STATEMENT OF BASIS FOR REMEDY SELECTION SITE 6A SOUTHERN AREA GROUNDWATER PLUME NWIRP CALVERTON NY

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TETRA TECH NUS

Statement of Basis For Remedy Selection
For
Site 6A - Southern Area Groundwater Plume

Naval Weapons Industrial Reserve Plant
Calverton, New York

Mid-Atlantic Division
Naval Facilities Engineering Command

Contract Number N62470-08-D-1001
Contract Task Order WE08

September 2011

STATEMENT OF BASIS FOR REMEDY SELECTION
FOR
SITE 6A - SOUTHERN AREA GROUNDWATER PLUME

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command
MidAtlantic
9742 Maryland Avenue
Norfolk, Virginia 23511

Submitted by:
Tetra Tech NUS, Inc.
600 Clark Avenue, Suite 3
King of Prussia, Pennsylvania 19406-1433

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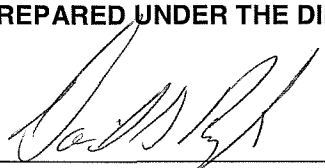
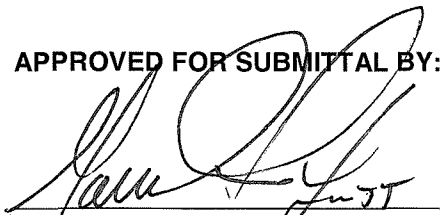
PREPARED UNDER THE DIRECTION OF:



DAVID D. BRAYACK
PROJECT MANAGER
TETRA TECH NUS, INC.
NORFOLK, VIRGINIA

APPROVED FOR SUBMITTAL BY:



JOHN TREPANOWSKI, P.E.
PROGRAM MANAGER
TETRA TECH NUS, INC.
KING OF PRUSSIA, PENNSYLVANIA

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ACRONYMS

µg/L	microgram per liter
AOC	Area of Concern
ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CMS	Corrective Measures Study
COC	chemical of concern
DCA	1,1,1- dichloroethane
DCE	1,1,1-dichloroethene
EISB	enhanced in-situ biodegradation
ER	Environmental Restoration
FS	Feasibility Study
gpm	gallon per minute
HNUS	Halliburton NUS
LUC	land use control
MCL	maximum contaminant level
MNA	monitored natural attenuation
NWIRP	Naval Weapons Industrial Reserve Plant
NYCRR	New York Code of Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
O&M	operation and maintenance
PRG	preliminary remediation goal
PRSC	Peconic River Sportsman's Club
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFI	RCRA Facility Investigation
RI	Remedial Investigation
ROD	Record of Decision
SCDHS	Suffolk County Department of Health Services
TCA	1,1,1-trichloroethane
Tetra Tech	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
VOC	volatile organic compound

1.0 INTRODUCTION

This Statement of Basis for Remedy Selection has been prepared as a condition of the existing Resource Conservation and Recovery Act (RCRA) Part 373 Permit for the former Naval Weapons Industrial Reserve Plant (NWIRP) located in Calverton, Suffolk County, New York. Specifically, it is the intent of this Statement of Basis to explain the proposed corrective measures for Site 6A - Southern Area partially located in Parcel B2 and extending off site to the Peconic River. Although not listed as an Area of Concern (AOC) on the current Part 373 Permit, the Southern Area is the area associated with Site 6A-Fuel Calibration Area in which contaminated groundwater has migrated to the Peconic River. The location of NWIRP Calverton is shown on Figure 1-1, and AOC/Environmental Restoration (ER) site locations are shown on Figure 1-2.

This Statement of Basis also includes a compendium of the engineering studies and remedial investigations completed; a description of the corrective measures evaluated; and the rationale for the proposed corrective measures for Site 6A - Southern Area.

Section 2.0 of this document provides an overview of the former NWIRP Calverton facility, including a description of Site 6A - Southern Area. Descriptions of the remedial investigations conducted at Site 6A - Southern Area are presented in Section 3.0. Section 4.0 describes the corrective measures that were evaluated. Section 5.0 presents the conclusions of the Statement of Basis and the proposed corrective measures to be implemented.

A list of relevant reference documents including environmental investigation reports and corrective measures studies (CMS) can be found at:

https://portal.navfac.navy.mil/portal/page/portal/navfac/navfac_ww_pp/navfac_hq_pp/navfac_env_pp/env_restoration_installations/lant/midlant/calverton/records

2.0 FACILITY AND DESCRIPTIONS

This section provides a general overview of the former NWIRP Calverton facility and a description of Site 6A - Southern Area. Figure 2-1 shows the location and physical features of the site.

2.1 FACILITY LOCATION AND DESCRIPTION

NWIRP Calverton facility is located in Suffolk County on Long Island, approximately 70 miles east of New York City. Formerly engaged in the manufacture of aircraft parts and subassemblies, the Calverton facility has phased out all of its manufacturing process operations. The former operator of the facility, Northrop Grumman Corporation, vacated the property in February 1996. Since that time, all the property contained within the perimeter fence, with the exception of three noncontiguous parcels of land, has been conveyed to the Town of Riverhead. Parcels A, B1, B2 and Site 7 of Parcel C, totaling approximately 209 acres, are being retained by the Navy to continue ER Program activities. There are currently no operational activities being conducted on the Navy's 209 acres. Provided below is a description of the ER sites contained within each parcel:

Parcel	Environmental Restoration Sites	Latitude	Longitude
Parcel A	Fire Training Area (ER Site 2)	N 40° 54' 26"	W 72° 48' 08"
Parcel B1	Fuel Calibration Area (ER Site 6A)	N 40° 54' 38"	W 72° 47' 25"
	Engine Test House (ER Site 10B)		
Parcel B2	On-Site Southern Area	N 40° 54' 28"	W 72° 47' 05"
Parcel C	Fuel Depot Area (ER Site 7)	N 40° 54' 51"	W 72° 47' 54"
	Jet Fuel Systems Lab (ER Site 10A)		

Currently, no process-type operations are being conducted at the Calverton facility that could generate hazardous waste. Similarly, there will be no hazardous materials brought onto the Navy property to be used as part of any process-type operations. Therefore, there are no requirements for the Navy to maintain a hazardous waste management area that would require permitting pursuant to 6 New York Code of Rules and Regulations (NYCRR) Part 373. However, as part of the management of any waste that may be generated as part of the Navy's ER Program, the Navy will accumulate and temporarily store any such waste at the parcels identified above. These parcels should be considered as less than 90-day storage areas that are exempt from 6 NYCRR Part 373 permit requirements. General descriptions of Site 6A - Southern Area included in this Statement of Basis are provided below.

2.2 SITE 6A - SOUTHERN AREA

In support of the NWIRP Calverton mission, Sites 6A – Fuel Calibration Area and 10B – Engine Test House were used in the testing of aircraft fuel and engine systems from the late 1950's to 1996. During

most of these operations, there was no secondary containment in place, and spills of fuels and waste oils to the ground surface likely occurred. Given that the groundwater table is shallow and the soil is permeable sand, releases to the ground surface would leach to and affect the groundwater. Between 2008 and 2010, during the remediation of site soils, structures located at these sites were demolished. The area is currently a relatively flat grassy field.

The Southern Area originates at Site 6A in Parcel B2 and extends off site to the southeast. This area was investigated because chlorinated solvents were detected in a Suffolk County monitoring well downgradient of the facility. Other than Sites 6A and 10B there are no known or suspected contaminant sources within this area and the area is hydraulically downgradient of Sites 6A and 10B. The groundwater flow direction though this area is southeast towards the Peconic River.

3.0 REMEDIAL INVESTIGATIONS

This section describes the environmental investigations conducted at Site 6A – Southern Area, including an evaluation of the vapor intrusion pathway at Peconic River Sportsman's Club (PRSC).

3.1 PHASE 2 RI AND SUPPLEMENTAL GROUNDWATER INVESTIGATION

The Phase 2 Remedial Investigation (RI) was completed in 2001 and was based on field activities conducted between 1997 and 2000 (Tetra Tech, 2001). This report also included field activities conducted at Sites 6A and 10B.

In 1997, 13 temporary monitoring wells were installed and sampled and 9 vertical profile borings were installed in onsite and offsite portions of the Southern Area. The samples were analyzed for VOCs. Several rounds of water level measurements were conducted.

In 2000, four vertical profile borings were installed and sampled on Connecticut Avenue, River Road, and the PRSC property. These samples were analyzed for VOCs. Twelve temporary piezometers were installed in clusters at four locations near the Peconic River. The piezometers were used for groundwater sampling at various depths and to evaluate the groundwater flow direction near the river. Also, two surface water samples were collected from the Peconic River and analyzed. Additionally, in 2000, a flow net study was conducted for the Peconic River to a depth of 80 feet below ground surface (bgs). The study concluded that groundwater to a depth of 80 feet flowed into the Peconic River.

3.2 SITE 6A AND SOUTHERN AREA SUPPLEMENTAL GROUNDWATER INVESTIGATION

Between 2001 and 2004, supplemental investigations were conducted at Sites 6A and 10B and the Southern Area, including groundwater at the PRSC, near the Peconic River, and to the southeast near Swan Pond (Tetra Tech, 2005). The groundwater sampling program for the Southern Area included collecting groundwater samples from nine piezometers and surface water samples were collected from two locations along the Peconic River. The samples were analyzed for VOCs.

3.3 SITE 6A AND SOUTHERN AREA ANNUAL DATA SUMMARY REPORTS

In 2006, the Navy installed and sampled two monitoring wells north of the Peconic River on Connecticut Avenue. In addition, five existing monitoring wells were sampled, and four surface water and four sediment samples were collected from the Peconic River (Tetra Tech, 2007). These samples were analyzed for VOCs.

In 2007 and 2008, the Navy installed 12 permanent monitoring wells along River Road/Grumman Boulevard and Connecticut Avenue. The monitoring wells allowed groundwater flow directions to be

determined, and supported the evaluation of contaminant migration. In addition, the Navy began quarterly sampling and analysis of water supply wells on the PRSC (Tetra Tech, 2008). Two rounds of groundwater, surface water, and sediment samples were collected in the Southern Area and analyzed for VOCs.

In 2009, 30 groundwater samples were collected from permanent monitoring wells and 51 groundwater samples were collected from 17 temporary well locations at Sites 6A, 10B, and the Southern Area. Groundwater samples were analyzed for VOCs and some of the monitoring wells were also analyzed for methane, ethane and ethene. A total of eight surface water samples and eight sediment samples were collected in the Peconic River during the two rounds of sampling and analyzed for VOCs (Tetra Tech, 2010).

In 2010, groundwater investigation and monitoring activities at Sites 6A and the Southern Area were conducted as a continuance of the annual groundwater monitoring program at these sites, to further delineate the Southern Area groundwater plume, and to address data gaps in the current monitoring well network (Southern Area) (Tetra Tech, 2011a). In March and April 2010, a groundwater investigation and sampling event was conducted in the area between Site 10B and River Road. Eight temporary wells were installed and sampled. In June 2010, a second sampling event was conducted and included the installation of 20 more temporary monitoring wells. These temporary monitoring wells were placed on site and off site between Site 10B and the PRSC, to the southeast, which included locations on Suffolk County Park's property. In September 2010, a third sampling event was conducted which included the installation of 12 temporary wells (Tetra Tech, 2011a). These samples were analyzed for VOCs.

Also in 2010, 19 piezometers were installed in the Southern Area during supplemental groundwater investigation activities. Eight piezometers were installed in the onsite portion of the Southern Area, nine piezometers were installed in the offsite portion of the Southern Area on Suffolk County Parklands property to fill in the data gaps south of River Road and west of Connecticut Avenue. Two additional piezometers were installed along the northern shore of the Peconic River to better monitor groundwater entering the river.

In addition, two pumping tests were conducted in 2010 to determine the hydraulic conductivity of the aquifer in the Southern Area and included the installation of 11 additional piezometers to monitor groundwater levels during the pumping tests. A total of eight surface water and eight sediment samples were collected during the 2010 investigation.

In 2010 and 2011, an enhanced in situ biodegradation (EISB) pilot-scale test was conducted in the Southern Area. Electron donor substrate (ethyl lactate) was injected into the aquifer in July/August 2010

and December 2010 to enhance conditions for indigenous dehalogenating microbes to dechlorinate VOCs. Performance monitoring data was collected in July, October, and December 2010, and March and June 2011.

In 2011, a soil vapor intrusion investigation was conducted at the PRSC (Tetra Tech, 2011b). The activities included indoor air, outdoor air, crawl space, and sub-slab vapor sampling conducted at the PRSC in February 2011. Air samples were analyzed for VOCs via United States Environmental Protection Agency (USEPA) TO-15 method.

3.4 SUMMARY OF EXTENT OF CONTAMINATION AND SITE RISKS

3.4.1 Groundwater

Site 6A - Southern Area is the area of VOC-contaminated groundwater that is down gradient of Sites 6A and 10B (see Figure 2-1). The chemicals of concern consist of chlorinated solvents and degradation products that are believed to have resulted from either intermittent releases at Sites 6A and 10B or from potential overland migration through a series of ditches and ponds in the area. This Statement of Basis addresses the on-site and off-site portions of the plume. The highest detected concentrations were near and downgradient of Site 10B, which is just downgradient of Site 6A. The contamination was generally detected within the upper 40 feet of the water table aquifer in the on-site and near-site portions of the plume and to a maximum depth of approximately 100 feet as it gets closer to the Peconic River. Site 6A - Southern Area extends from Sites 6A and 10B to the Peconic River. To date, the chemicals of concern have been detected infrequently in the river, and when detected, at concentrations below drinking water standards.

3.4.2 Summary of Site Risks

The on-site portion of the Southern Area groundwater plume is located on Navy-owned property and is currently not be used. Once the property meets certain environmental conditions, it will be transferred to the Town of Riverhead for economic redevelopment. The off-site Southern Area groundwater plume consists of several parcels that are owned by New York State, Suffolk County, and PRSC. Future land use in these areas is anticipated to be consistent with current land use, which is primarily environmental conservation and recreational use. Although contaminated groundwater has impacted the Suffolk County sole source aquifer, plans for installing additional potable water supplies for future use in the Southern Area Groundwater Plume have not been identified. Detailed results of the human health risk assessment are presented in the RCRA Facility Investigation (RFI) Report (Halliburton NUS [HNUS], 1995). Potential future use of VOC-contaminated groundwater as a potable water supply was identified as the primary risk to human health. An ecological risk assessment, which is provided in the CMS/Feasibility Study (FS), did not identify significant risk to ecological receptors under current conditions (Tetra Tech, 2011c).

3.4.3 Exceedances of Regulatory Standards and Criteria

Site-related contaminants are comprised of VOCs (1,1,1-trichloroethane [TCA] and associated degradation products and fuels [e.g., xylene]). 1,1-Dichloroethane (DCA), a degradation product of TCA, is the most prevalent VOC in the plume with a maximum detection of 2,100 micrograms per liter (µg/L). Approximately 25 percent (93 pounds) of the VOCs are located on-site (north of the fence line) and 75 percent of the VOCs (282 pounds) are located off-site (south of the fence line). Di- and tri-chlorinated benzene compounds are also present. These chemicals of concern (COCs) were identified because the maximum detected concentration in groundwater was greater than either NYSDOH maximum contaminant levels (MCLs) or surface water quality standards.

4.0 CORRECTIVE MEASURE ALTERNATIVES

This section describes the corrective measures alternatives developed and evaluated in the CMS/FS (Tetra Tech, 2011) for Site 6A – Southern Area. Remedial Action Objectives (RAOs) were developed in the CMS/FS for Site 6A - Southern Area as medium-specific and contaminant-specific objectives that will result in the protection of human health and the environment.

The RAOs are statements that define the extent to which sites require cleanup to protect human health and the environment and comply with applicable or relevant and appropriate requirements (ARARs). The RAOs reflect the COCs, exposure routes and receptors, and acceptable chemical concentrations (or range of acceptable chemical concentrations) for groundwater at Site 6A - Southern Area. The RAOs for Site 6A - Southern Area are as follows:

Groundwater

• Prevent human exposure to groundwater containing COCs above cleanup levels.

• Allow for unlimited use of groundwater (cleanup levels) within a reasonable timeframe.

• Prevent migration or discharge of COCs in groundwater to sediment and surface water at levels that would cause unacceptable risks to human or ecological receptors.

Soil Vapor Intrusion Indoor Air

• Prevent unacceptable risks to human receptors from exposure to vapors resulting from subsurface site-related COCs.

The Preliminary Remediation Goals (PRGs) for groundwater for Site 6A - Southern Area are provided in Table 4-1.

4.1 SITE 6A - SOUTHERN AREA GROUNDWATER PLUME

The alternatives analyzed for Site 6A – Southern Area are presented below. Alternatives 1 through 7 are numbered to correspond with the numbers in the CMS/FS Report. In addition, to further describe and evaluate these alternatives an Addendum to the CMS/FS was prepared (Tetra Tech, 2011d). This addendum considers the same technologies provided in the CMS, but details area-specific components. The Navy proposed remedy from the CMS/FS Addendum is currently identified as Alternative 8 (see Figure 4-1). These eight alternatives are as follows:

- Alternative 1: No Action
- Alternative 2: Land Use Controls
- Alternative 3: Monitored Natural Attenuation and Land Use Controls
- Alternative 4: Air Sparge, Monitored Natural Attenuation, and Land Use Controls

- Alternative 5: Anaerobic Enhanced Insitu Biodegradation (EISB), Monitored Natural Attenuation, and Land Use Controls
- Alternative 6: Anaerobic Enhanced Insitu Biodegradation (EISB), Air Sparge, Monitored Natural Attenuation, and Land Use Controls
- Alternative 7: Groundwater Extraction, Treatment, and Injection, Monitored Natural Attenuation, and Land Use Controls
- Alternative 8: Fenceline Groundwater Extraction, Treatment, and Discharge, Land Use Controls and Monitoring

4.1.1 Alternative 1: No Action

Regulations governing the Superfund program require that the "No Action" alternative be evaluated generally to establish a baseline for comparison. Under this alternative, the Navy would take No Action to prevent exposure to the VOC-contaminated groundwater. Additionally, the No Action alternative does not include monitoring the contaminant plume in groundwater or five-year reviews.

Capital Cost:	$0
Annual O&M Cost:	$0
Present Worth Cost:	$0
Construction Timeframe:	None

4.1.2 Alternative 2: Land Use Controls

This alternative consists of LUCs. The LUCs would target areas that require notifications and inspections during the operation of this alternative, until clean up goals are achieved. Additionally, this alternative would require monitoring and/or mitigation to address the potential for soil vapor intrusion issues. Groundwater use restrictions would be identified in the Record of Decision (ROD). The Navy is planning on transferring its property to the Town of Riverhead for economic redevelopment and the transfer documents restrict groundwater use and identify areas of residual contamination. Once the property is no longer under Navy control, the property owner would monitor groundwater and conduct annual inspections to identify potential wells that could result in adverse impacts to human health. Annual site inspections would be conducted to ensure that groundwater use restrictions are maintained and identify buildings that may be affected by potential soil vapor intrusion issues. A reevaluation of the site would be performed every 5 years to determine whether any changes to the controls or remedy would be required.

Capital Cost:	$8,000
O&M Cost:	$14,000 every five years (Five-Year Review) $7,000 annual (LUC)
Present Worth Cost:	$207,000 (20 years)
Time to Achieve RAOs:	20 years (10 to 40 years)

4.1.3 Alternative 3: Monitored Natural Attenuation and Land Use Controls

This alterative consists of MNA and LUCs. Like Alternative 2, LUCs would target areas that require notifications and inspections during the operation of this alternative, until clean up goals are achieved. The Navy is planning on transferring its property to the Town of Riverhead for economic redevelopment and the transfer documents restrict groundwater use and identify areas of residual contamination. Once the property is no longer under Navy control, groundwater monitoring and annual inspections would identify potential wells that could result in adverse impacts to human health. MNA would be used to evaluate VOC migration through the Southern Area and evaluate potential adverse impacts to the Peconic River. The existing monitoring well network and monitoring plan would be evaluated and if necessary modified to ensure an adequate evaluation of plume migration.

Capital Cost:	$314,000
O&M Cost:	$106,000 per event, 21 events over 20 years (Monitoring) $14,000 every five years (Five-Year Review) $7,000 per year (LUC)
Present Worth Cost:	$2,400,000 (20 years)
Construction Timeframe:	2 Years
Time to Achieve RAOs:	20 years (10 to 40 years)

4.1.4 Alternative 4: Air Sparge, Monitored Natural Attenuation, and Land Use Controls

This alternative consists of implementing LUCs, MNA, and installing and operating an air sparge treatment system in the former source area and/or near the Peconic River area. The LUCs would target areas that require notifications and inspections during implementation of this alternative, until clean up goals are achieved. MNA would target areas between treatment zones and portions of the groundwater plume with lower VOC concentrations (less than 50 µg/L) and/or where treatment cannot be effectively implemented because of site features (e.g., wetlands). The Source Area Air Sparge System would consist of one to four treatment lines. The final setup and number of treatment lines would be based on the ongoing source area groundwater monitoring and would be finalized during the Remedial Design to optimize performance in this area. Some air sparge wells and monitoring wells would be installed near or in wetlands and groundwater sampling would be conducted in these same areas

This alternative would result in the volatilization and photodegradation of approximately 21 pounds of VOCs from the source area and up to 354 pounds of VOCs at the Peconic River. The estimated time to reach cleanup levels in the River Area is 16 years. Within approximately 2 to 4 years, PRGs should be obtained in the source area.

Capital Cost:	$3,400,000
O&M:	$230,000 (Year 5 to 16) to $430,000 per year (Year 1 to 4)(Power and operator) $106,000 per event, 20 events over 16 years (Monitoring)

	$14,000 every five years (Five-Year Review)
	$7,000 per year (LUC)
Present Worth Cost:	$9,600,000 (16 years)
Construction Timeframe:	2 years
Time to Achieve RAOs:	16 years (8 to 32 years)

4.1.5 Alternative 5: Anaerobic Enhanced Insitu Biodegradation (EISB), Monitored Natural Attenuation, and Land Use Controls

This alternative consists of implementing LUCs, MNA, and installing and operating an anaerobic EISB system between the source area and downgradient portions of the Southern Area. The LUCs would target areas that require notifications and inspections during implementation of this alternative, until clean up goals are achieved. MNA would target areas between treatment zones and portions of the groundwater plume with lower VOC concentrations and/or where treatment cannot be effectively implemented because of site features (e.g., wetlands). The anaerobic EISB Systems would consist of one to five Biobarriers (Nos. 1 to 5) containing approximately 20 to 25 permanent 4-inch polyvinyl chloride injection wells. The final setup and number of treatment lines would be based on the ongoing groundwater monitoring and would be finalized during the Remedial Design to optimize performance in the source area and the rest of the onsite area.

Approximately 350 gallons of emulsified vegetable oil and 16,000 gallons of potable water would be injected into each well. If all 113 injection wells are required, a total of 40,000 gallons of emulsified vegetable oil and 1,800,000 gallons of potable water would be required. A second injection is assumed to be required five years after the first injection.

Some injection wells and monitoring wells would be installed near or in wetlands and groundwater sampling would be conducted in these same areas. In addition, the emulsified vegetable oil would be stored and mixed in areas adjacent to surface water and wetlands and injected under or near wetland areas.

Within approximately 4 to 8 years, PRGs should be obtained in the areas treated by the anaerobic EISB and approximately 150 pounds of VOCs would be destroyed through biodegradation.

Capital Cost:	$3,700,000
O&M Cost:	$1,100,000 (Year 5 injections)
	$119,000 per event, 16 events over 10 years (Monitoring)
	$14,000 every five years (Five-Year Review)
	$7,000 per year (LUC)
Present Worth Cost:	$6,700,000 (10 years)
Construction Timeframe:	2 years
Time to Achieve RAOs:	10 years

4.1.6 Alternative 6: Anaerobic Enhanced Insitu Biodegradation (EISB), Air Sparge, Monitored Natural Attenuation, and Land Use Controls

This Alternative is a combination of Alternatives 4 and 5, and consists of Anaerobic EISB, Air Sparge, MNA, and LUCs. The primary difference between Alternative 6 and a combination of Alternatives 4 and 5 is that the Source Area Air Sparge System would not be implemented. Instead, two Biobarriers would be used to treat VOC-contaminated groundwater in that area. This alternative includes aggressive treatment of all VOC-contaminated groundwater with DCA concentrations greater than 500 µg/L (on site and off site), and the majority of the onsite plume with DCA concentrations greater than 50 µg/L. The Peconic River Area Air Sparge would be used to treat VOCs that have migrated beyond the Biobarriers and also residual soluble organics and iron. The estimated time to reach cleanup levels in the Peconic River Area Air Sparge System is dependent on the implementation of source area treatment and the effectiveness of MNA in groundwater upgradient of this area. The cleanup time is estimated at 10 years.

Capital Cost:	$5,600,000
O&M Cost:	$1,100,000 (Year 5 injections) $230,000 (Year 1 to 10) (Power and operator) $119,000 per event, 16 events over 10 years (Monitoring) $14,000 every five years (Five-Year Review) $7,000 per year (LUC)
Present Worth Cost:	$11,700,000 (16 years)
Estimated Construction Timeframe:	2 years
Estimated Time to Achieve RAOs:	10 years

4.1.7 Alternative 7: Groundwater Extraction, Treatment, and Injection, Monitored Natural Attenuation, and Land Use Controls

This alternative consists of implementing LUCs, MNA, and installing and operating a groundwater extraction, treatment, and injection at the Navy fence line (property line) north of River Road and/or near the Peconic River area. The LUCs would target areas that require notifications and inspections during the operation of this alternative, until clean up goals are achieved. MNA would target areas between treatment zones and portions of the groundwater plume with lower VOC concentrations and/or where treatment cannot be effectively implemented because of site features (e.g., wetlands). One groundwater extraction well removing 100 gallons per minute of groundwater would be installed near the intersection of River Road and Grumman Boulevard (Fence Line Area) and two groundwater wells removing a total of 200 gallons per minute would be installed near Connecticut Avenue (River Area). These wells would capture the estimated width of the VOC-impacted groundwater at these areas, as follows:

Fence Line Area:	400 feet wide
Peconic River Area:	1,000 feet wide

In addition, the monitoring wells and groundwater extraction wells would be installed in or near wetlands. Groundwater sampling would be conducted in these same areas.

The cleanup time is estimated at 16 years. This alternative would result in the volatilization and photodegradation of approximately 93 pounds of VOCs from the Fence Line Area and up to 282 pounds of VOCs at the River Area.

Capital Cost:	$4,700,000
O&M Cost:	$999,000 per year (16)(Power and operator) $81,000 per event, 20 events over 16 years (Monitoring) $14,000 every five years (Five-Year Review) $7,000 per year (LUC)
Present Worth Cost:	$20,000,000 (16 years)
Estimated Construction Timeframe:	2 years
Estimated Time to Achieve RAOs:	16 years

4.1.8 Alternative 8: Fenceline Groundwater Extraction, Treatment, and Discharge, Land Use Controls and Monitoring

Alternative 8 consists of a groundwater extraction treatment, and discharge system at the NWIRP Calverton Southern Area property line (Fence Line), and LUCs and monitoring for the remainder of the area (see Figure 4-1). Based on monitoring data, this alternative also includes contingencies for: air sparging in the Source Area; anaerobic biodegradation in the Offsite Southern Area (VOCs greater than 500 µg/L); and air sparging at the Peconic River Area. In the CMS Addendum, five areas and the area specific components were evaluated as part of this Alternative. In total, 384 site-wide alternatives could be developed. The five areas and the area-specific components evaluated in the Addendum are as follows.

Source Area: Alternative 1 - No Action; Alternative 2 - LUCs and Monitoring; Alternative 3 - Air Sparging, LUCs, and Monitoring; and Alternative 4 - Anaerobic Biodegradation, LUCs, and Monitoring.

Fence Line Area: Alternative 1 - No Action; Alternative 2 - LUCs and Monitoring; Alternative 3 - Anaerobic Biodegradation, LUCs, and Monitoring; and Alternative 4 - Extraction, Treatment, and Discharge, LUCs, and Monitoring.

Offsite Southern Area (VOCs greater than 500 µg/L): Alternative 1 - No Action; Alternative 2 - LUCs and Monitoring; and Alternative 3 - Anaerobic Biodegradation, LUCs, and Monitoring.

Offsite Southern Area (VOCs less than 500 µg/L): Alternative 1 - No Action and Alternative 2 - LUCs and Monitoring.

Peconic River Area: Alternative 1 - No Action; Alternative 2 - LUCs and Monitoring; Alternative 3 - Air Sparging, LUCs, and Monitoring; and Alternative 4 - Extraction, Treatment, and Discharge, LUCs, and Monitoring.

The cleanup time is estimated at 16 years. This alternative would result in the volatilization and photodegradation of approximately 93 pounds of VOCs from the Fence Line Area.

Capital Cost:	$1,650,000
O&M Cost:	$243,000 (Year 1 to 5) (Power and operator) $154,000 per event, 18 events over 17 years (Monitoring) $14,000 every five years (Five-Year Review) $7,000 per year (LUC)
Present Worth Cost:	$4,660,000 (17 years)
Estimated Construction Timeframe:	2 years
Estimated Time to Achieve RAOs:	16 years

5.0 CONCLUSIONS AND EVALUATION OF ALTERNATIVES

This section identifies the proposed remedy for groundwater at Site 6A - Southern Area. This section also summarizes the performance of the proposed remedies against the four general standards and five remedy decision factors, noting how they compare to the other options under consideration. The general standards are protection of human health and the environment, attainment of media clean-up standards, controlling the source of releases, and compliance with waste management standards. The remedy decision factors are long-term reliability and effectiveness, reduction of toxicity, mobility, or volume of waste, short-term effectiveness, implementability, and cost. Additional details on the evaluation of corrective measures alternatives are included in the CMS/FS (Tetra Tech, 2011c).

5.1 SITE 6A - SOUTHERN AREA GROUNDWATER PLUME GROUNDWATER

The Navy's preferred alternative for the Southern Area Groundwater Plume is Alternative 8, which is presented in this Section. Figure 4-1 provides a summary of the area-specific remedies.

The preferred alternative consists of LUCs, monitoring, and the installation and operation of a groundwater extraction, treatment, and discharge system at the NWIRP southern property line (Fence Line Treatment System) (Figure 5-1). Also, based on monitoring data and trend analysis, the preferred alternative includes contingencies to install additional treatment options at the Source Area, in the Offsite Southern Area (VOCs greater than 500 µg/L), and at the Peconic River Area.

The LUCs would be implemented in each area to protect human health until cleanup goals are achieved. The LUCs would consist of restrictions on the use of VOC-impacted groundwater, annual inspections, and provisions for addressing soil vapor intrusion for new building construction in areas with VOC-contaminated groundwater. As VOC concentrations in groundwater decrease, LUC boundaries may be modified.

Monitoring would be conducted in each area to evaluate the presence and migration of VOC-contaminated groundwater. The monitoring would be used in combination with trigger values to be established in the Remedial Design to remove areas from further consideration, modify the operation of the existing treatment system, and if needed, implement additional groundwater treatment.

The preferred remedy complements the two source areas (Sites 6A and 10B) remedial actions that were completed in 2010. These actions have minimized the continuing impact to groundwater. The preferred alternative includes monitoring the former source area for VOC-contaminated groundwater, with the potential for implementing an air sparging system(s) to optimize operation of the Fence Line Treatment System. In addition, a water line extension to the PRSC, which is scheduled for 2011, will eliminate human potential exposure to VOC-contaminated groundwater.

The Fence Line Treatment System will use air stripping to remove an estimated total of 93 pounds of VOCs from 210 million gallons of groundwater over a 4-year period. These VOCs will be permanently destroyed via photochemical oxidation in the atmosphere. The treated water will be recharged into the local aquifer to maintain natural groundwater flow in the area and to the Peconic River.

Based on a groundwater monitoring program and trigger values established in the Remedial Design, In-Situ Biodegradation in the Offsite Southern Area (VOCs greater than 500 µg/L) and Air Sparging at the Peconic River may also be implemented. The need for these additional treatment remedies would be based on potential or actual sustained threats to ecological receptors in the Peconic River.

The estimated capital and present value cost of the Preferred Alternative is $1,650,000 and $4,660,000, respectively. Annual costs vary significantly based on the activity being conducted in each year and range from early-year operation, monitoring, and maintenance costs for the Fence Line Treatment System of $526,000 per year to out-year inspection costs of approximately $21,000 per year.

The preferred alternative was based on a careful evaluation of the nine criteria. Potential exposure to human health is limited and would be further controlled via LUCs and monitoring. Treatment would be used for groundwater contamination that can be effectively captured at the Fence Line Area. Monitoring would continue to be conducted in this area, but with minimal environmental impact. Additional treatment would be considered in the down gradient areas, but only if monitoring data demonstrates that ecological receptors will be adversely impacted.

5.1.1 Protection of Human Health and the Environment

Under current conditions, chlorinated solvents in groundwater present a risk to potential future residents. Alternative 1, No Action, would not be protective of human health and the environment since no steps would be taken to control or monitor these potential risks. Alternatives 2 and 3 would be partially protective of human health and the environment. Over time, the VOC concentrations in groundwater would decrease through degradation, dilution, and flushing. LUCs would be used to provide notice and restrict use of VOC-impacted groundwater for potable water applications until cleanup goals are met. Alternatives 4, 5, 6, 7, and 8 would be protective of human health and the environment under current- and future-use scenarios by prohibiting groundwater use and residential development while solvent-contaminated groundwater poses unacceptable risk under unrestricted use conditions, and monitoring contaminant concentrations and migration over time to identify when all cleanup goals are achieved. Contamination at the site would not be expected to pose a current or future potential risk to ecological receptors.

5.1.2 Attainment of Media Clean-Up Standards

Alternatives 1 and 2 would not meet applicable groundwater regulations for sole source drinking water aquifers. In the short term, Alternatives 3, 4, 5, 6, 7, and 8 would not meet applicable groundwater regulations for sole source drinking water aquifers, but will comply with chemical specific regulations in the long term. Location specific regulations (New York State wetland, endangered species, and Wild, Scenic, and Recreational Rivers Act) will require consultation and coordination to minimize short term impacts, no long-term impacts are anticipated. The alternatives will comply with non-hazardous waste management regulations. Additionally, Alternatives 4, 5, 6 and 8 would require compliance with the Underground Injection Control regulations.

5.1.3 Controlling the Sources of Releases

This criterion is not applicable to groundwater, which is not considered the source of the release. Contaminated soil at Sites 6A and 10B has been removed. Alternatives 2 through 8 include MNA and/or supplemental treatment in the source area. Trigger values will be established based on a groundwater monitoring program in the Remedial Design that would require implementation of In-Situ Biodegradation in the Offsite Southern Area (VOCs greater than 500 µg/L) and Air Sparging at the Peconic River. The need for these additional treatment remedies would be based on potential or actual sustained threats to ecological receptors in the Peconic River.

5.1.4 Compliance with Waste Management Standards

Minimal waste would be generated for the fence line treatment system and Groundwater Treatment Plant building alternative. Testing of wastes would be conducted under all these alternatives to assure proper management of wastes.

5.1.5 Long-Term Reliability and Effectiveness

Alternatives 4, 5, 6, 7, and 8 would result in the permanent reduction of chlorinated solvents to concentrations less than cleanup criteria listed in Table 4-1. LUCs would be implemented until cleanup goals are achieved. These controls would be effective on Navy-controlled property. The Navy will work with the landowner to assist in implanting these controls but will not have direct control to implement the LUCs.

Although no treatment would occur under Alternatives 2 and 3, potential threats to human health would be minimized through LUCs. LUCs will be in effect for all alternatives until clean up goals are met. Alternative 4, 5, 6, 7, and 8 would be effective and permanent and would address contamination faster than Alternatives 2 and 3.

5.1.6 Reduction in Toxicity, Mobility, or Volume of Wastes

Alternatives 2 and 3 would not use treatment as a component of the remedy, and therefore, Alternatives 2 and 3 do not satisfy this criterion.

Alternatives 4, 5, 6, 7, and 8 would reduce exposure to VOC-contaminated groundwater through LUCs, inspections, and monitoring. In addition Alternative 4 would remove VOCs through volatilization, Alternative 5 would remove VOCs through enhanced biodegradation, Alternative 6 would remove VOCs through volatilization and enhanced biodegradation, Alternative 7 would extract and treat VOC-contaminated groundwater, and Alternative 8 would extract and treat contaminated groundwater and as a contingency would remove VOCs through volatilization and enhanced biodegradation based on trigger values.

Alternatives 4, 6, and 7 would remove 375 pounds of VOCs from the Southern Area groundwater plume while Alternative 5 would remove 150 pounds of VOCs. Alternative 8 would remove 93 pounds of VOCs from the Fenceline Area in the Southern Area and if required the contingencies would remove additional VOCs.

5.1.7 Short-Term Effectiveness

No short-term effects are anticipated under Alternatives 3, 4, 5, 6, 7, and 8.

5.1.8 Implementability

All Alternatives 2, 3, 4, 5, 6, 7, and 8 are readily implementable; use standard and proven technologies; and require services and materials that are readily available. Alternatives 4, 5, 6, 7, and 8 use technologies that are readily available and have been performed successfully at similar sites; however, implementation in the offsite areas may be difficult and require several years to install based on cooperation with the property owner.

5.1.9 Cost

Each alternative was assessed based on capital costs (initial cost to implement) and annual operation and maintenance (O&M) costs. Alternative 2 is estimated to cost $207,000, Alternative 3 is estimated to cost $2,400,000, Alternative 4 is estimated to cost $9,600,000, Alternative 5 is estimated to cost $6,700,000, Alternative 6 is estimated to cost $9,600,000, Alternative 7 is estimated to cost $20,000,000, and Alternative 8 is estimated to cost $4,660,000. See Table 5-1 for additional detail on the preferred alternative.

5.1.10 Summary

The preferred alternative (Alternative 8) consists of LUCs, monitoring, and the installation and operation of a groundwater extraction, treatment, and discharge system at the NWIRP southern property line (Fence Line Treatment System). Also, based on monitoring data, the preferred alternative includes the potential installation and operation of an air sparging system at the Source Area, In-situ Biodegradation in the Offsite Southern Area (VOCs greater than 500 µg/L), and Air Sparging at the Peconic River Area.

The preferred alternative provides protection of human health and the environment in the most cost-effective manner. This alternative is expected to attain PRGs within a reasonable time frame (16 years).

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TABLE 4-1
PRELIMINARY REMEDIATION GOALS
SITE 6A - SOUTHERN AREA GROUNDWATER PLUME
NWIRP CALVERTON, NEW YORK

Groundwater Chemical of Concern	Preliminary Remediation Goals (µg/L)
Benzene	5
Chloroethane	5
Dichlorobenzene, 1,2- (ortho)	5
Dichlorobenzene, 1,3- (meta)	5
Dichlorobenzene, 1,4- (para)	5
Dichloroethane, 1,1-	5
Dichloroethene, 1,1-	5
Ethylbenzene	5
Isopropyl Benzene	5
Methylene Chloride	5
Naphthalene	50
Tetrachloroethene	5
Trichlorobenzene, 1,2,4-	5
Trichloroethane, 1,1,1-	5
Vinyl Chloride	2
Xylene	5

TABLE 5-1, ALTERNATIVE 8 - PREFERRED ALTERNATIVE COST ESTIMATE, SITE 6A - SOUTHERN AREA, NWIRP CALVERTON, NEW YORK

Area	1. Source Area			2. Fenceline			3. Offsite VOCs > 500 ug/L			4. Offsite VOCs < 500 ug/L			5. Peconic River Area		
Alternative	**2 - LUCs & Monitoring**			**4. Extraction, Treatment, Disposal, LUCs, & Monitoring**			**2 - LUCs & Monitoring**			**2 - LUCs & Monitoring**			**2 - LUCs & Monitoring**		
Duration	*4 years (geo mean of 2-8yr range)*			*8 years (prescribed timeframe/steps)*			*7 years (geo mean of 4-10yr timeframe)*			*10 years (geo mean of 6-14yr timeframe)*			*17 years (geo mean of 8-36yr timeframe)*		
Assumptions	*25% of baseline costs 12 existing LTM wells; 4 new LTM wells*														
TOTAL Present Value	**$245,414**			**$3,055,650**			**$168,868**			**$801,754**			**$385,534**		
Implementation	**$91,272**		LUC Implementation UFP-SAP Baseline Sampling & New LTM Wells	**$1,444,692**		LUC Implementation UFP-SAP Baseline Sampling & New LTM Wells Install & Startup Extraction System	**$23,879**		LUC Implementation UFP-SAP Baseline Sampling existing wells	**$91,286**		LUC Implementation UFP-SAP Baseline Sampling & Install New wells	**$33,645**		LUC Implementation UFP-SAP Baseline Sampling existing wells
Future Total PV	*$154,142*			*$1,610,959*			*$144,989*			*$710,469*			*$351,889*		
1	**$26,377**	$1,650 $24,727	LUC Inspection 9-month LTM	**$244,813**	$1,650 $243,163	LUC Inspection Extraction System O&M	**$17,674**	$825 $16,849	LUC Inspection 9-month LTM event	**$62,295**	$825 $61,470	LUC Inspection 9-month LTM event	**$21,235**	$1,650 $19,585	LUC Inspection 9-month LTM event
2	**$26,377**	$1,650 $24,727	LUC Inspection 18-month LTM	**$275,948**	$1,650 $243,163 $31,135	LUC Inspection Extraction System O&M Annual LTM	**$17,674**	$825 $16,849	LUC Inspection 18-month LTM event	**$62,295**	$825 $61,470	LUC Inspection 18-month LTM event	**$21,235**	$1,650 $19,585	LUC Inspection 18-month LTM event
3	**$51,104**	$1,650 $49,454	LUC Inspection 27- & 36-month LTM	**$275,948**	$1,650 $243,163 $31,135	LUC Inspection Extraction System O&M Annual LTM	**$34,523**	$825 $33,698	LUC Inspection 27- & 36-month LTM events	**$123,764**	$825 $122,939	LUC Inspection 27- & 36-month LTM events	**$40,820**	$1,650 $39,170	LUC Inspection 27- & 36-month LTM events
4	**$51,354**	$1,650 $24,977 $24,727	LUC Inspection Well Abandonment Annual LTM	**$275,948**	$1,650 $243,163 $31,135	LUC Inspection Extraction System O&M Annual LTM	**$17,674**	$825 $16,849	LUC Inspection Annual LTM	**$62,295**	$825 $61,470	LUC Inspection Annual LTM	**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
5				**$285,136**	$1,650 $3,450 $5,738 $243,163 $31,135	LUC Inspection 5YR Well Maintenance Extraction System O&M (Shut down end Year 5) Annual LTM	**$22,268**	$825 $1,725 $2,869 $16,849	LUC Inspection 5YR Well Maintenance Annual LTM	**$67,995**	$825 $3,450 $2,250 $61,470	LUC Inspection 5YR Well Maintenance Annual LTM	**$30,423**	$1,650 $3,450 $5,738 $19,585	LUC Inspection 5YR Well Maintenance Annual LTM
6				**$32,785**	$1,650 $31,135	LUC Inspection Annual LTM	**$17,674**	$825 $16,849	LUC Inspection Annual LTM	**$62,295**	$825 $61,470	LUC Inspection Annual LTM	**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
7				**$32,785**	$1,650 $31,135	LUC Inspection Annual LTM	**$22,191**	$825 $4,517 $16,849	LUC Inspection Well Abandonment Annual LTM	**$62,295**	$825 $61,470	LUC Inspection Annual LTM	**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
8				**$123,266**	$1,650 $27,731 $62,750 $31,135	LUC Inspection Well Abandonment Demo/Abandon Extraction System Annual LTM				**$62,295**	$825 $61,470	LUC Inspection Annual LTM	**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
9										**$62,295**	$825 $61,470	LUC Inspection Annual LTM	**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
10										**$90,890**	$825 $3,450 $2,250 $22,895 $61,470	LUC Inspection 5YR Well Maintenance Well Abandonment Annual LTM	**$30,423**	$1,650 $3,450 $5,738 $19,585	LUC Inspection 5YR Well Maintenance Annual LTM
11													**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
12													**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
13													**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
14													**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
15													**$30,423**	$1,650 $3,450 $5,738 $19,585	LUC Inspection 5YR Well Maintenance Annual LTM
16													**$21,235**	$1,650 $19,585	LUC Inspection Annual LTM
17													**$25,752**	$1,650 $4,517 $19,585	LUC Inspection Well abandonment Annual LTM

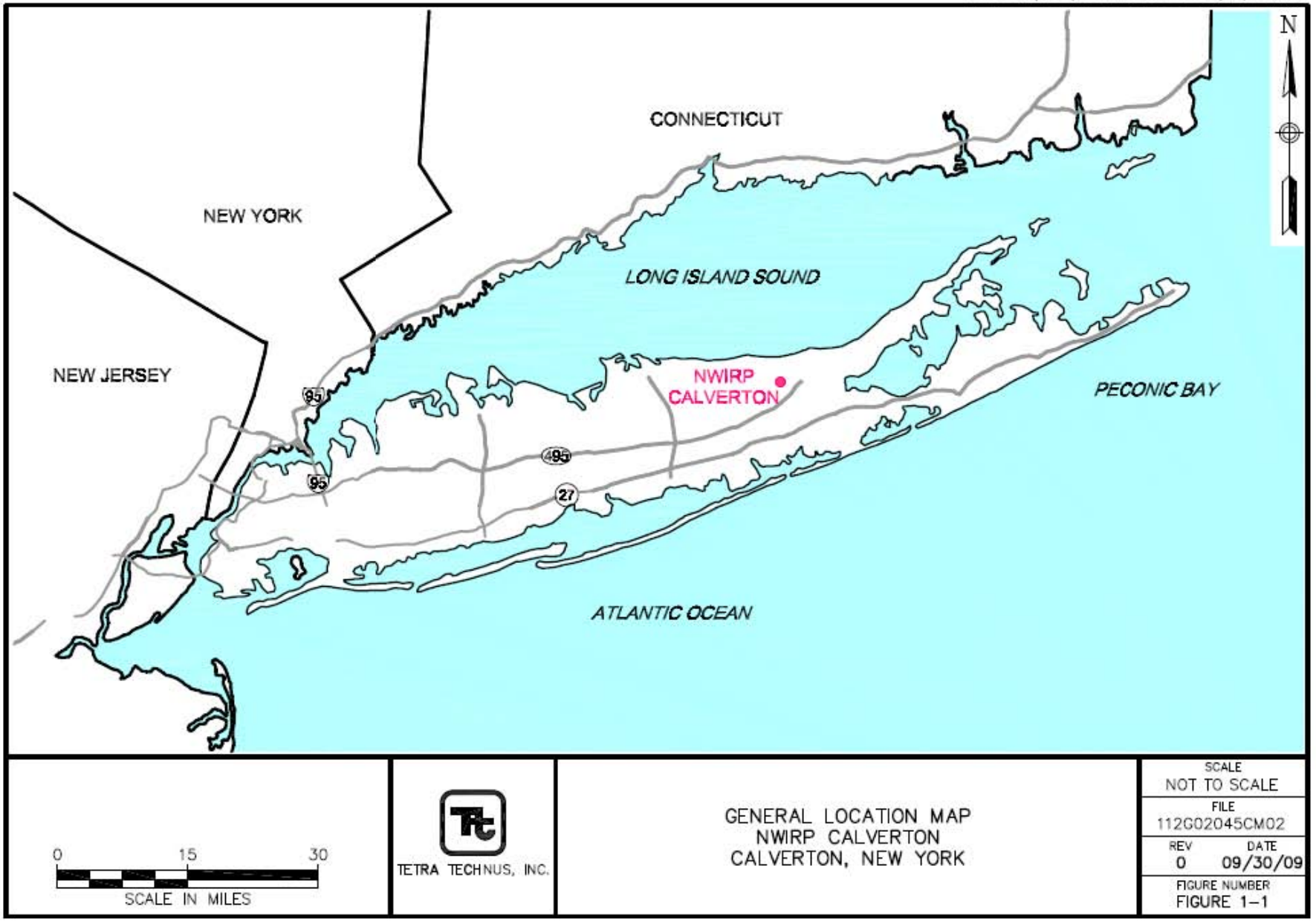
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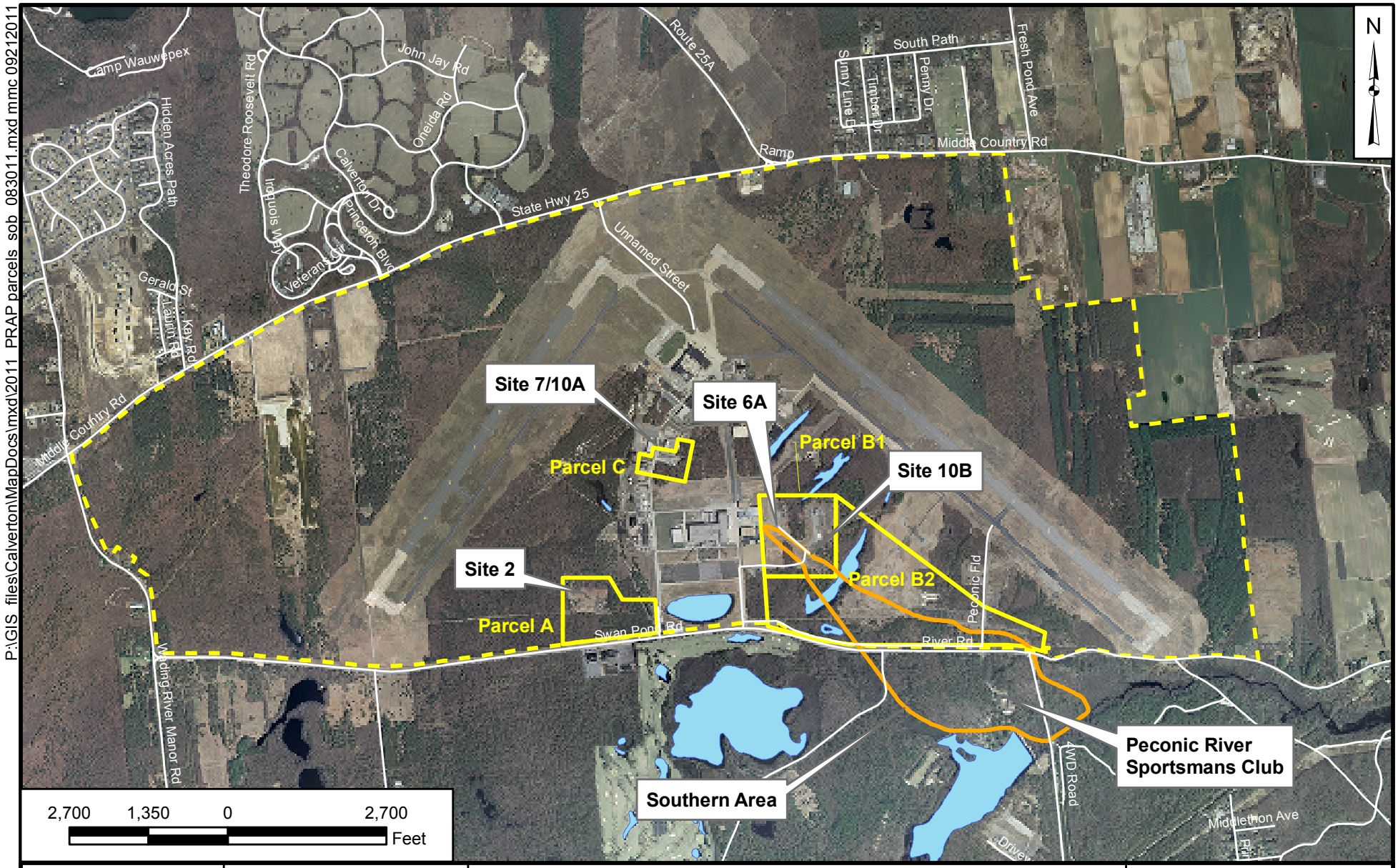
FIGURE 1-1



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Site 6A
Fuel Calibration Area

Site 10B
Engine Test House

Navy Property

Southern Area
Groundwater Plume

MCKAY LAKE

Swan Pond Rd

River Rd

Southern Area

Connecticut Ave

Peconic River

SWAN POND

River Rd

Peconic River
Sportsmen's Club

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SITE LAYOUT MAP
6A-SOUTHERN AREA
NWIRP CALVERTON
CALVERTON, NEW YORK

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SITE 6A

FUEL CALIBRATION AREA

ENGINE TEST HOUSE

SITE 10B

SOURCE AREA:
LUCs AND MONITORING WITH OPTION FOR SUPPLEMENTAL AIR SPARGING

FENCE LINE AREA:
EXTRACTION, TREATMENT, AND DISCHARGE

GRUMMAN BLVD.

TREATMENT PLANT

INFILTRATION GALLERY

RUNWAY 32-14

RIVER ROAD

OFFSITE SOUTHERN AREA
VOCs GREATER THAN 500 µg/L:
LUCs AND MONITORING WITH OPTION FOR SUPPLEMENTAL BIOLOGICAL TREATMENT

PECONIC RIVER

SWAN POND

OFFSITE SOUTHERN AREA
VOCs LESS THAN 500 µg/L:
LUCs AND MONITORING

PECONIC RIVER AREA:
LUCs AND MONITORING WITH OPTION FOR SUPPLEMENTAL AIR SPARGING

CONNECTICUT AVENUE

DONAHUE POND

LEGEND

- MONITORING WELL
- TEMPORARY WELL
- PROPOSED GROUNDWATER EXTRACTION WELL
- WELL WITH HIGHEST DETECTS OF CHEMICALS OF POTENTIAL CONCERN
- AREA BOUNDARY
- FACILITY FENCE LINE

0 500 1,000
SCALE IN FEET

TETRA TECH NUS, INC.

PROPOSED REMEDY FOR SOUTHERN AREA GROUNDWATER PLUME NWIRP CALVERTON CALVERTON, NEW YORK

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Legend

- Extraction Well
- Injection Well
- Fence Line
- Southern Area
- Freshwater Forested/Shrub Wetland
- Freshwater Pond

Infiltration Gallery No. 1 & Injection Well No. 1

Infiltration Gallery No. 2 & Injection Well No. 2

Treatment Plant

150 0 150 Feet

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FENCELINE GROUNDWATER TREATMENT SYSTEM 6A-SOUTHERN AREA NWIRP CALVERTON CALVERTON, NEW YORK

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FIGURE NO. 5-1	REV 0