N60201.AR.000580
NS MAYPORT
5090.3a

REMEDIAL ACTION PLAN FOR UNDERGROUND STORAGE TANK SITE 1363 NS MAYPORT FL

10/1/2001

TETRA TECH NUS

Remedial Action Plan
for
Underground Storage Tank
Site 1363

Naval Station Mayport
Mayport, Florida

Southern Division
Naval Facilities Engineering Command
Contract Number N62467-94-D-0888
Contract Task Order 0176

October 2001

01JAX0122

REMEDIAL ACTION PLAN
FOR
UNDERGROUND STORAGE TANK SITE 1363

NAVAL STATION MAYPORT
MAYPORT, FLORIDA

CONPREHENSIVE LONG-TERM
ENVIRONMENTAL ACTION NAVY (CLEAN) CONTRACT

Submitted to:
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29406

Submitted by:
Tetra Tech NUS, Inc.
Foster Plaza 7
661 Andersen Drive
Pittsburgh, Pennsylvania 15220-2745

CONTRACT NUMBER N62467-94-D-0888
CONTRACT TASK ORDER 0176

OCTOBER 2001

PREPARED UNDER THE SUPERVISION OF:

MARK A. PETERSON, P.G.
TASK ORDER MANAGER
TETRA TECH NUS, INC.
JACKSONVILLE, FLORIDA

APPROVED FOR SUBMITTAL BY:

DEBBIE WROBLEWSKI
PROGRAM MANAGER
TETRA TECH NUS, INC.
PITTSBURGH, PENNSYLVANIA

The professional opinions rendered in this decision document identified as Remedial Action Plan for Underground Storage Tank Site 1363, Naval Station Mayport, Mayport, Florida were developed in accordance with commonly accepted procedures consistent with applicable standards of practice. Decision documents were prepared under the supervision of the signing engineer and are based on information obtained from others. If conditions are determined to exist differently than those described in this document, then the undersigned professional engineer should be notified to evaluate the effects of any additional information on the project described in this document.

Gregory S. Root, P.E.
Professional Engineering Number 50842
Tetra Tech NUS, Inc. Engineering No. 7988

TABLE OF CONTENTS

TABLES

FIGURES

ACRONYMS

AAHSTO	American Association of State Highway and Transportation Officials
ASTM	American Society for Testing and Materials
atm	atmospheres
BEA	Bhate Environmental Associates, Inc.
BTEX	Benzene, Toluene, Ethylbenzene, Xylenes
bls	Below Land Surface
CA	Contamination Assessment
CAR	Contamination Assessment Report
CARA	Contamination Assessment Report Addendum
CLEAN	Comprehensive Long-term Environmental Action Navy
cm	Centimeter
COCs	Chemicals of Concern
CTO	Contract Task Order
EDB	Ethylene Dibromide
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FL-PRO	Florida Petroleum Range Organics
ft	feet (foot)
ft^2	Square feet
ft^3	Cubic feet
GAG	Gasoline Analytical Group
GCTLs	Groundwater Cleanup Target Levels
KAG	Kerosene Analytical Group
lbs	Pounds
mg/kg	Milligrams per Kilogram
mg/L	Milligrams per Liter
msl	mean sea level
MTBE	Methyl-tertiary-butyl-ether
Navy	United States Navy
NA	Not available
ND	No constituents detected
NR	Not Recorded
NS	Naval Station
NS	Not Sampled

ACRONYMS (CONTINUED)

O&M	Operations and Maintenance
OSHA	Occupational Safety and Health Administration
OVA-FID	Organic Vapor Analyzer Flame Ionization Detector
PAH	Polynuclear Aromatic Hydrocarbon
PE	Professional Engineer
ppm	Parts per million
RAC	Remedial Action Contractor
RAP	Remedial Action Plan
scfm	standard cubic feet per minute
SCTL	Soil Cleanup Target Level
sec	seconds
SOUTHNAVFACENGCOM	Southern Division, Naval Facilities Engineering Command
SVE	Soil Vapor Extraction
TRPH	Total Recoverable Petroleum Hydrocarbons
TtNUS	Tetra Tech NUS, Inc.
µg/L	Micrograms per Liter
USEPA	United States Environmental Protection Agency
UST	Underground Storage Tank
VOC	Volatile Organic Compounds
yd^3	Cubic Yards

EXECUTIVE SUMMARY

Tetra Tech NUS, Inc. (TtNUS) has completed a Remedial Action Plan (RAP) for Underground Storage Tank (UST) Site 1363 at Naval Station (NS) Mayport in accordance with the requirements of Chapter 62-770, Florida Administrative Code (FAC). This plan is being submitted to the Florida Department of Environmental Protection (FDEP) for approval.

TtNUS performed the following tasks during the preparation of the RAP:

- Reviewed past remedial activities for relevant technologies from sites at NS Mayport.
- Used the information provided by the Contamination Assessment Report (CAR) [Bhate Environmental Associates, Inc. (BEA), 1997] and CAR Addendum (CARA) (BEA, 1999) approved by the FDEP on December 30, 1999.
- Evaluated remedial alternatives to clean up the soil contamination at Site 1363.
- Prepared a RAP to remediate the soil and provide remedial equipment specifications.
- Specified a monitoring plan to track the remediation status of the site.

This RAP identified excavation and off-site disposal as the selected remedial alternative to remediate the soil contamination at the site. This alternative was chosen to be a cost-effective method. This decision was based on the relatively short remediation time and total source removal at the lowest cost. One month after the excavation is complete, a round of groundwater monitoring well samples shall be collected and analyzed. The results from this sampling event shall be used to determine the status of groundwater beneath the site.

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This RAP was prepared by TtNUS for the United States Navy (Navy) Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM) under Contract Task Order (CTO) 0176, for the Comprehensive Long-term Environmental Action Navy (CLEAN) III, Contract Number N62467-94-D-0888. The RAP was prepared to recommend treatment options for the contaminated soil at UST Site 1363 at NS Mayport in Mayport, Florida. Figure 1-1 depicts the location of NS Mayport and Figure 1-2 shows the location of Building 1363 on NS Mayport.

Site 1363 was previously investigated on two occasions. BEA prepared a CAR in 1997 (BEA, 1997). In 1999, BEA prepared a CARA to address FDEP comments (BEA, 1999). The CARA further delineated contamination at the site and presented a more complete representation of site characteristics. Upon completion of the CARA, the FDEP requested the preparation of a RAP for Site 1363 in a letter dated December 30, 1999. A copy of the FDEP letter is located in Appendix A.

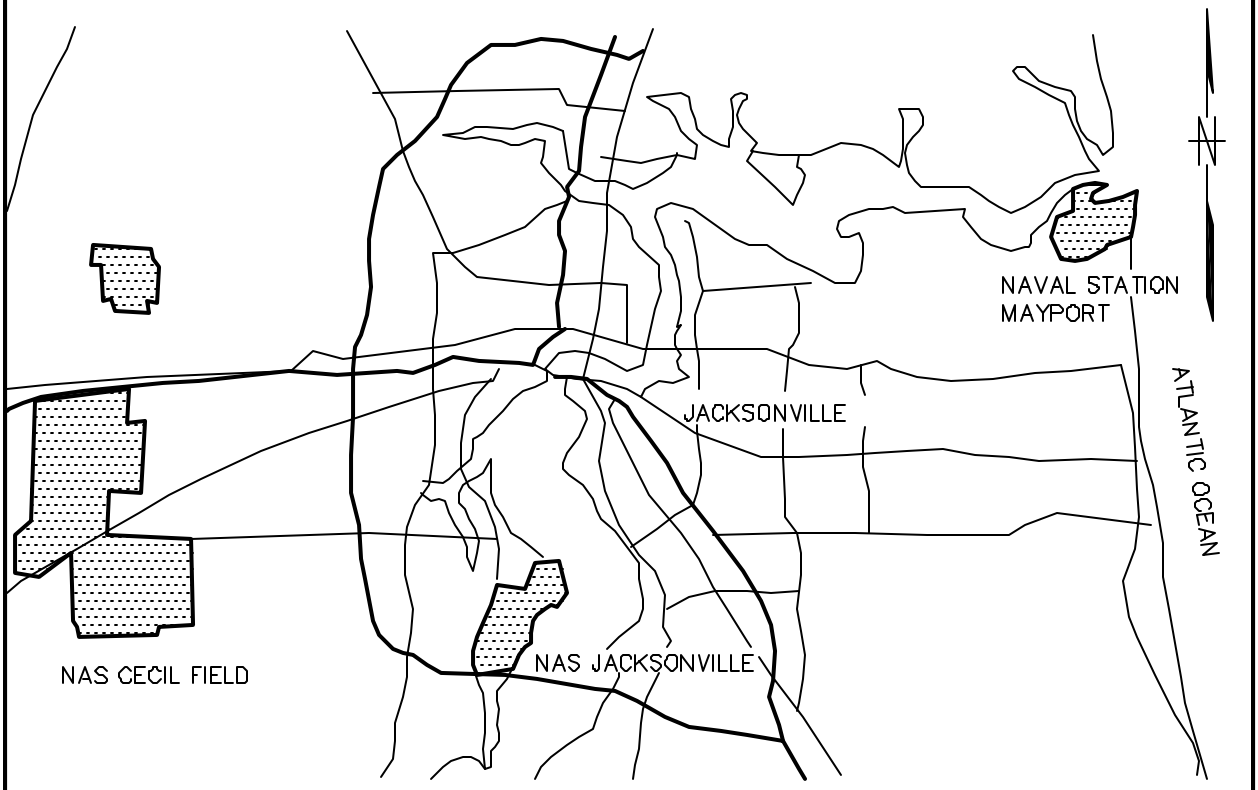
The purpose of the RAP is to determine an alternative to remediate the impacted soil in accordance with the requirements of Chapter 62-770, FAC in a cost effective and timely manner. This RAP addresses impacted soil for the area of concern by evaluating applicable alternatives that protect human health and the environment, reduce hydrocarbon constituent concentrations within impacted soil, and retard further migration of hydrocarbon constituents to downgradient areas. The RAP also provides a conceptual design for the selected remedial alternative.

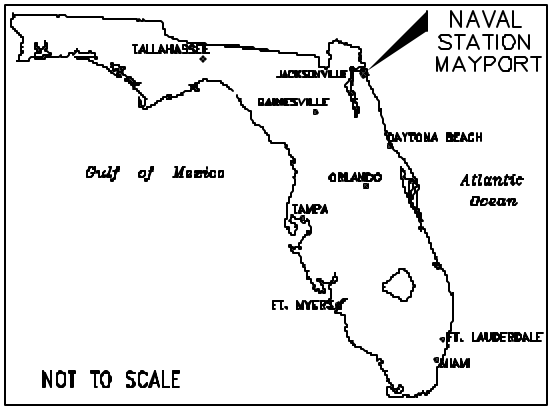
1.2 SITE DESCRIPTION

The site is located in the northeast area of NS Mayport (Figure 1-2). Two USTs were removed and replaced from a location approximately 80 feet (ft) south of Building 1363, the Medical Dispensary (Figure 1-3).

The ground surface at the site is relatively flat, but slopes slightly to the southwest. The ground surface in the immediate area of the USTs is not covered. Surface drainage is generally toward ditches to the south and east. A golf course is located immediately south of the USTs and is separated from the site by a drainage ditch. An asphalt access road and parking area are located between Building 1363 and the USTs.

F:\Projects\MayportNS\CAD\D199regional





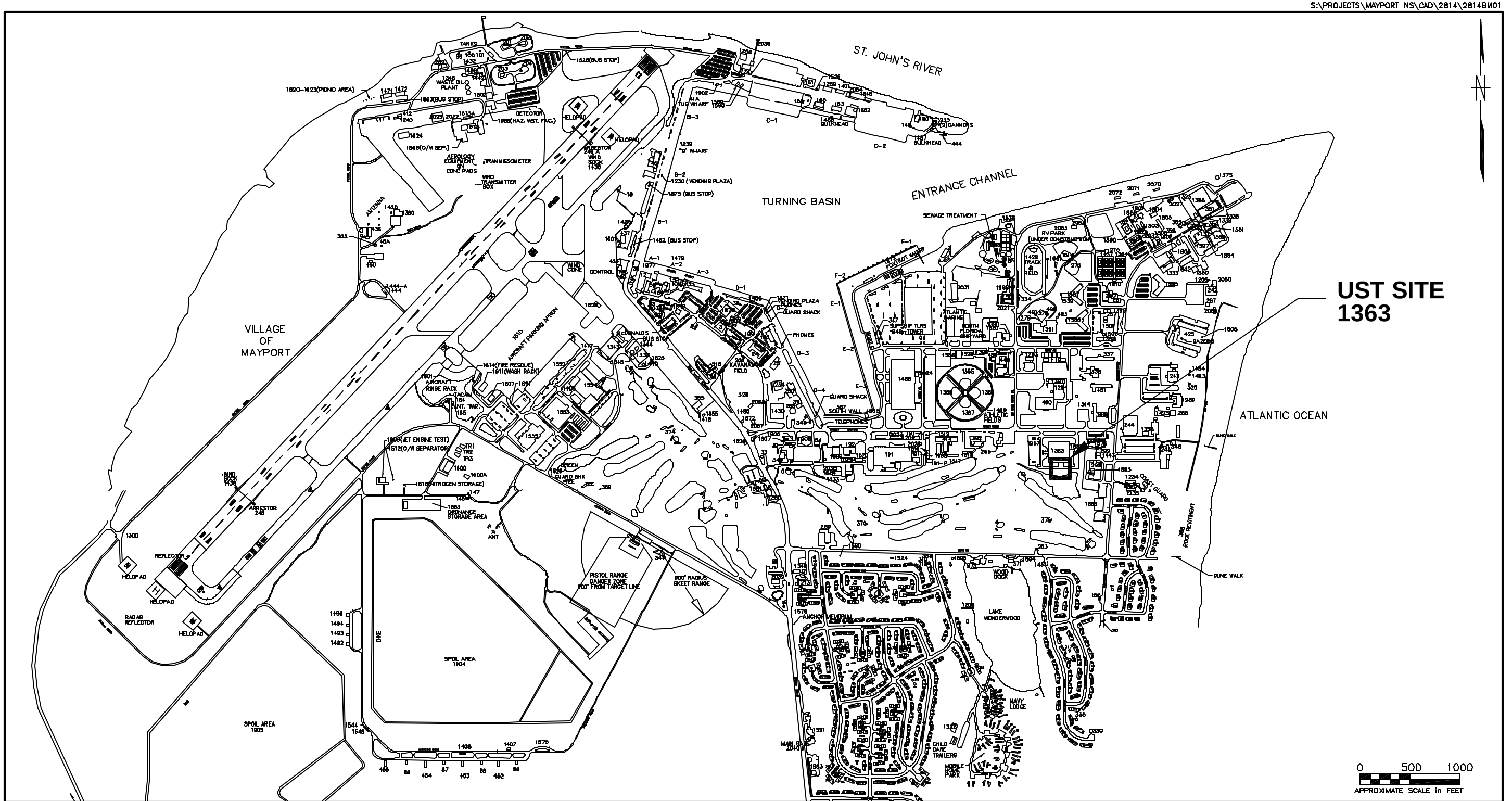
0 30000 60000

APPROXIMATE SCALE IN FEET

DRAWN BY HJP DATE 2/27/01		BASE LOCATION MAP U.S. NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 0199
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-1 / REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

S:\PROJECTS\MAYPORT NS\CAD\2814\2814BM01



NO.	DATE	REVISIONS	BY	CHKD	APPD	REFERENCES

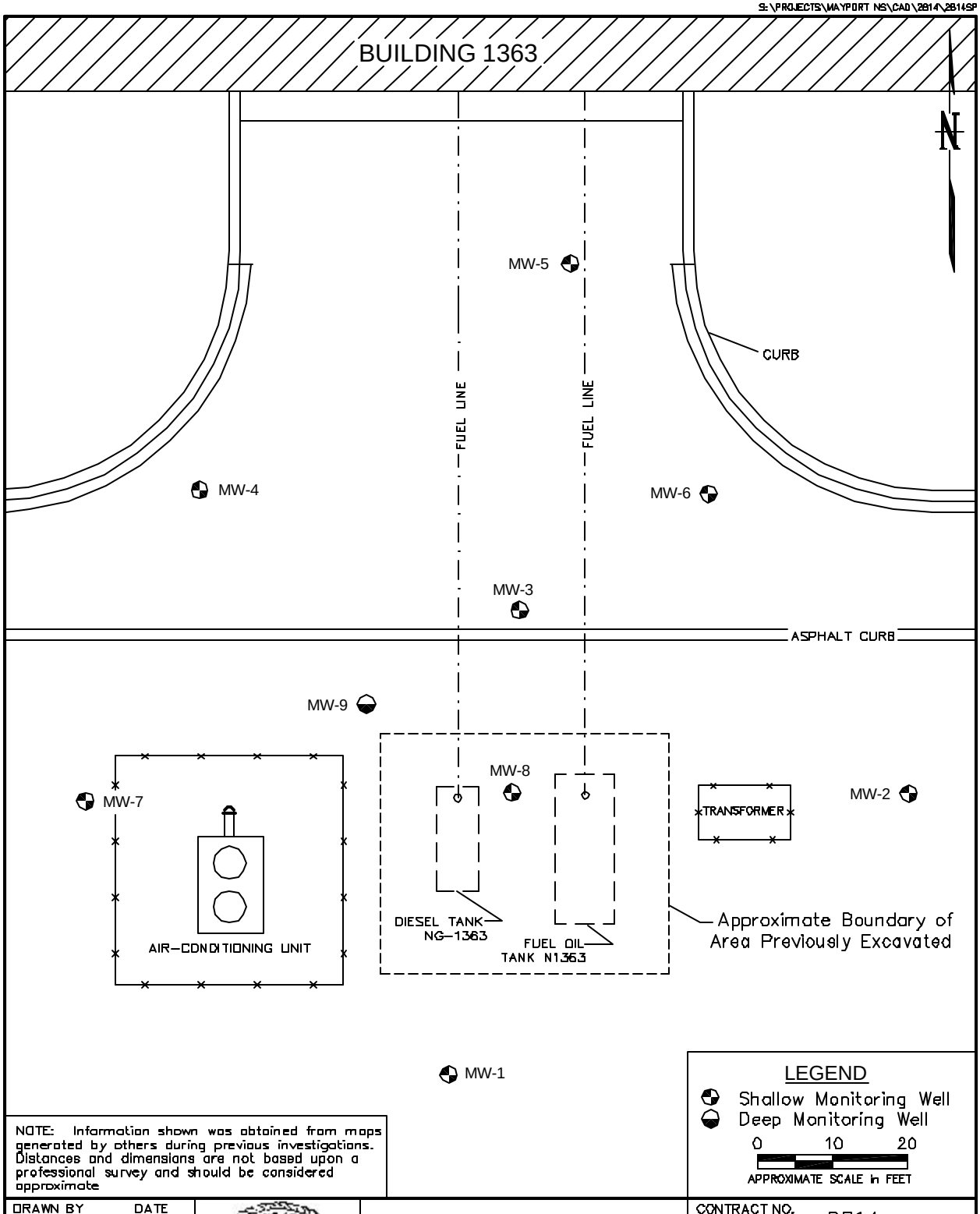
DRAWN BY LLK DATE 7/12/01
CHECKED BY DATE
COST/SCHED–AREA
SCALE AS NOTED

SITE VICINITY MAP
UST SITE 1363
NAVAL STATION MAYPORT
MAYPORT, FLORIDA

CONTRACT NO. 2814
APPROVED BY DATE
APPROVED BY DATE
DRAWING NO. FIGURE 1–2
REV. 0

FORM CADD NO. SOIV_BH.DWG – REV 0 – 1/20/98

S:\PROJECTS\MAYPORT NS\CAD\2814\2814SP



NOTE: Information shown was obtained from maps generated by others during previous investigations. Distances and dimensions are not based upon a professional survey and should be considered approximate

DRAWN BY LLK DATE 7/6/01		SITE PLAN SHOWING MONITORING WELL LOCATIONS UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 1-3 REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

1.3 SITE HISTORY

In April 1995, the 2,500-gallon Tank G-1363 and the 7,500-gallon Tank 1363 were removed in a single excavation effort. The fuel oil supply and return lines were also removed. Tank 1363 contained fuel oil and supplied a heating boiler at the Dispensary. Tank G-1363 contained diesel fuel and supplied an emergency generator. Heavily contaminated soils were encountered within the excavation area at the time of the tank removal. During the UST closures, a headspace analysis of the soils in the excavation area was conducted using an Organic Vapor Analyzer-Flame Ionization Detector (OVA-FID). Based on the results of the soil vapor screening, approximately 325 tons of "excessively contaminated" soils were removed during the tank excavation (BEA, 1999). Figure 1-3 depicts the limits of excavation. After the tanks were removed and the overexcavation was complete, two new USTs and associated piping were installed at the same location. They were designated Tank NG-1363 and Tank N1363, respectively.

As a result of the petroleum impacted soil discovered during the tank closures, a Contamination Assessment (CA) was conducted between May and July 1997. The CA field activities included the advancement of nine Geoprobe direct-push borings, a headspace gas survey to identify "excessively contaminated soil", and the installation of six-groundwater monitoring wells.

In response to the CAR, the FDEP requested that BEA complete a CA to further characterize the impact on soil and groundwater at the site. In June of 1998, as part of additional CA work, BEA installed three additional monitoring wells and advanced 21 soil borings. Upon completion of the CARA (BEA, 1999), the FDEP requested the preparation of a RAP to address soil contamination at the site. This document has been prepared as a result of FDEP's request.

1.4 REPORT ORGANIZATION

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

- Section 1.0: Introduction. Supplies the report's purpose, scope, site information, and report organization.

- Section 2.0: Previous Investigation Findings and Conclusions. Summarizes the CAR and CARA findings and conclusions.

- Section 3.0: Remedial Action Plan Goals. Sets the treatment objectives for the remedial system/plan.

- Section 4.0: Contaminant Distribution. Estimates the mass of contaminants in the soil.

- Section 5.0: Remedial Alternative Technology Screening. Presents the alternatives for remediation, determines the suitability for the site, and develops budgetary costs for each.

- Section 6.0: Remedial System Design. Presents all the assumptions made and provides the detailed design of the preferred remedial alternative.

- Section 7.0: Post Remedial Action Monitoring. Establishes start-up and Operations and Maintenance (O&M) procedures and provides a monitoring plan for the remediation system and sampling frequencies to evaluate the system's effectiveness.

- References. Lists all references used.

2.0 PREVIOUS INVESTIGATION FINDINGS AND CONCLUSIONS

Two site assessments were conducted at Site 1363 between 1997 and 1999. The CAR was submitted on September 30, 1997 and the CARA was submitted on September 9, 1999. The following is a summary of the data and information presented in these reports.

2.1 LITHOLOGIC FINDINGS

A layer of tan, loose, well-sorted, well-rounded fine sand containing varying amounts of shell fragments underlies the site. At approximately 5 ft below land surface (bls), the soil changes to a brown, loose, fine sand with shell fragments containing numerous organics and root material. This soil type extends to approximately 20 ft bls at which depth soil borings were terminated. No confining units were encountered during the soil investigation. Boring logs were provided in the CAR and CARA.

2.2 GROUNDWATER AND AQUIFER CHARACTERISTICS

Groundwater is encountered at approximately 4 bls. The groundwater gradient is relatively flat and prior determinations of groundwater flow have shown fluctuating flow directions ranging from the northwest to the southwest. The fluctuations in groundwater flow may be the result of tidal influences. Table 2-1 presents the groundwater elevation and monitoring well construction data. Figure 2-1 presents the groundwater potentiometric surface map from the CARA (BEA, 1999). The groundwater elevations used in this figure were collected on July 2, 1999.

The following aquifer parameters were calculated in the CAR (BEA, 1997).

Hydraulic conductivity	K	=	17.19 ft/day or 6.07×10^{-3} cm/sec
Hydraulic gradient	i	=	0.003 ft/ft
Effective porosity	n_e	=	0.30 (unitless)

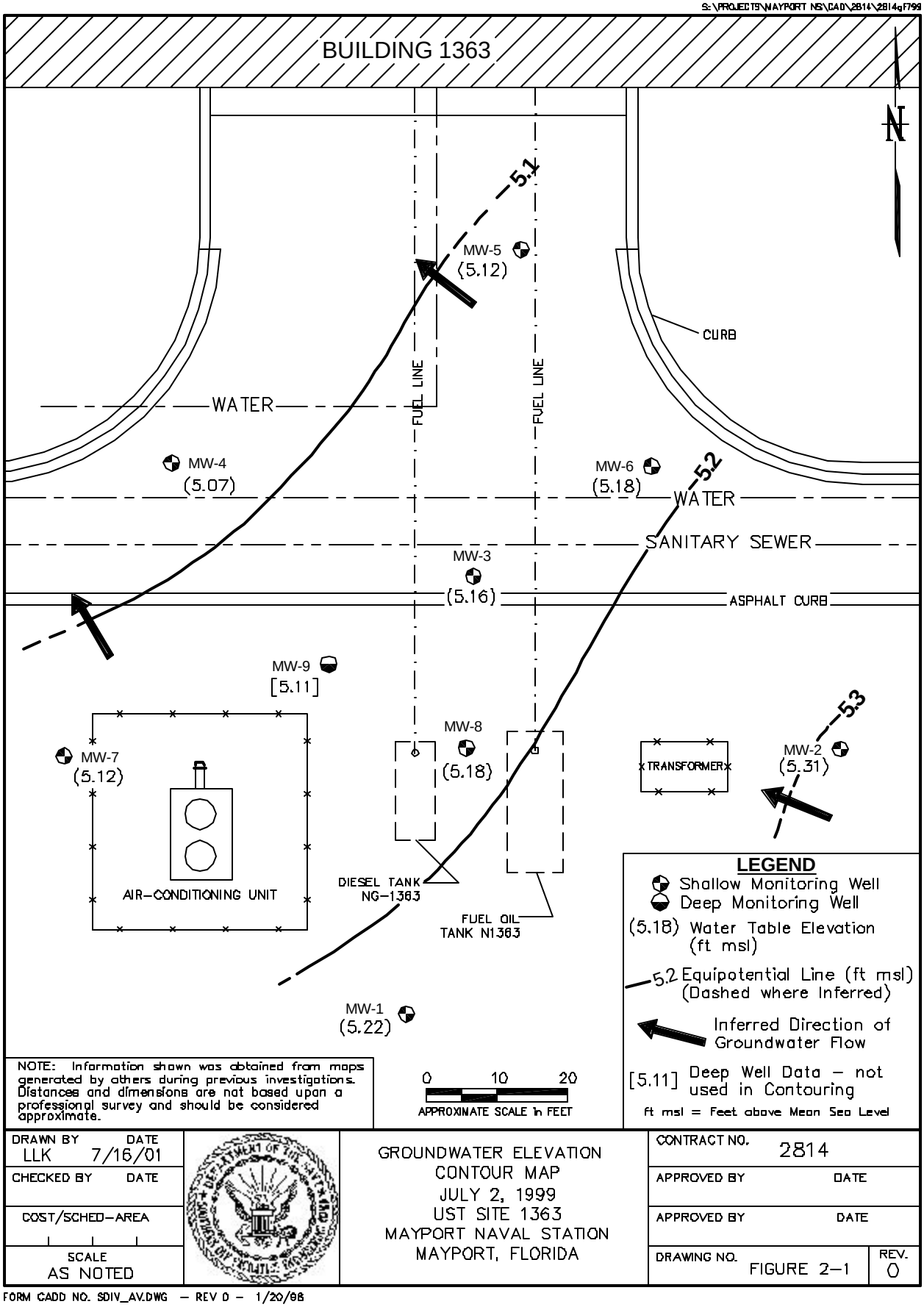
Table 2-1
Water Table Elevation and Monitoring Well Construction Data

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Monitoring Well ID	Screened Interval Depth (feet, bls)	Top-of Casing Elevation (ft)	9-Jun-97		16-Jul-97		30-Jun-98		2-Jul-99	
			Depth to Water Below Top of Casing (feet)	Water Elevation (msl)	Depth to Water Below Top of Casing (feet)	Water Elevation (msl)	Depth to Water Below Top of Casing (feet)	Water Elevation (msl)	Depth to Water Below Top of Casing (feet)	Water Elevation (msl)
MW-1	2.35-11.85	9.87	3.53	6.34	4	5.87	5.05	4.82	4.65	5.22
MW-2	3.27-13.48	10.09	3.58	6.51	4.21	5.88	5.06	5.03	4.78	5.31
MW-3	3.94-13.44	9.78	3.21	6.57	3.91	5.87	4.81	4.97	4.62	5.16
MW-4	3.5-13	9.86	3.41	6.45	4	5.86	4.93	4.93	4.79	5.07
MW-5	3.5-13	10.75	4.17	6.58	4.78	5.97	5.65	5.10	5.63	5.12
MW-6	3.6-13.1	9.81	3.26	6.55	3.96	5.85	4.72	5.09	4.63	5.18
MW-7	3.5-12.5	10.36	NA	NA	NA	NA	5.58	4.78	5.24	5.12
MW-8	4.5-13.5	11.26	NA	NA	NA	NA	6.37	4.89	6.08	5.18
MW-9	10.5-24.5	10.25	NA	NA	NA	NA	5.5	4.75	5.14	5.11

Notes:
NA=not available.
msl=mean sea level.

S:\PROJECTS\MAYPORT NS\CAD\2814\2814gF799



DRAWN BY LLK DATE 7/16/01		GROUNDWATER ELEVATION CONTOUR MAP JULY 2, 1999 UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED–AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2–1 REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

2.3 CONTAMINATED SOIL ASSESSMENT

The vertical and horizontal extent of petroleum impacted soil in the vadose zone was assessed through soil vapor analysis and analytical sampling performed during the soil boring investigation and monitoring well installations described in the CAR (BEA, 1997) and CARA (BEA, 1999). During the installation of the borings and monitoring wells, the soils were screened for petroleum vapors with an OVA-FID. In addition, eight confirmatory samples were collected and sent to a fixed-based laboratory for analysis of Total Recoverable Petroleum Hydrocarbons (TRPH) via Florida Petroleum Range Organic (FL-PRO) method during the CA. Three samples were collected and analyzed Kerosene Analytical Group (KAG) parameters during the additional CA reported in the CARA. Tables 2-2 and 2-3 summarize the results for the soil vapor measurements and the soil sampling analytical results as presented in the CAR. Tables 2-4 and 2-5 summarize the results for the soil vapor measurements and the soil sampling analytical results as presented in the CARA. The soil boring locations and laboratory analysis exceedances are shown on Figure 2-2. The results indicate that there are petroleum-impacted soils at the site exceeding FDEP Soil Cleanup Target Levels (SCTLs). Based on soil screening data and the fixed-based lab results, the contaminants appear to be present throughout the soil in the vadose zone. The soil contamination map for this RAP (Figure 2-3) has been drawn based on the OVA-FID results (Table 2-4) and the fixed-based lab results (Table 2-5).

2.4 CONTAMINATED GROUNDWATER ASSESSMENT

The vertical and horizontal extent of petroleum impacted groundwater was assessed via groundwater sampling and analysis performed after the monitoring well installations. Groundwater samples were collected from nine wells at the site and sent to a fixed-based laboratory for analysis. The groundwater analytical results from the CAR and CARA are summarized in Tables 2-6 and 2-7 respectively. The analytical results from the CAR indicated that groundwater samples from monitoring well MW-3 contained constituents with concentrations exceeding current FDEP groundwater standards for benzene, naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene. Analytical data from the CARA indicated similar results, except for benzene, which was below the listed Groundwater Cleanup Target Level (GCTL). In the CAR all nine wells were reported to exceed the GCTL for lead. However, of the five wells resampled in the second CA, none were reported to exceed the GCTL for lead. This has lead to the assumption that the initial results were caused by turbidity. All other analytes were below GCTLs as reported in the CARA. Figure 2-4 depicts groundwater analytical results at the site.

2.5 FREE PRODUCT

Free product was not detected at the site during the CAR and CARA investigations.

Table 2-2
Soil Head-Space Screening Summary

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Soil Boring No.	Date of Measurement	Sample Depth (feet bls)	Headspace Readings (ppm)		
			Total Organic Reading	Carbon Filtered Reading	Net Reading
S-1	5/5/1997	1-3	<1	NR	<1
S-2	5/5/1997	1-3	<1	NR	<1
S-3	5/5/1997	1-3	14	14	<1
S-4	5/5/1997	1-3	<1	NR	<1
S-5	5/5/1997	1-3	160	2	158
S-6	5/5/1997	1-3	<1	NR	<1
S-7	5/5/1997	1-3	<1	NR	<1
S-8	5/5/1997	1-3	<1	NR	<1

Source: CAR (BEA, 1997)
Notes: NR=not recorded.
bls=below land surface.
ppm=part per million equivalent methane.

Table 2-3
Confirmatory Soil Sampling Analytical Results

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Compound	DE1[1]/DE2[2]/LE[3] (mg/kg)	Boring Number							
		S-1	S-2	S-3	S-4	S-5	S-6	S-7	S-8
		5/5/1997	5/5/1997	5/5/1997	5/5/1997	5/5/1997	5/5/1997	5/5/1997	5/5/1997
Volatile Organic Compounds (USEPA Method 8060B(mg/kg)									
Benzene	1.1/1.6/0.007	**6.56**	ND	ND	ND	**16.2**	ND	ND	ND
Ethylbenzene	1100/8400/0.6	**7.47**	ND	ND	ND	**5.9**	ND	ND	ND
Toluene	380/2600/0.5	**40.1**	ND	ND	ND	**65.5**	ND	ND	ND
Total Xylenes	5900/40000/0.2	**88.1**	ND	ND	ND	**134.3**	ND	ND	ND
BTEX		142.2	ND	ND	ND	221.9	ND	ND	ND
FL-PRO (mg/kg)									
TRPH	340/2500/340	**6400**	ND	ND	81	**35000**	ND	ND	ND

Source: CAR (BEA, 1997)

[1]DE1=Direct Exposure limit for residential area from Chapter 62-777, FAC.

[2]DE2=Direct Exposure limit for industrial area from Chapter 62-777, FAC.

[3]LE=Leachability for groundwater limit from Chapter 62-777, FAC.

Notes: USEPA=United States Environmental Protection Agency.
BTEX=Total Benzene, Toluene, Ethylbenzene, and Xylenes.
mg/kg=milligrams per kilogram.
ND=no constituents detected.
TRPH=total recoverable petroleum hydrocarbons.

Table 2-4
Soil Head-Space Screening Summary

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Soil Boring No.	Date of Measurement	Sample Depth (feet bls)	Headspace Readings (ppm)		
			Total Organic Reading	Carbon Filtered Reading	Net Reading
SS-1	6/26/1998	1	20	150	20
		3	110	35	75
SS-2	6/26/1998	1	450	50	400
		3	1400	260	1140
SS-3	6/26/1998	1	380	100	280
		3	1000	260	740
SS-4	6/26/1998	1	100	80	20
		3	4	NR	4
SS-5	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-6	6/26/1998	1	30	0	30
		3	2	0	2
SS-7	6/26/1998	1	3	0	3
		3	7	0	7
SS-8	6/26/1998	1	0	NR	0
		3	880	52	828
SS-9	6/26/1998	1	0	NR	0
		3	630	120	510
SS-10	6/26/1998	1	4	NR	4
		3	580	1	579
SS-11	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-12	6/26/1998	1	0	NR	0
		3	1	NR	1
SS-13	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-14	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-15	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-16	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-17	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-18	6/26/1998	1	0	NR	0
		3	120	6	114
SS-19	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-20	6/26/1998	1	0	NR	0
		3	0	NR	0
SS-21	6/26/1998	1	0	NR	0
		3	0	NR	0
MW-7	6/26/1998	1	0	NR	0
		3	2	0	2
		4	200	250	---
MW-8	6/26/1998	1	0	NR	0
		3	0	NR	0
		4	800	850	---
MW-9	6/26/1998	1	0	NR	0
		3	300	1	299
		4	300	30	270

Source: CARA (BEA, 1999)
Notes: NR=not recorded.
bls=below land surface.
ppm=part per million equivalent methane.

Table 2-5
Confirmatory Soil Sampling Analytical Results

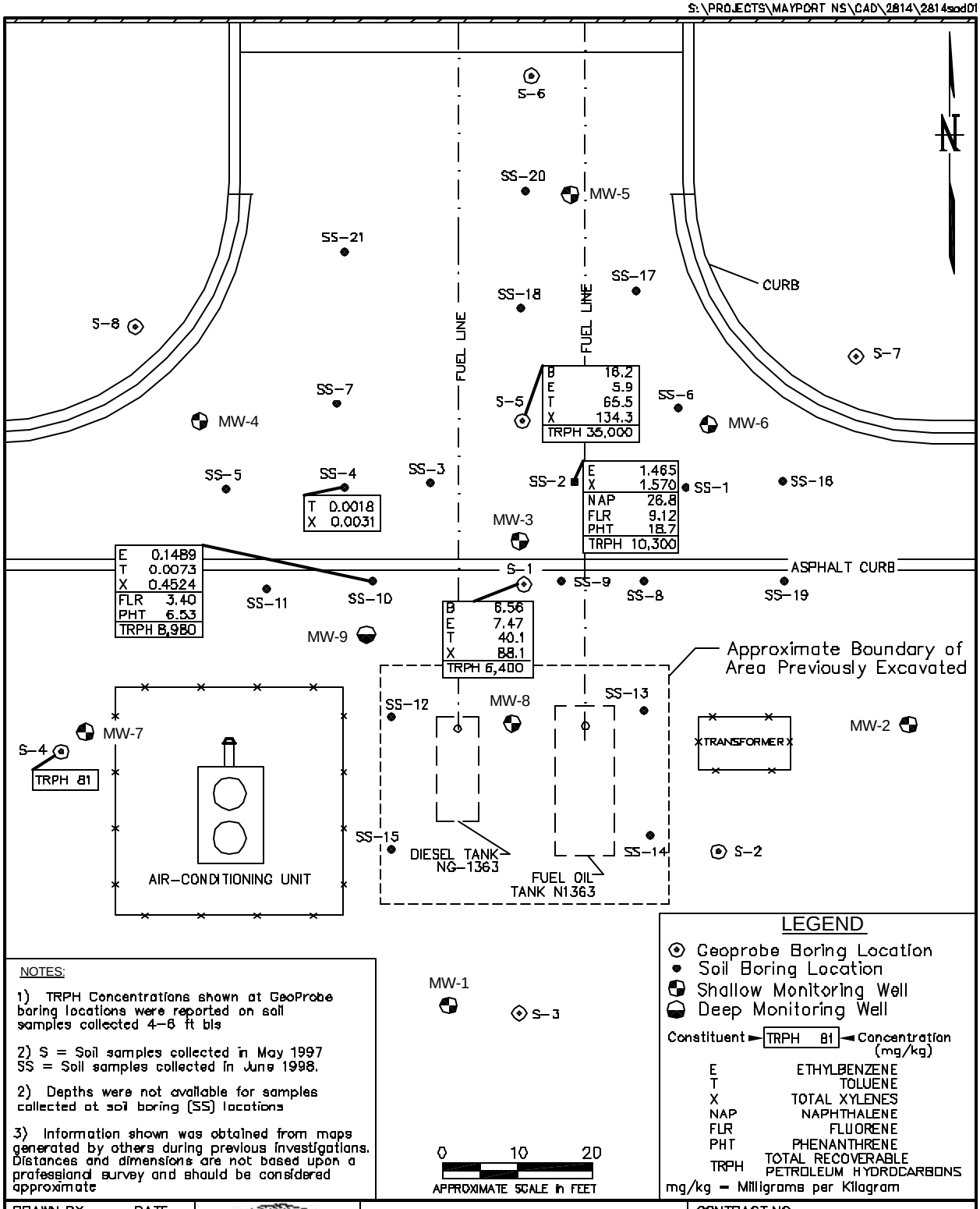
Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Compound	DE1[1]/DE2[2]/LE[3] (mg/kg)	Boring ID. 1363-SS-		
		2B	4B	10B
		6/26/1998	6/26/1998	6/26/1998
Volatile Organic Compounds (USEPA Method 8060B(mg/kg)				
Benzene	1.1/1.6/0.007	<.05	<.001	<.005
Ethylbenzene	1100/8400/0.6	**1.465**	<.001	0.1489
Toluene	380/2600/0.5	<0.0500	0.0018	0.0073
Total Xylenes	5900/40000/0.2	**1.57**	0.0031	**0.4524**
Polynuclear Aromatic Hydrocarbons (USEPA Method 8310)(mg/kg)				
Fluorene	2200/28000/17	9.12	<0.33	3.4
Naphthalene	40/270/1.7	**26.8**	<0.33	<3.33
Phenanthrene	2000/30000/250	18.7	<0.33	6.53
FL-PRO(mg/kg)				
TRPH	340/2500/340	**10300**	<10	**8980**

Source: CARA (BEA, 1999)
[1]DE1=Direct Exposure limit for residential area from Chapter 62-777, FAC.
[2]DE2=Direct Exposure limit for industrial area from Chapter 62-777, FAC.
[3]LE=Leachability for groundwater limit from Chapter 62-777, FAC.

Notes: ND = no constituents detected.

S:\PROJECTS\MAYPORT NS\CAD\2814\2814sod01



NOTES:

1) TRPH Concentrations shown at GeoProbe boring locations were reported on soil samples collected 4-6 ft bls

2) S = Soil samples collected in May 1997
SS = Soil samples collected in June 1998.

2) Depths were not available for samples collected at soil boring (SS) locations

3) Information shown was obtained from maps generated by others during previous investigations. Distances and dimensions are not based upon a professional survey and should be considered approximate

LEGEND

- Geoprobe Boring Location
- Soil Boring Location
- Shallow Monitoring Well
- Deep Monitoring Well

Constituent: TRPH 81 — Concentration (mg/kg)

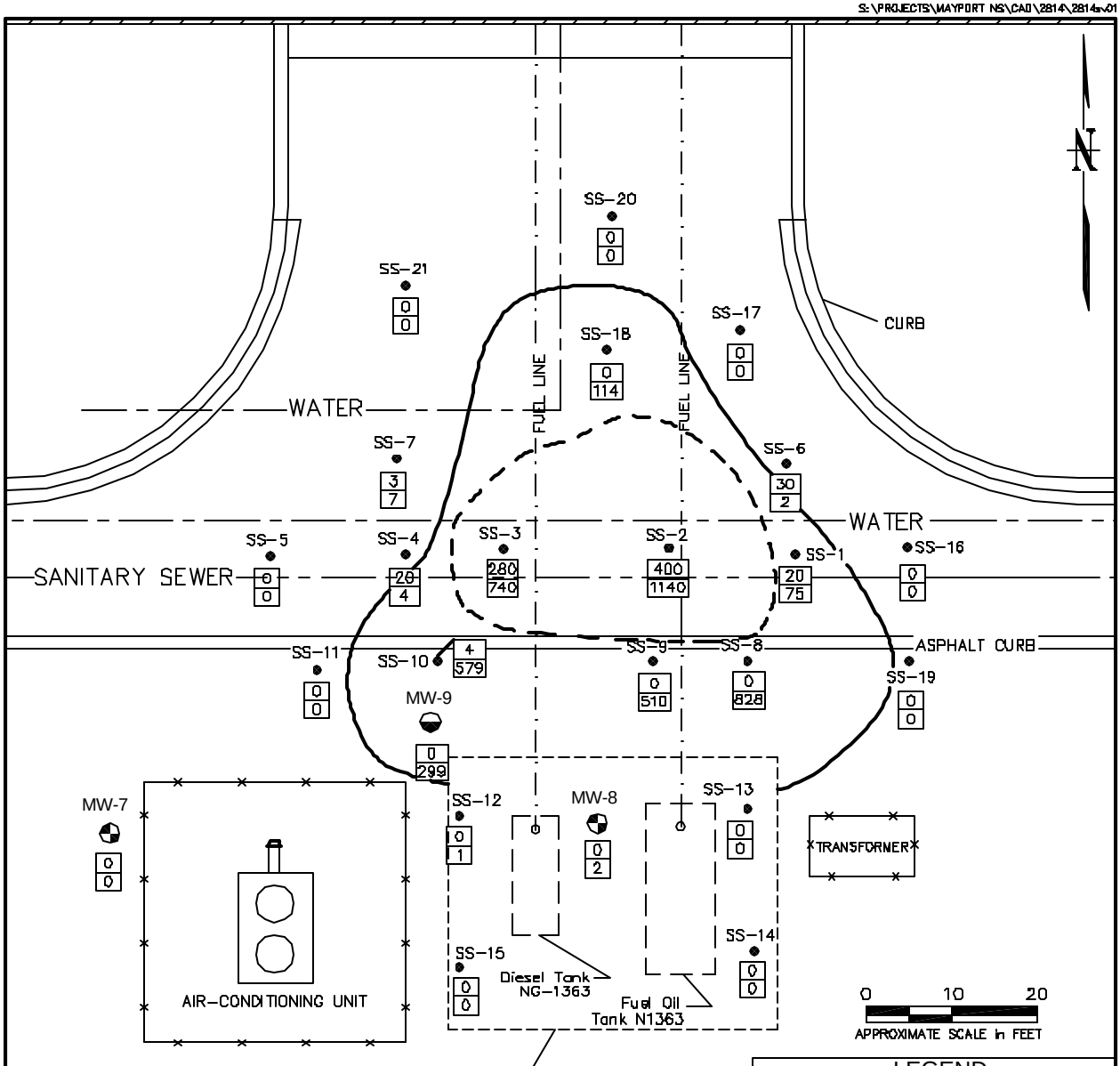
E	ETHYLBENZENE
T	TOLUENE
X	TOTAL XYLENES
NAP	NAPHTHALENE
FLR	FLUORENE
PHT	PHENANTHRENE
TRPH	TOTAL RECOVERABLE PETROLEUM HYDROCARBONS

mg/kg = Milligrams per Kilogram

DRAWN BY LLK	DATE 7/16/01	DETECTED CONSTITUENTS IN SOIL SAMPLES UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY	DATE		APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-2 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

S:\PROJECTS\MAYPORT NS\CAD\2814\2814sv01



LEGEND

- Soil Boring Location
- Shallow Monitoring Well
- Deep Monitoring Well

OVA-FID Measurements (ppm)

1 ft bls ► 4
3 ft bls ► 579

Approximate Area of Excessively Contaminated Soil 1 ft bls

Approximate Area of Excessively Contaminated Soil 3 ft bls

NOTE: Information shown was obtained from maps generated by others during previous investigations. Distances and dimensions are not based upon a professional survey and should be considered approximate.

OVA-FID = Organic Vapor Analyzer with Flame Ionization Detector
ppm = parts per million
ft bls = feet below land surface

DRAWN BY LLK DATE 7/16/01		OVA-FID MEASUREMENTS AND APPROXIMATE AREA OF EXCESSIVELY CONTAMINATED SOIL UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-3 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

Table 2-6
Summary of Groundwater Quality

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Compound	MW-1	MW-2	MW-3	MW-4	MW-5	MW-6
	6/9/1997	6/9/1997	6/9/1997	6/9/1997	6/9/1997	6/9/1997
Volatile Organic Compounds (USEPA Method 8021B)(µg/L)						
Bromodichloromethane	ND	ND	ND	ND	ND	ND
Benzene	ND	ND	**1.6**	ND	ND	ND
Toluene	ND	ND	ND	ND	ND	ND
Ethylbenzene	ND	ND	7.1	ND	ND	ND
Total Xylenes	ND	ND	ND	ND	ND	ND
Total BTEX	ND	ND	8.7	ND	ND	ND
MTBE	ND	ND	ND	ND	ND	ND
Polynuclear Aromatic Hydrocarbons(USEPA Method 8310)(µg/L)						
Acenaphthene	ND	ND	ND	ND	ND	ND
Flouranthene	ND	ND	ND	ND	ND	ND
Flourene	ND	ND	ND	ND	ND	ND
Naphthalene	ND	ND	**73**	9.5	ND	ND
Phenanthrene	ND	ND	ND	ND	ND	ND
Pyrene	ND	ND	ND	ND	ND	ND
1-Methylnaphthalene	ND	ND	**70**	1.4	ND	ND
2-Methylnaphthalene	ND	ND	**65**	1.4	ND	ND
FL-PRO(mg/L)						
TRPH	NS	NS	NS	NS	NS	NS
Metals Analysis(mg/L)						
Total Lead	**0.036**	**0.041**	**0.029**	**0.027**	**0.018**	**0.072**

Source: CAR (BEA, 1997)

Notes:

BTEX = benzene, toluene, ethylbenzene, total xylenes.
µg/L=micrograms per liter.
mg/L=milligrams per liter.
MTBE = metyl-tertiary-butyl-ether
ND = non detect.
NS = not sampled.
EDB=1,2 Dibromoethane=ethylene dibromide.

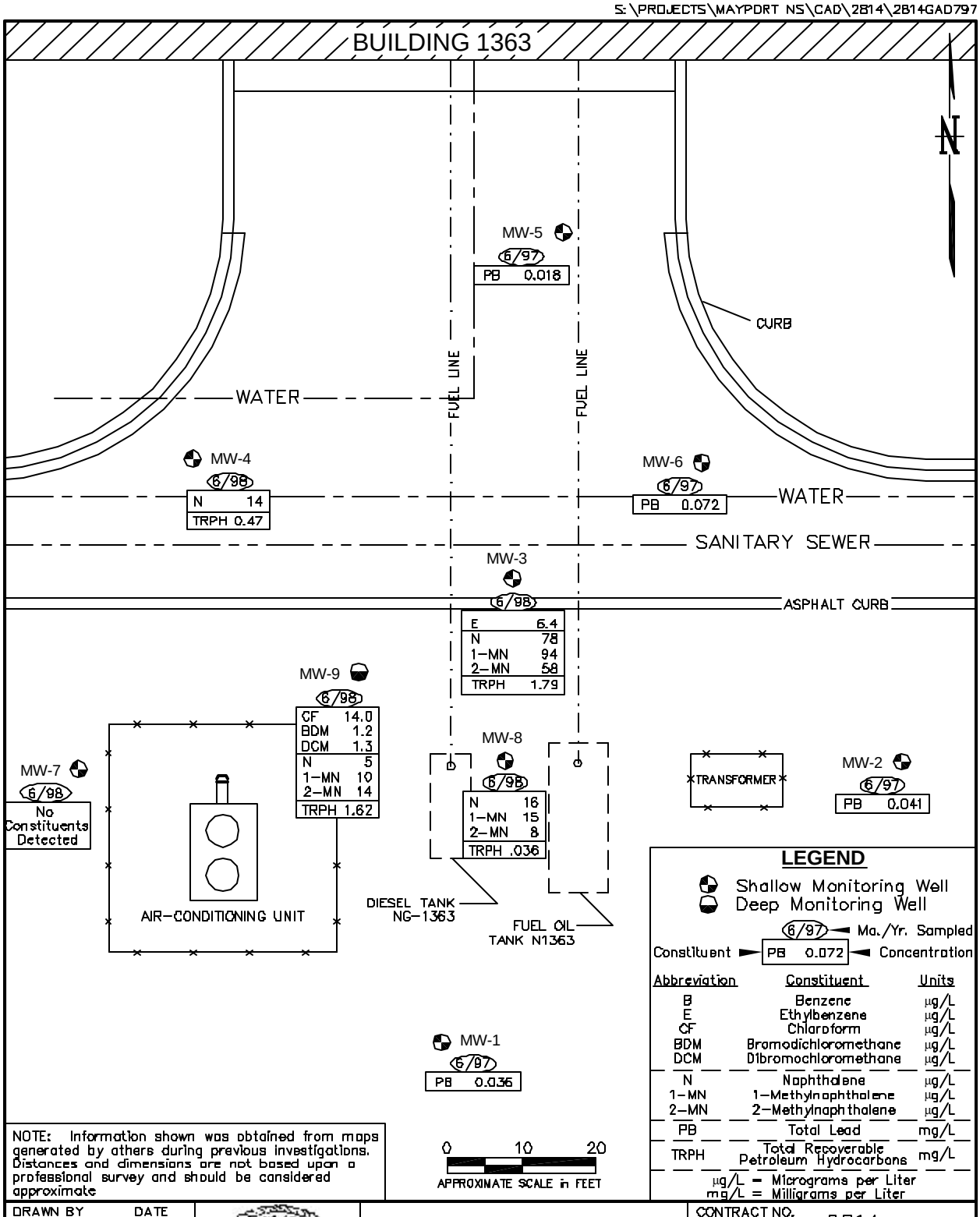
Table 2-7
Summary of Groundwater Quality

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Compound	MW-3		MW-4		MW-7		MW-8		MW-9	
	6/30/1998	7/1/1999	6/30/1998	7/1/1999	6/30/1998	7/1/1999	6/30/1998	7/1/1999	6/30/1998	7/1/1999
Volatile Organic Compounds (USEPA Method 8021B)(µg/L)										
Bromodichloromethane	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	1.2	NA
Benzene	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	NA
Toluene	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	NA
Ethylbenzene	6.4	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	NA
Total Xylenes	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	NA
Total BTEX	6.4	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	<1.0	NA
Chloroform	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	14	NA
Dibromochloromethane	<1.0	NA	<1.0	<1.0	<1.0	NA	<1.0	NA	1.3	NA
USEPA 504.1(µg/L)										
EDB	<1.0	<0.02	<1.0	<0.02	<1.0	<0.2	0	<0.2	<1.0	NA
Polynuclear Aromatic Hydrocarbons(USEPA Method 8310)(µg/L)										
Acenaphthene	<5.0	<1.1	<5.0	NA	<5.0	<1.0	<5.0	<1.0	<5.6	<1.1
Flouranthene	<5.0	<0.2	<5.0	NA	<5.0	<0.2	<5.0	<0.2	<5.6	<0.2
Flourene	<5.0	<0.2	<5.0	NA	<5.0	<0.2	<5.0	0.6	<5.6	<0.2
Naphthalene	**78**	<1.1	14	NA	<5.0	<1.0	16	4.9	5.0	4.8
Phenanthrene	<5.0	<0.7	<5.0	NA	<5.0	<0.7	<5.0	<0.7	<5.0	<0.7
Pyrene	<5.0	<0.3	<5.0	NA	<5.0	<0.3	<5.0	<0.3	<5.6	<0.3
1-Methylnaphthalene	**94**	NA	<5.0	NA	<5.0	NA	15	NA	10	NA
2-Methylnaphthalene	**58**	NA	<5.0	NA	<5.0	NA	8	NA	14	NA
FL-PRO(mg/L)										
TRPH	1.79	NA	0.47	NA	<0.2	NA	0.036	NA	1.62	NA
Metals Analysis(mg/L)										
Total Lead	<0.003	<0.2	<0.003	NA	<0.003	ND	<0.003	NA	<0.003	NA

Source: CARA (BEA, 1999)
Notes:
NA=not analyzed
ND = no constituents detected.

S:\PROJECTS\MAYPORT NS\CAD\2814\2814GAD797



LEGEND

- Shallow Monitoring Well
- Deep Monitoring Well
- 6/97 ◄ Mo./Yr. Sampled
- Constituent ► PB 0.072 ◄ Concentration

Abbreviation	Constituent	Units
B	Benzene	µg/L
E	Ethylbenzene	µg/L
CF	Chloroform	µg/L
BDM	Bromodichloromethane	µg/L
DCM	Dibromochloromethane	µg/L
N	Naphthalene	µg/L
1-MN	1-Methylnaphthalene	µg/L
2-MN	2-Methylnaphthalene	µg/L
PB	Total Lead	mg/L
TRPH	Total Recoverable Petroleum Hydrocarbons	mg/L

µg/L = Micrograms per Liter
mg/L = Milligrams per Liter

NOTE: Information shown was obtained from maps generated by others during previous investigations. Distances and dimensions are not based upon a professional survey and should be considered approximate.

DRAWN BY LLK	DATE 7/17/01	DETECTED CONSTITUENTS IN GROUNDWATER SAMPLES UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY	DATE		APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 2-4 REV. 0

FORM CADD NO. SDIV_AV.DWG – REV 0 – 1/20/98

2.6 CONTAMINATION ASSESSMENT REPORT CONCLUSIONS

2.6.1 Soils

Of the 30 soil borings screened in the CAR and CARA, 11 locations had soil vapor concentrations exceeding 50 parts-per-million equivalent methane (ppm). TRPH were detected in samples from four soil borings at concentrations exceeding the FDEP SCTLs for the residential and leachability standards of 340 mg/kg. The results from soil vapor screening and analytical soil sampling lead to the determination that soil remediation is necessary at the site.

2.6.2 Groundwater

No free-phase petroleum hydrocarbons were detected in the monitoring wells during the CAR and CARA investigations. In groundwater samples collected at the site, one volatile organic compound (VOC), benzene, was detected at a concentration exceeding the current applicable FDEP GCTLs during the CAR investigation (6/9/97). Three polynuclear aromatic hydrocarbons (PAHs), naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene, were detected in groundwater samples from MW-3 at concentrations exceeding the current applicable FDEP GCTLs, but all were below Natural Attenuation (NA) Default Concentrations as specified in Chapter 62-777, FAC, Table V.

3.0 REMEDIAL ACTION PLAN GOALS

The objective of this RAP is to present a proven, efficient, and cost-effective method to remediate the contaminated soil at the site. Additionally, after the completion of the remedial action, one round of groundwater sampling shall be conducted per FDEP requirements. Results of the groundwater monitoring shall be used to determine the status of groundwater beneath the site.

The goals of this RAP include:

- Select a remedial alternative that will result in the reduction or removal of the hydrocarbon constituents within the soil matrix;
- Select a remedial alternative that is protective of human health and the environment.

The SCTL concentrations for the soil at the subject site are shown on Table 3-1, as listed in the FDEP Chapter 62-777, FAC. The following subsections list the SCTLs for the site-specific chemicals of concern (COCs).

Table 3-1
Chemicals of Concern and Associated Selected SCTLs

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Site-Specific COC	Concentrations from Table II*
Naphthalene	1.7 mg/kg
Benzene	0.007 mg/kg
Toluene	0.5 mg/kg
Ethylbenzene	0.6 mg/kg
Total Xylenes	0.2 mg/kg
TRPHs	340 mg/kg

* Concentration is the lower of the residential direct exposure or leachability SCTLs based on groundwater criteria Table II, Chapter 62-777, FAC.

3.1 SOIL CLEANUP TARGET LEVELS

Based on the selected SCTLs listed in Table II of Chapter 62-777, FAC, Table 3-1 presents the soil remediation goals for the site specific COCs.

3.2 SITE RESTRICTIONS

Site 1363 has two new USTs, which supply Building 1363 with heating oil and diesel fuel. The tanks are connected to the building via two underground pipelines. A paved access road, a parking area, a sewer line, and a water line are located between the tanks and the building. In addition, there may also be utilities and piping associated with the transformer and the air-conditioning unit located at the site. The soil remedial action final design should take into account these site restrictions. Overhead utilities and protection of the tanks, transformer, air conditioning unit, and other equipment from being affected by the excavation (i.e., shoring) must be addressed during the remedial action final design. Care must be taken not to damage the tanks or pipelines during implementation of the remedial action alternative. Also, the chosen remedial alternative may require the destruction of parts of the access road and the parking area. Steps shall be taken to reroute automobile traffic away for the site during remedial activities. These areas shall be repaired after the completion of the remedial action.

4.0 CONTAMINANT DISTRIBUTION

4.1 ESTIMATED MASS OF CONTAMINANTS IN SOIL

Data acquired during the site assessment investigations indicated that soil contamination exists within the "smear zone" from 1 ft bls to the water table and the lateral limits of the soil plumes have been defined as depicted on Figure 2-3. The soil contamination is from land surface to approximately 4 ft and covers an estimated surface area of approximately 2,408 square feet (ft^2) yielding a total volume of approximately 357 cubic yards (yd^3) of contaminated soil. The fixed-based laboratory analysis of the 11 soil samples collected during the previous investigations indicates an average TRPH concentration of approximately 5,524 mg/kg. Based on this information, the estimated quantity of adsorbed hydrocarbons within the smear zone is approximately 5,502 pounds. Figure 2-3 depicts the area where "excessively contaminated" soils are assumed to exist. Appendix B presents calculations for the estimated mass of impacted soil.

5.0 REMEDIAL ALTERNATIVE TECHNOLOGY SCREENING

TtNUS conducted a screening of available technologies in order to determine a suitable remedial alternative for the subject site. Potential remedial technologies and process options for the soil remediation have been 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.

5.1 EVALUATION OF SOIL TREATMENT ALTERNATIVES

Based on the data from the CAR and the CARA, a total volume of approximately 357 yd^3 of soils exhibits hydrocarbon concentration in excess of FDEP SCTLs and soil headspace standards (50 ppm) (FDEP, 1997). TtNUS has investigated several methods for the removal of hydrocarbons from the soils at the site. The following actions have been identified for remediation of soil and are evaluated in this RAP:

- Soil excavation and on-site treatment
- Soil excavation and off-site treatment/disposal
- In-situ soil vapor extraction

The following sections briefly discuss each of these soil remedial actions with respect to their suitability for implementation at this site.

5.1.1 Excavation and On-site Treatment

This alternative consists of the physical removal and on-site treatment of impacted soils containing hydrocarbon constituents exceeding the SCTLs (see Table 2-3). To complete the excavation of impacted soils, removal of surface soil to the depth of the water table (approximately 4 ft bls) over an area of approximately 2,408 ft^2 would be required. If it becomes necessary to excavate below the water table (4 ft bls) dewatering with collection, treatment, and disposal of collected water will likely be required.

Removal operations can be accomplished using standard equipment and will involve hand excavation. Following removal and stockpiling of the impacted soil, samples shall be collected from the excavation sidewalls and bottom and analyzed to confirm the achievement of the SCTLs. Mobile treatment equipment shall be necessary to treat excavated soil either thermally or chemically. Treated soil must be

tested and certified as clean fill. The excavation shall be backfilled with the treated soil and the site restored to its original condition.

The FDEP requested in the letter dated December 30, 1999 (see Appendix A), that one round of groundwater samples and water levels be taken after the completion of the soil remediation. This will be used to make a recommendation regarding how to address impacted groundwater.

The estimated costs for soil excavation, on-site treatment, site restoration, and one round of groundwater sampling is presented in Table 5-1 and Appendix C, Table C1. A comparison of the advantages and disadvantages of each technology is included in Table 5-2.

Table 5-1
Soil Remedial Alternatives Cost Summary

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

ALTERNATIVE	CAPITAL COST	ANNUAL O&M	ESTIMATED YEARS OF OPERATION	O&M PRESENT WORTH	TOTAL PRESENT WORTH
Soil Vapor Extraction[1]	$138,000	$92,000	3	$241,000	$417,000
Excavation and Disposal	$160,000	$0	0	$0	$160,000
Excavation and On-site Treatment	$206,000	$0	0	$0	$206,000

Notes: [1]Contingency costs included in Total Present Worth only.
See Appendix C for detailed cost estimates for the soil remediation alternatives.

5.1.2 Excavation and Off-site Treatment/Disposal

This alternative consists of the physical removal and off-site treatment and/or disposal of impacted soils with hydrocarbon constituents exceeding the SCTLs. To complete excavation of impacted soils, removal of surface soil to the depth of the water table (approximately 4 ft bls) over an area of approximately 2,408 ft^2 would be required to remediate the contaminated zone. If it becomes necessary to excavate below the water table (4 ft bls) dewatering with collection, treatment, and disposal of collected water will likely be required.

Removal operations can be accomplished using standard equipment, including hand excavation. Following removal and immediate transportation or stockpiling of the impacted soil, samples collected from excavation sidewalls and bottom shall be analyzed to confirm achievement of the SCTLs. The excavation shall be backfilled with clean fill material and the site restored to its original condition. Any soil or other debris generated during excavation shall be sampled, characterized, loaded, and transported off-site to a permitted facility for treatment and/or disposal.

After the completion of the excavation, Chapter 62-770, FAC, requires one year of quarterly groundwater monitoring. However, the FDEP requested in the letter dated December 30, 1999 (see Appendix A), that one round of groundwater samples and water levels be taken after the completion of the soil remediation. This will be used to make a recommendation regarding how to address impacted groundwater.

The estimated costs for soil excavation, transportation, off-site treatment/disposal, site restoration, and one round of groundwater sampling is presented in Table 5-1 and Appendix C, Table C2. A comparison of the advantages and disadvantages of each technology is included in Table 5-2.

5.1.3 Soil Vapor Extraction

Soil vapor extraction (SVE) involves the introduction of a pressure gradient into the soil matrix in order to extract hydrocarbon vapors and enhance volatilization of adsorbed hydrocarbons. A typical SVE system consists of vapor extraction wells, a vacuum blower, associated piping and safety controls. During SVE operation, a vacuum is applied to extraction wells situated within the vadose zone. As air is drawn through the soil pores, soil gas is displaced and is drawn to the extraction wells and subsequently to above ground via piping for treatment. Extracted vapors are typically treated with an air-phase treatment unit (activated carbon) prior to discharge to the atmosphere. As the process continues, adsorbed and dissolved-phase hydrocarbons remaining in the vadose zone are gradually stripped from the soil matrix. In addition, volatilization of contaminants on the surface of the water table is enhanced. The SVE system shall be designed and constructed using explosion-proof equipment.

The SVE system also promotes oxygen recharge, which stimulates existing biological activity in the soil and enhanced aerobic biodegradation. The indigenous soil microbes, present at virtually all hydrocarbon release sites, tend to multiply rapidly in the presence of oxygen, which increases hydrocarbon digestion, and results in an accelerated remediation process.

Based on the soil hydrocarbon concentrations identified in the CARA and using standard industry calculations, the soil remediation time was calculated to be approximately six months using SVE (calculations are presented in Appendix D.). However, the calculation is theoretical and is based on an assumption that the concentration of the COCs in the soil pores is equal to the concentrations found in

the soil sampling analytical results. The actual concentration of contaminants in the soil vapor will most likely be much less than that of the soil samples. Hence, remediation time will be greater as less contaminant mass should be removed per pore volume exchange than calculated. Results from other SVE systems installed by TtNUS at sites with similar characteristics have historically taken more time than calculated. Therefore, a safety factor of six was used and the remediation time is estimated to be approximately three years. In addition, most SVE systems require a pilot study to determine the actual site characteristics (i.e. radius of influence, flow rates, etc.).

A pilot study would be necessary before implementing this alternative to ensure that the SVE system is designed correctly for the particular site. SVE is a proven technology for reducing BTEX and TRPH levels in soil and is an economical approach to in-situ soil remediation. However, historically SVE systems have exhibited asymptotic behavior. This means that the concentration of COCs drops rapidly at system start-up, but the concentrations stop decreasing after a period of time. At this point, if the concentrations are above SCTLs, another remedial action may need to be implemented to complete the cleanup.

During the three years of the SVE system operation, Chapter 62-770, FAC, required quarterly groundwater monitoring. An estimated cost of SVE implementation with three years of O&M is presented in Table 5-1 and Appendix C, Table C3. A comparison of the advantages and disadvantages of each technology is included in Table 5-2.

5.2 COST COMPARISON AND RATIONALE FOR SELECTION

A table comparing the estimated cost of remediation of soil contamination at the subject site using the evaluated alternatives is provided in Table 5-1. Table 5-2 provides a comparison of the advantages and disadvantages of each technology and presents the applicability of each. Based on a review of the advantages, disadvantages, costs, and TtNUS project experience at sites with similar conditions, TtNUS recommends the excavation and off-site disposal alternative for the site.

Excavation provides the highest degree of overall protection to human health and the environment by providing reduction in risk and hydrocarbon concentrations in a complete and timely manner. Source removal shall prevent continued leaching to the surrounding groundwater. The equipment needed for excavation is reliable, easily operated, commonly available, and requires no O&M. Minimal permitting is required for the implementation and operation of the excavation project. In addition, excavation and off-site disposal shall also provide the shortest time duration to achieve cleanup standards and goals compared to the other alternatives.

For the excavation of soil, care must be exercised during the excavation and backfilling process to prevent damage to the fuel supply lines that connect the tanks to Building 1363, and any utilities present at the site. The pipelines between the USTs and the building are synthetic, flexible, double-walled piping. Hand digging is the safest method while excavating the areas near the pipelines and utilities. Shoring may also be used to ensure safety at the site. The soil from the excavation may be sent to a recycler for treatment, disposal and reuse. In addition, much of the area of excavation is paved, and it shall be necessary to repair the asphalt, curbing, and road after completion of the remedial action.

Table 5-2
Remedial Alternative Feasibility Comparison

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Media	**Soil**		
Technology	**Soil Vapor Extraction**	**Excavation and Off-site Disposal**	**Excavation and On-site Treatment**
Advantages	Low capital cost, readily available equipment.	Removal of contamination, short remediation time, and clean backfill.	Source removal, short remediation time, treated soil tested before backfilling and soil remains on site.
Disadvantages	Asymptotic behavior, prolonged remedial time facilitates movement of contaminants, need for pilot study.	Transportation of contaminated soil off premises, potential to damage utilities and pipelines, potential short-term exposure to contaminants, and potential need for shoring.	Higher cost compared to off-site disposal, potential to damage utilities and pipelines in area, potential short-term exposure to contaminants, and potential need for shoring.
Screening Comment	Eliminate – Longer cleanup time than other alternatives.	Retain – Short remediation time and competitive cost.	Eliminate – Off-site disposal is more cost effective.

6.0 REMEDIAL SYSTEM DESIGN

The preferred remedial alternative presented in this RAP is Excavation and Off-Site Disposal. Excavation and Disposal was selected based on it being the most cost effective and timely method by which to remediate the contaminated soil in the vadose zone at the site.

6.1 TECHNOLOGY DESCRIPTION AND SYSTEM DESIGN

Major components of soil excavation and disposal include the following:

- Site preparation (pre-excavation activities)
- Excavation approach
- Excavation methods
- Site restoration

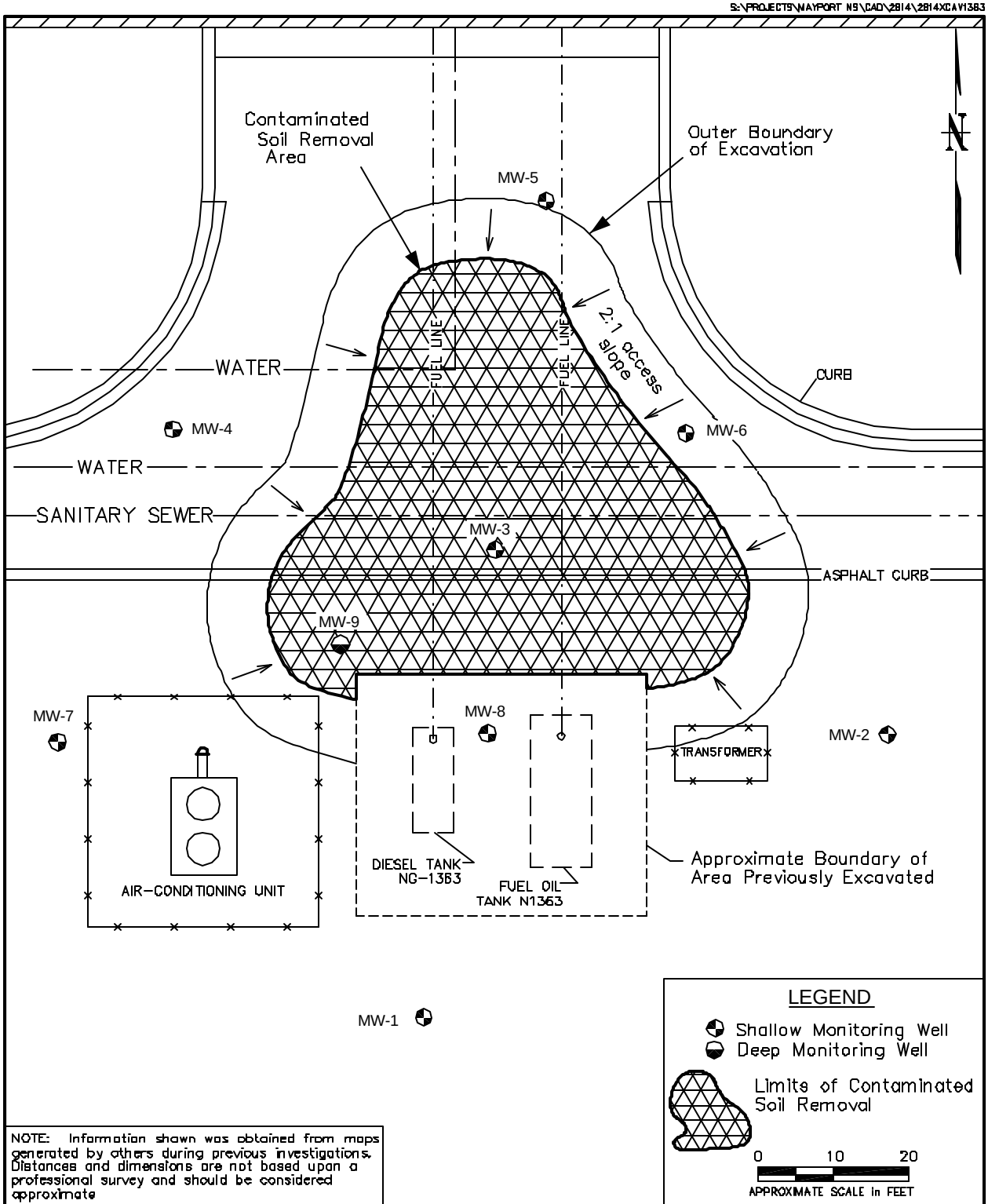
Figure 6-1 presents the boundaries of the excavation area. In some areas it shall be necessary to hand dig in order to avoid damaging utilities and the fuel supply pipelines that connect Building 1363 and the USTs. Also, shoring may be necessary near the tanks, the air conditioning unit, and the electrical transformer to prevent collapsing and ensure safety at the site. Based on the contaminated soil area boundary and an average depth of 4 ft bls, the estimated volume of excavated soil 357 yd^3, which is equivalent to 499 tons. (See Appendix D.)

6.1.1 Site Preparation (Pre-Excavation Activities)

Prior to excavation activities, the limits of excavation shall be surveyed and staked in the field. The designated areas shall be flagged and boundaries shall be established by florescent yellow caution tape to define the exclusion zone. Prior to beginning any excavation activities or any intrusive work, the designated areas shall be checked for any substructures, utility lines, and other potential interference. A professional survey to verify locations of site utilities was not conducted for this report; however, active or inactive subsurface obstructions may include electric lines, piping for sewer, gas distribution, etc.

Monitoring wells within or near the limits of the excavation shall be abandoned prior to excavation. The wells to be abandoned are MW-3, MW-5, MW-6, and MW-9. Monitoring wells should be abandoned by

S:\PROJECTS\MAYPORT NS\CAD\2814\2814XCAV1383



NOTE: Information shown was obtained from maps generated by others during previous investigations. Distances and dimensions are not based upon a professional survey and should be considered approximate

DRAWN BY LLK DATE 8/1/01		LIMITS OF CONTAMINATED SOIL REMOVAL UST SITE 1363 MAYPORT NAVAL STATION MAYPORT, FLORIDA	CONTRACT NO. 2814
CHECKED BY DATE			APPROVED BY DATE
COST/SCHED-AREA			APPROVED BY DATE
SCALE AS NOTED			DRAWING NO. FIGURE 6-1 REV. 0

FORM CADD NO. SDIV_AV.DWG - REV 0 - 1/20/98

overdrilling the well and grouting from the bottom of the boring to the surface with bentonite cement grout. The level of the grout shall be monitored during pumping to ensure complete placement of the grout. The grout should be checked 24 hours after emplacement and refilled to replace any losses due to settling. In addition, all local and state regulations shall be followed for well abandonment.

The Remedial Action Contractor (RAC) shall prepare all required planning documents, such as a Health and Safety Plan and an Excavation Plan. The Excavation Plan should address removal actions, soil disposal, erosion, sediment control, and shoring, if necessary. The Excavation Plan shall be reviewed and sealed by a Professional Engineer (PE) experienced in excavation and shoring activities (if shoring is used). The RAC shall also obtain all necessary permits.

6.1.2 Excavation Approach

An excavation approach has been developed to provide the RAC with the flexibility to adjust to onsite conditions encountered during the excavation. A number of complicating factors may arise during the excavation activities due to the presence of the existing UST system, and adjacent structures including the transformer, air conditioning unit, roadway, and limited available space.

Due to the presence of the existing UST system and nearby structures, alternative excavation methods may be warranted to ensure no damage occurs to these structures. Methods such as Cut and Fill excavation or shoring may be necessary to prevent damage to these structures during excavation and backfilling activities. In addition, hand excavation should be used to remove impacted soils in close proximity to these structures. Excavation methods are discussed in Section 6.1.3.

The anticipated aerial extent of the excavation is provided on Figure 6-1. It is recommended that a FID be used to field screen soils for petroleum impact and that the actual limits of the excavation should be based on this field data and subsequent closure soil sampling. Additional information regarding the use of field screening procedures is provided below in Section 6.1.3.1.

Existing data may be sufficient to allow for disposal characterization. As appropriate, the RAC may chose to excavate, load and transport contaminated media to the disposal facility without stockpiling. If existing data is not sufficient, additional soil data should be collected via hand auger methods to obtain pre excavation approval of the soil. Should stockpiling become necessary, care should be taken to follow the procedures outlined below in Section 6.1.3.2.

Backfilling and compaction is vital to the success of the remedial design. In areas where asphalt is present, it is recommended that gravel be used to minimize the potential for settling of soils. In other

areas, fill should be compacted as necessary to limit settling and prevent subsequent damage to structures. Detail regarding backfilling options and site restoration is provided in Section 6.1.4.

6.1.3 Excavation Methods

Soil excavation shall be within the area shown in Figure 6-1. Soil excavated from land surface to approximately 4 ft bls in the depicted area shall be handled as petroleum contaminated soil. Excavation shall be conducted using standard earthmoving equipment. All operators shall be certified in compliance with 29 Code of Federal Regulations 1910.120 health and safety requirements. Visual analysis and OVA-FID headspace screening shall be used to monitor soil contamination (see Section 6.1.2.2). Excavation shall be performed to the water table. This is expected to be at 4 ft bls at the time of excavation. By using pre-characterization sampling and/or OVA-FID screening the RAC may be able to avoid excavating near the obstructions at the southern end of the contamination area. Also, methods such as Cut and Fill may be used to avoid the need for shoring. However, if it is necessary to excavate near these structures shoring shall be used as deemed appropriate by the lead professional engineer.

Excavated soils that are screened, tested and determined to be clean shall be stockpiled on site and returned as backfill to the excavation south of the paved area. Stormwater run-on and run-off controls should be implemented to prevent off-site migration of sediment or contaminated stormwater during site activities.

The limits of the excavation shown on Figure 6-1 are representative of the anticipated footprint of the soil contamination area. The soil in the excavation area is described as a fine-sand with shell fragments and the sides of the excavation will naturally slope. Excavations shall be cut back and sloped to allow for safe entry into the excavation in accordance with Occupational Safety and Health Administration (OSHA) regulations. Hand digging is recommend around utilities and the fuel lines located within the excavation. The open excavation should be protected with suitable barriers, such as temporary fences. The area of the excavation shall be provided with a berm to minimize the amount of run-off that can enter the excavation.

Confirmatory soil samples shall be collected from the sides and bottom of the excavation and analyzed for the gasoline and kerosene analytical groups as specified in Chapter 62-770, FAC. A minimum of two confirmatory soil samples shall be collected from each sidewall and the bottom prior to backfilling of the excavation. The results of the sampling must be received and evaluated before backfilling begins. If the results of the sampling contain analytes detected above residential or leachability (whichever is less) SCTLs, then additional excavation will be necessary to remove the contaminated soils. This process shall continue until no constituents are detected above SCTLs.

The total volume of removed contaminated soil is estimated to be 357 yd^3. Based on the actual water table at the time of excavation, these volumes may vary.

6.1.3.1 Field Screening Procedures

During the excavation soil shall be screened with an OVA-FID to determine if the soil is excessively contaminated. Soil vapor analysis shall be performed in accordance with the headspace screening method prescribed by Chapter 62-770.200(2), FAC.

6.1.3.2 Stockpiling Procedures

If stockpiling becomes necessary, the excavated soil that is contaminated (greater than 50 ppm, or visibly stained) should be segregated for removal, stockpiled, sampled for waste profile characterization, and delivered to a permitted off-site disposal facility. Soil stockpiles shall be provided with erosion and sedimentation control such as silt fences or hay bails. Captured sediment from the contaminated soil stockpile must be treated or disposed. Contaminated soil stockpiles shall be placed on and covered with an impermeable surface, or liner, 20-mil thickness minimum. Water seeping out of the stockpiles of contaminated soil must be captured for treatment or disposal.

6.1.4 Site Restoration

The following shall be done to complete site restoration:

- Backfill excavation area
- Hydro seed grass areas
- Restore asphalt on paved areas
- Replace curbing
- Replace abandoned monitoring wells

Backfill of excavated areas may be performed simultaneous to excavation. All water from the excavation during soil replacement should be removed as necessary to accommodate backfill. In the area currently covered by asphalt, backfill material shall be American Association of State Highway and Transportation Officials (AAHSTO) Gradation Number 57 (¾ inch) gravel fill. This will serve as the base for the asphalt covering that will be used to repair the access road and parking area that is removed during the excavation. The area of the excavation that is south of the road shall be backfilled to land surface with well-graded granular soil, consisting of silica sand or other approved materials. Backfill materials shall be excavation soil stockpiled as uncontaminated or soil obtained from an acceptable borrow source.

Certification that all borrow sources are free of petroleum hydrocarbon contamination is required from the borrow source prior to delivery.

Based on the fact that gravel will be used as the base for the paved areas no compaction will be necessary in that area. Compaction shall be performed on the grassy area south of the parking lot to avoid damage to utilities and the fuel pipelines after settling. Compaction shall be completed with a sheep's foot or similar device, however, no compaction testing will be necessary. Approximately 360 yd^3 of backfill material shall be required. If excavation and backfill operations are performed simultaneously, a separation distance shall be maintained between the toe of the slope for excavation and the toe of the slope for backfill to prevent or minimize cross-contamination by direct contact with excessively contaminated soil. After all disturbed areas of the excavation have been backfilled, the site shall be graded and covered with asphalt to repair the access road and parking area. Also, any curbs destroyed in the excavation process shall be replaced and the end of the existing curbing shall be properly cut using a concrete saw. Other areas should be graded to drain and hydro-seeded with seed native to the area to match existing grass.

Following completion of the excavation, backfill, and site restoration, groundwater monitoring wells, abandoned or destroyed during remedial activities shall be replaced. Also, two additional wells recommended to the northeast and northwest of the excavation area to provide geographic coverage. A final survey shall be performed to identify the locations of the limits of excavation, final grading elevations, and new monitoring well locations. An as-built site plan (signed and sealed) should be provided for the excavation project area. A source removal report consistent with the requirements of Chapter 62-770.300, FAC shall be provided summarizing volumes removed, disposed or treated, replaced, and site activities.

7.0 POST REMEDIAL ACTION MONITORING

The following sections establish procedures for the post-remedial action monitoring requested by the FDEP in the letter dated December 30, 1999.

7.1 GROUNDWATER MONITORING

After completion of the soil remedial action and the new monitoring wells are installed, one round of groundwater sampling shall occur. At that time the following shall occur:

- Water levels should be measured in all wells at the site and a groundwater flow determination shall be made.

- Groundwater samples shall be collected from all wells existing and replaced at the site (currently identified as MW-1 through MW-9).

- Samples shall be analyzed for the KAG and Gasoline Analytical Group (GAG) parameters per Chapter 62-770, FAC.

- The data should be analyzed and a recommendation made to the FDEP regarding follow up actions required for groundwater.

REFERENCES

BEA (Bhate Environmental Associates, Inc.), 1997. *Contamination Assessment Report Tank Site 1363/1363-G*, Naval Station Mayport, Jacksonville, Florida.

BEA, 1999. *Addendum to the Contamination Assessment Report Tank Site 1363/1363-G*, Naval Station Mayport, Jacksonville, Florida.

FDEP (Florida Department of Environmental Protection), 1997. Florida Administrative Code, Petroleum Contamination Site Cleanup Site Criteria, Chapter 62-770, September.

R. S. Means, 2000. *Environmental Remediation Cost Data – Unit Price*, 6th Edition, Talisman Partners Ltd.

TtNUS (Tetra Tech NUS, Inc.), 1997. *Remedial Action Plan North Fuel Farm Site*, Naval Air Station Cecil Field, Jacksonville, Florida.

TtNUS, 1999. *Remedial Action Plan for Former Fire Fighting Training Facility*, Naval Air Station Jacksonville, Florida.

USEPA (U.S. Environmental Protection Agency), 1995. *How to Evaluate Alternative Cleanup Technologies For Underground Storage Tank Sites, A Guide For Corrective Action Plan Reviewers*, USEPA 510-B-95-007. May.

APPENDIX A

FDEP LETTER DATED DECEMBER 30, 1999

Department of Environmental Protection

Jeb Bush
Governor

Twin Towers Building
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

David B. Struhs
Secretary

December 30, 1999

Ms. Beverly Washington
Department of the Navy, Petroleum Program
Southern Division - Naval Facilities Engineering Command
PO Box 190010
2155 Eagle Drive
North Charleston, SC 29419-9010

file:1363sara1.doc

RE: Site Assessment Report Addendum, Tank Site 1363, Naval Station Mayport, Mayport, FL

Dear Ms. Washington:

I have reviewed the above document dated September 9, 1999 (received September 14, 1999). Information presented in the report confirms that the requirements of Chapter 62-770.600, F.A.C. have been fulfilled. Please prepare a Remedial Action Plan (RAP) as provided in Chapter 62-770.700, F.A.C. that addresses the soil contamination at the site. Following successful remediation, please conduct an additional round of ground water sampling and ground water flow determination and present recommendations for the site. Based on my examination of the ground water data, a Monitoring for Natural Attenuation Proposal may be appropriate if the contaminant levels in site monitoring wells have not changed significantly.

If further clarification is required or if you have any questions, please contact me at 850-921-4230.

Sincerely,

James H. Cason, P
Remedial Project Manager

JAMES H. CASON LICENSE No. 00193 STATE OF FLORIDA PROFESSIONAL GEOLOGIST

12-30-99
Date

CC: Jan Bouvier, NAVSTA Mayport
Michael Fitzsimmons, FDEP Northeast District
Jerry Young, City of Jacksonville

TJB JJC for ESN

"Protect, Conserve and Manage Florida's Environment and Natural Resources"

Printed on recycled paper.

APPENDIX B

ESTIMATED MASS OF CONTAMINATION CALCULATIONS

TABLE B1

ESTIMATED MASS OF CONTAMINANTS IN VADOSE ZONE SOIL MATRIX

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

INPUT:

Estimated Impacted Area[1]	**2,408**	**ft^2**
Estimated Average Impacted Thickness[2]	**4**	**ft**
Estimated Impacted Volume	**9,632**	**ft^3**
Average TRPH Concentration [3]	**5,524**	**mg/kg**

CALCULATIONS:

Estimated Mass of Impacted Unsaturated Soil[4]	**499**	**tons**
Estimated mass of hydrocarbons in soil[5]	**5506**	**lbs**

NOTES

TRPH - Total recoverable petroleum hydrocarbons
mg/kg - milligram per kilogram
lbs - pounds
ft - feet
ft^2 - square feet
ft^3 - cubic feet
yd3 - cubic yards

[1]Estimated area = Length (ft) x Width (ft) (assume area is a rectangle) = 60 ft x 55 ft
[2]Water levels varies from 3-6 ft (recent site visit). Majority of area is at 3 ft. Assume average of 4 ft.
[3]From fixed laboratory analysis of soil samples from S-1, SS-2, S-5 , and SS-10.
(See Tables 2-3 and 2-5)
[4]Estimated Mass of Impacted Unsaturated Soil = impacted volume (ft^3) x (1 yd^3/27 ft^3) x (1.4 tons/1yd^3)
[5]Estimated mass of hydrocarbons = hydrocarbon concentration (mg/kg) x impacted mass (ton) x
(907.2 kg/ton) x (kg/10^6 mg) x (2.2 lb/kg)

ASSUMPTIONS

Density of silty sand estimated to be 1.4 tons per cubic yard (TtNUS, 1999)

PREPARED BY: _____ **CHECKED BY:** _____
Date

APPENDIX C

REMEDIAL ALTERNATIVE COST ESTIMATES

Table C-1
Excavation and Onsite Treatment Cost

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization	$13,000
Planning Documents	$32,000
Field Sampling & Oversight	$12,000
Excavation Activities	$23,000
Onsite Treatment by LTTD	$67,000
Site Restoration and Demobilization	$7,000
Post-Remedial Action Monitoring	$6,000
Summary Data Reporting	$12,000
Costs for Onsite Treatment by LTTD	$172,000
Indirect Costs	
Contingency (@20%)	$34,000
Total Costs for Excavation and Onsite Treatment	**$206,000**

Table C-1 (Continued)
Excavation and Onsite Treatment Cost

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation and Mobilization				
Silt fencing/signs/misc. materials	1	ls	$5,000	$5,000
Decontamination pad	1	ls	$1,000	$1,000
Pressure washer (assume base will provide decon water)	10	day	$20	$200
Pick-up truck	2	wk	$350	$700
General site mob/demob	1	ls	$1,000	$1,000
Foreman (1 weeks * 50 hr/week) Assume 10 hour days	100	hrs	$50	$5,000
Foreman oversight for the entire field event, prep, excavation, demob, etc..				
Total For Site Preparation and Mobilization				**$12,900**
Site Sampling & Oversight				
Planning Documents				
Professional Engineer	40	hrs	$90	$3,600
Jr. Level Engineer	200	hrs	$45	$9,000
Sr. Scientist	80	hrs	$90	$7,200
Word Processor	80	hrs	$35	$2,800
CADD	160	hrs	$40	$6,400
ODCs	5	ls	$500	$2,500
Total for Planning Documents				**$31,500**
Field Sampling & Oversight				
Jr. Level Geologist	100	hrs	$35	$3,500
ODCs	1	ls	$1,000	$1,000
Volatile Organics, Method 8260, assume 16, 2QC	18	ea	$125	$2,250
PAHs, Method 8310, assume 16 samples, 2 QC	18	ea	$85	$1,530
TRPH (FLPRO) assume 16 samples, 2 QC	18	ea	$135	$2,430
Sampling equipment	1	ls	$1,000	$1,000
Total for Field Sampling & Oversight				**$11,710**
Excavation				
Excavation of Soil:				
(assume one trackhoe 10 hrs/day, for five days)				
Trackhoe operator labor included in costs				
2.5 CY, Track Loader	100	hrs	$125	$12,500
Dewatering (Assume vacuum truck onsite for 5 days, collection, transport, disposal of contaminated water)	10	day	$500	$5,000
Two laborers	200	hrs	$25	$5,000
Compaction using sheep' foot	110	cy	$3	$329
Compaction testing	357	cy	$1	$357
Subtotal for Excavation				**$23,186**
Onsite Treatment of Soil by LTTD				
Permitting/Engineering for Site	1	ea	$37,131	$37,131
(permitting site with treatability studies, interface with regulators)				
Minimum Mob/Demob Charge for Small Portable LTTD Unit	1	ea	$5,304	$5,304
Direct firing, Rental and Operations Cost to treat soil	499	ton	$23	$11,457
Front end loader with operator				
(for moving soil)	100	hr	$65	$6,486
Verification sampling, 24 hr TAT, (VOCs 8260, TRPH FLPRO, PAH 8310)	10	ea	$630	$6,300
Subtotal for soil treatment by LTTD				**$66,678**

Table C-1 (Continued)
Excavation and Onsite Treatment Cost

Site Restoration and Demobilization				
Hydroseeding	0.2	acre	$400	$80
Asphalt	200	yd^2	$22	$4,400
Concrete curb,	50	linear foot	$2	$88
Demobilization of Equipment	1	ls	$1,000	$1,000
Drill and install 4 - 2" PVC monitoring wells, each 15 feet deep	60	ft	$26.59	$1,595
Subtotal Site Restoration and Demob:				**$7,163**

Assumptions:
Curbs shall be replaced

INDIRECT COSTS

Post Remedial Action Groundwater Monitoring	Quantity	Unit	Unit Cost	Total Cost
Assumptions:				
Duration of alternative = 1event				
Use of 9 existing wells				
Labor: 1 Technician, 2 days per sampling event @10 hour days	20	hrs	$45	$900
1 Geologist, 2 days per sampling event @10 hour days	20	hrs	$30	$600
Car Rental: (two days per event)	2	ls	$50	$100
Total:				$1,600
Lab:				
Volatile Organics, Method 8260, assume 9 wells, 2QC	11	ea	$80	$880
PAHs, Method 8310, assume 9 wells, 1 QC	10	ea	$135	$1,350
TRPH (FLPRO) assume 9 wells, 1 QC	10	ea	$120	$1,200
Total Analysis:				$3,430
Expendables and Equipment Rental:				
Teflon tubing (150 feet per event)	150	ft	$2.00	$300
Silicon tubing (50 feet per event)	50	ft	$2.00	$100
Shipping and supplies (tape, bubble wrap, ice, gloves)	1	ls	$250	$250
Pumps for purging wells, 2 pumps, 2 days rental	4	days	$35	$140
Rental of Horiba U-22 meter for conductivity, Oxidation-Reduction Potential, pH, dissolved oxygen, turbidity, and temperature. 2 units for 2 days.	4	days	$60	$240
First Aid kit	1	ls	$50	$50
Water level indicator	4	days	$25	$100
Disposal of purge water, assume nonhaz., drums	1	ls	$150	$150
Total Expendables and Equipment Rental:				$1,330
Total costs for groundwater monitoring				**$6,360**

REPORTING

Summary Data Report				
Jr. Level Engineer	40	hrs	$45	$1,800
Professional Engineer	8	hrs	$90	$720
Senior Scientist	8	hrs	$80	$640
Mid-level Engineer	80	hrs	$60	$4,800
Word Processor	40	hrs	$35	$1,400
CADD	50	hrs	$40	$2,000
ODCs (reproduction, shipping, etc.)	1	ls	$500	$500
Total for Summary Data Report				**$11,860**

Table C-2
Excavation and Disposal Cost

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)	
DIRECT COSTS	
Site Preparation and Mobilization	$13,000
Planning Documents	$32,000
Field Sampling & Oversight	$12,000
Excavation Activities	$25,000
Offsite Disposal of Soil	$26,000
Site Restoration and Demobilization	$7,000
Total Direct Costs	**$115,000**
INDIRECT COSTS	
Post-Remedial Action Monitoring	$6,000
Summary Data Report	$12,000
Total Indirect Costs	**$18,000**
Costs for Excavation and Offsite Disposal	$133,000
Indirect Costs	
Contingency (@20%)	$27,000
Total Costs for Excavation and Offsite Disposal	**$160,000**

Table C-2 (Continued)
Excavation and Disposal Cost

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Site Preparation and Mobilization				
Silt fencing/signs/misc. materials	1	ls	$5,000	$5,000
Decontamination pad	1	ls	$1,000	$1,000
Pressure washer (assume base will provide decon water)	10	day	$20	$200
Pick-up truck	2	wk	$350	$700
General site mob/demob	1	ls	$1,000	$1,000
Foreman (1 weeks * 50 hr/week) Assume 10 hour days	100	hrs	$50	$5,000
Foreman oversight for the entire field event, prep, excavation, demob, etc..				
Total For Site Preparation and Mobilization				**$12,900**
Site Sampling & Oversight				
Planning Documents				
Professional Engineer	40	hrs	$90	$3,600
Jr. Level Engineer	200	hrs	$45	$9,000
Sr. Scientist	80	hrs	$90	$7,200
Word Processor	80	hrs	$35	$2,800
CADD	160	hrs	$40	$6,400
ODCs	5	ls	$500	$2,500
Total for Planning Documents				**$31,500**
Field Sampling & Oversight				
Jr. Level Geologist	100	hrs	$35	$3,500
ODCs	1	ls	$1,000	$1,000
Volatile Organics, Method 8260, assume 16, 2QC, 24 hr TAT	18	ea	$125	$2,250
PAHs, Method 8310, assume 16 samples, 2 QC, 24 hr TAT	18	ea	$85	$1,530
TRPH (FLPRO) assume 16 samples, 2 QC, 24 hr TAT	18	ea	$135	$2,430
Sampling equipment	1	ls	$1,000	$1,000
Total for Field Sampling & Oversight				**$11,710**
Excavation				
Excavation of Soil:				
(assume one trackhoe 10 hrs/day, for five days)				
Trackhoe operator labor included in costs				
2.5 CY, Track Loader	100	hrs	$125	$12,500
Gravel for backfill in parking area, includes spreading no compaction	360	yd^3	$7	$2,520
Dewatering (Assume vacuum truck onsite for 5 days, collection, transport, and disposal of contaminated water)	10	days	$500	$5,000
Two laborers	200	hrs	$25	$5,000
Compaction using sheep' foot	110	cy	$3	$329
Subtotal for Excavation				**$25,349**
Offsite Disposal of Soil				
Transportation, and disposal of contaminated soil to a Subtitle D Facility	499	ton	$47	$23,474
Characterization Sampling, 24 hr TAT (RCRA 8 metals, VOCs 8260, TRPH FLPRO)	4	ea	$510	$2,040
Note: Cost derived from quote from Andy Adams of Waste Transportation & Disposal Services (1-800-901-0081) cost quoted was $46.50/ton.				
Subtotal for Offsite Disposal of Soil:				**$25,514**
Site Restoration and Demobilization				
Hydroseeding	0.2	acre	$400	$80

Table C-2 (Continued)
Excavation and Disposal Cost

Asphalt	200	yd^2	$22	$4,400
Concrete curb,	50	linear	$2	$88
Demobilization of Equipment	1	ls	$1,000	$1,000
Drill and install 4 - 2" PVC monitoring wells, each 15 feet deep	60	ft	$26.59	$1,595
Subtotal Site Restoration and Demob:				**$7,163**

Assumptions:
Paved area shall be backfilled with gravel and repaved.
Curbs shall be replaced
Grass area will be backfilled with common fill and hydroseeded

INDIRECT COST

Post Remedial Action Groundwater Monitoring	Quantity	Unit	Unit Cost	Total Cost
Assumptions:				
Duration of alternative = 1event				
Use of 9 existing wells				
Labor: 1 Technician, 2 days per sampling event @10 hour days	20	hrs	$45	$900
1 Geologist, 2 days per sampling event @10 hour days	20	hrs	$30	$600
Car Rental: (two days per event)	2	ls	$50	$100
Total:				$1,600
Lab:				
Volatile Organics, Method 8260, assume 9 wells, 2QC	11	ea	$80	$880
PAHs, Method 8310, assume 9 wells, 1 QC	10	ea	$135	$1,350
TRPH (FLPRO) assume 9 wells, 1 QC	10	ea	$120	$1,200
Total Analysis:				$3,430
Expendables and Equipment Rental:				
Teflon tubing (150 feet per event)	150	ft	$2.00	$300
Silicon tubing (50 feet per event)	50	ft	$2.00	$100
Shipping and supplies (tape, bubble wrap, ice, gloves)	1	ls	$250	$250
Pumps for purging wells, 2 pumps, 2 days rental	4	days	$35	$140
Rental of Horiba U-22 meter for conductivity, Oxidation-Reduction Potential, pH, dissolved oxygen, turbidity, and temperature. 2 units for 2 days.	4	days	$60	$240
First Aid kit	1	ls	$50	$50
Water level indicator	4	days	$25	$100
Disposal of purge water, assume nonhaz., drums	1	ls	$150	$150
Total Expendables and Equipment Rental:				$1,330
Total costs for groundwater monitoring				**$6,360**

REPORTING

Summary Data Report				
Jr. Level Engineer	40	hrs	$45	$1,800
Professional Engineer	8	hrs	$90	$720
Senior Scientist	8	hrs	$80	$640
Mid-level Engineer	80	hrs	$60	$4,800
Word Processor	40	hrs	$35	$1,400
CADD	50	hrs	$40	$2,000
ODCs (reproduction, shipping, etc.)	1	ls	$500	$500
Total for Summary Data Report				**$11,860**

Table C-3
SVE Cost Alternative

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Estimator: RLM
Checked By:

COST SUMMARY TABLE (costs rounded to nearest $1000)		
DIRECT COSTS		
Treatability Study		$20,000
Health and Safety Plan		$6,000
Site Preparation		$35,000
SVE Well Installation		$1,000
Piping and Equipment		$24,000
Total Installation Labor		$19,000
Total Direct Cost		$105,000
INDIRECT COSTS		
Engineering and Design (20%)		$24,000
Sampling and Analysis Plan (SAP) for Monitoring Activities		$9,000
Total Indirect Costs		$33,000
Total Capital Costs (Direct + Indirect)		$138,000
OPERATIONS AND MAINTENANCE		
Administrative O&M		
Annual Groundwater Monitoring (4 quarters)		$26,000
Reporting, Site Activities Report/System Operation Report		$24,000
Total Administrative O&M, annual		$50,000
PRESENT WORTH OF O&M (7%, 3 yrs)	$131,216	$131,000
Treatment System O&M		
System Maintenance		$31,000
Utilities		$11,000
Total Treatment System O&M, annual		$42,000
Present Worth of Treatment System O&M (7%, 3 yrs)	$110,221	$110,000
Present Worth O&M (Administrative + Treatment System O&M)		$241,000
Total Capital and O&M Cost		$379,000
Contingency (10%)		$38,000
TOTAL COST		**$417,000**

Table C-3 (Continued)
Soil Vapor Extraction Cost Alternative

DIRECT COSTS	Quantity	Unit	Unit Cost	Total Cost
Treatability Study	1	ls	$20,000	**$20,000**
Health & Safety Plan				
Health & Safety Plan				
Jr. Level Scientist	40	hrs	$45	$1,800
Sr. Scientist	16	hrs	$90	$1,440
Word Processor	16	hrs	$35	$560
CADD	32	hrs	$40	$1,280
ODCs	1	ls	$500	$500
Total for Workplan & Health & Safety Plan				**$5,580**
Site Preparation				
Storage trailer	3	mo	$500	$1,500
Trailer delivery, setup, removal	2	ea	$1,000	$2,000
Treatment system concrete pad	1	ls	$2,000	$2,000
Fencing 30'x40'	120	ft	$16	$1,920
Trailer area, 40'x80'	240	ft	$16	$3,840
Gates for access to treatment system fence	2	ea	$581	$1,162
Utility connection for treatment system				
Including electric poles, cable, transformer, phone line for telemetry	1	ls	$15,000	$15,000
Signs, temp fencing, barricades to seclude construction area	1	ls	$1,500	$1,500
Pressure washer and water tank	3	mo	$504	$1,512
Plastic sheeting, drums, pumps, hoses, supplies	1	ls	$2,000	$2,000
Labor				
2 laborers, 4 days, 10 hrs/day	80	hr	$19	$1,520
1 foreman, 4 days, 10 hrs/day	40	hr	$35	$1,400
Total site preparation				**$35,354**
Soil Vapor Extraction System				
Soil Vapor Extraction well installation				
Drill and install 3 - 2" PVC horizontal monitoring wells, 3 feet deep, 10 feet lor	39	ft	$26.59	$1,037
Oversight, engr or geologist	10	hrs	$45	$450
Total Injection well Installation Cost:				**$1,487**
Piping and Equipment				
Vacuum Blower and Appurtenances	1	ea	$9,000	$9,000
Vapor Phase Treatment System (carbon drum for first month of start-up)	1	ls	$1,500	$1,500
Piping and trenching	150	ft	$15	$2,250
System plumbing	1	ls	$2,000	$2,000
System control panel	1	ea	$3,000	$3,000
Misc. construction materials	1	ls	$2,000	$2,000
Site restoration	1	ls	$1,000	$1,000
Remedial well survey	1	ls	$1,000	$1,000
System start-up	1	ls	$2,000	$2,000
Total Piping and Equipment				**$23,750**

Note: 3 Soil Vapor Extraction wells estimated based on 30 foot radius of influence, adjusted to 21 foot radius of influence for overlap. The 30 foot radius of influence is based on site information, and a treatability study will be required.

Table C-3 (Continued)
Soil Vapor Extraction Cost Alternative

Labor				
3 Laborers, 2 weeks @ 50 hrs/wk	300	hrs	$30	$9,000
1 Jr. Level Engineer, 2 weeks @ 50 hrs/wk	100	hrs	$45	$4,500
1 Sr. Engineer, 16 hours	24	hrs	$90	$2,160
1 Electrician, 1 week @ 50 hrs/wk	50	hrs	$75	$3,750
Total Labor:				**$19,410**
TOTAL DIRECT COSTS				**$105,581**
OPERATIONS AND MAINTENANCE				
Administrative O&M				
SAP for Monitoring and O&M Activities				
Labor:				
Jr.-Level Geologist/Scientist	80	hrs	$45	$3,600
Senior Geologist	16	hrs	$80	$1,280
ODC's, Production Support (editing, copying, binders, etc.)	1	ls	$1,000	$1,000
Word Processor	16	hrs	$35	$560
CADD, 8 hrs/figure, 4 figures	32	hrs	$40	$1,280
Editor	8	hrs	$60	$480
Copying: 50pgs x 25 copies	1250	page	$0.10	$125
Binding/shipping, 25 copies	25	ea	$20	$500
Total SAP				**$8,825**

Quarterly Groundwater Monitoring	Quantity	Unit	Unit Cost	Total Cost
Assumptions:				
Duration of alternative = 3 yrs				
Use of 9 existing wells				
Quarterly for all three years				
Labor: 1 Technician, 2 days per sampling event @10 hour days	20	hrs	$45	$900
1 Geologist, 2 days per sampling event @10 hour days	20	hrs	$30	$600
Car Rental: (two days per event)	2	ls	$50	$100
Lab:				
Volatile Organics, Method 8260, assume 9 wells, 3QC	12	ea	$80	$960
PAHs, Method 8310, assume 9 wells, 1 QC	10	ea	$135	$1,350
TRPH (FLPRO) assume 9 wells, 1 QC	10	ea	$120	$1,200
Total Analysis:				$5,110
Expendables and Equipment Rental				
Teflon tubing (150 feet per event)	150	ft	$2.00	$300
Silicon tubing (50 feet per event)	50	ft	$2.00	$100
Shipping and supplies (tape, bubble wrap, ice, gloves)	1	ls	$250	$250
Pumps for purging wells, 2 pumps, 3 days rental	6	days	$35	$210
Rental of Horiba U-22 meter for conductivity, Oxidation-Reduction Potential, pH, dissolved oxygen, turbidity, and temperature. 2 units for 3 days.	6	days	$60	$360
First Aid kit	1	ls	$50	$50
Water level indicator	4	days	$25	$100
Disposal of purge water, assume nonhaz., drums	1	ls	$150	$150
Total Expendables and Equipment Rental:				$1,370
Total quarterly costs for groundwater monitoring				**$6,480**

Table C-3 (Continued)
Soil Vapor Extraction Cost Alternative

REPORTING, Site Activities Report:				
1 Jr. Level Geologist	40	hrs	$45	$1,800
1 Senior Geologist	16	hrs	$80	$1,280
Production:				
Word processing	12	hrs	$35	$420
Technical Expert	6	hrs	$75	$450
Editor	8	hrs	$60	$480
CADD operator, 3 dwgs per report @ 8 hours per dwg	24	hrs	$40	$960
Reproduction: 100 pgs @ 20 copies	2000	pg	$0.10	$200
Shipping/binding: 20 reports	20	ea	$20	$400
Total Report Cost:				**$5,990**
TREATMENT SYSTEM O&M (annual)				
System Maintenance				
Labor:				
Jr. Engineer, 16 hrs per month, system operating data, control	192	hr	$45	$8,640
Sr. Engineer, 2 hours per month	24	hr	$90	$2,160
Technician, 16 hrs per month	192	hr	$30	$5,760
Project Mgr., 2 hrs per month	24	hr	$100	$2,400
Electrician, 4 hours per year	4	hr	$60	$240
Misc. equip/supplies	12	mo	$500	$6,000
SVE maintenance	12	mo	$500	$6,000
Total System Maintenance (annual):				**$31,200**
Utilities				
Electricity	175200	kWhr	$0.06	$10,512
Assume 20 kW*24hr/day*365 day/yr = 175,200 kWhr/yr				
Total Utilities				**$10,512**
Total Treatment System O&M (annual)				**$41,712**

APPENDIX D

SOIL VAPOR EXTRACTION CALCULATIONS

Table D-1
Estimated Remedial Time
Soil Vapor Extraction System

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

INPUT DATA

Density of Air at Standard Conditions (1 atm and 68°F)	**0.075**	**lb/ft^3**
Vacuum Extraction Flow Rate	**130**	**scfm**
SVE Operation Time	**24**	**hour**
Average TRPH Concentration in Unsaturated Soil (a)	**5,524**	**mg/kg**
Estimated Mass of Impacted Unsaturated Soil (b)	**499**	**ton**
Estimated Mass of TRPH in Unsaturated Soil (b)	**5,506**	**lbs**
Estimated Mass of Impacted Saturated Soil (c)	**0**	**kg**
Estimated Mass of TRPH in Groundwater (c)	**0**	**lbs**
Estimated Volume of Impacted Soil	**9,632**	**ft^3**
Soil Porosity	**0.3**	
Target Cleanup Level for TRPH in Soil	**340**	**mg/kg**

CALCULATIONS

Estimated TRPH Concentration in Saturated Soil (c)	**0**	**mg/kg**
Estimated Total TRPH Concentration in Saturated and Unsaturated Soil	**5,524.0**	**mg/kg**
Estimated Air Extraction Volumetric Flow Rate (e)	**187,200**	**ft^3/ day**
Estimated Air Extraction Mass Flow Rate (f)	**14,040**	**lbs air/day**
Estimated Total Mass of TRPH in Saturated and Unsaturated Soil	**5,506**	**lbs**

(a) Based on the fixed laboratory analysis of soil samples S-1, SS-2, S-5 , and SS-10
(b) Based on the calculations performed in Appendix B.
(c) Assumed that there is no groundwater contamination.
(d) Based on the SVE remedial time calculations presented in Appendix D.
(e) Estimated Air Extraction Volumetric Rate = flow rate (scfm) x 60 minutes x operation hours
(f) Estimated Air Extraction Mass Flow Rate = density of air (lb/ft3) x daily volumetric extraction rate (ft3/day)

NOTES
atm=atmospheres
scfm = Standard cubic feet per minute
mg/kg = Milligram per kilogram
TRPH = Total Petroleum Hydrocarbons
°F=degrees Fahrenheit

Table D-1
Estimated Remedial Time
Soil Vapor Extraction System

Remedial Action Plan
UST Site 1363
Naval Station Mayport
Mayport, Florida

Time (Month)	Mass Removed (lbs)	Cumulative Mass Removed (lbs)	Mass Remaining (lbs)	Soil Conc. Remaining (mg/kg)	Mass Removal Rate (lbs/day)	Cleanup Level Achieved?
1	2326.7	2326.7	3179.6	3189.8	77.56	no
2	1343.5	3670.3	1836.0	1841.9	44.78	no
3	775.8	4446.1	1060.2	1063.6	25.86	no
4	448.0	4894.1	612.2	614.2	14.93	no
5	258.7	5152.8	353.5	354.7	8.62	no
6	149.4	5302.2	204.1	204.8	4.98	yes
7	86.3	5388.4	117.9	118.3	2.88	yes
8	49.8	5438.2	68.1	68.3	1.66	yes
9	28.8	5467.0	39.3	39.4	0.96	yes
10	16.6	5483.6	22.7	22.8	0.55	yes
11	9.6	5493.2	13.1	13.1	0.32	yes
12	5.5	5498.7	7.6	7.6	0.18	yes

Note: The mass removed for the first month is determined using an assumption that the initial concentration in the soil is equal the concentration in the vapor removed from the soil. It is then multiplied by the extraction rate to calculate mass removed. The mass removed for the remaining months is determined by the remaining soil concentration multiplied by the extraction rate. (TtNUS, 1999)

Assumption: 1 month = 30 days

PREPARED BY: _____ **CHECKED BY:** _____
Date

APPENDIX E

FDEP REMEDIAL ACTION PLAN SUMMARY FORM

FLORIDA

Remedial Action Plan Summary

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

Site Name UNDERGROUND STORAGE TANK SITE 1363/1363-G
Location NAVAL STATION MAYPORT
Media Contaminated: ☐ Groundwater ☒ Soil

FDEP Facility ID No. _____
Current Date 9/10/01
Date of Last GW Analysis 7/1/99

Type(s) of Product(s) Discharged:
☐ Gasoline Analytical Group
☒ Kerosene Analytical Group (Diesel)
- Estimated Petroleum Mass (lbs):
  - Groundwater _____
  - Saturated Zone Soil _____
  - Vadose Zone Soil 5506
- Area of Plume 2408 (ft^2)
- Thickness of Plume 4 (ft)

Groundwater Recovery and Specifications:
- No. of Recovery Wells _____
  ☐ Vertical ☐ Horizontal
- Design Flow Rate/Well _____ (gpm)
- Total Flow Rate _____ (gpm)
- Hydraulic Conductivity _____ (ft/day)
- Recovery Well Screen Interval _____ (ft)
- Depth to Groundwater _____ (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 _____ (gal)
- Maximum Thickness _____ (in)
- Method of Recovery (check all that apply):
  ☐ Manual Bailing ☐ Skimming Pump
  ☐ Other _____

Method of Soil Remediation:
☒ Excavation
  Volume to be Excavated 357 (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: 15 (days)
- Method of Estimation
  ☐ Pore Volumes (no. of pore vols. = _____)
  ☐ Exponential Decay (Decay Rate) ____ (day^{-1})
  ☐ Groundwater Model
  ☒ Other PAST EXPERIENCE W/ EXCAVATION

Estimated Cost:
- Est. Capital Cost (incl. install.) $ 160,000.00
- Est. O & M Cost (per year) $ 0
- Est. Total Cleanup Cost $ 160,000.00