48 pounds of **VOC** contaminants through oxidation. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. A waste management area (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. LUCs would be implemented to prevent the use of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger** levels based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the plume along the shore of Allen Harbor.

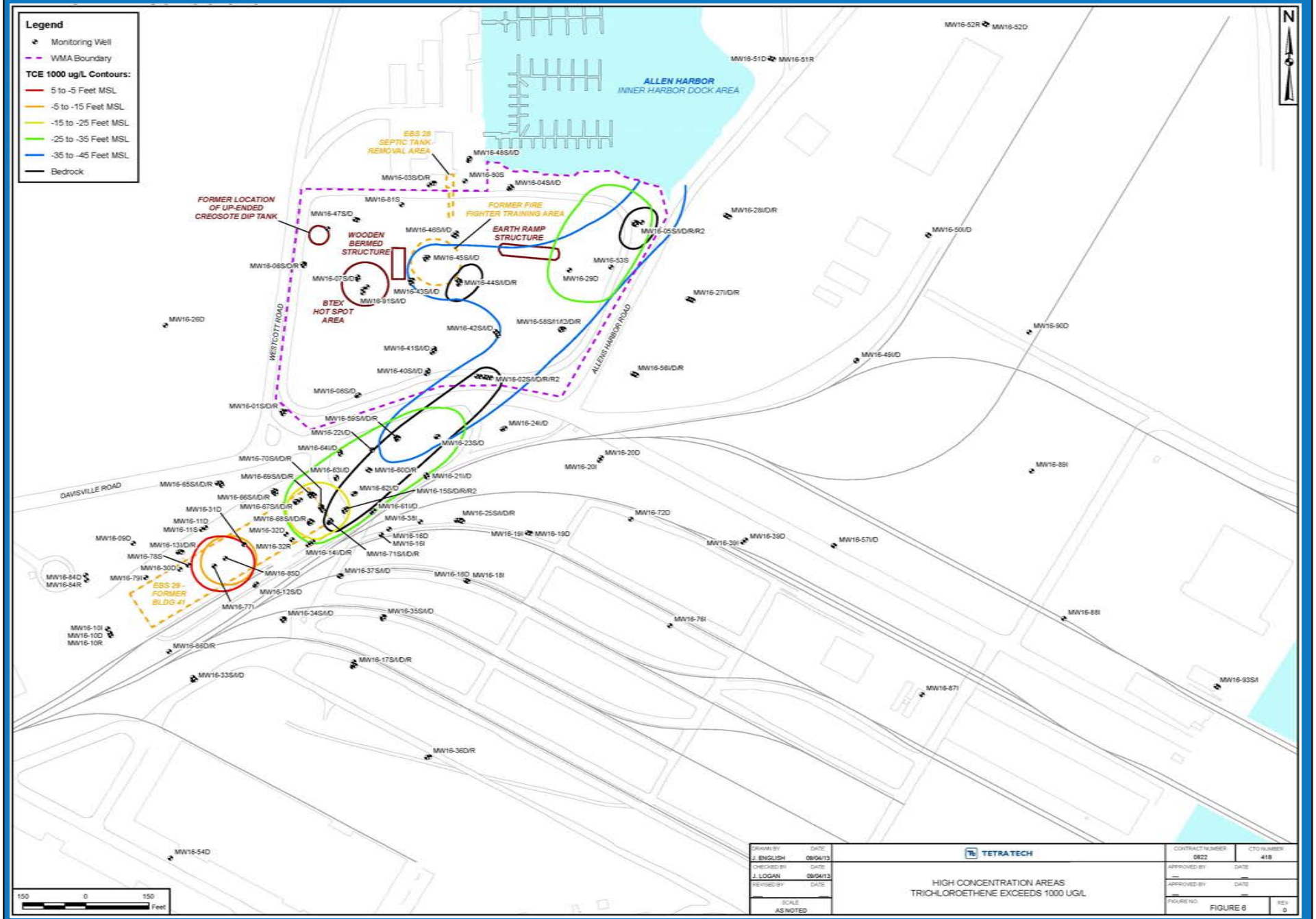


Figure 6: High Concentration Areas - Trichloroethene Exceeds 1000 UG/L

Alternative G-4: Enhanced Bioremediation (High-Concentration Areas), MNA, LUCs, and Five-Year Reviews

Alternative G-4 consists of the injection of a carbon source such as **emulsified vegetable** oil into the **groundwater** in the high-concentration areas to destroy approximately 324 pounds of **VOC** contaminants through **biological degradation**. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. A waste management area (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prevent the use of **groundwater** and to restrict building design and require construction methods to control unacceptable vapor intrusion.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger** levels based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the plume along the shore of Allen Harbor.

Alternative G-5: Groundwater Extraction and Treatment (High-Concentration Areas), MNA, LUCs, and Five-Year Reviews

Alternative G-5 consists of the extraction and on-site treatment of the **groundwater** in the high-concentration areas to destroy approximately 324 pounds of VOC contaminants through **air stripping and activated carbon adsorption**. Treated (cleaned) **groundwater** would be discharged to Narragansett Bay. Downgradient of the extraction zone, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. A waste management area (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prevent the use of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger** levels based on ecological and human health screening levels. If the **trigger levels** are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the **plume** would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the **plume** along the shore of Allen Harbor.

Alternative G-6: Enhanced Bioremediation, MNA, LUCs, and Five-Year Reviews (Reduced Remediation Time)

Alternative G-6 consists of the injection of a carbon source such as **emulsified vegetable oil** into the **groundwater** in a large area surrounding and including the high-concentration areas, to destroy approximately 670 pounds of **VOC** contaminants through **biological degradation**. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. A waste management area (and associated compliance boundary) would also be established in the area of the NCA, where the underlying groundwater would not be required to meet remedial goals. **LUCs** would be implemented to prevent the use of **groundwater except for routine sampling** and to restrict building design and require construction methods (such as a vapor barrier) to control unacceptable vapor intrusion. Because a large area would be treated by enhanced **biodegradation**, remediation of the **groundwater** contaminant **plume** is expected to be accomplished in a shorter time than anticipated for the other groundwater alternatives.

Groundwater samples from **monitoring** wells adjacent to Allen Harbor would be analyzed and compared to **trigger** levels based on ecological and human health screening levels. If the **trigger** levels are exceeded in the **groundwater**, then the need for a contingency remedial action to intercept the plume would be evaluated. One approach for a contingency remedial action would be to create a bio-barrier at the leading edge of the **plume** along the shore of Allen Harbor.

Evaluation of Alternatives

EPA has established nine criteria for use in comparing the advantages/disadvantages of cleanup alternatives. These criteria fall into three groups: threshold criteria, primary balancing criteria, and modifying criteria. The nine criteria are explained in the text box (Exhibit 3), “What are the Nine Evaluation Criteria?” A detailed analysis of alternatives can be found in the **FS** and is summarized in Tables 3 and 4 of this **Proposed Plan**.

Preferred Alternative

The Navy recommends Alternatives ***S-3A and G-3B*** to address contaminated soil and **groundwater** at Site 16 and to provide long-term risk reduction (Figures 7/8). Based on existing/current conditions no remedial action is required for surface water or sediment.

In summary, **Soil Alternative S-3A – Excavation, Off-site Disposal, Monitoring, LUCs, and Five-Year Review** consists of excavation and off-site disposal of shallow NCA-area soil (to a depth of 2 feet) that contains contaminant concentrations greater than industrial exposure-based soil clean-up levels to prevent unacceptable human exposure. The excavated areas would be backfilled with a clean soil cover to restore the pre-existing grade and to prevent

Exhibit 3: What are the Nine Evaluation Criteria?

Threshold Criteria (The selected remedy must satisfy these criteria):

1 - Overall Protectiveness of Human Health and the Environment determines whether an alternative eliminates, reduces, or controls threats to public health and the environment.

2 - Compliance with 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.

Balancing Criteria (These criteria are used to weigh the relative merits of the alternatives):

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

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

5 - Short-Term Effectiveness considers the length of time needed to implement an alternative, and the risk the alternative poses to workers, residents, 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 operation 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 to within a range of +50 to -30 percent.

Modifying Criteria (These criteria are also considered during remedy selection and incorporated into the ROD):

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

9 - Community Acceptance considers whether the local community agrees with the Navy's analyses and **Preferred Alternative.** Comments received on the **Proposed Plan** are an important indicator of community acceptance.

exposure to deeper contaminated soil. A small portion of the soil near Building E-107 (the Marina Building) exceeding RIDEM residential soil clean-up levels would be excavated to a depth of 2 feet, disposed of off-site, and backfilled with clean soil to the existing grade. LUCs would be implemented to:

- Prevent residential use of all areas exceeding residential risk levels.
- Prevent disturbance of the cover and other components of the remedy, as well as preventing the unauthorized excavation and/or disposal of contaminated soils.
- Permit the continued use of the area as a marina or other recreational use.

Long-term monitoring and maintenance would be required that includes:

- Inspections and any required maintenance of the cover.
- Groundwater and/or sediment/surface water monitoring, as necessary, to ensure underlying contamination is not migrating from the waste management area to Allen Harbor or Narragansett Bay at unacceptable levels.

In summary, **Groundwater Alternative G-3B – Focused In-Situ Chemical Oxidation at the Building 41 Source Area (only), MNA, LUCs, and Five-Year Review** consists of the injection of an oxidant such as **sodium permanganate** into the **groundwater** through existing injection wells at the eastern end of the former Building 41 to destroy the **VOC** contaminants through oxidation. Downgradient of the treatment area, the progress of the degradation of contaminants by **natural attenuation** would be monitored by a routine groundwater sampling program. This alternative is paired with Soil Alternative S-3A which creates a waste management area that has a groundwater compliance boundary around it. Groundwater outside the compliance boundary will attain cleanup levels over time through treatment and MNA, while inside the compliance boundary contaminated groundwater will be monitored to ensure it is not migrating and causing harm to Allen Harbor, Narragansett Bay, or surrounding areas of uncontaminated water. LUCs would be implemented to:

- Prevent exposure to contaminated groundwater.
- Restrict building design and require construction methods to control unacceptable risk as a consequence of vapor intrusion.

There will be yearly compliance monitoring of LUCs and five–year reviews to assess the protectiveness of the remedy. LUCs will apply to property that is currently owned by the Navy as well as property previously owned by the Navy (Figure 9).

Soil Alternative S-3A is recommended because:

- Chemical concentrations exceeding soil cleanup levels for the commercial/industrial land use scenario occur at

TABLE 3. EVALUATION OF SOIL ALTERNATIVES

	EVALUATION CRITERIA	Alt. S-1 No Action	Alt. S-2 Cover/Cap and Land Use Controls	Alt. S-3 Excavation and Land Use Controls	Alt. S-3A Excavation, WMA, and Land Use Controls	Alt. S-4 Cover, Excavation and Land Use Controls	Alt. S-5 Excavation – Unrestricted Use	Alt. S-6 Full Cover, Monitoring, and Land Use Controls
Threshold Criteria – Selected alternative must meet these criteria								
1	Protects Human Health and the Environment – *Will it protect people and animal life near the site? Is protection permanent?*	Ø	●	●	●	●	●	●
2	Meets Federal and State Standards – *Does alternative comply with federal and state environmental laws, regulations, and requirements?*	Ø	●	●	●	●	●	●
Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria								
3	Provides Long-Term Effectiveness and Permanence – *Do risks remain on site? If so, are the controls adequate and reliable?*	Ø	●	●	●	●	●	●
4	Reduces Mobility, Toxicity, and Volume Through Treatment – *Is treatment used to reduce contaminant threats?*	Ø	O	O	O	O	Ø	O
5	Provides Short-Term Protection – *How soon will risks be reduced? Will implementing the action cause impacts to people or the environment? If so, are the impacts controllable and acceptable?*	Ø	●	●	●	●	●	●
6	Implementability – *Can it be implemented? Is the alternative technically feasible? Are necessary goods and services available?*	●	●	●	●	●	O	●
7	Costs							
	Capital Costs (up front costs to design and construct)	$7,000	$2,051,000	$5,136,000	$1,943,000	$5,222,000	$29,115,000	$3,009,000
	Operation and Maintenance Costs (annual costs)	$0	$3,000	$3,000	$3,000	$3,000	$0	$3,000
	Five-Year Review Costs	$28,000	$28,000	$28,000	$28,000	$28,000	$28,000	$28,000
	Total Present Value (total cost over duration of alternative in today's $)	$120,000	$2,502,000	$5,312,000	$2,119,000	$5,398,000	$29,115,000	$3,185,000
	Assumed Duration of Alternative (Years)	30	30	30	30	30	1	30
	Time for construction (months)	NA	4	5	5	5	12	9
Modifying Criteria – May be used to modify recommended cleanup								
8	State Agency Acceptance – *Do state agencies agree with Navy's recommended alternative?*	To be determined after public comment period based on comments on Feasibility Study and Proposed Remedial Action Plan						
9	Community Acceptance – *What objections, modifications, or suggestions do the public offer during the public comment period?*	To be determined after public comment period based on comments on the Proposed Remedial Action Plan						

NOTES:

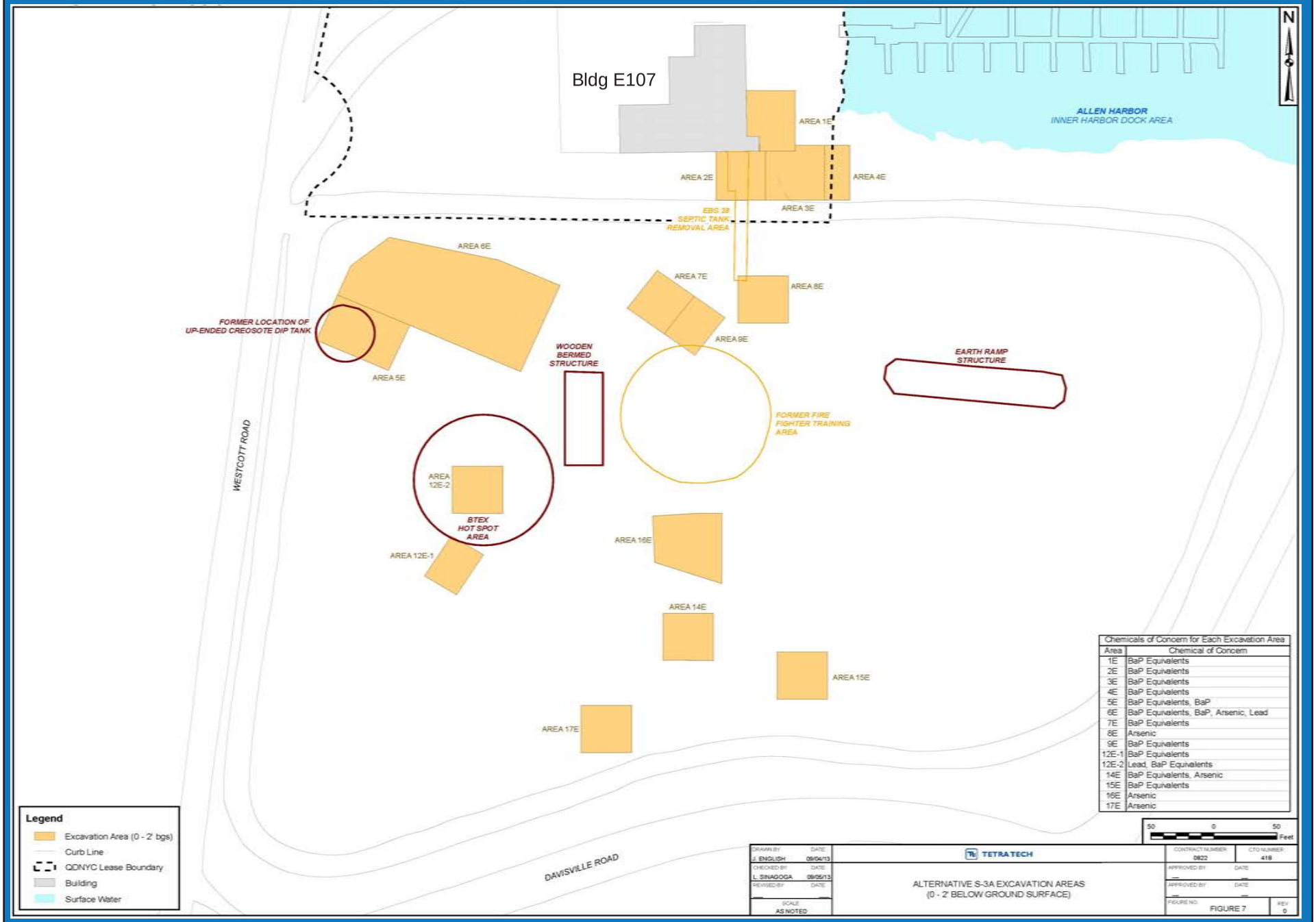
● Meets or Exceeds Criterion O Partially or Potentially Meets Criterion (some uncertainty) Ø Does NOT Meet Criterion

TABLE 4. EVALUATION OF GROUNDWATER ALTERNATIVES

	EVALUATION CRITERIA	Alt. G-1 No Action	Alt. G-2 MNA and LUCs	Alt. G-3 Chemical Oxidation, MNA, and LUCs	Alt. G-3A Chemical Oxidation (Source Area), MNA, and LUCs	Alt. G-3B Chemical Oxidation (East End of Former Building 41) MNA, and LUCs	Alt. G-4 Biorem., MNA, and LUCs	Alt. G-5 Extraction, Treatment, MNA, and LUCs	Alt.G-6 Biorem., MNA, and LUCs (Reduced Time)
Threshold Criteria – Selected alternative must meet these criteria									
1	Protects Human Health and the Environment – *Will it protect people and animal life near the site? Is protection permanent?*	Ø	●	●	●	●	●	●	●
2	Meets Federal and State Standards – *Does alternative comply with federal and state environmental laws, regulations, and requirements?*	Ø	●	●	●	●	●	●	●
Balancing Criteria – Used to differentiate between alternatives meeting threshold criteria									
3	Provides Long-Term Effectiveness and Permanence – *Do risks remain on site? If so, are the controls adequate and reliable?*	Ø	●	●	●	●	●	●	●
4	Reduces Mobility, Toxicity, and Volume Through Treatment – *Is treatment used to reduce contaminant threats?*	Ø	O	O	O	O	O	O	O
5	Provides Short-Term Protection – *How soon will risks be reduced? Will implementing the action cause impacts to people or the environment? If so, are the impacts controllable and acceptable?*	Ø	O	●	●	●	●	●	●
6	Implementability – *Can it be implemented? Is the alternative technically feasible? Are necessary goods and services available?*	●	●	O	O	O	O	O	O
7	Costs								
	Capital Costs (up front costs to design and construct)	$7,000	$44,000	$7,922,000	$4,283,000	$612,000	$6,160,000	$4,862,000	$17,614,000
	Operation and Maintenance Costs (annual costs)	$0	$45,000	$43,000	$48,000	$48,000	$43,000 - $91,000; $2,222,000 in Year 5	$228,000 - $258,000	$27,000 - $111,000; $6,000,000 in Year 5
	Five-Year Review Costs (per review)	$28,000	$28,000	$28,000	$28,000	$28,000	$28,000	$28,000	$28,000
	Total Present Value (total cost over duration of alternative in today's $)	$120,000	$1,124,000	$9,350,000	$5,587,000	$1,788,000	$9,656,000	$9,932,000	$24,186,000
	Assumed Duration of Alternative(1) (Years)	NA	NA	0.5	0.5	1	6	30	1
	Duration of alternative cleanup (Years) (except with Alt. S-5)	NA	300	100	100	100	100	100	50
	Duration of alternative cleanup (Years) with Alt. S-5	NA	300	100 to 150	100 to 150	100 to 150	100 to 150	100 to 150	50
Modifying Criteria – May be used to modify recommended cleanup									
8	State Agency Acceptance – *Do state agencies agree with Navy's recommended alternative?*	To be determined after public comment period based on comments on Feasibility Study and Proposed Remedial Action Plan							
9	Community Acceptance – *What objections, modifications, or suggestions do the public offer during the public comment period?*	To be determined after public comment period based on comments on the Proposed Remedial Action Plan							

NOTES:
1 - See Feasibility Study/Feasibility Study Addendum for details regarding the determination of assumed duration.

● Meets or Exceeds Criterion O Partially or Potentially Meets Criterion (some uncertainty) Ø Does NOT Meet Criterion



Chemicals of Concern for Each Excavation Area

Area	Chemical of Concern
1E	BaP Equivalents
2E	BaP Equivalents
3E	BaP Equivalents
4E	BaP Equivalents
5E	BaP Equivalents, BaP
6E	BaP Equivalents, BaP, Arsenic, Lead
7E	BaP Equivalents
8E	Arsenic
9E	BaP Equivalents
12E-1	BaP Equivalents
12E-2	Lead, BaP Equivalents
14E	BaP Equivalents, Arsenic
15E	BaP Equivalents
16E	Arsenic
17E	Arsenic

Figure 7: Alternative S-3A Excavation Areas (0 - 2' Below Ground Surface)

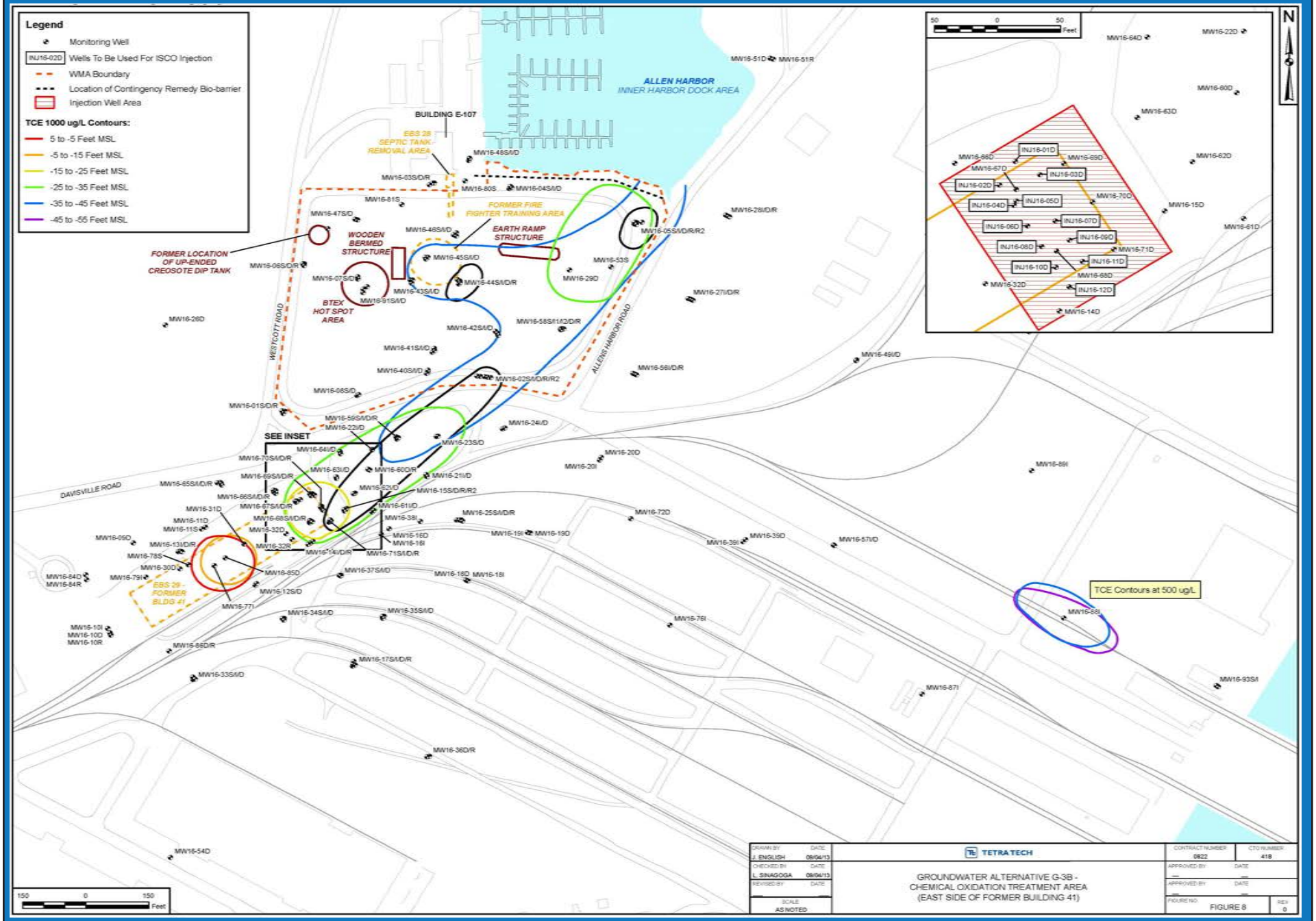


Figure 8: Groundwater Alternative G-3B - Chemical Oxidation Treatment Area (East Side of Former Building 41)

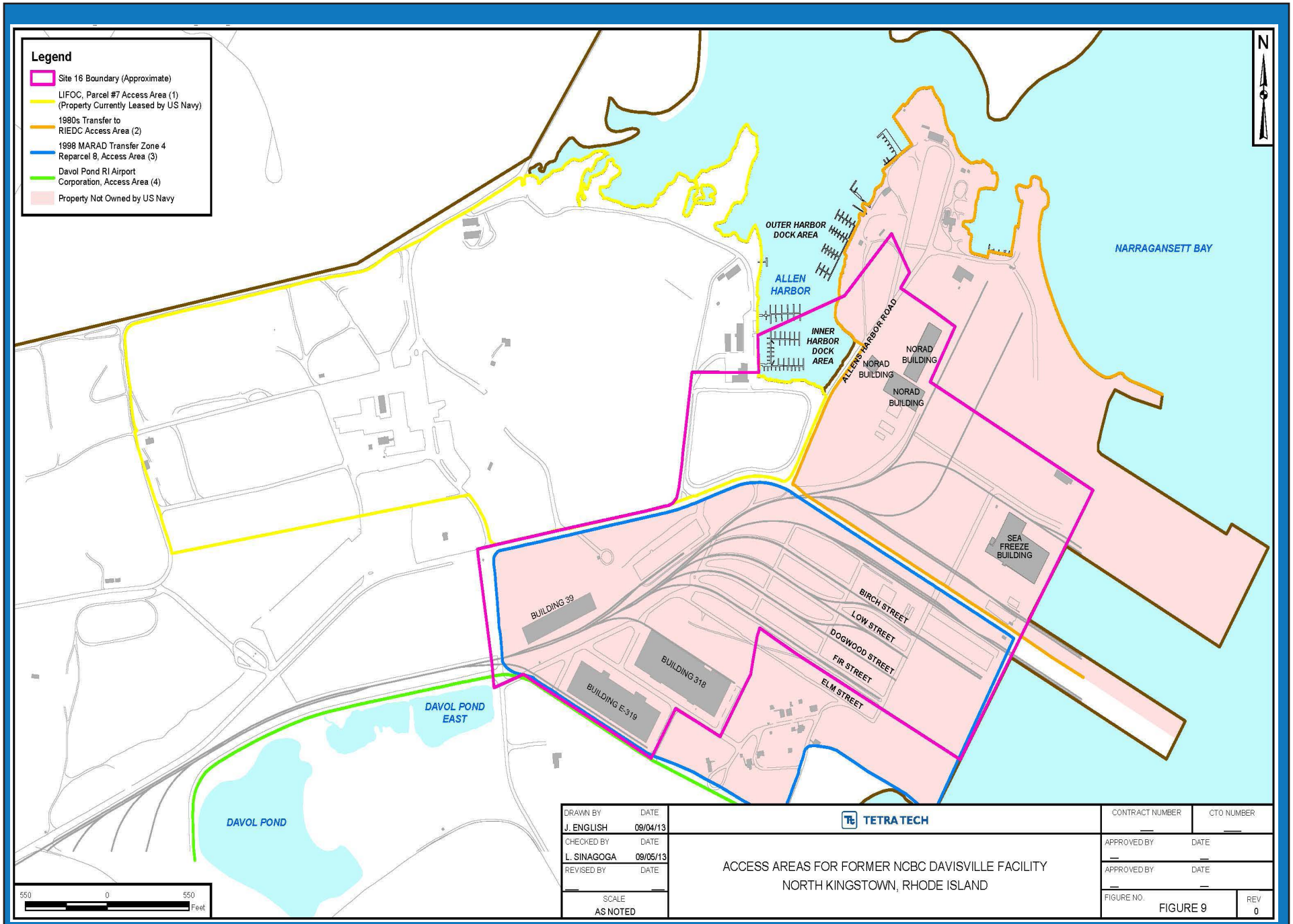


Figure 9: Access Areas for Former NCBC Davisville Facility. North Kingstown, Rhode Island

limited locations only across the NCA. These locations are accessible and easily excavated to prevent exposure.

- Chemical concentrations exceeding soil cleanup levels for the residential land use scenario occur in the vicinity of Building E-107 (the Marina area). With concurrence from RIDEM, in the Marina area, excavation of the top two feet of contaminated soils exceeding RIDEM criteria, maintenance of a clean two-foot cover, LUCs to protect the cover and prevent exposure to subsurface soils under the cover, and monitoring will achieve RIDEM standards to permit continued recreational use of the Marina area.

- LUCs, monitoring, and the five-year reviews will effectively prevent residential use of the Site and exposure to contaminated subsurface soils.

Groundwater Alternative G-3B is recommended because:

- Human health and the environment will be adequately protected through the implementation of **LUCs** and MNA, regardless of groundwater treatment.

- The current/future land use at Site 16 is primarily industrial/commercial and is not conducive to use of the underlying **groundwater** for public water supply; the **groundwater** underlying Site 16 is not currently used as a water supply source.

- The **groundwater** discharging to Allen Harbor and Narragansett Bay does not currently adversely impact human or ecological **receptors** in the harbor.

- **In-situ chemical oxidation** would permanently and irreversibly destroy an estimated 48 pounds of contaminants in **groundwater**.

- The remaining contaminants would naturally attenuate and be monitored until groundwater is restored to beneficial use. Under this alternative groundwater outside of the **waste management area** compliance boundary is calculated to take approximately 100 years to attain drinking water standards, compared to 300 years from the MNA only, alternative G-2.

- The time frame for remediation for Alternative G-3B is consistent with most other remedial alternatives summarized in Table 4. Therefore, more aggressive active remediation of **groundwater** is not considered cost-effective.

The Navy will solicit public comment as part of the Proposed Plan on the measures taken through the remedial action to protect floodplain and wetland resources. Specifically, covers will be installed and maintained to prevent any release of contamination that would impair federal floodplain (prevent washout in a 100 year storm event) or wetland resources.

The **Preferred Alternatives (S-3A and G-3B)** meet the threshold criteria. The Navy believes these alternatives provide the best balance of tradeoffs among the other alternatives, with respect to the modifying criteria (see Tables 3 and 4). The Navy proposes that the implementation of Preferred Alternatives S-3A and G-3B be the final remedy for Site 16.

The Navy expects the **Preferred Alternatives** to satisfy the following statutory requirements of **CERCLA** Section 121(b): (1) be protective of human health and the environment; (2) comply with Applicable Relevant and Appropriate Requirements (**ARARs**); (3) be cost-effective; (4) utilize permanent solutions to the maximum extent practicable; and (5) satisfy the preference for treatment as an element, to the extent practicable.

Next Steps

The Navy will accept public comments during a 30-day comment period. The Navy considers and uses these comments to improve its cleanup approach, and may decide to alter the **Preferred Alternatives** in response to public comment or new information.

During the public comment period, the Navy will accept written comments via mail, e-mail, and fax. Additionally, verbal comments may be made during the Public Hearing on October 24, 2013, which will be recorded by a stenographer. The Navy will provide an informational presentation prior to the start of the Public Hearing on October 24, 2013.

The Navy will review the transcript of all the comments received during the meeting and all written comments received during the comment period before making a final cleanup decision.

The Navy will then prepare a written response to all the written and oral comments received. The comments will become part of the official public record. The transcript of the meeting and the Navy's written responses will be issued in a document called a **Responsiveness Summary**, which will be submitted with the **Record of Decision for Site 16**. The **Responsiveness Summary** and **Record of Decision** will be made available to the public on-line (see below) and at the QDC Annex.

The Navy will announce the final decision on the cleanup plan through the local media and via the NCBC Davisville Environmental Restoration Program website, www.bracpmo.navy.mil.

You may send comments by U.S. mail, fax or e-mail. A tear-off mailer is provided for your convenience.

What Do You Think?

The Navy, as the lead agency, is accepting public comments on this **Proposed Plan** from October 15, 2013 through November 14, 2013. You don't have to be a technical expert to comment. If you have a comment, the Navy wants to hear it before the final decision about Site 16 is made.

Send Written Comments

Provide the Navy with your written comments about the **Proposed Plan** for Site 16. Please email (jeffrey.m.dale@navy.mil), fax (215)-897-4914, or mail comments, postmarked no later than November 14, 2013, to:

Mr. Jeff Dale
BRAC PMO Northeast
Building 679, Naval Business Center
4911 South Broad Street
Philadelphia, Pennsylvania 19112-1303

For More Detailed Information You May Go to the Public Information Repository or Visit Our Website

The **Proposed Plan** was prepared to help the public understand and comment on the proposal for this site and provides a summary of a number of reports and studies. The technical and public information documents used by the Navy to prepare the **Proposed Plan** are available at the following Information Repository:

Annex Building
Quonset Development Corporation (QDC)
95 Cripe Street
North Kingstown, Rhode Island 02852

Relevant documents can also be accessed via the Department of the Navy BRAC Program Management Office website, www.bracpmo.navy.mil/.

Glossary of Terms

This glossary defines the bolded terms used in this **Proposed Plan**. The definitions in this glossary apply specifically to this **Proposed Plan** and may have other meanings when used in different circumstances.

Air Stripping: The process of bubbling air through water to remove volatile organic substances from the water.

Aquatic: Growing or living-in or frequenting water.

Aquifer: A water-bearing stratum (subsurface zone) of permeable rock, sand, and gravel.

Activated Carbon Adsorption: Removal of soluble chemicals from water by contact with a highly adsorptive granular or powdered carbon. The contaminants are adsorbed (trapped) onto the carbon.

Applicable or Relevant and Appropriate Requirements (ARARs): Standards or requirements that address contaminants or actions at a CERCLA site. ARARs can be action-specific, location-specific, or chemical-specific.

Background (Conditions, Levels, or Values): Occurring naturally in the environment (soil, groundwater). Also includes anthropogenic background (man-made contaminants present in the environmental as a consequence of non-Navy sources.) Please note that the background soils study referenced in the Proposed Plan is dated and was conducted prior to publication of specifications in Section 8.06 of the RIDEM Remediation Regulations (Amended 2011).

Beneficial Use: With reference to non-saline groundwater use, the highest beneficial use would be use as a domestic water supply.

Benthic organisms: Organisms living at the bottom of a water body (e.g., in the sediments).

Biological Degradation: The breakdown of organic contaminants by microorganisms.

Bioremediation: The use of biological agents, such as bacteria or plants, to remove (destroy) or neutralize contaminants.

Carcinogens: Chemicals that cause cancer.

Chemical of Concern (COC): A substance detected at a level and/or in a location where it could have an adverse effect on human health and the environment.

Chemical of Potential Concern (COPC): Chemicals found at concentrations greater than federal and state risk-based screening levels.

Cleanup Level: A numerical concentration agreed upon by the Navy and EPA, in consultation with RIDEM, as having to be reached for a certain **chemical of concern** to meet one or more of the remedial action objectives. A **cleanup level** may be a regulatory-based criterion, a risk-based concentration, or even a background value. (For groundwater inside the compliance boundary established for the waste management area designated for the NCA, “cleanup levels” are “performance standards” to be used in data evaluations conducted in support of the long-term monitoring program established for Site 16.)

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA): A federal law, also known as “Superfund,” that was passed in 1980 and modified in 1986 by the Superfund Amendments and Reauthorization Act. This law created a tax on the chemical and petroleum industries and provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

Creosote: A black, oily liquid with a pungent odor, obtained by the distillation of coal tar and used as a wood preservative.

Compliance Boundary: The boundary of a waste management area.

Decommissioned: Removed from service.

Emulsified Vegetable Oil: Oils that are easily dispersed/mixed into the groundwater to promote bioremediation.

Environmental Baseline Survey (EBS) Items: An environmental baseline survey is conducted to provide a factual representation of environmental conditions at

a property. It is typically prepared to identify potential environmental issues to be addressed prior to property transfer and identifies areas of a property that should be further investigated during a remedial investigation (RI). The following areas identified during the EBS are within or adjoin Site 16. Most areas were resolved (i.e., a "no further action" decision was reached) prior to the RI for Site 16; contaminant releases at EBS items 28 and 29 are the primary contributor to the environmental contamination observed at Site 16.

EBS 28 - Former Creosote Dip Tank Area, Suspected Fire Fighting Training Area, and Two Suspected Underground Storage Tank Areas
EBS 29 - Former Building 41
EBS 30 – Railroad Yard Staging Area
EBS 57 – Building 39 Septic System
EBS 58 – Building E319 Septic System
EBS 60 - Building E-107 Septic Tanks
EBS 63 – Former Building 120 Septic System
EBS 68 – Building 39
EBS 79 – Building E319
EBS 81 - Former Building 41 Septic Tanks
EBS 85 – Former UST Area
EBS 86 – Building E-107 Floor Drains

Environmental Forensics: An environmental investigation and data review that is conducted to determine the likely sources of chemicals detected in an environmental medium (e.g., is the chemical present in an environmental medium as a consequence of site or non-site related activities?).

Feasibility Study (FS): A description and engineering study of the potential cleanup alternatives for a site.

Feasibility Study Addendum: Presents evaluation of additional remedial alternatives for both soil and groundwater consisted after the publication of the final Feasibility Study for Site 16.

Fill Material: Materials used to fill a low area such as a depression in the ground surface, or to build up the elevation of land (and generally consisting mainly of soil and/or rock). At Site 16 specifically, fill material also included construction debris, vegetation, and other discarded materials.

Geotextile: Permeable fabrics which, when used in association with soil, have the ability to separate, filter, reinforce, protect, or drain.

Groundwater: Water found beneath the earth's surface that fills pores between such materials as sand, soil, gravel, or rock.

Industrial/Commercial: Only industrial and/or commercial activities are permitted and residential/recreational use is prohibited.

In-Situ Chemical Oxidation: An environmental cleanup technique that introduces strong chemicals (referred to as oxidants) to destroy (or make less toxic) a chemical contaminant "in place" (i.e., in the aquifer).

Invertebrates: Animals lacking a spinal column.

Leachability: A soluble chemical's ability to be removed from soil by the action of a percolating liquid such as precipitation during a rainfall event.

Land Use Control (LUC): A legal or administrative restriction that prevents access or certain uses of land.

Low Permeability Soils: Soils that allow only a little water to pass through.

Monitoring: Collecting environmental information that helps to track changes in the magnitude and extent of contamination at a site or in the environment.

National Oil and Hazardous Substances Pollution Contingency Plan: More commonly called the **National Contingency Plan (NCP)**, it is the federal government's blueprint for responding to both oil spills and hazardous substance releases. Following the passage of Superfund (CERCLA) legislation in 1980, the **National Contingency Plan** was broadened to cover releases at hazardous waste sites requiring emergency removal actions. A key provision involves authorizing the lead agency to initiate appropriate removal action in the event of a hazardous substance release.

Natural Attenuation: The reduction of contaminant concentrations in the environment through biological processes, physical phenomena, and/or chemical reactions.

Non-carcinogens: Chemicals that may cause adverse effects other than cancer.

Performance Standards: The remedial levels presented in Table 2 of this Proposed Plan are considered "Performance Standards" for the groundwater underlying the waste management area. They are not specific target levels to be achieved as a result of a groundwater remedial alternative. They are standards to be considered during the data evaluations conducted as part of a long-term monitoring plan.

Plume: A volume of contaminated groundwater that extends downward and outward from a specific source; the shape and movement of the mass of the contaminated water is affected by the local geology, materials present in the plume, and the flow characteristics of the area groundwater.

Polycyclic Aromatic Hydrocarbons (PAHs): PAHs are a group of high molecular weight, moderately toxic organic chemicals. PAHs are relatively immobile and insoluble in water; they form from the incomplete combustion of hydrocarbons, such as coal and gasoline. Many of these compounds are highly **carcinogenic** at relatively low levels. Typical examples of **PAHs** are naphthalene and phenanthrene. The group of carcinogenic **PAHs** are often presented as one concentration referred to as the "benzo(a) pyrene equivalent concentration". Benzo(a)pyrene is often referred to as the "index" **PAH** chemical because it is the most studied **PAH** chemical.

Preferred Alternative: The remedy recommended by the Navy for cleaning up a site. The remedy may be modified or changed based on comments received during the Public Comment Period.

Preliminary Remediation Goals (PRGs): Chemical-specific goals for site contaminants that when achieved will result in site concentrations that pose an acceptable risk level.

Proposed Plan: A document that presents a proposed cleanup alternative, and requests public input regarding the proposed alternative.

Receptor: An individual, either a human, plant, or animal, that may be exposed to a chemical present at the Site.

Record of Decision (ROD): An official document that describes the selected action for a specific site. The **Record of Decision** documents the remedy selection process and is issued by the Navy following the public comment period.

Remedial Action Objectives (RAOs): The final cleanup objectives that must be met by the selected remedial alternative.

Remedial Investigation (RI): An in-depth study designed to gather data needed to determine the nature and extent of contamination at a Superfund site.

Responsiveness Summary: A section of the **Record of Decision** that includes a listing of the written and oral comments received during the public comment period and public meeting on the Proposed Plan and Navy's responses to the comments.

Recreational Use: Refers to remedial approach which will only permit recreational use within the Marina area of the property and that does not interfere with the CERCLA remedy established under the ROD, in this case the creation and maintenance of a two foot thick cover of clean soil over deeper contaminated soil. Permitted and prohibited activities, consistent with the CERCLA remedy will be established under a LUC, which will also restrict residential use of the area. Modification of the definitions of permitted and prohibited recreational activities under the LUC can only be made with approval of the Navy, USEPA, and RIDEM. It should be noted that the RI risk assessment did not assume that receptor exposure under a recreational land-use scenario is the "same" as receptor exposure under a residential land use scenario. The risk assessment presented in the RI used a more CERCLA-type risk assessment approach and assumes that the recreational receptor is exposed less frequently to soil contaminants than a residential receptor. For example, boats are removed from the marina during the cold winter months, thus, the potential for receptor exposure to soils at the marina is significantly reduced during the cold weather months (i.e., weather conditions limit the use of the marina area by recreational users.)

Risk Assessment: The evaluation and estimation of the current and future potential for adverse human health and/or ecological effects from exposure to contaminants. A **human health risk assessment** is an evaluation of current and future potential for adverse human health effects from exposure to site contaminants. An **ecological risk assessment** is a study that evaluates the potential risk to ecological receptors (various types of plants and animals) from contaminants at a site.

Saturated Zone: The portion of subsurface soil and rock where every available space is filled with water.

Seep: An area, generally small in size, where water percolates slowly to the land surface.

Shallow Groundwater: The zone including the water table (i.e., the upper-most groundwater zone) and generally extending to a depth of approximately 25-30 feet below the ground surface.

Sodium Permanganate: A strong chemical oxidant used to cleanup groundwater contaminants.

Surface Soil: The soil interval between the ground surface and 2 feet below ground surface.

Subsurface: Beneath the ground surface.

Superfund: Another name for the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)** (see above).

Trigger Level: A concentration in groundwater predicted not to result in an "unacceptable" concentration in a surface water body to which the groundwater discharges. Thus, the "trigger" level is designed to be protective of surface water receptors (both human and ecological) and is typically used in long-term monitoring programs to evaluate groundwater concentrations detected in monitoring wells abutting a shoreline.

Terrestrial: Living on or in or growing from land.

Vapor Intrusion: Migration of vapors emitted by volatile chemicals from the subsurface into the indoor air spaces of overlying buildings.

Vertebrates: An animal having a spinal column.

Volatile Organic Compound (VOC): An organic chemical that easily forms vapors under normal temperatures and pressures.

Waste Management Area (WMA): An area where waste is managed in place. For purposes of evaluating the remedial alternatives considered for Site 16, the **fill materials** and **subsurface** debris that exists throughout a significant portion of the NCA have been designated a **waste management area**. The groundwater underlying the WMA will not be required to meet remedial levels presented in this Proposed Plan. However, such levels will be used as "performance standards" for the groundwater underlying the WMA in the long-term monitoring program for Site 16

Use This Space to Write Your Comments

or to be Added to the Mailing List

Please use this form for your written comments and mail to the address below.

Your comments must be postmarked no later than November 14, 2013.

Mr. Jeff Dale
Remedial Project Manager
BRAC PMO Northeast
Building 679, Naval Business Center
4911 South Broad Street
Philadelphia, Pennsylvania 19112-1303
Fax: (215) 897-4914
E-mail: jeffery.m.dale@navy.mil

(Attach additional sheets as needed)

Comments submitted by:

Mailing List Additions, Deletions, or Changes

I would like to:

- Join the site mailing list. Name: _____
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Please check the appropriate box and fill in the correct address information above.

Former Naval Construction Battalion Center
Site 16 - Creosote Dip Tank Area, Fire-Fighting Training Area, and Former Building 41 Area (OU 9)
Public Comment Sheet (continued)

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MR. JEFF DALE
REMEDIAL PROJECT MANAGER
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BUILDING 679, NAVAL BUSINESS CENTER
PHILADELPHIA, PA 19112-1303

Fold on line, staple, stamp, and mail