N96095.AR.000677
NWIRP CALVERTON
5090.3a

Engineering Evaluation/Cost Analysis (EE/CA)
Site 2 – Fire Training Area

Naval Weapons Industrial Reserve Plant

Calverton, New York

Engineering Field Activity Northeast
Naval Facilities Engineering Command

Contract Number N62472-03-D-0057

Contract Task Order 0004

April 2008

ENGINEERING EVALUATION/COST ANALYSIS (EE/CA)
SITE 2 – FIRE TRAINING AREA

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Naval Facilities Engineering Command Mid-Atlantic
9742 Maryland Avenue
Norfolk, Virginia 23511-3095

Submitted by:
Tetra Tech NUS, Inc.
234 Mall Boulevard Suite 260
King of Prussia, Pennsylvania 19406

CONTRACT NUMBER N62472-03-D-0057
CONTRACT TASK ORDER 004

April 2008

PREPARED UNDER THE SUPERVISION OF:

DAVID D. BRAYACK
PROJECT MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

APPROVED FOR SUBMITTAL BY:

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

TABLE OF CONTENTS

SECTION **PAGE NO.**

ACRONYMS ..... **v**

1.0 INTRODUCTION **1-1**
1.1 FACILITY LOCATION 1-1
1.2 ACTIVITY BACKGROUND INFORMATION 1-1
1.2.1 Facility Layout 1-1
1.2.2 Facility History 1-2
1.3 TOPOGRAPHY 1-3
1.4 ECOLOGICAL SETTING 1-3
1.5 GEOLOGY AND SOILS 1-3
1.6 SURFACE WATER HYDROLOGY 1-4
1.7 HYDROGEOLOGY 1-4
1.8 CLIMATE AND METEOROLOGY 1-5
1.9 REPORT ORGANIZATION 1-6

2.0 SITE DESCRIPTION AND BACKGROUND **2-1**
2.1 SITE DESCRIPTION 2-1
2.1.1 Site Background and Physical Setting 2-1
2.1.2 Site History 2-1
2.1.3 Ecological Setting 2-2
2.2 SITE CHARACTERISTICS 2-3
2.2.1 Geology 2-3
2.2.2 Hydrogeology 2-3
2.3 PREVIOUS REMOVAL ACTIONS AND RELEVANT INFORMATION FROM PRIOR INVESTIGATION 2-4
2.4 REMEDIAL INVESTIGATION RESULTS 2-5
2.5 DESCRIPTION OF CURRENT CONDITIONS 2-7

3.0 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES AND TECHNOLOGY SCREENING **3-1**
3.1 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS 3-1
3.2 REMEDIAL ACTION OBJECTIVES 3-2
3.3 REMEDIAL ACTION SCHEDULE 3-3
3.4 STATUTORY LIMITS 3-3
3.5 TECHNOLOGY SCREENING 3-3
3.5.1 No Action 3-4
3.5.2 Institutional Controls and Monitoring 3-4
3.5.3 Containment 3-5
3.5.4 Excavation 3-6
3.5.5 In-Situ Treatment 3-7
3.5.6 Ex-Situ Treatment 3-9
3.5.7 Off-Site Disposal 3-10
3.6 SUMMARY OF APPLICABLE TECHNOLOGIES 3-10

4.0 IDENTIFICATION AND ANALYSIS OF REMEDIAL ACTION ALTERNATIVES **4-1**
4.1 ALTERNATIVE 1: NO ACTION 4-1

TABLE OF CONTENTS (CONTINUED)

SECTION **PAGE NO.**

4.1.1 Effectiveness 4-1
4.1.2 Implementability 4-1
4.1.3 Cost 4-1
4.2 ALTERNATIVE 2: PERMEABLE SOIL COVER (CONTAINMENT) 4-2
4.2.1 Effectiveness 4-3
4.2.2 Implementability 4-3
4.2.3 Cost 4-3
4.3 ALTERNATIVE 3: EXCAVATION AND OFF-SITE DISPOSAL 4-3
4.3.1 Effectiveness 4-4
4.3.2 Implementability 4-5
4.3.3 Cost 4-5

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES 5-1
5.1 EFFECTIVENESS 5-1
5.2 IMPLEMENTABILITY 5-1
5.3 COST 5-2
5.4 CONCLUSION 5-2

REFERENCES R-1

APPENDICES

A DATA SUMMARY REPORT - ANALYTICAL RESULTS SUMMARY
B QUANTITY CALCULATIONS
C COST ESTIMATES

TABLES

NUMBER		PAGE NO.
3-1	Federal Applicable or Relevant and Appropriate Requirements	3-12
3-2	Preliminary State Applicable or Relevant and Appropriate Requirements	3-17
5-1	Summary of Comparison of Removal Action Alternatives	5-3

FIGURES

NUMBER		PAGE NO.
1-1	General Location Map	1-7
1-2	Site Location Map	1-9
2-1	Site 2 Layout Map	2-11
2-2	Existing Conditions and Cross Section	2-13
2-3	Cross Section A-A'	2-15
4-1	Alternative 2 – Soil Cover (Containment)	4-7
4-2	Alternative 3 – Excavation and Off-Site Disposal	4-9

ACRONYMS

ARAR	Applicable or Relevant and Appropriate Requirement
AS/SVE	Air Sparging/Soil Vapor Extraction
AST	Aboveground Storage Tank
bgs	below ground surface
BTU	British Thermal Unit
CAMU	Corrective Action Management Unit
C&D	Construction and Demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CLEAN	Comprehensive Long-term Environmental Action Navy
CMS	Corrective Measures Study
CTO	Contract Task Order
cy	cubic yard
DOT	Department of Transportation
DRO	Diesel Range Organics
ECL	Environmental Conservation Law
EE/CA	Engineering Evaluation/Cost Analysis
E.O.	Executive Order
FFS	Focused Feasibility Study
FS	Feasibility Study
ft/day	feet per day
ft/min	feet per minute
GOCO	Government-Owned-Contractor-Operated
GRO	Gasoline Range Organics
HI	Hazard Index
HQ	Hazard Quotient
IAS	Initial Assessment Study
ICR	Incremental Cancer Risk
IR	Installation Restoration
LDR	Land Disposal Restrictions
MCL	Maximum Contaminant Level
µg/kg	microgram per kilogram
µg/L	microgram per liter

ACRONYMS (continued)

mg/kg	milligram per kilogram
MPC	Marine Pollution Control
MPE	Multi-Phase Extraction
msl	mean sea level
NCP	National Oil and Hazardous Substances Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NYCRR	New York Codes, Rules and Regulations
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NWIRP	Naval Weapons Industrial Reserve Plant
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
PA	Preliminary Assessment
PAH	Poylcyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyls
PID	Photo Ionization Detector
POTW	Publicly Owned Treatment Works
ppm	part per million
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RFA	RCRA Facility Assessment – Sampling Visit
RFI	RCRA Facility Investigation
RI	Remedial Investigation
sf	square feet
SI	Site Investigation
STARS	Spill Technology and Remediation Series
SVOC	Semivolatile Organic Compound
TAGM	Technical and Administrative Guidance Memorandum
TBC	To Be Considered
TPH	Total Petroleum Hydrocarbon
TtNUS	Tetra Tech NUS, Inc.
USC	United States Code
USDOI	U.S. Department of the Interior

ACRONYMS (continued)

USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

1.0 INTRODUCTION

This Engineering Evaluation/Cost Analysis (EE/CA) at Site 2 – Fire Training Area at the Naval Weapons Industrial Reserve Plant (NWIRP) in Calverton, New York was prepared by Tetra Tech NUS, Inc. (TtNUS) under the comprehensive Long-Term Environmental Action Nay (CLEAN) Contract N62472-03-D-0057, Contract Task Order (CTO) 004.

This work is part of the Navy's Installation Restoration (IR) Program, which is designed to identify contamination of Navy and Marine Corps lands and facilities resulting from past operations and to institute remedial actions as necessary and consists of four distinct stages. Stage 1 is the Preliminary Assessment (PA), which was formerly known as the Initial Assessment Study (IAS). Stage 2 is a Resource Conservation and Recovery Act (RCRA) Facility Assessment-Sampling Visit (RFA), also referred to as a Site Investigation (SI), which augments information collected in the PA. Stage 3 is the RCRA Facility Investigation (RFI) and Corrective Measures Study (CMS), also referred to as a Remedial Investigation (RI) and Feasibility Study (FS) or Focused Feasibility Study (FFS) that characterizes the contamination at a facility and develops options for remediation of the site. Stage 4 is the Corrective Action, also referred to as the Remedial Action, which results in the control or cleanup of contamination at sites. The Navy had determined that an interim removal action may be appropriate for Site 2 at NWIRP Calverton. This EE/CA will develop, evaluate, and recommend non-time critical removal actions to remove petroleum contaminated soil. This report has been prepared under Stage 3.

1.1 FACILITY LOCATION

NWIRP Calverton is located in Suffolk County, Long Island, New York, approximately 70 miles east of New York City (see Figure 1-1). The facility is located within the municipality of Riverhead. The facility covers approximately 358 acres of the original 6,000 acre facility.

1.2 ACTIVITY BACKGROUND INFORMATION

1.2.1 Facility Layout

The facility is bordered by Middle Country Road (Route 25) to the north, agricultural land to the east, River Road to the south, and Wading River Road to the west. The primary features of the facility were two paved runways. Runway 5-23 was located on the western half of the facility, and oriented southwest to northeast. Runway 32-14 was located on the eastern half of the facility, and oriented southeast to northwest.

NWIRP Calverton consists of four separate parcels of land totaling approximately 358 acres. Eight Navy IR sites are included within these parcels as follows. The location of the parcels and sites are presented in Figure 1-2.

Parcel A (32 acres)

Site 2 - Fire Training Area

Parcel B1 (40 acres)

Site 6A - Fuel Calibration Area

Site 10B - Engine Test House

Parcel B2 (131) acres

Southern Area

Parcel C (10 acres)

Site 7 - Fuel Depot

Site 10A - Jet Fuel Systems Laboratory

Parcel D (145 acres)

Site 1 - Northeast Pond Disposal Area

Site 9 - ECM Area

1.2.2 Facility History

NWIRP Calverton has been owned by the United States Navy since the early 1950's. At that time, the property was purchased from a number of private owners. The facility was expanded in 1958 through additional purchases of privately-owned land. Northrop Grumman Corporation (previously Grumman Corporation) has operated the facility since its construction (Navy, 1986).

NWIRP Calverton was constructed in the early 1950's for use in the development, assembly, testing, refitting, and retrofitting of Naval combat aircraft. Northrop Grumman has been the sole operator of the facility, which is known as a Government-Owned-Contractor-Operated (GOCO) installation. Construction was completed in 1954. The facility supports aircraft design and production at nearby NWIRP Bethpage, which is also operated by Northrup Grumman.

The majority of industrial activities at the facility were confined to the developed area in the center and south center of the facility, between the two runways. Industrial activities at the facility were related to the manufacturing and assembly of aircraft and aircraft components. Hazardous waste generation at the

facility was related to metal finishing processes, such as metal cleaning and electroplating. The painting of aircraft and components resulted in additional waste generation (Navy, 1986; HNUS, 1992).

Northrop Grumman operations at the facility ended in February 1996. In September 1998, the majority of the land within the developed section of the facility was transferred to the Town of Riverhead for redevelopment. Because of the need for additional environmental investigation and the potential need for remediation, the Navy retained four parcels of land within the developed section. The four parcels and associated Navy IR Sites are presented on Figure 1-2.

Approximately 3,000 acres of undeveloped land outside of the fenced areas was transferred to the Veterans Administration and the New York State Department of Environmental Conservation (NYSDEC) in 1999.

1.3 TOPOGRAPHY

NWIRP Calverton is located in an area underlain by permeable glacial material and characterized by limited surface water drainage features. Normal precipitation at the facility is expected to infiltrate rapidly into the soil. Wetland areas and glacially formed lakes and ponds are located south and southwest of the facility. NWIRP Calverton occupies a relatively flat, intermorainal area. The topographic relief at NWIRP Calverton is 54 feet and elevations range from 30 to 84 feet above mean sea level (msl)

1.4 ECOLOGICAL SETTING

NWIRP Calverton is located in the Long Island Pine Barrens, an area characterized by forests dominated by pitch pine (*Pinus rigida*) and oaks (*Quercus* sp.) growing on coarse-textured upland soils. Rainfall leaches rapidly through the soils recharging a vast underlying aquifer, but creating a dry environment at the surface which predisposes the vegetation to periodic wildfires. Where the natural fire cycle has been suppressed by human activity, as it has been since 1952 inside the NWIRP Calverton fence, taller oaks begin to dominate.

Also typical of the Long Island Pine Barrens are coastal plain ponds, isolated shallow ponds with fluctuating levels of acidic, tea-colored water. Emergent wetland communities typically fringe these ponds.

1.5 GEOLOGY AND SOILS

NWIRP Calverton lies within the Atlantic Coastal Plain Physiographic Province. Generally, this region can be characterized as an area of relatively undissected low-lying plains. The Atlantic Coastal Plain is

underlain by a thick sequence of unconsolidated deposits. The surface topography has been created or modified by Pleistocene glaciation (Isbister, 1966). The facility is underlain by approximately 1,300 feet of unconsolidated sediments that consist of four distinct geologic units. These units, in descending order, are the Upper Glacial Formation, the Magothy Formation, the Raritan Clay Member of the Raritan Formation, and the Lloyd Sand Member of the Raritan Formation (McClymonds and Franke, 1972).

Soil boring and sampling activities previously completed at NWIRP Calverton reveal that the sites are predominantly underlain by fine to coarse sediments of probable galciofluvial origin. Three distinct lithofacies were encountered. The upper lithofacies represent a mixture of soil, fill, and glacial deposits and consist predominantly of silty, fine-grained sand with varying amounts of peat and clay. Fill material, where present, is always associated with the upper lithofacies. The middle lithofacies consist of predominantly fine-grained sand with varying amounts of medium- to coarse-grained sand and pebbles, and are probably representative of undisturbed glacial deposits. The lower lithofacies consist of micaceous, silty clay and may represent the Magothy Formation.

1.6 SURFACE WATER HYDROLOGY

The majority of the facility is located within the Peconic River drainage basin. The eastward-flowing Peconic River is located approximately 1,300 feet south of the facility at its closest point. The Peconic River discharges to Peconic Bay located 8.5 stream miles from the facility.

Major surface water features near the facility include McKay Lake and Northeast Pond. McKay Lake is a man-made groundwater recharge basin located north of River Road, midway along the southern site border. Northeast Pond is located at the northeast corner of the facility. Several small drainage basins exist near the Fuel Calibration Area (Runway Ponds). All of these surface water features are land locked, with the exception of McKay Lake, which has an intermittent discharge to Swan Pond, located 1,500 feet to the south of NWIRP Calverton. Overhead flow from the drainage basins to the Peconic River may also occur periodically.

A number of small wetlands exist on the Calverton facility. The U.S. Department of the Interior (USDOI), Fish and Wildlife Department classifies the western half of the 2-acre Northeast Pond as palustrine, forested/scrub/shrub/emergent wetland. The drainage basins are classified as palustrine, scrub/shrub/emergent wetland (USDOI, 1980).

1.7 HYDROGEOLOGY

The unconsolidated sediments that underlie NWIRP Calverton are generally coarse-grained with high porosities and permeabilities. These factors create aquifers with high yields and transmissivities.

The Upper Glacial Formation, the Magothy Formation, and the Lloyd Sand are the major regional aquifers. The Upper Glacial and Magothy aquifers are of principle importance in Suffolk County because of their proximity to the ground surface. The Raritan Clay of the Raritan Formation has a very low permeability and acts as a regional confining layer that is believed to minimize the local risk of contamination to the underlying Lloyd Sand aquifer (McClymonds and Franke, 1972). The Lloyd Sand has not been extensively developed due to its depth and the abundant water available in the overlying aquifers.

The Upper Glacial aquifer is widely used as a source of groundwater in Suffolk County. The water table beneath the NWIRP Calverton lies within this aquifer. Porosities in excess of 30 percent have been calculated for the Upper Glacial aquifer in adjoining Nassau County. Hydraulic conductivity is estimated at 270 feet per day (ft/day).

The Magothy aquifer is widely used as a source of groundwater in Suffolk County. The most productive units are coarser sand and gravel. The permeability of the Magothy is high and hydraulic conductivity has been calculated in excess of 70 ft/day.

The Upper Glacial and Magothy aquifers are believed to be hydraulically interconnected and to function as a single unconfined aquifer. Logs from on-site monitoring wells, previous hydrogeologic investigations, and geologic mapping indicate that although clay lenses that may create locally confining and/or perched conditions are present in both aquifers, these lenses are not widespread and do not function as regional aquitards (McClymonds and Franke, 1972; Fetter, 1976).

NWIRP Calverton straddles a regional groundwater divide, with groundwater beneath the northern half of the facility flowing to the northeast, with the Long Island Sound as the probable discharge point for groundwater in the shallow aquifer zones. Groundwater beneath the southern half of the facility flows to the southeast and the Peconic River basin is the likely discharge point. Groundwater on the divide, the location of which can fluctuate, flows to the east.

1.8 CLIMATE AND METEOROLOGY

NWIRP Calverton is located in an area classified as a humid-continental climate. Its proximity to the Atlantic Ocean and Long Island Sound add maritime influences to the classification (NOAA, 1982).

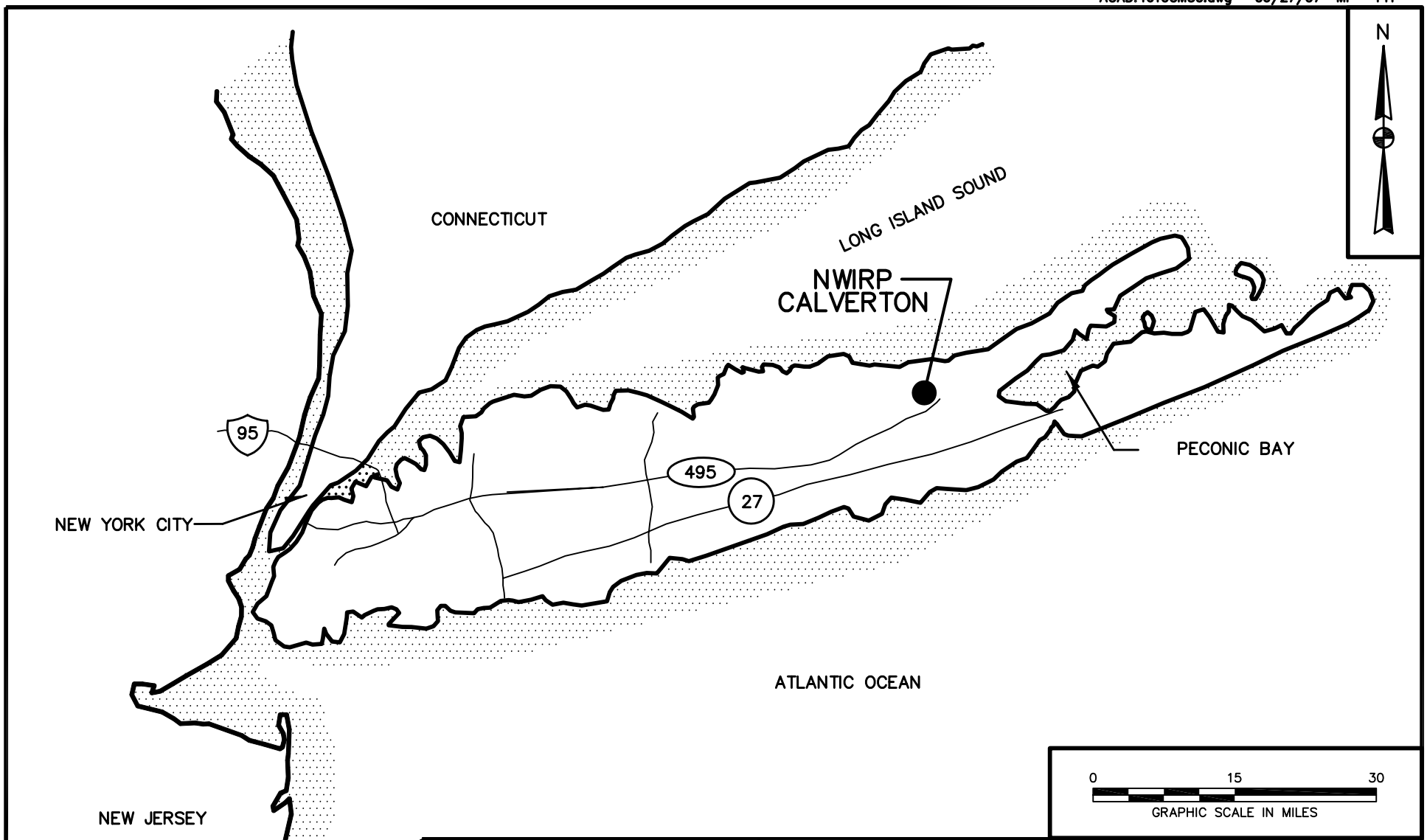
The average annual temperature at the National Oceanic and Atmospheric Administration (NOAA) Riverhead Research Station, located 4.5 miles northeast of the site, is 52.2°F, with a maximum average monthly temperature of 73.3°F in July and a minimum average monthly temperature of 30.9°F in January.

Annual precipitation at the Riverhead Research Station averages 45.32 inches. The highest average monthly precipitation is 4.46 inches, occurring in December. The lowest average monthly precipitation is 2.90 inches, occurring in July. The average annual evapotranspiration rate is 29 inches, resulting in a net annual precipitation rate of 16.32 inches. A 2-year, 24-hour rainfall can be expected to bring 3.4 inches of precipitation (NOAA, 1982; USDOC, 1961).

1.9 REPORT ORGANIZATION

This section provided a brief introduction and a discussion of general facility characteristics. Section 2.0 of the report provides a site description and background for Site 1. Section 3.0 presents the identification of remedial action objectives (RAOs), applicable or relevant and appropriate requirements (ARARs), and technology screening. Remedial action alternatives are identified and analyzed in Section 4.0 and a comparative analysis of these alternatives is presented in Section 5.0. Conceptual design calculations, cost estimates, and analytical results are presented in the appendices.

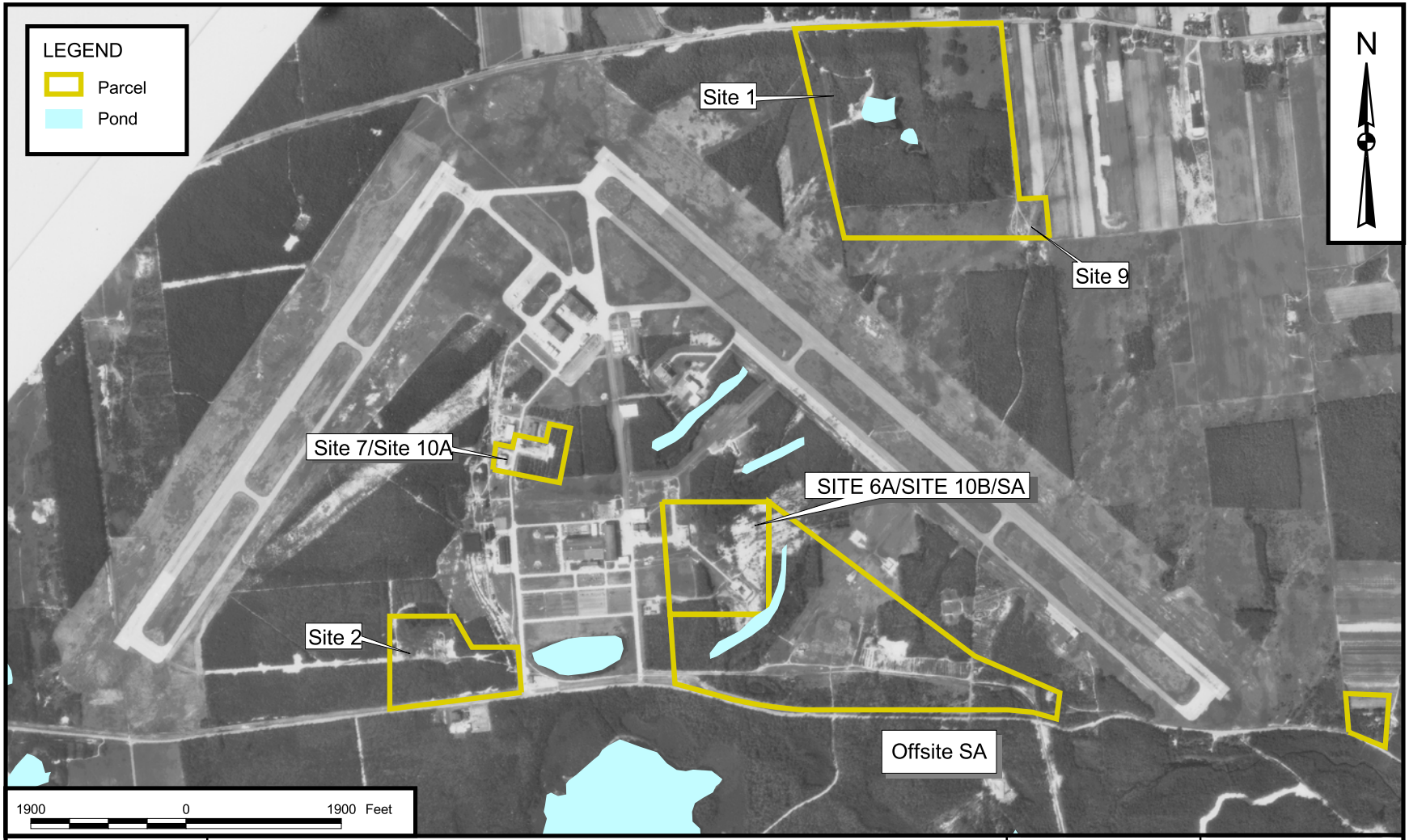
ACAD:1610CM30.dwg 06/27/07 MF PIT



DRAWN BY MF	DATE 6/27/07	Tetra Tech NUS, Inc.	GENERAL LOCATION MAP NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 0804	
OWNER NO.	
APPROVED BY	DATE
DRAWING NO. FIGURE 1-1	REV. 0

FORM CADD NO. TTNUS-AH.DWG - REV 1 -9/10/98



DRAWN BY J. LAMEY	DATE 11/22/99	Tetra Tech NUS, Inc.	CONTRACT NUMBER 7398 / OWNER NUMBER 0270
CHECKED BY ____	DATE ____	SITE LOCATION MAP NWIRP CALVERTON, NEW YORK	APPROVED BY ___ / DATE ___
COST/SCHEDULE-AREA			APPROVED BY ___ / DATE ___
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV 0

P:\GIS\NWIRP_CALVERTON\SURFACE_WATER_HYDROLOGY.APR SITE LOCATION MAP 06/28/07 SS

2.0 SITE DESCRIPTION AND BACKGROUND

2.1 SITE DESCRIPTION

2.1.1 Site Description and Physical Setting

Site 2 – Fire Training Area is located on the eastern side of a 9-acre clearing in the south-central area of NWIRP Calverton facility and is shown on Figure 2-1. A circular, concrete pit in the southeast corner of the clearing was used to contain liquids for fire training exercises. The pit is approximately 80 feet in diameter and is located approximately 500 feet north and 800 feet west of the facility south gate. A 1,000-gallon steel aboveground storage tank (AST) located approximately 75 feet north of the training pit was used to store fuel. This tank was removed in 1996. A 6,000-gallon storage tank was also located north of the training area before 1982. Little information is available on the 6,000-gallon storage tank, other than it was likely an aboveground tank located north of the concrete pit and is no longer present at the site.

The eastern portion of the fire training area was partially excavated at an unknown time. A small embankment up to 4 feet high is located along the eastern edge of the area, and a dirt access road is located along the southern edge. The fire training area is surrounded by woodlands. Some of the area within the clearing to the west of the concrete pit is covered by marsh-type vegetation, although there is no evidence of standing water. The water table is approximately 14 to 20 feet below ground surface (bgs).

2.1.2 Site History

The Fire Training Area was used by Northrup Grumman and Navy crash rescue crews as a training area since 1955, and possibly as early as 1952. According to the IAS, soil disturbances in the area were continuously evident in historical photographs. Before 1982, activities at the site consisted of clearing an area up to 100 feet or more in diameter and enclosing it with an earthen berm. A layer of water was then placed within the bermed area. Waste fuels, oils, and waste solvents were floated on the water and ignited. The IAS reports that up to 450 gallons of waste solvent were mixed with up to 2,100 gallons of waste fuel per year for use in the training exercises. Aircraft sections were sometimes placed in the area to simulate actual crash conditions. After 1975, waste solvents were reportedly no longer mixed with the waste fuels and oils to be ignited.

Fire fighting materials used in the training exercises included aqueous fire fighting foam, gaseous Halon 1301, water, and dry chemical extinguishers (NEESA, 1986).

The 6,000-gallon storage tank formerly located north of the fire training ring was used for an unknown period of time prior to 1982 to store waste fuels and solvents at the site. An unknown quantity of liquid was released from the tank in August 1982. The concrete pit was constructed after the spill cleanup to prevent further soil contamination by waste fuels. The 1,000-gallon AST was installed to replace the 6,000-gallon storage tank (Navy, 1986). A second spill of approximately 300 gallons of waste No. 2 fuel oil occurred in 1983. The spill emanated from a leak in the piping associated with the 1,000 gallon AST.

2.1.3 Ecological Setting

Vegetation: Three plant communities cover Site 2. Vegetation in the clearing west of the training ring includes successional grasses and forbs, such as panic grass (*Pacnicum lanuginosum*), broomsedge (*Andropogon viginicus*), wild oats (*Avena fatua*), phragmites (*Phragmites australis*), fescues (*Festuca* sp.), quackgrass (*Agropyron repens*), raspberries (*Rubus* sp.), pigweed (*Amaranthus retroflexus*), and yellow sweet clover (*Melilotus officinalis*). The vegetation is generally dense throughout, except in the immediate vicinity of the fire training ring, where it is sparse.

The forest cover east, south, and west of the clearing is dominated by pitch pine (*Pinus rigida*) and oaks (primarily scarlet oak, *Quercus coccinea*) in roughly equal proportion. This forest cover is typical of the Long Island Pine Barrens. However, scrub oak (*Quercus ilicifolia*), described as common throughout the Pine Barrens, is only sparingly present. The forest cover north of the clearing is dominated by red maple (*Acer rubrum*) and undergrown by dense patches of woody shrubs such as sweet pepperbush (*Clethra alnifolia*), honeysuckle (*Lonicera* sp.), and highbush blueberry (*Vaccinium corymbosum*). There are also dense but localized patches of ladyfern (*Athyrium felix-femina*). Such forest vegetation sometimes occurs in seasonally saturated wetlands, but it is also a common type of successional forest in areas of former human disturbance.

Wetlands: There are no areas on or adjoining the Fire Training Area that meet the technical criteria for delineation as wetlands (Environmental Laboratory, 1987). Although several dense patches of phragmites occur in the clearing west of the training ring, this is disturbed upland soil rather than hydric (wetland) soil.

Wildlife: The grassy clearing provides good habitat for wildlife favoring forest edges, such as the whitetail deer (*Odocoileus virginianus*), northern bobwhite (*Colinus virginanus*), eastern kingbird (*Tyrannus tyrannus*), indigo bunting (*Passerina cyanea*), and song sparrow (*Melospiza melodia*) (Kricher, 1988). As expected, several whitetail deer were observed during the June 1997 site visit. A diversity of food types for wildlife are available, including dry seeds from the grasses in the field, nuts (acorns) from the oaks in the forest, and fleshy berries from the blueberry cover in the forest. The presence of the clearing, as well as several wide road tracks and firebreaks crossing the forest, render the entire forest in

this part of NWIRP Calverton of poor value to forest interior wildlife such as neotropical birds. Waterfowl and other wildlife typical of areas with wetlands and open water are not expected to occur in this area because there are no wetlands or water on or near Site 2.

Aquatic Biota: There are no aquatic habitats, and hence no aquatic biota, on or close to Site 2.

2.2 SITE CHARACTERISTICS

2.2.1 Geology

Based on previous subsurface investigations, Site 2 is underlain by three distinct lithofacies. The upper lithofacies range from 1 to 7 feet thick and consist of predominantly dark brown, brown, and orange, silty, fine-grained sand with varying amounts of peat and clay. Fill encountered at the site is always associated with the upper lithofacies. The middle lithofacies range from 54 to 78 feet thick and consist of light brown and tan fine-grained sand with varying amounts of medium-grained sand and pebbles. The middle lithofacies probably represent undisturbed glacial deposits. The lower lithofacies consist of gray, silty clay. The subsurface geology of Site 2 is consistent with that found in other areas of the facility.

2.2.2 Hydrogeology

Groundwater in the glacial deposits occurs under unconfined conditions. The depth to groundwater ranged from 11.68 to 29.90 feet below ground in 1995. The elevation of the water table is approximately 40 to 43 feet above mean sea level. Groundwater elevation data was derived from static water level measurements of wells FT-MW-01-I/S through FT-MW-07-S. Based on water level measurements collected concurrent with free product monitoring between 1994 and 1997, depth to water across the site ranged between 12 and 20 feet. Seasonal fluctuations in the water table on the order of 3 feet are normal. The seasonal high water table occurs in spring, between March and May. The seasonal low water table occurs in late fall and early winter.

The direction of groundwater flow is to the south-southeast. Based upon previous water level measurements, there is no vertical gradient present. The hydraulic conductivity calculated for glacial deposits ranges from 0.038 feet per minute (ft/min) (55 ft/day) to 0.077 ft/min (111 ft/day) for sediments shallower than 28 feet and from 0.024 ft/min (35 ft/day) to 0.056 ft/min (81 ft/day) for sediments deeper than 64 feet.

Surface water runoff from the Fire Training Area would generally flow to the southeast following local topography. However, there is no evidence of overland flow of surface water or associated drainage channels. The nearest potential receiving water is Swan Pond, located 2,000 feet to the southeast.

2.3 PREVIOUS REMOVAL ACTIONS AND RELEVANT INFORMATION FROM PRIOR INVESTIGATIONS

Marine Pollution Control (MPC) of Calverton, New York removed 327 cubic yards of contaminated soil in 1982 because of the spill that occurred in August 1982 from the 6,000-gallon storage tank. In addition, four groundwater monitoring wells were installed in the spill area. Following the second spill of approximately 300 gallons in 1983, seven additional monitoring wells were installed by MPC to monitor potential contamination resulting from the spills.

In 1986, an IAS was performed for NWIRP Calverton. This study identified seven potential areas of concern, including Site 2. As a follow-up to the IAS, the seven potential areas of concern were investigated under a SI (HNUS, 1992). The sites investigated can be classified as either landfill-type sites or sites resulting from documented or suspected historic spills or leaks of fuels, oils, and/or solvents. Spills have been documented at Site 2. In addition, floating free product has been identified in monitoring wells.

A groundwater and free product (oil) recovery system was installed in December 1987. This system consisted both of an active and a passive free product recovery system. The active recovery system included a groundwater pumping well, an oil recovery well, and an oil/water separator tank. The passive recovery system consisted of hydrophobic filters located in shallow wells. The active recovery system was shut down in 1993. Passive free product recovery continued until 1996. As of December 1996, approximately 325 gallons of petroleum product have been removed from this site.

A pilot-scale air sparging/soil vapor extraction (AS/SVE) system was installed in 1995. As of 2000, approximately 80 pounds of target volatile organic compounds (VOCs) have been removed. In addition, an estimated 30,000 pounds of organics have been destroyed through biodegradation. VOC concentrations in soil and groundwater have been reduced by approximately 70 to 95 percent.

The Navy conducted an EE/CA in 1998 for several sites at NWIRP Calverton, including Site 2 (TtNUS, 1998). The analysis recommended that free product recovery be restarted at Site 2.

Groundwater extraction tests were conducted in 1999 in anticipation of a new free product recovery system (vapor-assisted oil skimming). However, based on subsequent field testing, several interferences were noted that impact the ability to successfully extract and treat the groundwater. An alternate recommendation was made to recover product using passive techniques (i.e. absorbent pillows).

In 2000, the Navy proceeded with passive free product recovery using adsorbent media and restarted the AS/SVE system at Site 2. Minimal free product was recovered and operation of the system was discontinued.

2.4 REMEDIAL INVESTIGATION RESULTS

A RFI was conducted in 1994/1995 (HNUS 1995a; HNUS 1995b). The conclusions from this investigation are summarized as follows.

- VOCs were detected at relatively high concentrations in Site 2 soil. The fire training pit is the most likely primary source area. Other relatively minor source areas were, or are, present at the site including an area west of the fire training pit (based on groundwater data) and an area north of the fire training pit. VOCs detected in soil include solvents and fuel-related contaminants. Solvents detected include 2-butanone (5,900 micrograms per kilogram [µg/kg]), chloroethane (330 µg/kg), dichlorobenzene (900 µg/kg), tetrachloroethene (470 µg/kg), and 1,1,1-trichloroethane (9,900 µg/kg). Fuel-related contaminants detected include ethylbenzene (3,700 µg/kg), toluene (6,100 µg/kg), and xylenes (85,000 µg/kg).

- A RCRA hazardous waste characteristic evaluation [40 Code of Federal Regulations (CFR) 261] of soil samples indicated that the material did not exhibit the Toxicity Characteristic. One soil sample was measured to have a flash point less than 140°F, which is the threshold for the characteristic of ignitability. This sample, however, did not have a measurable British Thermal Unit (BTU) value, indicating that only trace levels of fuel-related chemicals are present and likely caused the measurable flash point.

- Polychlorinated biphenyls (PCBs) (3,640 µg/kg), pesticides (less than 100 µg/kg), and semivolatile organic compounds (SVOCs), including polycyclic aromatic hydrocarbons (PAHs) and phthalates, were detected in several soil samples. Typical PCB standards for industrial use and residential use are 10,000 µg/kg and 1,000 µg/kg, respectively.

- Metals including antimony [7.9 milligrams per kilogram (mg/kg)], lead (390 mg/kg), and selenium (0.89 mg/kg) were detected in soil at concentrations greater than background levels.

- One drum was found on the surface of the site. The drum was placed in an overpack container during RFI field activities and was removed as a separate interim action. Despite an extensive geophysical survey of the site and test pit program, no other drums were found at Site 2. It appears that widespread drum disposal or burial did not occur at Site 2.

- Groundwater testing during the initial RFI in 1994 and 1995 detected the following VOCs at concentrations above federal Maximum Contaminant Levels (MCLs) or New York groundwater quality standards: chloroethane (1,100 micrograms per liter [µg/L]), 1,1-dichloroethane (1,200 µg/L), toluene (320 µg/L), 1,1,1-trichloroethane (140 µg/L), and xylenes (230 µg/L). By June 1997, the maximum detected chlorinated VOC concentration was 78 µg/L (1,2-dichloroethene). The maximum detected fuel-related concentration was for xylenes (91 µg/L). The area of these detections was addressed by the pilot-scale AS/SVE system that operated between 1995 and 1997. The state groundwater standard for most VOCs is 5 µg/L. PCBs (18 µg/L), PAHs (3 µg/L), and lead (30.8 µg/L) were detected at concentrations above federal MCLs or state groundwater quality standards. Phthalates and pesticides were also detected at concentrations below these standards in several monitoring well samples. Based on the similarity between chemicals found in Site 2 soil and groundwater, it is likely that soil contaminants have affected groundwater.

- Floating free product has been identified at Site 2. The location of the free product corresponds to the location of the most contaminated groundwater. Free product recovery was an ongoing Northrop Grumman operation until 1996.

- The estimated areal extent of contaminated soil is 80,000 square feet. At an average depth of 8.2 feet, the estimated volume of contaminated soil was 25,000 cubic yards. This volume has been reduced significantly since the operation of the AS/SVE system (CF Braun, 1996a; CF Braun, 1996b).

- The horizontal and vertical extent of groundwater contamination had been adequately characterized except to the south (off site) and east. This is based on the detection of VOCs in well FT-MW-05-S, the most southeastern monitoring well.

The results of the risk assessment developed during the 1995 RFI (HNUS, 1995) are summarized below. Additional detail is provided in Table 5-17 of the 1995 RFI. The identified receptors have been evaluated on the basis of a current land use scenario (and include both maintenance worker and future residential receptors).

- Current Maintenance Worker Exposure: The total incremental cancer risk (ICR) calculated for a maintenance worker assuming exposure to contaminants in the soil at Site 2 was 4.3E-05. This cancer risk estimate is within the 1E-06 to 1E-04 target risk range often used by the U.S. Environmental Protection Agency (USEPA) in determining the need for action at Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)/RCRA sites or in the formulation of standards and criteria (e.g., the Federal Safe Drinking Water Act standards). Individual risk estimates developed

for benzo(a)pyrene, benzo(b)fluoranthene, and PCBs exceeded 1E-06. However, only the risk estimate for benzo(a)pyrene exceeded 1E-05.

- The hazard index (HI), which is an indicator of the potential for adverse noncarcinogenic health effects was calculated to be 0.012 for the maintenance worker. Adverse noncarcinogenic health effects are not anticipated when the hazard index is below unity (1.0).

- Future Residential Exposure: The risk assessment for a future residential receptor at Site 2 considered exposures to the potential chemicals of concern in soil and groundwater. The total ICR for an adult residential receptor was calculated as 9.6E-03, which exceed the USEPA target risk range of 1E-06 to 1E-04. The ICR estimate developed for contaminants in soil (4.9E-04) is lower than that for contaminants in groundwater (9.1E-03). The risk estimates for 1,1,2,2-tetrachloroethane, several PAHs, and PCBs exceeded 1E-06. Only the risk estimate for benzo(a)pyrene in soil exceeds 1E-04.

- The noncarcinogenic HIs developed for adult and child receptors assuming a future residential land use scenario were 28.9 and 66.5, respectively. There is a potential for adverse noncarcinogenic health effects when either the cumulative HI or chemical-specific hazard quotients (HQs) exceed 1.0. As with cancer risk, most of the noncarcinogenic risk is associated with exposure to chemicals in groundwater. HQs for individual contaminants in soil did not exceed 1.0. Individual HQs calculated for the following chemicals in groundwater exceed 1.0 for adult and/or child receptors: 1,1-dichloroethane, 1,2-dichloroethene, 4-methylphenol, Aroclor-1254 (a PCB), arsenic, and manganese.

In 1997 to 1998, a Phase 2 RI was conducted (CF Braun, 1998) to further evaluate on-site groundwater near the fence, the off-site groundwater near the site, off-site seeps, and an off-site irrigation well.

2.5 DESCRIPTION OF CURRENT CONDITIONS

In May 2005, the Navy conducted a soil investigation at Site 2 to better define subsurface conditions. This field effort supplements previous investigations that had identified an area of shallow petroleum-contaminated soils [1 to 5 feet (bgs)] located south of the fire training ring and floating free product located near the water table [approximately 14 feet (bgs)] south and east of the fire training ring.

A pilot-scale AS/SVE system operated seasonally in this area at the site from 1995 to 2000 and removed an estimated 30,000 pounds of petroleum hydrocarbons through biodegradation. However, this system was not completely effective at cleaning up of the site. The shallow petroleum-contaminated soil likely inhibited air flow at some locations and therefore the efficiency of this test.

Mechanical and manual free product collection at the site removed approximately 2,400 pounds of petroleum hydrocarbons from 1987 through approximately 2000. Floating free product can be periodically observed at the site, but not at quantities that are effectively recoverable (less than 6 inches).

During the May 2005 soil investigation, field observations and photo ionization detector (PID) readings were used to characterize the subsurface soils. Soil samples were also collected and analyzed for VOCs, PAHs, PCBs, pesticides, metals, and total petroleum hydrocarbons (TPH) - diesel range organics (DRO) and gasoline range organics (GRO). Sample results from the 2005 Data Summary Report are included in Appendix A (TtNUS 2005). Table 2-1 presents a summary of the analytical results. Included are all positive detections of TPH-DRO/GRO and PCBs plus other chemical that exceed New York State (NYS) Technical and Administrative Guidance Memorandum (TAGM) values (i.e. PAHs). Most of the samples had detectable concentrations of metals, PAHs, and pesticides, but not at concentrations greater than TAGM 4046. Some samples had detections of VOCs, but not at concentrations greater than TAGM 4046.

Based on site data and potential remedial options, the waste/contaminated materials at Site 2 – Fire Training Area are divided into five categories, as follows:

- Shallow petroleum-contaminated soil
- Deep petroleum-contaminated soil
- Contaminated surface soil (coal)
- Other contaminated subsurface soil
- Debris (e.g. concrete, steel, and plastic)

Shallow Petroleum-Contaminated Soil

Shallow petroleum-contaminated soil is located underneath, south, and southeast of the Fire Training Ring (see Figures 2-2 and 2-3). This area may represent a former earthen depression that was used for fire training activities and that was later backfilled with petroleum-contaminated soil. Spills and leaks may have also accumulated in this area. Debris including wood and bricks is present in this material. This material is mostly continuous over a 0.5 acre area, but there may be some pockets of clean fill. The material extends from near the surface to a maximum depth of approximately 5 feet. The thickness of the material varies from approximately 1 foot around the edges to 5 feet in the middle.

Approximately 4,300 cubic yards (cy) or 7,000 tons of shallow petroleum-contaminated soil are present at the site. The shallow petroleum-contaminated soil has an average TPH-DRO concentration of 3,100 mg/kg (0.31%), and a maximum TPH-DRO concentration of 11,000 mg/kg (1.1%). PCBs were detected in 5 of 7 samples with a maximum concentration of 1.8 mg/kg. PAHs were detected in the soils at concentrations

greater than TAGM 4046 in 3 of 7 samples. There is an estimated 44,100 pounds of petroleum hydrocarbons present in the shallow petroleum-contaminated soil.

Deep Petroleum-Contaminated Soil

Deep petroleum-contaminated soil is located underneath, south, and southeast of the Fire Training Ring (see Figures 2-2 and 2-3). This area was likely formed from free petroleum product migrating from the surface to the water table and then spreading out along the water table. The water table at the site averages approximately 14 feet below ground surface and has been measured to vary by approximately 3 feet.

The fluctuations in the water table would cause the free product to create a smear zone near and below the average water table. The deep petroleum-contaminated soil covers an area of approximately 0.5 acres, but may not be completely delineated to the southeast. The contamination is centered near the water table and has an approximate average thickness of 1 foot.

Approximately 920 cy or 1,500 tons of deep petroleum-contaminated soil are present at the site. The deep petroleum-contaminated soil has an average TPH-DRO concentration of 8,100 mg/kg (0.81%), and a maximum TPH-DRO concentration of 13,000 mg/kg (1.3%). The samples were not analyzed for other chemical constituents, but likely contain low levels of PCBs and PAHs at concentration similar to that observed in the shallow petroleum-contaminated soils. There is an estimated 24,100 pounds of petroleum hydrocarbons in the deep petroleum-contaminated soil.

Contaminated Surface Soil (Coal)

Some of the surface soil at the site contains residual petroleum contamination (see Figure 2-3). Material in this category includes pea-sized coal that was used as a road base material. The surface soil would have been impacted by historic leaks and spills at the site and may have been treated with oil to suppress dust. The material is relatively loose, with minimal natural organics and/or vegetation.

The material is mostly continuous over a 0.8 acre area, of which 0.5 acres is already being addressed by the shallow petroleum-contaminated soil area calculation. There may also be some pockets of clean fill in this area. The material extends from near the surface to a maximum depth of approximately 12 inches.

Approximately 1,500 cy or 2,500 tons of contaminated surface soil is present at the site, of which 1,200 cy or 1,900 tons is being addressed with the shallow petroleum-contaminated soil volume calculation. The contaminated surface soil has an average TPH-DRO concentration of 360 mg/kg (0.036%) and a maximum

TPH-DRO concentration of 1,100 mg/kg (0.11%). PCBs were detected in 5 of 5 samples with a maximum concentration of 2.03 mg/kg. PAHs were detected in the soils at concentrations greater than TAGM 4046 in 2 of 5 samples. Excluding the surface soil being addressed with the shallow petroleum-contaminated soil, there is an estimated 430 pounds of petroleum in this material.

Other Contaminated Soil

Other contaminated soil at the site includes material that is not addressed by the shallow or deep petroleum-contaminated soil or the contaminated surface soil. This material includes soil that is beyond the horizontal extent or between the shallow and deep petroleum-contaminated soils.

The other contaminated soil is mostly clean coarse-grained sands that continue to be impacted by shallow petroleum-contaminated soils. It is also characterized by one or more, 3- to 6-inch thick layers of black stained soils. Based on the horizontal layout, the thin layer may represent a historic water table elevation (see Figure 2-3). One continuous thin layer of black stained soil is present at a depth ranging from 7 to 12 feet below ground surface. The areal extent of this layer is similar to that of the shallow petroleum-contaminated soil (0.5 acres). Other less extensive thin black stained layers or pockets of contamination are also present at the site.

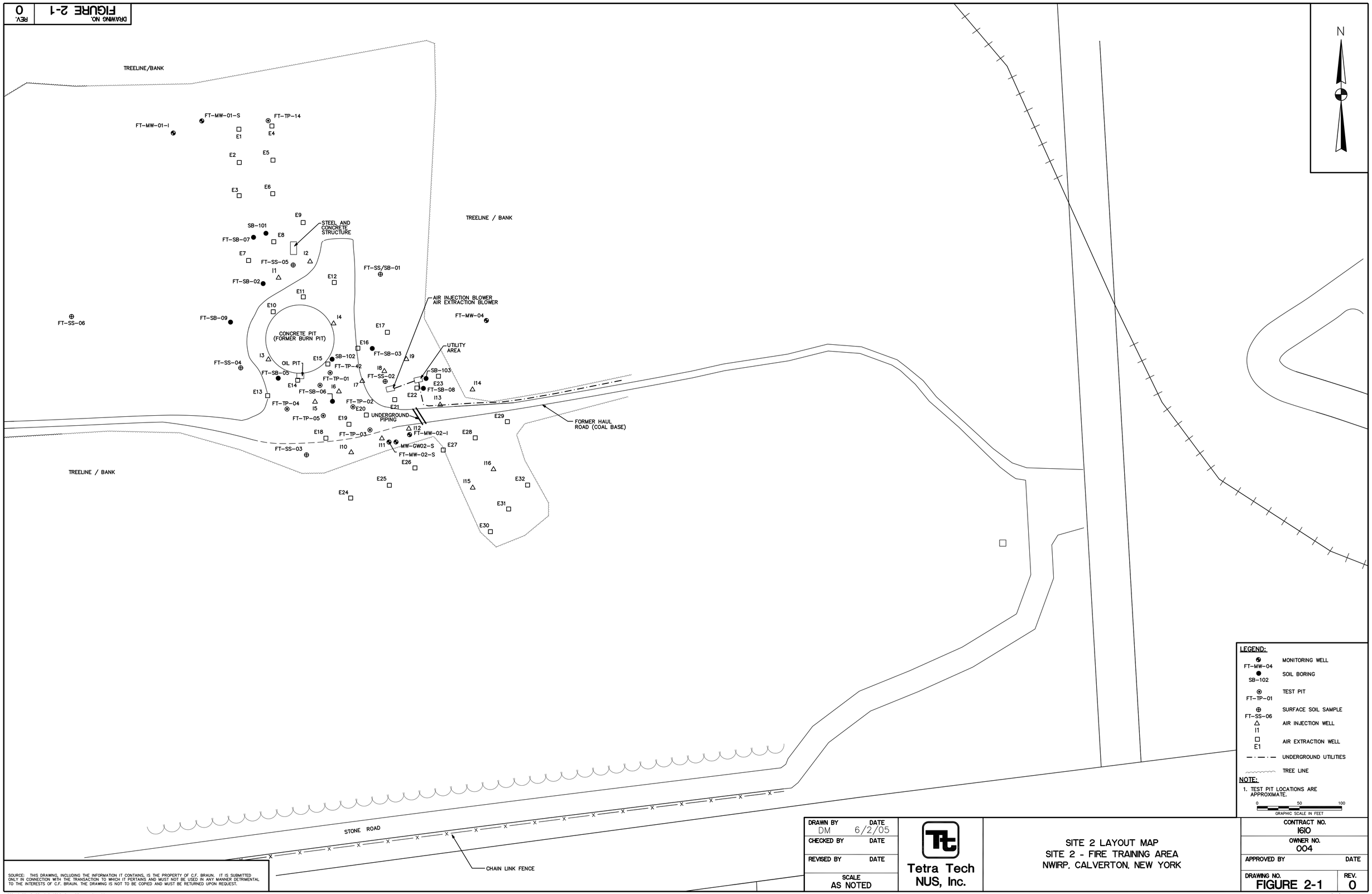
Based on an assumed area extent of 0.5 acres and the distance between the shallow and deep petroleum-contaminated soils (8 feet), there is approximately 14,000 pounds of petroleum contamination in this soil.

The other contaminated soil has an overall average TPH-DRO concentration of 620 mg/kg (0.064%). However the TPH-DRO concentration averages 3,000 mg/kg (0.3%) within the thin black stained soil and 68 mg/kg (0.0068%) elsewhere. PCBs were detected in 3 of 8 samples with a maximum concentration of 0.17 mg/kg. PAHs were detected in the soils at concentrations greater than TAGM 4046 in 2 of 8 samples.

Debris

Debris at the site consists of: concrete and steel present in the Fire Training Ring; a secondary containment structure for a 1,000-gallon aboveground fuel tank; plastic pipe used in the AS/SVE system; plastic sheeting around the SVE wells; AS/SVE blowers; a 30-gallon moisture separator; a wooden stockade fence; miscellaneous electrical fuse boxes and control panels; and a buried underground electrical line.

Based on site measurements, the Fire Training Ring contains approximately 135 cy (275 tons) of concrete. The other debris at the site can be placed within two 20-cubic yard dumpsters.



DRAWN BY	DATE
DM	6/2/05
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

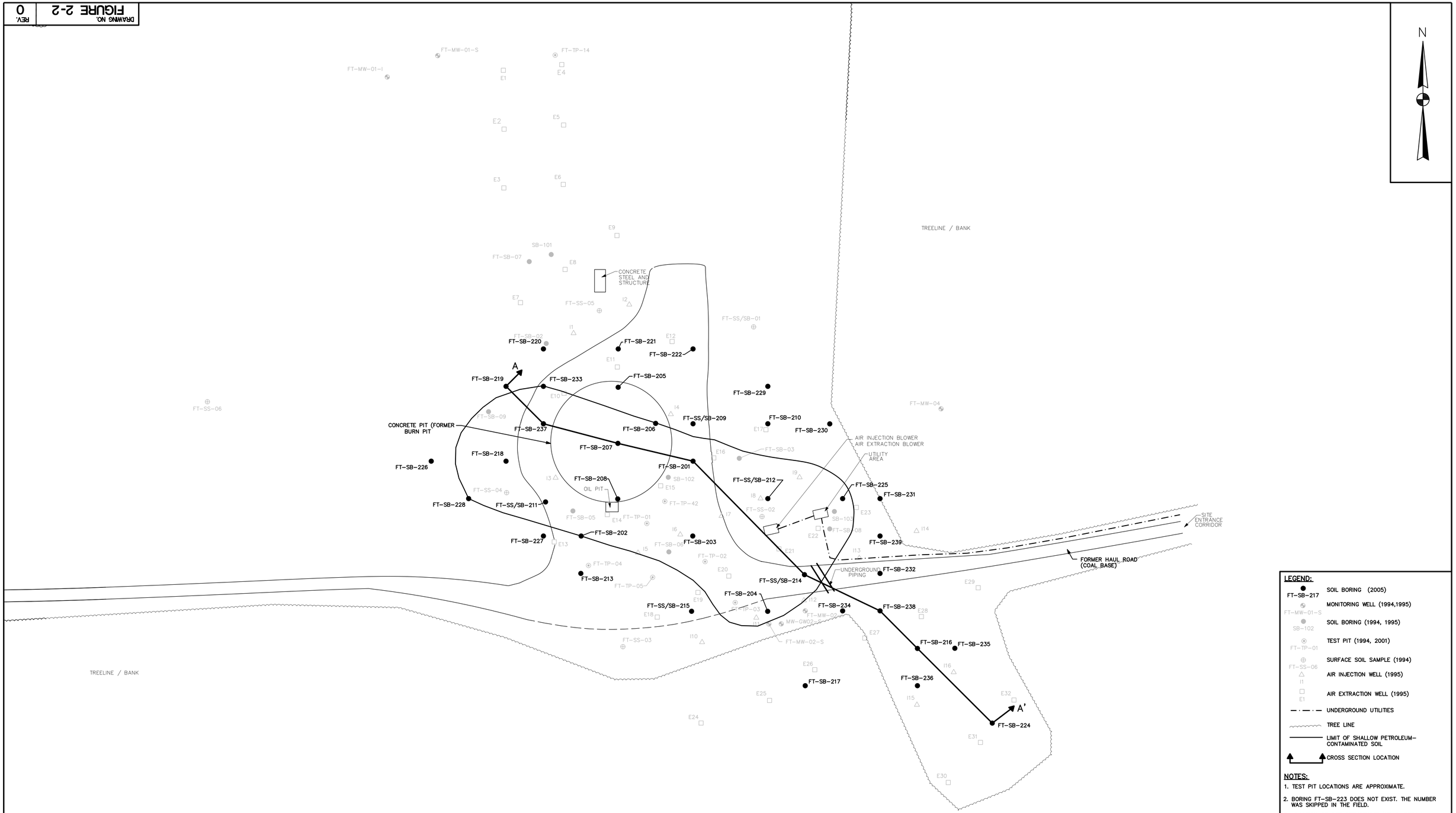
Tetra Tech NUS, Inc.

SITE 2 LAYOUT MAP
SITE 2 - FIRE TRAINING AREA
NWIRP, CALVERTON, NEW YORK

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 2-1
REV. 0

SOURCE: THIS DRAWING, INCLUDING THE INFORMATION IT CONTAINS, IS THE PROPERTY OF C.F. BRAUN. IT IS SUBMITTED ONLY IN CONNECTION WITH THE TRANSACTION TO WHICH IT PERTAINS AND MUST NOT BE USED IN ANY MANNER DETRIMENTAL TO THE INTERESTS OF C.F. BRAUN. THE DRAWING IS NOT TO BE COPIED AND MUST BE RETURNED UPON REQUEST.

DRAWING NO. FIGURE 2-1 REV. 0



LEGEND:

- FT-SB-217 — SOIL BORING (2005)
- FT-MW-01-S — MONITORING WELL (1994,1995)
- SB-102 — SOIL BORING (1994, 1995)
- FT-TP-01 — TEST PIT (1994, 2001)
- FT-SS-06 — SURFACE SOIL SAMPLE (1994)
- I1 — AIR INJECTION WELL (1995)
- E1 — AIR EXTRACTION WELL (1995)
- UNDERGROUND UTILITIES
- TREE LINE
- LIMIT OF SHALLOW PETROLEUM-CONTAMINATED SOIL
- CROSS SECTION LOCATION

NOTES:

1. TEST PIT LOCATIONS ARE APPROXIMATE.
2. BORING FT-SB-223 DOES NOT EXIST. THE NUMBER WAS SKIPPED IN THE FIELD.
3. LOCATION OF SITE STRUCTURES/AIR INJECTION WELLS/AIR EXTRACTION WELLS ARE OFFSET FROM MONITORING WELL LOCATIONS BY FIVE FEET. USE SITE STRUCTURES /AIR INJECTION WELLS/ AIR EXTRACTION WELLS AS REFERENCE POINTS.

0 30 60
GRAPHIC SCALE IN FEET

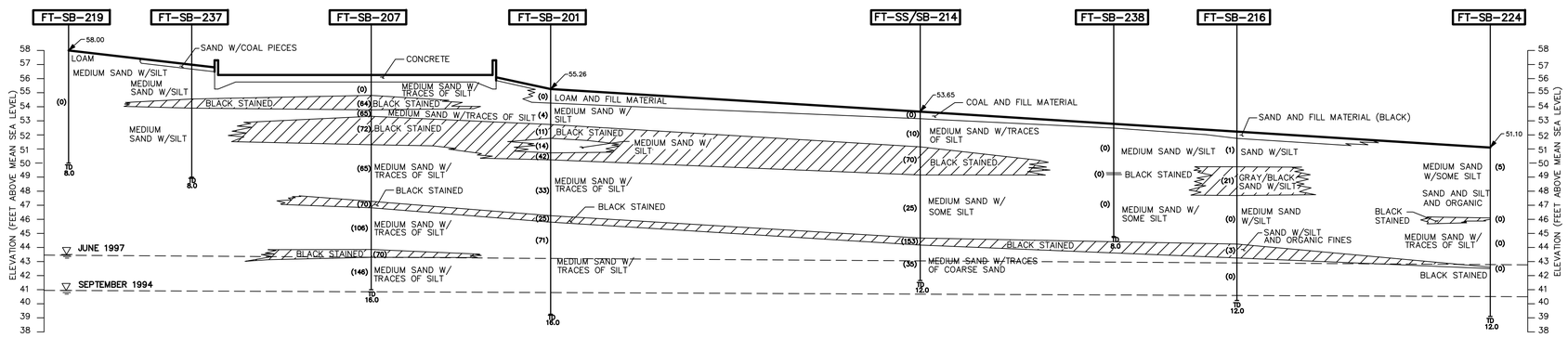
DRAWN BY DM	DATE 4/5/05	Tetra Tech NUS, Inc.	EXISTING CONDITIONS AND CROSS SECTION LOCATION MAP SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 2-2
REV. 0

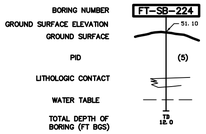
DRAWING NO. FIGURE 2-2
REV. 0

FORM CADD NO. TTNUS-D-STD.SVG - REV 1 - 9/11/98

ACAD:1610CP14.dwg 06/02/05 DM PIT



LEGEND:



NOTES:

1. PHOTO IONIZATION DETECTOR (PID) READINGS (IN PARENTHESES) ARE THE MAXIMUM DETECTED WITHIN A GIVEN MATERIAL ENCOUNTERED.
2. WATER TABLE INFORMATION TAKEN FROM MEASUREMENTS AT FT-MW-02-S AND PROVIDED IN THE 1995 RCRA FACILITY INVESTIGATION (HALIBURTON) AND THE 2001 PHASE 2 REMEDIAL INVESTIGATION (TtNUS).

0 20 40
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET

DRAWN BY DM DATE 5/26/05	Tetra Tech NUS, Inc.	CROSS SECTION A-A' SITE 2 - FIRE TRAINING CENTER NWIRP CALVERTON, NEW YORK	CONTRACT NO. 1610
CHECKED BY DATE			OWNER NO. 004
REVISED BY DATE			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-3 REV. 0

DRAWING NO. FIGURE 2-3 REV. 0

3.0 IDENTIFICATION OF REMEDIAL ACTION OBJECTIVES AND TECHNOLOGY SCREENING

The RAOs are developed to provide guidelines for evaluating the removal action and ensuring that the action complies with regulatory requirements. This section provides an evaluation of ARARs, the RAOs and schedule, statutory limits, and discussions of applicable technologies for shallow petroleum-contaminated soil removal.

3.1 COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ARARs are used to develop cleanup criteria for the RAOs and to identify removal action technologies. The term ARAR is defined in the National Oil and Hazardous Substances Contingency Plan (NCP) as follows:

- Applicable requirements are generally defined as cleanup standards, standards of control, or other substantive environmental protection requirements promulgated under Federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, or location. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as applicable requirements.

- Relevant and appropriate requirements are defined as cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under Federal or state environmental or facility siting laws that are not directly “applicable” to a hazardous substance, pollutant, contaminant, remedial action, or location, but address situations sufficiently relevant to those encountered at the site that their use is appropriate. Only those state standards that are identified by a state in a timely manner and that are more stringent than Federal requirements may be considered as relevant and appropriate requirements.

- Any promulgated standard, requirement, criterion, or limitation under a state environmental or facility-siting law that is more stringent than the associated Federal standard, requirement, criterion, or limitation.

Based on the manner in which they are applied during a removal action, ARARs are classified into three categories.

- Chemical-Specific. Chemical-specific ARARs were developed to provide health or risk-based concentration limits. These limits are specific for an individual chemical or group of chemicals. Often, these ARARs are used to determine the extent of site remediation. Chemical-specific ARARs may be concentration-based cleanup goals or may provide the basis for calculating such levels. In cases where no chemical-specific ARAR exists, chemical advisories may be used to develop Removal Action Objectives.

- Location-Specific. Location-specific ARARs are considered in view of natural or man-made site features. These ARARs are intended to limit activities within designated areas.

- Action-Specific. Action-specific ARARs pertain to the implementation of a given remedy. These ARARs control or restrict hazardous substance- or pollutant-related activities. These controls are considered when specific removal activities are planned for a site.

In addition to ARARs, other regulations and guidance may be classified as guidance "To Be Considered" (TBC). TBCs are non-promulgated, non-enforceable guidelines or criteria that may be useful for developing removal actions or necessary for determining what is protective of human health and/or the environment. TBCs are also identified in this section to aid in the evaluation of the removal actions. Potential Federal and state ARARs and TBCs are presented in Tables 3-1 and 3-2, respectively.

Section 121(d)(4) of CERCLA identifies circumstances under which ARARs may be waived, including the instance where the selected removal action is an interim remedy and the final remedial action will attain the ARAR upon its completion. As such, the selected removal actions for the sites being addressed under this EE/CA do not necessarily need to comply with all identified ARARs.

3.2 REMEDIAL ACTION OBJECTIVES

The Navy has determined that an interim action is to be considered under this non-time-critical removal action. The RAOs are as follows:

- Reduce or eliminate human exposure of petroleum contaminants in soil at concentrations greater than cleanup goals. PAHs and PCBs are present in surface and near-surface soils at concentrations greater than NYS TAGM No. 4046.

- Reduce or eliminate continuing migration of petroleum and associated contaminants from shallow soil to groundwater. Precipitation infiltration and petroleum/soil matrix degradation cause a continuing

migration of free product and VOCs from soil to groundwater and inhibit achievement of groundwater remediation goals. The petroleum/soil matrix also appears to act as a relatively impermeable unit that inhibits air/soil gas transport and natural degradation of site contaminants.

3.3 REMEDIAL ACTION SCHEDULE

Field activities should start in 2008 and be completed in 2009.

3.4 STATUTORY LIMITS

The statutory limits for fund-financed removal actions are presented in Section 104(c)(1) of CERCLA. These limits are not applicable because the actions at NWIRP Calverton are not financed by Superfund.

3.5 TECHNOLOGY SCREENING

This section identifies, screens, and evaluates the potential technologies and process options that may be applicable to assemble remedial alternatives for Site 2 at NWIRP Calverton. Screening evaluations at this stage generally focus on effectiveness and implementability, with less emphasis on cost.

Effectiveness

Effectiveness is evaluated based on the following criteria:

- Ability of the technology to address the estimated areas or volumes of contaminated medium.
- Ability of the technology to meet the goals identified in the RAOs.
- Technical reliability (innovative versus well proven) with respect to contaminants and site conditions.
- Potential impacts to human health and the environment during implementation.

Implementability

Implementability is evaluated based on the following criteria:

- Overall technical feasibility at the site.
- Availability of vendors, mobile units, storage, disposal services, etc.
- Administrative feasibility.

Cost

Cost is evaluated based on the following criteria:

- Capital costs.
- Operation and maintenance costs.

3.5.1 No Action

Under a no action alternative, neither a removal action nor periodic maintenance is undertaken at the site.

Effectiveness

No action would not protect human health or the environment because it would allow petroleum-contaminated soil to remain at the site. Human receptors could contact petroleum-contaminated soil, and the soil would be a continuing source of groundwater contamination.

Effectiveness of a previous remedy at the site (AS/SVE) was inhibited by the shallow-petroleum contaminated soil at the site.

Implementability

No action is technically and administratively feasible at the site. The availability of vendors, mobile units, storage, disposal services, etc. and long-term maintenance and operations requirements are not applicable.

Cost

There are no costs for this technology.

Conclusion

No action is implementable and costs are minimal, but it is not effective. However, no action will be retained as a baseline for comparison to other options.

3.5.2 Institutional Controls and Monitoring

Institutional controls consist of administrative (non-engineering) controls and procedures to limit access to and activities at a site. A monitoring program, subject to regulatory approval, would be developed that would

include routine sampling and analysis of environmental media and additional sampling to further evaluate risk and to monitor potential migration of soil contaminants.

Effectiveness

Prohibiting residential development and the development of facilities in which children would be exposed would prevent the occurrence of unacceptable risks from direct exposure by human receptors. The control of work permits would limit exposure to on-site workers. However, the effectiveness of institutional controls is dependent on the long-term enforcement of a land use control plan. Institutional controls would not be effective in reducing the migration of soil contaminants to groundwater

Implementability

Institutional actions are readily implementable because only administrative action and limited remedial activities would be required. Deed restrictions could be implemented by the Navy or could be incorporated into property transfer documents.

Cost

The capital cost for institutional controls and monitoring would be low. Operating costs will be low to moderate, but the need for enforcement of the land use controls and monitoring could be indefinite.

Conclusion

Institutional controls and monitoring are eliminated from further consideration because institutional controls and monitoring would not effectively reduce contaminant migration from soil to groundwater.

3.5.3 Containment

Permeable covers, asphalt covers, and low-permeable caps are the technologies being considered for containment.

Covers and caps can minimize the potential for human contact with surface and subsurface soil. They can also reduce the migration of contaminants caused by surface water infiltration, runoff, and wind erosion. Permeable covers consist of a layer of soil or gravel placed or compacted over areas of soil contamination. Asphalt covers can be placed over areas of soil contamination where regular vehicular access must be maintained. Low-permeable caps, including multimedia caps, can consist of layers of soil, synthetic materials, and/or composite materials placed or compacted over areas of soil contamination.

Effectiveness

Soil covers, asphalt covers, and multimedia caps can be effective in minimizing human exposure to contaminated surface and subsurface soil. The use of low-permeability materials such as compacted clay, synthetic membranes, or composite materials would be effective in minimizing rainfall infiltration into the contaminated material beneath the cover.

Implementability

Covers and caps would be easy to implement. The resources, materials, and services required to implement this technology are readily available.

Cost

Costs for soil covers and asphalt caps are low to moderate. Costs for engineered caps are moderate to high, depending on the materials and labor involved in placement.

Conclusions

Containment is retained in combination with other process options for the development of remedial alternatives.

3.5.4 Excavation

Excavation can be performed by various types of equipment such as front-end loaders, backhoes, grade-alls, etc. The type of equipment selected must take into consideration several factors such as the type of material to be removed, the load-bearing capacity of the ground surrounding the removal area, the depth and aerial extent of removal, the required rate of removal, and the elevation of the groundwater table. Excavation is the technology of choice for the removal of well-consolidated material such as unsaturated soil to a depth of up to 30 feet.

The logistics of excavation must take into account the available space for operating the equipment, loading and unloading of the excavated material, location of the site, etc. After excavation is completed, the location is filled and graded with clean fill material or treated soils.

Effectiveness

Excavation is a well-proven and effective method of removing contaminated material from a site. Sampling is typically required to verify the effectiveness of the removal action. Excavation would not be expected to have significant short-term impacts on the community or environment. Any dust that would be generated could be adequately controlled. Erosion and sedimentation controls would be considered to control off-site migration of soil contaminants. Excavation would expose workers to contaminants during the implementation phase, although exposure would be minimized through the use of proper health and safety procedures. Excavation would provide protection of human health and the environment at the site for the long term because contaminated material would be removed from the site. The excavated material would require further treatment and/or disposal. Excavation is most effective above the water table. Once the water table is reached, dewatering becomes an issue.

Implementability

Excavation of shallow petroleum-contaminated soil at Site 2 would be implementable. Because of the location of the water table, excavation of deep petroleum-contaminated soil would be more difficult to implement. Excavation equipment is readily available from multiple vendors. This technology is well proven and established in the construction and remediation industry. During excavation, site-specific health and safety procedures and Occupational Safety and Health Administration (OSHA) regulations would have to be complied with to ensure that the exposure of workers to contaminants is minimized.

Cost

The cost of excavation at Site 2 would be low to moderate for the shallow petroleum-contaminated soil and moderate to high for the deep petroleum-contaminated soil.

Conclusion

Excavation is retained in combination with other process options for the development of removal action alternatives. It permanently removes the contamination from the site. Its cost effectiveness improves as soil volumes decreases.

3.5.5 In-Situ Treatment

The process options considered under in-situ treatment are SVE and multi-phase extraction (MPE).

SVE is a process that physically removes contaminants by inducing air flow by applying a vacuum to extraction wells screened in the saturated zone. VOCs tend to partition into air as the air moves through the soil to the extraction wells. The gas leaving the soil may be treated to recover or destroy the contaminants, depending on air discharge regulations. SVE is one of the presumptive remedies identified by USEPA where VOCs are present in soil.

MPE is an enhancement of the SVE option under the presumptive remedy for sites with VOCs in soil. MPE simultaneously extracts both groundwater and soil vapor. The water table is lowered so that the SVE process can be applied to the newly exposed soil. This allows the VOCs sorbed on the previously saturated soil to be stripped by the induced airflow and extracted. In addition, soluble VOCs present in the extracted groundwater are also removed.

Effectiveness

SVE is a well-demonstrated technique for removing VOCs from the vadose zone (i.e., above the water table) on sites with suitable subsurface soil permeability. It may not be as effective at sites with low-permeability soils. It is not as effective for most PAHs. An SVE system has been in operation at Site 2 in the past. The SVE system was successful in destroying approximately 30,000 pounds of petroleum through biodegradation. However, SVE was not completely effective in destroying petroleum located in the shallow petroleum-contaminated soil layer. The presence of a three-phase petroleum-water-soil matrix appeared to inhibit the flow of air.

MPE has proven to be more effective at removing subsurface VOCs at low- to moderate-permeability sites than conventional pump-and-treat and SVE systems alone. It can remove contaminants from above and below the water table. MPE was evaluated at the Site but was not found to be highly effective.

Implementability

SVE is a readily available conventional process that has been used at numerous Superfund sites, including Site 2. Air pollution controls may be required.

MPE is an innovative process that has been applied at dozens of sites. Air pollution controls may be needed. The aquifer must be able to be dewatered for MPE to be successful. Although some transfer of VOCs from groundwater to the vapor phase is expected, extracted groundwater may need to be further treated prior to discharge. Air pollution controls may be required.

Cost

The cost of SVE is low. Costs for MPE would be higher because additional equipment would be needed, groundwater dewatering would be necessary (requiring the need for a sheet piling wall, a slurry wall, or well points), and the extracted groundwater would require treatment.

Conclusion

SVE for removal of VOCs from shallow petroleum-contaminated soil is eliminated because of effectiveness concerns identified during previous operation within the petroleum-contaminated soil area. MPE is also eliminated because of effectiveness concerns for the SVE part of the MPE process. SVE may be considered as a long term remedy, to be used in conjunction with AS, to address deep petroleum-contaminated soil and groundwater.

3.5.6 Ex-Situ Treatment

The process option considered under ex-situ treatment is low-temperature thermal desorption.

Low-temperature thermal desorption is a physical separation process that treats wastes at 200 to 600 degrees Fahrenheit (°F) to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organic contaminants to a gas treatment system. The bed temperatures and residence times will volatilize selected contaminants but typically will not oxidize or destroy them. Two common thermal desorption designs are the rotary dryer and thermal screw. Rotary dryers are horizontal cylinders that can be indirect or direct fired. The dryer is normally inclined and rotated. For thermal screw units, screw conveyors or hollow augers are used to transport the medium through an enclosed trough. Hot oil or stream circulates through the auger to indirectly heat the medium.

Effectiveness

Thermal desorption should be effective at volatilizing the VOCs of concern. Contaminant destruction efficiencies in the afterburners of these units are greater than 95 percent. The same equipment could probably meet stricter requirements with minor modifications, if necessary. Decontaminated soil could be used as backfill if contaminant levels meet cleanup levels or it can be transported to an off-site landfill.

Implementability

Low-temperature thermal desorption is an innovative process that is being used more often. Full-scale and mobile units are available. All thermal desorption systems require treatment of the off-gas to remove

particulates and contaminants. Dewatering may be necessary to achieve acceptable soil moisture content. Heavy metals in the feed may produce a solid residue that requires further treatment or disposal. On-site thermal desorption would be preferred over off-site treatment because the soil could be used to backfill excavated areas, assuming that soil cleanup levels can be attained.

Costs

The relative cost of low-temperature thermal desorption is low to moderate. However, mobilization costs would be relatively high for smaller volumes of soil.

Conclusion

Low-temperature thermal desorption would be effective and implementable for removing VOCs. The relatively small volume of contaminated soil would not justify mobilization of on-site treatment equipment. Therefore, this process is eliminated from consideration.

3.5.7 Off-Site Disposal

Disposal in an off-site landfill is an effective technology and can be easily implemented if volumes are not excessive. This technology requires excavation, loading, and hauling of contaminated soil to an approved facility for final disposal. All contaminated material can be disposed at a properly permitted facility.

Effectiveness

Off-site disposal is a very effective long-term disposal action for contaminated soil. Off-site disposal would provide long-term protection of human health and the environment. After the contamination is removed, there would not be unacceptable residual risks. Off-site transport of a large volume of contaminated material could impact the community (e.g., increased traffic, potential for spills). Off-site disposal is a very reliable removal action because the contaminated materials are removed from the facility and operation and maintenance (O&M) activities are not required.

Implementability

Off-site disposal is implementable because facilities with adequate capacity are available.

Cost

The capital cost associated with off-site disposal is medium to high depending on the waste classification. There are no O&M costs associated with this technology.

Conclusion

Off-site disposal is readily implemented, and requires no post-remedial monitoring or maintenance. For small volumes of soil, it is cost competitive. It is retained in combination with other process options for the development of removal action alternatives.

3.6 SUMMARY OF APPLICABLE TECHNOLOGIES

The following table summarizes the identified technologies that will be retained or not retained for consideration.

Remedial Technologies	Retained for Consideration	Not Retained for Consideration
No Action	X	
Institutional Controls and Monitoring		X
Containment	X	
Excavation	X	
In-Situ Treatment		X
Ex-Situ Treatment		X
Off-Site Disposal	X	

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
CHEMICAL-SPECIFIC		
Safe Drinking Water Act (42 USC 300) - Maximum Contaminant Level Goals (40 CFR 141.50-141.51) - Maximum Contaminant Levels (40 CFR 141.61-141.62)	Applicable only to groundwater. This EE/CA does not address groundwater	Not applicable.
Reference Doses, USEPA Office of Research and Development	To be considered requirement in the public health assessment.	To be considered.
Carcinogenic Potency Factors, USEPA Environmental Criteria and Assessment Office; USEPA Carcinogen Assessment Group	To be considered requirement in the public health assessment.	To be considered.
Health Advisories, USEPA Office of Drinking Water	To be considered requirement in the public health assessment.	To be considered.
Clean Water Act (33 USC 1251-1376), Federal Ambient Water Quality Criteria Standards (40 CFR 131)	AWQC may be considered for actions that involve discharge to surface water at Site 2. Discharge to surface waters is not anticipated.	Not applicable.
Clean Air Act (42 USC 7401) - National Ambient Air Quality Standards (40 CFR Part 50)	NWIRP site alternatives may result in emission of unacceptable levels of airborne particulates to the atmosphere. The primary (and secondary standard) for particulate matter, expressed as PM-10 is 150 [24-hour, annual arithmetic mean] and 50 [1-year, annual arithmetic mean]. VOC emissions may also be of concern during the excavation/regrading of soils.	Potentially applicable.
Clean Air Act (42 USC 7401) National Emissions Standards for Hazardous Air Pollutants (40 CFR Part 61)	Standards are possibly, but not likely, to be relevant and appropriate since these standards were developed for specific, significant sources. Particulates and VOCs are of primary concern.	Potentially relevant and appropriate.

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
Guidance on Remedial Actions for Superfund Sites with PCB Contamination (OSWER Directive No. 9355.4-01, August 1990)	Low level PCB contamination is present at the Site. Worker contact during remediation and potential exposure to contaminated soils after remediation needs to be considered.	To be considered.
USEPA Polychlorinated Biphenyls Spill Policy (40 CFR Part 761; April 2, 1987)	Maximum detected PCB concentrations are below PCB criteria.	Not applicable.
LOCATION-SPECIFIC		
Clean Water Act Section 401 and 404 (b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material (40 CFR 230; 33 CFR 320-330)	Section 401 and 404 of the Clean Water Act regulates the discharge of dredged or fill material into U.S. waters, including wetlands. The purpose of Section 401 and 404 is to ensure that proposed discharges are evaluated with respect to impacts on the aquatic ecosystem. No activity that adversely affects a wetland is permitted if a practicable alternative that has less effect is available. If there is no other practicable alternative, impacts must be mitigated.	Not applicable.
Groundwater Protection Strategy (USEPA, 1984)	Groundwater beneath and downgradient of the NWIRP site is designated as Class I. Interim Site 2 activities are not expected to effect groundwater.	To be considered.
Considering Wetlands at CERCLA Sites (OSWER 9280.0-03)	No wetlands are on or adjacent to Site 2.	Not applicable.
The Clean Air Act Prevention of Significant Deterioration Standards (40 CFR Part 52.21)	The NWIRP site is in a National Ambient Air Quality Standard nonattainment area for ozone. Interim Site 2 activities are not expected to effect ozone quality.	Not applicable.
Federal Protection of Wetlands Executive Order (E.O. 11990)	Federal agencies are required to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance natural and beneficial values	Not applicable.

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
	of wetlands. No wetlands are on or adjacent to Site 2.	
The Flood Disaster Protection Act and National Flood Insurance Act (24 CFR 1909)	Site 2 is not within a 100 year flood plain, therefore, this act is not applicable.	Not applicable.
Federal Floodplains Management Executive Order (E.O. 11988)	Site 2 is not within a 100 year flood plain, therefore, this act is not applicable.	Not applicable.
Endangered Species Act of 1978 (16 USC 1531)	Federal agencies are required to consider the impacts on endangered and threatened species and their critical habitats. No species or habitat of federally listed species were identified at the NWIRP; however, migrating species may occasionally move through the area.	Potentially applicable.
Fish and Wildlife Coordination Act (16 USC 661)	The appropriate state agency and U.S. Fish and Wildlife Service is to be notified of activities which may impact aquatic life. No wetland is on or adjacent to Site 2.	Not applicable.
Fish and Wildlife Improvement Act of 1978 (16 USC 742a) and the Fish and Wildlife Conservation Act of 1980 (16 USC 2901)	This act requires the consideration of impacts on wetlands and protected habitats. No wetland is on or adjacent to Site 2.	Not applicable.
The Archaelogical and Historic Preservation Act (16 USC Section 469)	Prior to site activities as well as during excavation, actions must be taken to identify, recover and preserve artifacts. The majority of Site 2 activities will occur in fill material.	Not applicable.

ACTION-SPECIFIC

Resource Conservation and Recovery Act of 1976 (Amended 1984):		
• Identification and Listing of Hazardous Waste (40 CFR Part 261)	Specific materials at the site can be classifiable as characteristic hazardous wastes. This act may be applicable if wastes are removed from the site. Soils at the site are not expected to be a hazardous	Potentially applicable.

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
	waste.	
• LDRs (40 CFR Part 268)	Treatment or disposal of contaminated soils/wastes and/ or disposal of treatment residuals which may be considered hazardous waste would be subject to land disposal restrictions. Soils at the site are not expected to be a hazardous waste.	Potentially applicable.
• Treatment, Storage, and Disposal of Hazardous Waste (40 CFR Parts 262-265, and 266)	During site restoration, waste generation, transport, and/or treatment, storage, and disposal activities may occur. Soils at the site are not expected to be a hazardous waste.	Potentially applicable.
• CAMUs and Temporary Units, Final Rule (40 CFR Parts 260, 264, 265, 268, 270, and 271)	CAMU designated areas qualify for certain exemptions from RCRA Subtitle C requirements. Particularly, remediation wastes can be moved between sites within the designated area and can be treated and replaced on site without triggering LDRs. Soils at the site are not expected to be a hazardous waste.	Potentially applicable.
National Environmental Policy Act (40 CFR Part 6)	Potential environmental impacts at NWIRP may include wetlands and endangered species. Consideration of environmental impacts of remedial actions will be addressed in this report.	Potentially applicable.
Clean Water Act Regulations (40 CFR 122)	The Site 2 interim actions are not anticipated to require discharge to surface waters. Water generated will likely be taken off site for treatment and disposal.	Not applicable to Site 2 interim actions.
Control of Air Emissions from Superfund Air Strippers at Superfund Groundwater Sites (OSWER Directive 9355.0-28)	The Site 2 interim action is not anticipated to require air stripping towers.	Not to be considered to Site 2 interim actions.
General Pretreatment Regulations for Existing and New Sources of Pollutants (40 CFR Part	The Site 2 interim action is not anticipated to require discharge to a POTW. Water generated will	Not applicable to Site 2

TABLE 3-1

FEDERAL APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
403)	likely be taken off site for treatment and disposal.	interim actions.
Underground Injection Control Program (40 CFR Parts 144, 147)	The Site 2 interim action is not anticipated to require discharge to groundwater. Water generated will likely be taken off site for treatment and disposal.	Not applicable to Site 2 interim actions.
Toxic Substances Control Act (40 CFR Part 761.6-761.79 Subpart D Storage and Disposal)	Soil/waste concentrations of PCBs at Site 2 are less 10 ppm. This act regulates materials with PCB concentrations greater than 50 ppm.	Not applicable to Site 2 interim actions.
OSHA Requirements (29 CFR Parts 1910, 1926, and 1904)	Required for site workers during construction and operation of remedial activities.	Must be met during remediation.
DOT Rules for Hazardous Materials Transport (40 CFR Parts 107, 171-179)	Remedial actions may include offsite treatment and disposal of wastes/soils, as well as samples analysis	Must be met during remediation.

CAMU	Corrective Action Management Units
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
DOT	Department of Transportation
E.O.	Executive Order
LDRs	Land Disposal Restrictions
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response
POTW	Publicly Owned Treatment Works
ppm	part per million
USC	United States Code
USEPA	U.S. Environmental Protection Agency

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQURIEMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
CHEMICAL SPECIFIC		
New York Ambient Air Quality Standards (6 NYCRR Parts 256 and 257)	The NWIRP Calverton area is classified as Level II. Particulate and non-methane hydrocarbon standards will be applicable to the site.	Applicable.
New York Water Classifications and Quality Standards (6 NYCRR Parts 609, 700-704)	Standards would not apply to Site 2 interim actions. Any contaminated water generated would be disposed off site.	Not applicable to Site 2 interim actions.
New York Public Water Supply Regulations (10 NYCRR Part 5)	Standards would not apply to Site 2 interim actions. Any contaminated water generated would be disposed off site.	Not applicable to Site 2 interim actions.
Technical Guidance for Screening Contaminated Sediments (Division of Fish and Wildlife and the Division of Marine Resources, NYSDEC)	Standards would not apply to Site 2 interim actions. Any contaminated water generated would be disposed off site.	Not applicable to Site 2 interim actions.
New York Technical and Administrative Guidance Memorandum on Determination of Soil Cleanup Objectives and Cleanup Levels (TAGM 4046)	Subsurface soils/wastes at Site 2 exceed the soil cleanup objectives and levels under this guidance. Actions that may expose contaminated soils/wastes would need to consider these criteria for handling and placement practices.	To be considered.
New York Spill Technology and Remediation Series, Petroleum-Contaminated Soil Guidance (STARS Memo #1)	Subsurface soils/wastes at Site 2 may exceed the soil cleanup objectives and levels under this guidance document. Actions that may expose contaminated soils/wastes would need to consider these criteria for handling and placement practices.	To be considered.

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQURIEMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
LOCATION-SPECIFIC		
New York Freshwater Wetlands Act (Article 24 and Title 23 of Article 71 of the New York ECL) and New York Freshwater Wetlands Regulations (6 NYCRR Parts 662 - 64)	Activities within or adjacent to a state regulated wetlands requires a permit or letter of approval. No state regulated wetlands are present or adjacent to Site 2.	Not applicable.
New York Preservation of Endangered, Threatened and Indigeneous Species; Species of Special Concern (NYCRR Section 182)	An endangered specie and a special concern specie have been confirmed at the NWIRP Calverton, but not at Site 2.	Not applicable
New York Regulation for Administration and Management of the Wild Scenic and Recreational Rivers System in New York State Excepting the Adirondack Park (6 NYCRR Part 666)	The Peconic River and some of its tributaries are classified as a Scenic River. Site 2 does not discharge to the river. As a result, this regulation is not applicable to Site 2 interim actions.	Not applicable to Site 2 interim actions.
NYCRR 375 Inactive Hazardous Waste Disposal Site	NWIRP Calverton is listed as on inactive hazardous waste site.	Applicable.
New York State, State Environmental Quality Review (Part 617)	Site 2 is not located within an area classified as high potential Prehistoric Sensitivity Area.	Not applicable.
ACTION-SPECIFIC		
New York ECL (New York Consolidated Laws, Chapter 43-B):		
• Water Pollution Control (ECL, Article 17)	Discharges to state groundwater are prohibited unless in compliance with all standards, criteria, limitation, rules and regulations. Site 2 interim actions will not discharge contaminated water to the groundwater.	Not applicable to Site 2 interim actions.
• Air Pollution Control Act (ECL, Article 19)	Provides policy to maintain the quality of air resources of the state. Regulations provided in 6 NYCRR Parts 200 to 257. Site 2 interim actions will not discharge contaminated media to the air.	Not applicable to Site 2 interim actions.
• New York Solid and Hazardous Waste	Addresses solid and hazardous waste management.	Potentially applicable.

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQURIEMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
Management Laws (ECL, Article 27)	Soils and wastes at Site 2 are not classifiable as hazardous wastes. However, additional testing may be required during excavation.	
• Uniform Procedures (ECL, Article 70)	Establishes uniform review procedures for major regulatory programs. Procedures are provided for coordinating permitting for a project requiring one or more NYSDEC permits.	Not applicable.
New York Air Pollution Control Regulations (6 NYCRR Parts 200-254)	Site 2 interim actions will not discharge contaminated media to the air.	Not applicable to this interim action.
New York Waste Management Facilities Rules (6 NYCRR Part 360)	Provides standards for solid waste management facilities. Remedial activities may need to consider standards for solid waste management facilities. Includes landfill closure requirements.	Relevant and appropriate.
New York Rules for Siting Industrial Hazardous Waste Facilities (6 NYCRR Part 361)	Provides evaluation criteria for siting new industrial hazardous waste facilities.	Not applicable.
New York Waste Transport Permit Regulations (6 NYCRR Part 364)	Off-site transport of contaminated soils/wastes or treatment residuals will require compliance with these regulations.	Applicable.
New York General Hazardous Waste Management System Regulations (6 NYCRR Part 370)	Soils and wastes at Site 2 are not classifiable as hazardous wastes. However, additional testing may be required during excavation.	Potentially applicable.
New York Identification and Listing of Hazardous Wastes Regulations (6 NYCRR Part 371)	Soils and wastes at Site 2 are not classifiable as hazardous wastes. However, additional testing may be required during excavation.	Potentially applicable.
New York Hazardous Waste Manifest System Regulations (6 NYCRR Part 372)	Manifests may be required for off-site disposal/treatment of residuals.	Potentially applicable.
New York Hazardous Waste Treatment, Storage and Disposal Facility Permitting Requirements (6 NYCRR Subpart 373-1)	Site 2 is not a treatment, storage, and disposal facility.	Not applicable.

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQURIEMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
New York Final Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage and Disposal Facilities (6 NYCRR Subpart 373-2)	Site 2 is not a treatment, storage, and disposal facility.	Not applicable.
New York Interim Status Standards for Owners and Operators of Hazardous Waste Facilities (6 NYCRR Subpart 373-3)	Standards may apply to final corrective action requirements. Soils and wastes at Site 2 are not classifiable as hazardous wastes. However, additional testing may be required during excavation. These standards should be considered as part of the interim remedy.	Not applicable.
New York Standards for Managing Specific Hazardous Wastes and Hazardous Waste Management Facilities (6 NYCRR Part 374)	Although unlikely, NWIRP Calverton site remedial alternatives may include recovery.	Potentially applicable.
New York Rules for Inactive Hazardous Waste Disposal Sites (6 NYCRR Part 375)	State review and concurrence with the selected remediation scheme will be required. The hierarchy of preferred remedial technologies is as follows: (1) Destruction, (2) Separation/ treatment, (3) Solidification/chemical fixation, and (4) Control and isolation. NWIRP Calverton corrective action measures are addressed under an existing RCRA permit.	Applicable.
New York Land Disposal Restrictions Regulations (6 NYCRR Part 376)	Regulates the disposal of contaminated soil/waste. Soils and wastes at Site 2 are not classifiable as hazardous wastes. However, additional testing may be required during excavation. Actions that may expose contaminated soils/wastes would need to consider these criteria for off-site disposal.	Potentially applicable.
New York Rules on Hazardous Waste Program Fees (6 NYCRR Parts 483 and 484)	No hazardous waste program fees are payable related to cleanup, remediation, or corrective action activities. However, waste transporter program fees	Not applicable.

TABLE 3-2

PRELIMINARY STATE APPLICABLE OR RELEVANT AND APPROPRIATE REQURIEMENTS
NWIRP, CALVERTON, NEW YORK

ARAR Citation	Rationale for Use at NWIRP Site	Type of Requirement
	will be required for off-site disposal of wastes or treatment residuals.	
New York Water Classifications and Quality Standards (6 NYCRR Parts 609, 700-704)	Site 2 interim actions will not discharge contaminated water to the ground or surface water.	Not applicable to Site 2 interim actions.
New York Regulations on State Pollutant Discharge Elimination System (6 NYCRR Parts 750 through 758)	Permits (SPDES or NPDES) would be required for discharges to surface waters. Site 2 interim actions will not discharge contaminated water to the ground or surface water.	Not applicable to Site 2 interim actions.

ECL Environmental Conservation Law
NYCRR New York Codes, Rules and Regulations
NYSDEC New York State Department of Environmental Conservation
STARS Spill Technology and Remediation Series
TAGM Technical and Administrative Guidance Memorandum

4.0 IDENTIFICATION AND ANALYSIS OF REMEDIAL ACTION ALTERNATIVES

Several remedial action alternatives for the petroleum-contaminated soil at Site 2, Fire Training Area, were developed and evaluated. Alternative 1 is the no action alternative. Alternative 2 includes installing a permeable soil cover. Alternative 3 includes excavation and off-site disposal of petroleum-contaminated soil. Alternatives 2 and 3 also incorporates excavation and off-site disposal of coal, demolition and disposal of the concrete pit and supporting structures, abandoning, demolition, and disposal of the AS/SVE system, and regrading and vegetation.

The following sections will evaluate these remedial action alternatives based on effectiveness, implementability, and cost.

4.1 ALTERNATIVE 1: NO ACTION

The No Action alternative is evaluated to provide a comparative baseline against which other alternatives can be evaluated. Under this alternative, no remedial action will be taken and the site is left “as is”, without the implementation of any remedial, treatment, or other mitigating actions.

Currently, petroleum contamination exists in surface and subsurface soil and is seeping to the groundwater and creating a free product layer at the groundwater surface. Without remediation, human receptors could contact PAH- and PCB-contaminated soil, and soil contaminants (petroleum and VOCs) would continue to migrate to groundwater.

4.1.1 Effectiveness

The No Action alternative would not be effective and would not achieve the RAOs. Potential risks to humans and the environment at the site would remain. Human receptors could contact petroleum-contaminated soil, and the soil would be a continuing source of groundwater contamination.

4.1.2 Implementability

Under the No Action alternative, no remedial action would be taken; therefore, there would not be difficulties or uncertainties associated with implementation.

4.1.3 Cost

There would be no capital, operational, or maintenance costs associated with this alternative.

4.2 ALTERNATIVE 2: PERMEABLE SOIL COVER (CONTAINMENT)

Alternative 2 consists of placing a soil cover over the limit of shallow petroleum-contaminated soil. Temporary erosion and sediment controls would be installed to limit erosion and sediment migration during implementation of this alternative. The cover would consist of 2 feet of native soil. The horizontal extent of the 2-foot cover would be the limit of shallow petroleum-contaminated soil. The limit of the soil cover would extend out an additional 6 feet at a slope of 3 foot horizontal to 1 foot vertical (3H:1V) (Figure 4-1). The total area to be capped is approximately 27,500 square feet (sf) (0.63 acres). The capped area would be revegetated.

Alternative 2 also consists of excavation and off-site disposal of the surface coal. The area of coal outside the limit of the soil cover that requires excavation is approximately 11,100 sf (0.25 acres). Approximately 1 foot of coal will be removed from the site for a volume of 410 cy (670 tons).

The concrete pit, supporting structures, and the AS/SVE system require demolition and off-site disposal. Supporting structures of the concrete pit include the concrete and steel structure located north of the concrete pit and steel structures located within the concrete pit. Abandoning of the AS/SVE system will include removing existing air injection and air extraction piping and grouting the air injection and air extraction wells with a cement bentonite mixture. Disposal of all structures will be at a permitted construction and demolition (C&D) landfill. Based on field measurements and assumptions, a total of approximately 135 cy (275 tons) of concrete from the concrete pit would be demolished and disposed off site. Quantity calculations are provided in Appendix B.

As part of this alternative, the haul road leading to the site will require stabilization. It is assumed that stabilization fabric and 6 inches of gravel will be placed along the haul road. Trees located along the haul road will require trimming.

A temporary decontamination pad would be constructed. Electrical power will be supplied to the site. Equipment and vehicles used during site preparation and soil handling would be cleaned and decontaminated at this location. The actual size, design, and location of the decontamination pad(s) would be determined during the remedial design phase.

Land use controls would be implemented to prevent residential use of the capped area. Long-term inspection and maintenance of the capped area and 5-year reviews would be required.

4.2.1 Effectiveness

Alternative 2 would meet one of the two RAOs. Covering the petroleum-contaminated soil would prevent direct exposure but would not reduce migration to groundwater. There are no anticipated short-term impacts to the public. Short-term impacts to workers and the environment would be controlled.

4.2.2 Implementability

The equipment and services needed for installation of a soil cover are readily available. Upon award of this project, construction could begin within approximately 3 months. Construction time is estimated to take 2 months. Post-construction documents could be completed within another 4 months. Therefore, this alternative could be implemented within approximately 9 months from award date.

4.2.3 Cost

The estimated present worth cost of Alternative 2 is $681,541. Costing information is provided in Appendix C.

4.3 ALTERNATIVE 3: EXCAVATION AND OFF-SITE DISPOSAL

Alternative 3 would consist of excavating the shallow petroleum-contaminated soil at Site 2 with disposal at an off-site landfill. The aerial extent of shallow petroleum-contaminated soil is presented on Figure 4-2 and is estimated to be 23,500 sf (0.54 acres). The excavation limits were developed by determining the horizontal extent of shallow petroleum-contaminated soil from soil borings installed during the May 2005 supplemental sampling event. The vertical extent of shallow petroleum-contaminated soil of 5 feet was determined from the cross section provided in Figure 2-3. An additional one vertical foot will be excavated to ensure removal of petroleum-contaminated soil. For stability, the slope of the excavation sidewalls will be 2 feet horizontal to 1 foot vertical (2H:1V). Based on the area and depth of shallow petroleum-contaminated soil, and taking into consideration excavation sidewalls, a total of approximately 6,000 cy (9,800 tons) of soil would be excavated and disposed off site (of which, 4,300 cy is shallow petroleum-contaminated soil).

Alternative 3 also consists of excavation and off-site disposal of the surface coal. The area of coal outside the limit of the soil cover that requires excavation is approximately 10,500 sf (0.25 acres). Approximately 1 foot of coal will be removed from the site for a volume of 400 cy (630 tons).

The total area affected by excavation includes the limit of excavation (following a 6-foot excavation at 2H:1V sideslopes) and the area of surface coal excavation is approximately 41,500 sf (0.95 acres)

The concrete pit, supporting structures, and the AS/SVE system require demolition and off-site disposal. Supporting structures of the concrete pit include the concrete and steel structure located north of the concrete pit and steel structures located within the concrete pit. Abandoning of the AS/SVE system will include removing existing air injection and air extraction piping and grouting the air injection and air extraction wells with a cement bentonite mixture. Disposal of all structures will be at a permitted C&D landfill. Based on field measurements and assumptions, a total of approximately 135 cy (275 tons) of concrete from the concrete pit would be demolished and disposed off site. Volume calculations are provided in Appendix B.

As part of this alternative, the haul road leading to the site will require stabilization. It is assumed that stabilization fabric and 6 inches of gravel will be placed along the haul road. Trees located along the haul road will require trimming.

The initial phase of the removal action would be the implementation of erosion and sediment controls to reduce the potential migration of soil contaminants to downgradient areas. The erosion and sediment controls would be implemented before the remaining portions of the removal action are implemented.

Staging area(s) would be constructed for temporary handling of contaminated soil before off-site transport. It is assumed that contaminated soil will be staged in 500 cy piles. A temporary decontamination pad would also be constructed. Electrical power will be supplied to the site. Equipment and vehicles used during site preparation, excavation, and soil handling would be cleaned and decontaminated at this location. The actual size, design, and location of the staging area(s) would be determined during the remedial design phase.

Contaminated soil would be excavated using common excavation equipment. Visual inspection and PID screening would be used to verify the removal of petroleum-contaminated soil.

After all shallow petroleum-contaminated soil has been removed, the excavated areas would be regraded or backfilled with clean fill and then vegetated. The staging area and decontamination pad would be removed.

4.3.1 Effectiveness

Excavation and off-site disposal would minimize potential risks to human health and the environment by removing shallow petroleum-contaminated soil and contaminated surface soil, and therefore meet the RAOs. This alternative would also eliminate continuing migration of petroleum and soil contaminants to groundwater.

This alternative is expected to provide long-term effectiveness and permanence in removing shallow petroleum-contaminated soil from the site. Approximately 54% of the total petroleum contamination at the site will be removed (Appendix A). Excavation and off-site disposal is commonly used at sites to remove contaminated soil. Excavation below the water table becomes ineffective because of the issue of contaminated groundwater at Site 2. Therefore, it is not a component of this alternative.

Hauling the material off site would have a short-term impact on the community by generating additional traffic. Although there would be a potential for spills of contaminated soil during transport, all materials would be solids that could easily be redeposited into the transport container. Any dust that would be generated could be adequately controlled. Exposure of workers during remediation would be minimized through use of proper personal protective equipment and health and safety standards. Erosion and sediment controls would be needed to control off-site migration of soil contaminants during removal activities.

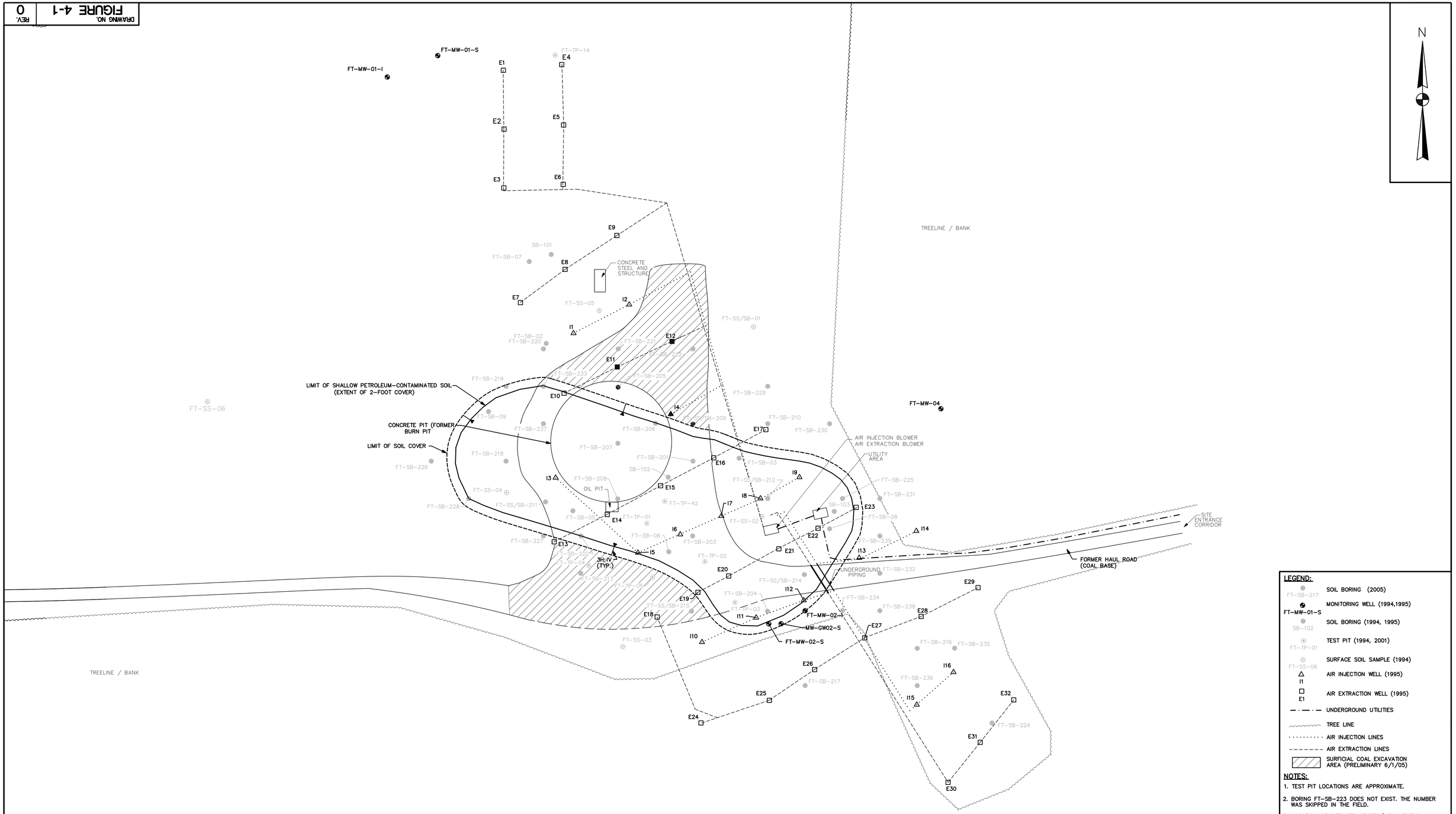
4.3.2 Implementability

Excavation and off-site disposal are common remediation methods. Excavation sideslopes of 2H:1V will be used so that no shoring of the excavation would be needed. There will be no excavation below the water table so no dewatering would be required. Excavation and off-site disposal could be implemented with common construction equipment and transportation methods. Personnel trained to excavate contaminated soils are readily available. Disposal capacity for the anticipated quantity of contaminated soil is available. No long-term O&M would be necessary for this alternative.

The equipment and services needed for excavation are readily available. Upon award of this project, construction could begin within approximately 4 months. Construction time is estimated to take 4 months. Post-construction documents could be completed within another 4 months. Therefore, this alternative could be implemented within approximately 1 year from award date.

4.3.3 Cost

The total estimated capital cost for Alternative 3 is $2,283,965. A detailed cost estimate, including backup calculations, is presented in Appendix C.



LEGEND:

- FT-SB-217 — SOIL BORING (2005)
- FT-MW-01-S — MONITORING WELL (1994,1995)
- SB-102 — SOIL BORING (1994, 1995)
- FT-TP-01 — TEST PIT (1994, 2001)
- FT-SS-06 — SURFACE SOIL SAMPLE (1994)
- I1 — AIR INJECTION WELL (1995)
- E1 — AIR EXTRACTION WELL (1995)
- UNDERGROUND UTILITIES
- TREE LINE
- AIR INJECTION LINES
- AIR EXTRACTION LINES
- SURFICIAL COAL EXCAVATION AREA (PRELIMINARY 6/1/05)

NOTES:

1. TEST PIT LOCATIONS ARE APPROXIMATE.
2. BORING FT-SB-223 DOES NOT EXIST. THE NUMBER WAS SKIPPED IN THE FIELD.
3. LOCATION OF SITE STRUCTURES/AIR INJECTION WELLS/AIR EXTRACTION WELLS ARE OFFSET FROM MONITORING WELL LOCATIONS BY FIVE FEET. USE SITE STRUCTURES /AIR INJECTION WELLS/ AIR EXTRACTION WELLS AS REFERENCE POINTS.

0 30 60
GRAPHIC SCALE IN FEET

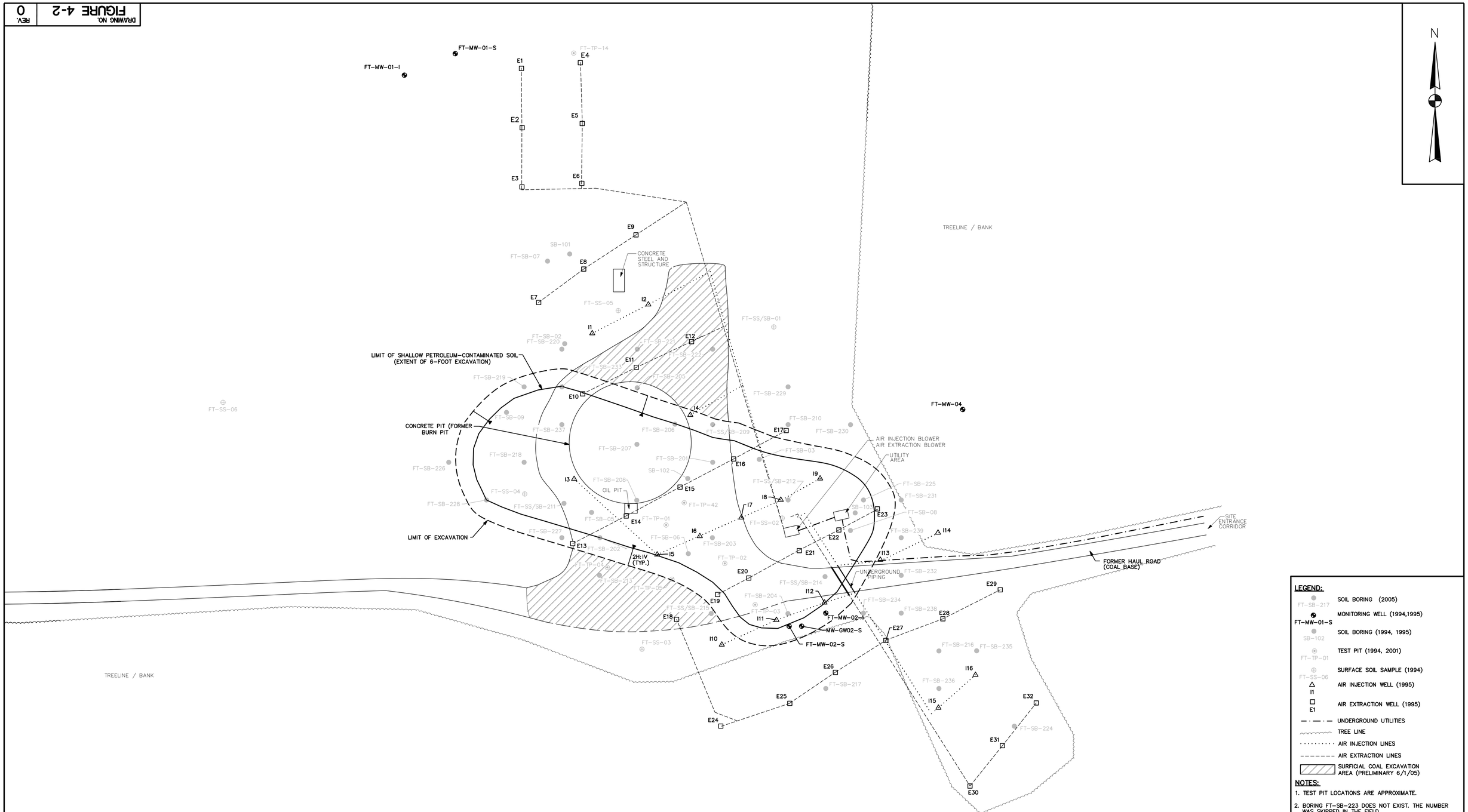
DRAWN BY HJB	DATE 6/1/05	Tetra Tech NUS, Inc.	ALTERNATIVE 2 - SOIL COVER (CONTAINMENT) SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 4-1
REV. 0

FORM CADD NO. TTNUS-D-STD.DWG - REV 1 - 9/11/98

ACAD:1610CP15.dwg 06/01/05 HJB PIT

DRAWING NO. FIGURE 4-1
REV. 0



DRAWN BY HJB	DATE 6/1/05	Tetra Tech NUS, Inc.	ALTERNATIVE 3 - EXCAVATION AND OFF-SITE DISPOSAL SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 4-2
REV. 0

FORM CADD NO. TTNUS-D-STD.DWG - REV 1 - 9/11/98

ACAD:1610CP16.dwg 06/02/05 DM PIT

DRAWING NO. FIGURE 4-2
REV. 0

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

A comparative analysis of the three alternatives is presented in this section. Table 5-1 provides a summary of the comparative analysis presented below.

5.1 EFFECTIVENESS

The No Action alternative would not be effective because shallow petroleum-contaminated soil and contaminated surface soil would remain on site. Alternative 2 (Soil Cover) would reduce potentials risks to human health but would not reduce contaminant migration to groundwater. Alternative 3 (Excavation and Off-Site Disposal) would be an effective solution, as this alternative would prevent direct exposure to petroleum-contaminated soil and prevent or minimize further migration of petroleum contaminants from soil to groundwater.

Alternatives 2 and 3 are both technically reliable with respect to contaminants and site conditions. Soil covers and excavation and off-site disposal are well proven methods to address contamination.

There are no short-term impacts to human health under Alternative 1. For alternatives 2 and 3, exposure of workers during remediation would be minimized through the use of proper protective equipment and health and safety standards.

There are no short-term impacts to the environment under Alternative 1. Activities proposed under Alternative 2 would not affect the surrounding environment. Erosion and sediment controls would be needed to control off-site migration of soil contaminants during containment. For Alternative 3, hauling a large quantity of material off site would have a short-term impact on the community by generating additional traffic. Erosion and sediment controls would be needed to control off-site migration of soil contaminants during removal activities. Alternative 3 is expected to provide long-term effectiveness and permanence in removing petroleum-contaminated soil from the site.

In summary, Alternative 1, No Action, would be ineffective, Alternative 2 would be partially effective, and Alternative 3 would be effective.

5.2 IMPLEMENTABILITY

The No Action alternative would be easiest to implement of the three alternatives because no action would be taken, and therefore, there would not be difficulties or uncertainties associated with implementation.

The technologies to be utilized for the action-oriented alternatives are well-proven. Alternatives 2 and 3 would use locally available materials, including soil. Equipment required to implement both Alternatives 2 and 3 are readily available. Disposal capacity for the volume of soil under Alternative 3 and C&D debris excavated under Alternatives 2 and 3 is available. Alternatives 2 and 3 would not require operational considerations, easements or right-of-ways, or would impact adjoining properties. Alternative 2 would require inspection and maintenance after heavy rainfall events.

Alternatives 2 and 3 could be implemented in less than one year.

5.3 COST

Detailed cost estimates for the alternatives are provided in Appendix B. The estimated capital costs of the alternatives would be as follows:

Alternative 1: $0
Alternative 2: $681,541
Alternative 3: $2,283,965

5.4 CONCLUSIONS

Alternative 3 (Excavation and Off-Site Disposal) provides the best balance of trade-offs based on the evaluation criteria.

TABLE 5-1

SUMMARY OF COMPARISON OF REMOVAL ACTION ALTERNATIVES
SITE 2 – FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

Evaluation Criteria	Alternative 1 – No Action	Alternative 2 – Containment	Alternative 3 – Excavation and Off-Site Disposal
Effectiveness	No reduction in potential risks to human health or the environment. Contaminants would remain at the site. No short-term impacts or concerns.	Provides protection by eliminating exposure to contaminated soil. Approximately 0.5% of the petroleum contamination would be removed from the site. Exposure of workers to contaminants can be adequately controlled. Includes erosion and sediment controls to reduce off-site migration of soil contaminants.	Provides protection by removing shallow petroleum-contaminated soil and surface soil. Approximately 54% of the petroleum contamination would be removed from the site. Hauling soil off site would have short-term effects on the community. Exposure of workers to contaminants can be adequately controlled. Includes erosion and sediment controls to reduce off-site migration of soil contaminants.
Implementability	No action to implement.	Consists of common remediation practices that are readily available and implementable. Could be implemented in less than 1 year. Institutional controls are required.	Consists of common remediation practices that are readily available and implementable. Could be implemented in 1 year. No institutional controls required.
Capital Cost	$0	$681,541	$2,283,965

REFERENCES

C.F. Braun, 1996a. Summary Results Report for Pilot Study Air Sparging/Vapor Extraction System, Naval Weapons Industrial Reserve Plant, Calverton, New York. King of Prussia, Pennsylvania.

C.F. Braun, 1996b. Phase 2 Air Sparging/Soil Vapor Extraction Pilot Study, Naval Weapons Industrial Reserve Plant, Calverton, New York. King of Prussia, Pennsylvania.

CF Braun, 1998. Draft Phase 2 RCRA Facility Investigation for Sites 1, 2, and 7 at the Naval Weapons Industrial Reserve Plant, Calverton, New York. January.

Environmental Laboratory, 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. U.S. Army Corps of Engineers Waterways Experiment Station, Vicksburg, Mississippi.

Fetter, C.W., Jr., 1976. Hydrogeology of the South Fork of Long Island, New York. Bulletin, Geological Society of America, Volume 87, pp. 401-406.

Halliburton NUS Corporation (HNUS), 1992. Final Site Investigation for Naval Weapons Industrial Reserve Plant, Calverton, New York. April.

HNUS,1995a. RCRA Facility Investigation for Naval Weapons Industrial Reserve Plant, Calverton, New York. August.

HNUS, 1995b. Final RCRA Facility Investigation for Naval Weapons Industrial Reserve Plant, Calverton, New York. September.

Isbister, J., 1966. Geology and Hydrology of Northeastern Nassau County, Long Island, New York. Water Supply Paper 1925, U.S. Geological Survey.

Kricher, J.C., 1988. A Field Guide to Eastern Forests. Peterson Field Guide Series.

McClymonds, N., and O. Franke, 1972. Water Transmitting Properties of Aquifers on Long Island, New York. U.S. Geological Survey Professional Paper 627-E.

National Oceanic and Atmospheric Administration (NOAA), 1982. No. 81, Climatography of the United States, Monthly Normals of Temperature, Precipitation, and Heating and Cooling Degree Days, 1951-1980. New York. September.

Naval Energy and Environmental Support Activity (NEESA), 1986. Initial Assessment Study of NWIRP Bethpage and NWIRP Calverton, New York. NEESA 13-100, Rogers, Golden, & Halpern, Philadelphia, PA. December.

Navy, 1986. Initial Assessment Study of NWIRP Bethpage and NWIRP Calverton, New York. NEESA 13-100, Rogers, Golden & Halpern, Philadelphia, PA. December.

Tetra Tech NUS, Inc., (TtNUS, 1998). Engineering Evaluation/Cost Analysis for Sites 2, 6A, 7, and 10B, Naval Weapons Industrial Reserve Plant, Calverton, New York. Prepared for Northern Division, Naval Facilities Engineering Command, Lester, Pennsylvania, September.

Tetra Tech NUS, Inc., (TtNUS, 2005). Data Summary Report for Site 2 – Fire Training Area, Naval Weapons Industrial Reserve Plant, Calverton, New York. Prepared for Northern Division, Naval Facilities Engineering Command, Lester, Pennsylvania, September.

United States Department of Commerce (USDOC), 1961. Weather Bureau Technical Paper No. 40. Rainfall Frequency Atlas of the United States.

United States Department of the Interior (USDOI), 1980. National Wetlands Inventory Maps for Wading River, Riverhead, and Mattituk, New York. Fish and Wildlife Service. April.

APPENDIX A

DATA SUMMARY REPORT – ANALYTICAL RESULTS

TABLE 3-1

SUMMARY OF POSITIVE RESULTS - SURFACE SOIL
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value (1)	FT-SS-209	FT-SS-211	FT-SS-212	FT-SS-214	FT-SS-215
Petroleum Hydrocarbons (mg/kg)						
DIESEL RANGE ORGANICS	1000	480	**1100**	18		
GASOLINE RANGE ORGANICS	1000					
Semivolatile Organics (ug/kg)						
2-METHYLNAPHTHALENE	36400				44	
ACENAPHTHYLENE	41000			4.8 J	35 J	20 J
ANTHRACENE	50000	230	3600 J	2.9 J	1.1 J	3.3 J
BENZO(A)ANTHRACENE	224	**730**	**13000**	18	5.6 J	50
BENZO(A)PYRENE	61	**700**	**12000**	17	5.3 J	61
BENZO(B)FLUORANTHENE	1100	660	**11000**	18	17	60
BENZO(G,H,I)PERYLENE	50000	470	7400	15	13	47
BENZO(K)FLUORANTHENE	1100	430	**7200**	11	7 J	38
CHRYSENE	400	**720**	**12000**	17	8.6	51
DIBENZO(A,H)ANTHRACENE	14	**160 J**	**1800 J**		7.9	12
FLUORANTHENE	50000	1600	30000	32	10	80
FLUORENE	50000	110 J	2800 J	2.3 J		
INDENO(1,2,3-CD)PYRENE	3200	580	**7700**	13	18	54
NAPHTHALENE	13000				11 J	
PHENANTHRENE	50000	1100	20000	16	24	30
PYRENE	50000	1200	31000	33	12	100
Pesticides/PCBs (ug/kg)						
4,4'-DDD	2900	4 J		1 J	2.1 J	3.5 J
4,4'-DDE	2100	6.2 J	88 J	1.6 J	1.3 J	9 J
4,4'-DDT	2100			4.3	35	
ALPHA-CHLORDANE	540	6.1 J		1.7 J	1.4 J	13 J
AROCLOR-1248	1000					**1100**
AROCLOR-1254	1000			67		
AROCLOR-1260	1000	1000	190	40	730	930
ENDOSULFAN II	900			2.5 J		24

TABLE 3-1

SUMMARY OF POSITIVE RESULTS - SURFACE SOIL
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SS-209	FT-SS-211	FT-SS-212	FT-SS-214	FT-SS-215
Inorganics (mg/kg)						
ALUMINUM	16800 [2]	2300	3380	3580	4720	6120
ANTIMONY	31/410 [3]	0.46				
ARSENIC	14 [2]	2.1	2.5	0.79	2	5.5
BARIUM	300	21.2	11.3	5.1	15.7	76.2
BERYLLIUM	0.16	0.1			0.15	**0.4**
CADMIUM	1.9 [2]	0.51	0.35	0.039	0.19	0.051
CALCIUM [4]	447 [2]	192	**2130**	42.1	153	**1040**
CHROMIUM	50	13.7	6.8	4.5	9.1	7.7
COBALT	30	0.58	0.88	0.51	3.3	1.6
COPPER	25	10.4	6.8	2.4	6	12.2
IRON	16900 [2]	2940	3280	2980	5990	10000
LEAD	48.6 [2]	41.4	15.2	5.2	14.3	9.2
MAGNESIUM [4]	1560 [2]	191	1260	220	811	689
MANGANESE	90.8 [2]	21.8	31	15.6	**156**	41.3
MERCURY	0.1	0.07	0.023	0.012	0.017	0.033
NICKEL	13	1.7	2.4	1.5	5.1	6.4
POTASSIUM [4]	348 [2]	68.3	83.6	75.5	192	204
SELENIUM	2	0.76	0.75		0.31	0.49
SILVER	390/5,100 [3]	0.19	0.27			0.19
SODIUM [4]	285 [2]	**286**	259	276	220	241
VANADIUM	150	7.5	7.6	6.9	10.8	29.3
ZINC	38.4 [2]	33.6	19	6.1	18.3	11.7

NOTES:
1 Screening values taken from NYSDEC TAGM No. 4046 unless otherwise noted.
2 Background value from RCRA Facility Assessment-Sampling Visit (NUS, 1995).
3 USEPA Region III RBC (residential/industrial) value (http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc0405.pdf). Lesser of two numbers used as screening value.
4 Calcium, magnesium, sodium, and potassium are essential nutrients.

Bold indicates exceedance of screening level.
Blank cells indicate result was non-detect.
J = Estimated due to uncertainty near the detection limit.

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-201-0305	FT-SB-201-1012	FT-SB-201-1516	FT-SB-202-0305	FT-SB-202-0305-D	FT-SB-202-1112	FT-SB-203-0204	FT-SB-203-0608	FT-SB-203-1516
Petroleum Hydrocarbons (mg/kg)										
DIESEL RANGE ORGANICS	1000	**4900**	**3800**	**2100**			400	**11000**	**2100**	**8400**
GASOLINE RANGE ORGANICS	1000	110	19	120				79		
Volatile Organics (ug/kg)										
1,1-DICHLOROETHANE	200	0.51 J	NS	NS			NS	1 J	NS	NS
2-BUTANONE	300	8.3 J	NS	NS	2.3 J		NS	3.1 J	NS	NS
ACETONE	200	38 J	NS	NS	12 J		NS	13 J	NS	NS
BENZENE	60		NS	NS			NS		NS	NS
CIS-1,2-DICHLOROETHENE	NC	1 J	NS	NS	2.5 J		NS	1.1 J	NS	NS
ETHYLBENZENE	5500	9.9	NS	NS			NS	11	NS	NS
ISOPROPYLBENZENE	NC	8.7	NS	NS			NS	11	NS	NS
METHYL CYCLOHEXANE	NC	1.5 J	NS	NS			NS	8.5	NS	NS
METHYLENE CHLORIDE	100		NS	NS		2.6 J	NS		NS	NS
TOLUENE	1500	36	NS	NS			NS	8.6	NS	NS
TOTAL XYLENES	1200	87	NS	NS			NS	130	NS	NS
TRICHLOROETHENE	700	0.89 J	NS	NS			NS		NS	NS
VINYL CHLORIDE	200		NS	NS			NS		NS	NS
Semivolatile Organics (ug/kg)										
2-METHYLNAPHTHALENE	36400	4100 J	NS	NS			NS	8700	NS	NS
ACENAPHTHENE	50000		NS	NS			NS	380 J	NS	NS
ACENAPHTHYLENE	41000		NS	NS	13 J		NS		NS	NS
ANTHRACENE	50000	10 J	NS	NS	32 J	15 J	NS	110 J	NS	NS
BENZO(A)ANTHRACENE	224	31 J	NS	NS	73 J	35 J	NS	**960**	NS	NS
BENZO(A)PYRENE	61	39 J	NS	NS	**82 J**	42 J	NS	**610**	NS	NS
BENZO(B)FLUORANTHENE	1100	40 J	NS	NS	70 J	41 J	NS	1000	NS	NS
BENZO(G,H,I)PERYLENE	50000	53 J	NS	NS	65 J	32 J	NS	680	NS	NS
BENZO(K)FLUORANTHENE	1100	26 J	NS	NS	40 J	24 J	NS	600	NS	NS
CHRYSENE	400	30 J	NS	NS	71 J		NS	**1100**	NS	NS
DIBENZO(A,H)ANTHRACENE	14	**20 J**	NS	NS	6.2 J	6.2 J	NS	**190 J**	NS	NS
FLUORANTHENE	50000	76 J	NS	NS	170 J	78 J	NS	3200	NS	NS
FLUORENE	50000	160 J	NS	NS	17 J	7.6 J	NS	730	NS	NS
INDENO(1,2,3-CD)PYRENE	3200	60 J	NS	NS	57 J	29 J	NS	600	NS	NS
NAPHTHALENE	13000	1200 J	NS	NS		6.9 J	NS	2200	NS	NS
PHENANTHRENE	50000	290 J	NS	NS	120 J	55 J	NS	2300	NS	NS
PYRENE	50000	78 J	NS	NS	170 J	86 J	NS	3200	NS	NS

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-201-0305	FT-SB-201-1012	FT-SB-201-1516	FT-SB-202-0305	FT-SB-202-0305-D	FT-SB-202-1112	FT-SB-203-0204	FT-SB-203-0608	FT-SB-203-1516
Pesticides/PCBs (ug/kg)										
4,4'-DDD	2900	1.5 R	NS	NS	8.2	5.8	NS	4.3 R	NS	NS
4,4'-DDE	2100	4.5	NS	NS	1.7 J	1.1 J	NS	7.2 J	NS	NS
4,4'-DDT	2100		NS	NS	1 R	0.63 R	NS		NS	NS
ALPHA-CHLORDANE	540	4.9	NS	NS			NS		NS	NS
AROCLOR-1248	10000		NS	NS			NS		NS	NS
AROCLOR-1260	10000	510	NS	NS			NS	1800	NS	NS
DIELDRIN	44	2.5 J	NS	NS	0.29 R	0.33 J	NS	3.1 R	NS	NS
ENDOSULFAN II	900		NS	NS			NS		NS	NS
ENDOSULFAN SULFATE	1000	5	NS	NS			NS		NS	NS
ENDRIN	100		NS	NS	0.21 R		NS		NS	NS
ENDRIN ALDEHYDE	0		NS	NS			NS		NS	NS
GAMMA-CHLORDANE	540	2.1 R	NS	NS	1.1 J	0.9 J	NS	2.8 R	NS	NS
Inorganics (mg/kg)										
ALUMINUM	16800 [2]	2810	NS	NS	2240	2120	NS	2710	NS	NS
ANTIMONY	31/410 [3]		NS	NS			NS		NS	NS
ARSENIC	14 [2]	0.76	NS	NS	0.69	0.65	NS	0.57	NS	NS
BARIUM	300	11	NS	NS	11	10.1	NS	13.9	NS	NS
BERYLLIUM	0.16		NS	NS			NS		NS	NS
CADMIUM	1.9 [2]	0.19	NS	NS	0.06	0.082	NS	0.053	NS	NS
CALCIUM [4]	447 [2]	311	NS	NS	**1220**	**1110**	NS	**549**	NS	NS
CHROMIUM	50	5.7	NS	NS	4.1	4	NS	3.5	NS	NS
COBALT	30	0.44	NS	NS	0.41	0.33	NS	0.3	NS	NS
COPPER	25	3.3	NS	NS	2.4	2.5	NS	2.5	NS	NS
IRON	16900 [2]	1660	NS	NS	1650	1580	NS	1460	NS	NS
LEAD	48.6 [2]	14.8	NS	NS	3.4	3.8	NS	13.4	NS	NS
MAGNESIUM [4]	1560 [2]	119	NS	NS	305	254	NS	119	NS	NS
MANGANESE	90.8 [2]	9.5	NS	NS	21.8	17.3	NS	11	NS	NS
MERCURY	0.1	0.019	NS	NS	0.0093	0.0059	NS	0.016	NS	NS
NICKEL	13	1.2	NS	NS	1.3	1.2	NS	1.2	NS	NS
POTASSIUM [4]	348 [2]	65.7	NS	NS	52.1	53.7	NS	66.1	NS	NS
SELENIUM	2	0.3	NS	NS	0.58	0.67	NS		NS	NS
SILVER	390/5,100 [3]	0.17	NS	NS			NS		NS	NS
SODIUM [4]	285 [2]	**322**	NS	NS	**330**	277	NS	275	NS	NS
VANADIUM	150	7	NS	NS	5.9	5.5	NS	7.5	NS	NS
ZINC	38.4 [2]	22.3	NS	NS	6.6	5.8	NS	11.9	NS	NS

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-204-0204	FT-SB-204-0608	FT-SB-204-1416	FT-SB-204-1416-D	FT-SB-205-0305	FT-SB-206-0506	FT-SB-206-1416	FT-SB-207-0305	FT-SB-207-1012
Petroleum Hydrocarbons (mg/kg)										
DIESEL RANGE ORGANICS	1000	23		**8900**	**6000**		**1500**		**8400**	**3200**
GASOLINE RANGE ORGANICS	1000				27		8.6		36	
Volatile Organics (ug/kg)										
1,1-DICHLOROETHANE	200		NS	NS	NS	NS	NS	NS	4.8 J	NS
2-BUTANONE	300		NS	NS	NS	NS	NS	NS	5.3 J	NS
ACETONE	200		NS	NS	NS	NS	NS	NS	19 J	NS
BENZENE	60		NS	NS	NS	NS	NS	NS	0.96 J	NS
CIS-1,2-DICHLOROETHENE	NC		NS	NS	NS	NS	NS	NS	10	NS
ETHYLBENZENE	5500		NS	NS	NS	NS	NS	NS	25	NS
ISOPROPYLBENZENE	NC		NS	NS	NS	NS	NS	NS	14	NS
METHYL CYCLOHEXANE	NC		NS	NS	NS	NS	NS	NS	4.3 J	NS
METHYLENE CHLORIDE	100		NS	NS	NS	NS	NS	NS		NS
TOLUENE	1500		NS	NS	NS	NS	NS	NS	38	NS
TOTAL XYLENES	1200		NS	NS	NS	NS	NS	NS	210	NS
TRICHLOROETHENE	700		NS	NS	NS	NS	NS	NS		NS
VINYL CHLORIDE	200		NS	NS	NS	NS	NS	NS	1.1 J	NS
Semivolatile Organics (ug/kg)										
2-METHYLNAPHTHALENE	36400		NS	NS	NS	NS	NS	NS	540	NS
ACENAPHTHENE	50000		NS	NS	NS	NS	NS	NS		NS
ACENAPHTHYLENE	41000	63	NS	NS	NS	NS	NS	NS		NS
ANTHRACENE	50000	5.1 J	NS	NS	NS	NS	NS	NS	6.4 J	NS
BENZO(A)ANTHRACENE	224	29	NS	NS	NS	NS	NS	NS	37	NS
BENZO(A)PYRENE	61	38	NS	NS	NS	NS	NS	NS	23	NS
BENZO(B)FLUORANTHENE	1100	40	NS	NS	NS	NS	NS	NS	30	NS
BENZO(G,H,I)PERYLENE	50000	26	NS	NS	NS	NS	NS	NS	18	NS
BENZO(K)FLUORANTHENE	1100	30	NS	NS	NS	NS	NS	NS	17	NS
CHRYSENE	400	29	NS	NS	NS	NS	NS	NS	29	NS
DIBENZO(A,H)ANTHRACENE	14	13	NS	NS	NS	NS	NS	NS	5.5 J	NS
FLUORANTHENE	50000	58	NS	NS	NS	NS	NS	NS		NS
FLUORENE	50000		NS	NS	NS	NS	NS	NS	23	NS
INDENO(1,2,3-CD)PYRENE	3200	29	NS	NS	NS	NS	NS	NS	20	NS
NAPHTHALENE	13000	3.6 J	NS	NS	NS	NS	NS	NS	150	NS
PHENANTHRENE	50000	28	NS	NS	NS	NS	NS	NS	69	NS
PYRENE	50000	66	NS	NS	NS	NS	NS	NS	53	NS

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-204-0204	FT-SB-204-0608	FT-SB-204-1416	FT-SB-204-1416-D	FT-SB-205-0305	FT-SB-206-0506	FT-SB-206-1416	FT-SB-207-0305	FT-SB-207-1012
Pesticides/PCBs (ug/kg)										
4,4'-DDD	2900		NS	NS	NS	NS	NS	NS	4.8	NS
4,4'-DDE	2100	1.3 J	NS	NS	NS	NS	NS	NS	4.6	NS
4,4'-DDT	2100	14	NS	NS	NS	NS	NS	NS		NS
ALPHA-CHLORDANE	540		NS	NS	NS	NS	NS	NS		NS
AROCLOR-1248	10000		NS	NS	NS	NS	NS	NS	67	NS
AROCLOR-1260	10000	41	NS	NS	NS	NS	NS	NS	140	NS
DIELDRIN	44		NS	NS	NS	NS	NS	NS	1.5 R	NS
ENDOSULFAN II	900		NS	NS	NS	NS	NS	NS		NS
ENDOSULFAN SULFATE	1000		NS	NS	NS	NS	NS	NS	3.8 J	NS
ENDRIN	100		NS	NS	NS	NS	NS	NS		NS
ENDRIN ALDEHYDE	0		NS	NS	NS	NS	NS	NS		NS
GAMMA-CHLORDANE	540		NS	NS	NS	NS	NS	NS	1 R	NS
Inorganics (mg/kg)										
ALUMINUM	16800 [2]	1870	NS	NS	NS	NS	NS	NS	1780	NS
ANTIMONY	31/410 [3]		NS	NS	NS	NS	NS	NS		NS
ARSENIC	14 [2]	0.74	NS	NS	NS	NS	NS	NS	0.65	NS
BARIUM	300	7.2	NS	NS	NS	NS	NS	NS	11.8	NS
BERYLLIUM	0.16		NS	NS	NS	NS	NS	NS		NS
CADMIUM	1.9 [2]	0.12	NS	NS	NS	NS	NS	NS	0.31	NS
CALCIUM [4]	447 [2]	107	NS	NS	NS	NS	NS	NS	**1680**	NS
CHROMIUM	50	3.1	NS	NS	NS	NS	NS	NS	8.6	NS
COBALT	30	0.49	NS	NS	NS	NS	NS	NS	5.7	NS
COPPER	25	2.2	NS	NS	NS	NS	NS	NS	6.9	NS
IRON	16900 [2]	1410	NS	NS	NS	NS	NS	NS	1780	NS
LEAD	48.6 [2]	4.6	NS	NS	NS	NS	NS	NS	18.1	NS
MAGNESIUM [4]	1560 [2]	91.6	NS	NS	NS	NS	NS	NS	268	NS
MANGANESE	90.8 [2]	13.1	NS	NS	NS	NS	NS	NS	28.1	NS
MERCURY	0.1	0.0043	NS	NS	NS	NS	NS	NS	0.028	NS
NICKEL	13	1.4	NS	NS	NS	NS	NS	NS	1.1	NS
POTASSIUM [4]	348 [2]	54.7	NS	NS	NS	NS	NS	NS	103	NS
SELENIUM	2	0.39	NS	NS	NS	NS	NS	NS		NS
SILVER	390/5,100 [3]		NS	NS	NS	NS	NS	NS		NS
SODIUM [4]	285 [2]	277	NS	NS	NS	NS	NS	NS	**448**	NS
VANADIUM	150	4.5	NS	NS	NS	NS	NS	NS	5.6	NS
ZINC	38.4 [2]	9	NS	NS	NS	NS	NS	NS	18.2	NS

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-207-1416	FT-SB-208-0204	FT-SB-208-1416	FT-SB-209-0305	FT-SB-210-0406	FT-SB-211-0305	FT-SB-213-0305	FT-SB-215-0305	FT-SB-219-0507
Petroleum Hydrocarbons (mg/kg)										
DIESEL RANGE ORGANICS	1000	**1300**		30		290	990	21		32
GASOLINE RANGE ORGANICS	1000	130					64			
Volatile Organics (ug/kg)										
1,1-DICHLOROETHANE	200	NS	NS	NS		NS				NS
2-BUTANONE	300	NS	NS	NS		NS	8.8			NS
ACETONE	200	NS	NS	NS		NS	25			NS
BENZENE	60	NS	NS	NS		NS				NS
CIS-1,2-DICHLOROETHENE	NC	NS	NS	NS		NS				NS
ETHYLBENZENE	5500	NS	NS	NS		NS	11			NS
ISOPROPYLBENZENE	NC	NS	NS	NS		NS	7.2			NS
METHYL CYCLOHEXANE	NC	NS	NS	NS		NS	7.5			NS
METHYLENE CHLORIDE	100	NS	NS	NS		NS				NS
TOLUENE	1500	NS	NS	NS		NS	0.99 J			NS
TOTAL XYLENES	1200	NS	NS	NS		NS	98			NS
TRICHLOROETHENE	700	NS	NS	NS		NS				NS
VINYL CHLORIDE	200	NS	NS	NS		NS				NS
Semivolatile Organics (ug/kg)										
2-METHYLNAPHTHALENE	36400	NS	NS	NS	4.9 J				5.5 J	
ACENAPHTHENE	50000	NS	NS	NS						
ACENAPHTHYLENE	41000	NS	NS	NS						
ANTHRACENE	50000	NS	NS	NS		5.3 J	26	12 J		2.5 J
BENZO(A)ANTHRACENE	224	NS	NS	NS		30	73	84		11
BENZO(A)PYRENE	61	NS	NS	NS		27	**80**	**100**		15
BENZO(B)FLUORANTHENE	1100	NS	NS	NS		30		97		12
BENZO(G,H,I)PERYLENE	50000	NS	NS	NS		51	120	79		21
BENZO(K)FLUORANTHENE	1100	NS	NS	NS		19	43	62		7.4
CHRYSENE	400	NS	NS	NS		30	68	82		11
DIBENZO(A,H)ANTHRACENE	14	NS	NS	NS		11	**19 J**	**25**		5.9 J
FLUORANTHENE	50000	NS	NS	NS		63	170	150	1.6 J	18
FLUORENE	50000	NS	NS	NS			12 J	9.1 J		2.1 J
INDENO(1,2,3-CD)PYRENE	3200	NS	NS	NS		31	59	86		19
NAPHTHALENE	13000	NS	NS	NS						
PHENANTHRENE	50000	NS	NS	NS	3.3 J	38	130	69	5 J	11
PYRENE	50000	NS	NS	NS	0.6 J	62	160	160	1.2 J	21

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-207-1416	FT-SB-208-0204	FT-SB-208-1416	FT-SB-209-0305	FT-SB-210-0406	FT-SB-211-0305	FT-SB-213-0305	FT-SB-215-0305	FT-SB-219-0507
Pesticides/PCBs (ug/kg)										
4,4'-DDD	2900	NS	NS	NS		0.48 R	2.9	0.39 R		
4,4'-DDE	2100	NS	NS	NS	0.25 R		0.51 J	0.39 J		
4,4'-DDT	2100	NS	NS	NS	3		2.8	2.5		1.6 J
ALPHA-CHLORDANE	540	NS	NS	NS	0.72 J	4.9	3.5	0.69 J		0.66 R
AROCLOR-1248	10000	NS	NS	NS						
AROCLOR-1260	10000	NS	NS	NS		170		4.8 J		28 J
DIELDRIN	44	NS	NS	NS		4.4				
ENDOSULFAN II	900	NS	NS	NS	0.77 J	6.5		0.68 J		0.92 J
ENDOSULFAN SULFATE	1000	NS	NS	NS			0.3 R			0.82 J
ENDRIN	100	NS	NS	NS	0.27 R	4.8 R	0.83 J	0.37 J		0.49 R
ENDRIN ALDEHYDE	0	NS	NS	NS		1.1 R				
GAMMA-CHLORDANE	540	NS	NS	NS	0.92 J	1.6 R	0.7 J	0.46 J		0.57 J
Inorganics (mg/kg)										
ALUMINUM	16800 [2]	NS	NS	NS	3590	1420	2180	2050	1660	3450
ANTIMONY	31/410 [3]	NS	NS	NS		0.43				
ARSENIC	14 [2]	NS	NS	NS	0.97	0.65	1	0.47	0.63	0.83
BARIUM	300	NS	NS	NS	5.7	5.3	16.1	3.2	3.5	5.4
BERYLLIUM	0.16	NS	NS	NS	**0.17**	0.095	**0.19**	0.092	0.096	0.12
CADMIUM	1.9 [2]	NS	NS	NS		0.18	0.094			
CALCIUM [4]	447 [2]	NS	NS	NS	38.4	35	**913**	45.7	26.1	52.5
CHROMIUM	50	NS	NS	NS	4.6	8.2	7.1	4.2	3.7	5
COBALT	30	NS	NS	NS	1.1	0.62	0.55	0.61	0.68	0.94
COPPER	25	NS	NS	NS	1.8	2.4	2.6	1.7	1.7	2
IRON	16900 [2]	NS	NS	NS	3620	2140	1920	1740	1590	3240
LEAD	48.6 [2]	NS	NS	NS	2.2	14.4	6.2	1.8	1.6	3.3
MAGNESIUM [4]	1560 [2]	NS	NS	NS	327	179	149	113	141	403
MANGANESE	90.8 [2]	NS	NS	NS	23.2	10.9	19.4	11.9	14.5	23.3
MERCURY	0.1	NS	NS	NS	0.0079	0.013	0.028	0.011		0.0071
NICKEL	13	NS	NS	NS	1.6	1.2	1.4	1.1	0.96	1.8
POTASSIUM [4]	348 [2]	NS	NS	NS	101	86.7	62	58.8	68.2	112
SELENIUM	2	NS	NS	NS	0.19		0.38		0.32	
SILVER	390/5,100 [3]	NS	NS	NS			0.055	0.052	0.048	
SODIUM [4]	285 [2]	NS	NS	NS		15.8	26.9	12.5	16.3	
VANADIUM	150	NS	NS	NS	7.6	4.4	5.8	4	3.8	6.8
ZINC	38.4 [2]	NS	NS	NS	6.8	8.3	16.4	3.2	2.9	9.4

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

PARAMETER	Screening Value [1]	FT-SB-219-0507	FT-SB-221-0406	FT-SB-224-0305	FT-SB-224-0305-D	FT-SB-225-0305	FT-SB-226-0305
Petroleum Hydrocarbons (mg/kg)							
DIESEL RANGE ORGANICS	1000	32			6.4 J	**1200**	46
GASOLINE RANGE ORGANICS	1000						
Volatile Organics (ug/kg)							
1,1-DICHLOROETHANE	200	NS	NS				
2-BUTANONE	300	NS	NS				
ACETONE	200	NS	NS				11 J
BENZENE	60	NS	NS				
CIS-1,2-DICHLOROETHENE	NC	NS	NS				
ETHYLBENZENE	5500	NS	NS				
ISOPROPYLBENZENE	NC	NS	NS				
METHYL CYCLOHEXANE	NC	NS	NS				
METHYLENE CHLORIDE	100	NS	NS		2.5 J		
TOLUENE	1500	NS	NS				
TOTAL XYLENES	1200	NS	NS				
TRICHLOROETHENE	700	NS	NS				
VINYL CHLORIDE	200	NS	NS				
Semivolatile Organics (ug/kg)							
2-METHYLNAPHTHALENE	36400		8 J			53	
ACENAPHTHENE	50000						
ACENAPHTHYLENE	41000						7.9 J
ANTHRACENE	50000	2.5 J					71
BENZO(A)ANTHRACENE	224	11		1.2 J	1.4 J	9	190
BENZO(A)PYRENE	61	15		1.5 J	1.6 J	17	**180**
BENZO(B)FLUORANTHENE	1100	12		2.1 J	1.8 J	32	160
BENZO(G,H,I)PERYLENE	50000	21		2 J	4.2 J	97	110
BENZO(K)FLUORANTHENE	1100	7.4		1.2 J	0.88 J	11	110
CHRYSENE	400	11		1.3 J	2.1 J	9.7	180
DIBENZO(A,H)ANTHRACENE	14	5.9 J				**15**	**27 J**
FLUORANTHENE	50000	18		3.5 J	4 J		460
FLUORENE	50000	2.1 J					53
INDENO(1,2,3-CD)PYRENE	3200	19		1.2 J	2.1 J	45	130
NAPHTHALENE	13000					11 J	
PHENANTHRENE	50000	11	3.2 J	4.3 J	3.4 J	20	380
PYRENE	50000	21		3.9 J	4.1 J	22	490

TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

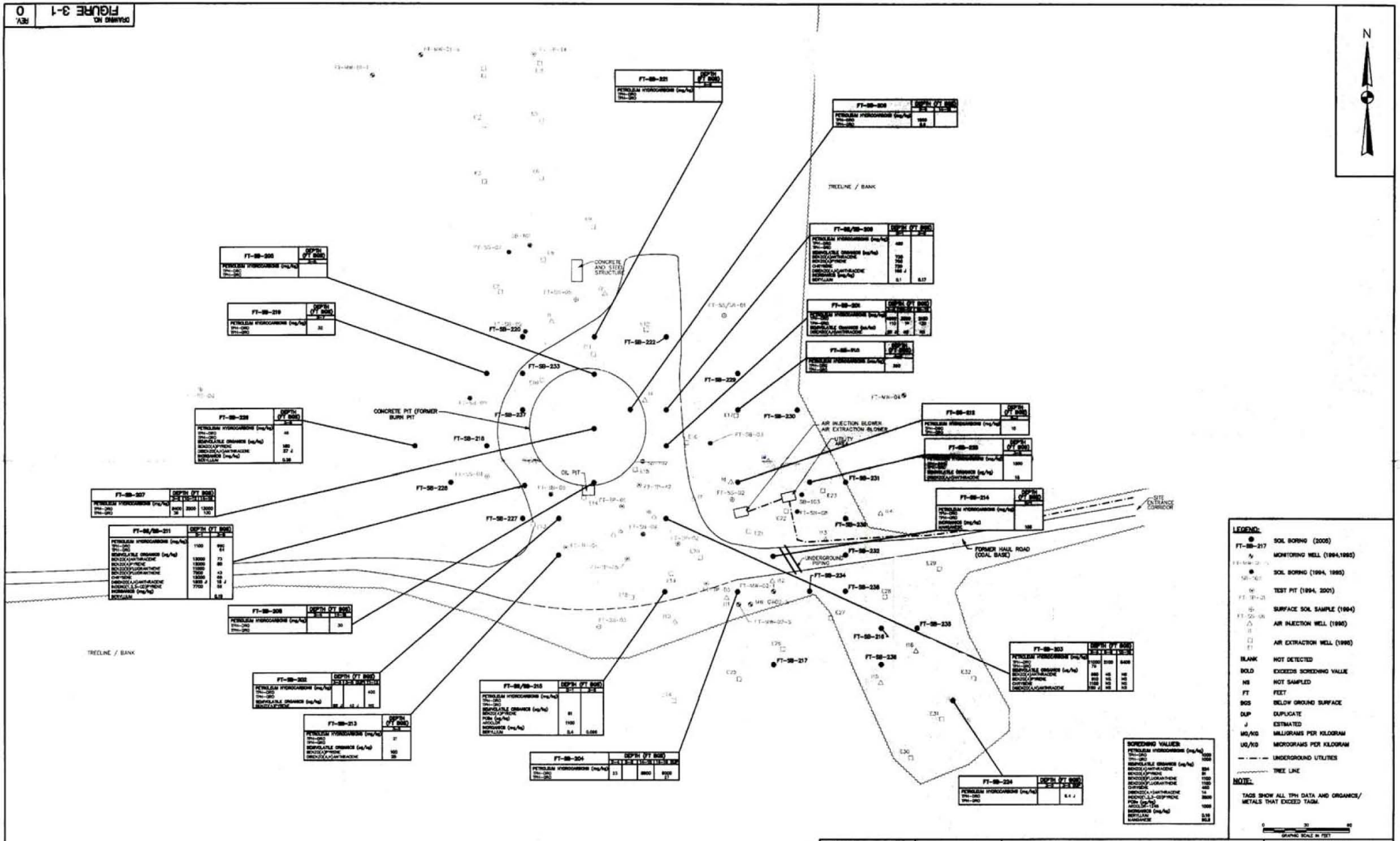
PARAMETER	Screening Value [1]	FT-SB-219-0507	FT-SB-221-0406	FT-SB-224-0305	FT-SB-224-0305-D	FT-SB-225-0305	FT-SB-226-0305
Pesticides/PCBs (ug/kg)							
4,4'-DDD	2900		0.25 R			0.38 R	0.73 J
4,4'-DDE	2100			0.53 J	0.52 J	1.3 J	2.5
4,4'-DDT	2100	1.6 J		0.56 R	0.35 R		5.5
ALPHA-CHLORDANE	540	0.66 R	0.32 J	0.68 J	0.77 J	0.82 R	
AROCLOR-1248	10000						
AROCLOR-1260	10000	28 J				46	
DIELDRIN	44				0.24 J	0.3 R	
ENDOSULFAN II	900	0.92 J	0.37 J		0.28 R		
ENDOSULFAN SULFATE	1000	0.82 J		0.34 J	0.25 J	0.51 J	
ENDRIN	100	0.49 R	0.24 R	0.24 J	0.28 J	4	0.22 R
ENDRIN ALDEHYDE	0		0.74 J			2 R	
GAMMA-CHLORDANE	540	0.57 J		0.7 J	0.71 J	0.95 R	0.76 R
Inorganics (mg/kg)							
ALUMINUM	16800 [2]	3450	4530	1510	1640	2600	3130
ANTIMONY	31/410 [3]						
ARSENIC	14 [2]	0.83	1.1	0.4	0.44	0.7	1.9
BARIUM	300	5.4	7.9	2.5	2.8	18.1	20.3
BERYLLIUM	0.16	0.12	0.16	0.11	0.11	0.13	**0.26**
CADMIUM	1.9 [2]		0.067			0.44	0.044
CALCIUM [4]	447 [2]	52.5	54	40.9	40.3	66.1	**652**
CHROMIUM	50	5	5.4	2.5	2.8	10.5	4.2
COBALT	30	0.94	0.96	0.83	0.78	0.92	0.91
COPPER	25	2	2.2	1.2	1.3	3.1	7.2
IRON	16900 [2]	3240	4210	1530	1570	1550	2450
LEAD	48.6 [2]	3.3	3	1.5	1.8	31	4.8
MAGNESIUM [4]	1560 [2]	403	376	107	118	287	181
MANGANESE	90.8 [2]	23.3	19.6	26.4	24.4	12.5	20.1
MERCURY	0.1	0.0071	0.02	0.0047	0.0054	0.024	0.018
NICKEL	13	1.8	2	0.77	0.83	1.5	2
POTASSIUM [4]	348 [2]	112	108	72	70.9	107	74.5
SELENIUM	2		0.28			0.22	0.35
SILVER	390/5,100 [3]			0.049	0.059	0.067	0.071
SODIUM [4]	285 [2]		14.7	17	14.6		25
VANADIUM	150	6.8	7.8	3.5	3.9	5.3	7.4
ZINC	38.4 [2]	9.4	8.1	3	3.1	22.8	7.2

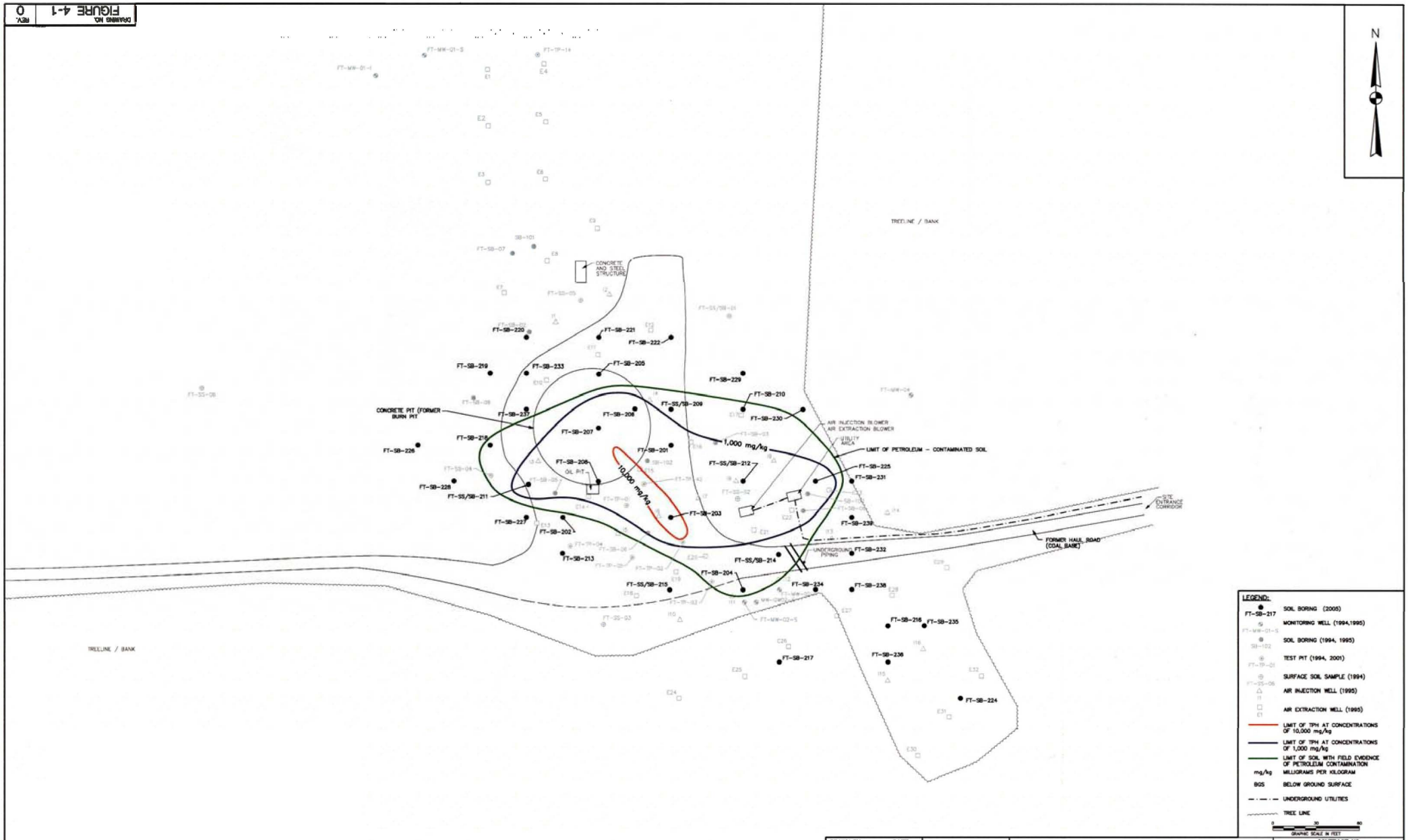
TABLE 3-2

SUMMARY OF POSITIVE RESULTS - SOIL BORINGS
SOIL INVESTIGATION DATA SUMMARY REPORT
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK

NOTES:
1 Screening values taken from NYSDEC TAGM No. 4046 unless otherwise noted.
2 Background value from RCRA Facility Assessment-Sampling Visit (NUS, 1995).
3 USEPA Region III RBC (residential/industrial) value (http://www.epa.gov/reg3hwmd/risk/human/rbc/rbc0405.pdf). Lesser of two numbers used as screening value.
4 Calcium, magnesium, sodium, and potassium are essential nutrients.

Bold indicates exceedance of screening level.
Blank cells indicate result was non-detect.
J = Estimated due to uncertainty near the detection limit.
NC = No criteria.
NS = Not sampled.
R = Rejected.

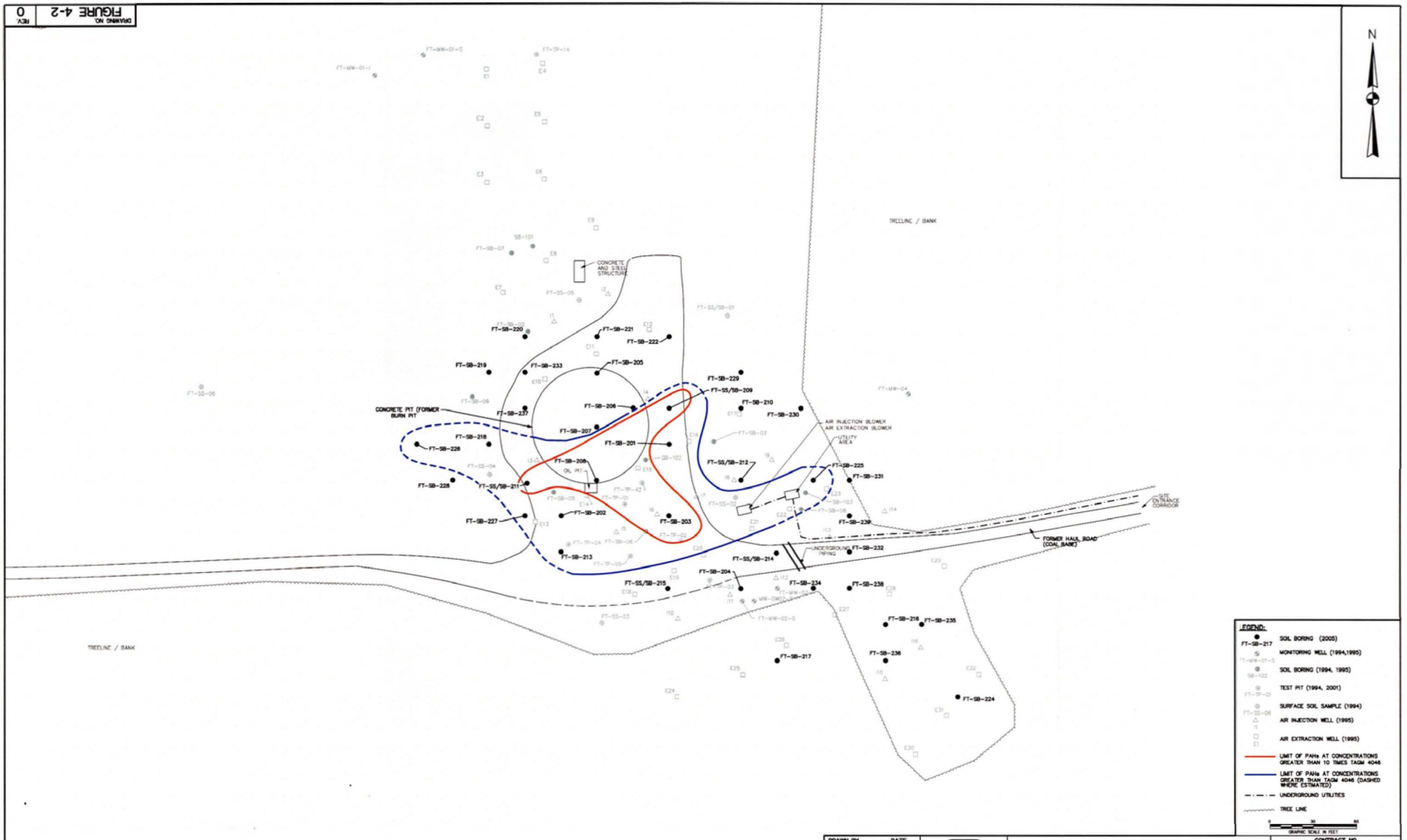

N
TREELINE / BANK
CONCRETE AND STEEL STRUCTURE
CONCRETE PIT (FORMER BURN PIT
OIL PIT
AIR INJECTION BLOWER
AIR EXTRACTION BLOWER
UTILITY VAULT
UNDERGROUND PIPING
FORMER HAUL ROAD (COAL BASE)
SITE ENTRANCE CORRIDOR
FT-SB-220
FT-SB-222
FT-SB-229
FT-SB-230
FT-SB-231
FT-SB-232
FT-SB-234
FT-SB-235
FT-SB-236
FT-SB-237
FT-SB-233
FT-SB-227
FT-SB-228
FT-SB-216
FT-SB-217
LEGEND:
FT-SB-217 SOIL BORING (2005)
MONITORING WELL (1994,1995)
SOIL BORING (1994, 1995)
TEST PIT (1994, 2001)
SURFACE SOIL SAMPLE (1994)
AIR INJECTION WELL (1995)
AIR EXTRACTION WELL (1995)
BLANK NOT DETECTED
BOLD EXCEEDS SCREENING VALUE
NS NOT SAMPLED
FT FEET
BGS BELOW GROUND SURFACE
DUP DUPLICATE
J ESTIMATED
MG/KG MILLIGRAMS PER KILOGRAM
UG/KG MICROGRAMS PER KILOGRAM
UNDERGROUND UTILITIES
TREE LINE
NOTE:
TAGS SHOW ALL TPH DATA AND ORGANICS/ METALS THAT EXCEED TAGM.
SCREENING VALUES:
GRAPHIC SCALE IN FEET
DRAWN BY HJB DATE 7/13/15
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
Tetra Tech NUS, Inc.
SURFACE SOIL AND SOIL BORING TAG MAP
SITE 2 - FIRE TRAINING AREA
NWIRP CALVERTON, NEW YORK
CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 3-1
REV. 0
DRAWING NO. FIGURE 3-1
REV. 0



DRAWN BY HJB	DATE 8/3/05	Tetra Tech NUS, Inc.	TPH ISOCONCENTRATION MAP DEPTH 0 TO 6 FEET BGS SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 4-1
REV. 0

DRAWING NO. FIGURE 4-1 REV. 0



DRAWN BY HJB	DATE 7/13/15	Tetra Tech NUS, Inc.	PAH ISOCONCENTRATION MAP DEPTH 0 TO 6 FEET BGS SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 160
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 4-2
REV. 0

DRAWING NO. FIGURE 4-2
REV. 0

DRAWN BY HJB	DATE 8/4/05	Tetra Tech NUS, Inc.	TPH ISOCONCENTRATION MAP DEPTH GREATER THAN 14 FEET BGS SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO.	1610
OWNER NO.	004
APPROVED BY	DATE
DRAWING NO. FIGURE 4-3	REV. 0

DRAWING NO. FIGURE 4-3 REV. 0

APPENDIX B

QUANTITY CALCULATIONS

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-6-05	CHECKED BY: Date:	APPROVED BY:	DATE:

OBJECTIVE:

To calculate volume and mass quantities for the Engineering Evaluation/Cost Analysis for Site 2 - Fire Training Area at the Naval Weapons Industrial Reserve Plant in Calverton, New York.

APPROACH:

1. From Figure A-1, determine the area of shallow petroleum-contaminated soil. From FigureA-2, determine the vertical extent of shallow petroleum-contaminated soil. Calculate the volume of shallow petroleum-contaminated soil.

2. From Figure A-3, determine the limits of soil cover. Calculate the volume of native soil required to install the soil cover (Alternative 2). Also determine the volume of surface soil (coal) to excavate and dispose off site.

3. From Figure A-4, determine the limits of excavation. Assume an over-excavation of 1 foot. Calculate the excavation volume (Alternative 3). Also determine the volume of surface soil (coal) to excavate and dispose off site.

4. Using measurement taken in the field, determine the total volume of concrete at the concrete pit (former burn pit) and supporting structures.

5. Determine the quantity of miscellaneous site features to abandon.

6. Evaluate the average concentration of total petroleum hydrocarbon - diesel range organics (TPH-DRO) in shallow petroleum-contaminated soils, deep petroleum-contaminated soils, surface soil (coal), and other contaminated soil. Determine the quantity of TPH-DRO that will be excavated under Alternative 3.

CALCULATIONS

1. Determine the Volume of Shallow Petroleum-Contaminated Soil

From Figure A-1 (Figure 2-2), the area of shallow petroleum-contaminated soil is:

Shallow Petroleum-Contaminated Soil Area = 23,241 sf

From Figure A-2 (Figure 2-3), the maximum depth of shallow petroleum-contaminated soil is:

Depth of Shallow Petroleum-Contaminated Soil = 5 ft

Therefore, the total volume of shallow petroleum-contaminated soil is:

Volume of Shallow Petroleum-Contaminated Soil = 116,205 cf
= 4,304 cy

The weight of the shallow petroleum-contaminated soil is as follows:

Density of Soil = 120 pcf
Weight of Soil = 6,972 tons

CLIENT: NWIRP CALVERTON			JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS				
BASED ON:			DRAWING NUMBER:	
BY: JLM Date: 6-6-05		CHECKED BY: Date:	APPROVED BY:	DATE:

2. Determine Volume of Cover Soil Required and the Volume of Surface Soil (Coal) to Excavate (Alternative 2)

From Figure A-3 (Figure 4-1), the limits of soil cover are as follows:

Extent of 2-Foot Soil Cover =	23,241	sf
Limit of Total Soil Cover (Including Edges) =	27,521	sf

The volume of cover soil required for Alternative 2 is calculated as follows:

Depth of Soil Cover =	2	ft
Volume of Cover Soil =	50,762	cf
=	1,880	cy

The volume of surface soil (coal) to excavate under Alternative 2 is as follows:

Northern Area of Surface Soil (Coal) =	5,968	sf
Southern Area of Surface Soil (Coal) =	5,141	sf
Total Area of Surface Soil (Coal) =	11,109	sf
Depth of Surface Soil (Coal) to Excavate =	1	ft
Volume of Surface Soil (Coal) to Excavate =	11,109	cf
=	411	cy
Density of Surface Soil =	120	pcf
Weight of Soil =	667	tons

3. Determine the Excavation Volume and the Volume of Surface Soil (Coal) to Excavate (Alternative 3)

From Figure A-4 (Figure 4-2), the limits of excavation are as follows:

Extent of 6-Foot Excavation =	23,241	sf
Limit of Excavation =	31,128	sf

The excavation volume as shown on Figure A-5 (Figure 2-3) is calculated as follows:

Depth of Petroleum Contaminated Soil =	5	ft
Depth of Over-Excavation =	1	ft
Excavation Depth =	6	ft
Excavation Volume =	163,107	cf
=	6,041	cy

The weight of excavation volume is as follows:

Density of Soil =	120	pcf
Weight of Soil =	9,786	tons

The volume of surface soil (coal) that is included in the established excavation area is as follows:

Limit of Excavation =	31,128	sf
Depth of Surface Soil (Coal) =	1	ft
Volume of Surface Soil (Coal) Within Excavation Area =	31,128	cf

CLIENT: NWIRP CALVERTON			JOB NUMBER: 112GN1610 0000.1130
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS			
BASED ON:			DRAWING NUMBER:
BY: JLM Date: 6-6-05	CHECKED BY: Date:		APPROVED BY: DATE:

=	1,153	cy
Density of Surface Soil =	120	pcf
Weight of Soil =	1,868	tons

The volume of surface soil (coal) to excavate under Alternative 3 is as follows:

Northern Area of Surface Soil (Coal) =	5,554	sf
Southern Area of Surface Soil (Coal) =	4,795	sf
Total Area of Surface Soil (Coal) =	10,349	sf
Depth of Surface Soil (Coal) to Excavate =	1	ft
Volume of Surface Soil (Coal) to Excavate =	10,349	cf
=	383	cy
Density of Surface Soil =	120	pcf
Weight of Soil =	621	tons

The total excavation volume plus the volume of surface soil (coal) to excavated is as follows:

Total Excavation Volume =	6,424	cy
=	10,407	tons

Note:
From soil boring information, soil at Site 2 is typically classified as a medium sand with silt. According to 29 CFR Part 1926.650-.652, this soil would be considered a Type C soil. Table B-1 of 29 CFR Part 1926.652, the maximum allowable slope of Type C soil is 1.5H :1V. To be conservative, 2H:1V sideslopes have been used.

Excavation Sideslope = 2H:1V

4. Determine the Volume of Concrete at the Concrete Pit and Supporting Structures

Measurements of the concrete pit were taken during the May 2005 supplemental sampling event. The measurements are used to determine the total volume of concrete in the concrete pit.

Description	Length (ft)	Width (ft)	Height (ft)	Volume (cf)	Volume (cy)
Outside Footer	251.33	1	2.00	502.65	18.62
Base (6")	4,778.36		0.50	2,389.18	88.49
Stepped Structure to West 1	5	0.5	0.21	1.04	0.04
Stepped Structure to West 2	5	0.5	0.75	5.25	0.19
Stepped Structure to West 3	5	0.5	1.29	11.63	0.43
Inside Square 1	87.83	0.5	0.5	21.96	0.81
Inside Square 2	99.83	0.5	0.5	23.71	0.88
Cross	61	0.5	0.5	15.25	0.56
Circular Portion to East 1	50.27	0.5	0.5	12.57	0.47
Circular Portion to East 2	165.13		0.50	82.56	3.06

Volume of Concrete = 113.55 cy

To account for uncertain base conditions of the concrete pit, an additional 20% of volume will be added to the estimate.

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-6-05	CHECKED BY: Date:	APPROVED BY:	DATE:

Volume of Concrete Pit =	136	cy
Density of Concrete =	150	lb/cf
Total Weight of Concrete =	275	tons

Supporting structures of the concrete pit include a steel and concrete structure to the north of the concrete pit and steel structures located within the concrete pit. It is assumed that the supporting structures of the concrete pit will fit in one 20 cy dumpster.

5. Determine the Quantity of Miscellaneous Site Features to Abandon

The AS/SVE system consist of the following wells that must be grouted in place:

Number of Injection Wells =	16	
Average Depth of Injection Wells =	30	ft
Number of Extraction Wells =	32	
Average Depth of Extraction Wells =	8	ft
Total Length of Wells to Abandon =	736	ft
Diameter of Wells =	2	in

The AS/SVE system consist of the following above-ground piping that must be disposed off site:

Length of Injection Above-Ground Piping =	825	ft
Length of Extraction Above-Ground Piping =	1,595	ft
Total Length of Above-Ground Piping =	2,420	ft

Miscellaneous components of the AS/SVE system consist of various control panels and other operating equipment. It is assumed that all of the components of the AS/SVE system and other miscellaneous components will fit in one 20 cy dumpster. This dumpster is in addition to the dumpster used for the miscellaneous features of the concrete pit.

6. Determine Quantity of TPH-DRO to be Excavated Under Alternative 3

The quantity of TPH-DRO is determined by breaking the lithology of Site 2 into four categories : shallow petroleum-contaminated soil, deep petroleum-contaminated soil, surface soil (coal) outside the excavation area, and other contaminated soil.

First, the volume of each soil category will be calculated. Then, average concentration of TPH-DRO will be determined based on analytical results. Finally, the quantity of TPH-DRO in each category will be calculated

SOIL VOLUME ESTIMATES

Shallow Petroleum-Contaminated Soil (From 1)

Volume of Shallow Petroleum-Contaminated Soil =	116,205	cf

Deep Petroleum-Contaminated Soil

CLIENT: NWIRP CALVERTON			JOB NUMBER: 112GN1610 0000.1130
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS			
BASED ON:			DRAWING NUMBER:
BY: JLM Date: 6-6-05	CHECKED BY: Date:		APPROVED BY: DATE:

Figure A-6 (Figure 2-2) shows the area of deep petroleum-contaminated soil. The thickness of deep petroleum-contaminated soil ranges from approximately 6 inches to 3 feet. Therefore, an average thickness of 1 foot will be assumed. Refer to Section 2 for discussions on the deep petroleum-contaminated soil layer.

Deep Petroleum-Contaminated Soil Area =	24,775	sf
Thickness of Deep Petroleum-Contaminated Soil =	1	ft
Volume of Deep Petroleum-Contaminated Soil =	24,775	cf

The weight of the deep petroleum-contaminated soil is as follows:

Density of Soil =	120	pcf
Weight of Soil =	1,487	tons

Surface Soil (Coal) Outside Excavation Area (From 3)

The volume of surface soil (coal) that is outside the excavation area and requires excavation under Alternative 3 is as follows.

Volume of Surface Soil (Coal) to Excavate =	10,349	cf
=	383	cy

The weight of the surface soil (coal) is as follows:

Density of Soil =	120	pcf
Weight of Soil =	621	tons

Other Contaminated Soil

The volume of other contaminated soil is calculated by taking the shallow petroleum-contaminated soil area and multiplying by the thickness.

Shallow Petroleum-Contaminated Soil Area =	23,241	sf
Vertical Extent of Shallow Petroleum-Contaminated Soil =	6	ft
Depth to Deep Petroleum-Contaminated Soil =	14	ft
Thickness of Other Contaminated Soil =	8	ft
Volume of Other Contaminated Soil =	185,928	cf

CONCENTRATION ESTIMATES

Shallow Petroleum-Contaminated Soil

Boring	Depth	Concentration (mg/kg)
FT-SB-201	3 - 5	4,900
FT-SB-202	3 - 5	130
FT-SB-203	2 - 4	11,000
FT-SB-204	2 - 4	23
FT-SB-206	5 - 6	1,500
FT-SB-207	3 - 5	8,400

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS		
BASED ON:		DRAWING NUMBER:
BY: JLM Date: 6-6-05	CHECKED BY: Date:	APPROVED BY: DATE:

FT-SB-208	2 - 4	8
FT-SB-211	3 - 5	990
FT-SB-225	3 - 5	1,200

Average = 3,128

Deep Petroleum-Contaminated Soil

Boring	Depth	Concentration (mg/kg)
FT-SB-201	15 - 16	2,100
FT-SB-203	15 - 16	8,400
FT-SB-204	14 - 16	8,900
FT-SB-207	14 - 16	13,000

Average = 8,100

Surface Soil (Coal) Outside Excavation Area

Boring	Depth	Concentration (mg/kg)
FT-SS-209	0 - 1	480.0
FT-SS-211	0 - 1	1,100
FT-SS-212	0 - 1	18
FT-SS-214	0 - 1	79
FT-SS-215	0 - 1	110.0

Average = 357

Other Contaminated Soil

Boring	Depth	Concentration (mg/kg)
FT-SB-201	10 - 12	3,800
FT-SB-202	11 - 12	400
FT-SB-203	6 - 8	2,100
FT-SB-204	6 - 8	6.4
FT-SB-205	3 - 5	11
FT-SB-206	14 - 16	12
FT-SB-207	10 - 12	3,200
FT-SB-208	14 - 16	30
FT-SB-209	3 - 5	8.3
FT-SB-210	4 - 6	290
FT-SB-213	3 - 5	21
FT-SB-215	3 - 5	7
FT-SB-219	5 - 7	32
FT-SB-221	4 - 6	9.3
FT-SB-224	3 - 5	15
FT-SB-226	3 - 5	46

Average = 624

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA QUANTITY CALCULATIONS			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-6-05	CHECKED BY: Date:	APPROVED BY:	DATE:

TPH-DRO VOLUME ESTIMATES

Previous investigations at Site 2 have determined an average density for soils of 120 pcf.

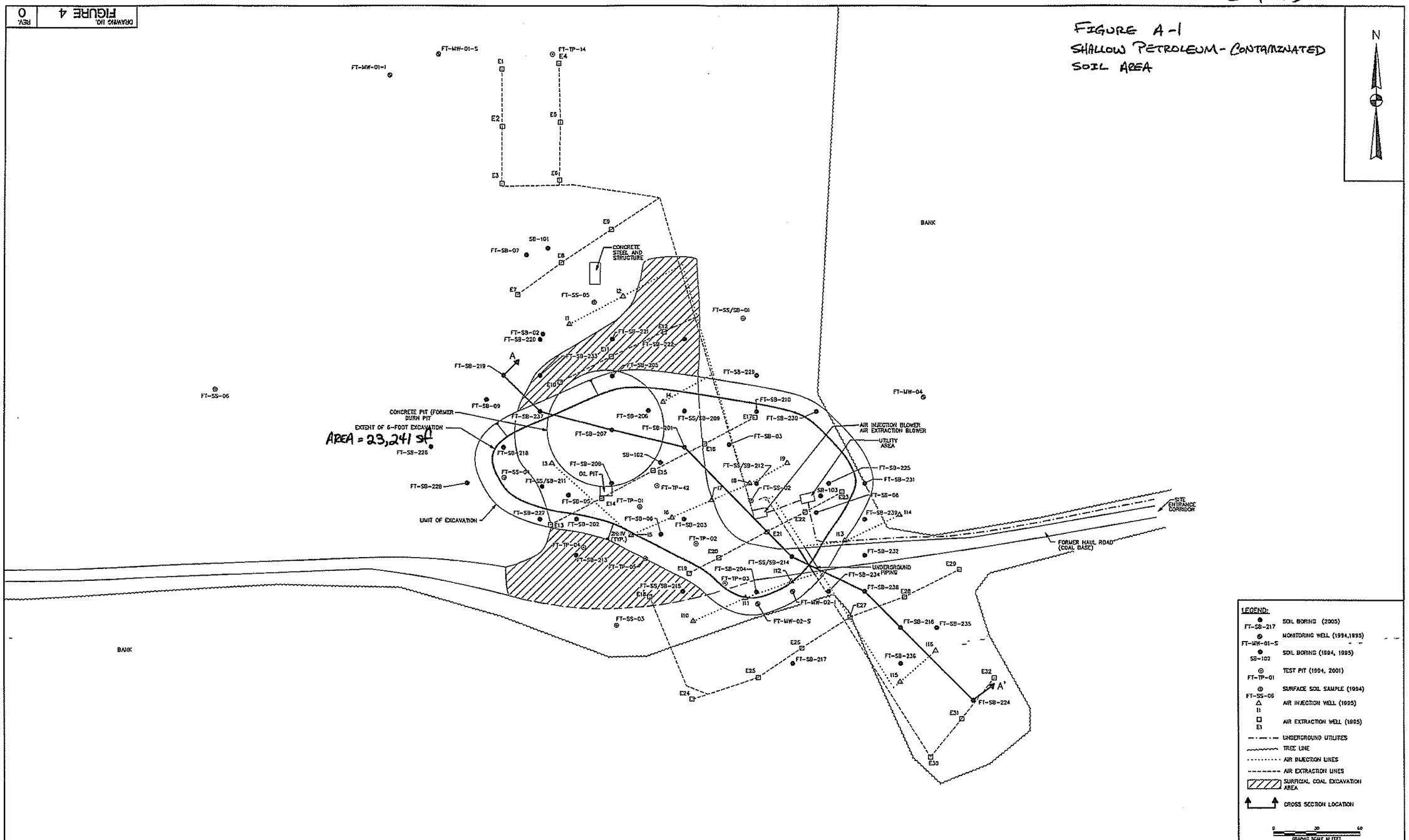
Area	Volume (cf)	Concentration (mg/kg)	TPH-DRO Volume (lbs)	Percent of Total
Shallow	116,205	3,128	43,617	53.1%
Deep	24,775	8,100	24,081	29.3%
Surface Soil (Coal)	10,349	357	444	0.5%
Other	185,928	624	13,928	17.0%

Total = 82,070

Under Alternative 3, the shallow petroleum-contaminated soil and surficial coal will be excavated. Therefore, the following mass and percent of TPH-DRO will be removed.

Mass of TPH-DRO Removed Under Alternative 3 = 44,061 lbs
Percent of TPH-DRO Removed Under Alternative 3 = 53.6%

FIGURE A-1
SHALLOW PETROLEUM-CONTAMINATED SOIL AREA

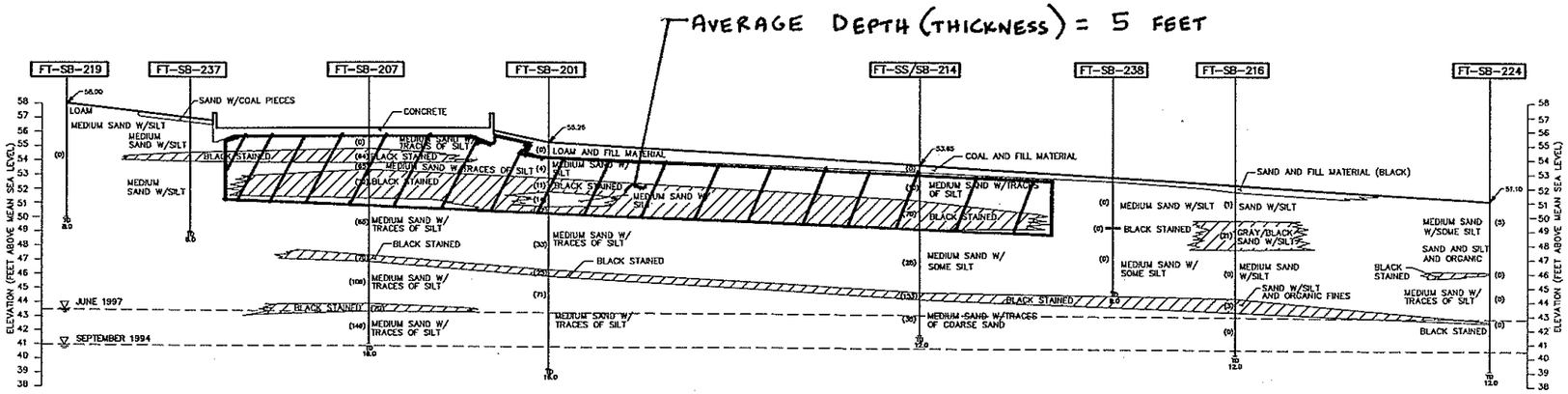


DRAWN BY DM	DATE 8/24/05	Tetra Tech NUS, Inc.	EXCAVATION PLAN AND CROSS SECTION LOCATION SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

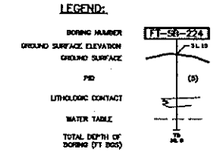
CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 4 REV. 0

DRAWING NO. FIGURE 4 REV. 0

FIGURE A-2
SHALLOW PETROLEUM-CONTAMINATED SOIL DEPTH



LEGEND:



NOTES:

1. PHOTO IONIZATION DETECTOR (PID) READINGS (IN PARENTHESES) ARE THE MAXIMUM DETECTED WITHIN A GIVEN MATERIAL ENCOUNTERED.
2. WATER TABLE INFORMATION TAKEN FROM MEASUREMENTS AT FT-MW-02-S AND PROVIDED IN THE 1995 RCRA FACILITY INVESTIGATION (HALIBURTON) AND THE 2001 PHASE 2 REMEDIAL INVESTIGATION (TINUS).

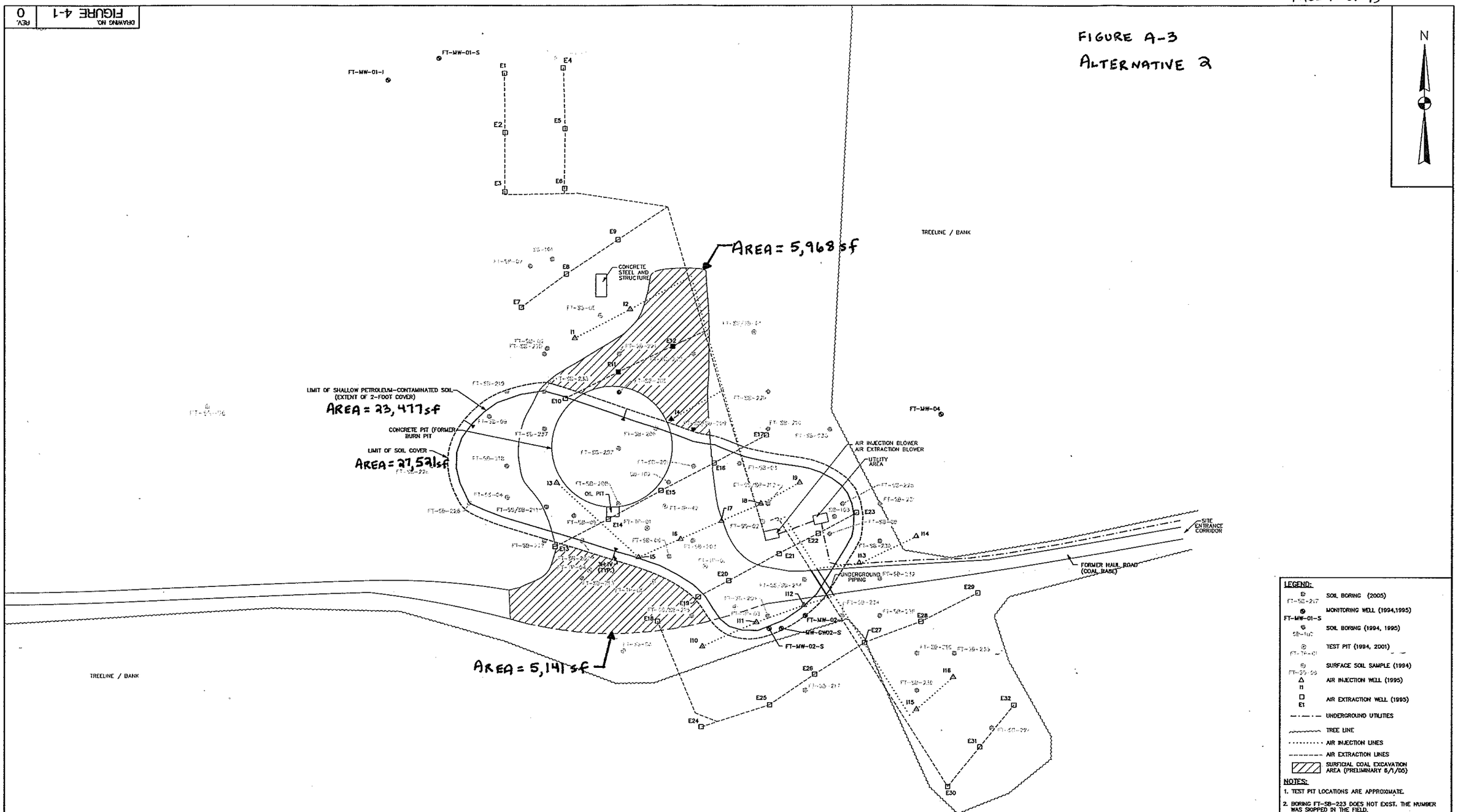
HORIZONTAL SCALE IN FEET (0, 20, 40)

VERTICAL SCALE IN FEET (0, 5, 10)

DRAWN BY DM	DATE 5/26/05	Tetra Tech NUS, Inc.	CROSS SECTION A-A' SITE 2 - FIRE TRAINING CENTER NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		CONTRACT NO. 1610
REVISED BY	DATE		OWNER NO. 004
SCALE AS NOTED			APPROVED BY / DATE
			DRAWING NO. FIGURE 2-3 / REV. 0

DRAWING NO. FIGURE 2-3 REV. 0

FIGURE A-3
ALTERNATIVE 2



LEGEND:

- SOIL BORING (2005)
- MONITORING WELL (1994,1995)
- SOIL BORING (1994, 1995)
- TEST PIT (1994, 2001)
- SURFACE SOIL SAMPLE (1994)
- AIR INJECTION WELL (1995)
- AIR EXTRACTION WELL (1995)
- UNDERGROUND UTILITIES
- TREE LINE
- AIR INJECTION LINES
- AIR EXTRACTION LINES
- SURFICIAL COAL EXCAVATION AREA (PRELIMINARY 6/1/05)

NOTES:

1. TEST PIT LOCATIONS ARE APPROXIMATE.
2. BORING FT-SB-223 DOES NOT EXIST. THE NUMBER WAS SKIPPED IN THE FIELD.
3. LOCATION OF SITE STRUCTURES/AIR INJECTION WELLS/AIR EXTRACTION WELLS ARE OFFSET FROM MONITORING WELL LOCATIONS BY FIVE FEET. USE SITE STRUCTURES /AIR INJECTION WELLS/ AIR EXTRACTION WELLS AS REFERENCE POINTS.

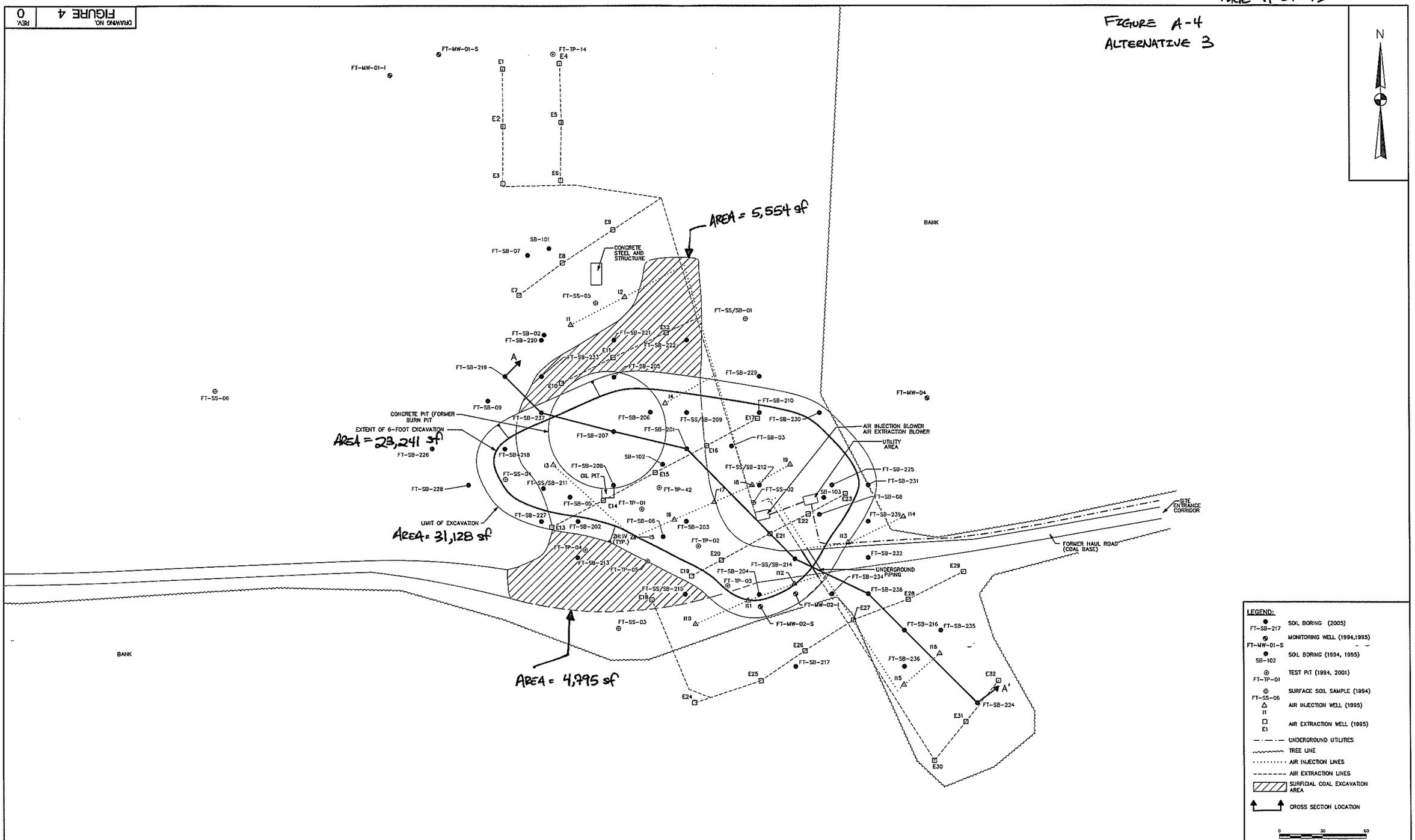
0 30 60
GRAPHIC SCALE IN FEET

DRAWN BY HJB	DATE 6/1/05	Tetra Tech NUS, Inc.	ALTERNATIVE 2 - SOIL COVER (CONTAINMENT) SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		CONTRACT NO. 160
REVISED BY	DATE		OWNER NO. 004
SCALE AS NOTED			APPROVED BY / DATE
			DRAWING NO. FIGURE 4-1 / REV. 0

ACAD:1910CP13.dwg 09/01/05 HJB PIT

FIGURE 4-1 DRAWING NO. REV. 0

FIGURE A-4
ALTERNATIVE 3



DRAWN BY DM	DATE 8/24/05	Tetra Tech NUS, Inc.	EXCAVATION PLAN AND CROSS SECTION LOCATION SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

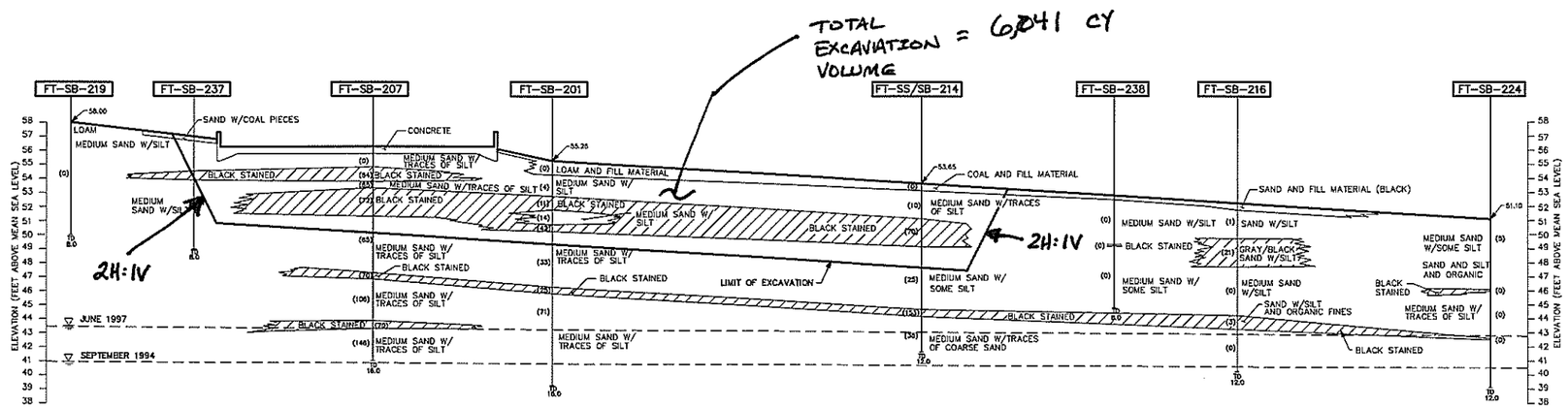
CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY | DATE
DRAWING NO. FIGURE 4 | REV. 0

DRAWING NO. FIGURE 4 | REV. 0

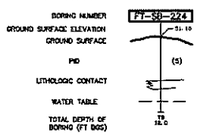
FORM CAD3 NO TITLE-D-STRING - REV 1 - 9/11/98

ACAD:1610CP34.dwg 08/15/05 HJB PIT

FIGURE A-5
TOTAL EXCAVATION VOLUME
ALTERNATIVE 3



LEGEND:



NOTES:

1. PHOTO IONIZATION DETECTOR (PID) READINGS (IN PARENTHESES) ARE THE MAXIMUM DETECTED WITHIN A GIVEN MATERIAL ENCOUNTERED.
2. WATER TABLE INFORMATION TAKEN FROM MEASUREMENTS AT FT-MW-02-S AND PROVIDED IN THE 1995 RCRA FACILITY INVESTIGATION (HALIBURTON) AND THE 2001 PHASE 2 REMEDIAL INVESTIGATION (TENUS).

0 20 40
HORIZONTAL SCALE IN FEET

0 5 10
VERTICAL SCALE IN FEET

DRAWN BY DM	DATE 5/26/05	Tetra Tech NUS, Inc.	CROSS SECTION A-A' SITE 2 - FIRE TRAINING CENTER NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		
REVISED BY	DATE		
SCALE AS NOTED			

CONTRACT NO. 1610
OWNER NO. 004
APPROVED BY DATE
DRAWING NO. FIGURE 5 REV. 0

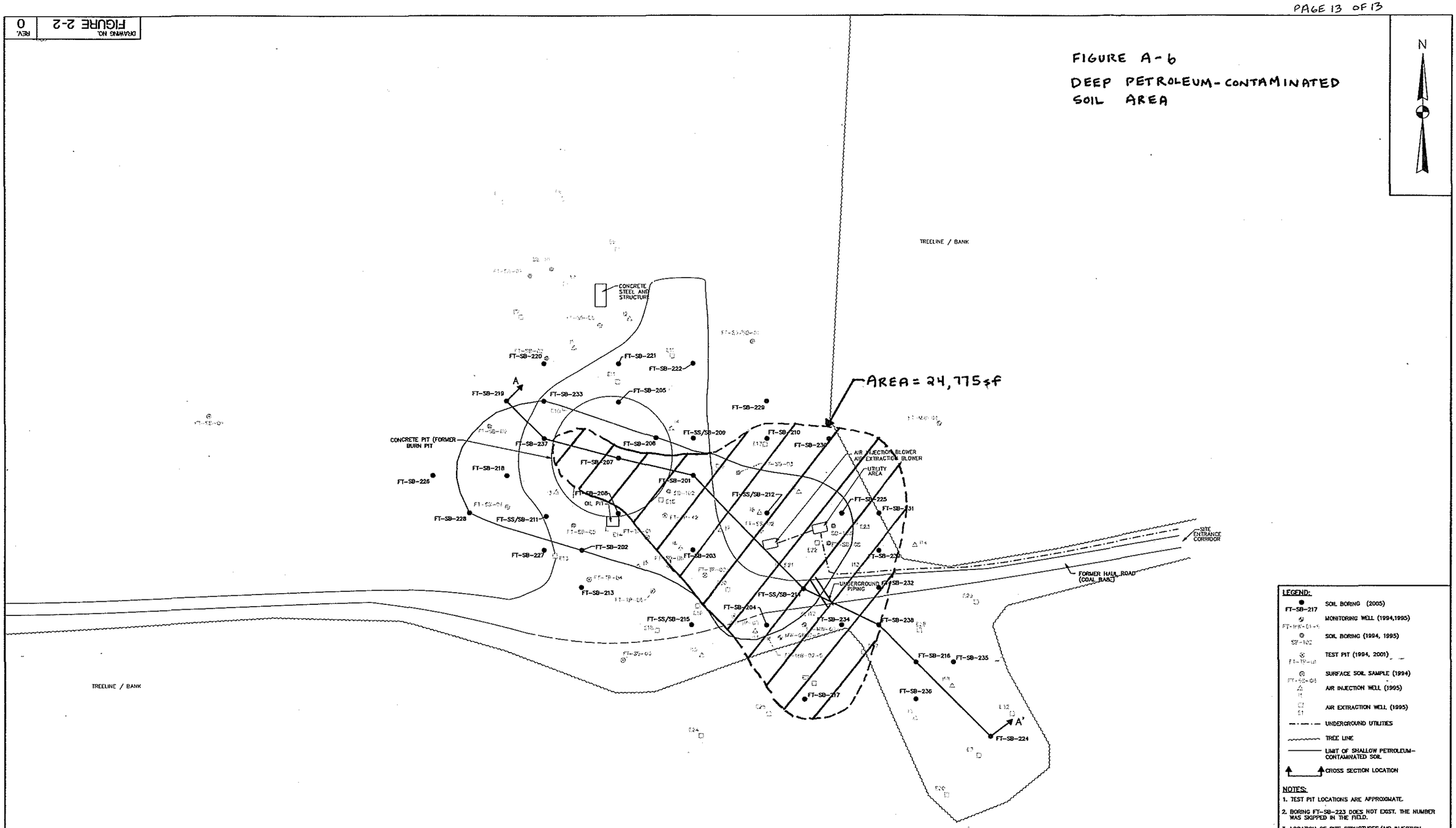
FORM CADD NO. TTNUS-D-STD2VC - REV 1 - 9/11/98

ACAD:1810CX10.dwg 09/13/05 KJB PIT

DRAWING NO. FIGURE 5 REV. 0

FIGURE A-6

DEEP PETROLEUM-CONTAMINATED SOIL AREA



LEGEND:

- FT-SB-217 — SOIL BORING (2005)
- MONITORING WELL (1994,1995)
- SOIL BORING (1994, 1995)
- TEST PIT (1994, 2001)
- SURFACE SOIL SAMPLE (1994)
- AIR INJECTION WELL (1995)
- AIR EXTRACTION WELL (1995)
- UNDERGROUND UTILITIES
- TREE LINE
- LIMIT OF SHALLOW PETROLEUM-CONTAMINATED SOIL
- CROSS SECTION LOCATION

NOTES:

1. TEST PIT LOCATIONS ARE APPROXIMATE.
2. BORING FT-SB-223 DOES NOT EXIST. THE NUMBER WAS SKIPPED IN THE FIELD.
3. LOCATION OF SITE STRUCTURES/AIR INJECTION WELLS/AIR EXTRACTION WELLS ARE OFFSET FROM MONITORING WELL LOCATIONS BY FIVE FEET. USE SITE STRUCTURES /AIR INJECTION WELLS/ AIR EXTRACTION WELLS AS REFERENCE POINTS.

0 30 60
GRAPHIC SCALE IN FEET

DRAWN BY DM	DATE 4/5/05	Tetra Tech NUS, Inc.	EXISTING CONDITIONS AND CROSS SECTION LOCATION MAP SITE 2 - FIRE TRAINING AREA NWIRP CALVERTON, NEW YORK
CHECKED BY	DATE		CONTRACT NO. 1610
REVISED BY	DATE		OWNER NO. 004
SCALE AS NOTED			APPROVED BY / DATE
			DRAWING NO. FIGURE 2-2 / REV. 0

DRAWING NO. FIGURE 2-2 REV. 0

FORM CARD NO. 77NUS-B-STANDARD - REV 1 - 9/21/98

ACAD:1610CP14.dwg 08/02/05 DM PIT

APPENDIX C

COST ESTIMATES

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 2 - SOIL COVER (CONTAINMENT)			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

OBJECTIVE:
To provide support for the quantities used in the Naval Weapons Industrial Reserve Plant Calverton Site 2 – Fire Training Area Cost Estimate for Alternative 2 - Soil Cover (Containment) of the Engineering Evaluation/Cost Analysis Report.

CALCULATIONS:
This alternative consists of demolition of existing site features (including the concrete pit, the steel and concrete structure to the north of the concrete pit, steel structures within the concrete pit, and the AS/SVE system), a 2-foot soil cover, and site restoration.

Assume mobilization of three pieces of equipment (excavator, dozer, and front end loader).

A decontamination pad will be constructed at the site. A pressure washer and water storage tanks will be rented.

Assume stabilization fabric and 6 inches of gravel will be placed along the haul road from the main road to the site.

Length of Haul Road =	300	ft
Width of Haul Road =	15	ft
Area of Haul Road =	4,500	sf
=	500	sy

Clearing and grubbing will take place within the area of the soil cover, surface soil excavation area, haul road, and miscellaneous handling areas that is assumed to be 20% of the total.

Area of Soil Cover =	27,521	sf
Area of Surface Soil Excavation =	11,109	sf
Area of Haul Road =	4,500	sf
Clear and Grub Area =	1.19	ac

Existing site features to be demolished and disposed off site include the concrete pit and miscellaneous structures associated with the concrete pit that include the steel and concrete structure north of the concrete pit and steel structures within the concrete pit. It is assumed that all miscellaneous features will fit in one 20 cy dumpster. Volume estimates are provided in the Volume Calculations located in Appendix A.

Volume of Concrete =	136	cy
Density of Concrete =	150	pcf
Total Weight of Concrete =	275	tons

The duration of demolition of the concrete pit and miscellaneous structures is as follows:

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 2 - SOIL COVER (CONTAINMENT)			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

Concrete Demolition Rate =	60	cy/day
Days for Concrete Demolition =	3	days
Days for Misc. Structures Demolition =	2	days
Additional Days for Demolition =	2	days
Total Days for Demolition =	7	days

Abandon 16 air injection wells, 32 air extraction wells, and 2 monitoring wells. Total length to abandon is as follows:

Number of Injection Wells =	16	
Average Depth of Injection Wells =	30	ft
Number of Extraction Wells =	32	
Average Depth of Extraction Wells =	8	ft
Total Length of Monitoring Wells =	88	ft
Total Length of Wells to Abandon =	824	ft
Diameter of Wells =	2	in

The duration of abandoning the wells is as follows:

Abandoning Rate =	300	ft/day
Days for Abandoning =	3	day

The AS/SVE system consist of the following above-ground piping that must be disposed off site. It is assumed that the piping will fit in one 20 cy dumpster.

Length of Injection Above-Ground Piping =	825	ft
Length of Extraction Above-Ground Piping =	1,595	ft
Total Length of Above-Ground Piping =	2,420	ft

Miscellaneous components of the AS/SVE system consist of various control panels and other operating equipment. The other miscellaneous components are assumed to fit in the 20 cy dumpster above.

The volume of surface soil (coal) outside the area of soil cover to be excavated is as follows. Refer to the Volume Calculation provided in Appendix A.

Total Area of Surface Soil (Coal) =	11,109	sf
Depth of Surface Soil (Coal) to Excavate =	1	ft
Volume of Surface Soil (Coal) to Excavate =	411	cy
Weight of Soil =	667	tons

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 2 - SOIL COVER (CONTAINMENT)		
BASED ON:		DRAWING NUMBER:
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY: DATE:

Assume the limiting factor affecting the duration of surface soil excavation is hauling the soil off site at an approved landfill. Therefore, the surface soil excavation time is as follows:

Assume 20 tons per truck.

Number of Truck Loads =	34	truckloads
Number of Truck Loads/Day =	16	truckloads/day
Number of Days =	3	days
Additional Days for Weather =	1	days
Total Days =	4	days

The soil cover will consist of 2 feet of native soil (sand). The volume of native soil is as follows:

Extent of 2-Foot Soil Cover =	23,477	sf
Limit of Total Soil Cover (Including Edges) =	27,521	sf
Thickness of Native Soil (Sand) =	2	ft
Volume of Native Soil (Sand) =	50,998	cf
=	1,889	cy

Additional native soil will be needed to make up the volume of the concrete pit. The additional native soil is assumed to be the volume of the concrete pit plus an additional 20% to allow for site grading for proper site drainage.

Volume of Concrete Pit =	136	cy
Additional 20% =	405	cf
Additional Native Soil (Sand) =	541	cy
Total Volume of Native Soil (Sand) =	2,430	cy
Density of Native Soil (Sand) =	120	pcf
Weight of Native Soil (Sand)	3,937	tons

Assume the limiting factor of soil cover placement will be bringing the material on site. Therefore, the total duration of soil cover is as follows:

Assume 20 tons per truck.

Total Volume of Native Soil (Sand) =	3,937	tons
Number of Truck Loads =	197	truckloads
Number of Truck Loads/Day =	35	truckloads/day
Number of Days =	6	days
Additional Days for Weather =	2	days
Total Days =	8	days

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 2 - SOIL COVER (CONTAINMENT)			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

Hydroseeding, including mulch and fertilizer, will be spread over the clear and grub area.

Hydroseed Area =	1.19	acres
=	52	msf

The time to complete construction is estimated as follows:

Task	Days	
Mob, Decon Pad Setup, Haul Road, Clear Brush	10	(Equipment = 5 days)
Demolition of Existing Site Features	7	
Abandon Air Injection and Air Extraction Wells	3	
Surface Soil (Coal) Excavation	4	
Soil Cover	8	
Restoration	5	
Demob	5	
Total Days	42	
or	2	months

Total Capital Cost of Alternative 2 has been adjusted for inflation based upon Consumer Price Index adjustment 2005 to 2008 (8.39%).
Source US Department of Labor, Bureau of Labor Statistics

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 2: SOIL COVER (CONTAINMENT)
CAPITAL COST

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PRE-CONSTRUCTION											
1.1 Prepare Remedial Action Plan	200	hr			$32.00		$0	$0	$6,400	$0	$6,400
2 MOBILIZATION/DEMOBILIZATION											
2.1 Office Trailer	2	mo				$286.00	$0	$0	$0	$572	$572
2.2 Storage Trailer	2	mo				$105.00	$0	$0	$0	$210	$210
2.3 Trailers Mob/Demob	2	ea				$225.00	$0	$0	$0	$450	$450
2.4 Field Office Support	2	mo		$143.00			$0	$286	$0	$0	$286
2.5 Utility Connection/Disconnection (Phone/Electric	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
2.6 Site Utilities (Phone & Electric)	2	mo		$302.00			$0	$604	$0	$0	$604
2.7 Mobilization/Demobilization Construction Equipm	3	ea			$147.00	$350.00	$0	$0	$441	$1,050	$1,491
3 DECONTAMINATION											
3.1 Decontamination Services	2	mo		$375.00	$1,200.00	$900.00	$0	$750	$2,400	$1,800	$4,950
3.2 Pressure Washer	2	mo				$1,100.00	$0	$0	$0	$2,200	$2,200
3.3 Equipment Decon Pad	1	ls		$500.00	$450.00	$155.00	$0	$500	$450	$155	$1,105
3.4 Decon Water Storage Tank, 6,000 gallon	2	mo				$645.00	$0	$0	$0	$1,290	$1,290
3.5 Clean Water Storage Tank, 4,000 gallon	2	mo				$580.00	$0	$0	$0	$1,160	$1,160
3.6 Disposal of Decon Waste (Liquid & Solid)	2	mo	$900.00				$1,800	$0	$0	$0	$1,800
4 SITE PREPARATION											
4.1 Haul Road - Stabilization Fabric	500	sy		$0.91			$0	$455	$0	$0	$455
4.2 Haul Road - Gravel (6 inches)	500	sy		$6.25			$0	$3,125	$0	$0	$3,125
4.3 Excavator (1.5 cy) & Operator	5	days			$277.20	$591.02	$0	$0	$1,386	$2,955	$4,341
4.4 Loader (170 HP) & Operator	5	days			$277.20	$366.41	$0	$0	$1,386	$1,832	$3,218
4.5 Laborers (2)	5	days			$427.20		$0	$0	$2,136	$0	$2,136
4.6 Clearing & Grubbing	1.19	ac			$1,250.00	$2,875.00	$0	$0	$1,488	$3,421	$4,909
4.7 Tree Thinning	100	ea			$1.54	$2.40	$0	$0	$154	$240	$394
5 SITE DEMOLITION											
5.1 Excavator (1.5 cy) & Operator	10	days			$277.20	$591.02	$0	$0	$2,772	$5,910	$8,682
5.2 Hydraulic Hammer	10	days				$89.14	$0	$0	$0	$891	$891
5.3 Loader (170 HP) & Operator	10	days			$277.20	$366.41	$0	$0	$2,772	$3,664	$6,436
5.4 Laborers (2)	10	days			$427.20		$0	$0	$4,272	$0	$4,272
5.5 Dumpster (20 cy)	2	ea	$3,915.00				$7,830	$0	$0	$0	$7,830
5.6 Transport/Disposal Concrete	275	tons	$42.15				$11,591	$0	$0	$0	$11,591
5.7 Driller - Mob/Demob	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
5.8 Driller - Backhoe	3	days	$218.00				$654	$0	$0	$0	$654
5.9 Driller - Abandon Monitoring Wells	824	ft	$6.00				$4,944	$0	$0	$0	$4,944
6 SURFACE SOIL EXCAVATION											
6.1 Excavator (1.5 cy) & Operator	4	days			$277.20	$591.02	$0	$0	$1,109	$2,364	$3,473
6.2 Loader (170 HP) & Operator	4	days			$277.20	$366.41	$0	$0	$1,109	$1,466	$2,574
6.3 Dozer (140 HP) & Operator	4	days			$277.20	$470.38	$0	$0	$1,109	$1,882	$2,990
6.4 Laborers (2)	4	days			$427.20		$0	$0	$1,709	$0	$1,709
6.5 Characterize Surface Soil (1 sam/810 ton or 500 (	1	ea	$757.00				$757	$0	$0	$0	$757
6.6 Transport/Disposal Surface Soil	667	tons	$76.45				$50,992	$0	$0	$0	$50,992
6 SOIL COVER AND RESTORATION											
7.1 Import Native Soil (Sand)	3,937	tons		$21.60			$0	$85,039	$0	$0	$85,039
7.2 Excavator (1.5 cy) & Operator	8	days			$277.20	$591.02	$0	$0	$2,218	$4,728	$6,946

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 2: SOIL COVER (CONTAINMENT)
CAPITAL COST

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
7.3 Loader (170 HP) & Operator	8	days			$277.20	$366.41	$0	$0	$2,218	$2,931	$5,149
7.4 Dozer (140 HP) & Operator	8	days			$277.20	$470.38	$0	$0	$2,218	$3,763	$5,981
7.5 Laborers (2)	8	days			$427.20		$0	$0	$3,418	$0	$3,418
7.6 Hyrdroseeding With Mulch and Fertilizer	52	msf	$55.50				$2,886	$0	$0	$0	$2,886
8 MISCELLANEOUS											
8.1 Construction Oversight	42	day			$250.00		$0	$0	$10,500	$0	$10,500
8.2 Field Personnel (30% of Time)	13	day			$200.00		$0	$0	$2,600	$0	$2,600
8.3 Post Construction Documents	100	hr			$32.00		$0	$0	$3,200	$0	$3,200
Subtotal							$88,454	$90,759	$57,462	$44,935	$281,610
Local Area Adjustments							100.0%	112.3%	130.4%	100.0%	
Subtotal							$88,454	$101,923	$74,931	$44,935	$310,242
Overhead on Labor Cost @ 30%									$22,479		$22,479
G & A on Labor Cost @ 10%									$7,493		$7,493
G & A on Material Cost @ 10%								$10,192			$10,192
G & A on Equipment Cost @ 10%										$4,493	$4,493
G & A on Subcontract Cost @ 10%							$8,845				$8,845
Total Direct Cost							$97,300	$112,115	$104,903	$49,428	$363,746
Indirects on Total Direct Cost @ 25%		(Not including Transportation & Disposal Costs)									$72,883
Profit on Total Direct Cost @ 10%											$36,375
Subtotal											$473,003
Health & Safety Monitoring @ 1%											$4,730
Total Field Cost											$477,733
Contingency on Total Field Cost @ 10%											$47,773
Engineering on Total Field Cost @ 5%											$23,887
TOTAL COST											**$549,393**
ADJ 2008 TOTAL COST											**$595,488**

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 2: SOIL COVER (CONTAINMENT)
ANNUAL COST

Item	Item Cost Years 1 - 30	Item Cost Every 5 Years	Notes
Cover Inspection	$1,200		One person trip to site for inspection
Additional Soil	$984		Replace 5% of initial soil.
Hydroseed	$144		Hydroseed 5% of initial area.
Annual Reports	$2,000		Annual report of conditions.
Site Review		$15,000	Review of documents and data evaluation/recommend
TOTALS	**$4,329**	**$15,000**	

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 2: SOIL COVER (CONTAINMENT)
PRESENT WORTH ANALYSIS

Year	Capital Cost	Annual Cost	Annual Discount Rate at 7%	Present Worth
0	$595,488		1.000	$595,488
1		$4,329	0.935	$4,047
2		$4,329	0.873	$3,779
3		$4,329	0.816	$3,532
4		$4,329	0.763	$3,303
5		$19,329	0.713	$13,781
6		$4,329	0.666	$2,883
7		$4,329	0.623	$2,697
8		$4,329	0.582	$2,519
9		$4,329	0.544	$2,355
10		$19,329	0.508	$9,819
11		$4,329	0.475	$2,056
12		$4,329	0.444	$1,922
13		$4,329	0.415	$1,796
14		$4,329	0.388	$1,679
15		$19,329	0.362	$6,997
16		$4,329	0.339	$1,467
17		$4,329	0.317	$1,372
18		$4,329	0.296	$1,281
19		$4,329	0.277	$1,199
20		$19,329	0.258	$4,987
21		$4,329	0.242	$1,048
22		$4,329	0.226	$978
23		$4,329	0.211	$913
24		$4,329	0.197	$853
25		$19,329	0.184	$3,556
26		$4,329	0.172	$745
27		$4,329	0.161	$697
28		$4,329	0.150	$649
29		$4,329	0.141	$610
30		$19,329	0.131	$2,532
			TOTAL PRESENT WORTH	**$681,541**

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 3 - EXCAVATION AND OFF-SITE DISPOSAL			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

OBJECTIVE:
To provide support for the quantities used in the Naval Weapons Industrial Reserve Plant Calverton Site 2 – Fire Training Area Cost Estimate for Alternative 3 - Excavation and Off-Site Disposal of the Engineering Evaluation/Cost Analysis Report.

CALCULATIONS:
This alternative consists of demolition of existing site features (including the concrete pit, the steel and concrete structure to the north of the concrete pit, steel structures within the concrete pit, and the AS/SVE system), excavation of petroleum-contaminated soil, off-site disposal, and site restoration.

Assume mobilization of three pieces of equipment (excavator, dozer, and front end loader).

A decontamination pad will be constructed at the site. A pressure washer and water storage tanks will be rented.

Assume stabilization fabric and 6 inches of gravel will be placed along the haul road from the main road to the site.

Length of Haul Road =	300	ft
Width of Haul Road =	15	ft
Area of Haul Road =	4,500	sf
=	500	sy

Clearing and grubbing will take place within the area of excavation, surface soil excavation area, haul road, and miscellaneous handling areas that is assumed to be 20% of the total.

Area of Excavation =	31,128	sf
Area of Surface Soil Excavation =	10,348	sf
Area of Haul Road =	4,500	sf
Clear and Grub Area =	1.27	ac

Existing site features to be demolished and disposed off site include the concrete pit and miscellaneous structures associated with the concrete pit that include the steel and concrete structure north of the concrete pit and steel structures within the concrete pit. It is assumed that all miscellaneous features will fit in one 20 cy dumpster. Volume estimates are provided in the Volume Calculations located in Appendix A.

Volume of Concrete =	136	cy
Density of Concrete =	150	pcf
Total Weight of Concrete =	275	tons

The duration of demolition of the concrete pit and miscellaneous structures is as follows:

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 3 - EXCAVATION AND OFF-SITE DISPOSAL			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

Concrete Demolition Rate =	60	cy/day
Days for Concrete Demolition =	3	days
Days for Misc. Structures Demolition =	2	days
Additional Days for Demolition =	2	days
Total Days for Demolition =	7	days

Abandon 16 air injection wells, 32 air extraction wells, and 2 monitoring wells. Total length to abandon is as follows:

Number of Injection Wells =	16	
Average Depth of Injection Wells =	30	ft
Number of Extraction Wells =	32	
Average Depth of Extraction Wells =	8	ft
Total Length of Monitoring Wells =	88	ft
Total Length of Wells to Abandon =	824	ft
Diameter of Wells =	2	in

The duration of abandoning the air injection and air extraction wells is as follows:

Abandoning Rate =	300	ft/day
Days for Abandoning =	3	day

The AS/SVE system consist of the following above-ground piping that must be disposed off site. It is assumed that the piping will fit in one 20 cy dumpster.

Length of Injection Above-Ground Piping =	825	ft
Length of Extraction Above-Ground Piping =	1,595	ft
Total Length of Above-Ground Piping =	2,420	ft

Miscellaneous components of the AS/SVE system consist of various control panels and other operating equipment. The other miscellaneous components are assumed to fit in the 20 cy dumpster above.

The volume of surface soil (coal) outside the area of soil cover to be excavated is as follows. Refer to the Volume Calculation provided in Appendix A.

Total Area of Surface Soil (Coal) =	10,349	sf
Depth of Surface Soil (Coal) to Excavate =	1	ft
Volume of Surface Soil (Coal) to Excavate =	383	cy
Weight of Soil =	621	tons

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 3 - EXCAVATION AND OFF-SITE DISPOSAL			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

The excavation volume (including sideslopes) can be found in the Volume Calculation provided in Appendix A.

Volume of Excavation =	6,041	cy
=	9,786	tons

Assuming the surface soil (coal) and shallow petroleum-contaminated soil will be excavated at the same time, the total volume of excavation is as follows:

Total Excavation Volume =	6,424	cy
=	10,407	tons

Assume the limiting factor affecting the duration of excavation is hauling the soil off site at an approved landfill. Therefore, the total excavation time is as follows:

Assume 20 tons per truck.

Number of Truck Loads =	521	truckloads
Number of Truck Loads/Day =	16	truckloads/day
Number of Days =	33	days
Additional Days for Weather =	4	days
Total Days =	37	days

Backfill will consist of native soil (sand). The volume of backfill is assumed to be equal to the total volume of excavation plus the volume of the concrete pit plus an additional 20% to allow for site grading and proper site drainage.

Total Volume of Excavation =	6,424	cy
Volume of Concrete Pit =	136	cy
Volume of Native Soil (Sand) =	6,560	cy
Density of Native Soil (Sand) =	120	pcf
Weight of Native Soil (Sand)	10,628	tons

Assume the limiting factor of backfill will be bringing the material on site. Therefore, the total duration of backfill is as follows:

Assume 20 tons per truck.

Total Volume of Native Soil (Sand) =	10,628	tons
Number of Truck Loads =	532	truckloads
Number of Truck Loads/Day =	35	truckloads/day
Number of Days =	16	days
Additional Days for Weather =	4	days
Total Days =	20	days

CLIENT: NWIRP CALVERTON		JOB NUMBER: 112GN1610 0000.1130	
SUBJECT: SITE 2 - FIRE TRAINING AREA ALTERNATIVE 3 - EXCAVATION AND OFF-SITE DISPOSAL			
BASED ON:		DRAWING NUMBER:	
BY: JLM Date: 6-7-05	CHECKED BY: Date:	APPROVED BY:	DATE:

Hydroseeding, including mulch and fertilizer, will be spread over the clear and grub area.

Hydroseed Area =	1.27	acres
=	55	msf

The time to complete construction is estimated as follows:

Task	Days	
Mob, Decon Pad Setup, Haul Road, Clear Brush	10	(Equipment = 5 days)
Demolition of Existing Site Features	7	
Abandon Air Injection and Air Extraction Wells	3	
Excavation	37	
Backfill and Restoration	20	
Demob	5	
Total Days	82	
or	4	month

Total Capital Cost of Alternative 2 has been adjusted for inflation based upon Consumer Price Index adjustment 2005 to 2008 (8.39%).
Source US Department of Labor, Bureau of Labor Statistics

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 3: EXCAVATION AND OFF-SITE DISPOSAL
CAPITAL COST

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
1 PRE-CONSTRUCTION											
1.1 Prepare Remedial Action Plan	200	hr			$32.00		$0	$0	$6,400	$0	$6,400
2 MOBILIZATION/DEMOBILIZATION											
2.1 Office Trailer	4	mo				$286.00	$0	$0	$0	$1,144	$1,144
2.2 Storage Trailer	4	mo				$105.00	$0	$0	$0	$420	$420
2.3 Trailers Mob/Demob	2	ea				$225.00	$0	$0	$0	$450	$450
2.4 Field Office Support	4	mo		$143.00			$0	$572	$0	$0	$572
2.5 Utility Connection/Disconnection (Phone/Electric)	1	ls	$5,000.00				$5,000	$0	$0	$0	$5,000
2.6 Site Utilities (Phone & Electric)	4	mo		$302.00			$0	$1,208	$0	$0	$1,208
2.7 Mobilization/Demobilization Construction Equipme	3	ea			$147.00	$350.00	$0	$0	$441	$1,050	$1,491
3 DECONTAMINATION											
3.1 Decontamination Services	4	mo		$375.00	$1,200.00	$900.00	$0	$1,500	$4,800	$3,600	$9,900
3.2 Pressure Washer	4	mo				$1,100.00	$0	$0	$0	$4,400	$4,400
3.3 Equipment Decon Pad	1	ls		$500.00	$450.00	$155.00	$0	$500	$450	$155	$1,105
3.4 Decon Water Storage Tank, 6,000 gallon	4	mo				$645.00	$0	$0	$0	$2,580	$2,580
3.5 Clean Water Storage Tank, 4,000 gallon	4	mo				$580.00	$0	$0	$0	$2,320	$2,320
3.6 Disposal of Decon Water	8,000	gal	$0.50				$4,000	$0	$0	$0	$4,000
4 SITE PREPARATION											
4.1 Haul Road - Stabilization Fabric	500	sy		$0.91			$0	$455	$0	$0	$455
4.2 Haul Road - Gravel (6 inches)	500	sy		$6.25			$0	$3,125	$0	$0	$3,125
4.3 Excavator (1.5 cy) & Operator	5	days			$277.20	$591.02	$0	$0	$1,386	$2,955	$4,341
4.4 Loader (170 HP) & Operator	5	days			$277.20	$366.41	$0	$0	$1,386	$1,832	$3,218
4.5 Laborers (2)	5	days			$427.20		$0	$0	$2,136	$0	$2,136
4.6 Clearing & Grubbing	1.19	ac			$1,250.00	$2,875.00	$0	$0	$1,488	$3,421	$4,909
4.7 Tree Thinning	100	ea			$1.54	$2.40	$0	$0	$154	$240	$394
5 SITE DEMOLITION											
5.1 Excavator (1.5 cy) & Operator	10	days			$277.20	$591.02	$0	$0	$2,772	$5,910	$8,682
5.2 Hydraulic Hammer	10	days				$89.14	$0	$0	$0	$891	$891
5.3 Loader (170 HP) & Operator	10	days			$277.20	$366.41	$0	$0	$2,772	$3,664	$6,436
5.4 Laborers (2)	10	days			$427.20		$0	$0	$4,272	$0	$4,272
5.5 Dumpster (20 cy)	2	ea	$3,915.00				$7,830	$0	$0	$0	$7,830
5.6 Transport/Disposal Concrete	275	tons	$42.15				$11,591	$0	$0	$0	$11,591
5.7 Driller - Mob/Demob	1	ls	$2,000.00				$2,000	$0	$0	$0	$2,000
5.8 Driller - Backhoe	3	days	$218.00				$654	$0	$0	$0	$654
5.9 Driller - Abandon Monitoring Wells	824	ft	$6.00				$4,944	$0	$0	$0	$4,944
6 EXCAVATION											
6.1 Excavator (1.5 cy) & Operator	38	days			$277.20	$591.02	$0	$0	$10,534	$22,459	$32,992
6.2 Loader (170 HP) & Operator	38	days			$277.20	$366.41	$0	$0	$10,534	$13,924	$24,457
6.3 Laborers (2)	38	days			$427.20		$0	$0	$16,234	$0	$16,234
6.4 Survey Control	38	days				$60.50	$0	$0	$0	$2,299	$2,299
6.5 Characterize Surface Soil (1 sam/810 ton or 500 c	14	ea	$757.00				$10,598	$0	$0	$0	$10,598
6.6 Transport/Disposal Soil	10,614	tons	$76.45				$811,440	$0	$0	$0	$811,440
7 BACKFILL AND RESTORATION											
7.1 Import Native Soil (Sand)	10,834	tons		$21.60			$0	$234,014	$0	$0	$234,014
7.2 Loader (170 HP) & Operator	20	days			$277.20	$366.41	$0	$0	$5,544	$7,328	$12,872
7.3 Dozer (140 HP) & Operator	20	days			$277.20	$470.38	$0	$0	$5,544	$9,408	$14,952
7.4 Laborers (2)	20	days			$427.20		$0	$0	$8,544	$0	$8,544
7.5 Hyrdroseeding With Mulch and Fertilizer	56	msf	$55.50				$3,108	$0	$0	$0	$3,108
8 MISCELLANEOUS											
8.1 Field Supervisor	83	day			$250.00		$0	$0	$20,750	$0	$20,750
8.2 Field Personnel (30% of Time)	25	day			$200.00		$0	$0	$5,000	$0	$5,000
8.3 Post Construction Documents	200	hr			$32.00		$0	$0	$6,400	$0	$6,400

NAVAL WEAPONS INDUSTRIAL RESERVE PLANT
CALVERTON, NEW YORK
SITE 2 - FIRE TRAINING AREA
ALTERNATIVE 3: EXCAVATION AND OFF-SITE DISPOSAL
CAPITAL COST

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Subtotal							$861,165	$241,374	$117,539	$90,450	$1,310,529
Local Area Adjustments							100.0%	112.3%	130.4%	100.0%	
							$861,165	$271,063	$153,271	$90,450	$1,375,950
Overhead on Labor Cost @	30%								$45,981		$45,981
G & A on Labor Cost @	10%								$15,327		$15,327
G & A on Material Cost @	10%							$27,106			$27,106
G & A on Equipment Cost @	10%									$9,045	$9,045
G & A on Subcontract Cost @	10%						$86,117				$86,117
Total Direct Cost							$947,282	$298,170	$214,580	$99,495	$1,559,527
Indirects on Total Direct Cost @	25%	(Not including Transportation & Disposal Costs)									$181,166
Profit on Total Direct Cost @	10%										$155,953
Subtotal											$1,896,646
Health & Safety Monitoring @	1%										$18,966
Total Field Cost											$1,915,612
Contingency on Total Field Costs @	5%										$95,781
Engineering on Total Field Cost @	5%										$95,781
TOTAL COST											**$2,107,174**
ADJ 2008 TOTAL COST											**$2,283,965**