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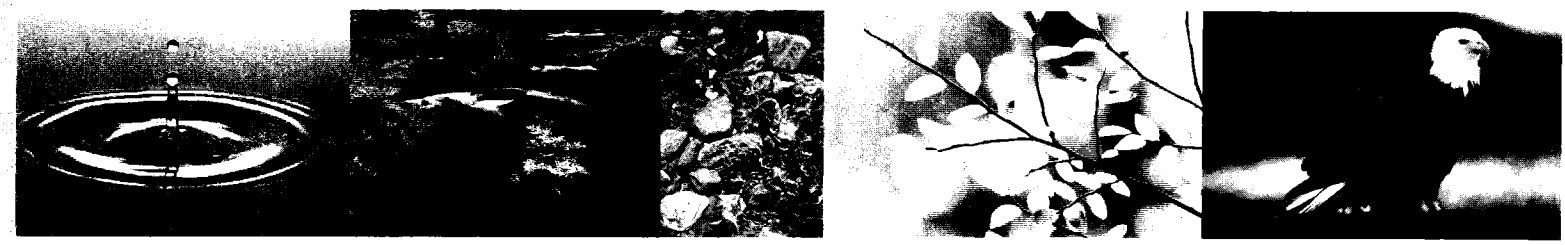
REMEDIAL ACTION PLAN FOR UNDERGROUND STORAGE TANK SITE 2406 NAS SAUFLEY FIELD FL

08/22/2006

TETRA TECH

Comprehensive Long-term Environmental Action Navy

CONTRACT NUMBER N62467-94-D-0888



Rev. 1
08/22/06

Remedial Action Plan
for
Underground Storage Tank Site 2406 Outlying Landing Field Saufley

Naval Air Station Pensacola
Pensacola, Florida

Contract Task Order 0274

August 2006

NAVFAC

Naval Facilities Engineering Command
Southeast
2155 Eagle Drive
North Charleston, South Carolina 29406

TETRA TECH NUS, Inc.

Rev. 1
08/22/06

REMEDIAL ACTION PLAN
FOR
UNDERGROUND STORAGE TANK
SITE 2406
OUTLYING LANDING FIELD SAUFLEY

NAVAL AIR STATION PENSACOLA
PENSACOLA, FLORIDA

COMPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

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This document, *Remedial Action Plan for Site 2406, Outlying Landing Field Saufley, Naval Air Station Pensacola, Pensacola, Florida*, has been prepared under the direction of a Florida Registered Professional Engineer. The work and professional opinions rendered in this report were conducted or developed in accordance with commonly accepted procedures consistent with applicable standards of practice. This document was prepared for *Site 2406, Outlying Landing Field Saufley,* Pensacola, Florida and should not be construed to apply to any other site.

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ACRONYMS

AST	Aboveground Storage Tank
AVGAS	Aviation Gasoline
bls	below land surface
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
BTOC	below top of casing
cfm	cubic feet per minute
CLEAN	Comprehensive Long-term Environmental Action Navy
COC	Contaminants of Concern
CTO	Contract Task Order
DE	Direct Exposure Limit
DE1	Direct Exposure-Residential
DE2	Direct Exposure-Industrial
DO	Dissolved Oxygen
DOT	Department of Transportation
DPE	Dual-Phase Extraction
DPT	Direct-Push Technology
DTW	Depth-to-groundwater
EDB	Ethyldibromide
EDC	1,2-dichloroethane
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FID	Flame Ionization Detector
FL-PRO	Florida Petroleum Range Organics
ft	Feet (Foot)
ft^2	Square Feet
GAC	Granular Activated Carbon
GAG	Gasoline Analytical Group
gals	Gallons
GCTLs	Groundwater Cleanup Target Levels
Hg	Mercury
i	Hydraulic Gradient
K	Hydraulic Conductivity
LDA	Large Diameter Auger
LE	Leachability Limit
lbs	Pounds

ACRONYMS (Continued)

µg/L	Micrograms per Liter
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
MOP	Monitoring Only Plan
MTBE	Methyl Tertiary Butyl Ether
NADC	Natural Attenuation Default Concentration
NAAS	Naval Auxiliary Air Station
NAS	Naval Air Station
NAVFAC EFD SOUTH	Southern Division, Naval Facilities Engineering Command
NETPDTC	Naval Education and Training Professional Development and Technical Center
NETPMSA	Naval Education and Training Program Management Support Activity
NTTC	Naval Technical Training Center
n	Porosity
OLF	Outlying Landing Field
OVA	Organic Vapor Analyzer
PAH	Polynuclear aromatic hydrocarbon
ppm	parts per million
PWC	Public Works Center
RAP	Remedial Action Plan
ROI	Radius of Influence
SA	Site Assessment
SAR	Site Assessment Report
SARA	Site Assessment Report Addendum
SCTLs	Soil Cleanup Target Levels
SCFM	standard cubic feet per minute
STP	Standard Temperature and Pressure
SVE	Soil Vapor Extraction
SWL	Static water level
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has been tasked to prepare a Remedial Action Plan (RAP) for the United States Navy Southern Division, Naval Facilities Engineering Command (NAVFAC EFD SOUTH) under Contract Task Order (CTO) 0274, for the Comprehensive Long-term Environmental Action Navy (CLEAN) III, Contract Number N62467-94-D-0888. This RAP was prepared for Underground Storage Tank (UST) Site 2406 located at Outlying Landing Field (OLF) Saufley, Naval Education and Training Professional Development and Technical Center (NETPDTC), Naval Air Station (NAS) Pensacola, Pensacola, Florida in accordance with the requirements of Chapter 62-770, Florida Administrative Code (F.A.C.), and is being submitted to the Florida Department of Environmental Protection (FDEP) for approval.

The objectives of the RAP were met by conducting the following tasks during the preparation of this RAP:

- Review the information provided in the Site Assessment Report (SAR) (SDIV, 1998) and the subsequent SAR Addendums (SARAs), SARA and SARA No. 2 (TtNUS, 2003 and 2005, respectively).

- Evaluate remedial alternatives for removal of light non-aqueous phase liquids (free product) at UST Site 2406.

- Prepare a RAP to provide a conceptual design, including equipment specifications, for the removal of free product.

- Specify a monitoring plan to evaluate the effectiveness of the free product removal at the site.

This RAP identifies remedial alternatives to remove free product at UST Site 2406, in general accordance with requirements defined by Chapter 62-770, F.A.C. Dual-phase extraction (DPE) was selected to remove the free product. Based on the conceptual design presented in this RAP, the remedial time frame is estimated at approximately six months to achieve the remedial action goal for the removal of free product. Following the implementation of this RAP, a re-evaluation of the petroleum-impacted soil and groundwater at the site will be conducted and a subsequent RAP will be prepared to address the remaining soil and groundwater contamination.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This RAP was prepared by TtNUS for NAVFAC EFD SOUTH under CTO 0274, for the CLEAN III, Contract Number N62467-94-D-0888. This RAP was prepared to address the free product present at UST Site 2406. Site 2406 is located at OLF Saufley, NETPDTC, NAS Pensacola, Pensacola, Florida (Figure 1-1).

The purpose of this RAP is to evaluate remedial options and recommend a feasible, cost effective, and timely remedial alternative to conduct the removal of free product at Site 2406. The scope of this RAP provides a conceptual design for the selected alternative in accordance with the requirements of Chapter 62-770, F.A.C.

Following the implementation of this RAP, a re-evaluation of the petroleum-impacted soil and groundwater at the site will be conducted and a subsequent RAP will be prepared to address the remaining soil and groundwater contamination.

1.2 SITE DESCRIPTION

OLF Saufley Field is located in northwest Florida, within Escambia County. The base is situated between Interstate Highway 10 (I-10) and Perdido Bay approximately five miles northwest of NAS Pensacola. OLF Saufley consists of four airstrips, two of which are active. The base also has a small number of support buildings and a Federal Prison, which are located south of the airfield (Figure 1-2). OLF Saufley covers 866 acres of land, the majority of which is wooded or used for the airstrips.

Site 2406 is in the vicinity of the former location of potable water well number 4 (PW04; Figure 1-2), which was located at the southwest corner of Building 2406. Most of the area in the vicinity of Site 2406 is paved with asphalt or concrete. Buildings 811 and 845 are located immediately to the west of Building 2406. Two wooded areas, approximately a half acre and two acres respectively, are located south-southwest of Building 2406. A former tank area containing six 20,000 gallon USTs (Figure 1-3) was situated within these wooded areas. A 10-inch fuel line distributed the aviation gasoline (AVGAS) or jet fuel to the landing field from the UST area. In addition to the USTs and fuel product line, there are also two 20,000 gallon aboveground storage tanks (ASTs) located behind Building 804 and four 7,800 gallon USTs located beneath the ASTs. The 7,800 gallon USTs were abandoned in place in November 1988.

1.3 SITE HISTORY

OLF Saufley opened in 1940 as Naval Auxiliary Air Station (NAAS) Saufley. NAAS Saufley was used to train pilots during World War II and the Korean Conflict. In 1957, the mission at Saufley Field was changed to basic training for naval aviators. NAAS Saufley was re-designated as a NAS in 1968 and retained that status until 1976 when NAS Saufley operations were discontinued and the facility was placed in caretaker status. Between 1976 and 1979, Saufley Field was used as an OLF for NAS Whiting Field. In 1979, Saufley Field was reactivated as Naval Educational and Training Program Management Support Activity (NETPMSA). Saufley Field was renamed the NETPDTC in 1996. Saufley Field is now used primarily to train and educate Naval personnel and to house Federal prisoners. NAS Whiting Field pilots use two of the airstrips for touch and go landing exercises.

In 1994, the Public Works Center (PWC) potable water treatment system at OLF Saufley included two active potable water wells (PW03 and PW04; Figure 1-2). On May 9, 1994, a water sample from PW04 effluent indicated benzene contamination levels of 0.032 milligrams per liter (mg/L), exceeding the FDEP drinking water standard of 0.001 mg/L. PW04 was taken off-line, and was subsequently placed on quarterly sampling for one year for observation and corrective action to remove the contamination. In April 1996, PW03 and PW04 were abandoned in-place. Currently the only source of potable water for OLF Saufley is a well field located at the Naval Technical Training Center (NTTC) Corry Station, located approximately 5 miles north of Bayou Grande.

1.4 REPORT ORGANIZATION

This RAP is organized into eight sections. Below is a list of the sections and a brief description of their purpose:

Section 1.0	**Introduction**	Summarizes the report's purpose, scope, site information, and report organization.
Section 2.0	**Previous Investigations**	Provides information from the approved SAR and SARAs, and summarizes their findings and conclusions.
Section 3.0	**RAP Goals**	Establishes the objectives for the free product removal conceptual remedial design.
Section 4.0	**Contaminant Distribution**	Estimates the mass of free product present at the site.
Section 5.0	**Remedial Alternative Technology Screening**	Presents the remedial alternatives, determines the feasibility, and develops cost estimates for each.
Section 6.0	**Remedial System Design**	Presents all of the assumptions made and provides the conceptual design of the preferred remedial alternative.
Section 7.0	**Monitoring Plan**	Provides a monitoring plan for the evaluating the free product removal effectiveness.
	References	Lists references used in this RAP.

2.0 PREVIOUS INVESTIGATIONS

The following is a summary of the data and information presented in the SAR (SDIV, 1998), SARA, and SARA No. 2 (TtNUS, 2003 and 2005, respectively). The SAR and both SARAs recommended the preparation of a RAP.

2.1 PREVIOUS INVESTIGATIONS

A site assessment (SA) was conducted at Site 2406 during April and May of 1996 by NAS Pensacola PWC. A total of ten monitoring wells (nine shallow and one deep) were installed and soil samples were collected from boreholes during the installation of the monitoring wells. Figure 2-1 presents the soil boring locations for Site 2406 and Figure 2-2 presents the monitoring well locations for Site 2406. Soil samples were collected at 3 foot (ft) intervals to a depth of 39 ft below land surface (bls), and analyzed for organic vapors. Organic vapors exceeding 50 parts per million (ppm) were detected in soil samples from the boreholes associated with the installation of monitoring wells OLFS-2406-MW3, OLFS-2406-MW4, and OLFS-2406-DMW10. Groundwater sampled from OLFS-2406-MW3 contained ethylbenzene, toluene, total xylenes, naphthalene, total recoverable petroleum hydrocarbons (TRPH), lead, and ethyldibromide (EDB) above FDEP Groundwater Cleanup Target Levels (GCTLs) (SDIV, 1998). NAS Pensacola PWC concluded that excessively contaminated soil existed in the vicinity of OLFS-2406-MW3 and OLFS-2406-DMW10. Petroleum constituents existed in the groundwater near OLFS-2406-MW3; however, the source could not be determined, and no free product was present. NAS Pensacola PWC recommended the development of a RAP for soil and development of a Monitoring Only Plan (MOP) for groundwater.

After review of the SAR, the FDEP responded with comments requiring additional assessment to further delineate the extent of the soil and groundwater contamination, as well as, determine the source of the contamination. FDEP specifically requested an additional shallow monitoring well and an intermediate monitoring well be installed.

From 2000 through 2004, TtNUS performed SA activities and completed two SARAs, SARA (TtNUS, 2003) and SARA No. 2 (TtNUS, 2005) for Site 2406 at OLF Saufley.

During July and August, 2000, additional SA was conducted by TtNUS in the area near PW04. Seven soil borings were advanced at the site to total depths of 42 ft. Soil samples from the borings were screened for soil contamination and five soil samples were sent to a laboratory for confirmatory analysis of gasoline and kerosene analytical group parameters Soil screening results were less than 50 ppm and the soil sample laboratory analytical results were less than FDEP Soil Cleanup Target Levels (SCTLs).

Three new monitoring wells were installed, one shallow well screened at the water table (OLFS-2406-MW11), one intermediate well (OLFS-2406-DMW12 screened from 65-70 ft bls), and one deep well (OLFS-2406-DMW13 screened from 130-140 ft). Slug tests were conducted on two intermediate monitoring wells (OLFS-2406-DMW10 and OLFS-2406-DMW12) and one deep monitoring well (OLFS-2406-DMW13) to provide site specific hydraulic conductivity data. Groundwater samples were collected from OLFS-2406-DMW10, OLFS-2406-DMW12, and OLFS-2406-DMW13. These groundwater samples were also analyzed for gasoline and kerosene analytical group parameters. During this sampling event water table wells OLFS-2406-MW3, OLFS-2406-MW4, and OLFS-2406-MW11 were dry likely due to drought conditions. Results of the additional SA indicated that a groundwater sample from monitoring well OLFS-2406-DMW12 contained EDB [0.024 micrograms per liter (µg/L)] and benzene (400 µg/L) at concentrations exceeding FDEP's GCTLs of 0.02 and 1 µg/L, respectively.

Based on the exceedances reported in monitoring well OLFS-2406-DMW-12, the SA was continued and included the installation of three additional monitoring wells (OLFS-2406-DMW-14, OLFS-2406-DMW-15, and OLFS-2406-DMW-16) surrounding monitoring well OLFS-2406-DMW-12. In October and November 2001, groundwater samples were collected from six monitoring wells including: OLFS-2406-MW10, OLFS-2406-MW12, OLFS-2406-MW13, OLFS-2406-MW14, OLFS-2406-MW15, and OLFS-2406-MW16 and analyzed for gasoline and kerosene analytical group parameters.

The analytical results for the additional sampling event indicated that benzene was present in four of the monitoring wells at concentrations ranging from 40 to 6,200 µg/L, which exceeded the FDEP GCTL of 1 µg/L for benzene. Ethylbenzene, total xylenes, and toluene were detected in the groundwater sample from monitoring well OLFS-2406-MW16 at concentrations of 170 µg/L, 539 µg/L, and 3,100 µg/L, respectively. All three detected concentrations exceeded the respective FDEP GCTLs. 1,2-Dichloroethene was detected in the groundwater sample from monitoring well OLFS-2406-MW12 at a concentration (13 µg/L) exceeding the FDEP GCTL of 3 µg/L. Total xylenes, chloroform, and methylene chloride were also detected in groundwater samples collected during the sampling event; however, detected concentrations did not exceed the FDEP GCTLs.

Because of the elevated concentrations detected in the deep monitoring wells located at the site, NAVFAC EFD SOUTH determined that additional investigation and assessment was warranted.

To address these elevated concentrations and surrounding areas, TtNUS conducted additional assessment activities and completed a subsequent SARA, SARA No. 2 in 2004.

The following activities were conducted as part of SARA No. 2:

- Review of available Navy documents to identify potential sources and receptors for petroleum hydrocarbons in the vicinity of UST Site 2406.
- Assessment of the nature and extent of petroleum constituents in soil and groundwater in the vicinity of UST Site 2406 using direct-push technology (DPT) methods for soil and groundwater sampling and mobile laboratory analysis.
- Installation of 6 shallow permanent monitoring wells, 13 intermediate monitoring wells, and two deep monitoring wells.
- Collection of groundwater samples from the permanent monitoring wells for laboratory analysis of volatile organic aromatics (VOAs), polynuclear aromatic hydrocarbons (PAHs), EDB, TRPH, and lead.
- Comparison of soil analytical results to the SCTLs and the groundwater analytical results to the GCTLs in Chapter 62-777 F.A.C.
- Evaluation of aquifer properties to interpret the movement of groundwater at the site.

Conclusions and Recommendations

The conclusions based on the data collected during all SA activities performed by TtNUS at UST Site 2406, are summarized below:

- Free product was detected in up to six shallow monitoring wells in the vicinity of the AVGAS UST area and fuel distribution pipelines, approximately at the intersection of Raby Avenue and McKinnon Street.
- Field screening samples and laboratory analytical data indicated an area of soil contamination in the vicinity of the free product plume.
- Laboratory analyses of soil samples with organic vapor analysis (OVA) results greater than 50 ppm indicated that concentrations of petroleum constituents in site soil were greater than the SCTLs.
- Groundwater sampling results from DPT and monitoring wells indicated that concentrations of dissolved petroleum contaminants of concern (COCs) in site groundwater exceeded GCTLs.

- No GCTL exceedances were detected in the deep monitoring wells.

- Exposure pathways of human receptors to groundwater via surface water or supply wells are not complete.

2.2 SITE LITHOLOGY

Interpretation of site lithology and stratigraphy at UST Site 2406 was based on visual examination of soil cores collected from soil borings during monitoring well installation. Typical lithology at the site consists of inter-bedded, various colored, silty clayey sands, silty sands, clayey silty sands, and silty sand. A lithologic cross-section for Site 2406 is presented as Figure 2-3.

The typical lithology at Site 2406 consists of six distinct layers: brown silty clayey sand (0-4 ft bls), reddish-brown silty clayey sand (4-30 ft bls), light-brown and yellowish-brown silty sand (10-50 ft bls), light grey silty clayey sand (40-70 ft bls), yellowish-orange silty clayey sand (70-90 ft bls), and gray silty sand (below 90 ft bls). A lithologic cross-section presenting the subsurface material at the site is included as Figure 2-3. These layers were found in borings to the west and southwest of Building 2406 from ground surface to depths of approximately 135 ft.

Soil boring logs and regional lithology information are provided in the SARAs (TtNUS, 2003 and 2005, respectively).

2.3 GROUNDWATER AND AQUIFER CHARACTERISTICS

During the previous SA activities, hydrogeologic data were collected to evaluate movement of groundwater in the surficial aquifer at Site 2406. Depth-to-groundwater (DTW) measurements and groundwater elevation data were used to determine the groundwater flow direction and water table gradient at the site. Hydraulic conductivity values for the surficial aquifer were calculated from data collected during slug tests. Groundwater flow velocity at the site was also estimated from the hydraulic conductivity and gradient data.

2.3.1 Static Water Level and Groundwater Elevations

In January 2003, static water level (SWL) measurements in the shallow wells ranged from 40.98 ft below top of casing (BTOC) to 45.23 ft BTOC. The relative groundwater elevations in the shallow wells ranged from 83.65 ft to 88.95 ft. Although free product was present in six monitoring wells, the water levels from these wells were corrected for density differences of free product.

The SWL measurements in the intermediate and deep wells ranged from 28.45 ft BTOC to 48.91 ft BTOC. The relative groundwater elevations in the intermediate and deep wells ranged from 74.17 ft to 88.06 ft.

The relative groundwater elevation in deep well OLFS-2406-DMW37 was 7.4 ft lower than in the adjacent shallow well OLFS-2406-MW17. The difference in groundwater elevation and screened interval indicate a downward vertical gradient of approximately 0.16 ft. The relative groundwater elevation in deep well OLFS-2406-DMW32 was 0.25 ft lower than in the adjacent intermediate well OLFS-2406-DMW31. The difference in groundwater elevation and screened interval indicate a downward vertical gradient of approximately 0.005 ft. Historical DTW and free product measurements as well as groundwater elevation data are presented in Table 2-1.

During the additional assessment in 2004, on-site DTW measurements and groundwater elevations were recorded from site monitoring wells on July 28, 2004.

For the most part, groundwater elevations and flow direction were similar to that found during the 2003 SA. The relative groundwater elevations in the shallow wells ranged from 79.97 ft to 100.60 ft. Although free product was present in four monitoring wells (OLFS-2406-MW17, -MW18, -MW20, and -MW22), the water levels from these wells were corrected for density differences of free product using an assumed free product specific gravity of 0.8. The groundwater flow for the shallow (45 to 56 ft bls) screened groundwater interval was in a radial direction with the high point located in the former fuel farm area. Based on the current data it is unclear if this pattern is consistent in the area south of the fuel tank area.

The water level measurements in the intermediate and deep wells ranged from 27.20 ft BTOC to 47.71 ft BTOC. The relative groundwater elevations in the intermediate and deep wells ranged from 75.42 ft to 98.12 ft.

2.3.2 Groundwater Flow Direction

To evaluate the direction of groundwater flow at the site, the groundwater elevations from the shallow, intermediate, and deep site monitoring wells are presented Figures 2-4, 2-5, and 2-6, respectively. Interpretation of data from the site indicates that groundwater flow in the shallow (45 to 56 ft bls) screened groundwater interval is to the north-northeast; the groundwater flow for the intermediate (65 to 81 ft bls) screened groundwater interval is generally to the west; and the groundwater flow in the deep (130 to 142 ft bls) screened groundwater interval is to the west-southwest.

2.3.3 Aquifer Characteristics

In January 2003, the average horizontal groundwater gradient across the site was calculated from the groundwater elevations measured in shallow monitoring wells and the estimated groundwater flow direction.

In addition, rising-head slug tests were conducted in select site monitoring wells to provide data to estimate the hydraulic conductivity (K) in the surficial aquifer. The slug test data indicated an order of magnitude variation in hydraulic conductivity between the shallow and deep zones of the aquifer. The slug test results are summarized in the SARA (TtNUS, 2003).

Using an average hydraulic conductivity of 10.08 ft/day, an average hydraulic gradient of 0.01 ft, and an effective porosity value of 30 percent, the estimated average groundwater velocity for the shallow zone at the site was calculated at 0.336 ft/day. A site-specific transmissivity value was also calculated from the estimated hydraulic conductivity.

The shallow aquifer characteristics estimated in the initial SARA (TtNUS, 2003), are summarized below:

- Hydraulic conductivity K = 10.08 feet/day or 4.06×10^{-3} cm/sec
- Hydraulic gradient i = 0.01 ft/ft
- Transmissivity T = 72,000
- Average Groundwater Velocity V = 0.336 feet/day
- Effective Porosity n_e = 0.30 (unitless)*

*Review of standard literature suggests that a representative effective porosity for the lithology at this site is approximately 30 percent (Heath, 1983).

2.4 CONTAMINATED SOIL ASSESSMENT

The vertical and horizontal extent of petroleum impacted soil in the vadose zone was assessed through soil vapor analysis, and supplemented with fixed-base soil confirmation analysis, performed during the soil boring investigations and monitoring well installations described in the SARA (TtNUS, 2003).

2.4.1 Headspace Screening Analysis of Soil

During the SA activities conducted in 2003 for the SARA, the extent of soil contamination was determined by the advancement of soil borings and OVA-Flame Ionization Detector (FID) screening of soil samples.

Thirty-three soil borings were advanced at Site 2406. Soil boring locations are presented on Figure 2-1. Soil samples for OVA screening were collected at 4-ft intervals from each soil boring. Although OVA screening samples were collected at 4-ft intervals, in some instances multiple discreet samples were collected from the same sample interval and analyzed. A summary of the historical soil OVA results at Site 2406 is presented in Table 2-2.

The OVA data indicated that no contamination is present between 4 and 25 ft bls. Between 25 and 44 ft bls, seven soil borings had non-carbon filtered (uncorrected) OVA results exceeding 50 ppm defined as excessively contaminated soil per Chapter 62-770, F.A.C. OVA results are presented in Figure 2-7.

2.4.2 Mobile Laboratory Analysis of Soil

Soil samples were submitted to a mobile laboratory as part of the initial SA for screening level analysis of benzene, toluene, ethylbenzene and xylene (BTEX), naphthalene, and methyl tertiary-butyl ether (MTBE).

Nineteen soil samples were submitted for mobile laboratory screening analysis from 12 of the soil boring locations at the site. In order to confirm the OVA results, the soil samples were collected from intervals with OVA results ranging from 0 to greater than 5000 ppm. The soil samples were analyzed for BTEX at the mobile laboratory.

Analysis of soil samples collected from borings OLFS-2406-SB2 and OLFS-2406-SB29 at 4 ft bls, and from OLFS-2406-SB2 at the 8-12 ft bls interval did not indicate concentrations exceeding instrument detection limits. These results confirm the absence of elevated OVA results from the same intervals. Mobile lab screening analysis also confirmed contamination in the 25 to 44 ft bls interval. The results are presented in the SARA (TtNUS, 2003) and are summarized below:

- Benzene was detected in soil samples from four soil borings at concentrations ranging from 0.017 to 9.8 milligrams per kilogram (mg/kg). All of the detected concentrations except soil boring OLFS-2406-SB25 30' exceeded FDEP SCTLs for residential (DE1) (1.1 mg/kg), industrial (DE2) (1.6 mg/kg), and leachability (LE) (0.007 mg/kg). However, because all of the samples were collected from depths greater than 2 ft bls, direct exposure is not a concern. The detected concentration in soil boring OLFS-2406-SB25 30' was 0.017, which exceeds the FDEP SCTL for LE, but not the DE1 and DE2 SCTLs.

- Ethylbenzene, toluene, and total xylenes were all detected at elevated concentrations in seven borings (OLFS-2406-SB7 40-45', OLFS-2406-SB21 40', OLFS-2406-SB25 30', OLFS-2406-SB25 44', OLFS-2406-SB29 32', OLFS-2406-SB29 44', and OLFS-2406-SB30 44'). Six of the seven soil borings (excluding OLFS-2406-SB25 30') contain all these compounds at concentrations exceeding the FDEP SCTL for LE (0.60, 0.50, 0.20 mg/kg, respectively). In addition, a single occurrence of toluene was reported in sample OLFS-2406-SB28 41' at a concentration less than the FDEP SCTLs.
- Toluene was detected above the DE1 SCTL (380 mg/kg) in boring OLFS-2406-SB30 44'.

2.4.3 Fixed-Base Laboratory Analysis of Soil

Four soil samples were collected for off-site fixed-based laboratory confirmatory analysis to correlate OVA and mobile lab analysis results with contaminant concentrations. The sample intervals were selected to correspond with low (OLFS-2406-SB26-40 at 51 ppm), medium (OLFS-2406-SB21-29 at 432 ppm and OLFS-2406-SB21-40 1,200 ppm), and high (OLFS-2406-SB28-44 at >2,256 ppm) OVA results detected during OVA screening. The soil samples were submitted to an off-site laboratory to be analyzed for volatile organic compounds (VOCs), PAHs, and TRPH.

Three VOCs (benzene, ethylbenzene, and total xylenes) were detected in two of the four soil samples analyzed at the off-site laboratory. Toluene was detected in all four soil samples at concentrations ranging from 0.0053 to 554 mg/kg. Benzene was detected in samples OLFS-2406-SB21-40 and OLFS-2406-SB28-44 above the DE1, DE2, and LE SCTLs. However, because the samples were recovered from depths greater than 2 ft bls, direct exposure is not a concern. Ethylbenzene and total xylenes were also detected in these two samples above the LE SCTLs. Toluene was detected in sample OLFS-2406-SB21-40 and OLFS-2406-SB28-44 above the LE SCTL.

PAHs were not detected in the soil samples collected during the SA; however, TRPH was detected in two samples, OLFS-2406-SB21-40 and OLFS-2406-SB28-44. TRPH was detected above the FDEP DE1 (340 mg/kg) and LE SCTL in sample OLFS-2406-SB28-44. Again, because this sample was collected from a depth of 44 ft bls direct exposure is not a concern.

The results of the soil assessment confirm that there are petroleum-contaminated soils at the site exceeding FDEP SCTLs. A summary of the historical analytical results for all soil samples collected at Site 2406 is presented in Table 2-3.

2.5 CONTAMINATED GROUNDWATER ASSESSMENT

The vertical and horizontal extent of petroleum contaminated groundwater was delineated through groundwater sampling and analysis performed during field investigations as described in the SARAs (TtNUS, 2003 and 2005, respectively). A monitoring well location map is presented as Figure 2-2 and includes all monitoring wells installed as part of the SA at Site 2406.

In 2003, groundwater samples were collected from 33 soil borings during the DPT screening investigation and one monitoring well for on-site mobile laboratory analysis. Three confirmation samples were collected and submitted to an off-site fixed-based laboratory to verify the results of the on-site analyses. Following the DPT investigation, groundwater samples were collected from 15 newly installed monitoring wells [13 intermediate (65 – 80 ft bls) and 2 deep (>80 ft bls)].

In 2004, groundwater samples were collected from eight previously installed monitoring wells [two shallow (55 ft bls) and six deep (130 ft bls)] and 11 newly installed monitoring wells [eight shallow (45 to 56 ft bls) and three deep (130 to 133 ft bls)]. A summary of the historical analytical results for groundwater is presented in Tables 2-4 and 2-5.

2.5.1 Groundwater Screening Results

Groundwater samples were submitted to an on-site mobile laboratory as part of the 2003 SA for screening level analysis of BTEX, naphthalene, and MTBE. This screening investigation was conducted to assist in delineating the extent of petroleum-impacted groundwater and to aid in the placement of permanent monitoring wells.

Groundwater samples were submitted for mobile laboratory screening analysis from 33 DPT soil boring locations (Figure 2-1) and one existing deep monitoring well OLFS-2406-DMW16. Shallow groundwater samples were collected at the water table in each of the DPT soil boring locations at depths ranging from 45 to 55 ft bls, as well as, deep groundwater samples, 65 to 80 ft bls, in 20 of the DPT borings.

The groundwater screening results are summarized in the SARA (TtNUS, 2003) and briefly discussed in the following sections. The screening data is presented in Tables 4-5 and 4-6 of the SARA and the mobile laboratory analytical report is located in Appendix D of the SARA.

Shallow Groundwater Screening Results

Benzene was detected in 16 of the 33 shallow groundwater samples at concentrations ranging from 0.8 to 9,000 µg/L. However, only 12 of the detected concentrations were above the FDEP GCTL of 1 µg/L. Elevated concentrations of toluene occurred in 24 of the 33 groundwater samples ranging from 1.0 to

59,000 µg/L; however, only seven samples contained concentrations above the FDEP GCTL of 40 µg/L. Eight of the 33 shallow groundwater samples contained detected concentrations of ethylbenzene ranging from 1.0 to 2,800 µg/L, including five samples with concentrations above the FDEP GCTL of 30 µg/L. Total xylenes were detected in 11 of the 33 groundwater samples at concentrations ranging from 1.4 to 5,800 µg/L. Of the 11 total xylenes detections, five were reported above the FDEP GCTL of 20 µg/L.

Deep Groundwater Screening Results

Benzene was detected in 11 of the 21 deep groundwater samples (including one monitoring well) at concentrations ranging from 1.2 to 8,800 µg/L. All of the elevated detected concentrations were above the FDEP GCTL of 1 µg/L. Toluene was reported present in 5 of the 21 groundwater samples at concentrations ranging from 1.0 to 400 µg/L. One sample contained a toluene concentration (400 µg/L) above the FDEP GCTL of 40 µg/L. One of the 21 deep groundwater samples (NASP-2406-SB49 80') was reported with an elevated concentration of ethylbenzene (27.6 µg/L). However, the concentration was less than the FDEP GCTL of 30 µg/L. Total xylenes were detected in 2 of the 21 groundwater deep samples. Both of the groundwater samples with detectable levels of total xylenes contained total xylenes above the FDEP GCTL of 20 µg/L.

Benzene, toluene, ethylbenzene, and total xylenes were detected in the groundwater sample from OLFS-2406-DMW16 at concentrations of 3,400, 160, 880, and 360 µg/L, respectively. All of the detected concentrations exceeded the FDEP GCTLs.

Groundwater Confirmation Samples

Three groundwater confirmation samples, OLFS-2406-SB21-GW45, OLFS-2406-SB26-GW48, and OLFS-2406-SB28-GW48, collected during the DPT screening investigation were sent to an off-site fixed-based laboratory for analysis. The confirmation samples were submitted to a fixed-base laboratory for VOCs, PAHs, EDB, TRPH and lead analysis. All BTEX constituents were detected in confirmation samples, OLFS-2406-SB21-GW45 (high concentration) and OLFS-2406-SB28-GW48 (medium concentration) with a similar concentration range as detected in the on-site mobile lab screening analyses. All concentrations exceeded the respective FDEP GCTLs. The BTEX concentrations in the confirmation sample OLFS-2406-SB26-GW48 (representing the low range) were below the FDEP GCTLs, or not detected, and were similar to concentrations detected in the on-site mobile lab analysis.

2.5.2 Groundwater Monitoring Well Sampling Results

In 2003, groundwater samples were collected from 13 intermediate (65 to 80 ft bls) and 2 deep (130 to 135 ft bls) monitoring wells at the site. The shallow monitoring wells were not sampled due to the

presence of free product. Groundwater samples collected from the monitoring wells were submitted to an off-site fixed-based laboratory and analyzed for VOCs (including EDB), PAHs, TRPH, and lead.

Intermediate Monitoring Well Groundwater Samples

Seven VOCs (EDB, 1,2-dichloroethane [EDC], benzene, chloroform, ethylbenzene, toluene, and total xylenes) were detected in the intermediate groundwater samples. The intermediate groundwater samples also contained detectable levels of three PAH compounds: 1-methylnaphthalene, 2-methylnaphthalene, and naphthalene. Lead and TRPH were also detected in the intermediate groundwater samples.

1,2-dibromoethane was detected in three groundwater samples (OLFS-2406-DMW-28, OLFS-2406-DMW29 and OLFS-2406-DMW33) at concentrations (0.031, 0.048 and 0.23 µg/L, respectively) above the FDEP GCTL of 0.02 µg/L. Elevated concentrations of EDC were reported in two groundwater samples (OLFS-2406-DMW29, and OLFS-2406-DMW33) at concentrations (4.8, and 4.8 µg/L, respectively), above the FDEP GCTL of 3 µg/L.

Seven groundwater samples were reported with detected concentrations of benzene ranging from 0.58 (estimated) to 15,600 µg/L. Benzene concentrations exceeded the FDEP GCTL of 1 µg/L in five of the groundwater samples. Elevated concentrations (837 and 120 µg/L) of ethylbenzene were reported in two groundwater samples (OLFS-2406-DMW23 and OLFS-2406-DMW25, respectively) above the FDEP GCTL of 30 µg/L. Toluene was reported in four groundwater samples, including two groundwater samples (OLFS-2406-DMW23 and OLFS-2406-DMW25) with concentrations (10,700 and 2,930 µg/L, respectively) above the FDEP GCTL of 40 µg/L. Elevated concentrations of total xylenes were reported in three groundwater samples. However, only two samples [OLFS-2406-DMW23 (2,480 µg/L) and OLFS-2406-DMW25 (580 µg/L)] had concentrations exceeding the FDEP GCTL of 20 µg/L.

Also, lead was reported in two groundwater samples (OLFS-2406-DMW29 and OLFS-2406-DMW34R) with concentrations (17.9 and 69.5 µg/L, respectively) above the FDEP GCTL of 15 µg/L.

Deep Monitoring Well Groundwater Samples

No detected concentrations of contaminants were reported in the deep monitoring well groundwater samples at Site 2406.

2.5.3 Additional Groundwater Monitoring Well Sampling Results

Additional groundwater sampling was conducted in 2004 during additional assessment activities for SARA No. 2. The analytical results from the additional groundwater sampling are presented in Table 2-5 and summarized below:

Existing Wells

Six existing monitoring wells (OLFS-2406-DMW13D, -MW28, MW29, -MW32D, -MW34D, and –MW37D) were re-sampled for specific parameters based on the results reported in the SARA (TtNUS, 2003).

Intermediate monitoring wells OLFS-2406-MW28D and OLFS-2406-MW34D were re-sampled for lead only. Analytical results from the previous sampling event (in January 2003) indicated lead (17.9 µg/L and 69.5 µg/L, respectively) was present in the groundwater samples at concentrations above the FDEP GCTL of 15 µg/L. The previously detected lead concentrations were not confirmed by this resampling event.

Intermediate monitoring well OLFS-2406-MW29D was re-sampled for VOCs only. Three VOCs: benzene, chloroform, and 1,2-diochloroethane were detected in the groundwater sample. The results from the re-sampling event indicated benzene and 1,2-diochloroethane were detected at concentrations (308 µg/L and 5.1 µg/L, respectively) that exceeded the FDEP GCTLs. The previous sampling event indicated benzene (194 µg/L), 1,2-dichloroethane (4.8 µg/L), and 1,2-dibromoethene (0.048 µg/L) were present in the groundwater samples at concentrations exceeding their respective FDEP GCTLs.

Deep monitoring wells OLFS-2406-MW13D, OLFS-2406-MW32D, and OLFS-2406-MW37D were re-sampled for VOCs and lead only. Lead was not detected in any of the three groundwater samples at concentrations above instrument detection limits.

Shallow Monitoring Well Groundwater Samples – New Wells

Seven VOCs including toluene, ethylbenzene, total xylene, acetone, MTBE, benzene, and chloroform were detected in the shallow groundwater samples from the newly installed monitoring wells. The groundwater sample OLFS-2406-MW41 was the only sample to contain VOC concentrations exceeding the FDEP GCTLs. Detected concentrations of toluene (368 µg/L), ethylbenzene (30.5 µg/L), total xylene (88.6 µg/L), and benzene (439 µg/L) exceeded the FDEP GCTLs of 40 µg/L, 30 µg/L, 20 µg/L, and 1 µg/L, respectively. Detected concentrations exceeding the instrument detection limits of toluene, ethylbenzene, acetone, total xylene, and chloroform were detected in groundwater samples from the remaining shallow monitoring wells; however, none of the detected concentrations exceeded the FDEP GCTLs. Lead was not detected in any of the shallow monitoring well groundwater samples.

Deep Monitoring Well Groundwater Samples – New Wells

Groundwater samples from deep monitoring wells were reported to contain elevated concentrations of two VOCs: toluene and chloroform. Analytical results for samples OLFS-2406-MW42D and OLFS-2406-MW43D contained toluene at estimated concentrations of 0.51µg/L and 0.53 µg/L, respectively. Both concentrations were less than the FDEP GCTL of 40 µg/L. Chloroform was also detected in the groundwater sample from monitoring well OLFS-2406-MW43D at a concentration of 1.6 µg/L, which is less than FDEP GCTL of 70 µg/L.

No other compounds detected in groundwater samples submitted for fixed-base laboratory analysis exceeded FDEP GCTLs.

2.6 EXTENT OF FREE PRODUCT

Free product thickness measurements were recorded from site monitoring wells in July 2004 and again in January and February 2006. During each event, four monitoring wells at the site contained measurable free product (greater than 0.01 ft). Free product measurements have ranged from a 0.01 ft to 0.81 ft in thickness. Figure 2-8 presents the estimated extent of free product at the site.

A determination of free product mass at Site 2406 was completed and included in the SARA No. 2 (TtNUS, 2004). Based on the July 2004 data, the free product mass was estimated at approximately 57,470 pounds (lbs). This estimate has been modified based on the more recent data (2006), please see Section 4.0 for the updated estimate of free product mass at Site 2406.

2.7 SITE ASSESSMENT CONCLUSIONS AND RECOMMENDATIONS

The conclusions based on the data collected and evaluated during the entire SA for UST Site 2406 are summarized as follows:

- Free-phase petroleum product (thickness of 0.01 ft or greater) was detected in as many as six monitoring wells during SA activities at Site 2406.
- The horizontal and vertical extent of free product has been delineated.
- Exposure pathways to human receptors via surface water or supply wells are not complete.

The conclusions below are separated into three groups, the conclusions of the SAR (SDIV, 1998), the first SARA completed in August 2003 (TtNUS, 2003), and the second SARA, SARA No. 2, completed in November 2005 (TtNUS, 2005).

Conclusions - SAR

The initial SAR identified three petroleum systems as potential sources of petroleum releases that may have resulted in the contamination detected in potable well PW04 before it was abandoned:

- Four fuel-oil USTs with a capacity of 7,800 gallons each are located in the vicinity of potable water supply well PW04, near the intersection of Raby Avenue and Pou Street. These fuel oil USTs are located upgradient of PW04 and were reportedly abandoned in place in November 1988. No documentation of a tank closure assessment for these tanks has been found. Two 20,000 gallon fuel oil ASTs are located above the abandoned USTs. These fuel oil tanks are temporarily out of service. (SDIV, 1998)

- Six 20,000 gallon USTs used to supply AVGAS or jet fuel to the flight line are located southwest of potable water supply well PW04, at the intersection of Raby Avenue and McKinnon Street. These AVGAS USTs are located downgradient of PW04. No documentation of a tank closure assessment for these tanks was found. (SDIV, 1998)

- A 10-inch fuel line system, reportedly two miles long, was used to distribute the fuel to the flight line fuel hydrant system. The pipeline system appears to originate at a pump house adjacent to the six 20,000 gallon USTs. Three fuel pipelines exit the UST area and extend under Pou Street to the flight line. Approximately 20 segments of pipeline, with an unknown number of junctions and valves, connect the USTs to the fueling pits. Approximately 55 fueling pits were associated with this system are located on the flight line. Reportedly there are two additional tanks associated with this system located on the flight line. No documentation of a pipeline closure assessment for this system has been found. (SDIV, 1998)

Conclusions - SARA

The SARA included all three areas and resulted in the following conclusions:

- Petroleum contaminants above the FDEP SCTLs are present in the soil at 25 to 45 ft bls in the vicinity of the free product plume.

- Free-product was present covering an approximate area of 45,000 square feet in the vicinity of the former tank farm area and fuel distribution pipelines, near at the intersection of Raby Avenue and McKinnon Street.

- Dissolved petroleum contaminants above the FDEP GCTLs are present in the groundwater. The groundwater contamination is located from the water table (approximately 45 ft bls) to 130 ft bls, in an area that extends from 200 ft east of the free product plume to 500 ft southwest of the free product plume to 600 ft west of the free product plume.

- Exposure pathways of human receptors to subsurface soil are not complete; therefore, direct exposure to the subsurface soil is not possible.

- Exposure pathways of human receptors to groundwater via surface water or potable water supply wells are not complete; therefore, direct exposure to the groundwater is not possible.

Based upon the data presented in the SARA, the source of contamination was determined to be the intersection between the fuel supply line and the former tank farm. The free product plume and surrounding area of soil contamination are in the vicinity of this intersection. The groundwater contamination has moved in a downgradient direction, which is to be expected, but it is possible that dissolved contamination has also moved in an upgradient direction during past operation of the potable water well, PW04.

Conclusions - SARA No. 2

The second SARA confirmed many of the conclusions from the SARA along with some additional findings:

- The six 20,000 gallon USTs and junction with the buried 10-inch fuel line have been determined to be the most likely source of contamination based on the present free product plume location and area of soil contamination.

- An additional potential source area is the overall extent of the 10-inch fuel line system reportedly two-miles long used to distribute fuel to the flight line fuel hydrant system. This possible source area remains a concern; however, it is believed to be separate from the free product and groundwater contamination identified as the primary sources in this investigation. The fuel line and flightline fuel distribution system are currently being assessed as a separate investigation by the Navy.

- The results of the SARA indicated petroleum constituents were present in the site soil (TtNUS, 2003). Based on OVA results at soil borings, the surface soil (0 to 4 ft bls) and shallow subsurface soil (4 to 25 ft bls) at the site are unaffected. OVA results did indicate "excessively contaminated soil" was present in the 25 to 55 ft bls interval surrounding the former AVGAS tank area and the fuel transfer line pump house. Analytical results from the off-site fixed-base laboratory confirmed that benzene, toluene, ethylbenzene, total xylenes, and TRPH were present at

concentrations above FDEP SCTLs within the area of "excessively contaminated soil". Due to the depth of contaminated soil, direct contact to the contamination is not a concern, however the contaminated soil remains as a leaching concern for groundwater.

- Based on the July 2004 data, free-product was present on site covering an approximate area of 20,000 square ft with an average thickness of 0.38 ft and an approximate free product contaminant mass of 57,470 lbs.

- Based on the groundwater assessment results reported in the SARA in combination with the groundwater results from SARA No. 2, concentrations of petroleum related VOCs are present in on-site groundwater at concentrations exceeding the FDEP GCTLs. Monitoring well locations with FDEP GCTL exceedances include an area that extends from Building 845 (east of the former AVGAS tank area) to an open area approximately 300 ft northwest of the tank farm, to the southwestern edge of the wooded area located southwest of the former tank area. Analytical results indicate that benzene, toluene, ethylbenzene, total xylenes, and 1,2-dichloroethane are present in the groundwater above FDEP GCTLs. No PAHs were detected at concentrations exceeding FDEP GCTLs. The extent of dissolved groundwater contamination has been delineated within the facility boundaries.

- Elevated lead concentrations reported in the SARA were not confirmed by resampling of the same monitoring wells for SARA No. 2. Therefore, lead is not a concern for the remediation of the site.

Based upon the data presented in the original SAR, the SARA, and SARA No. 2, and in accordance with the conclusions of each report, and the requirements of Chapter 62-770, F.A.C., TtNUS has prepared this RAP to address the existing free product. Following the implementation of this RAP, a re-evaluation of the petroleum-impacted soil and groundwater at UST Site 2406 will be conducted and a subsequent RAP will be prepared to address the remaining soil and groundwater contamination.

3.0 REMEDIAL ACTION PLAN GOALS

The purpose of this RAP is to evaluate remedial options and recommend a feasible, reliable, cost effective, and timely method to conduct free product removal at UST Site 2406, OLF Saufley Field, in accordance with Chapter 62-770.300, F.A.C.

The goal and expected accomplishments of this RAP is to:

- Identify a method to perform free product recovery in the affected area, to the extent practicable, in accordance with Chapter 62-770.300, F.A.C.

3.1 FREE PRODUCT TARGET LEVELS

Chapter 62-770, F.A.C. defines free product as petroleum or petroleum product in excess of 0.01 ft in thickness, measured at its thickest point, floating on surface water or groundwater. Per this definition, the remedial action goal for free product removal at Site 2406 will be to remove all free product in excess of 0.01 ft.

4.0 CONTAMINANT DISTRIBUTION

4.1 ESTIMATED MASS OF FREE PRODUCT

A determination of the estimated free product mass has been completed for Site 2406. Free product thickness measurements were recorded from site monitoring wells in July 2004 and, in preparation of this RAP, in January and February 2006. Each time, four of the monitoring wells (OLFS-2406-MW-17, -MW18, -MW20, and -MW22) at the site contained measurable thickness of free product (0.01 ft or greater). Free product measurements ranged from 0.01 ft to 0.81 ft in thickness. The estimated area of free product, 21,554 square ft (ft^2), was calculated from Figure 2-8, via CAD measuring software used to measure the area encompassing all wells that contained free product.

A calculation of free product mass was completed for the site based on the average 2006 (January and February) thickness data. The free product mass was calculated using the formula below:

$$\text{Total free product mass} = A * T * n * Cf * Dfp$$

where:

A = Total area of plume (ft^2) = 21,554 ft^2

T = Average observed thickness (ft) = 0.25 ft

n = Porosity = 0.30 (typical of NAS Whiting Field soils)

Cf = Correction factor for soil type (0.50 for sand)*

Dfp = Density of free product (49.12 lb/ft^3)*

*From the guidance document, *How to Effectively Recover Free Product at Leaking Underground Storage Tank Sites* (USEPA, 1996)

Based on the above assumptions the free product mass was estimated at approximately 40,100 lbs. This converts to an estimated volume of 40,709 gallons (gals) of free product. Appendix A, Table A-1 presents the calculations for the estimated mass of free product at Site 2406.

5.0 REMEDIAL ALTERNATIVE TECHNOLOGY SCREENING

TtNUS conducted a screening of available technologies in order to determine a suitable remedial alternative for Site 2406. Potential remedial technologies for the free product removal, were identified and evaluated based on their ability to meet clean-up objectives (effectiveness), applicability based on site conditions, feasibility of implementation, reliability, anticipated duration, and cost. Table 5-1 presents a summary of the remedial alternatives applicable to Site 2406.

5.1 EVALUATION OF FREE PRODUCT REMOVAL/TREATMENT ALTERNATIVES

Based on most recent estimate, approximately 40,100 lbs or 40,709 gals of free product is present (see Appendix A) at Site 2406. It should be noted that this is only an estimate and actual free product mass and volume may differ significantly from this estimate. TtNUS has investigated various methods for the removal of free product from the site. The following methods have been identified for removal of free product and will be evaluated in this RAP:

- Dual-Phase Extraction (DPE)
- Soil Excavation with Dewatering
- Excavation via Large Diameter Augers (LDAs)

The following sections briefly discuss each of these free product removal alternatives with respect to their suitability for implementation at this site.

5.1.1 Dual-Phase Extraction

The concept of DPE is to extract free product and vapor by vacuum enhanced pumping techniques. Dual-phase systems recover free product and facilitate vapor-based unsaturated zone cleanup through each well point (USEPA, 1996). This approach has several benefits compared to other free product recovery methods. A cone of depression is not formed at the air/oil interface or the air/water interface. Therefore, smearing of the free product zone is minimized. Vapor-phase hydrocarbons and mobile free product are collected simultaneously.

There are two main conceptual approaches to DPE, differing only in the location or vertical positioning of the intake; 1) Recovery of free product and water by a single vacuum/liquid pump. 2) Extraction of free product, air, and water with a single pump and a vacuum extraction point set at the air/product interface.

DPE can be applied using either an in-situ system or a via specialized mobile vacuum truck (Vac Truck). The use of a Vac Truck is a modification of DPE. Permanent DPE systems typically involve a large capital cost for equipment and installation. Permanent DPE systems are also typically used for long-term operations. DPE via a Vac Truck system allows sites with small amounts or areas of free product to be remediated via DPE at a low capital cost. Mobile DPE systems are also typically implemented in situations where pilot studies or short-term recovery events apply.

Due to the estimated volume of free product at the site and current site conditions, a mobile Vac Truck would be the most feasible option at Site 2406. The vacuum pressures provided by the Vac Truck may provide a large radius of influence (ROI), thereby influencing a larger area. Additionally, a mobile dual-phase system can be connected to multiple wells at one time. Based on previous experience with Vac Truck systems at similar sites, the estimated ROI for extraction wells/points could range from 20 ft to 100 ft. However, a conservative estimate of 40 ft was assumed for Site 2406. Using a ROI of 40 ft, the four shallow wells located within the free product plume would be sufficient to capture the entire area.

DPE systems are most applicable in medium to low permeability media or thin (less than 0.5 ft) saturated thickness (with water table depths of 5 to 45 ft), settings in which conventional pumping approaches or trenches are inappropriate or ineffective, and free product plumes that are located under paved or sealed surfaces (USEPA, 1996).

An estimated cost for the mobile DPE system implementation is included in Table B-1 presented in Appendix B.

5.1.2 Soil Excavation with Dewatering

Free product may be recovered along with potential excavation activities by dewatering using trash pumps or conventional vacuum trucks. During excavation activities, free product and groundwater present in the excavation would be removed by one of the above-mentioned methods. The removed product and water from dewatering activities would be treated at or disposed of at an off-site facility.

Free product removal via dewatering would be implemented during soil excavation activities, and therefore the duration of the excavation phase of the project would determine the remedial time for free product removal.

An estimated cost for the dewatering alternative is included in Appendix B. Table B-2 presents a cost for free product removal by dewatering during excavation assuming soil excavation is chosen as the alternative for remediation. This implementation strategy would integrate certain costs that are common between both methods.

5.1.3 Excavation and Free-Product Removal via Large Diameter Augers (LDAs)

Excavation is a highly effective method where buildings or other structures do not prevent its use to remediate the contamination source. Soils can be removed with conventional earth-moving equipment such as a backhoe and front-end loader and in special circumstances soils and free product can be removed at depth with non-traditional equipment such as LDA drill rigs. Once removed, the soils are disposed in a permitted landfill and replaced with clean fill. In addition, excavation into the water table with LDAs allows for the removal of free product at the same time as soil removal for total source removal in one event. Source excavation can be implemented in two general ways: 1) excavate to depth from land surface and backfill, 2) excavate to depth from depth (i.e. putting equipment in the excavation with proper shoring or benching). Based on the current site conditions and access, excavation via LDAs is a viable alternative for this site.

An estimated cost for excavation via LDAs is included in Table B-3 presented in Appendix B.

5.2 RATIONALE FOR SELECTION OF FREE PRODUCT ALTERNATIVE

Based on a review of the effectiveness, implementability, and cost, DPE is the recommended technology for Site 2406. TtNUS recommends DPE via a mobile Vac Truck system for removal of free product.

When comparing DPE with the excavation/dewatering alternatives for the removal of free product alone (without soil removal) and free-product removal via LDAs, DPE has a significantly lower cost. Even when integrating the costs for a potential soil excavation and dewatering during the excavation for the removal of free product, estimated costs are significantly higher than the costs for DPE. Thus, neither the excavation/dewatering alternative or the excavation via LDA alternative were selected as they would be cost prohibited.

A mobile Vac Truck equipped for DPE would allow for a pilot test simulation (the first event) and eliminate the need for an on-site remedial system. To accomplish free product removal with DPE, monitoring wells OLFS-2406-MW17, -MW18, -MW20, and –MW22 will be used as DPE extraction wells. Based on the 40 ft ROI, additional well installations would not be required for the free product removal using DPE. Based on the use of DPE at similar sites in northeast Florida and moderate free product levels, it is estimated that free product recovery may be achieved within seven 24-hour DPE events.

6.0 REMEDIAL SYSTEM DESIGN

The preferred remedial alternative presented in this RAP was selected based on the effectiveness, implementability, and costs for the recovery of free product on site and disposal off-site. The potential remedial technologies and process options for free product removal were identified and screened, and the results were presented in Section 5.0. The selected remedial alternative is DPE for the removal of free product.

6.1 DPE DESIGN SPECIFICATIONS

DPE is a technology that is used for rapid recovery of free product and is often the most cost-effective approach for product recovery. DPE uses a vacuum or liquid ring pump to recover both fluids (groundwater/free product) and vapor phase hydrocarbons from monitoring/recovery wells. DPE via a mobile Vac Truck can generate high vacuum and airflow rates.

The application of DPE for Site 2406 was chosen based on knowledge of site lithology and soil permeability and based on DPE applications at other sites with similar soil conditions. Based on discussions with DPE vendors and the use of this technology at other sites in Florida, it is expected that seven DPE events will remove free product from the site. DPE guidance material indicates that each DPE event should be conducted for at least eight hours, but for this application, the events will be conducted for 24 hours. The following subsections provide the specifications and outline the components for the DPE remedial system.

The vacuum truck selected will meet the following specifications:

- The vacuum truck tank should have a minimum storage capacity of 5,000 gallons.
- The tank should be designed and constructed in full compliance with Department of Transportation (DOT) Specification DOT 407/DOT 412.
- The vacuum pump or blower shall be capable of running continuously for at least 24 hours.
- The pump or blower of the vacuum truck shall be capable of operating continuously at vacuum pressures between 24 and 27 inches of mercury (Hg) and the airflow at those vacuum pressures shall be at least 400 cubic ft per minute (cfm) (i.e., 400 cfm @ 24 inches of Hg). "Free Air" specifications shall not be accepted. High vacuum pressures increase recovery of hydrocarbons. High flow rates

(cfm) will likely result in quicker recovery of free product and fewer site visits. Pump curves for the vacuum pump/blower (preferably from the pump manufacturer) will be requested to verify capacity.

- According to the American Petroleum Institute's Publication 2219, *Safe Operating Guidelines for Vacuum Trucks in Petroleum Service* (1986), it is stated that "pneumatic-conveyor (blower) equipment operates on a high-airflow principle and is not suitable for hydrocarbon service." It is strongly recommended that the safety guidelines presented in the American Petroleum Institute's Publication 2219 are followed. It is also recommended that the exhaust stack be elevated to enhance the dispersion of emissions.

- Each DPE event shall be conducted for at least a 24-hour period or until the vacuum truck tank is full of free product and groundwater. The vacuum truck shall be equipped with a 4-inch or 6-inch diameter recovery hose, which is connected to the wells containing free product. A 1-inch to 1.5 inch "stinger" intake pipe with the inlet positioned approximately 12 inches below the static water level for each well. The stinger pipe shall then be sealed to the well head to prevent vacuum loss. Locations of the proposed DPE extraction wells are presented on Figure 6-1.

Further details including a schematic of the DPE system layout are provided in Appendix C.

6.1.1 Treatment of Recovered Liquids and Vapors

All free product and water recovered from the location shall be stored in the tank of the Vac Truck. After completion of the each event the DPE subcontractor shall be responsible for disposing of the waste at an appropriate licensed disposal facility with prior approval from the NAVFAC EFD SOUTH.

If needed, extracted soil vapors will be treated on site via granular activated carbon (GAC) canisters in order to comply with the total VOC effluent discharge limitation (max 13.7 lbs/day) as required by the FDEP. Air emission treatment is required if total VOC discharge is greater than 13.7 lbs/day.

6.1.2 Limitations

As is the case with most extraction technologies, DPE is most effective when located under paved or sealed surfaces, which reduces the possibility of "short circuiting" the high vacuum pressure. About 60 percent of the area where the DPE will be conducted is paved and the water table is approximately 35 ft bls. Typically, a pilot study would be performed to determine effectiveness; however, the costs and application of the pilot study would be similar to one DPE event. Therefore, it is suggested that the first DPE event conducted at the site be used to determine overall effectiveness and if "short-circuiting" is a

factor. Given the site conditions, mainly the depth of the water table and well screen intervals, it is unlikely "short-circuiting" will occur. If it is determined during the first event that DPE not adequate effective for removal of free product, then modifications to the DPE setup or a different technology may be evaluated. Options for modifications may include sealing the surface with visqueen sheeting or some other temporary covering and/or installing additional recovery wells.

6.1.3 DPE Activities

The primary goal of DPE is to rapidly remove free product from the groundwater and capillary fringe. The amount of free product in the well will be measured before the initial recovery attempt. After the recovery attempt, the amount of free product will again be measured. Recovery attempts shall continue if the free product removal is determined to be effective. Based on free product estimates, similar experience in Florida, and discussions with vendors, the number of recovery attempts is estimated at seven. Free product thickness measurements and vapor measurements shall be obtained during each DPE event.

In general, the following apply:

- Because of high vacuum, an increase in product thickness may occur after the first event. This is not unusual because the high vacuum forces water, product, and air to the vacuum wells. Each DPE event shall be conducted for approximately 24 hours per event in order to maximize effectiveness.

- The ROI is assumed to be 40 ft for this RAP. During the first event the water levels and vacuum pressures in nearby wells will be measured and the ROI will be adjusted as necessary. This information may also be useful for system optimization.

The following text describes what measurements and data will be collected during each DPE event:

- When the DPE vac truck arrives on site, a safety check of all equipment shall be performed. The vacuum truck tank shall be inspected to verify that the tank is free of any residual petroleum.

- Prior to each DPE event, free product and groundwater measurements shall be obtained from the selected/proposed monitoring/recovery wells and all other wells at the site.

- Connect DPE to four wells (OLFS-2406-MW17, -MW18, -MW20, and –MW22) and begin operation.

- During the DPE operation the parameters listed below shall be collected at 15-minute intervals for the first 2 hours, and at 30-minute intervals thereafter:

- Vacuum pressures pre blower or pump and at nearby wells (non-DPE wells).

- Water levels and free product measurements at nearby wells (non-DPE wells).

- Air velocity rates (via an Anemometer or Pitot Tube) measured from the center of the stack (note the inside diameter dimension of the stack) or discharge outlet.

- Temperature from the stack or discharge outlet (dry bulb and wet bulb or dry bulb and relative humidity).

- TPH ppm (via an OVA-FID) measured from the stack or discharge outlet. A FID that has a range of 0-10,000 ppm or 0-100,000 ppm is an approved instrument for determining TPH concentrations. When recovering high boiling point hydrocarbons (e.g., heating oil), expect low TPH concentrations from the discharge stack of the truck.

- After the completion of the event, free product and groundwater measurements shall be collected from all the DPE wells and the volume of free product recovered in the vacuum truck tank shall also be recorded.

- Disconnect DPE system and demobilize.

- Measure for the presence of free product in all wells two weeks after the DPE event. If free product is present in wells at the site, schedule another DPE event. If free product is not present in any well after the two-week measurement, continue to measure for free product every two weeks until three months have past. If free product is not present (<0.01 ft) after one full quarter following a DPE event, then conduct additional sampling to re-evaluate soil and groundwater conditions and proceed with subsequent RAP upon approval.

- The above measurements (velocity, temperature, TPH concentrations, and diameter of stack) will be used to calculate a mass vapor phase removal rate [pounds per hour (lb/hr)] by using the equations below. From the emission calculations, convert the units from pounds to gallons removed. To arrive at a total gallons removed, add the gallons (from emission calculation) to the total gallons of free product measured in the tank of the vacuum truck. All measurements and calculations for each event shall be incorporated into a "DPE Event/Free Product Removal Letter Report". The equations necessary for the vapor phase mass removal rates are:

Equation to Determine Flow in Standard Cubic Feet Per Minute (SCFM):

B_{ws} = (B_{wsw}/18 lb-mole H_2O)/ [1/28.84 lb-mole dry air) + (B_{wsw}/18 lb-mole H_2O)]

Q_{std} = (60 sec/min) (1-B_{ws}) (V) (A) (528 R^o / T_s)

Where:

Q_{std} = flow at SCFM

B_{wsw} = lb. of water per lb. of dry air (use high temperature psychrometric chart for air-water vapor mixtures in Perry's Chemical Engineers' Handbook)

B_{ws} = water vapor % by volume

V = velocity in ft/sec [obtain with hot wire anemometer or pitot tube (use average value)]

A = cross sectional area of discharge stack in sq. ft. at sampling location

T_s = stack temperature in degrees Rankin (R^o), R^o = degrees Fahrenheit (F^o) + 460 (use average value)

Equations to determine Vapor Phase Mass Removal rate (PMR_h):

$ppm_w = ppm_{measured}$

$ppm_d = (ppm_w) / (1-B_{ws})$

$ppm_c = (ppm_d)$ (K)

$C_{c:m} = ppm_c (M_c/K_3)$

$C_c = C_{c:m} (62.43x10^{-9}$ lb-m^3/mg-ft^3)

$PMR_c = C_c$ (Qstd) (60 min/hr)

$PMR_h = (PMR_c) (M_h/M_{ch})$

Where:

ppm_w = "wet" concentration

$ppm_{measured}$ = obtained directly from OVA (use average value)

ppm_d = "dry" concentration

K = number of carbons in calibration gas (methane K=1, propane K=3, hexane K=6)

$ppm_c = ppm_v$, volumetric concentration of VOC emissions as carbon, dry basis, at standard temperature and pressure (STP)

$C_{c:m}$ = mg/dsm^3, mass concentration of VOC emissions as carbon

M_c = 12.01 mg/mg-mole, molecular weight of carbon

K_3 = 24.07 $dsm^3/10^6$ mg-mole, mass to volume conversion factor at STP

C_c = lb/dscf, mass concentration of VOC emissions as carbon, dry basis, at STP

PMR_c = lb/hr, pollutant mass removal rate of VOCs as carbon

PMR_h = lg/hr, pollutant mass removal rate of VOCs as heating oil

M_h = mg/mg-mole, molecular weight. of heating oil

M_{ch} = mg/mg-mole, weight of carbon in heating oil molecule

7.0 OPERATION AND MONITORING PLAN

The following sections establish procedures for the routine operation of the DPE remediation equipment, monitoring of the DPE operating parameters, and establishes procedures for system implementation of each DPE event, and final reporting and monitoring after completion of the proposed remedial action.

7.1 DPE EVENT IMPLEMENTATION

Upon final approval and acceptance of the RAP by the NAVFAC EFD SOUTH and FDEP, the mobile Vac Truck DPE system will be mobilized to the site and set up for initial implementation. During Event 1, following collection of water levels and free-product measurements, all of the wells (DPE extraction wells and observation wells) will be sampled and analyzed using USEPA Method 8021 for BTEX, USEPA Method 8310 for PAHs, and Florida Petroleum Range Organics (FL-PRO) for TRPH. The initial round of measurements and groundwater analytical results will establish the baseline contaminant profiles and comparable monitoring parameters.

7.2 DESIGNATION OF DPE OBSERVATION WELLS

A select number of observation wells will be used to monitor the effectiveness of the remediation system efforts at the site. These wells include OLFS-2406-MW17, -MW18, -MW20, and -MW22 (inside the free-product plume, when not being employed as extraction wells) and OLFS-2406-MW19, -MW21, -MW38, -MW39, and -MW45 (outside the plume). Figure 7-1 presents the monitoring wells selected as DPE observation wells at Site 2406.

7.3 DPE MONITORING PLAN

A monitoring program will be initiated upon approval of this RAP and following subsequent implementation. The monitoring plan will include measurements and data collection in addition to those collected during the 24-hour DPE events. The monitoring plan has three main objectives:

- To monitor the overall effectiveness of the remedial action in removing free product from the site.
- To verify that the contaminant plume is not migrating beyond the remediation area.
- To monitor the performance of the remediation equipment.

The proposed monitoring plan includes the following:

- DTW measurements in the monitoring wells to determine groundwater mounding and to verify the ROI. Measurements will be taken bi-weekly for the first month following the first DPE event, monthly for the next two months, and quarterly thereafter. Measurement will be performed using a oil-water interface probe.

- Sampling and laboratory analysis of groundwater from selected monitoring wells to document remediation of the free-product/groundwater plume will be performed quarterly during implementation. The groundwater samples will be analyzed using USEPA Method 8021 for purgeable aromatics, USEPA Method 8310 for PAHs, and FL-PRO for TRPH.

Table 7-1 summarizes the proposed monitoring plan. Groundwater samples will be collected from these wells on a quarterly basis following the completion of the DPE implementation.

7.4 MONITORING OF REMEDIATION PROGRESS

The monitoring program will be evaluated after each DPE event and subsequent events may be modified as necessary to maximize the effectiveness of the remediation. During DPE events, three phases of petroleum will be removed: the free product, the dissolved phase (groundwater), and the soil vapor phase. Evaluating the following data and modifying the process as necessary should enhance the overall effectiveness of the proposed remediation and cleanup progress and will be monitored by evaluating the following monitoring data:

- The mass of free product removed by the DPE system.

- The cumulative mass of free product recovered by the DPE system in comparison with the estimated cumulative mass of free product present (see Section 4.0).

- The mass rate of hydrocarbons removed by the DPE system in comparison with the estimated mass present. After each DPE event, a brief letter/status report shall be submitted providing the information stated in Section 6.0 and recommendations for future actions. The status reports are discussed in further detail in subsection 7.6.

- The presence of free product in monitoring wells located within the free product plume. The free product will be measured immediately after the DPE event and then two weeks later (bi-weekly). If free product is present at that time the next DPE event shall be scheduled. The DPE events shall be scheduled at an interval to allow for free product monitoring for two weeks and to allow submission of status reports to determine if an additional DPE event is necessary.

- The trend of free product thickness as the remediation progresses. If the trend in free product thickness indicates the technology is effective in remediating the area, the additional events shall be performed. If after the first or second DPE event the DPE event(s) are determined to be unsuccessful, then the DPE events shall be discontinued and modification or an alternate approach shall be considered.

This monitoring data will be used to determine if the objectives of the RAP are being met (i.e., free product thickness is less than 0.01 ft). The remediation will be modified if the monitoring data indicates that the cleanup goals can be met earlier or cannot be met in the time frame as specified in the RAP. Modifications to the remedial action will be based on the site-specific monitoring data.

7.5 DPE REMEDIATION COMPLETION

If the DPE events are successful in removing the free product from the site, and free product is not present (i.e., free product is less than 0.01 ft) for three consecutive months after any single DPE event, then a Remedial Action Completion Report will be completed with a recommendation to proceed to the subsequent RAP to address soil and groundwater contamination.

7.6 REMEDIATION STATUS REPORTS

During the implementation of the remedial action described in this RAP, status reports shall be prepared and submitted to the NAVFAC EFD SOUTH after each DPE event. The reports will summarize all remedial activities and shall contain the following information:

- DPE event date
- Estimated volume of free product recovered
- Hydrocarbon constituent concentrations in recovered vapors
- Cumulative mass of hydrocarbon removed by the DPE system
- Free product measurements in each monitoring/extraction well before and after DPE event

- Summary of system operational data
- Conclusions as to the effectiveness of the DPE event, and recommendations for further monitoring and operation

REFERENCES

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TABLES

TABLE 2-1
GROUNDWATER ELEVATION SUMMARY
UST SITE 2406 - JANUARY 6, 2003
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 1 OF 4

Well ID	TOC Elevation (ft)**	Depth of Well (ft BTOC)	Screened Interval (ft BTOC)	Depth to Water (ft BTOC)	Depth to Free Product (ft BTOC)	Free Product Thickness (ft)	Water Level Elevation (ft)
SHALLOW							
OLFS-2406-MW01	127.71	47.01	37 - 47	43.83	ND	NA	83.88
OLFS-2406-MW02	128.54	46.74	37 - 47	44.53	ND	NA	84.01
OLFS-2406-MW03	128.45	47.6	37 - 47	44.8	ND	NA	83.65
OLFS-2406-MW05	127.69	46.39	37 - 47	43.50	ND	NA	84.19
OLFS-2406-MW06	128.68	45.57	37 - 47	44.87	ND	NA	83.81
OLFS-2406-MW07	128.67	46.18	37 - 47	45.23	ND	NA	83.44
OLFS-2406-MW08	128.12	45.9	37 - 47	44.72	ND	NA	83.40
OLFS-2406-MW09	128.79	45.8	37 - 47	45.14	ND	NA	83.65
OLFS-2406-MW11	128.7	47.00	37 - 47	44.68	ND	NA	84.02
OLFS-2406-MW17	129.93	53.90	39.5 - 54.5	40.98	39.90	1.08	88.95***
OLFS-2406-MW18*	129.60	55.00	39.5 - 54.5	41.09	41.03	0.06	88.51***
OLFS-2406-MW19	130.29	55.63	39.5 - 54.5	42.35	42.25	< 0.10	87.94***
OLFS-2406-MW20	129.63	55.74	39.5 - 54.5	41.19	41.01	0.18	88.44***
OLFS-2406-MW21	129.46	55.85	39.5 - 54.5	41.89	41.79	0.10	87.57***
OLFS-2406-MW22	130.28	54.80	39.5 - 54.5	42.00	41.60	0.40	88.28***
INTERMEDIATE							
OLFS-2406-MW04	127.94	71.42	37 - 47	43.72	ND	NA	84.22
OLFS-2406-DMW10	128.54	67.00	62 - 67	45.25	ND	NA	83.29
OLFS-2406-DMW12	128.71	69.88	60 - 69	45.23	ND	NA	83.48
OLFS-2406-DMW14	128.12	72.00	65 - 70	46.50	ND	NA	81.62
OLFS-2406-DMW15	128.73	70.09	65 - 70	45.46	ND	NA	83.27
OLFS-2406-DMW16	128.9	70.49	65 - 70	45.60	ND	NA	83.3
OLFS-2406-DMW23	129.24	81.18	74.5 - 79.5	45.24	ND	NA	84.00
OLFS-2406-DMW24	127.85	81.25	74.5 - 79.5	42.88	ND	NA	84.97
OLFS-2406-DMW25	120.92	81.23	74.5 - 79.5	46.75	ND	NA	74.17
OLFS-2406-DMW26	130.07	65.85	59.5 - 64.5	45.00	ND	NA	85.07
OLFS-2406-DMW27	129.29	66.44	59.5 - 64.5	41.23	ND	NA	88.06
OLFS-2406-DMW28	128.44	80.13	74.5 - 79.5	46.61	ND	NA	81.83
OLFS-2406-DMW29	119.42	80.40	74.5 - 79.5	39.02	ND	NA	80.40
OLFS-2406-DMW30	120.00	81.80	74.5 - 79.5	35.45	ND	NA	84.55
OLFS-2406-DMW31	108.32	79.35	74.5 - 79.5	28.45	ND	NA	79.87
OLFS-2406-DMW33	119.56	80.25	74.5 - 79.5	31.50	ND	NA	88.06
OLFS-2406-DMW34	125.32	77.90	74.5 - 79.5	48.91	ND	NA	76.41
OLFS-2406-DMW34R	N/A	65.90	60 - 65	48.10	ND	NA	N/A
OLFS-2406-DMW35	130.11	81.12	74.5 - 79.5	46.66	ND	NA	83.45
OLFS-2406-DMW36	128.47	79.12	74.5 - 79.5	45.93	ND	NA	82.54
DEEP							
OLFS-2406-DMW13	128.28	142.00	137 - 142	46.5	ND	NA	81.78
OLFS-2406-DMW32	108.50	135.70	130 - 135	28.88	ND	NA	79.62
OLFS-2406-DMW37	129.93	135.80	130 - 135	48.38	ND	NA	81.55

Notes:

TOC = Top Of Casing
ft BTOC = feet below top of casing
* = Water level data from 12/16/2002
** = Benchmark is arbitrary at 127.94 ft. at OLFS-2406-MW4 from the intersection of Raby Avenue and Pou Street
*** = corrected for free product thickness
ND = Free Product not detected
NA = Not Applicable
N/A = Not Available

TABLE 2-1 (CONTINUED)
GROUNDWATER ELEVATION SUMMARY
UST SITE 2406 - JULY 28, 2004
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Well ID	TOC Elevation (ft)*	Depth of Well (ft BTOC)	Screened Interval (ft BTOC)	Depth to Water (ft BTOC)	Depth to Free Product (ft BTOC)	Free Product Thickness (ft)	Water Level Elevation (ft)
SHALLOW							
OLFS-2406-MW01	127.71	47.01	37 - 47	40.85	ND	NA	86.86
OLFS-2406-MW02	128.54	46.74	37 - 47	41.49	ND	NA	87.05
OLFS-2406-MW03	128.45	47.6	37 - 47	41.88	ND	NA	86.57
OLFS-2406-MW05	127.69	46.39	37 - 47	40.98	ND	NA	86.71
OLFS-2406-MW06	128.68	45.57	37 - 47	40.59	ND	NA	88.09
OLFS-2406-MW07	128.67	46.18	37 - 47	42.38	ND	NA	86.29
OLFS-2406-MW08	128.12	45.9	37 - 47	42.39	ND	NA	85.73
OLFS-2406-MW09	128.79	45.8	37 - 47	N/A	ND	NA	N/A
OLFS-2406-MW11	128.7	47.00	37 - 47	41.94	ND	NA	86.76
OLFS-2406-MW17**	129.93	53.90	39.5 - 54.5	39.33	38.65	0.68	90.06
OLFS-2406-MW18**	129.60	55.00	39.5 - 54.5	38.34	38.28	0.06	91.21
OLFS-2406-MW19	130.29	55.63	39.5 - 54.5	40.93	ND	ND	89.36
OLFS-2406-MW20**	129.63	55.74	39.5 - 54.5	39.76	39.75	0.01	89.86
OLFS-2406-MW21	129.46	55.85	39.5 - 54.5	40.02	ND	ND	89.44
OLFS-2406-MW22**	130.28	54.80	39.5 - 54.5	40.89	40.08	0.81	88.74
OLFS-2406-MW38	131.20	56.00	39 - 56	41.22	ND	NA	89.98
OLFS-2406-MW39	129.65	56.00	39 - 56	36.02	ND	NA	93.63
OLFS-2406-MW40	130.06	56.00	41 - 56	41.15	ND	NA	88.91
OLFS-2406-MW41	128.47	56.00	42 - 57	40.30	ND	NA	88.17
OLFS-2406-MW42S	127.36	56.00	39 - 56	33.77	ND	NA	93.59
OLFS-2406-MW43S	119.40	56.00	35 - 50	18.80	ND	NA	100.60
OLFS-2406-MW44S	109.01	56.00	41 - 56	29.04	ND	NA	79.97
OLFS-2406-MW45	128.79	45.00	31 - 46	35.95	ND	NA	92.84
INTERMEDIATE							
OLFS-2406-MW04	127.94	71.42	37 - 47	40.98	ND	NA	86.96
OLFS-2406-MW10D	128.54	67.00	62 - 67	42.36	ND	NA	86.18
OLFS-2406-MW12D	128.71	69.88	60 - 69	42.37	ND	NA	86.34
OLFS-2406-MW14D	128.12	72.00	65 - 70	41.66	ND	NA	86.46
OLFS-2406-MW15D	128.73	70.09	65 - 70	42.17	ND	NA	86.56
OLFS-2406-MW16D	128.9	70.49	65 - 70	42.37	ND	NA	86.53
OLFS-2406-MW23D	129.24	81.18	74.5 - 79.5	47.71	ND	NA	81.53
OLFS-2406-MW24D	127.85	81.25	74.5 - 79.5	41.17	ND	NA	86.68
OLFS-2406-MW25D	120.92	81.23	74.5 - 79.5	45.5	ND	NA	75.42
OLFS-2406-MW26D	130.07	65.85	59.5 - 64.5	43.91	ND	NA	86.16
OLFS-2406-MW27D	129.29	66.44	59.5 - 64.5	38.98	ND	NA	90.31
OLFS-2406-MW28D	128.44	80.13	74.5 - 79.5	46.14	ND	NA	82.30
OLFS-2406-MW29D	119.42	80.40	74.5 - 79.5	38.37	ND	NA	81.05
OLFS-2406-MW30D	120.00	81.80	74.5 - 79.5	38.73	ND	NA	81.27
OLFS-2406-MW31D	108.32	79.35	74.5 - 79.5	27.73	ND	NA	80.59
OLFS-2406-MW33D	119.56	80.25	74.5 - 79.5	N/A	ND	NA	N/A
OLFS-2406-MW34DR	125.32	77.90	74.5 - 79.5	27.2	ND	NA	98.12
OLFS-2406-MW35D	130.11	81.12	74.5 - 79.5	45.2	ND	NA	84.91
OLFS-2406-MW36D	128.47	79.12	74.5 - 79.5	44.94	ND	NA	83.53
DEEP							
OLFS-2406-MW13D	128.28	142.00	137 - 142	43.73	ND	NA	84.55
OLFS-2406-MW32D	108.50	135.70	130 - 135	28.13	ND	NA	80.37
OLFS-2406-MW37D	129.93	135.80	130 - 135	47.09	ND	NA	82.84
OLFS-2406-MW42D	127.68	130.00	125 - 130	45.14	ND	NA	82.54
OLFS-2406-MW43D	119.24	133.20	120 - 130	37.6	ND	NA	81.64
OLFS-2406-MW44D	108.92	130.00	125 - 130	28.89	ND	NA	80.03

Notes:

TOC = Top Of Casing
ft BTOC = feet below top of casing
* = Benchmark is arbitrary at 127.94 ft. at OLFS-2406-MW4 from the intersection of Raby Avenue and Pou Street
** = corrected for free product thickness
ND = Free Product not detected
NA = Not Applicable
N/A = Not Available

TABLE 2-1 (CONTINUED)
GROUNDWATER ELEVATION SUMMARY
UST SITE 2406 - JANUARY 2006
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Well ID	TOC Elevation (ft)*	Depth of Well (ft BTOC)	Screened Interval (ft BTOC)	Depth to Water (ft BTOC)	Depth to Free Product (ft BTOC)	Free Product Thickness (ft)	Water Level Elevation (ft)
SHALLOW							
OLFS-2406-MW01	127.71	47.01	37 - 47	NM	NM	NA	NA
OLFS-2406-MW02	128.54	46.74	37 - 47	NM	NM	NA	NA
OLFS-2406-MW03	128.45	47.6	37 - 47	NM	NM	NA	NA
OLFS-2406-MW05	127.69	46.39	37 - 47	NM	NM	NA	NA
OLFS-2406-MW06	128.68	45.57	37 - 47	NM	NM	NA	NA
OLFS-2406-MW07	128.67	46.18	37 - 47	NM	NM	NA	NA
OLFS-2406-MW08	128.12	45.9	37 - 47	NM	NM	NA	NA
OLFS-2406-MW09	128.79	45.8	37 - 47	N/A	N/A	NA	N/A
OLFS-2406-MW11	128.7	47.00	37 - 47	NM	NM	NA	NA
OLFS-2406-MW17**	129.93	53.90	39.5 - 54.5	34.82	34.15	0.67	94.57
OLFS-2406-MW18**	129.60	55.00	39.5 - 54.5	33.97	33.96	0.01	95.62
OLFS-2406-MW19	130.29	55.63	39.5 - 54.5	36.9	ND	NA	93.39
OLFS-2406-MW20**	129.63	55.74	39.5 - 54.5	35.51	35.50	0.01	94.11
OLFS-2406-MW21	129.46	55.85	39.5 - 54.5	36.31	ND	NA	93.15
OLFS-2406-MW22**	130.28	54.80	39.5 - 54.5	36.20	35.76	0.44	93.73
OLFS-2406-MW38	131.20	56.00	39 - 56	36.93	ND	NA	94.27
OLFS-2406-MW39	129.65	56.00	39 - 56	33.99	ND	NA	95.66
OLFS-2406-MW40	130.06	56.00	41 - 56	NM	NM	NA	NA
OLFS-2406-MW41	128.47	56.00	42 - 57	NM	NM	NA	NA
OLFS-2406-MW42S	127.36	56.00	39 - 56	NM	NM	NA	NA
OLFS-2406-MW43S	119.40	56.00	35 - 50	NM	NM	NA	NA
OLFS-2406-MW44S	109.01	56.00	41 - 56	NM	NM	NA	NA
OLFS-2406-MW45	128.79	45.00	31 - 46	31.36	ND	NA	97.43
INTERMEDIATE							
OLFS-2406-MW04	127.94	71.42	37 - 47	NM	NM	NA	NA
OLFS-2406-MW10D	128.54	67.00	62 - 67	NM	NM	NA	NA
OLFS-2406-MW12D	128.71	69.88	60 - 69	NM	NM	NA	NA
OLFS-2406-MW14D	128.12	72.00	65 - 70	NM	NM	NA	NA
OLFS-2406-MW15D	128.73	70.09	65 - 70	NM	NM	NA	NA
OLFS-2406-MW16D	128.9	70.49	65 - 70	NM	NM	NA	NA
OLFS-2406-MW23D	129.24	81.18	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW24D	127.85	81.25	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW25D	120.92	81.23	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW26D	130.07	65.85	59.5 - 64.5	NM	NM	NA	NA
OLFS-2406-MW27D	129.29	66.44	59.5 - 64.5	NM	NM	NA	NA
OLFS-2406-MW28D	128.44	80.13	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW29D	119.42	80.40	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW30D	120.00	81.80	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW31D	108.32	79.35	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW33D	119.56	80.25	74.5 - 79.5	N/A	NM	NA	N/A
OLFS-2406-MW34DR	125.32	77.90	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW35D	130.11	81.12	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW36D	128.47	79.12	74.5 - 79.5	NM	NM	NA	NA
DEEP							
OLFS-2406-MW13D	128.28	142.00	137 - 142	NM	NM	NA	NA
OLFS-2406-MW32D	108.50	135.70	130 - 135	NM	NM	NA	NA
OLFS-2406-MW37D	129.93	135.80	130 - 135	NM	NM	NA	NA
OLFS-2406-MW42D	127.68	130.00	125 - 130	NM	NM	NA	NA
OLFS-2406-MW43D	119.24	133.20	120 - 130	NM	NM	NA	NA
OLFS-2406-MW44D	108.92	130.00	125 - 130	NM	NM	NA	NA

Notes:

TOC = Top Of Casing
ft BTOC = feet below top of casing
* = Benchmark is arbitrary at 127.94 ft. at OLFS-2406-MW4 from the intersection of Raby Avenue and Pou Street
** = corrected for free product thickness
ND = Free Product not detected
NA = Not Applicable
N/A = Not Available NM = Not Measured

TABLE 2-1 (CONTINUED)
GROUNDWATER ELEVATION SUMMARY
UST SITE 2406 - FEBRUARY 2006
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Well ID	TOC Elevation (ft)*	Depth of Well (ft BTOC)	Screened Interval (ft BTOC)	Depth to Water (ft BTOC)	Depth to Free Product (ft BTOC)	Free Product Thickness (ft)	Water Level Elevation (ft)
SHALLOW							
OLFS-2406-MW01	127.71	47.01	37 - 47	NM	NM	NA	NA
OLFS-2406-MW02	128.54	46.74	37 - 47	NM	NM	NA	NA
OLFS-2406-MW03	128.45	47.6	37 - 47	NM	NM	NA	NA
OLFS-2406-MW05	127.69	46.39	37 - 47	NM	NM	NA	NA
OLFS-2406-MW06	128.68	45.57	37 - 47	NM	NM	NA	NA
OLFS-2406-MW07	128.67	46.18	37 - 47	NM	NM	NA	NA
OLFS-2406-MW08	128.12	45.9	37 - 47	NM	NM	NA	NA
OLFS-2406-MW09	128.79	45.8	37 - 47	N/A	N/A	NA	N/A
OLFS-2406-MW11	128.7	47.00	37 - 47	NM	NM	NA	NA
OLFS-2406-MW17**	129.93	53.90	39.5 - 54.5	34.43	33.86	0.57	95.04
OLFS-2406-MW18**	129.60	55.00	39.5 - 54.5	33.58	33.57	0.01	96.01
OLFS-2406-MW19	130.29	55.63	39.5 - 54.5	NM	NM	NA	NA
OLFS-2406-MW20**	129.63	55.74	39.5 - 54.5	34.98	34.97	0.01	94.64
OLFS-2406-MW21	129.46	55.85	39.5 - 54.5	35.76	ND	NA	93.70
OLFS-2406-MW22**	130.28	54.80	39.5 - 54.5	35.65	35.35	0.30	94.63
OLFS-2406-MW38	131.20	56.00	39 - 56	NM	NM	NA	NA
OLFS-2406-MW39	129.65	56.00	39 - 56	NM	NM	NA	NA
OLFS-2406-MW40	130.06	56.00	41 - 56	NM	NM	NA	NA
OLFS-2406-MW41	128.47	56.00	42 - 57	NM	NM	NA	NA
OLFS-2406-MW42S	127.36	56.00	39 - 56	NM	NM	NA	NA
OLFS-2406-MW43S	119.40	56.00	35 - 50	NM	NM	NA	NA
OLFS-2406-MW44S	109.01	56.00	41 - 56	NM	NM	NA	NA
OLFS-2406-MW45	128.79	45.00	31 - 46	NM	NM	NA	NA
INTERMEDIATE							
OLFS-2406-MW04	127.94	71.42	37 - 47	NM	NM	NA	NA
OLFS-2406-MW10D	128.54	67.00	62 - 67	NM	NM	NA	NA
OLFS-2406-MW12D	128.71	69.88	60 - 69	NM	NM	NA	NA
OLFS-2406-MW14D	128.12	72.00	65 - 70	NM	NM	NA	NA
OLFS-2406-MW15D	128.73	70.09	65 - 70	NM	NM	NA	NA
OLFS-2406-MW16D	128.9	70.49	65 - 70	NM	NM	NA	NA
OLFS-2406-MW23D	129.24	81.18	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW24D	127.85	81.25	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW25D	120.92	81.23	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW26D	130.07	65.85	59.5 - 64.5	NM	NM	NA	NA
OLFS-2406-MW27D	129.29	66.44	59.5 - 64.5	NM	NM	NA	NA
OLFS-2406-MW28D	128.44	80.13	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW29D	119.42	80.40	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW30D	120.00	81.80	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW31D	108.32	79.35	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW33D	119.56	80.25	74.5 - 79.5	N/A	NM	NA	N/A
OLFS-2406-MW34DR	125.32	77.90	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW35D	130.11	81.12	74.5 - 79.5	NM	NM	NA	NA
OLFS-2406-MW36D	128.47	79.12	74.5 - 79.5	NM	NM	NA	NA
DEEP							
OLFS-2406-MW13D	128.28	142.00	137 - 142	NM	NM	NA	NA
OLFS-2406-MW32D	108.50	135.70	130 - 135	NM	NM	NA	NA
OLFS-2406-MW37D	129.93	135.80	130 - 135	NM	NM	NA	NA
OLFS-2406-MW42D	127.68	130.00	125 - 130	NM	NM	NA	NA
OLFS-2406-MW43D	119.24	133.20	120 - 130	NM	NM	NA	NA
OLFS-2406-MW44D	108.92	130.00	125 - 130	NM	NM	NA	NA

Notes:

TOC = Top Of Casing
ft BTOC = feet below top of casing
* = Benchmark is arbitrary at 127.94 ft. at OLFS-2406-MW4 from the intersection of Raby Avenue and Pou Street
** = corrected for free product thickness
ND = Free Product not detected
NA = Not Applicable
N/A = Not Available NM = Not Measure

TABLE 2-2
OVA SCREENING RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 1 OF 7

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB1	10/23/02	55	4-8	0	
			40-45	0	
			55	0	collected GW
			80	0	collected GW
OLFS2406SB2	10/24/02	55	4-8	0	
			8-12	0	
			40-44	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB3	10/24/02	55	4-8	0	
			40-44	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB4	10/25/02	55	4-8	0	
			40-44	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB5	10/25/02	55	4-8	0	
			40-45	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB6	10/26/02	45	4-8	0	
			44	NA	collected GW
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB7	10/26/02	55	4-8	0	
			40-45	0	
			50-55	>1000	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB8	10/27/02	55	4-8	0	
			40-44	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB9	10/27/02	55	4-8	0	
			40-44	0	
			80	NA	collected GW
OLFS2406SB10	10/28/02	55	4-8	0	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB11	10/28/02	55	4-8	NA	
			55	NA	collected GW
			80	NA	collected GW

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
OVA SCREENING RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 2 OF 7

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB12	10/29/02	55	4-8	NA	
			55	NA	collected GW
			80	NA	collected GW
OLFS2406SB13	10/30/02	55	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB14	10/30/02	55	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB15	10/30/02	55	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB16	10/30/02	50	65	NA	collected GW
OLFS2406SB17	10/31/02	50	65	NA	collected GW
			80	NA	collected GW
OLFS2406SB18	10/31/02	50	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB19	10/31/02	50	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB20	11/1/02	55	55	NA	collected GW
			80	NA	collected GW
OLFS2406SB21	11/1/02	45	5-9	0	
			9-13	0	
			13-17	0	
			17-21	0	
			21-25	0	
			25-29	432	
			29-33	3,397	
			33-37	488	
			37-41	1,200	
			41-45	3,300	
			45	NA	collected GW
OLFS2406SB22	11/2/02	45	45	NA	collected GW
			80	NA	collected GW
OLFS2406SB23	11/2/02	45	50	NA	collected GW
			80	NA	collected GW
OLFS2406SB24	11/2/02	45	25-29	12	
			29-33	166	
			36-40	79	
			45	NA	collected GW (free product)

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
OVA SCREENING RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB25	11/4/02	45	4-8	0	
			8-12	0	
			12-16	0	
			16-20	0	
			20-24	0	
			24-28	0	
			28-32	607	
			32-36	402	
			36-40	>4995	
			40-44	>4995	
			45	NA	collected GW
OLFS2406SB26	11/4/02	45	28-32	110	
			40-44	51	
			48	NA	collected GW
OLFS2406SB27	11/4/02	45	28-32	38	
			40-44	0	
			48	NA	collected GW
OLFS2406SB28	11/4/02	45	28-32	182	
			40-44	422	
			45	>2256	
			48	NA	collected GW
OLFS2406SB29	11/5/02	45	28-32	1,839	
			40-44	>5000	
			48	NA	collected GW
OLFS2406SB30	11/5/02	45	28-32	3,417	
			40-44	>5000	
			48	NA	collected GW
OLFS2406SB31	11/5/02	45	28-32	0	
			40-44	0	
			48	NA	collected GW
OLFS2406SB32	11/6/02	45	28-32	0	
			40-44	0	
			48	NA	collected GW
OLFS2406SB33	11/6/02	45	50	NA	collected GW
			80	NA	collected GW

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
SOIL OVA HEADSPACE RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB34	07/07/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
			35-40	0	
		41	40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB35	7/7/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
		36	35-40	0	
			40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB36	7/8/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
			35-40	0	
		45	40-45	0	
			45-50	0	
			50-55	0	
			55-60	0	
			60-65	0	
			65-70	0	
			70-75	0	
			75-80	0	
			80-85	0	
			85-90	0	
			90-95	0	
			95-100	0	
			100-105	0	
			105-110	0	
			110-115	0	
			115-120	0	
			120-125	0	Boring terminated at
			125-130	0	130 ft bls

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
SOIL OVA HEADSPACE RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB37	7/9/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
		34	30-35	0	
			35-40	0	
			40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB38	7/9/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
		38	35-40	0	
			40-45	0	
			45-50	0	
			50-55	0	
			55-60	0	
			60-65	0	
			65-70	0	
			70-75	0	
			75-80	0	
			80-85	0	
			85-90	0	
			90-95	0	
			95-100	0	
			100-105	0	
			105-110	0	
			110-115	0	
			115-120	0	
			120-125	0	Boring terminated at
			125-130	0	130 ft bls
OLFS2406SB39	7/10/04		0-5	0	
			5-10	0	
			10-15	0	
		19	15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
			35-40	0	
			40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
SOIL OVA HEADSPACE RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 6 OF 7

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB40	7/11/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
			35-40	0	
		41	40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB41	7/11/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	0	
			35-40	16	
		40	40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB42	7/12/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
		29	25-30	0	
			30-35	0	
			35-40	0	
			40-45	0	
			45-50	0	
			50-55	0	
			55-60	0	
			60-65	0	
			65-70	0	
			70-75	0	
			75-80	0	
			80-85	0	
			85-90	0	
			90-95	0	
			95-100	0	
			100-105	0	
			105-110	0	
			110-115	0	
			115-120	0	
			120-125	0	Boring terminated at
			125-130	0	130 ft bls

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-2 (CONTINUED)
SOIL OVA HEADSPACE RESULTS
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 7 OF 7

SAMPLE LOCATION NO.	SAMPLE DATE	DEPTH TO WATER (ft bls)	SAMPLE INTERVAL (ft bls)	TOTAL OVA READING (ppm)	COMMENTS
OLFS2406SB43	7/13/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
		29	25-30	0	
			30-35	0	
			35-40	16	
			40-45	0	
			45-50	0	Boring terminated at
			50-55	0	56 ft bls
OLFS2406SB44	7/13/04		0-5	0	
			5-10	0	
			10-15	0	
			15-20	0	
			20-25	0	
			25-30	0	
			30-35	500	
		36	35-40	4,350	Boring terminated at
			40-45	210	46 ft bls

Notes:
ft bls = feet below land surface
ppm = parts per million
GW = groundwater
OVA = Organic Vapor Analysis
NA = not available; readings were not recorded below the water table

TABLE 2-3
SUMMARY OF CONTAMINANTS DETECTED IN SOIL SAMPLES
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 1 OF 3

Sample No.		OLF06SB011517	OLFS06SB042022	OLFS06SB051517	OLB06SB062527	OLBS06SB072022
Sample Location		SB-01	SB-04	SB-05	SB-06	SB-07
Sample Depth (ft bls)		15'-17'	20'-22'	15'-17'	25'-27'	20'-22'
Analysis Date		5/31/2000	5/31/2000	5/31/2000	5/31/2000	5/31/2000
	DE1[1] / DE2[2] / LE[3] (mg/kg)					
VOCs [4] (mg/kg)						
Benzene	**1.1** / **1.6** / **0.007**	--	--	--	--	--
Ethylbenzene	1100 / 8400 / **0.60**	--	--	--	--	--
Toluene	380 / 2600 / **0.50**	--	--	--	--	--
Total Xylenes	5900 / 40000 / **0.20**	--	--	--	--	--

[1] Direct Exposure Residential as provided in Chapter 62-777, F.A.C.
[2] Direct Exposure Industrial as provided in Chapter 62-777, F.A.C.
[3] Leachability based on Groundwater as provided in Chapter 62-777, F.A.C.
[4] VOCs = Volatile Organic Compounds (SW-846 8260B)

Notes:
mg/kg = milligrams per kilogram
-- = Analyte not detected above the instrument detection limit
F.A.C. = Florida Administrative Code
ft bls = feet below land surface

TABLE 2-3 (CONTINUED)
SUMMARY OF CONTAMINANTS DETECTED IN SOIL SAMPLES
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 2 OF 3

Sample No.		OLFS2406SB2 4'-8'	OLFS2406SB2 8'-12'	OLFS2406SB5 40'-45'	OLFS2406SB6 40'-45'	OLFS2406SB7 40'-45'	OLFS2406SB21 29'
Sample Location		SB-2	SB-2	SB-5	SB-6	SB-7	SB-21
Sample Depth (ft bls)		4-8	8-12	40-45	40-45	40-45	29
Analysis Date		10/24/2002	10/24/2002	10/25/2002	10/26/2002	10/26/2002	11/1/2002
	DE1[1] / DE2[2] / LE[3] (mg/kg)						
VOCs [4] (mg/kg)							
Benzene	**1.1 / 1.6 / 0.007**	--	--	--	--	**11**	--
Ethylbenzene	1100 / 8400 / **0.60**	--	--	--	--	**37**	--
Toluene	380 / 2600 / **0.50**	--	--	--	--	**330**	--
Total Xylenes	5900 / 40000 / **0.20**	--	--	--	--	**100**	--

Sample No.		OLFS2406SB21 40'	OLFS2406SB24 33'	OLFS2406SB24 38'	OLFS2406SB25 30'	OLFS2406SB25 32'	OLFS2406SB25 44'
Sample Location		SB-21	SB-24	SB-24	SB-25	SB-25	SB-25
Sample Depth (ft)		40	33	38	30	32	44
Analysis Date		11/1/2002	11/2/2002	11/2/2002	11/4/2002	11/4/2002	11/4/2002
	DE1[1] / DE2[2] / LE[3] (mg/kg)						
VOCs [4] (mg/kg)							
Benzene	1.1 / 1.6 / **0.007**	--	--	--	**0.017**	--	--
Ethylbenzene	1100 / 8400 / **0.60**	**14**	--	--	0.013	--	**11**
Toluene	380 / 2600 / **0.50**	**42**	--	--	0.24	--	**50**
Total Xylenes	5900 / 40000 / **0.20**	**51.6**	--	--	0.034	--	**35**

[1] Direct Exposure Residential as provided in Chapter 62-777, F.A.C.
[2] Direct Exposure Industrial as provided in Chapter 62-777, F.A.C.
[3] Leachability based on Groundwater as provided in Chapter 62-777, F.A.C.
[4] VOCs = Volatile Organic Compounds (SW-846 8260B)

Notes:
mg/kg = milligrams per kilogram
-- = Analyte not detected above the instrument detection limit
F.A.C. = Florida Administrative Code
ft bls = feet below land surface

TABLE 2-3 (CONTINUED)
SUMMARY OF CONTAMINANTS DETECTED IN SOIL SAMPLES
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 3 OF 3

Sample No.		OLFS2406SB26 40'	OLFS2406SB28 41'	OLFS2406SB29 4'	OLFS2406SB29 32'	OLFS2406SB29 44'	OLFS2406SB30 44'
Sample Location		SB-26	SB-28	SB-29	SB-29	SB-29	SB-30
Sample Depth (ft bls)		40	41	4	32	44	44
Analysis Date		11/4/2002	11/4/2002	11/5/2002	11/5/2002	11/5/2002	11/5/2002
	DE1[1] / DE2[2] / LE[3] (mg/kg)						
VOCs [4] (mg/kg)							
Benzene	**1.1** / **1.6** / **0.007**	--	--	--	--	**9.8**	**2.4**
Ethylbenzene	1100 / 8400 / **0.60**	--	--	--	**19.0**	**63**	**62**
Toluene	**380** / 2600 / **0.50**	--	0.016	--	**48**	**360**	**570**
Total Xylenes	5900 / 40000 / **0.20**	--	--	--	**61**	**107**	**293**

Sample No.		OLFS2406SB31 44'
Sample Location		SB-31
Sample Depth (ft)		44
Analysis Date		11/5/2002
	DE1[1] / DE2[2] / LE[3] (mg/kg)	
VOCs [4] (mg/kg)		
Benzene	1.1 / 1.6 / 0.007	--
Ethylbenzene	1100 / 8400 / 0.60	--
Toluene	380 / 2600 / 0.50	--
Total Xylenes	5900 / 40000 / 0.20	--

[1] Direct Exposure Residential as provided in Chapter 62-777, F.A.C.
[2] Direct Exposure Industrial as provided in Chapter 62-777, F.A.C.
[3] Leachability based on Groundwater as provided in Chapter 62-777, F.A.C.
[4] VOCs = Volatile Organic Compounds (SW-846 8260B)

Notes:
mg/kg = milligrams per kilogram
-- = Analyte not detected above the instrument detection limit
F.A.C. = Florida Administrative Code
ft bls = feet below land surface

TABLE 2-4
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - OCTOBER 2000
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 1 OF 2

Sample No.		OLFS06MW10GW	OLFS06MW12GW	OLFS06MW13GW	OLFS06MW14GW	OLFS06MW15GW
Sample Location		MW-10	MW-12	MW-13	MW-14	MW-15
Collect Date		10/25/2000	10/25/2000	10/25/2000	11/7/2000	11/7/2000
	GCTL [1] (ug/L)					
VOC [2] (ug/L)						
1,2-Dribromoethane	0.02	--	--	--	--	--
Benzene	1	--	**490**	--	**40**	**180J**
Xylenes, total	20	--	10	--	--	3.3
1, 2-Dichloroethane	3	--	**13**	--	--	--
Chloroform	5.7	--	--	--	0.6J	--
Methylene Chloride	5	--	--	--	**1.1**	**1.3**
PAH [3] (ug/L)						
1-Methylnaphthalene	20	--	--	--	--	--
2-Methylnaphthalene	20	--	--	--	--	--
Naphthalene	20	--	--	--	--	--
Acenaphthene	20	--	--	--	--	--
Acenaphthylene	210	--	--	--	--	--
Phenanthrene	210	--	--	--	--	--
TRPH [4] (ug/L)	5000	0.37	0.43	0.44	--	--
Metals [5] (ug/L)						
Lead	15	--	--	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-4
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - OCTOBER 2000
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Sample No.		OLFS06MW16GW
Sample Location		MW-16
Collect Date		11/9/2000
	GCTL [1] (ug/L)	
VOC [2] (ug/L)		
1,2-Dribromoethane	0.02	--
Benzene	1	--
Xylenes, total	20	--
1, 2-Dichloroethane	3	--
Chloroform	5.7	--
Methylene Choride	5	--
PAH [3] (ug/L)		
1-Methylnaphthalene	20	0.294
2-Methylnaphthalene	20	0.459
Naphthalene	20	1.94
Acenaphthene	20	0.118
Acenaphthylene	210	0.118
Phenanthrene	210	0.224
TRPH [4] (ug/L)	5000	2.28
Metals [5] (ug/L)		
Lead	15	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Sample No.		OLFS-2406-DMW-23	OLFS-2406-DMW-24	OLFS-2406-DMW-25	OLFS-2406-DMW-26	OLFS-2406-DMW-27
Sample Location		DMW-23	DMW-24	DMW-25	DMW-26	DMW-27
Collect Date		1/7/2003	1/7/2003	1/7/2003	1/7/2003	1/7/2003
Sample Depth (ft bls)		74.5-79.5	74.5-79.5	74.5-79.5	59.5-64.5	59.5-64.5
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)						
1,2-Dibromoethane (EDB)	**0.02**	--	--	--	--	--
1,2-Dichloroethane (EDC)	3	--	--	--	--	--
Benzene	**1**	**15600**	0.66 J	**4190**	--	0.58 J
Chloroform	5.7	--	0.92 J	--	--	1.3
Ethylbenzene	**30**	**837**	--	**120**	--	--
Toluene	**40**	**10700**	0.61 J	**2930**	1	--
Xylenes, Total	**20**	**2480**	--	**580**	--	--
PAHs [3] (µg/L)						
1-Methylnaphthalene	28	3.1	--	--	--	--
2-Methylnaphthalene	28	3.6	--	1.1 J	--	--
Naphthalene	14	5.8	--	1.5 J	0.69 J	--
TRPH [4] (mg/L)	5	4.01	--	1.17	--	--
Metals [5] (µg/L)						
Lead	**15**	--	--	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Sample No.		OLFS-2406-DMW-28	OLFS-2406-DMW-29	OLFS-2406-DMW-30	OLFS-2406-DMW31	OLFS-2406-DMW32
Sample Location		DMW-28	DMW-29	DMW-30	DMW-31	DMW-32
Collect Date		1/7/2003	1/7/2003	1/7/2003	1/6/2003	1/6/2003
Sample Depth (ft bls)		74.5-79.5	74.5-79.5	74.5-79.5	74.5-79.5	130-135
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)						
1,2-Dibromoethane	0.02	**0.031**	**0.048**	--	--	--
1,2-Dichloroethane	3	--	**4.8**	--	--	--
Benzene	1	**4240**	**194**	--	--	--
Chloroform	5.7	--	--	--	0.97 J	--
Ethylbenzene	30	--	--	--	--	--
Toluene	40	--	--	--	--	--
Xylenes, Total	20	--	--	--	--	--
PAHs [3] (µg/L)						
1-Methylnaphthalene	28	--	--	--	--	--
2-Methylnaphthalene	28	--	--	--	--	--
Naphthalene	14	--	--	--	--	--
TRPH [4] (mg/L)	5	1.23	0.201 J	--	1.05	--
Metals [5] (µg/L)						
Lead	15	**17.9**	--	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 3 OF 7

Sample No.		OLFS-2406-DMW33	OLFS-2406-DMW34R	OLFS-2406-DMW35	OLFS-2406-DMW36	OLFS-2406-DMW37
Sample Location		DMW-33	DMW-34	DMW-35	DMW-36	DMW-37
Collect Date		1/6/2003	3/10/2003	1/8/2003	1/8/2003	1/6/2003
Sample Depth (ft bls)		74.5-79.5	49.5 - 64.5	74.5-79.5	74.5-79.5	130-135
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)						
1,2-Dibromoethane	**0.02**	**0.23**	--	--	--	--
1,2-Dichloroethane	**3**	**4.8**	--	--	--	--
Benzene	**1**	**35.6**	--	--	--	--
Chloroform	5.7	--	--	--	--	--
Ethylbenzene	30	1.9	--	--	--	--
Toluene	40	--	--	--	--	--
Xylenes, Total	20	2.4 J	--	--	--	--
PAHs [3] (µg/L)						
1-Methylnaphthalene	28	--	--	--	--	--
2-Methylnaphthalene	28	--	--	--	--	--
Naphthalene	14	--	--	--	--	--
TRPH [4] (mg/L)	5	--	--	--	--	--
Metals [5] (µg/L)						
Lead	**15**	--	**69.5**	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Sample No.		OLFS-2406-MW38	OLFS-2406-MW39	OLFS-2406-MW40	OLFS-2406-MW41	OLFS-2406-MW42S
Sample Location		OLFS-2406-MW38	OLFS-2406-MW39	OLFS-2406-MW40	OLFS-2406-MW41	OLFS-2406-MW42S
Collect Date		7/31/2004	7/30/2004	7/30/2004	7/31/2004	7/28/2004
Sample Depth (ft bls)		38.5 - 55.5	39 - 56	39 - 56	38.5 - 55.5	39 - 56
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)						
Methylene Chloride	5	--	--	--	--	--
Toluene	**40**	3.8	2.7	--	**368**	--
Ethylbenzene	**30**	1.3	0.58J	--	**30.5**	--
Total Xylenes	**20**	1.5J	--	--	**88.6**	--
Benzene	**1**	--	--	--	**439**	--
1,2-DCA	3	--	--	--	--	0.62J
Chloroform	5.7	--	0.54J	0.71J	--	--
PAHs [3] (µg/L)						Not Analyzed
Naphthalene	14	--	--	--	0.46J	
TRPH [4] (mg/L)	5	0.314	1.01	--	1.02	Not Analyzed
Metals [5] (µg/L)						
Lead	15	--	--	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:
* = monitoring well was re-sampled based on analytical results reported in the SARA
Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

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Sample No.		OLFS-2406-MW43S	OLFS-2406-MW44S	OLFS-2406-MW45	OLFS-2406-MW28	OLFS-2406-MW29
Sample Location		OLFS-2406-MW43S	OLFS-2406-MW44S	OLFS-2406-MW45	OLFS-2406-MW28D*	OLFS-2406-MW29D*
Collect Date		7/29/2004	7/28/2004	7/30/2004	7/30/2004	7/26/2004
Sample Depth (ft bls)		36 - 51	39 - 56	29.5 - 44.5	64.5 - 79.5	64.5 - 79.5
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)					Not Analyzed	
Methylene Chloride	5	--	--	--		--
Toluene	40	--	--	--		--
Ethylbenzene	30	--	--	--		--
Total Xylenes	20	--	--	--		1.7J
Benzene	1	--	--	--		**308**
Chloroform	5.7	--	--	--		--
1,2-DCA	3	--	0.65J	--		5.1
PAHs [3] (µg/L)		Not Analyzed	Not Analyzed		Not Analyzed	Not Analyzed
Naphthalene	14			--		
TRPH [4] (mg/L)	5	Not Analyzed	Not Analyzed	--	Not Analyzed	Not Analyzed
Metals [5] (µg/L)						
Lead	15	--	--	--	--	Not Analyzed

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

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J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

PAGE 6 OF 7

Sample No.		OLFS-2406-DMW34	OLFS-2406-DMW13	OLFS-2406-DMW32	OLFS-2406-DMW37	OLFS-2406-DMW42D
Sample Location		OLFS-2406-MW34D*	OLFS-2406-MW13D*	OLFS-2406-MW32D*	OLFS-2406-MW37D*	OLFS-2406-MW42D
Collect Date		7/30/2004	7/31/2004	7/31/2004	7/31/2004	7/28/2004
Sample Depth (ft bls)		62.5 - 76.5	137 - 142	130.2 - 135.2	130.3 - 135.3	124.5 - 129.5
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)		Not Analyzed				
Methylene Chloride	5		--	1.1	1.3	--
Toluene	40		--	--	0.71J	0.51J
Ethylbenzene	30		--	--	--	--
Total Xylenes	20		--	--	--	--
Benzene	1		--	--	--	--
Chloroform	5.7		--	--	--	--
1,2-DCA	3		--	--	--	--
PAHs [3] (µg/L)		Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
Naphthalene	14					
TRPH [4] (mg/L)	5	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed	Not Analyzed
Metals [5] (µg/L)						
Lead	15	--	--	--	--	--

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:
* = monitoring well was re-sampled based on analytical results reported in the SARA
Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
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FL-PRO = Florida Petroleum Range Organics

TABLE 2-5
SUMMARY OF CONTAMINANTS DETECTED IN GROUNDWATER - 2003 AND 2004
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Sample No.		OLFS-2406-MW43D	OLFS-2406-MW44D	OLFS-2406-RB01	TRIP BLANK	TRIP BLANK
Sample Location		OLFS-2406-MW43D	OLFS-2406-MW44D	N/A	N/A	N/A
Collect Date		7/28/2004 & 08/19/04	7/29/2004	7/31/2004	7/31/2004	7/30/2004
Sample Depth (ft bls)		127.5 - 132.5	124 5 - 129.5	N/A	N/A	N/A
	GCTL[1] (µg/L)					
VOCs [2] (µg/L)						
Methylene Chloride	5	--	--	--	--	--
Toluene	40	0.53J	--	--	--	--
Ethylbenzene	30	--	--	--	--	--
Total Xylenes	20	--	--	--	--	--
Benzene	1	--	--	--	--	--
Chloroform	5.7	1.6	--	--	--	--
1,2-DCA	3	--	--	--	--	--
PAHs [3] (µg/L)		Not Analyzed	Not Analyzed		Not Analyzed	Not Analyzed
Naphthlene	14			--		
TRPH [4] (mg/L)	5	Not Analyzed	Not Analyzed	--	Not Analyzed	Not Analyzed
Metals [5] (µg/L)					Not Analyzed	Not Analyzed
Lead	15	--	--	--		

[1] Groundwater Cleanup Target Level as provided in Chapter 62-777, F.A.C.
[2] VOCs = Volatile Organic Compounds (SW-846 8260B)
[3] PAHs = Polynuclear aromatic hydrocarbons (SW-846 8310)
[4] TRPH = Total Recoverable Petroleum Hydrocarbons (FDEP-FL-PRO)
[5] SW-846 6010B

Notes:

* = monitoring well was re-sampled based on analytical results reported in the SARA
Bold indicates an exceedance of limits.
ft bls = feet below land surface
µg/L = micrograms per liter
-- = Analyte not detected above the instrument detection limit
J = Compound was detected at an estimated concentration
mg/L = milligrams per liter
F.A.C. = Florida Administrative Code
FDEP = Florida Department of Environmental Protection
FL-PRO = Florida Petroleum Range Organics

TABLE 5-1
COMPARISON SUMMARY FOR REMEDIAL ALTERNATIVES
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

MEDIA	TECHNOLOGY	ADVANTAGES	DISADVANTAGES	SCREENING COMMENT
Free Product	Dual-Phase Extraction	Low costs Easily implementable with mobile Vac Truck Flexible implementation	Requires off-site disposal of free product and groundwater	Selected
	Soil Excavation with Dewatering	Could be combined with potential soil excavation Large ROI	Requires off-site disposal of free product, soil, and groundwater	Eliminated
	Excavation via Large Diameter Augers	Easily implementable given current site conditions Very effective	Relatively high cost Requires off-site disposal of soil and free product	Eliminated

Notes:

ROI = Radius of Influence

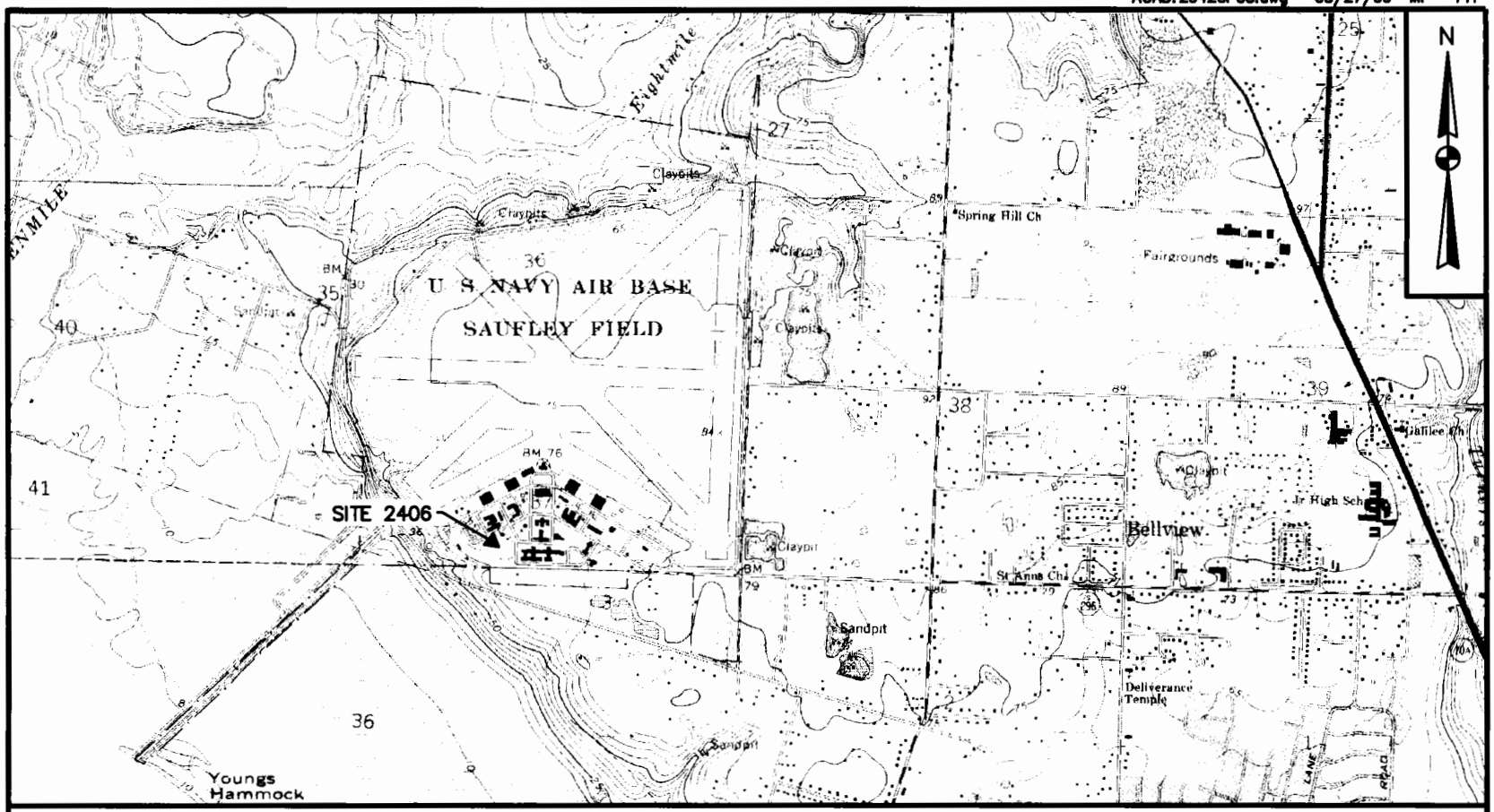
TABLE 7-1
PROPOSED MONITORING PLAN
UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Monitoring/Sample Location	Parameters	Frequency/Reporting
DPE Extraction Wells (OLFS-2406-MW17, -MW18, -MW20, and -MW22)	Depth-to-water, Free Product Levels and DO	Bi-weekly for the first month and monthly thereafter during DPE implementation.
DPE Observation/Monitoring Wells (OLFS-2406-MW19, -MW21, -MW38, -MW39, and -MW45)	Depth-to-water, Free Product Levels and DO	Bi-weekly for the first month, monthly for two months, and quarterly thereafter.
DPE Observation/Monitoring Wells (OLFS-2406-MW19, -MW21, -MW38, -MW39, and -MW45)	BTEX, PAHs, and TRPH (USEPA Methods 8021, 8310, and FL- PRO)	Quarterly

Notes:
DPE - Dual-phase extraction
DO - Dissolved Oxygen
BTEX - Benzene, toluene ethylbenzene, and xylenes
PAH - Polynuclear aromatic hydrocarbons
TRPH - Total Recoverable Petroleum Hydrocarbons
FL-PRO - Florida Petroleum Range Organics

FIGURES

ACAD: 2642CP35.dwg 03/27/06 MF PIT



0 2000 4000

GRAPHIC SCALE IN FEET

SOURCE: U.S.G.S. TOPOGRAPHIC QUADRANGLE WEST PENSACOLA, FLORIDA (1970 EDITION–PHOTOREVISED 1987).

QUADRANGLE LOCATION

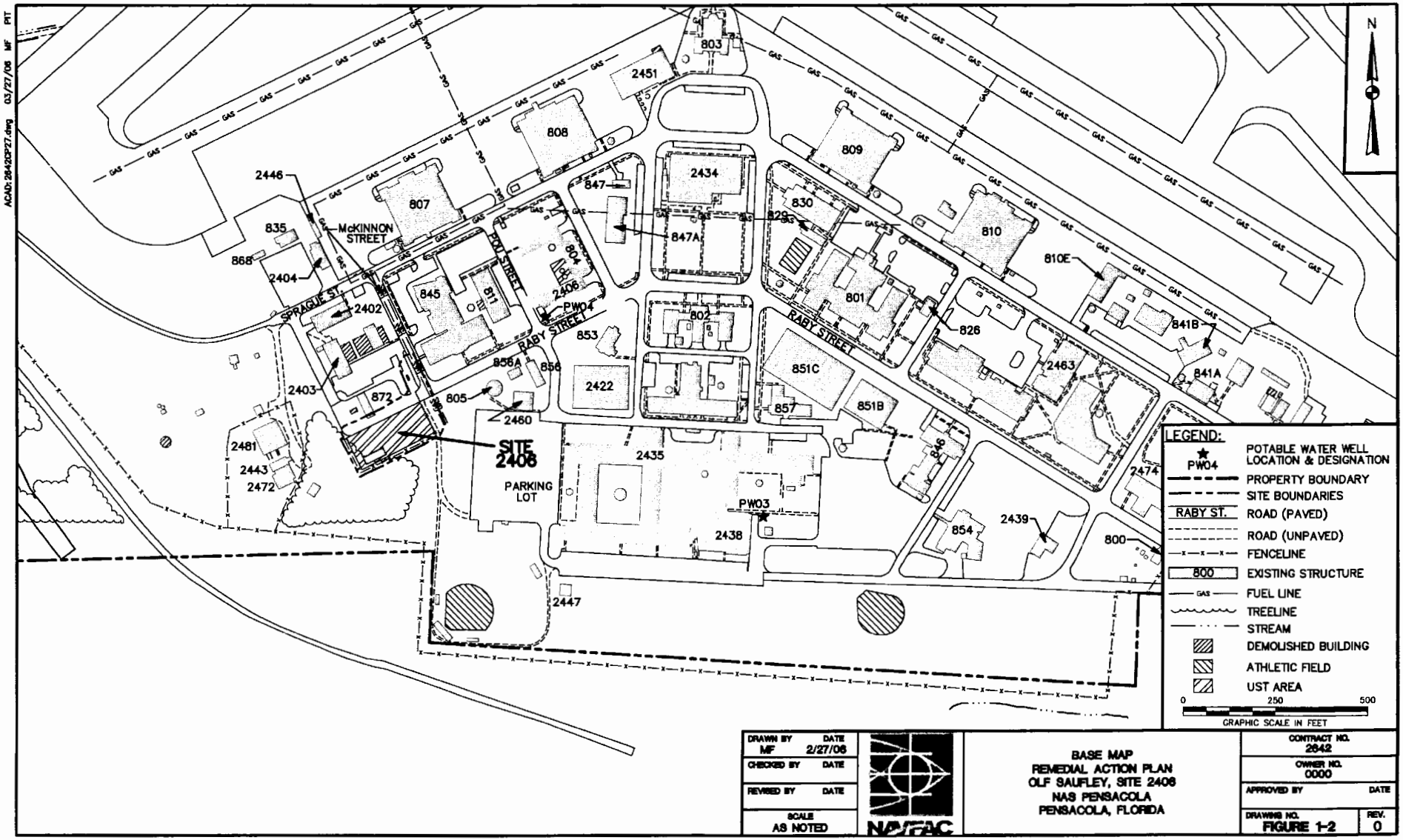
DRAWN BY MF	DATE 2/27/06
CHECKED BY	DATE
REVISED BY	DATE
SCALE AS NOTED	

NAVFAC

SITE VICINITY MAP
REMEDIAL ACTION PLAN
OLF SAUFLEY, SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA

CONTRACT NO. 2642	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 1-1	REV. 0

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

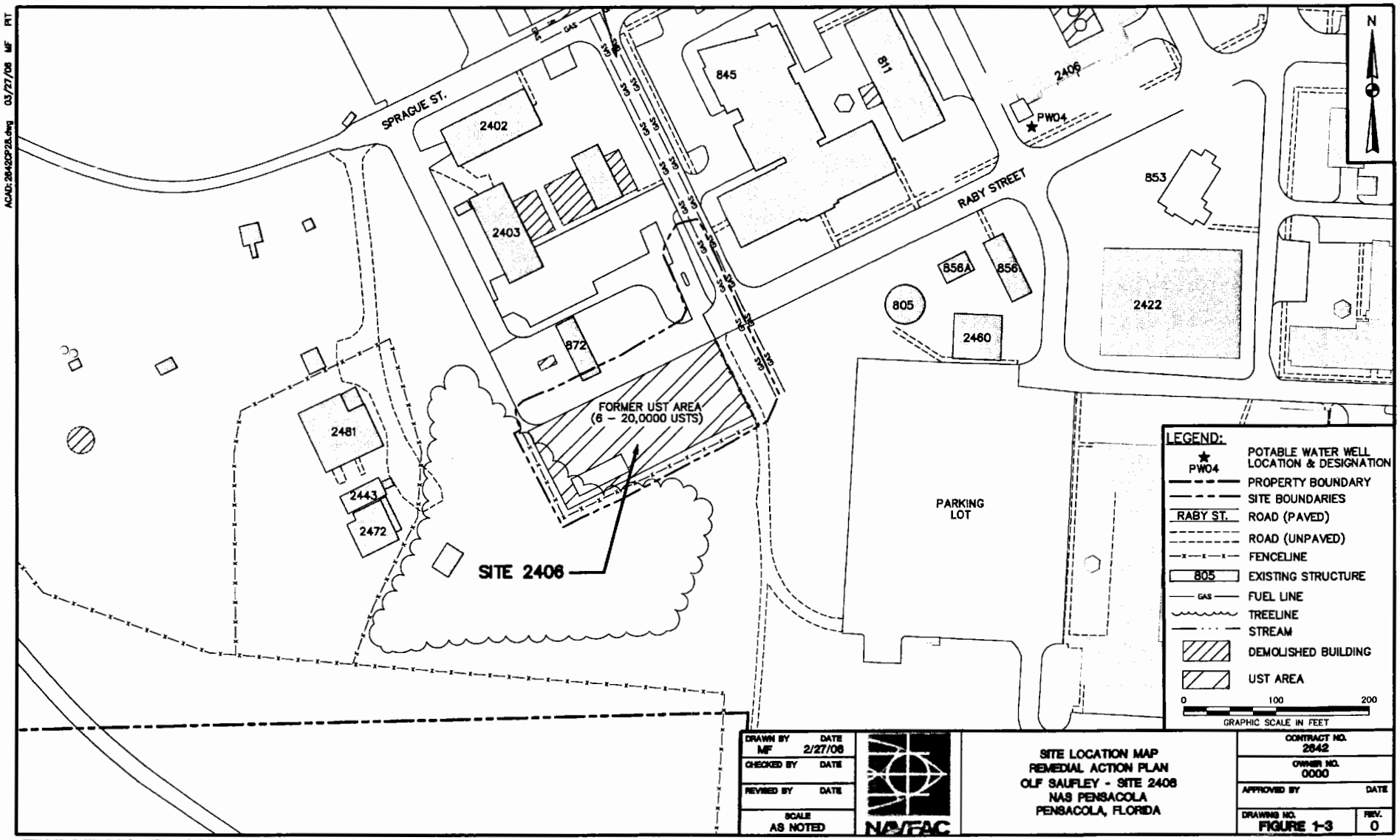


DRAWN BY MF	DATE 2/27/06	BASE MAP REMEDIAL ACTION PLAN OLF SAUFLEY, SITE 2408 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-2 / REV. 0

NAVFAC

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

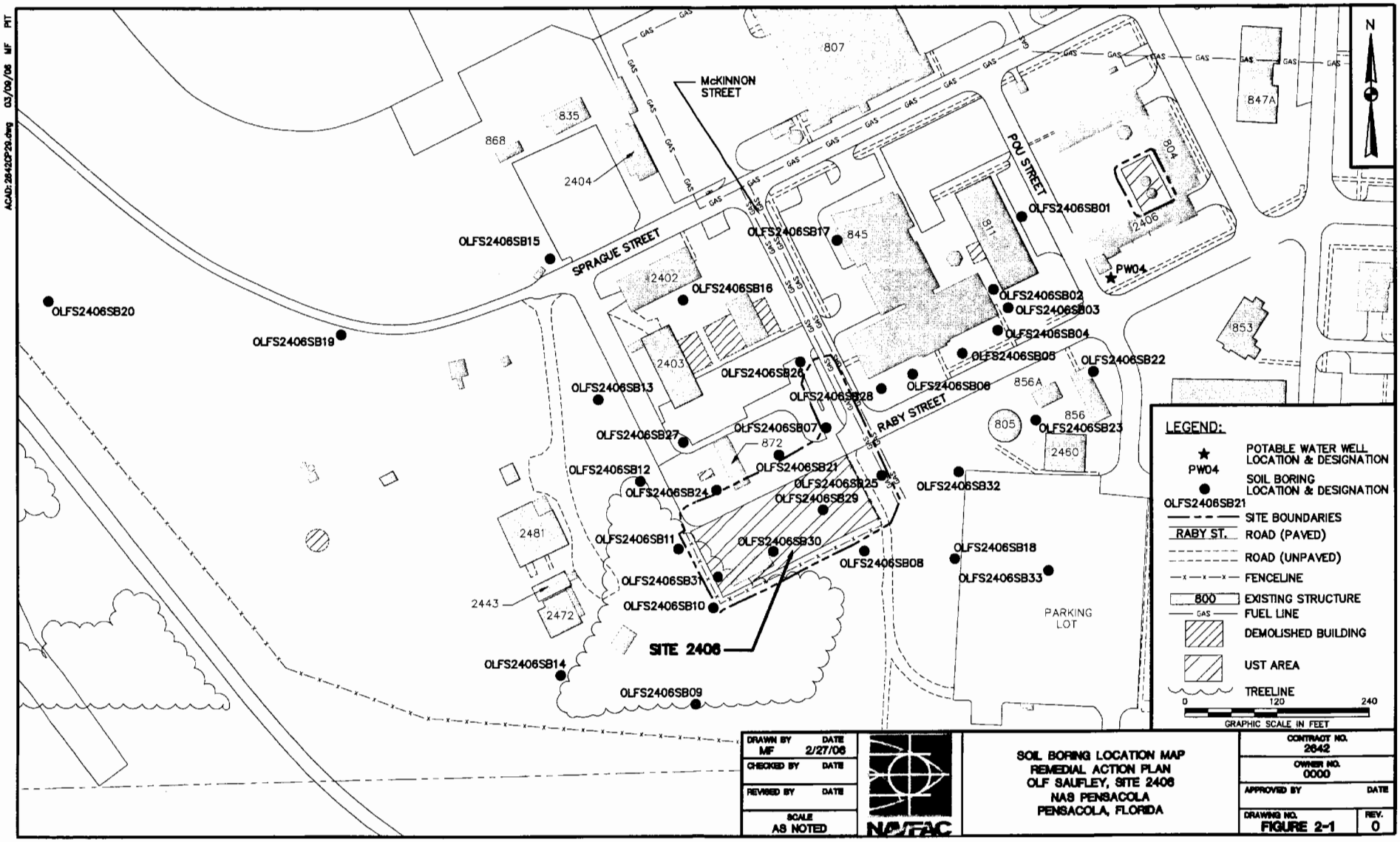
ACAD: 2642CP27.dwg 03/27/06 MF PIT



DRAWN BY MF	DATE 2/27/06	SITE LOCATION MAP REMEDIAL ACTION PLAN OLF SAUFLEY - SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED		NAVFAC	DRAWING NO. FIGURE 1-3 / REV. 0

ACAD: 2642CP2B.dwg 03/27/06 MF RT

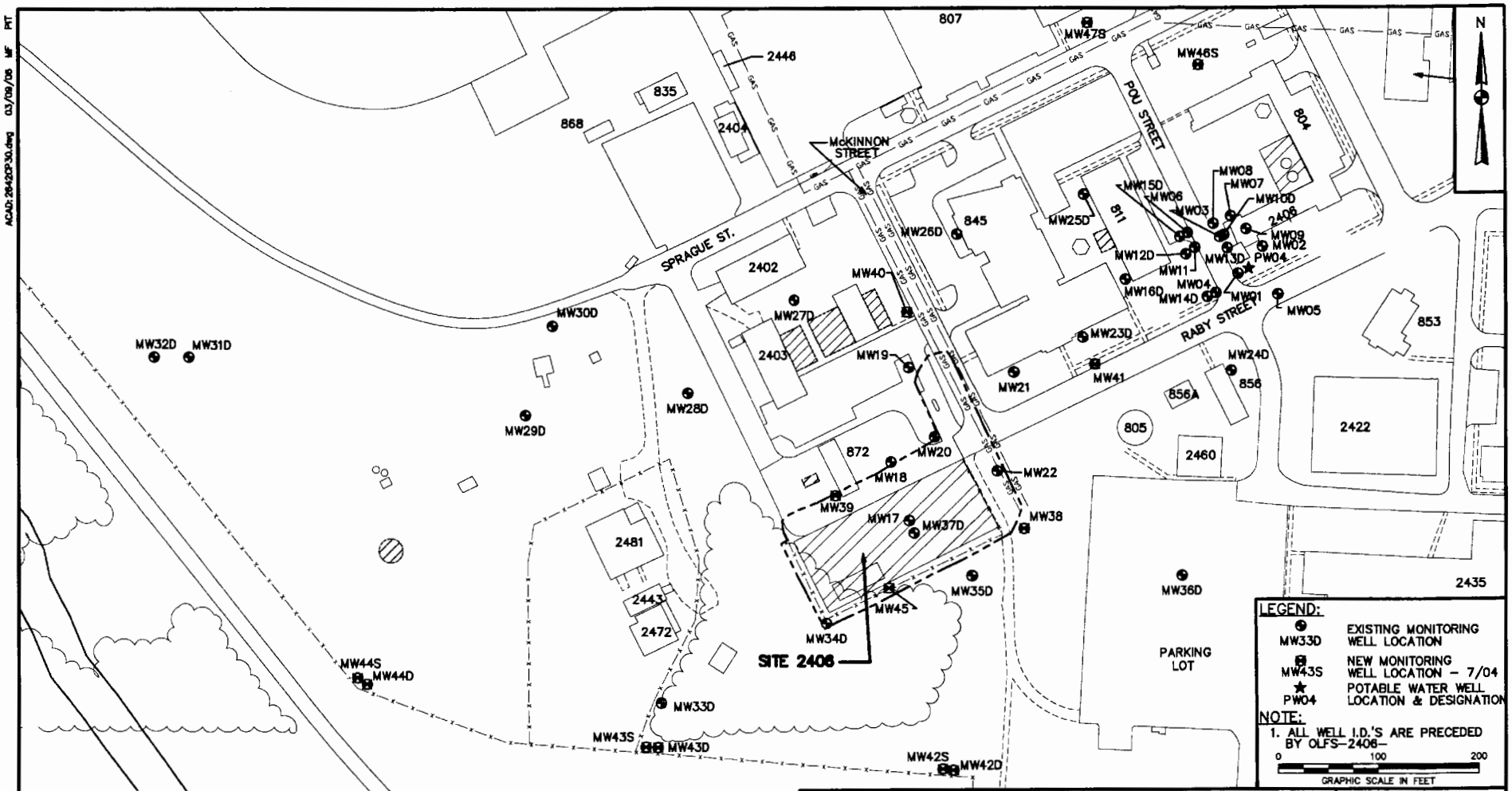
FORM CADD NO. SDIV-IN-LDWG - REV 1 - 9/10/98



DRAWN BY MF	DATE 2/27/06	SOIL BORING LOCATION MAP REMEDIAL ACTION PLAN OLF SAUFLEY, SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED		NAVFAC	DRAWING NO. FIGURE 2-1 / REV. 0

ACAD: 2642CP20.dwg 03/09/06 MF PIT

FORM CADD NO. SDIV-BMLDWG - REV 1 - 9/10/98

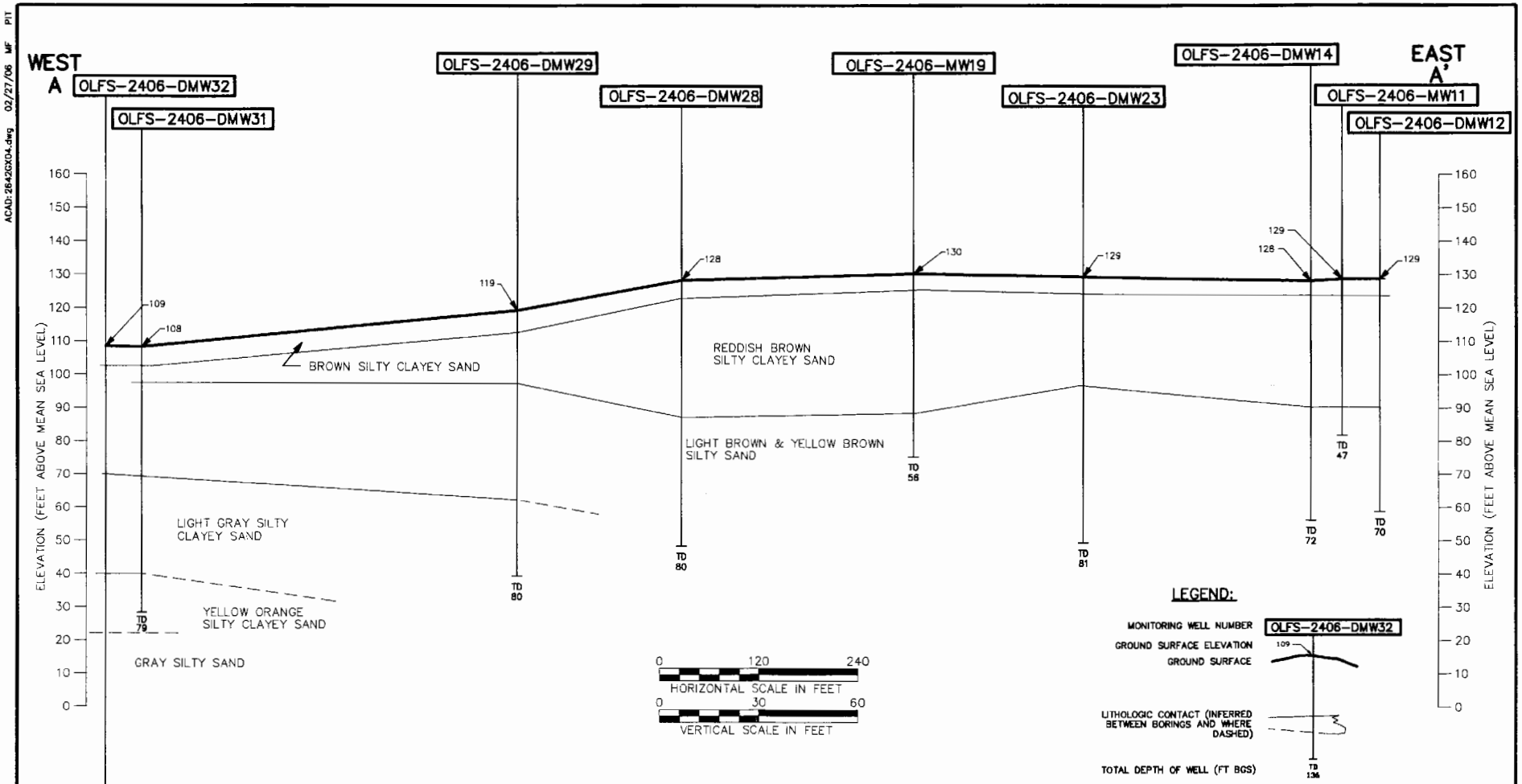


DRAWN BY MF	DATE 2/27/06	MONITORING WELL LOCATION MAP REMEDIAL ACTION PLAN OLF SAUFLEY - SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 / REV. 0

NAVFAC

FORM CADD NO. SDIV-3M.DWG - REV 1 - 9/10/98

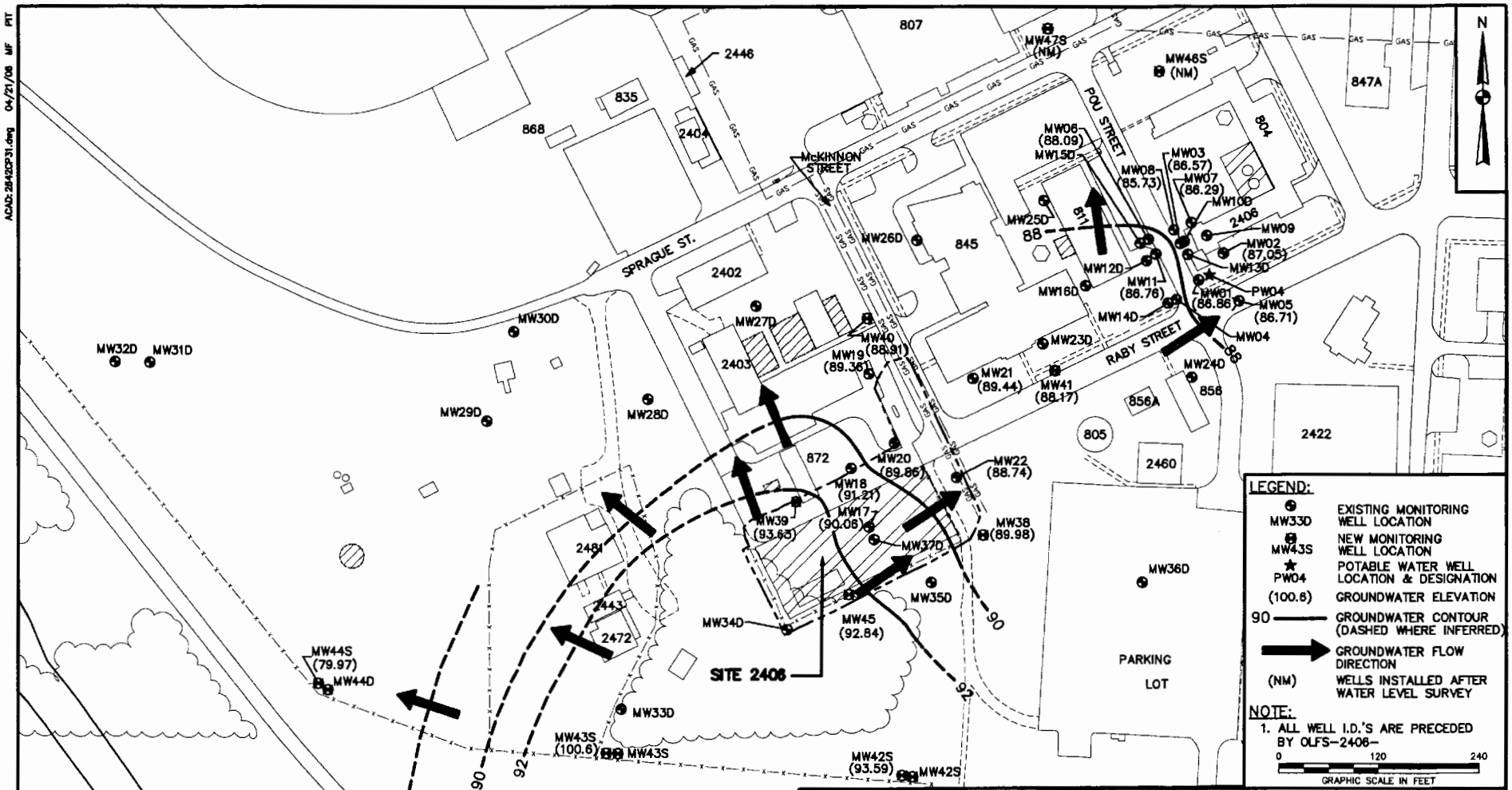
ACAD: 2642CP30.dwg 03/09/06 MF PKT



DRAWN BY MF	DATE 2/27/06	LITHOLOGIC CROSS SECTION A-A' REMEDIAL ACTION PLAN OLF SAUFLEY, SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED		NAVFAC	DRAWING NO. FIGURE 2-3 / REV. 0

ACAD: 2642GX04.dwg 02/27/06 MF PIT

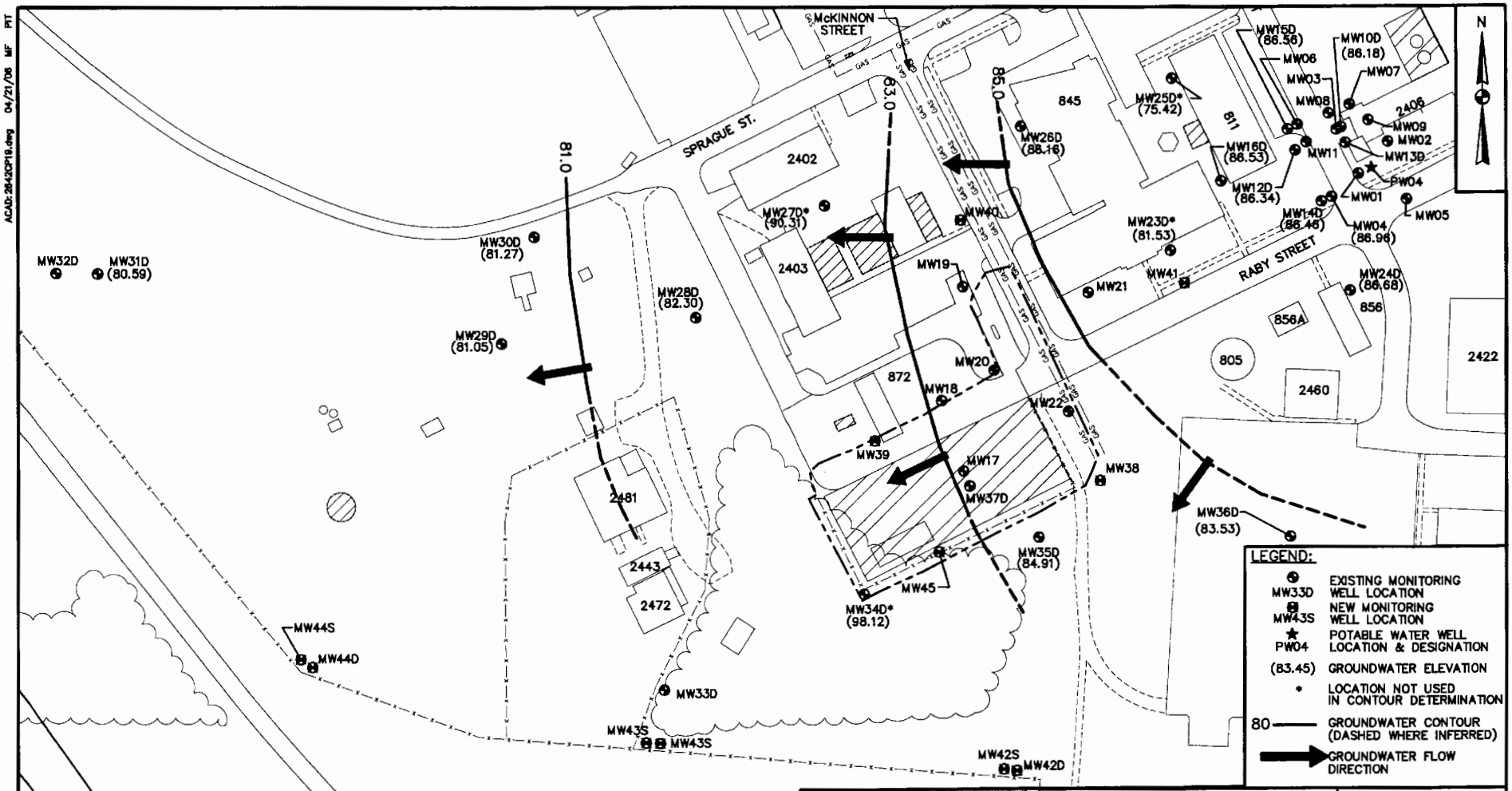
FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98



DRAWN BY mf	DATE 2/27/06	SHALLOW GROUNDWATER FLOW 7/28/04 REMEDIAL ACTION PLAN OLF SAUFLEY - SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA	CONTRACT NO. 2642
CHECKED BY	DATE		OWNER NO. 0000
REVISED BY	DATE		APPROVED BY / DATE
SCALE AS NOTED		NAVFAC	DRAWING NO. FIGURE 2-4 / REV. 0

ACAD:2642CP31.dwg 04/21/06 MF PIT

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98



LEGEND:

MW33D	EXISTING MONITORING WELL LOCATION
MW43S	NEW MONITORING WELL LOCATION
PW04	POTABLE WATER WELL LOCATION & DESIGNATION
(83.45)	GROUNDWATER ELEVATION
*	LOCATION NOT USED IN CONTOUR DETERMINATION
80	GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
	GROUNDWATER FLOW DIRECTION

NOTE:
1. ALL WELL I.D.'S ARE PRECEDED BY OLFS-2406-

0 100 200
GRAPHIC SCALE IN FEET

DRAWN BY DM	DATE 11/16/04	
CHECKED BY	DATE	
REVISED BY	DATE	
SCALE AS NOTED		

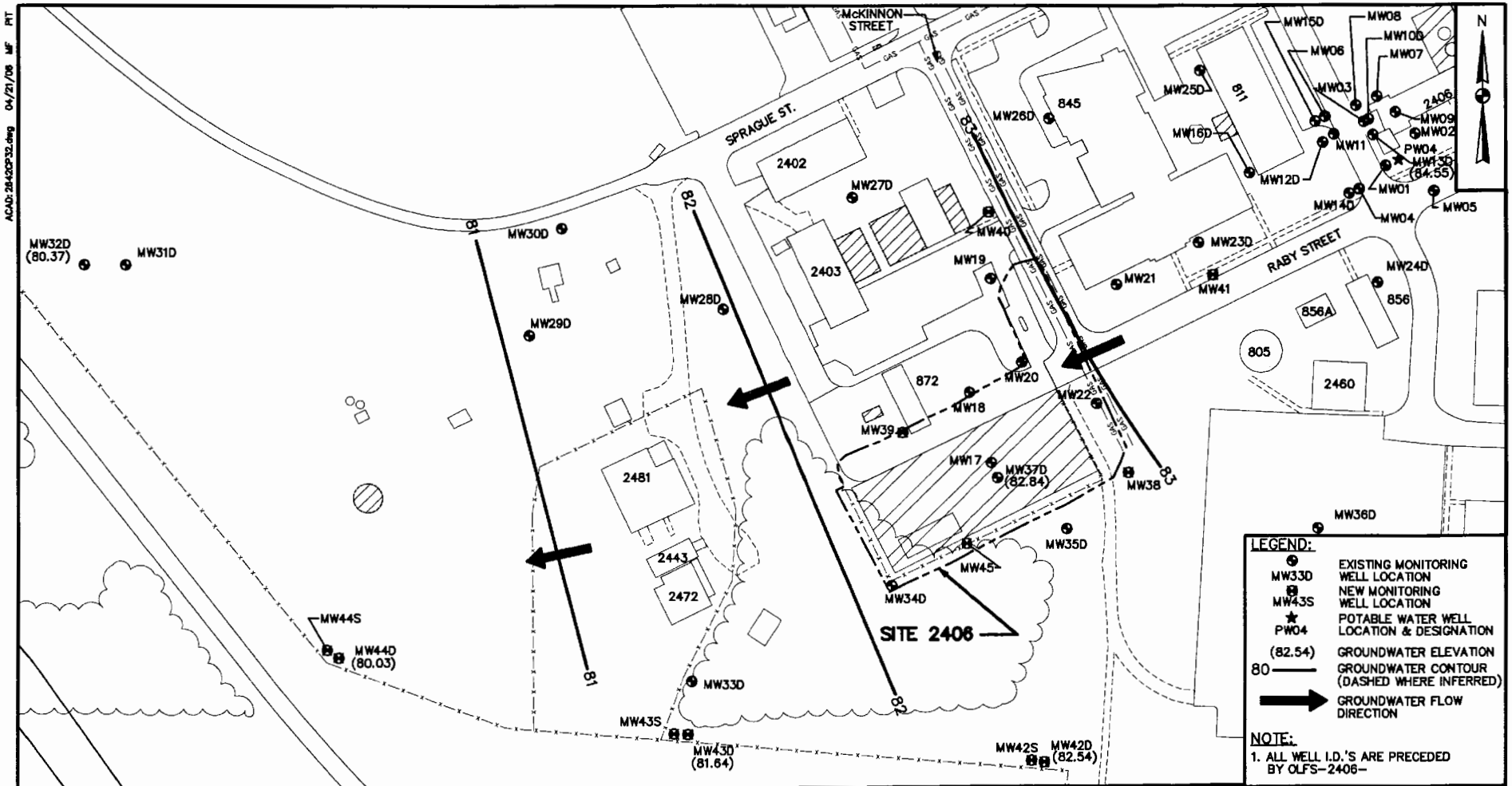
NAVFAC

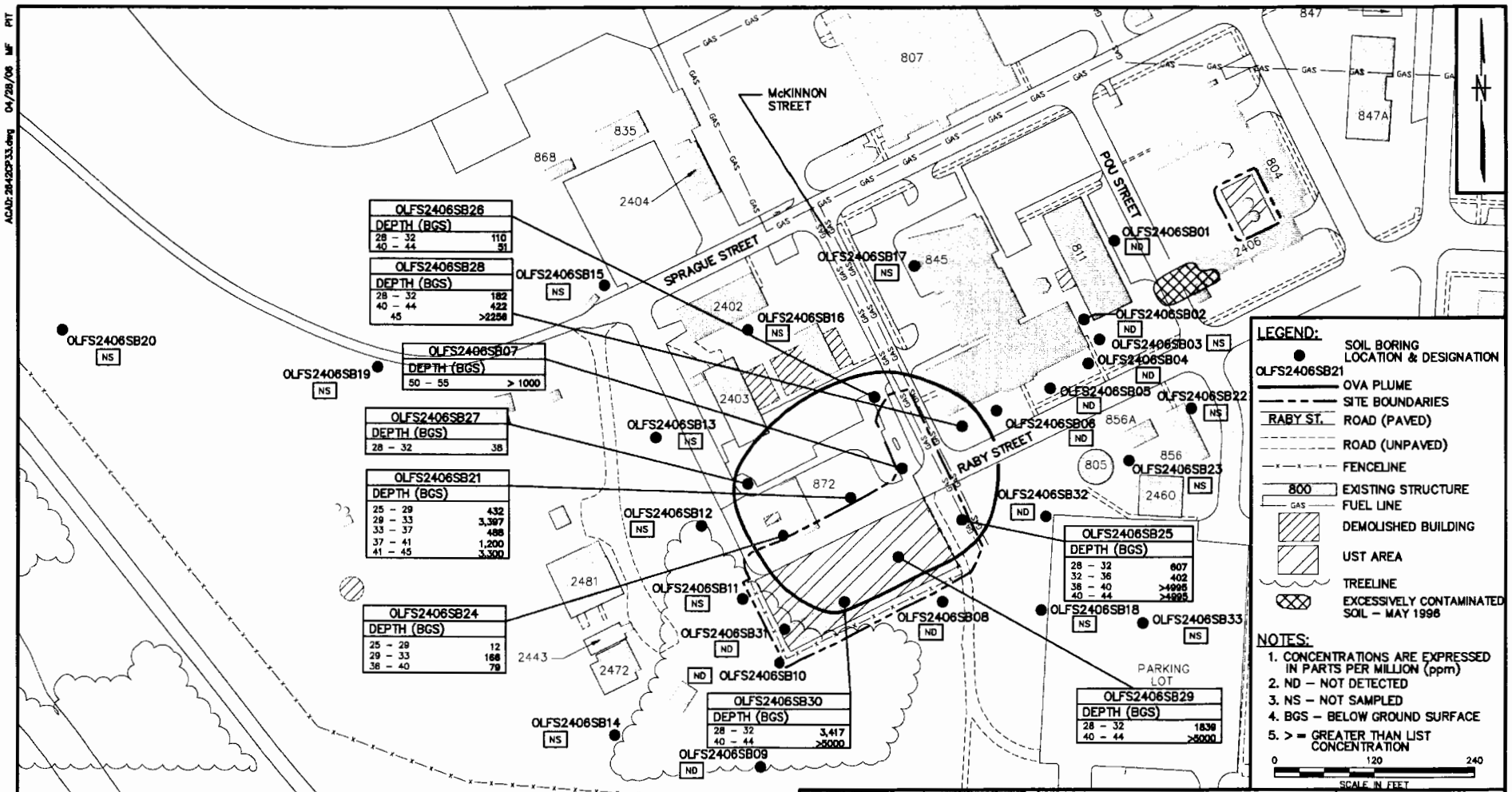
INTERMEDIATE GROUNDWATER FLOW - 7/28/04
REMEDIAL ACTION PLAN
OLF SAUFLEY - SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA

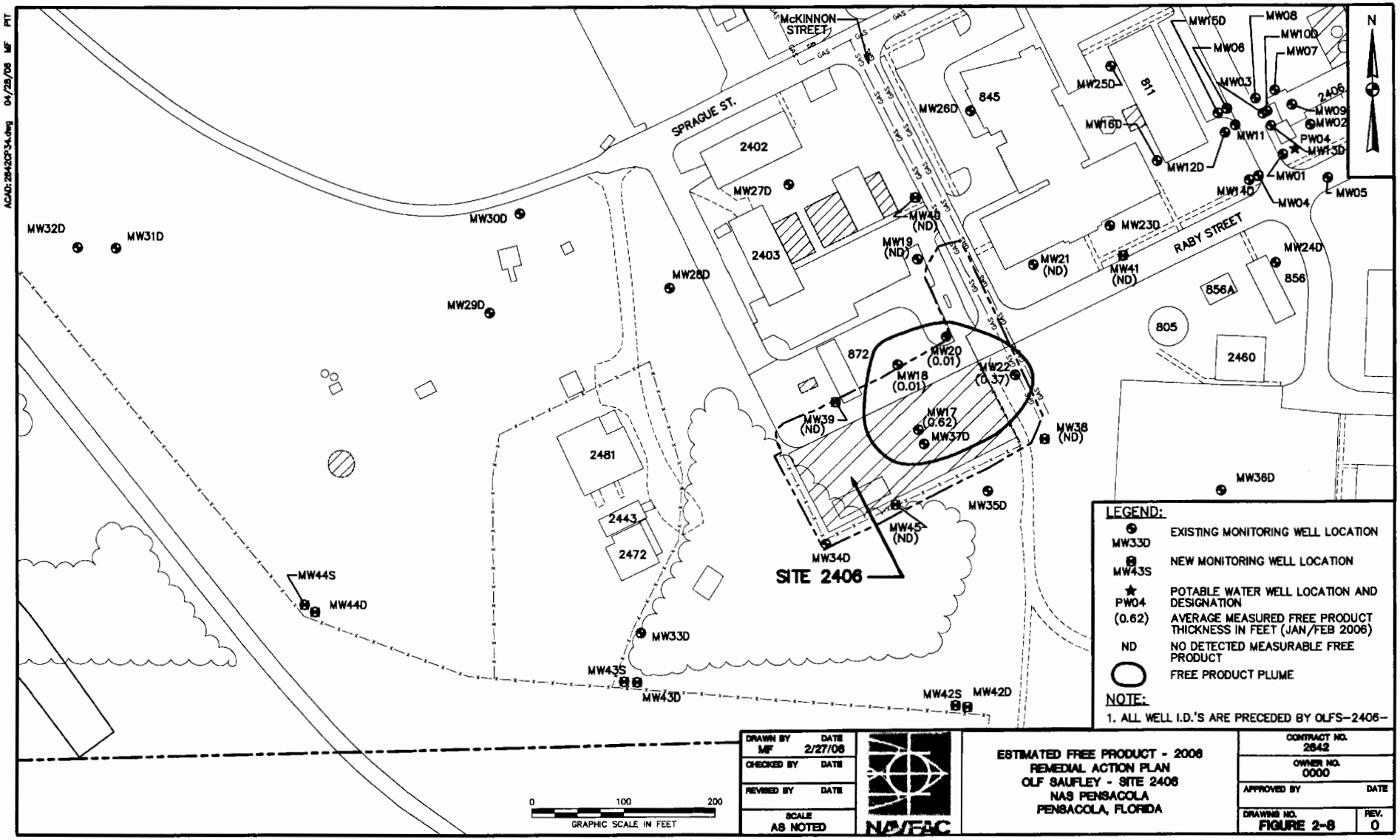
CONTRACT NO. 2642	
OWNER NO. 0000	
APPROVED BY	DATE
DRAWING NO. FIGURE 2-5	REV. 0

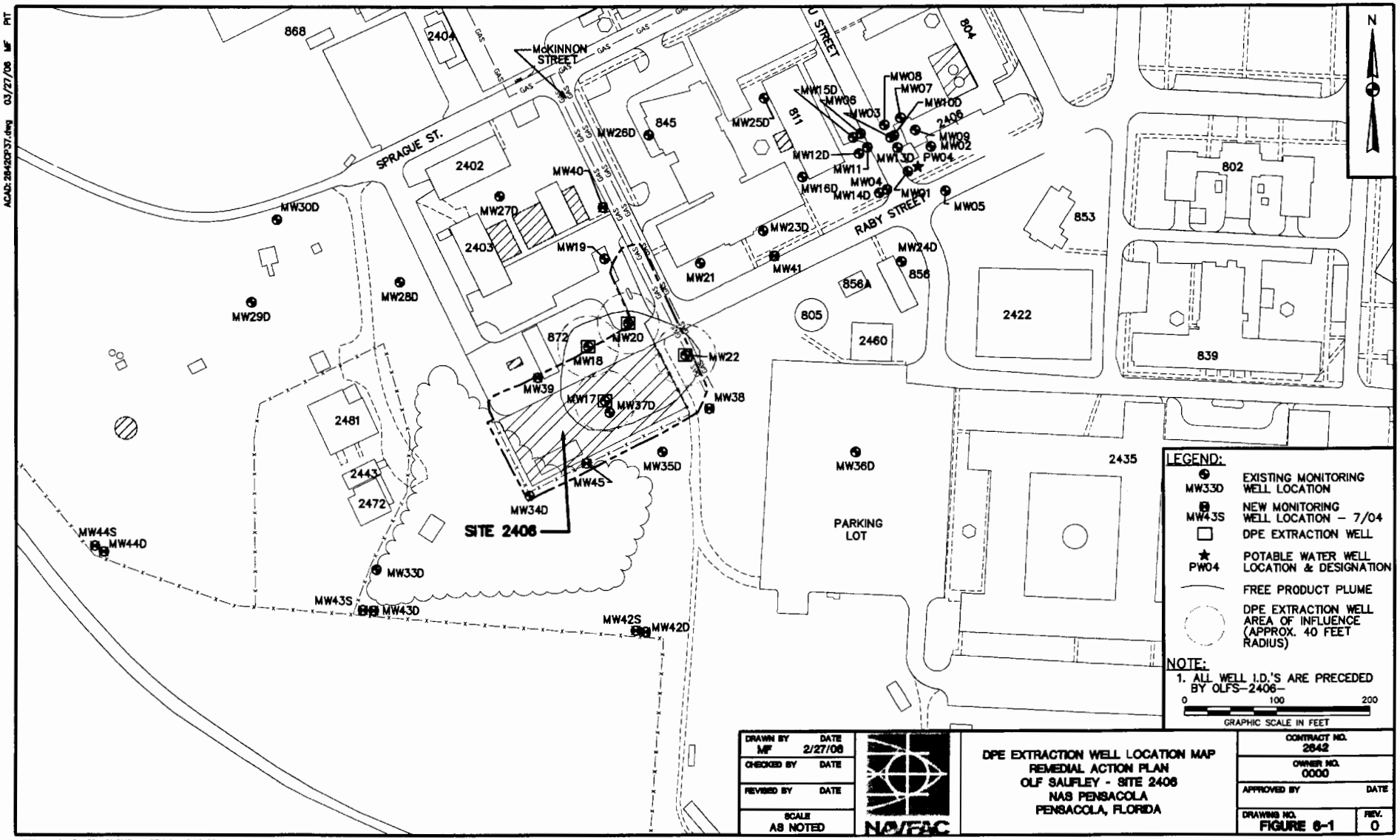
ACAD: 2642CP18.dwg 04/21/05 MF PIT

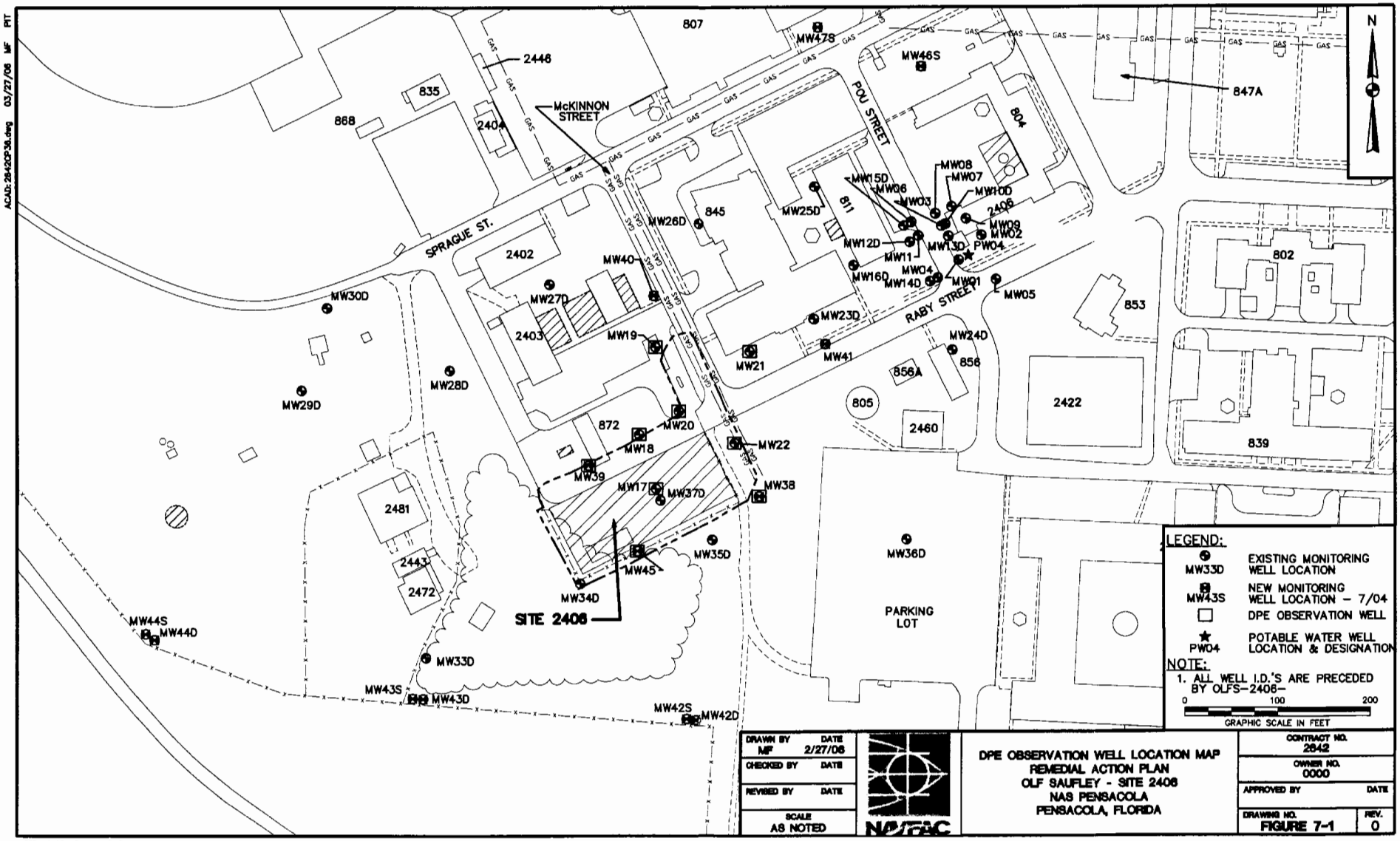
FORM CADD NO. SDIV-IH.DWG - REV 1 - 9/10/98


McKINNON STREET
SPRAGUE ST.
RABY STREET
GAS
2402
2403
2481
2443
2472
872
845
811
805
856A
856
2460
2406
MW01
MW02
MW03
MW04
MW05
MW06
MW07
MW08
MW09
MW10D
MW11
MW12D
MW13D (84.55)
MW14D
MW15D
MW16D
MW17
MW18
MW19
MW20
MW21
MW22
MW23D
MW24D
MW25D
MW26D
MW27D
MW28D
MW29D
MW30D
MW31D
MW32D (80.37)
MW33D
MW34D
MW35D
MW36D
MW37D (82.84)
MW38
MW39
MW40
MW41
MW42S
MW42D (82.54)
MW43S
MW43D (81.64)
MW44S
MW44D (80.03)
MW45
PW04
SITE 2406
81
82
83
N
0
100
200
GRAPHIC SCALE IN FEET
LEGEND:
MW33D EXISTING MONITORING WELL LOCATION
MW43S NEW MONITORING WELL LOCATION
PW04 POTABLE WATER WELL LOCATION & DESIGNATION
(82.54) GROUNDWATER ELEVATION
80 GROUNDWATER CONTOUR (DASHED WHERE INFERRED)
GROUNDWATER FLOW DIRECTION
NOTE:
1. ALL WELL I.D.'S ARE PRECEDED BY OLFS-2406-
DRAWN BY MF DATE 2/27/06
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
NAVFAC
DEEP GROUNDWATER FLOW 7/28/04
REMEDIAL ACTION PLAN
OLF SAUFLEY - SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 2642
OWNER NO. 0000
APPROVED BY DATE
DRAWING NO. FIGURE 2-6
REV. 0
ACAD: 2642CP32.dwg 04/21/06 MF PIT
FORM CADD NO. SDIV-BM.DWG - REV 1 - 9/10/98


McKINNON STREET
SPRAGUE STREET
POU STREET
RABY STREET
PARKING LOT
807
847
847A
835
868
2404
2402
2403
845
811
804
2406
856A
856
805
2460
872
2481
2443
2472
OLFS2406SB01 ND
OLFS2406SB02 ND
OLFS2406SB03 NS
OLFS2406SB04 ND
OLFS2406SB05 ND
OLFS2406SB06 ND
OLFS2406SB07
DEPTH (BGS)
50 – 55 > 1000
OLFS2406SB08 ND
OLFS2406SB09 ND
OLFS2406SB10 ND
OLFS2406SB11 NS
OLFS2406SB12 NS
OLFS2406SB13 NS
OLFS2406SB14 NS
OLFS2406SB15 NS
OLFS2406SB16 NS
OLFS2406SB17 NS
OLFS2406SB18 NS
OLFS2406SB19 NS
OLFS2406SB20 NS
OLFS2406SB21
DEPTH (BGS)
25 – 29 432
29 – 33 3,397
33 – 37 488
37 – 41 1,200
41 – 45 3,300
OLFS2406SB22 NS
OLFS2406SB23 NS
OLFS2406SB24
DEPTH (BGS)
25 – 29 12
29 – 33 166
36 – 40 79
OLFS2406SB25
DEPTH (BGS)
28 – 32 607
32 – 36 402
36 – 40 >4995
40 – 44 >4995
OLFS2406SB26
DEPTH (BGS)
28 – 32 110
40 – 44 51
OLFS2406SB27
DEPTH (BGS)
28 – 32 38
OLFS2406SB28
DEPTH (BGS)
28 – 32 182
40 – 44 422
45 >2256
OLFS2406SB29
DEPTH (BGS)
28 – 32 1839
40 – 44 >5000
OLFS2406SB30
DEPTH (BGS)
28 – 32 3,417
40 – 44 >5000
OLFS2406SB31 ND
OLFS2406SB32 ND
OLFS2406SB33 NS
LEGEND:
SOIL BORING LOCATION & DESIGNATION
OLFS2406SB21
OVA PLUME
SITE BOUNDARIES
RABY ST. ROAD (PAVED)
ROAD (UNPAVED)
FENCELINE
800 EXISTING STRUCTURE
GAS FUEL LINE
DEMOLISHED BUILDING
UST AREA
TREELINE
EXCESSIVELY CONTAMINATED SOIL – MAY 1996
NOTES:
1. CONCENTRATIONS ARE EXPRESSED IN PARTS PER MILLION (ppm)
2. ND – NOT DETECTED
3. NS – NOT SAMPLED
4. BGS – BELOW GROUND SURFACE
5. > = GREATER THAN LIST CONCENTRATION
0 120 240
SCALE IN FEET
DRAWN BY MF DATE 2/27/06
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
NAVFAC
SOIL OVA RESULTS
REMEDIAL ACTION PLAN
OLF SAUFLEY, SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 2642
OWNER NO. 0000
APPROVED BY DATE
DRAWING NO. FIGURE 2-7
REV. 0
ACAD: 2642CP33.dwg 04/28/06 MF PIT
FORM CADD NO. SDIV-3H.DWG - REV 1 - 9/10/98


McKINNON STREET
SPRAGUE ST.
RABY STREET
N
MW08
MW10D
MW07
MW15D
MW06
MW03
MW25D
811
845
MW26D
MW16D
MW11
MW12D
2406
MW09
MW02
PW04
MW13D
MW01
MW14D
MW04
MW05
2402
MW27D
MW32D
MW31D
MW30D
MW40 (ND)
MW19 (ND)
2403
MW28D
MW29D
MW23D
MW21 (ND)
MW41 (ND)
MW24D
856
856A
805
2460
872
MW20 (0.01)
MW18 (0.01)
MW22 (0.37)
MW17 (0.62)
MW37D
MW39 (ND)
MW38 (ND)
MW36D
MW35D
MW45 (ND)
MW34D
SITE 2406
2481
2443
2472
MW44S
MW44D
MW33D
MW43S
MW43D
MW42S
MW42D
0
100
200
GRAPHIC SCALE IN FEET
LEGEND:
MW33D EXISTING MONITORING WELL LOCATION
MW43S NEW MONITORING WELL LOCATION
PW04 POTABLE WATER WELL LOCATION AND DESIGNATION
(0.62) AVERAGE MEASURED FREE PRODUCT THICKNESS IN FEET (JAN/FEB 2006)
ND NO DETECTED MEASURABLE FREE PRODUCT
FREE PRODUCT PLUME
NOTE:
1. ALL WELL I.D.'S ARE PRECEDED BY OLFS-2406-
DRAWN BY MF DATE 2/27/06
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
NAVFAC
ESTIMATED FREE PRODUCT - 2006
REMEDIAL ACTION PLAN
OLF SAUFLEY - SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 2642
OWNER NO. 0000
APPROVED BY DATE
DRAWING NO. FIGURE 2-8
REV. 0
ACAD: 2642CP34.dwg 04/28/06 MF PIT
FORM CADD NO. SDIV-BHJDVG - REV 1 - 9/10/98


N
SPRAGUE ST.
McKINNON STREET
U STREET
RABY STREET
GAS
868
2404
845
811
804
802
853
2402
2403
2422
839
2460
805
856A
856
2481
2443
2472
872
PARKING LOT
2435
SITE 2406
MW30D
MW29D
MW28D
MW27D
MW26D
MW25D
MW23D
MW24D
MW21
MW41
MW40
MW19
MW20
MW18
MW22
MW39
MW17
MW37D
MW38
MW35D
MW36D
MW45
MW34D
MW33D
MW44S
MW44D
MW43S
MW43D
MW42S
MW42D
MW15D
MW06
MW03
MW08
MW07
MW10D
MW09
MW02
MW12D
MW11
MW13D
PW04
MW04
MW16D
MW14D
MW01
MW05
LEGEND:
MW33D EXISTING MONITORING WELL LOCATION
MW43S NEW MONITORING WELL LOCATION – 7/04
DPE EXTRACTION WELL
PW04 POTABLE WATER WELL LOCATION & DESIGNATION
FREE PRODUCT PLUME
DPE EXTRACTION WELL AREA OF INFLUENCE (APPROX. 40 FEET RADIUS)
NOTE:
1. ALL WELL I.D.'S ARE PRECEDED BY OLFS–2406–
0 100 200
GRAPHIC SCALE IN FEET
DRAWN BY MF DATE 2/27/06
CHECKED BY DATE
REVISED BY DATE
SCALE AS NOTED
NAVFAC
DPE EXTRACTION WELL LOCATION MAP
REMEDIAL ACTION PLAN
OLF SAUFLEY - SITE 2406
NAS PENSACOLA
PENSACOLA, FLORIDA
CONTRACT NO. 2642
OWNER NO. 0000
APPROVED BY DATE
DRAWING NO. FIGURE 6-1
REV. 0
ACAD: 2642CP37.dwg 03/27/06 MF PIT
FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98



LEGEND:

- MW33D — EXISTING MONITORING WELL LOCATION
- MW43S — NEW MONITORING WELL LOCATION – 7/04
- DPE OBSERVATION WELL
- PW04 — POTABLE WATER WELL LOCATION & DESIGNATION

NOTE:

1. ALL WELL I.D.'S ARE PRECEDED BY OLFS-2406-

0 100 200
GRAPHIC SCALE IN FEET

DRAWN BY MF	DATE 2/27/06	DPE OBSERVATION WELL LOCATION MAP REMEDIAL ACTION PLAN OLF SAUFLEY - SITE 2406 NAS PENSACOLA PENSACOLA, FLORIDA
CHECKED BY	DATE	
REVISED BY	DATE	
SCALE AS NOTED		

NAVFAC

CONTRACT NO. 2642
OWNER NO. 0000
APPROVED BY DATE
DRAWING NO. FIGURE 7-1
REV. 0

ACAD: 2642CP36.dwg 03/27/06 MF PIT

FORM CADD NO. SDIV-BH.DWG - REV 1 - 9/10/98

APPENDIX A

CONTAMINANT MASS CALCULATIONS

APPENDIX A
TABLE A-1
ESTIMATED MASS OF FREE PRODUCT

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Free Product Mass Estimate (lbs)

Area of free product (from RAP Fig. 2-8 via CADD):	21554	ft^2
Thickness (2006 avg)*:	0.253	ft
Jan. - 0.2825		
Feb. - 0.2225		
Volume:	5442.385	ft^3
	201.57	yd^3
	40709.04	gals
Porosity (typical of Whiting Field soils):	0.30	
Correction Factor (for sand)**:	0.50	
Density of free product**:	49.12	lb/ft^3
Mass of Free Product:	**40099.49**	lbs

Notes:
*Free product mass calculation was based on the average thickness of the January and February 2006 events.
**From guidance, How to Evaluate Alternative Recover Free Product at Leaking Underground Storage Tank Sites (USEPA, '

PREPARED BY: Mike Jaynes **DATE:** 3/29/2006

CHECKED BY: _____ **DATE:** _____

TABLE B-1
MOBILE DUAL-PHASE EXTRACTION (DPE) SYSTEM (ALTERNATIVE 1)
COST ESTIMATE

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Estimator: Mike Jaynes
Checked By:

IMPLEMENTATION - Free Product Removal by DPE

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Free Product Recovery Via Mobile Dual-Phase Extraction System				
Recovery well installation	0	ea	$3,000	$0
8 hour MDPE event / Vac truck rental	6	ea	$1,500	$9,000
Storage tank/ trailer rental	6	ea	$1,100	$6,600
System operator	6	ea	$800	$4,800
Generator rental	6	ea	$350	$2,100
Free product/water recovery and disposal @ 1,920 gal per event ($1 45/gal)	11,520	gal	$1.45	$16,704
Sub-total for initial costs				$39,204
Labor OH (30%)				$11,761
Engineering and Design (20%)				$7,841
Total Direct Costs:				**$58,806**

LABOR				
MDPE Costs for Oversight and Free Product Monitoring				
Oversight by Staff Engineer during MDPE event (12 hrs per event)	72	hrs	$45	$3,240
Free product monitoring by Technician (not during DPE event - assume 4 hrs once a month for up to 9 month project duration)	36	hrs	$30	$1,080
Free Product interface probe rental	30	day	$25	$750
Travel (assume 6 hrs for Engineer and Tech per event)	36	hrs	$75	$2,700
Hotel and Per diem	12	ea	$85	$1,020
Truck rental	30	ea	$50	$1,500
Total Labor Cost:				**$10,290**

PLANNING DOCUMENTS				
Health and Safety Plan - (prior to implementation)				**$6,000**

REPORTING:				
Status Letter Reports - (assume 6 reports, one report after each event)				
Staff Engineer - 16 hrs per report	96	hrs	$45	$4,320
Senior Engineer - 4 hrs	24	hrs	$80	$1,920
Technical Expert - 2 hrs	12	hrs	$75	$900
CADD Technician - 2 hrs	12	hrs	$40	$480
Word processing - 4 hrs	24	hrs	$35	$840
Editor - 1 hrs	6	hrs	$60	$360
Total				**$8,820**
Final Remedial Action Completion Report:				
Staff Engineer	80	hrs	$45	$3,600
Senior Engineer	16	hrs	$80	$1,280
Technical Expert	4	hrs	$75	$300
CADD Technician	8	hrs	$40	$320
Word processing	12	hrs	$35	$420
Editor	4	hrs	$60	$240
Total				**$6,160**
Report Production				
Reproduction: 100 pgs @ 28 copies	2,800	pg	$0.10	$280
Shipping/binding: 28 reports	28	ea	$20	$560
Total Report Cost:				**$15,820**

TOTAL DPE IMPLEMENTATION AND REPORTING COST ESTIMATE: **$90,916**

TABLE B-2
FREE PRODUCT REMOVAL BY DEWATERING DURING EXCAVATION
COST ESTIMATE

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Estimator: Mike Jaynes
Checked By:

COST ESTIMATE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization*	$5,000
Field Sampling & Oversight	$12,000
Excavation Activities	$250,000
Site Restoration and Demobilization	$3,000
Total Direct Costs	**$270,000**
INDIRECT COSTS	
Health and Safety	$6,500
Admin Costs	$3,000
Contingency (@20%)	$54,000
Total Indirect Costs	**$63,500**
Total Costs for Excavation and Off-site Treatment*	**$333,500**

*Note: Assumes excavation was selected as the remedial alternative for soil

TABLE B-2A
FREE PRODUCT REMOVAL BY DEWATERING DURING EXCAVATION
(ALTERNATIVE 2A) COST ESTIMATE

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Estimator: Mike Jaynes
Checked By:

COST ESTIMATE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization*	$5,000
Field Sampling & Oversight	$12,000
Excavation Activities	$250,000
Site Restoration and Demobilization	$3,000
Total Direct Costs	**$270,000**
INDIRECT COSTS	
Health and Safety	$6,500
Admin Costs	$3,000
Contingency (@20%)	$54,000
Total Indirect Costs	**$63,500**
Total Costs for Excavation and Off-site Treatment*	**$333,500**

*Note: Assumes excavation was selected as the remedial alternative for soil

TABLE B-2B
FREE PRODUCT REMOVAL BY DEWATERING WITHOUT EXCAVATION (ALTERNATIVE 2B) COST ESTIMATE

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Estimator: Mike Jaynes
Checked By:

COST ESTIMATE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization*	$20,000
Field Sampling & Oversight	$12,000
Excavation Activities	$300,000
Site Restoration and Demobilization	$3,000
Total Direct Costs	**$335,000**
INDIRECT COSTS	
Health and Safety	$6,500
Admin Costs	$3,000
Contingency (@20%)	$67,000
Total Indirect Costs	**$76,500**
Total Costs for Excavation and Off-site Treatment*	**$411,500**

*Note: Assumes excavation was **not** selected as the remedial alternative for soil

TABLE B-3

FREE PRODUCT REMOVAL VIA LDA EXCAVATION COST ESTIMATE

UST SITE 2406
REMEDIAL ACTION PLAN
OUTLYING LANDING FIELD SAUFLEY
PENSACOLA, FLORIDA

Estimator: Mike Jaynes
Checked By:

COST ESTIMATE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization	$5,000
Field Sampling & Oversight	$12,000
Excavation Activities	$600,000
Site Restoration and Demobilization	$3,000
Total Direct Costs	**$620,000**
INDIRECT COSTS	
Health and Safety	$6,500
Admin Costs	$3,000
Contingency (@20%)	$124,000
Total Indirect Costs	**$133,500**
Total Costs for Excavation and Off-site Treatment:	**$753,500**

APPENDIX C

DESIGN SPECIFICATIONS

PETRO-CHEM ENVIRONMENTAL SYSTEMS, INC.

Fax

To:	Mike Jaynes	**From:**	Chris Schmidt
Fax:	850-385-9860	**Fax:**	813-972-0955
Phone:	850-385-9899	**Phone:**	813-972-1331
Date:	3/14/2006	**Pages:**	2

Subject: BUDGETARY ESTIMATE
NAS MPE Events
Pensacola, FL

Notes:

Mike:

Attached is a rough estimate for doing one day events at the NAS in Pensacola. We would most likely work with our vendors to provide the equipment and services.

For the purpose of costs, I assumed you would want to do a full 24 hour event. However, you could probably cut the costs a bit if you do it less since water recovery and disposal costs would go down.

I think I have included everything, but let me know if I have forgotten any information or did not consider something

I should be in most of this week.

Thanks for the opportunity to assist you.

Petro-Chem Environmental Systems, Inc.

15310 Amberly Drive • Suite 250 • Tampa, FL 33647 Phone: (813) 972-1331 Fax: (813) 972-0955

Tuesday, March 14, 2006

Mike Jaynes
Tetra Tech NUS, Inc.
Tallahassee, FL

Re: EQUIPMENT AND DISPOSAL SERVICES FOR MPE EVENTS
NAS Site
Pensacola, FL

BUDGETARY PROPOSAL SUMMARY

Scope of Work – Recover water from 4 MPE wells with mobile high vacuum equipment and transfer to holding portable holding tank or trailer for disposal. Assumes 1 GPM recovery per well (4 GPM total) over 1-day period of operation.

- Mobilize to site with portable equipment for 1-day Multiphase Extraction (MPE) Event
- Setup / Breakdown
- Equipment Operator
- Capture recovered water in frac tank or liquid trailer.
- Dispose of water
- Includes generator, mileage, per diem
- Demobilize from site

Estimated Costs (per 24 hour event)

- Disposal of 5,760 gallons recovered water (4 GPM x 1440 min / day) @ $1.45 / gal =	$8,352
- Frac tank / trailer rental	$1,100
- Mobile High Vacuum Equipment Rental	$1,500
- Operator (optional)	$800
- Generator	$350
TOTAL ESTIMATED COST (per event)	**$12,102**

Note: This is a budgetary estimate. Please contact Petro-Chem for firm and final pricing.

Please feel free to contact me with any questions or if you require additional information.

Sincerely,

Christopher A. Schmidt
Technical Services Manager

TETRA TECH NUS, INC.
3360 Capital Circle N. E., Suite B
Tallahassee, Florida 32308
Telephone: (850) 385-9899
Facsimile: (850) 385-9860

FAX

To: CHRIS SCHMIDT	**Date:** 3/8/06
Company: PETRO-CHEM	
Location:	
Fax Number: 813-972-0955	
From: MIKE JAYNES	
No. of Pages Including Cover: 3	

Comments:

CHRIS,

HERE'S THE SET UP + SPECS AS THEY ARE CURRENTLY:

→ DPE VIA 4 EXISTING 2-INCH ID M-WELLS (SEE-FIG.)

→ WATER LEVEL - ≈ 35' BLS/BTOC

→ EST. YIELD - ≈ 0.5-1.0 GPM PER WELL

→ LITHOLOGY - SILTY CLAYEY - SILTY SAND FROM 0-50' BLS

ALSO,
SEE ATTACHED AQUIFER CHARTS.

THANKS,
MIKE

This facsimile contains PRIVILEGED AND CONFIDENTIAL INFORMATION intended only for the use of the Addressee(s) named above. If you are not the intended recipient of this facsimile, or the employee or agent responsible for delivering it to the intended recipient, you are hereby notified that any dissemination or copying of this facsimile is strictly prohibited. If you have received this facsimile in error, please immediately notify us by telephone and return the original facsimile to us at the above address via U.S. Postal Service. Thank you.

The shallow aquifer characteristics estimated in the initial SARA (TtNUS, 2003), are summarized below:

- Hydraulic conductivity K = 10.08 feet/day or 4.06×10^{-3} cm/sec
- Hydraulic gradient i = 0.01 ft/ft
- Transmissivity T = 72,000
- Average Groundwater Velocity V = 0.336 feet/day
- Effective Porosity n_e = 0.30 (unitless)*.

*Review of standard literature suggests that a representative effective porosity for the lithology at this site is approximately 30% (Heath, 1983).

During the additional assessment in 2004 for SARA No. 2, on-site depth to water measurements and groundwater elevation determinations were recorded from site monitoring wells on July 28, 2004.

For the most part, groundwater elevations and flow direction were similar to that found during the initial (2000-2003) SA. The relative groundwater elevations in the shallow wells ranged from 79.97 feet to 100.60 feet. Although free product was present in four monitoring wells (OLFS-2406-MW17, -MW18, -MW20, and -MW22), the water levels from these wells were corrected for density differences of free product using an assumed free product specific gravity of 0.8. The groundwater flow for the shallow (45 to 56 feet bls) screened groundwater interval was in a radial direction with the high point located in the former fuel farm area. Based on the current data it is unclear if this pattern is consistent in the area south of the fuel tank area.

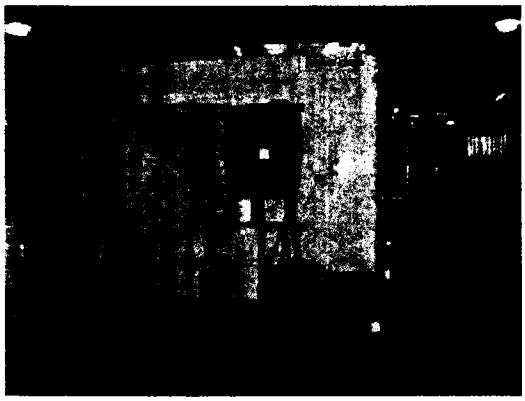
The water level measurements in the intermediate and deep wells ranged from 27.20 feet BTOC to 47.71 feet BTOC. The relative groundwater elevations in the intermediate and deep wells ranged from 75.42 feet to 98.12 feet. The groundwater flow for the intermediate (65 to 81 feet bls) screened groundwater interval is generally in a radial direction near the former fuel farm area and to the west southwest near production well PW04. Because of the flow patterns there appears to be a north northwest to south southeast trending trough located beneath Building 845. The groundwater flow on the deep (130 to 142 feet bls) screened groundwater interval is toward the west southwest.

2.4 CONTAMINATED SOIL ASSESSMENT

The vertical and horizontal extent of petroleum impacted soil in the vadose zone was assessed through soil vapor analysis, and supplemented with fixed-base soil confirmation analysis, performed during the soil boring investigations and monitoring well installations described in the SARA (TtNUS, 2003).

RTS-020 System Specification Sheet

150 acfm Claw SVE, 65 scfm Claw Sparge Trailer



Application:
This treatment system is designed to draw water and air in from wells using a high vacuum rotary claw pump. It is capable of handling water and air with explosive contaminants. This includes hydrocarbons such as gasoline and toluene as well as furnace oil and diesel oil. The water and air is drawn through an inlet separator that separates the water from the air. The air exits the top of the separator and passes through the pump. The water collects in the bottom of the separator and is pumped out using a high suction progressive cavity pump. The water can be pumped through carbon vessels which are not included with the system. The system also includes a 7.5hp rotary claw air sparge compressor. This compressor is capable of producing 65 scfm of air at 25 psi and can be used to push fresh air down air sparging wells. The sparge compressor is setup only to run if the sve blower is on.

Construction:
The treatment system is installed in an 8'x16' trailer. The process piping is assembled from a combination of galvanized steel fittings and PVC hose and fittings.

Specifications:

Process Specifications:		**Power Specifications:**	
Rated Water Processing Flow Rate:	10gpm	Power Requirement:	80A of 230/120v, 3ph power
Rated Water Discharge Pressure for pumping to downstream locations:	30psi	Service Required:	100A, 230/120V, 3ph
Rated Vacuum and Flow Rate for Vapor Extraction System:	150acfm @ 24" hg	Main Disconnect By:	MLEE
Rated Pressure and Flow for the Air Sparge Compressor:	65scfm @ 25 psig	Area Classification of Process Equipment:	Class 1 Div 2 Group D
Approximate Weight:	5600lb	Area Classification around Control Panel:	General Purpose, Outdoor
Approximate Outside Dimensions:	8'x16' (not including 3' towing hitch section)	Electrical Approvals:	cUL approved System
Acceptable Ambient operating Temperatures:	-40 to +35 deg C	Telephone Line Requirement:	Yes for remote telemetry

Standard Features:

- Explosion Proof Heater / Lighting / Ventilation
- Remote access system with data-logging function.
- Automated control system for independent operation.
- Note: Air phase carbon, liquid phase carbon, bag filter elements, oil water separator media all require purchasing with rental of the system.

Options Table: The following options can be chosen to customize this rental system for your specific application.

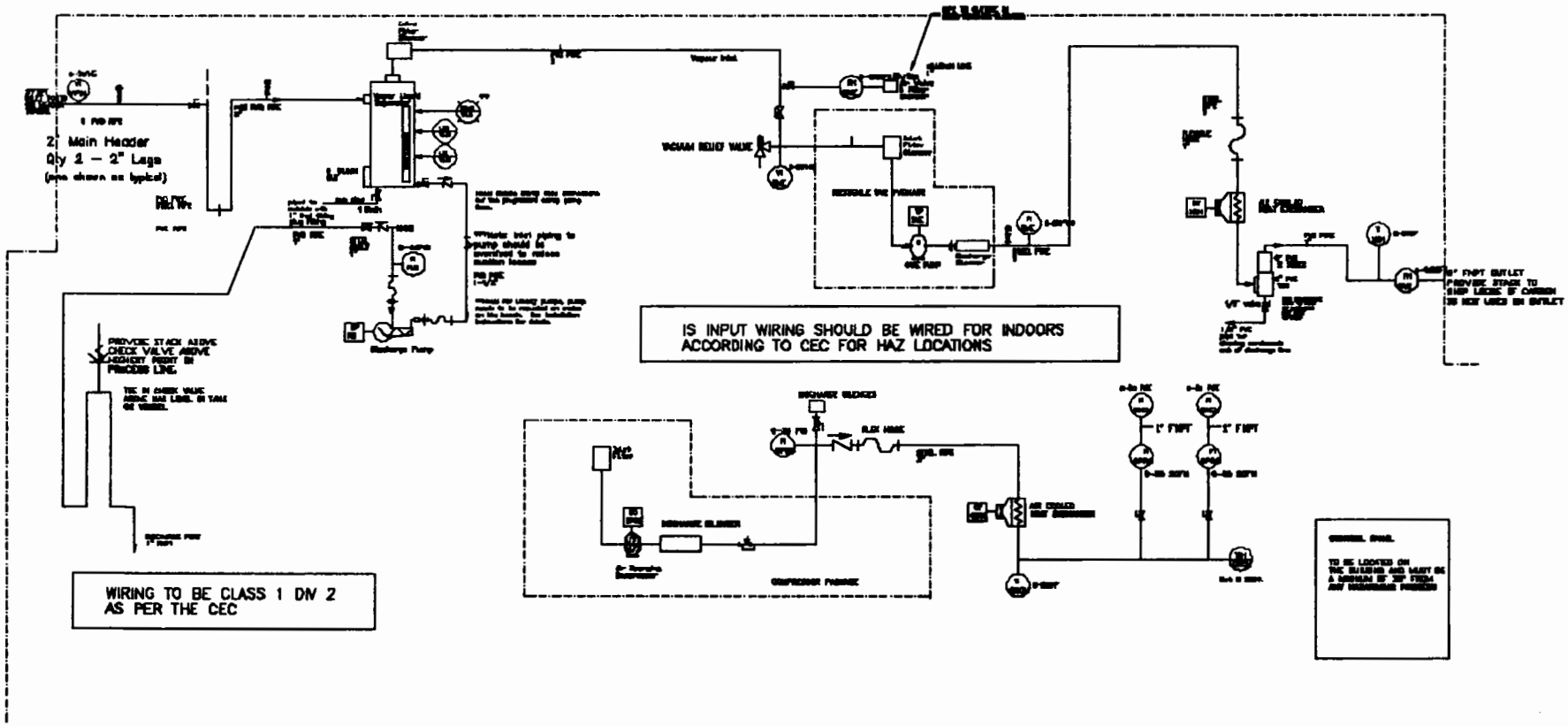
Option	Description
Bag Filter Elements	Various filter bags can be supplied with the system. 1, 5, 10, 25, 50, 100 micron are all available
Extra Bag Filter Housings	Another two bag filter housing can be installed in parallel with the existing unit to reduce the time required between changing filter bags and allow for a higher nominal flow rate.
Carbon and Clay vessels	Up to six carbon or clay filter vessels can be installed on the skid in any order. For example we can supply 6 carbon vessels, in two parallel lines to increase the nominal flow rate, or we can install one clay vessel and two carbon vessels in series, or just two carbon vessels in series.
Well Pumps	MLEE can also rent well pumps that hook into our panel and pump down wells or drainage ditches.
Larger Air Phase Carbon Vessels	The standard vessels included with this system are 1000 lb vessels. Larger vessels can be installed if required.
Air Compressor and solenoid Valves	MLEE can supply an air compressor to operate pneumatic pumps on site.

1325 California Ave., P.O. Box 1517, Brockville, Ontario K6V 5Y6
Ph. 1-800-420-4056 www.maple-leaf.ca fax (613) 345-7633

RTS-020 System Specification Sheet

150 acfm Claw SVE, 65 scfm Claw Sparge Trailer

Process Flow and Instrumentation Diagram

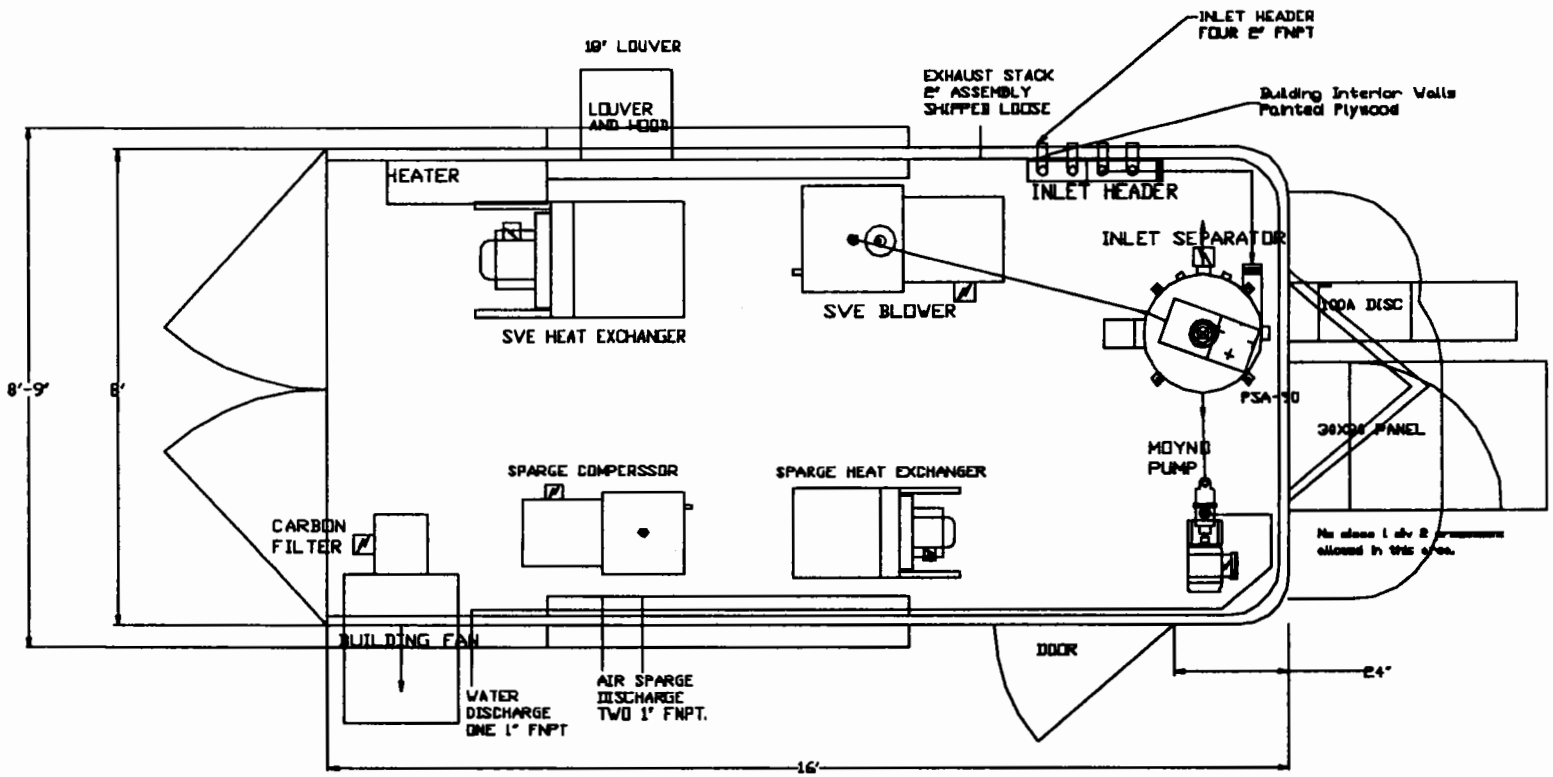


Maple Leaf Environmental Equipment Ltd.
1325 California Ave., P.O. Box 1517, Brockville, Ontario K6V 5Y6
Ph. 1-800-420-4056 www.maple-leaf.ca fax (613) 345-7633

RTS-020 System Specification Sheet

150 acfm Claw SVE, 65 scfm Claw Sparge Trailer

Layout Diagram



Maple Leaf Environmental Equipment Ltd.
1325 California Ave., P.O. Box 1517, Brockville, Ontario K6V 5Y6
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APPENDIX D

RAP SUMMARY SHEET AND CHECKLIST

Remedial Action Plan Summary

DEP Form # 62-770.900(4)
Form Title: Remedial Action Plan Summary
Effective Date: September 23, 1997

Site Name Site 2406
Location Outlying Landing Field Saufley, NAS Pensacola
Media Contaminated: ☑ Groundwater ☑ Soil

FDEP Facility ID No. NA
Current Date 4 / 7 / 6
Date of Last GW Analysis 7 / / 4

Type(s) of Product(s) Discharged:
☐ Gasoline Analytical Group
☑ Kerosene Analytical Group (Diesel)
- Estimated Petroleum Mass (lbs):
  Groundwater _____
  Saturated Zone Soil _____
  Vadose Zone Soil _____
- Area of Plume 21,554 (ft^2)
- Thickness of Plume < 1 (ft)

Groundwater Recovery and Specifications:
- No. of Recovery Wells 4
  ☑ Vertical ☐ Horizontal
- Design Flow Rate/Well _____ (gpm)
- Total Flow Rate _____ (gpm)
- Hydraulic Conductivity _____ (ft/day)
- Recovery Well Screen Interval _____ (ft)
- Depth to Groundwater 35 (ft)

Method of Groundwater Remediation:
☐ Pump-and-Treat
☐ Air Stripper
☐ Low Profile ☐ Packed Tower
☐ Diffused Aerator
☐ Activated Carbon
☐ Primary Treatment ☐ Polishing
☐ In Situ Air Sparging
- No. of Sparge Points _____
  ☐ Vertical ☐ Horizontal
- Pressure _____ (psi)
- Design Air Flow Rate/Well _____ (cfm)
- Total Air Flow Rate _____ (cfm)

☐ Biosparging
- No. of Sparge Points _____
  ☐ Vertical ☐ Horizontal
- Design Air Flow Rate/Well _____ (cfm)

☐ Bioremediation
☐ In Situ ☐ Ex Situ
☐ Other _____

Method of Groundwater Disposal:
☐ Infiltration Gallery ☐ Sanitary Sewer
☐ Surface Discharge/NPDES ☐ Injection Well
☐ Other _____

Free Product Present: ☑ Yes ☐ No
- Estimated Volume 40,000 (gal)
- Maximum Thickness 10 (in)
- Method of Recovery (check all that apply):
  ☐ Manual Bailing ☐ Skimming Pump
  ☑ Other Dual-Phase Extraction

Method of Soil Remediation:
☐ Excavation
Volume to be Excavated _____ (yds^3)
☐ Thermal Treatment ☐ Land Farming On Site
☐ Landfill ☐ Bioremediation
☐ Other _____
☐ Vapor Extraction System (VES)
- No. of Venting Wells _____
  ☐ Vertical ☐ Horizontal
- VES - Applied Vacuum _____ (wg)
- Design Air Flow Rate _____ (cfm)
- Design Radius of Influence _____ (ft)
- Air Emissions Treatment
  ☐ Thermal Oxidizer ☐ Catalytic Converter
  ☐ Carbon ☐ Other _____

☐ Soil Bioventing
- No. of Venting Wells _____
  ☐ Vertical ☐ Horizontal
- Design Air Flow Rate _____ (cfm)

☐ In Situ Bioremediation
☐ Other _____

Natural Attenuation:
- Method of Evaluation
  ☐ Rule 62-770.690(1)(e), F.A.C.
  ☐ Rule 62-770.690(1)(f), F.A.C.

Estimated Time of Cleanup: 180 (days)
- Method of Estimation
  ☐ Pore Volumes (no. of pore vols. = _____)
  ☐ Exponential Decay (Decay Rate) ____ (day^{-1})
  ☐ Groundwater Model
  ☑ Other Experience at similar sites

Estimated Cost:
- Est. Capital Cost (incl. install.) $ 86,000.00
- Est. O & M Cost (per year) $ 0.00
- Est. Total Cleanup Cost $ 86,000.00

REMEDIAL ACTION PLAN & SYSTEM DESIGN CHECKLIST

Bureau of Petroleum Storage Systems
Florida Department of Environmental Protection

Facility Name:	OLF Saufley Field Site 2406, NAS Pensacola	Preapproval Site:	[ ]
Location:	Pensacola, Florida	State Cleanup Site:	[ ]
FAC ID No:	NA	Voluntary Cleanup Site:	[X]
Reviewer:		Contractor:	Tetra Tech NUS, Inc.

This checklist should not be applied in blanket fashion. Technical judgment may be necessary in determining the applicability of some items. However, all information listed that is relevant to the remedial design should be provided.

I. GENERAL

_____ (1) RAP signed, sealed, and dated by Florida P.E. (per Section 471.025, FS)

_____ (2) indication whether proposed plan is for preapproval program, state contracted cleanup, or voluntary cleanup

_____ (3) recap of SAR information and conclusions pertinent to RAP preparation

__No__ (4) current sampling results [within nine (9) months] used for remediation system design

_____ (5) potable water considerations:

- method of potable water supply to site and surrounding area
- locations of private wells within 1/4-mile, and public wells within 1/2-mile radius of site
- indication whether FDEP district office drinking water program was notified if contaminated groundwater could be expected to reach any public or private water well. Method of notification, person notified, and date

_____ (6) identification underground utilities locations, and those which may enhance transport of contaminants

_____ (7) • cleanup time: estimated cleanup time for the groundwater, for the soil

_____ (8) fencing of treatment area required, unless public access is restricted by institutional controls

__NA__ (9) local, state, and federal permits to be obtained, and conditions stated

_____ (10) recap of alternatives discussed and/or alternative selected during pre-RAP conference, or cost-effectiveness analysis of alternatives and identification of recommended alternative

_____ (11) statement that signed and sealed as-built (record) drawings will be provided

__NA__ (12) nuisance noise and odor to neighbors avoided by careful location of equipment items and exhaust stacks or other mitigating measures

II. REQUIREMENTS OF THE PRE-APPROVAL PROGRAM REMEDIAL ACTION INITIATIVE (RAI)

For cleanup projects affected by the Pre-Approval Program Remedial Action Initiative, the requirements of this section apply. The items listed below in this section are to be taken into account for each of the operations covered by the other sections of this checklist.

FAC ID No:_____

___NA_ (1) Cleanup Goals established. End of Active Remediation goal: 70% of natural attenuation default concentrations (NADC), or 90% reduction of each contaminant group, in each key well in the source area, whichever is more stringent, in the specified time frame (typically one to four years). Longer cleanup times to achieve end of active remedial action goal require special justification.

___NA_ (2) Pilot testing of the proposed remediation strategy is generally required. Exceptions require special justification.

_____ (3) Remediation equipment must meet the specifications contained in the Remedial Action Initiative including reasonable safety factors.

_____ (4) System designs includes adequate source area treatment wells, e.g. a safety factor of 2, and consideration of using parallel or zoned systems.

_____ (5) Ultimate cleanup target levels need to be indicated, either (CTLs) of Chapter 62-770 for unconditional NFA, or Alternative CTLs for conditional NFA. For conditional NFA, owner's acknowledgement of future institutional controls at cleanup completion should be documented

_____ (6) End of Active Remediation to be followed by Natural Attenuation Monitoring. An evaluation of "time to switch" from active remedial action to Natural Attenuation Monitoring to reach ultimate cleanup target levels may be performed to allow for the continuation of active remedial action if justified.

_____ (7) Milestones schedule must be included in RAP using the BPSS milestone model. The schedule must identify key wells, contaminants of concern, baseline contaminant concentrations, and time to reach the end of active remedial action. A linear concentration vs. time profile shall apply to each contaminant group in each key well.

_____ (8) Applicability of "difficult sites" evaluation procedures established (mandatory if post-assessment cleanup cost will likely exceed $500,000 or cleanup time will exceed 4 years). Some elements of the "difficult sites" evaluation procedures may be applicable to sites with cleanups, which will not exceed $500,000, or a 4 year cleanup time. If applicability established, FDEP PE must complete difficult sites checklist attached to May 21, 2003 Difficult Sites memorandum.

_____ (9) RAP must include a Construction Plan and a construction schedule.

_____ (10) RAP must include a Startup Test Plan, and startup testing must be conducted in accordance with manufacturer's recommendations.

_____ (11) RAP must include a Preventative and Routine Maintenance Plan and checklist, a Repair Response Plan and maintenance visit schedule. The repair response plan must address sytem monitoring, equipmant operation and replacement part availability and supply.

_____ (12) RAP must indicate that equipment will be UL approved (or equivalent) and will have a warranty

_____ (13) Hour meters, flow meters, pressure gauges, and vacuum gauges specified for all critical components, including individual wells if necessary for optimization of system efficiency

_____ (14) Autodialer system specified (telemetry may be specified with justification)

_____ (16) Equipment items must be protected (covered or housed in a trailer).

_____ (17) Specifications, and an Operations Manual must be provided to FDEP/LP, and a copy must be kept at the site.

_____ (18) RAP specifies that Startup, Quarterlyand Annual Reports will be provided, and must include the information detailed in the RAI.

FAC ID No:_____

III. FREE PRODUCT REMOVAL

_____ (1) free product plume identification

_____ (2) description/design details of free product recovery system including:

♦ oil/water separator sizing calculations and detention time ♦ free product storage tank of adequate size

__NA__ (3) automated product pump shutdown for high level in product tank

__NA__ (4) safety considerations: ♦ static electricity ♦ electrical & instruments per National Electrical Code

_____ (5) proper disposal and safe handling of flammable free product recovered

IV. SOIL REMEDIATION - GENERAL

__NA__ (1) volume of contaminated soil

_____ (2) recap of Source Removal activities and soil volume already excavated, if any

_____ (3) indication that contaminated soil will be remediated, or provide rationale for 'no action'

(4) soil cleanup target levels identified, extent of soil contamination should be delineated by use of both OVA screening results and laboratory analysis results

(5) Use of Level I Risk Management Options for soil considered, if applicable, including SPLP, TRPH fractionation, and calculation of site specific SCTLs based on soil properties

_____ (6) proper handling & treatment of excavated, contaminated soil, or proper handling & disposal of hazardous soil (e.g., ignitable, corrosive, reactive, toxic, or petroleum refining waste)

V. LAND FARMING OF SOIL

__NA__ (1) adequate surface area available (_____ sq ft) to spread soil 6 to 12 inches thick

_____ (2) location of land farming operation

_____ (3) land farming area is flat (less than 5% slope)

_____ (4) impermeable base provided. Type: _____

_____ (5) surface water runoff controls provided

_____ (6) groundwater monitoring plan proposed if land farm is outside of immediate contamination area

_____ (7) frequency of tilling provided

_____ (8) frequency and details of nutrient application or other enhancements provided (if proposed)

_____ (9) soil sampling frequency and sampling methods provided

_____ (10) potential for land farm causing nuisance conditions evaluated

(11) underlying soil and groundwater monitoring procedures provided and acceptable

_____ (12) land farming will be continued until the contaminants of concern meet soil cleanup target levels

_____ (13) cost-effectiveness

_____ (14) ultimate disposition of soil discussed

_____ (15) need to fence land farm area considered

VI. LANDFILLING OF SOIL

__No__ (1) landfill lined and permitted by FDEP

Disposal of soil to be

FAC ID No:_____

__No__ (2) name and location of landfill provided along with conditions of acceptance selcted by RAC

_____ (3) cost-effectiveness

_____ (4) For out-of-state landfill disposal, evidence provided that petroleum contaminated soil disposal in the landfill complies with the landfill regulations of the other state.

VII. SOIL THERMAL TREATMENT

__NA__ (1) name and location of thermal treatment facility provided

_____ (2) facility is permitted for thermal treatment of petroleum contaminated soil

_____ (3) pretreatment soil sample analyses

_____ (4) cost-effectiveness

VIII. COMMERCIAL BIOREMEDIATION OF SOIL

__NA__ (1) name and location of bioremediation facility provided

_____ (2) facility is permitted for bioremediation of petroleum contaminated soil

_____ (3) pretreatment soil sample analyses

_____ (4) cost-effectiveness

IX. IN SITU BIOVENTING OF SOIL

__NA__ (1) soil cleanup criteria identification

_____ (2) estimated mass of contaminants of concern in the vadose zone

_____ (3) recap of information and data from pilot study that is pertinent full-scale system design

_____ (4) layout

- well type — vertical or horizontal
- well construction details
- location of air injection and air extraction wells with respect to contaminated soil plume location and depth
- location and depth of soil gas monitoring probes with respect to contaminated soil plume and the air injection and extraction wells

_____ (5) design and operating parameters, equipment sizing calculations, mechanical details

_____ (6) instruments, controls, gauges, and valves

_____ (7) monitoring plan: CO_2; pertinent bioremediation parameters; contaminants of concern

_____ (8) air emissions

- demonstration that primary mechanism of remediation will be bioremediation and not volatilization. Air flow rates will be limited based on oxygen demand for bioremediation as demonstrated by pilot study results
- evaluation of methods for off-gas treatment if pilot test indicated that a significant amount of hydrocarbon volatilization will occur

X. SOIL VAPOR EXTRACTION

__NA__ (1) prerequisites: ♦ relatively permeable soil ♦ depth to groundwater > 3 ft ♦ relatively volatile contaminants

_____ (2) recap of information and data from pilot study that is pertinent to full-scale system design:

FAC ID No:_____

(3) full-scale design

NA (a) layout and spacing of SVE wells (consideration given to radius of influence and overlapping of radii)

_____ (b) vapor extraction well(s)

- ♦ no. of wells ♦ cfm each well ♦ total cfm ♦ well type (vertical or horizontal) ♦ well construction details

_____ (c) pneumatic design

- ♦ operating vacuum @ wellhead(s) (inches of water)
- ♦ piping system friction losses
- ♦ pump motor (hp) based on system losses plus required vacuum at wellhead

_____ (d) vacuum source type: regenerative blower; positive displacement vacuum pump; other

- ♦ design specifications: cfm @ inches of water; operating cfm @ inches of water
- ♦ mfr; model; motor hp; rpm; performance curves
- ♦ nonferrous materials of construction and/or assembly to minimize potential for sparking and friction
- ♦ explosion-proof motor

_____ (e) moisture separator/condensation trap ("knock out pot") prior to inlet of vacuum pump

_____ (f) surface sealing provided for vacuum extraction, or existing concrete or asphalt adequate

_____ (g) safety

- ♦ system operation at approximately 25% of Lower Explosive Limit (LEL)
- ♦ bleed valve provided to control flammable vapor concentrations

_____ (h) instrumentation, gauges, and appurtenances

_____ (i) air emissions control (general)

- ♦ method of off-gas treatment to be provided during first month of system operation (provide details in Section X or XI for carbon adsorption or thermal oxidation of off-gas, or provide details of an alternative method)

_____ (j) system monitoring

- ♦ sample and analyze air emissions for total petroleum hydrocarbons, weekly for first month, monthly for next two months, quarterly thereafter
- ♦ vacuum measurement locations (suggestion: use monitor wells at various radial distances from extraction wells)
- ♦ acknowledge that air emission controls must be provided for at least first 30 days, but may have to be continued longer until petroleum hydrocarbon emissions to the atmosphere are less than 13.7 lbs/day

XI. VAPOR-PHASE CARBON ADSORPTION (for control of air emissions)

NA (1) recap of information and data from pilot study that is pertinent to full-scale system design, if a pilot was conducted

_____ (2) cost-effectiveness evaluation in comparison to other alternatives for control of air emissions

_____ (3) mechanical details, sizing calculations, and operating parameters

_____ (4) instrumentation, controls, gauges, sampling and valves

_____ (5) safety

- ♦ operation of system below Lower Explosive Limit (LEL) for type of vapors being handled

FAC ID No:_____

- observance of appropriate requirements in Series 500 articles of the National Electrical Code — equipment shall meet either Class I, Group D, Division 1 or Class I, Group D, Division 2 hazardous area requirements, whichever is applicable, when an equipment item is located in a hazardous area as defined by the code

XII. THERMAL/CATALYTIC OXIDATION (for control of air emissions)

__NA__ (1) cost-effectiveness evaluation in comparison to other alternatives for control of air emissions

_____ (2) mechanical details, equipment sizing calculations, and operating parameters

_____ (3) instrumentation, controls, gauges, and valves. [schematic or mobile unit manufacturer's drawings indicating instrumentation, controls, gauges, and valves for all process streams (contaminant-laden influent, fuel gas, and combustion air)]

_____ (4) safety considerations include, but are not limited to:

- bleed valve or dilution control valve to maintain influent flammable vapor concentration at 25% of the Lower Explosive Limit (LEL)
- air purge prior to re-ignition
- observance of appropriate requirements in Series 500 articles of the National Electrical Code — equipment shall meet either Class I, Group D, Division 1 or Class I, Group D, Division 2 hazardous area requirements, whichever is applicable, when located in a hazardous area as defined by the code
- use of thermal or catalytic oxidizers which meet appropriate fire codes for handling natural or propane gas and prevention of furnace explosions — National Fire Protection Association, Industrial Risk Insurer's, Factory Mutual, etc. Some of the most important safety shutdowns for gas-fired burners occur upon: high gas pressure; low gas pressure; loss of combustion supply air; loss or failure to establish flame; loss of control system actuating energy; power failure

XIII. GROUNDWATER EXTRACTION

__NA__ (1) feasibility of using existing on-site wells for groundwater extraction considered

_____ (2) recovery well summary

- recovery well or trench location(s) and construction details included (diameter, screen length, grout, etc.)
- recovery well depth and screen length appropriate for depth of contamination

_____ (3) predicted horizontal and vertical area of influence provided

_____ (4) expected drawdown in recovery well or trench

_____ (5) consideration of multiple well configuration to minimize drawdown

_____ (6) groundwater pump performance requirements, sizing, and description

- hydraulic design considerations (friction losses and suction lift)
- pump performance curve or information provided (flow rate vs. pressure)
- pump manufacturer, model; hp, rpm

_____ (7) automated well level controls provided for stopping/starting groundwater pump(s)

_____ (8) totalizing flowmeter installed on influent line from each groundwater recovery pump

FAC ID No:_____

_____ (9) check valve provided on pump discharge piping if not integral to pump

_____ (10) shutoff/throttling valve provided on pump discharge piping

XIV. GROUNDWATER TREATMENT SYSTEM - GENERAL

__NA__ (1) influent concentrations for each contaminant of concern, for design of treatment system, based on either actual dynamic pump test sample, weighted averaging procedure, or other reasonable assumption

_____ (2) feasibility & cost-effectiveness of direct discharge of recovered contaminated groundwater to sewer treatment plant, instead of onsite treatment

_____ (3) site piping summary

- schematics of all treatment components, piping, valves, controls and appurtenances provided
- influent and effluent sampling ports provided
- piping type and size provided

_____ (4) fouling & scaling considerations

- whether control of iron fouling is necessary, either by filtration of influent to remove particulately-bound iron, and/or by removal or sequestering of dissolved iron to prevent precipitation in process equipment items
- whether pretreatment or other measures necessary to prevent precipitation of calcium carbonate (Langelier Index)
- whether pretreatment or scheduled O&M measures will be needed for control of biofouling

XV. AIR STRIPPING TREATMENT PROCESS

__NA__ (1) packed tower

- type, size, and surface area of packing
- design and operating parameters, sizing calculations, mechanical details (tower height; packing type, height, surface area; air/water ratio; pressure drop; blower type, model, hp; mist eliminator; etc.)

_____ (2) diffused aerator (tank type)

- design and operating parameters, sizing calculations, mechanical details (tank volume; contact time; air flow rate; pressure drop; removal efficiency of contaminants of concern; blower type, model, hp; etc.)

_____ (3) low profile air stripper

- design and operating parameters, sizing calculations, mechanical details (number of trays; water flow rate; air flow rate; air/water ratio; pressure drop; blower type, model, hp; mist eliminator)

_____ (4) general

- instrumentation, controls, gauges and valves
- air emissions calculations; emissions stack height
- equipment description if emissions treatment necessary
- automated recovery well shutdown when blower failure occurs
- sampling of effluent, daily for first three days, monthly for next two months, quarterly thereafter

XVI. LIQUID-PHASE CARBON ADSORPTION

__NA__ (1) recap of information and data from pilot study that is pertinent to full-scale system design, if a pilot was conducted

FAC ID No:_____

_____ (2) indication whether adsorption is for primary treatment of groundwater or polishing of effluent

__NA__ (3) carbon specifications

_____ (4) carbon unit(s) sizing calculations (carbon usage rate, contact time, pressure losses) design assumptions

_____ (5) TOC in groundwater determined and effect on carbon usage considered

_____ (6) need for sand filter or cartridge unit prior to carbon unit considered

_____ (7) pressure gauge and pressure relief valve provided on carbon (and sand) filter

_____ (8) carbon disposal and replacement method

_____ (9) series configuration of carbon units considered to allow for maximum carbon utilization and prevention of contaminant breakthrough to system effluent

_____ (10) automated recovery well shutdown if primary carbon unit pressure too high

_____ (11) schedule for sampling between and after carbon adsorption units

XVII. IN SITU AIR SPARGING OF GROUNDWATER

__NA__ (1) prerequisites

- no or little free product which could spread via sparge turbulence, or prolong sparging
- volatile (C_3-C_{10}) petroleum fractions with Henry's Constant ≥ 0.00001 atm$*$m^3/mol (approx. rule of thumb, unless biosparging is proposed)
- no high concentrations of metals (iron, magnesium) to form oxides which plug aquifer or well screens, or high concentrations of dissolved calcium, which could react with CO_2 in air to clog aquifer w/calcium carbonate

_____ (2) recap of information and data from pilot study that is pertinent to full-scale system design

(3) full-scale design

_____ (a) groundwater contamination plume coverage

- location(s) and radius of influence for full-scale air injection well(s)
- adequate coverage by overlapping radii of influence if multiple well system

_____ (b) air injection well(s): no. of wells; well design; operating air pressure at wellheads; cfm each well; total cfm

_____

_____ (c) avoidance of long screen allowing air to diffuse at top portion only, where air flow resistance is least (typ screen is 1 to 3 ft long)

_____ (d) well depth and screened interval (or depth of sparge tip) appropriate w/respect to depth of contamination

_____ (e) vapor extraction well(s) in conjunction w/sparging situated properly to recover volatiles and prevent their release to atmosphere

- injection cfm of air typically 20 to 80% of vapor extraction cfm (0.2 to 0.8)
- automatic shutdown of air injection upon loss of, or low, vapor extraction system vacuum, or failure of vacuum pump motor, in order to prevent air emissions
- adequate and cost-effective treatment of vapor extraction system off-gas proposed to prevent air emissions

_____ (f) compressor

- design: cfm @ psig; operating cfm @ psig

FAC ID No:_____

- type; mfr; model; motor hp; rpm; performance curves; air filter at compressor inlet; oil trap or oil-free compressor to avoid introducing more contamination to aquifer

_____ (g) safety: pressure relief valve at discharge of compressor and/or high pressure switch for automatic shutdown

_____ (h) instrumentation and gauges: pressure indicating gauges at each sparging well

_____ (i) air flow control: shutoff/throttling valve at each well; other flow control device or method

XVIII. IN SITU BIOREMEDIATION

NA (1) general:

- media to be remediated: groundwater; soil
- application method: direct-injection; recirculating/re-injection type system; addition to excavation pit
- aerobic or anaerobic
- stimulation of indigenous microorganisms or addition of microorganisms

_____ (2) recap of information and data from pilot study that is pertinent to full-scale system design

_____ (3) design and operating parameters (e.g.: injection well construction details; layout and spacing of wells commensurate with injection radius of influence for adequate horizontal coverage; screened interval of injection wells commensurate with vertical extent of contamination for adequate vertical coverage; injection pump develops adequate pressure and flow rate for injection , for the site-specific conditions.)

_____ (4) dosage (of nutrients and/or microorganisms, per pound of hydrocarbon contaminants to be biodegraded) (Some bioremediation products may express dosage as a required amount per cubic yard of contaminated media.)

_____ (5) RAP (or RAP Mod) must contain the necessary underground injection control information required by Chapter 62-528 FAC. [That is, the RAP must contain enough information for a state or local program reviewer to fill out the 2-page UIC notification memorandum titled "Proposed Injection Well(s) for In Situ Aquifer Remediation at a Petroleum Remedial Action Site".] This includes the following information:

- chemical analysis (composition) of the fluid to be injected. Note: The injected fluid must meet primary and secondary drinking water standards of Chapter 62-550, FAC, and the minimum groundwater criteria of Chapters 62-520 and 62-777 FAC, otherwise Rule 62-522.300(2)(c) may apply and/or a zone of discharge variance may be necessary.
- no. of injection wells
- no. of injection events
- injection volume per well per injection event
- total injection volume (i.e. the total for all injection wells, all injection events)

_____ (7) anticipated schedule of injection events for nutrients and/or microorganisms (i.e. the timing and frequency of injections over the life of the project)

_____ (7) provide additional oxygen, if necessary, if the bioremediation is aerobic and site's groundwater is lacking in dissolved oxygen. (method by which additional oxygen will be delivered.; provide design details if method of delivery is mechanical, e.g. air sparge, O_2 injection, iSOC, etc.; provide chemical information if oxygen is supplied chemically: e.g. magnesium peroxide, calcium peroxide, hydrogen peroxide, etc.)

_____ (9) ♦ sampling plan includes not just the analysis of samples for petroleum contaminants of concern at a site, but also analyses necessary for any of the following that apply: compliance with the underground injection control

FAC ID No:_____

regulations of Chapter 62-528; compliance with Rule 62-522.300(2)(c); and compliance with the terms of an injection zone of discharge variance. Also, analysis for more than just the reagents may be necessary, depending on the situation. In some cases, if there are environmental or toxicological concerns, it may be necessary to include analysis for intermediate degradation products of the reagents, or intermediate by-products formed by the interaction of those reagents with the petroleum contaminants of concern at a site.

- other samples and operating parameter measurements for a bioremediation project may inlcude, but are not necessarily limited to the following: pH, DO, ORP, N, P, Temperature, TOC, Alkalinity., microbe counts

XIX. LEAD (this section can also be adapted to other heavy metals if necessary)

__NA__ (1) discussion of area(s) where groundwater lead concentration exceeds 15 ppb

_____ (2) lead concentrations (ppb): unfiltered (____); filtered (____); background (____)

_____ (3) proposal for lead removal by filtration if unfiltered sample is greater than 15 ppb and filtered sample is less than 15 ppb

_____ (4) method of lead removal, including pertinent design calculations

_____ (5) if lead (or other heavy metals) will not be removed by filtration, then provide details of proposed treatment

XX. INFILTRATION GALLERY

__NA__ (1) recap of field percolation test results (preferably with double-ring infiltrometer)

_____ (2) infiltration gallery construction details and location (upgradient location if site layout allows)

_____ (3) gallery calculations/assumptions with mounding analysis

_____ (4) piezometer and cleanout pipe in gallery

_____ (5) geotextile filter fabric to be installed around and above gallery

_____ (6) discussion or modeling of gallery for effect on plume migration

XXI. INJECTION WELL (for effluent disposal)

__NA__ (1) discussion of injection zone and relevant lithology information

_____ (2) recap of information and data from pilot study that is pertinent to full-scale system design, if a pilot was conducted

_____ (3) injection well location and construction details

_____ (4) screened interval appropriate

_____ (5) effluent discharge pump adequately sized for required injection flow rate and pressure

_____ (6) carbon polishing unit (or equivalent)

_____ (6) air release valve at highest point of effluent discharge piping

_____ (7) injection rate (well hydraulics) calculations

_____ (8) Underground Injection Control (UIC) inventory information provided. (RAP or RAP Mod must contain enough information for a technical reviewer to complete the 2-page UIC effluent injection notification.)

_____ (9) evaluation of injection well's effect on potable wells and plume migration

FAC ID No:_____

XXII. ALTERNATIVE EFFLUENT DISPOSAL METHODS

__NA__ (1) cost-effectiveness comparison of alternatives (including general permit fee of $2,500 per year in the cost estimate for NPDES disposal, if it is one of the alternatives being compared)

_____ (2) for surface water discharge

- conditions for NPDES general permit met
- indication that notice of intent for NPDES permit will be submitted after RAP approval

_____ (3) if applicable, consumptive use permit obtained from Water Management District

_____ (4) approval from municipality for sewer discharge, and conditions and effluent standards to be met

_____ (5) applicable permits for stormwater discharge

XXIII. SAMPLING REQUIREMENTS

_____ (1) designated / key monitoring wells and frequency of their sampling per 62-770.700, FAC

_____ (2) analysis of designated / key monitoring well samples for appropriate contaminants of concern for the site

__NA__ (3) sampling of influent from recovery well(s); daily first 3 days, monthly next 2 months, quarterly thereafter

__NA__ (4) sampling of system effluent, daily for first three days, monthly for next two months, quarterly thereafter

_____ (5) water level data collected at same time & frequency of monitoring well and recovery well sampling

XXIV. IN SITU CHEMICAL OXIDATION

__NA__ (1) media to be remediated: groundwater; soil

_____ (2) recap of information and data from pilot study that is pertinent to full-scale system design

_____ (3) design and operating parameters (e.g.: injection well construction details; layout and spacing of wells commensurate with injection radius of influence for adequate horizontal coverage; screened interval of injection wells commensurate with vertical extent of contamination for adequate vertical coverage; flow rates; temperatures; pressures; pH; concentrations, etc.)

_____ (4) amount of reagents required per pound of hydrocarbons to be destroyed (theoretical amount, actual amount)

_____ (5) RAP (or RAP Mod) must contain the necessary underground injection control information required by Chapter 62-528 FAC. [That is, the RAP must contain enough information for a state or local program reviewer to fill out the 2-page UIC notification memorandum titled "Proposed Injection Well(s) for In Situ Aquifer Remediation at a Petroleum Remedial Action Site".] This includes the following information:

- chemical analysis (composition) of the fluid to be injected. Note: The injected fluid must meet primary and secondary drinking water standards of Chapter 62-550, FAC, and the minimum groundwater criteria of Chapters 62-520 and 62-777 FAC, otherwise Rule 62-522.300(2)(c) may apply and/or a zone of discharge variance may be necessary.
- no. of injection wells
- no. of injection events
- injection volume per well per injection event
- total injection volume (i.e. the total for all injection wells, all injection events)

_____ (6)
- sampling plan includes not just the analysis of samples for petroleum contaminants of concern at a site, but also analyses necessary for any of the following that apply: compliance with the underground injection control

FAC ID No:_____

regulations of Chapter 62-528; compliance with Rule 62-522.300(2)(c); and compliance with the terms of an injection zone of discharge variance. Also, analysis for more than just the reagents may be necessary, depending on the situation. In some cases, if there are environmental or toxicological concerns, it may be necessary to include analysis for intermediate degradation products of the reagents, or intermediate by-products formed by the interaction of those reagents with the petroleum contaminants of concern at a site.

- other samples and operating parameter measurements for a chemical oxidation project may inlcude, but are not necessarily limited to the following: pH, DO, ORP, Temperature, and Alkalinity.

_____ (7) anticipated schedule of injection events for reagents (i.e. the timing and frequency of injections over the life of the project)

_____ (8) safety (items applicable to fire, explosion, toxicological and safe handling of chemicals may include, but are not necessarily limited to those listed below)

- material safety data sheets, toxicity, or other information pertinent to the chemicals and catalysts involved
- safe handling of chemicals: avoidance of mixing, premature mixing, or improper storage of incompatible chemicals
- Lower Explosive Level (LEL) considerations
- potential for vapor migration, either passively or by convection, or driven by air or other gases used, or generated by the heat of exothermic chemical reactions or the vaporization of free product by such heat
- the minimum tolerable distance between underground storage tanks and product piping and any in situ heat-generating process
- the need replace the flammable contents of petroleum storage tanks and their associated piping with non-flammable inerts such as nitrogen or carbon dioxide, in order to reduce risk of fire and explosion.
- observance of National Electrical Code (typically Series 500 articles for Class I, Group D, Division 1 or 2 hazardous area requirements) (for electrical equipment items located in a hazardous area)
- appropriate chemical-resistant and/or spark-resistant materials of construction for equipment items
- personal protection of workers
- safety considerations regarding neighbors and passersby