N00213.AR.000227
NAS KEY WEST
5090.3a

REMEDIAL ACTION PLAN FLYING CLUB SITE BUILDING A-127 BOCA CHICA FIELD NAS KEY WEST FL

8/1/1997

ABB ENVIRONMENTAL SERVICES INC

0094

REMEDIAL ACTION PLAN

FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
BOCA CHICA FIELD
KEY WEST, FLORIDA

UNIT IDENTIFICATION CODE: N00213
CONTRACT NO. N62467-89-D-0317/098

AUGUST 1997

SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
NORTH CHARLESTON, SOUTH CAROLINA
29419-9010

REMEDIAL ACTION PLAN

FLYING CLUB SITE, BUILDING A-127
NAVAL AIR STATION KEY WEST
BOCA CHICA FIELD
KEY WEST, FLORIDA

Unit Identification Code: N00213

Contract No.: N62467-89-D-0317/098

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle, East
Tallahassee, Florida 32301

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418

Byas Glover, Code 18410, Engineer-in-Charge

August 1997

CERTIFICATION OF TECHNICAL
DATA CONFORMITY (MAY 1987)

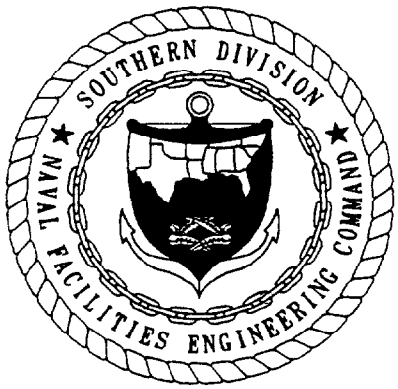
The Contractor, ABB Environmental Services, Inc., hereby certifies that, to the best of its knowledge and belief, the technical data delivered herewith under Contract No. N62467-89-D-0317/098 are complete and accurate and comply with all requirements of this contract.

DATE: August 15, 1997

NAME AND TITLE OF CERTIFYING OFFICIAL: Kathleen M. Hodak
Task Order Manager

NAME AND TITLE OF CERTIFYING OFFICIAL: Michael K. Dunaway, P.E., P.G.
Project Technical Lead

(DFAR 252.227-7036)



FOREWORD

Subtitle I of the Hazardous and Solid Waste Amendments (HSWA) of 1984 to the Solid Waste Disposal Act (SWDA) of 1965 established a national regulatory program for managing underground storage tanks (USTs) containing hazardous materials, especially petroleum products. Hazardous wastes stored in USTs were already regulated under the Resource Conservation and Recovery Act (RCRA) of 1976. Subtitle I requires that the U.S. Environmental Protection Agency (USEPA) promulgate UST regulations. The program was designed to be administered by individual States, who were allowed to develop more stringent, but not less stringent standards. Local governments were permitted to establish regulatory programs and standards that are more stringent, but not less stringent than either State or Federal regulations. The USEPA UST regulations are found in the Code of Federal Regulations, Title 40, Part 280 (40 CFR 280) (*Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks*) and 40 CFR 281 (*Approval of State Underground Storage Tank Programs*). 40 CFR 280 was revised and published on September 23, 1988, and became effective December 22, 1988.

The Navy's UST program policy is to comply with all Federal, State, and local regulations pertaining to USTs. This report was prepared to satisfy the requirements of Chapter 62-770, Florida Administrative Code (FAC) (*State Underground Petroleum Environmental Response*) regulations on petroleum contamination in Florida's environment as a result of spills or leaking tanks or piping.

Questions regarding this report should be addressed to the Commanding Officer, Naval Air Station Key West, Boca Chica Field, Key West, Florida, or to Southern Division, Naval Facilities Engineering Command, Byas Glover, Code 18410, at AUTOVON 563-0658 or (803) 743-0658.

EXECUTIVE SUMMARY

The purpose of this Remedial Action Plan (RAP) is to present a plan for remediation of petroleum contamination at the Flying Club site, Building A-127 at Naval Air Station Key West, Boca Chica Field, Key West, Florida. The RAP presented herein is designed for implementation at the Flying Club site to reduce the level of petroleum-related contamination in the soil and groundwater in accordance with the requirements of Chapter 62-770, Florida Administrative Code (FAC).

This RAP presents the rationale for the remedial actions to be implemented at the Flying Club. Implementation of remedial actions described in this RAP are covered under the FDEP Bureau of Waste Cleanup, Engineering Support Section guideline number ESS-9 "Limited Scope RAPs." This RAP will include the following tasks:

- excavation and treatment of excessively contaminated soil;
- installation of one well in the center of the excavation area and replacement of monitoring wells that may become damaged or destroyed during excavation activities;
- development of a groundwater monitoring program to establish that the RAP cleanup goals have been met; and
- monitoring of the system for up to 1 year.

ACKNOWLEDGMENTS

In preparing this report, the Underground Storage Tank Section of the Comprehensive Long-Term Environmental Action, Navy, group at ABB Environmental Services, Inc., commends the support, assistance, and cooperation provided by the personnel at Naval Air Station Key West, Boca Chica Field, Key West, Florida, and Southern Division, Naval Facilities Engineering Command.

TABLE OF CONTENTS

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

TABLE OF CONTENTS (Continued)

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

LIST OF FIGURES

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

LIST OF TABLES

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
AST	aboveground storage tank
AVGAS	aviation gasoline
bls	below land surface
CA	contamination assessment
CAR	Contamination Assessment Report
FAC	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
mg/ℓ	milligrams per liter
MTBE	methyl tert-butyl ether
NAS	Naval Air Station
OVA	organic vapor analyzer
PAH	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
ppb	parts per billion
ppm	parts per million
RAP	Remedial Action Plan
SOUTHNAV-FACENGCOM	Southern Division, Naval Facilities Engineering Command
SVE	soil vapor extraction
TRPH	total recoverable petroleum hydrocarbons
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VOA	volatile organic aromatics
yd^3	cubic yard

1.0 INTRODUCTION

A Contamination Assessment Report (CAR) for the Boca Chica Flying Club at Naval Air Station (NAS) Key West, Florida, was submitted by ABB Environmental Services, Inc., (ABB-ES) in April 1994 to Southern Division, Naval Facilities Engineering Command (SOUTHNAVFACENGCOM). The CAR was approved on May 10, 1994, by the Florida Department of Environmental Protection (FDEP) (Appendix A). After approval of the CAR, ABB-ES was authorized by SOUTHNAVFACENGCOM to develop a Remedial Action Plan (RAP) in accordance with Chapter 62-770.700, Florida Administrative Code (FAC). This work is being performed under Contract Task Order No. 98 of the Comprehensive Long-term Environmental Action, Navy contract.

1.1 PURPOSE. The purpose of this RAP is to present a plan for remediation of petroleum contamination at the Flying Club site, Building A-127. The RAP presented herein is designed for implementation at the Flying Club site to reduce the level of petroleum-related contamination in the soil and groundwater in accordance with the requirements of Chapter 62-770, FAC.

1.2 SCOPE. This RAP presents the rationale for the remedial actions to be implemented at the Flying Club. Implementation of remedial actions described in this RAP are covered under the FDEP Bureau of Waste Cleanup, Engineering Support Section guideline number ESS-9 "Limited Scope RAPs." This RAP will include the following tasks:

- excavation and treatment of excessively contaminated soil;
- installation of one well in the center of the excavation area and replacement of monitoring wells that may become damaged or destroyed during excavation activities;
- development of a groundwater monitoring program to establish that the RAP cleanup goals have been met; and
- monitoring of the system for up to 1 year.

2.0 BACKGROUND

2.1 SITE DESCRIPTION. NAS Key West is located approximately 150 miles southwest of Miami in Monroe County, Florida (Figure 2-1). NAS Key West, a complex of activities located in numerous areas of the Lower Florida Keys, encompasses approximately 5,000 acres. The majority of these activities are concentrated on Boca Chica Key and Key West. The mission of NAS Key West is to maintain and operate facilities and provide services and materials to support operations of aviation activities and units designated by the Chief of Naval Operations. The Flying Club is a former parking and refueling area that was located along the northwest boundary of Taxiway "H," approximately 50 to 100 feet south of Building A-133 at Boca Chica Field (Figure 2-2). The northwest boundary of the site is bordered by an 8-foot chain-link fence. There are three structures located on the northern side of the fence: Buildings A-126, A-127, and A-133.

The area in the immediate vicinity of the Flying Club is covered by a caliche-type surface (a hard soil layer cemented by calcium carbonate) with scattered grass and some broken asphalt. The site is bordered along the southeast by a concrete apron that is part of Taxiway "H," which is used for airplane and helicopter parking. A 6-inch-high concrete curb running northeast to southwest is located approximately 20 feet northwest of Taxiway "H." An underground storm drain parallels the concrete curb over much of the site area. An underground utility line also runs parallel to the concrete curb on the northwest side of the curb.

2.2 SITE HISTORY AND CURRENT SITE ACTIVITIES AND CONDITIONS. Building A-126 was formerly used as a transportation facility and is currently used as an electrical maintenance and repair facility. Building A-127 was formerly used as a transportation facility and is currently inactive. Building A-133 is a remnant of a former motor pool refueling point and is currently used to store transformers, some of which contain polychlorinated biphenyls (PCBs). Discussions with activity personnel indicated that underground storage tank(s) (USTs) associated with the motor pool refueling operations had been removed. Labels on the transformers indicated that they contained less than 50 parts per million (ppm) of PCBs. Interviews with NAS Key West personnel indicate that the area in the vicinity of Building A-133 may also have been used as an automotive hobby shop and staging area.

The Flying Club is currently inactive. During the site investigation, routine engine testing and refueling operations were observed on the Taxiway "H" southeast of the Flying Club. The Flying Club site is the former location of four aboveground storage tanks (ASTs) and associated dispensers and piping, which reportedly contained aviation gasoline (AVGAS). Three ASTs reportedly had capacities of 560 gallons each. The fourth AST reportedly had a capacity of 1,000 gallons. According to facility personnel, the Boca Chica Flying Club was in operation until the late 1960s. The ASTs, fuel dispensers, and associated piping were removed from the site in February 1992. Overfilling of the ASTs is the suspected cause of petroleum contamination at the site.

2.3 CAR SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS. ABB-ES was contracted by the SOUTHNAVFACENGCOM to perform a contamination assessment (CA) at the Flying Club site at NAS Key West to investigate the reported leakage of former gasoline ASTs.

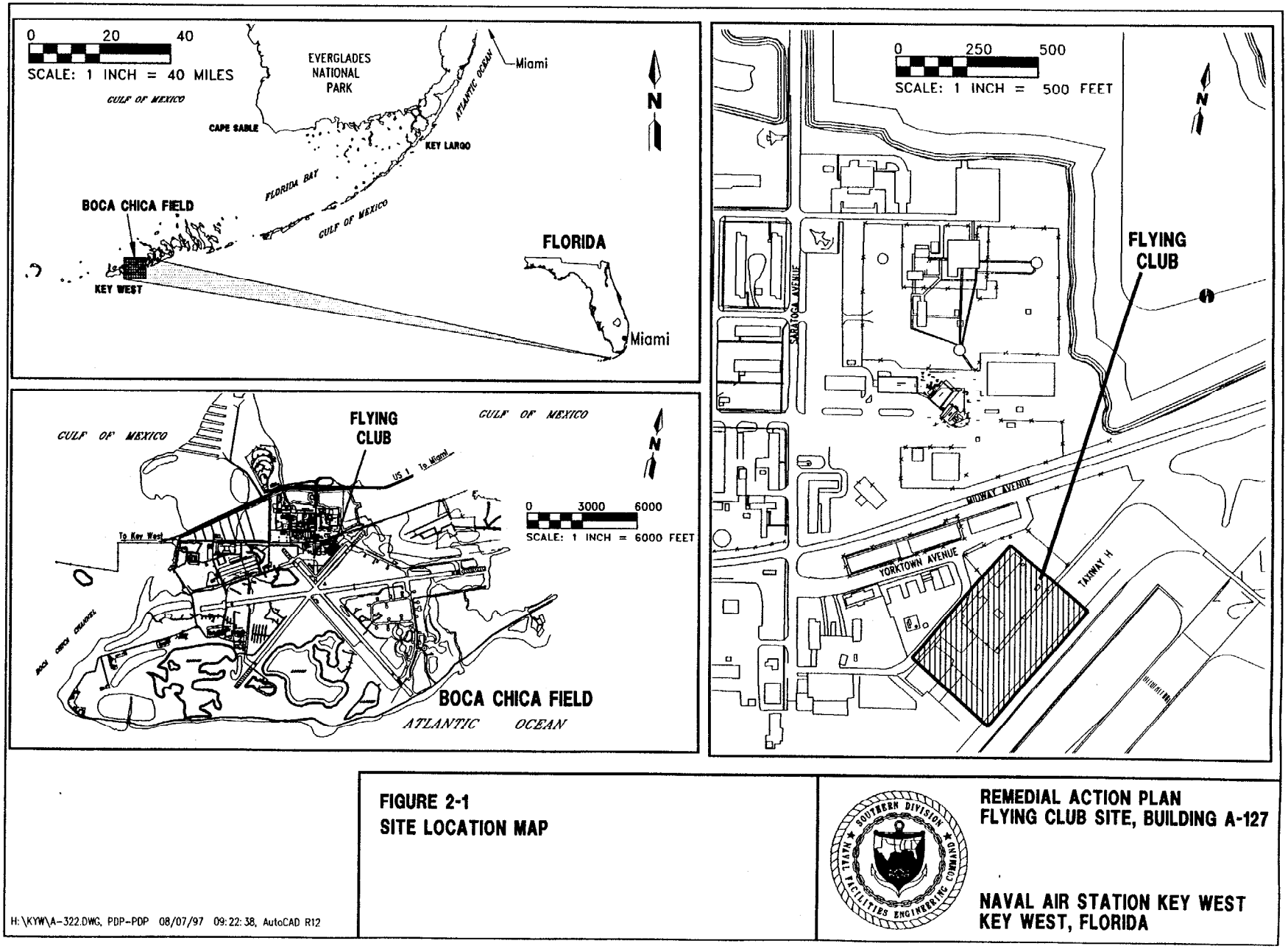


FIGURE 2-1
SITE LOCATION MAP

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

H:\KYW\A-322.DWG, PDP-PDP 08/07/97 09:22:38, AutoCAD R12

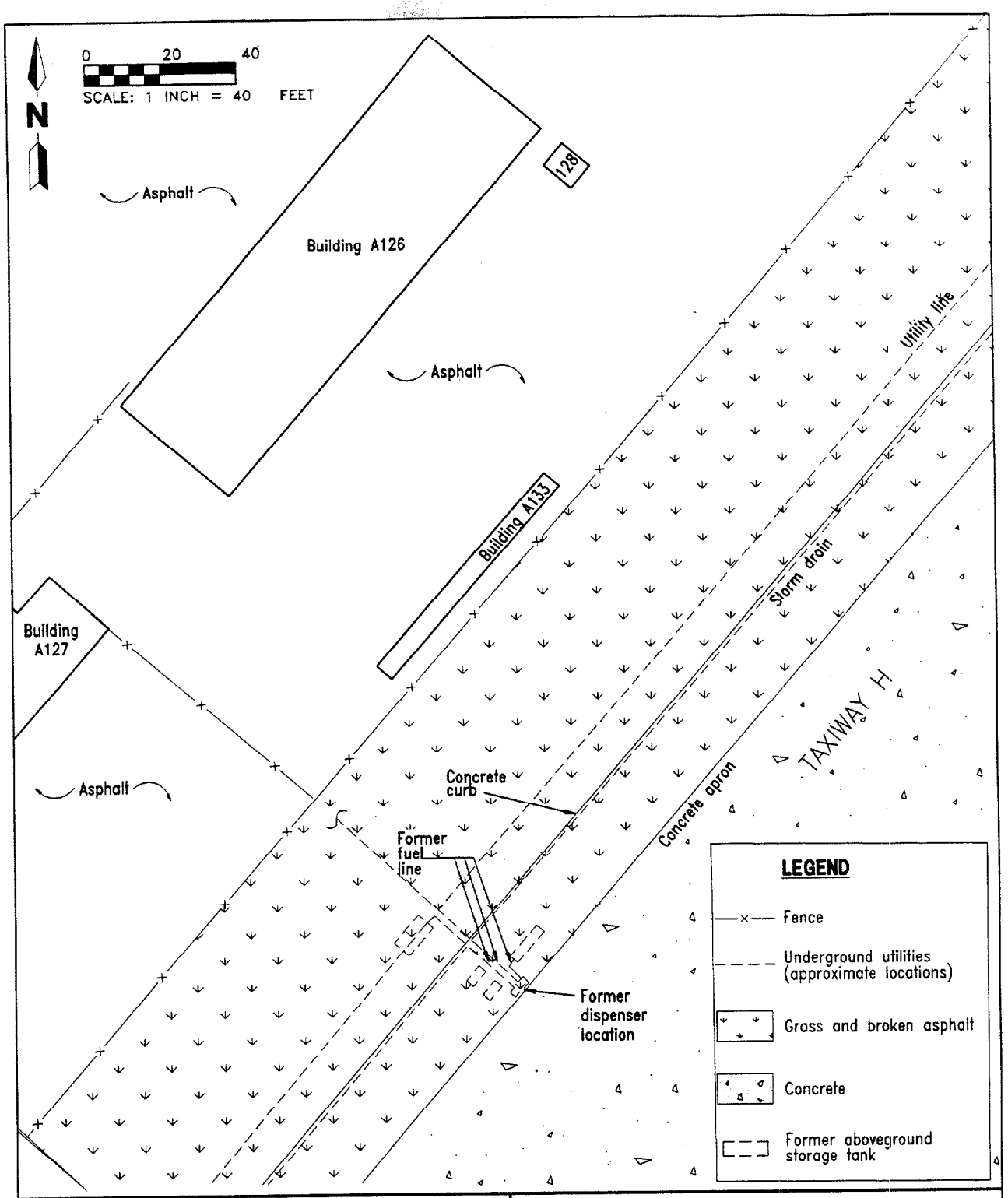


FIGURE 2-2
SITE PLAN

H:\KYW\RAP\FLYCLUB.DWG, -PDP 07/29/97 15:23:45, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

The CA was conducted from October to December 1993. The objectives were to identify petroleum contaminants, assess the degree and extent of petroleum contamination in the soil and the groundwater, and recommend remedial actions, if necessary, to attain compliance with State regulations. The assessment involved a field investigation and sampling program to assess the source(s) and extent of contamination in the site vicinity and included the following:

- drilling 71 soil borings and analyzing site soil to assess the extent of soil contamination;
- installing and sampling 20 groundwater monitoring wells and sampling one existing, compliance monitoring well to assess the extent of groundwater contamination;
- collecting water-level data to assess the groundwater flow direction and hydraulic gradient at the site;
- conducting a potable well inventory within a 1-mile radius of the site;
- conducting slug tests on selected wells to estimate aquifer characteristics; and
- reducing and analyzing pertinent data gathered during the CA.

2.3.1 CAR Summary Based on the findings of the CA field investigations and laboratory analytical results, a summary of existing conditions at the site is detailed below.

- The primary water-bearing zone of concern at the site is the surficial aquifer. The surficial aquifer in the Boca Chica area is unconfined. Water quality data indicate that the surficial aquifer in the Key West area is an unlikely source of potable water (McKenzie, 1990); thus, the surficial aquifer is treated herein as a Class G-III groundwater source.
- The surficial aquifer was penetrated to a depth of 32 feet below land surface (bls) during the investigation. Indigenous subsurface material is generally composed of a mixture of oolitic sand; light gray, non-plastic clay; and limestone gravel.
- The water table at the site was encountered at depths ranging from 2.5 to 4.5 feet bls.
- The direction of groundwater flow in the surficial aquifer is to the northeast. A tidal influence study indicates that groundwater elevations are tidally affected; however, the direction of groundwater flow appears to be consistently to the northeast.
- Four separate areas of excessively contaminated soil were observed using organic vapor analyzer (OVA) headspace analyses. The most extensive soil contamination was detected along the southeast side of Building A-133. Excessive soil contamination appears to be restricted to within 1 to 2 feet above the water table.

- Total volatile organic aromatics (VOA); methyl tert-butyl ether (MTBE); polynuclear aromatic hydrocarbons (PAH), including naphthalenes; total recoverable petroleum hydrocarbons (TRPH), lead, and several chlorinated compounds were detected in groundwater samples. Total VOA, TRPH, and lead results were compared to State target levels for Class G-III groundwater. Because Class G-III groundwater target levels are not available for the other contaminants, other standards were applied for comparative purposes. MTBE and total naphthalenes concentrations were compared to Class G-II groundwater target levels (Chapter 62-770, FAC). PAH (excluding naphthalenes) and chlorinated compound concentrations were compared to State groundwater guidance concentrations (Florida Department of Environmental Regulation, 1989).

- State target levels for Class G-III groundwater were exceeded for total VOA, benzene, and lead. Total VOA concentrations exceeded the State target level of 200 parts per billion (ppb) in only the samples collected from monitoring wells KYW-A-127-MW4 (1,300 ppb) and KYW-A-127-MW6 (305 ppb). Lead exceeded the State target level of 50 ppb in only the sample collected from monitoring well KYW-A-127-MW11 (65 ppb). TRPH concentrations were below the State target level of 5 ppm for Class G-III groundwater.

- Total naphthalenes concentrations exceed the State target level of 100 ppb for G-II groundwater in only the sample collected from monitoring well KYW-A-127-MW1 (186 ppb). PAH concentrations exceed the State groundwater guidance concentration of 10 ppb in only the samples collected from monitoring wells KYW-A-127-MW1 (35 ppb) and KYW-A-127-MW6 (11 ppb).

- No potable water sources were identified within a 1-mile radius of the site. There are no potable wells on Boca Chica Key, and potable water is obtained from southern Florida.

- No free product was found in any site monitoring wells.

2.3.2 CAR Conclusions Based on the findings of the CA and site conditions, the following was concluded.

- Excessively contaminated soil directly above the water table may be an indication of residual groundwater contamination rather than soil contamination. The highest OVA headspace readings were almost exclusively recorded in samples collected just above the water table. The tidal influence study indicates that significant variations in water table elevations as a result of tidal fluctuations occur at the site. The vertical movement of the groundwater as a result of tidal fluctuations will cause a spreading of contamination in the soil both immediately above and below the water table. The high OVA readings recorded in soil samples collected just above the water table may be the result of residual groundwater contamination during periods of low water table elevations.

- The areal extent of groundwater contamination exceeding applicable (and compared) standards appears to be restricted to the vicinity of the

former AVGAS ASTs and along the southeast side of Building A-133, near the former motor pool refueling point.

- Benzene is the major contaminant of concern at the site. Benzene concentrations exceed the State target level of 200 ppb for Class G-III groundwater in only the sample collected from monitoring well KYW-A-127-MW4 (710 ppb).

- Groundwater petroleum contamination appears to decrease with depth. With the exception of 1,1-dichloroethene, which was detected in the sample collected from vertical extent monitoring well KYW-A-127-MW15D, contaminant concentrations were either not detected or were below applicable (or compared) standards in the samples collected from the vertical extent wells, KYW-A-127-MW14D and KYW-A-127-MW15D.

- The reported sources of groundwater contamination, the AVGAS ASTs, associated piping and dispensers, and the gasoline USTs located at the former motor pool refueling point near Building A-133, have been removed from the site.

- Because there are no potable water sources at Boca Chica Field, the risk to human health caused by groundwater contamination at the site appears to be low.

- There is no evidence indicating that groundwater contaminants are migrating off the site. There are no surface water bodies that appear to be threatened by the contaminated area. Therefore, groundwater contamination at the site appears to be a low risk to area fish and wildlife.

2.3.3 CAR Recommendations Based on the findings, conclusions, and interpretations of the CA, ABB-ES recommended that groundwater remediation be implemented at the site to comply with State regulations regarding concentrations of benzene, lead, and total VOA in Class G-III groundwater. The manner of groundwater remediation should be presented in an RAP.

2.4 SUPPLEMENTAL ANALYTICAL RESULTS. In August 1996, a second round of groundwater data was collected to confirm the conditions at the site were consistent with 1993 analytical data presented in the CAR. The 1996 data indicated some significant change in the magnitude and location of the groundwater contaminants. In addition to groundwater data, natural attenuation parameters were collected to investigate the feasibility of natural attenuation as a remedial action.

2.4.1 Summary of 1996 Supplemental Analytical Results A summary of the 1996 analytical results follows.

- The water table at the site was encountered between 2.7 and 4.2 feet bls.

- All 20 monitoring wells at the site were sampled for volatile organics (U.S. Environmental Protection Agency [USEPA] Method 602) including MTBE, PAHs (USEPA Method 610), ethylene dibromide (USEPA Method 504), TRPH (FL-PRO), and dissolved lead (USEPA Method 239.2).

- Groundwater at the site has been identified in the approved CAR as G-III groundwater. No Further Action (NFA) G-III groundwater State target levels were exceeded only in monitoring wells KYW-A-127-MW6. Benzene concentrations exceeded the State target level of 200 ppb (210 ppb) and the total VOA target level of 200 ppb (1,470 ppb).

- Groundwater analyticals for natural attenuation parameters were collected from KYW-A-127-MW4 for dissolved iron, total iron, sulfide, chlorine, bacteria and specific petroleum degrading bacteria, hardness, alkalinity, sulfate, nitrate and nitrite.

- Groundwater analytical data, collected for natural attenuation purposes, from KYW-A-127-MW4 indicated concentrations that were below the detection limits for dissolved iron, total iron, sulfide, sulfate, phosphates, nitrate and nitrite. Concentrations were reported for chlorine as 17 ppm. The groundwater from KYW-A-127-MW4 had a pH of 7, hardness of 146 milligrams per liter (mg/ℓ) as calcium carbonate and an alkalinity of 180 mg/ℓ as calcium carbonate. The number of colony forming units of bacteria for total bacteria and specific petroleum degrading bacteria were below the quantitation limits.

- Dissolved oxygen readings were collected from each monitoring well using a dissolved oxygen meter. Dissolved oxygen concentrations are contoured on Figure 2-3.

- One soil sample (RB-1) was collected in an area of previously identified excessively contaminated soil south of Building A-133 at a depth of 3 to 5 feet bls. This sample was collected for grain size analysis, total organic carbon, fraction of organic carbon, total nitrogen, phosphate, total petroleum hydrocarbon (TPH), bacteria and specific petroleum degraders. Soil natural attenuation parameter results are located in Appendix F.

2.4.2 Discussion of 1996 Supplemental Analytical Results

2.4.2.1 **Groundwater Analytical Results** Groundwater analytical results from 1993 indicated three locations that exceeded the NFA G-III State target levels. These locations included KYW-A-127-MW4 for benzene (710 ppb) and total VOA (1,300 ppb), KYW-A-127-MW6 for total VOA (305 ppb), and KYW-A-127-MW11 for lead (65 ppb). Groundwater analytical results from August 1996 show a decrease in contaminant concentrations to below NFA G-III State target levels for two of the three locations, KYW-A-127-MW4 and KYW-A-127-MW11, and an increase in concentration for the remaining location, KYW-A-127-MW6, for total VOA (1,470 ppb) and benzene (210 ppb).

Groundwater concentrations around KYW-A-127-MW4 and KYW-A-127-MW11 may have been reduced due to plume redistribution or lack of contact with the limited extent of excessive soil contamination in that area. Concentrations at KYW-A-127-MW6 may have increased due to increased groundwater contact with the excessive soil contamination identified in that area.

2.4.2.2 **Natural Attenuation Analytical Results** Natural attenuation parameters appear to be too low for biodegradation to have occurred in the groundwater around monitoring well KYW-A-127-MW4. Nitrogen and phosphorous are generally necessary

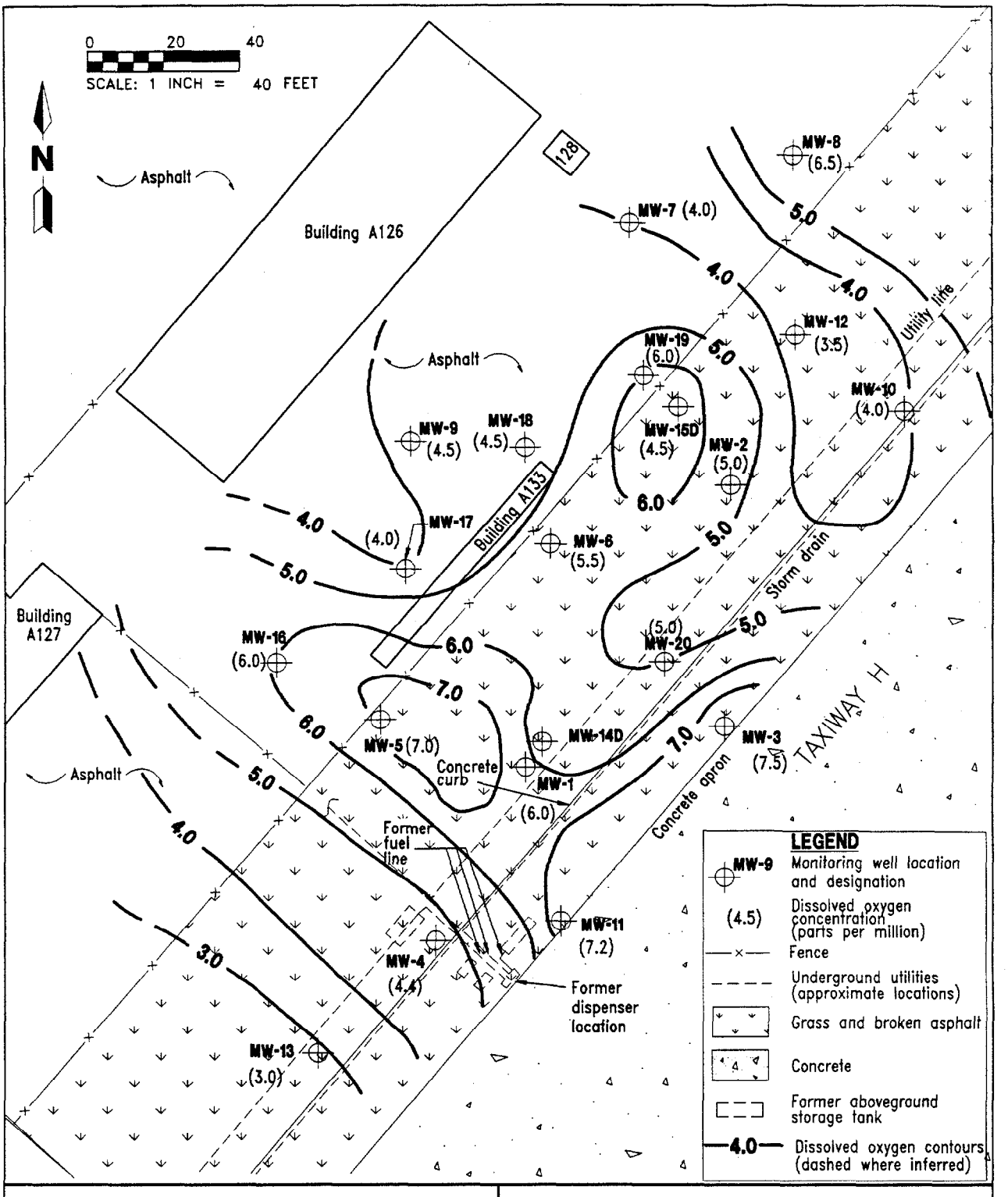


FIGURE 2-3
DISSOLVED OXYGEN DISTRIBUTION MAP

H:\KYW\RAP\FLYCLUB.DWG, PDP-PDP 08/11/97 09:07:29, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

to promote biological activity in an aerobic environment. The absence of these nutrients in the soil or the groundwater would tend to inhibit the biodegradation of contaminants in the saturated soil zone. Also, due to the low population of bacteria and specific petroleum degraders present in the groundwater, it is unlikely that biodegradation is responsible for the reduction in the groundwater concentrations around KYW-A-127-MW4.

Dissolved oxygen concentrations across the site do not present a pattern of oxygen utilization across the site, but instead, display an increase in oxygen concentrations in the excessively contaminated soil area. This indicates that aerobic biodegradation of the contaminants is not the reason for reduction in contaminant concentrations around KYW-A-127-MW4 and KYW-A-127-MW11.

Natural attenuation parameters collected from RB-1 appear to be too low for biodegradation to occur in the unsaturated soil zone. Nutrient samples of nitrogen and phosphorous were below the detection limits. The absence of these nutrients in the soil would tend to inhibit the biodegradation of the contaminants within the unsaturated zone. Also, the low population of bacteria and specific petroleum degrading bacteria within the soil indicate that biodegradation alone may not contribute significantly to the reduction of contaminated soil concentrations.

2.4.2.3 **Soil Analytical Results** The CA indicates that excessive soil contamination is present in four areas (Figure 2-4). Soil borings OVA readings identify contamination at depths between 2 and 6 feet bls. Readings between 4 and 6 feet bls are not displayed on Figure 2-4 due to the degree of saturation of the soil at that depth. Only SB-13 had an OVA reading greater than 50 ppm in the zero to 2 foot bls interval. One soil sample and a duplicate sample taken in 1996, from soil boring RB-1, indicate TPH concentrations of 3,530 mg/ℓ and 3,890 mg/ℓ, respectively. These soil samples collected at depths between 3 and 5 feet bls indicate that contaminated soil identified during the CA is still present and may be a continuing source of contamination at the site.

2.4.3 **Revised Recommendations for Remediation** Remediation of the contaminated soil at the site should be implemented to address the soil contamination and associated groundwater issues. Groundwater contamination at the site in excess of the NFA G-III State target levels is generally limited to the area of excessively contaminated soils and should be treated as soil contamination for remediation efforts. Once residual soil contamination in the water table fluctuation zone is removed, groundwater concentrations should return below the NFA G-III State target levels.

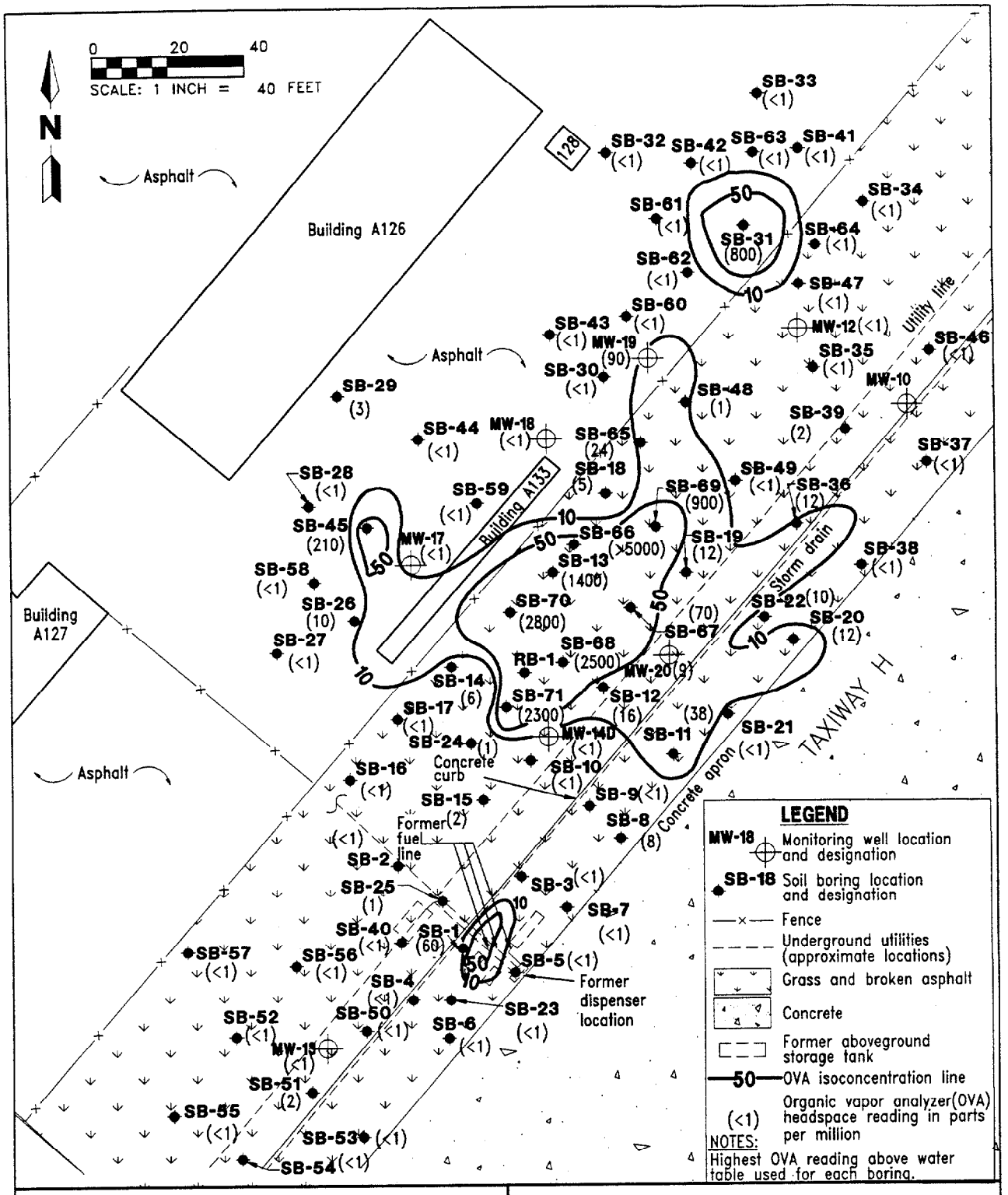


FIGURE 2-4
SOIL CONTAMINATION DISTRIBUTION MAP

H:\KYW\RAP\FLYCLUB.DWG, NMP-PDP 08/08/97 12:10:26, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

3.0 REMEDIAL ALTERNATIVES

3.1 CONTAMINANTS OF CONCERN. Contamination at the site appears to be the result of leaks and spills from the former AVGAS ASTs. Based on the available data, the Chapter 62-770, FAC, kerosene analytical group of contaminants are contaminants of concern for soil and groundwater remedial efforts. For soil, contaminants of concern include excessively contaminated soil, whereby excessively contaminated soil is identified as soil with an OVA reading of greater than 50 ppm. For groundwater, the contaminants of concern include

- volatile organics,
- PAHs,
- ethylene dibromide, and
- dissolved lead.

MTBE and TRPH were detected at concentrations below action levels as prescribed by Chapter 62-770, FAC; therefore, MTBE and TRPH are not considered to be site contaminants of concern.

3.2 APPLICABLE CLEANUP STANDARDS.

3.2.1 Applicable Soil Cleanup Standards Soil contamination at the site exceeds standards presented in Chapter 62-770, FAC. For the kerosene analytical group, soil with an OVA reading greater than 50 ppm is considered excessively contaminated. The target cleanup concentration for soil contamination is 10 ppm, which is the lower limit whereby soil may or may not be treated. Standards and regulations regarding required remedial goals for soil are contained in the *Guidelines for Assessment and Remediation of Petroleum Contaminated Soil* (FDEP, 1994) and should be applied following treatment by any method. Table 3-1 provides the organic standards for clean soil, and Table 3-2 gives the metal standards for clean soil.

3.2.2 Groundwater Cleanup Standards The Chapter 62-770, FAC, kerosene analytical group of contaminants, the contaminant migration potential, and future groundwater usage will be the basis for the groundwater remedial consideration. No potable water sources were identified within a 1-mile radius of the site. There are no potable wells on Boca Chica Key, and potable water is obtained from southern Florida. The groundwater in the surficial aquifer at the Flying Club site is identified in the approved CAR to be classified as G-III. Action levels to meet NFA G-III State target levels for groundwater concentrations of contaminants detected at the Flying Club site are as follows:

Parameter	Groundwater Target Concentration
Benzene	200 ppb
Total VOA	200 ppb
Dissolved lead	50 ppb

3.3 EXTENT OF CONTAMINATION. Presently, there are no known active sources of petroleum contamination. All storage tanks have been removed and fuel carrying pipes are currently inactive. The extent of contamination requiring remediation

Table 3-1
Organics Standards for Clean Soil

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

Contaminant	Maximum Concentration
Total Volatile Organic Aromatics, and 1 or 2.	100 ppb
1. Total Recoverable Petroleum Hydrocarbons (TRPH), or	10 ppm
2. TRPH, and	50 ppm
Polynuclear Aromatic Hydrocarbons	1 ppm
Volatile Organic Halocarbons	50 ppb

Notes: ppb = parts per billion.
ppm = parts per million.

Table 3-2
Metals Standards for Clean Soil

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

Metal	Maximum Concentration	
	TCLP (mg/ℓ)	Total (mg/kg)
Arsenic	5.0	10
Barium	100.0	4,940
Cadmium	1.0	37
Chromium	5.0	50
Lead	5.0	108
Mercury	0.2	23
Selenium	1.0	389
Silver	5.0	353

Notes: TCLP = toxicity characteristic leaching procedure.
mg/ℓ = milligrams per liter.
mg/kg = milligrams per kilogram.

at the Flying Club site is limited to the excessively contaminated soil. Groundwater samples were collected from each monitoring well on October 9, 1993, and again on August 20, 1996. Samples were analyzed for constituents of the kerosene analytical group. A summary of the analytical results is presented in Appendix B, Table B-1. A summary of the soil samples and OVA analyses is presented in Appendix B, Table B-2.

3.3.1 Groundwater Contamination Groundwater contamination that exceeds the NFA criteria for G-III groundwater is evident at this site in only one groundwater monitoring well (KYW-A-127-MW6). This groundwater contamination is believed to be the result of groundwater contact with the excessive soil contamination in the water table fluctuation zone.

3.3.2 Soil Contamination The soil contamination for the Flying Club site is associated with a limited area of excessively contaminated soil at depths between 1 and 6 feet bls. Four areas of excessively contaminated soil were identified by OVA headspace analysis in the unsaturated zone between zero and 4 feet bls (Figure 3-1). OVA concentrations collected from the saturated soils between 4 and 6 feet bls are not included on Figure 3-1 due to the degree of saturation of the soil samples collected during the CA. However, the seasonal water table may fall below 4.5 feet bls during drier seasons, revealing soil contamination in the lower range of the water table smear zone.

The largest area of excessive soil contamination is located southeast of Building A-133. This area is approximately 70 feet long and 40 feet wide. Three smaller isolated areas were identified: (1) in the vicinity of the former AVGAS ASTs surrounding soil boring SB-1, (2) on the northwest side of Building A-133 at soil boring SB-45, and (3) in the northern part of the site at soil boring SB-31.

3.3.3 Free Product Free product was not observed in any site monitoring wells during the investigation conducted in 1993 or during the resampling event performed in August 1996.

3.4 SITE-SPECIFIC LIMITATIONS TO ALTERNATIVES. Site-specific limitations often exist that can affect remedial alternative selection. At the Flying Club site, several factors that should be considered in the design process are the low permeability of the soil at the water table, the shallow water table, and the hard caliche surface covering the site. While the Flying Club site is inactive, the adjacent taxiway is active, and access to the site is limited due to aircraft traffic along this taxiway. Subsurface features such as stormwater sewers, electric lines, telephone lines, and service lines exist (Figure 3-2). These subsurface features should be located with the base public works department prior to any excavation, drilling, or trenching activities at the site.

3.5 REMEDIAL STRATEGY. A remedial effort should be designed to address the area associated with excessively contaminated soil. This treatment effort should have a scope that corresponds to the degree of contamination present and should complete the remedial action efficiently. Remedial construction and monitoring activities should be discreet due to the aircraft traffic along Taxiway "H." Removal of the contaminated soil within the water table fluctuation zone should eliminate soil contamination as a source for contamination at the site. Once soil

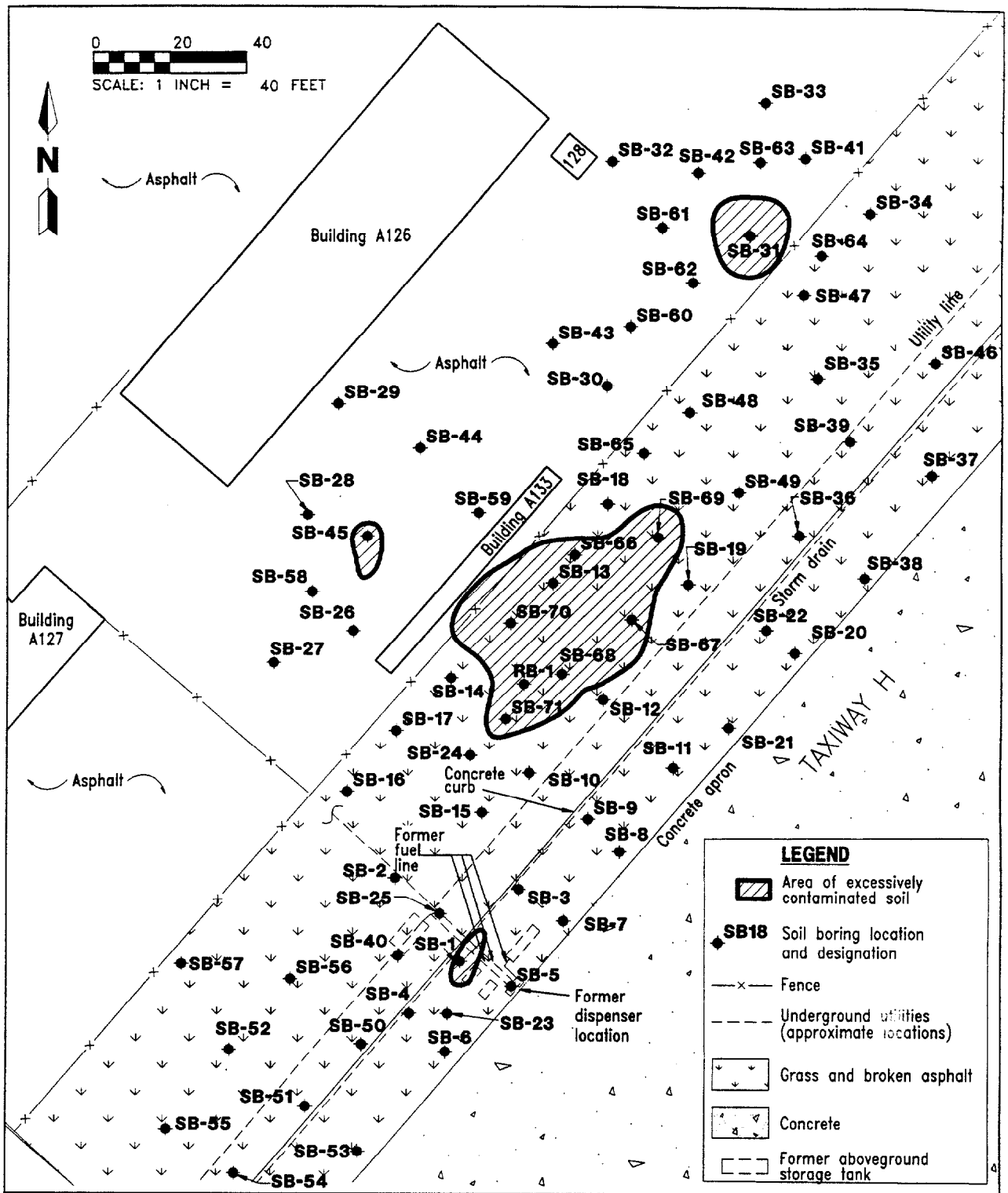


FIGURE 3-1
APPROXIMATE AREAS OF EXCESSIVELY CONTAMINATED SOIL

H:\KYW\RAP\FLYCLUB.DWG, PDP-PDP 08/07/97 14:51:33, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

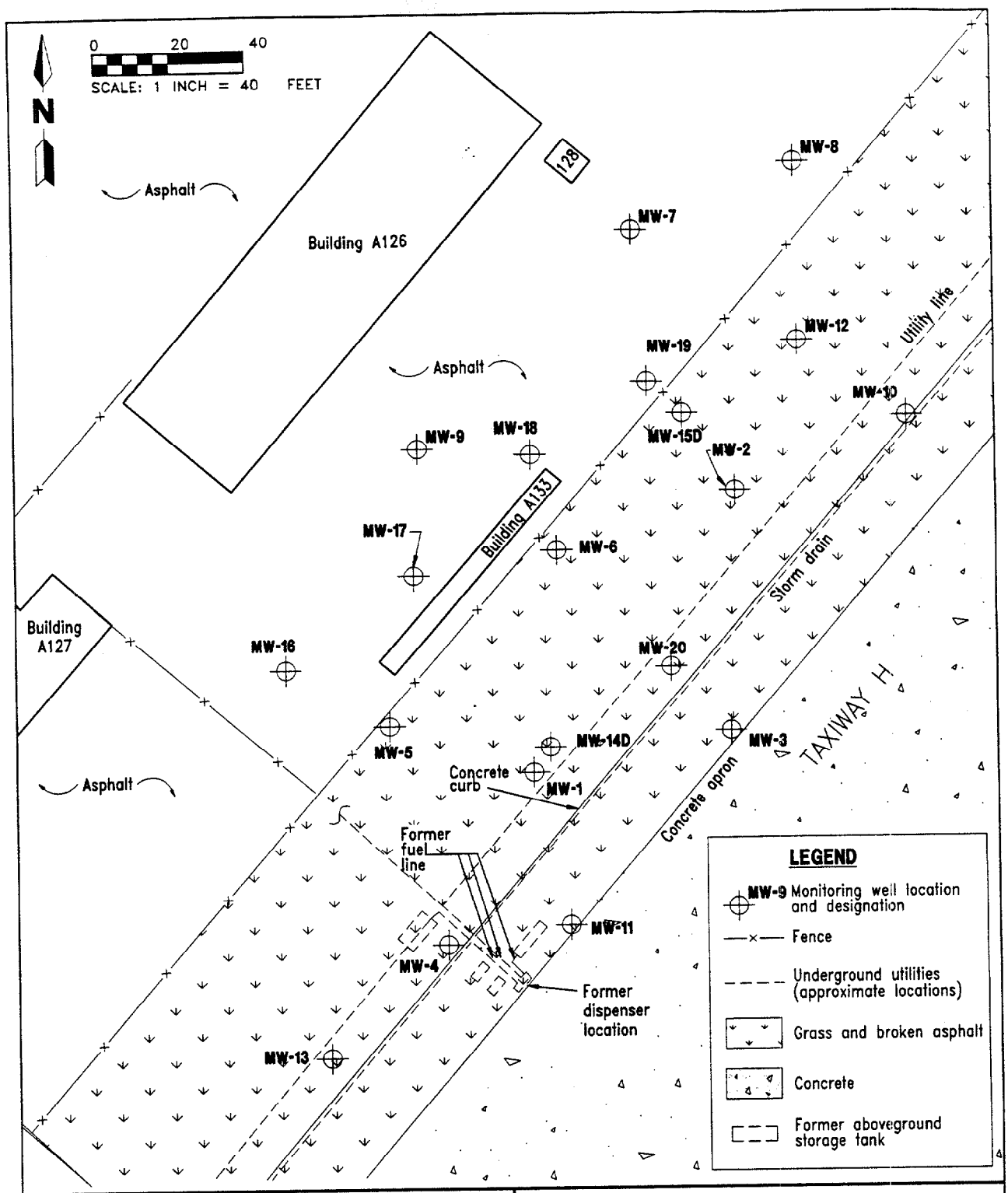


FIGURE 3-2
KNOWN UTILITIES

H:\KYW\RAP\FLYCLUB.DWG, PDP-PDP 08/07/97 15:36:13, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

contamination in the water table fluctuation zone is removed, groundwater, which is no longer in contact with excessively contaminated soils, should return to concentrations below the NFA G-III State target levels.

3.6 **DISCUSSION OF ALTERNATIVES**. After defining the contaminants of concern, the applicable cleanup standards, the extent of contamination, and developing a remedial strategy, it is necessary to identify and screen technologies that may be applicable to mitigating the contamination at the site. Because each site is unique and cleanup technologies applicable to sites contaminated with petroleum substances are continually being improved and developed, it is important to develop remedial action alternatives using the most effective technologies available. Generally, two possible approaches are available for soil remediation. These are *ex situ* and *in situ* alternatives.

3.6.1 ***Ex Situ* Treatment** *Ex situ* treatment alternatives involve soil excavation followed by a selected treatment alternative. Six *ex situ* treatment technologies that are applicable to this site are onsite incineration, onsite oxidation and reduction, thermal desorption, thermal aeration, off-site incineration, and off-site landfilling. Each of these alternatives is briefly described in Table 3-3.

3.6.2 ***In Situ* Treatment** Two types of *in situ* treatments that may be suitable to this site are soil vapor extraction (SVE) and biological degradation or intrinsic biodegradation.

SVE systems may be used to remediate soil in the vadose zone or dewatered saturated zones. This technology generally consists of vacuuming gases from unsaturated soil through SVE wells with vacuum pumps. Negative pressure induced by the vacuum draws gases through the soil pore spaces. Air inlet wells combined with a surface cover may be used to facilitate the flow of atmospheric air into the soil to replace the extracted gases. Soil permeability and contaminant volatility are major factors in the success of these systems. The extracted gases can be treated as necessary before discharge to the atmosphere. Implementation of an SVE system at the Flying Club site may be difficult due to the shallow water table. SVE systems that have a vadose zone of less that 10 feet tend to short circuit air flow from the surface and lower the effectiveness of an SVE system.

Intrinsic biodegradation or biological degradation can be accomplished if sufficient oxygen, nutrients and moisture levels occur below land surface. If microorganisms are present in the vadose zone and proper conditions are met, aerobic or anaerobic degradation of the contaminants can occur. Oxygen levels in the vadose zone are sometimes controlled to maximize the degrading capacity of the microorganisms. Samples taken in the excessively contaminated area using TerraProbe℠ sampling capabilities were analyzed for petroleum degrading bacteria, total phosphorous, and total Kjeldahl nitrogen. These samples did not indicate favorable conditions for biological degradation at this site.

3.7 **ALTERNATIVE SELECTION**. The remedial action taken at the Flying Club site should take into account the existing site-specific considerations and conditions. In this section, alternatives will be considered and an appropriate selection will be made.

Table 3-3
Ex Situ Soil Treatment Technologies

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West
Boca Chica Field, Key West, Florida

General Response Action	Soil or Sediment Technology	Description
Soil removal and disposal	Off-site landfill	Soil or sediment not regulated by RCRA land disposal restrictions is excavated and hauled to a secure, existing landfill.
Soil removal and treatment	Onsite incineration	Soil or sediment is excavated and treated by a mobile incinerator that thermally destroys organics in a direct-fired treatment unit.
	Thermal aeration	Soil or sediment is excavated and treated by a mobile unit that volatilizes organic contaminants from soil or sediment and destroys them in a secondary combustion chamber.
	Thermal desorption	Soil or sediment is excavated and treated by a mobile unit that volatilizes organic contaminants from soil or sediment and condenses them into a liquid stream.
	Off-site incineration	Soil or sediment is excavated and hauled to a licensed incinerator that thermally destroys organics in a direct-fired treatment unit.
	Onsite Chemical Reduction Process	Soil or sediment is excavated and hauled to a mobile unit that reduces the contaminants in the soil through oxidation and ionic reactions.

Note: RCRA = Resource Conservation and Recovery Act.

3.7.1 **Soil Remediation** In the area of excessively contaminated soil, excavation to a depth of approximately 6 feet bls is recommended for the contaminated area contained within the 50 ppm isoconcentration line.

Ex situ onsite treatment alternatives for sites of this magnitude are not generally considered feasible because the amount of soil to be excavated does not warrant the mobilization of equipment and manpower to treat it. For this reason, many onsite options are eliminated from further consideration.

An *ex situ* off-site alternative would usually be suggested due to the small amount of soil to be remediated; however, the closest permitted treatment facility is maintained in Dade County, Florida, which would require the transportation of the contaminated soil over a distance of 160 miles. Expenses incurred in the transportation of the contaminated soil over that distance requires that other onsite options be evaluated.

3.7.2 **Conclusion** Due to the increase in concentration in monitoring well KYW-A-127-MW6, soil remediation of the excessively contaminated soil around and upgradient of this monitoring well is recommended. Remediation of the soil will be conducted in an effort to capture any excessive contamination contained in the capillary fringe and the water table fluctuation zone. The seasonal fluctuation of the water table at the site has caused the groundwater to contact the excessively contaminated soil. Excavation of the soil within that seasonal water table fluctuation zone will remove the excessively contaminated soil and reduce the groundwater concentrations around KYW-A-127-MW6 to below NFA G-III State target levels.

4.0 RECOMMENDED REMEDIAL ACTION

The recommended remedial action for contaminated soils at the Flying Club site is the implementation of a soil excavation effort to remove contaminants from the unsaturated zone and the water table fluctuation zone. Excavation and treatment by chemical reduction should be performed. Excavation to a depth of 6 feet bls is proposed for the area shown on Figure 4-1. The total volume of soil to be excavated is approximately 2,126 cubic yards (yd^3). The upper foot of soil will be screened to determine if it is excessively contaminated and may be stored onsite to be used as fill during site restoration activities. The remaining volume associated with contaminated soil is approximately 1,770 yd^3. Soil volume calculations, presented in Appendix C, include a swell factor of 67 percent for the excavation of limestone.

Onsite chemical reduction is retained as the recommended remedial action due to the logistics and potential transportation costs associated with off-site technologies. Chemical reduction is retained over other onsite technologies, such as onsite mobile incineration, due to the ease of implementability of the chemical reduction setup and the possibility of raising public concern over incineration operations. Chemical reduction also does not discharge petroleum hydrocarbons as vapors and will not require air monitoring during treatment. Onsite chemical reduction also will not require excessive transportation of the contaminated soil. Soils will be transported approximately 6 miles to a large paved area at Trumbo Point, which will be the location of the chemical reduction setup. Chemical reduction of the contaminated soil will not destroy the organics in the soil and will allow the native soil to be used as backfill following proper sampling and analysis of the treated soils.

4.1 EXCAVATION. Excavation of the excessively contaminated soil will be conducted using standard earthmoving equipment. All operators will be certified by the Occupational Safety and Health Administration. Excavated soil from the top foot, approximately 365 yd^3, may not be contaminated and will be screened with an OVA to determine if the top foot of soil may be stockpiled onsite in a designated area. OVA headspace analyses will be performed at set intervals during the excavation to monitor soil contaminant levels. When excessive soil contamination (OVA readings in excess of 50 ppm) is reached, excavation of contaminated soil will continue vertically to a depth of 6 feet bls, and horizontally until contaminant concentrations are below 50 ppm on the OVA. Any water that is removed from the excavation will be removed and disposed of by a licensed hazardous waste transporter. Manifests for the water disposal should be retained for inclusion in the excavation completion report.

The excavation should have sides sloped or shored in accordance with applicable standards to prevent unstable conditions during excavation that could pose hazards to personnel or surrounding structures and pavements. Stormwater runoff controls should be implemented to prevent off-site migration of sediment or contaminated stormwater during site activities. Dust control should be implemented to prevent soil particle transfer onto the adjacent taxiway during excavation and soil handling. Dust control is essential at this location due to the potential for damage to the jet engines of the aircraft that operate on the adjacent taxiway. Benchmarks, existing structures, fences, sidewalks, utilities, and other cultural features shall be protected from excavation equipment. A professional survey to

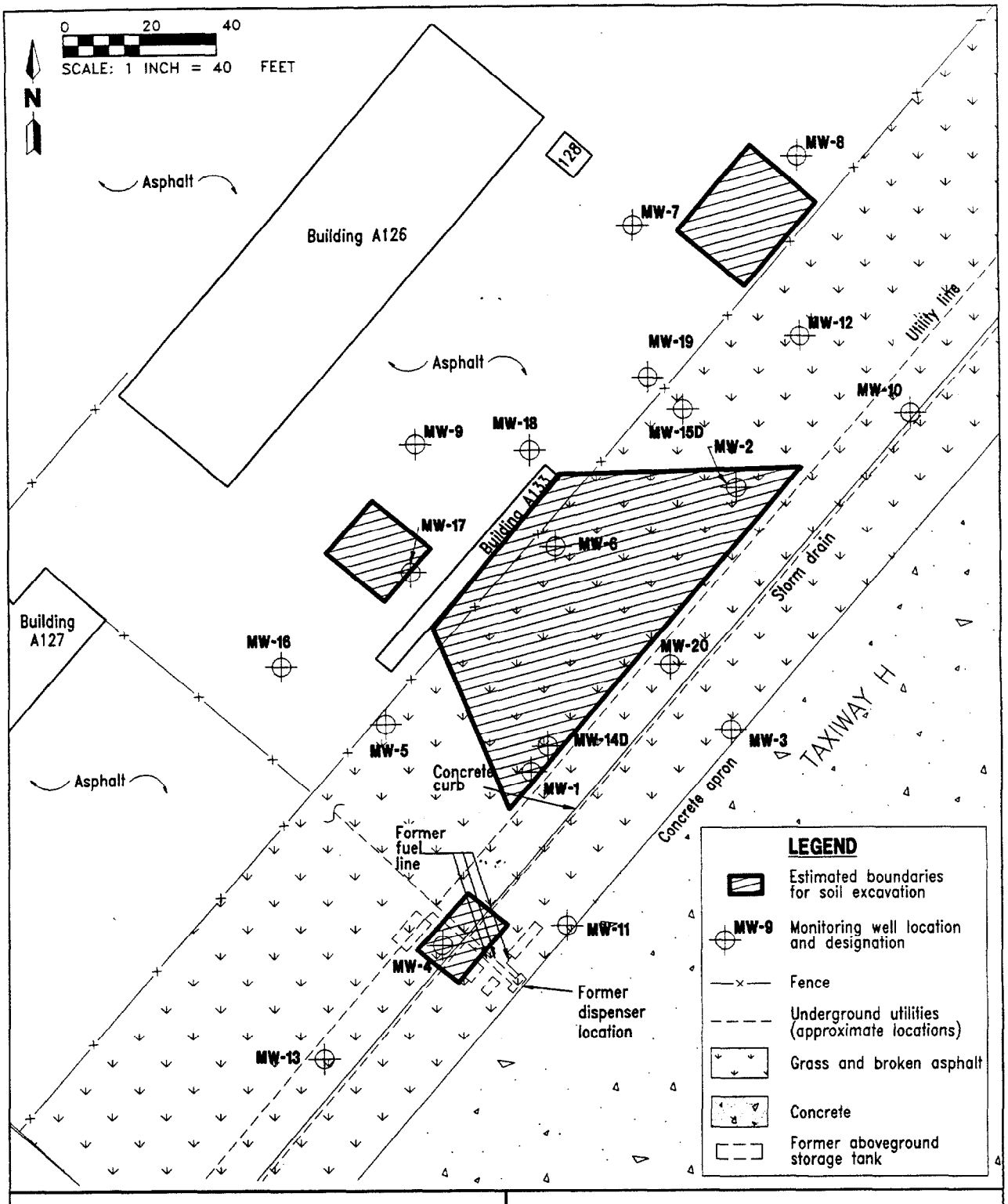


FIGURE 4-1
ESTIMATED BOUNDARIES FOR SOIL EXCAVATION

H:\KYW\RAP\FLYCLUB.DWG, PDP-PDP 08/07/97 16:13:13, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

verify locations of site utilities was not conducted for this report; however, active or inactive subsurface obstructions are believed to be present. Obstructions may include piping for sanitary sewerage, gas distribution, storm drainage and/or fresh and salt water distribution. Subsurface features should be field verified prior to excavating.

Monitoring wells should be abandoned (grouted and sealed) in accordance with Chapter 40C-3.57, FAC, prior to excavation. Well abandonment should be performed a minimum of 12 hours prior to the excavation. Proper permits will also be required. It is anticipated that the following wells will require abandonment and replacement: KYW-A-127-MW1, KYW-A-127-MW2, KYW-A-127-MW4, KYW-A-127-MW6, KYW-A-127-MW14D, KYW-A-126-MW17, and KYW-A-127-MW20. Each abandoned well will be replaced following completion of backfilling so that groundwater in those areas may be monitored following the remedial action. The original installation logs for these monitoring wells are provided in Appendix C. Typical shallow and deep monitoring well installation details for the Flying Club site are presented as Figures 4-2 and 4-3, respectively.

Access to the site is restricted due to the traffic of military aircraft along the taxiway adjacent to the Flying Club site. Excavation efforts will require a high level of caution and control for the debris and dust created during the excavation effort. Access to the flightline should be limited to one access point, and the adjacent taxiway will be swept twice daily to ensure particles from the excavation effort do not travel onto the flightline and into the traffic patterns of the military aircraft using the flightline taxiway.

4.1.1 **Excavated Soils Pretreatment Monitoring** Pretreatment soil samples will be collected every 50 tons and combined every 400 tons to make one composite sample for every 400 tons of soil excavated. Pretreatment soil samples will be analyzed at an analytical laboratory for the constituents indicated in Table 4-1. Excavated soil that is contaminated should be loaded directly into trucks to facilitate immediate site removal for treatment at the mobile chemical reduction facility and to prevent spreading of the contaminated soil at the site.

4.2 ***EX SITU* ONSITE TREATMENT TECHNOLOGY**. The selected technology uses ionized water and potassium permanganate in a process that chemically reduces the contaminants to water and carbon dioxide. The ionized water, which has a pH of 8 and small amounts of hydrogen peroxide, is run through an ion collider where it receives a charge prior to being mixed into the soil matrix. The contaminated soil moves through a five-step continuous feed process: (1)The soil is screened to remove debris, rocks and oversized materials, (2)sprayed with a mixture of ionized water and potassium permanganate, (3)mixed in a blade mill where more ionized water is added, (4)remixed, and (5)allowed to cure in a 400-ton stockpile for 12 to 48 hours (Figures 4-4 and 4-5).

The hydrocarbons in the soil will oxidize into carbon dioxide and water with residuals of potassium carbonate and manganese dioxide. This patented chemical oxidation process, by Nacor, Inc., is detailed in an FDEP review letter in Appendix D.

Excavated soils will be transported approximately 6 miles to the former sea plane parking area on Trumbo Point. This transportation away from the flightline area will minimize the potential for damage to naval aircraft engines from dust

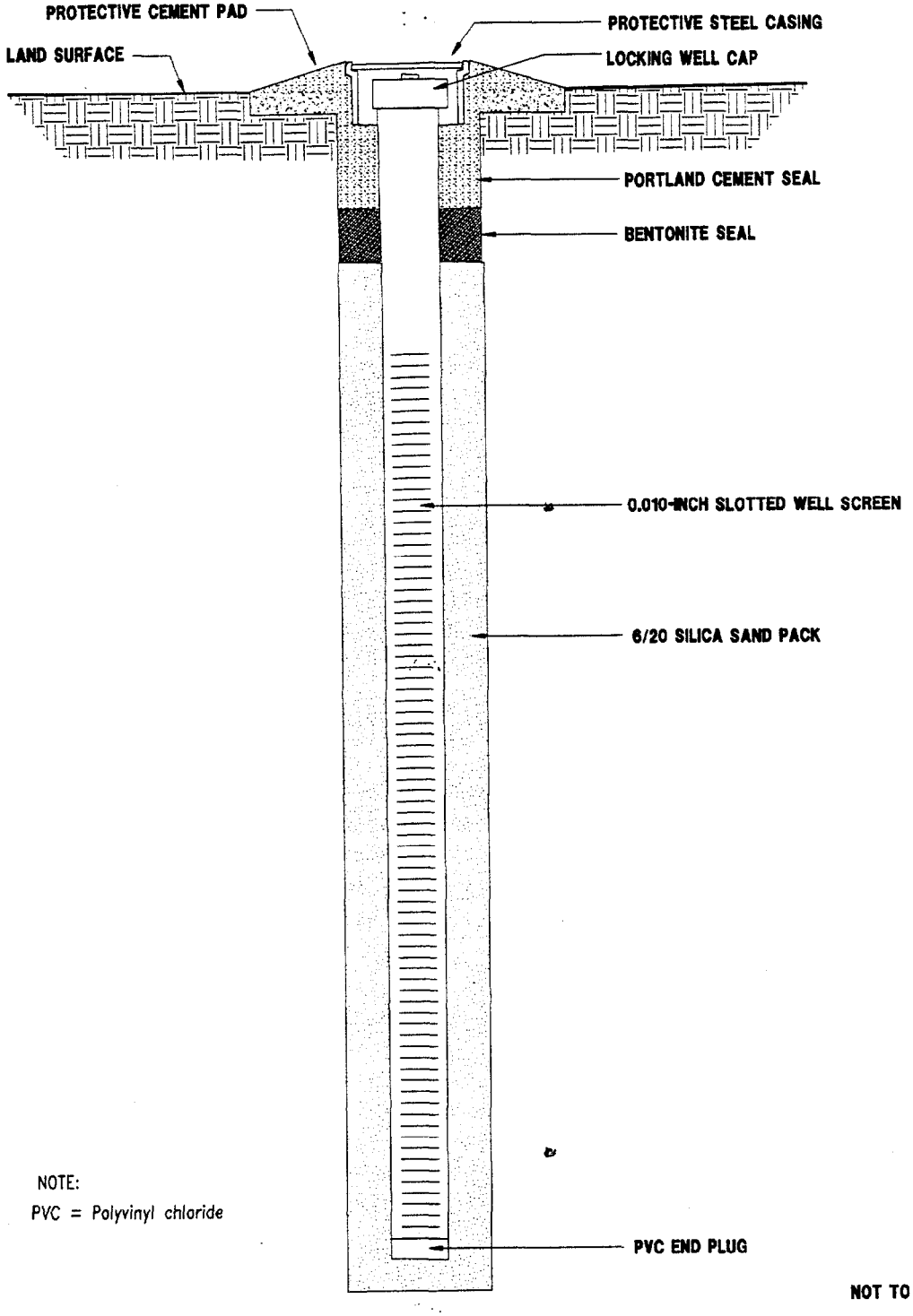
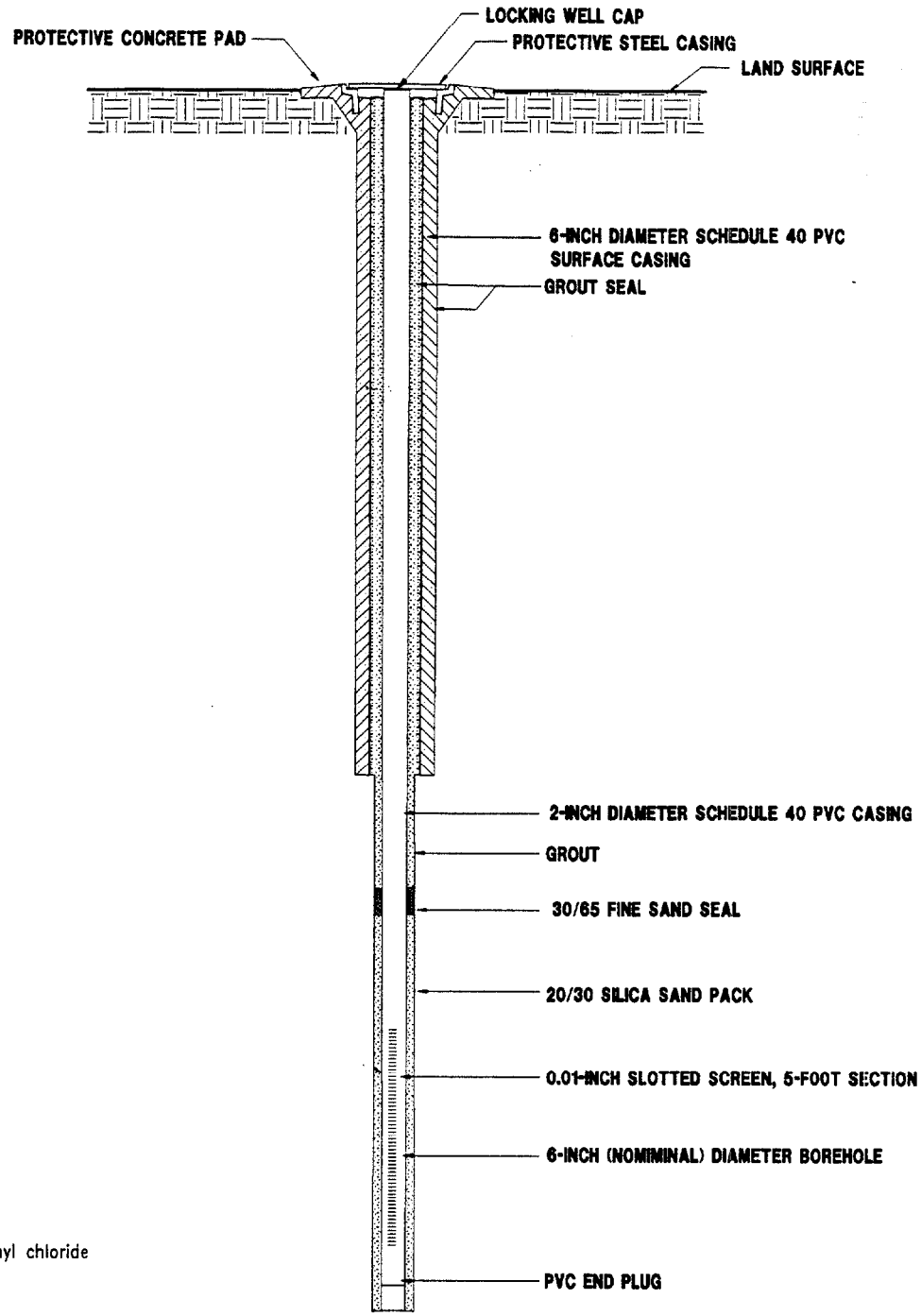


FIGURE 4-2
TYPICAL MONITORING WELL INSTALLATION DETAIL

H:\KYW\RAP\KEYWELL.DWG, NP-PDP 07/24/97 16:49:23, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA



NOTE:

PVC = Polyvinyl chloride

FIGURE 4-3
TYPICAL DEEP MONITORING WELL INSTALLATION DETAIL

H:\KYW\RAP\KEYWELL.DWG, NAB-PDP 07/25/97 09:27:12, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

Table 4-1
Soil Sampling and Analyses

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

Contaminant	Test Method
Total volatile organic aromatics (VOA)	USEPA Methods 5030/8020
Total recoverable petroleum halocarbons	USEPA Draft Method 9073
Polynuclear aromatic hydrocarbons (PAH)	USEPA Methods 3540/8100, 3550/8100, 3540/8250, 3540/8270, 3550/8250, 3550/8270, 3540/8310, or 3550/8320
Volatile organic halocarbons (VOH)	USEPA Method 5030/8010
Metals	
Arsenic	USEPA Methods 7060, 7061, or 6010
Barium	USEPA Method 7080 or 6010
Cadmium	USEPA Method 7130, 7131, or 6010
Chromium	USEPA Method 7190, 7191, or 6010
Lead	USEPA Method 7420, 7421, or 6010
Mercury	USEPA Method 7471
Selenium	USEPA Method 7040, 7041, or 6010
Silver	USEPA Method 7760 or 6010

Source: Chapter 62-775.400(4) through 62-775-410(1)(e), Florida Administrative Code.

Note: USEPA = U.S. Environmental Protection Agency.

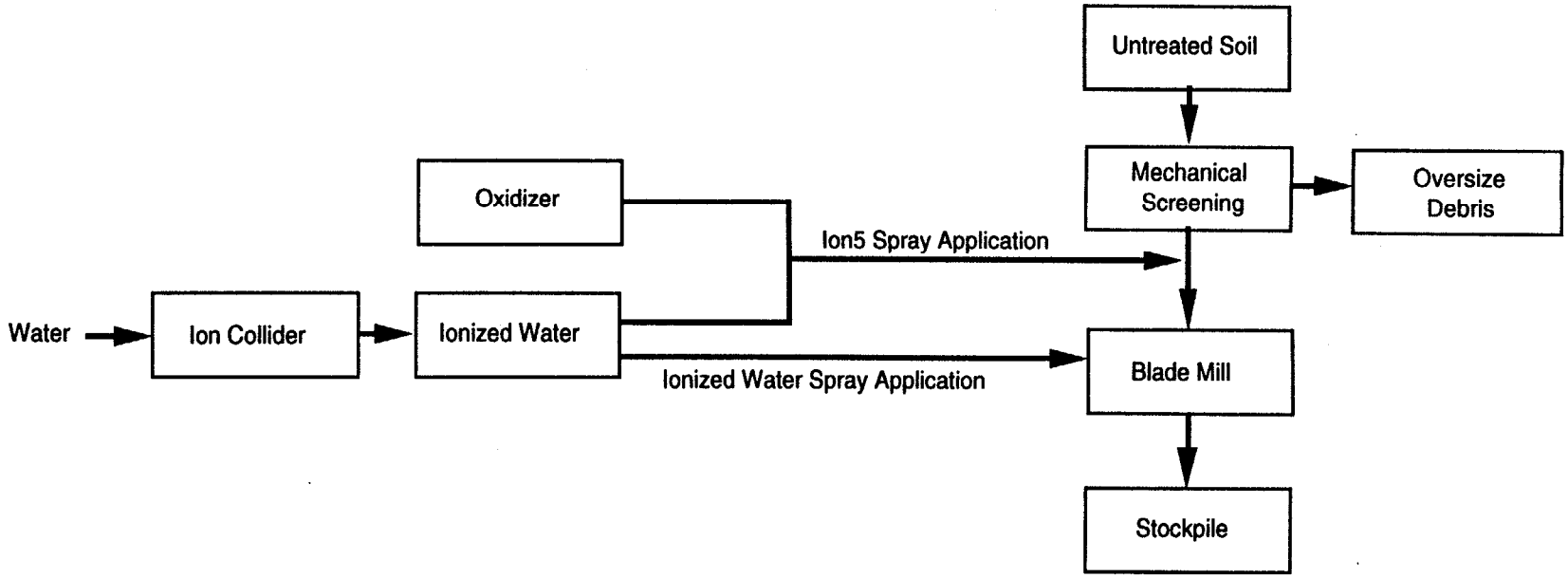


FIGURE 4-4
SOIL TREATMENT PROCESS FLOW DIAGRAM

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

8508-52 FIG 4-4 081297MAW

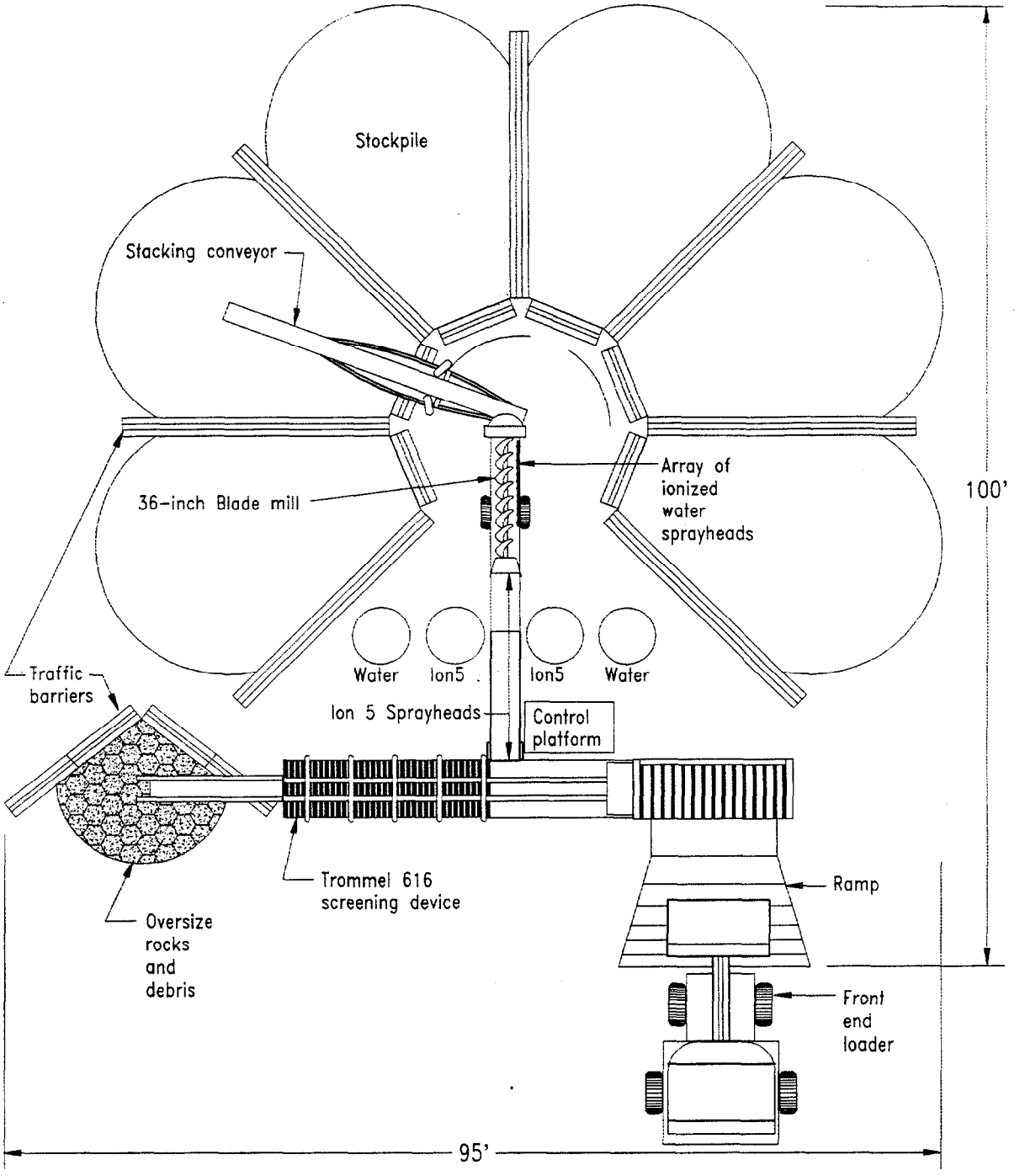


FIGURE 4-5
MOBILE TREATMENT UNIT LAYOUT

H:\KYW\RAP\STAKCON1.DWG, PDP-PDP 08/11/97 09:50:45, AutoCAD R12

REMEDIAL ACTION PLAN
FLYING CLUB SITE, BUILDING A-127

NAVAL AIR STATION KEY WEST
KEY WEST, FLORIDA

particles that may become airborne during soil handling and treatment activities. Stockpiled soils will be deposited in a Visqueen™-lined area bermed with traffic barriers to eliminate the spreading of any residual contamination. Stockpiles will be covered with Visqueen™ at the end of each day and during periods of precipitation to eliminate the potential for surface water runoff. Any stormwater or leachate that may collect in the Visqueen™-lined stockpile areas will be collected and removed from the site by a licensed hazardous waste transporter. Manifests for collected materials will be retained and included in the site completion report.

Calculations for the mass of emissions from the stockpiled soil indicate that the 13.7 pounds-per-day limit for petroleum will not be exceeded (Appendix C). Water content for the soil is not expected to exceed 20 to 40 percent saturation; therefore, leaching of contaminants from the soil is not expected.

4.3 SITE RESTORATION AND DEMOBILIZATION. Following the 12- to 48-hour soil curing period, soil samples will be collected from approximately 3 feet below the surface of each 400-ton soil stockpile. These samples will be sent to an analytical laboratory to be analyzed for the constituents in Table 4-1. These samples will be analyzed to ensure that the soil is suitable to return to the excavation. Once acceptable results are received from the analytical laboratory, the soil will be returned to the excavation as backfill. Soil Cleanup criteria are discussed in Chapter 3.0 of this report and displayed in Tables 3-1 and 3-2.

The stockpiled soil and backfill materials will be blended to a uniform consistency when placed in the excavation and field compacted in place to surrounding conditions with earthmoving equipment tracks to a minimum of 85 percent Proctor (American Society for Testing and Materials D1557) or approved equivalent. Backfill material will be compacted in lifts of approximately 1 foot. The excavation will be raised to above surrounding elevations and the grade will be sloped from the center outward to a minimum slope of 50 horizontal to 1 vertical so that runoff will flow away from the backfilled area. The slope will be blended into level areas, and the grade changes will be gradual. The gradation of the site will not be such that runoff will be directed onto the flightline taxiway.

Water should be removed from the excavation as necessary to accommodate soil compaction. Water removed from the excavation should be removed and disposed of by a licensed hazardous waste transporter. Manifests from the water disposal should be retained for inclusion in the excavation completion report.

Utility services should be disconnected, as necessary, during back fill operations, in coordination with base personnel. After completion, benchmarks, existing structures, fences, sidewalks, utilities, monitoring wells, and other cultural features to remain that were damaged or removed during remedial activities will be repaired or replaced. One additional shallow monitoring well will be placed in the center of the excavation for monitoring purposes. This well will be designated KYW-A-127-MW21. All lines and grades will be verified after all equipment and materials have been removed from the site and work is complete. Final review of project documentation as well as a walkover of the site will be conducted to assure satisfactory completion of the project prior to leaving the site.

4.4 QUARTERLY GROUNDWATER SAMPLING. Sampling and laboratory analysis of groundwater at the following designated locations will be conducted on a quarterly basis following site restoration.

- KYW-A-127-MW5 (upgradient monitoring well),
- KYW-A-127-MW6 (formerly contaminated monitoring well),
- KYW-A-127-MW12 (downgradient monitoring well), and
- KYW-A-127-MW21 (future monitoring well to be placed in the center of the excavation).

Groundwater samples from these wells, along with proper Quality Assurance/Quality Control samples (one trip blank, one equipment blank, and one duplicate sample), will be collected and analyzed at an approved laboratory for the parameters listed in the Chapter 62-770, FAC, kerosene analytical group. The schedule for site monitoring activities is shown in Table 4-2.

Table 4-2
Sampling Schedule, First Year

Remedial Action Plan
Flying Club Site, Building A-127
Naval Air Station Key West, Boca Chica Field
Key West, Florida

Task	Month											
	1	2	3	4	5	6	7	8	9	10	11	12
Measure water levels	X			X			X			X		
Sampling monitoring wells for Kerosene analytical group constituents	X			X			X			X		

Includes KYW-A-127-MW5, KYW-A-127-MW6, KYW-A-127-MW12, and KYW-A-127-MW21.

Groundwater samples will be collected with low-flow sampling equipment and shipped to an approved analytical laboratory, following proper procedures in accordance with ABB-ES's FDEP-approved Comprehensive Quality Assurance Plan (ABB-ES, 1992).

Upon completion of the fourth quarter sampling event, and if none of the monitoring parameters exceeds FDEP target cleanup levels, a request for an NFA designation will be prepared and submitted.

5.0 COST ESTIMATE

The cost estimate is inserted following Appendix E in report copies that require it and has been omitted in others. This was done to facilitate Navy procurement requirements.

6.0 SCHEDULE

The total cleanup time involved will constitute approximately 5 weeks.

- Mobilization of equipment and field crew for the actual excavation will take 1 day.
- Utility clearance for this site will take approximately 3 days.
- It is estimated that 1 day will be necessary for pretreatment sampling, allowing for 1 week turnaround time for laboratory analyses and report preparation.
- The soil removal will take approximately 5 days for excavation, transport, and treatment. Treated soil curing will take an additional 2 days.
- It is estimated that 1 day will be necessary for posttreatment sampling, allowing for 1 week turnaround time for laboratory analyses and report preparation.
- Time for compaction and backfill is estimated to be 2 days.
- Site restoration will take 2 days.
- Standby time such as time spent removing water or time spent during onsite analyses, will constitute 1 day of excavation time.

7.0 DOCUMENTATION

A site closure report will be provided following the excavation. The report should provide at a minimum the following:

- volume of soil removed;
- log of OVA readings and pretreatment sampling locations and laboratory analytical results;
- a map of the excavated area, including locations of utilities and obstructions;
- Material Safety Data Sheets for materials used or being treated;
- manifests and documentation of treatment and disposal;
- posttreatment soil analytical results;
- soil compaction confirmation; and
- volume and disposition of water removed for fill compaction purposes.

8.0 PROFESSIONAL REVIEW CERTIFICATION

This RAP was prepared using standard engineering practices and designs. The plan for remediating this site is based on the soil OVA concentration information collected between October and December 1993, the most recent groundwater concentration data collected in August 1996 and engineering detailed in the text and appended to this report. If conditions are determined to exist differently than those described, the undersigned professional engineer should be notified to evaluate the effects of any additional information on the design described in this report.

This RAP was developed for the Flying Club site, Building A-127, NAS Key West, Boca Chica Field, Key West, Florida, and should not be construed to apply to any other site.

Michael K. Dunaway
8/15/97

Michael K. Dunaway
Florida P.E. No. 39451

REFERENCES

ABB Environmental Services, Inc. (ABB-ES). 1992. *Comprehensive Quality Assurance Plan*. Tallahassee, Florida.

ABB-ES. 1994. *Contamination Assessment Report, Flying Club Site, Building A-127, Naval Air Station Key West, Boca Chica Field, Key West, Florida*. Prepared for Southern Division, Naval Facilities Engineering Command, North Charleston, South Carolina.

Florida Department of Environmental Regulation. 1989. Groundwater Guidance Concentrations. Compiled by R. Merchant, Division of Water Facilities 14 p. (February).

FDEP. 1994. Bureau of Waste Cleanup: Guidelines for Assessment and Remediation of Petroleum Contaminated soil. p.42 (May).

McKenzie, D.J. 1990. *Water Resources Potential of the Freshwater Lens at Key West, Florida*. U.S. Geological Survey, Water-Resources Investigations Report 90-4115.

APPENDIX A

DOCUMENTATION OF CONTAMINATION ASSESSMENT REPORT (CAR) APPROVAL

Florida Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

May 10, 1994

Mr. Gabriel Magwood
Code 1849
Department of the Navy
SOUTHNAVFACENGCOM
2155 Eagle Drive
North Charleston, South Carolina 29418

RE: Flying Club Site, Building A-127
Naval Air Station Key West
Boca Chica, Florida

Dear Mr. Magwood:

The Bureau of Waste Cleanup has reviewed the Contamination Assessment Report (CAR) dated April 1, 1994 (received April 15, 1994), submitted for this site. We found all the documents submitted to date to be adequate to meet the contamination assessment requirements of Rules 17-770.600 and 17-770.630, Florida Administrative Code (F.A.C.). Therefore, you must now submit a Remedial Action Plan (RAP) in accordance with Rule 17-770.700, F.A.C.

Please submit two copies of the RAP addressed to Eric S. Nuzie, Federal Facilities Coordinator, Department of Environmental Protection within two (2) months of receipt of this request, as required by Rule 17-770.700(1), F.A.C. If you should have any questions concerning this review, please contact me at (904) 488-0190.

Sincerely,

Jorge R. Caspary, P.G.
Technical Review Section
Bureau of Waste Cleanup

/jrc

cc: Bill Hunt, NAS Key West
Lisa Gordon, DER Southeast District Marathon Satellite Office
Roger Durham, ABB-Tallahassee
Caron Falconer, EPA-Atlanta

APPENDIX A

DOCUMENTATION OF CONTAMINATION ASSESSMENT REPORT (CAR) APPROVAL

Florida Department of
Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

May 10, 1994

Mr. Gabriel Magwood
Code 1849
Department of the Navy
SOUTHNAVFACENGCOM
2155 Eagle Drive
North Charleston, South Carolina 29418

RE: Flying Club Site, Building A-127
Naval Air Station Key West
Boca Chica, Florida

Dear Mr. Magwood:

The Bureau of Waste Cleanup has reviewed the Contamination Assessment Report (CAR) dated April 1, 1994 (received April 15, 1994), submitted for this site. We found all the documents submitted to date to be adequate to meet the contamination assessment requirements of Rules 17-770.600 and 17-770.630, Florida Administrative Code (F.A.C.). Therefore, you must now submit a Remedial Action Plan (RAP) in accordance with Rule 17-770.700, F.A.C.

Please submit two copies of the RAP addressed to Eric S. Nuzie, Federal Facilities Coordinator, Department of Environmental Protection within two (2) months of receipt of this request, as required by Rule 17-770.700(1), F.A.C. If you should have any questions concerning this review, please contact me at (904) 488-0190.

Sincerely,

Jorge R. Caspary, P.G.
Technical Review Section
Bureau of Waste Cleanup

/jrc

cc: Bill Hunt, NAS Key West
Lisa Gordon, DER Southeast District Marathon Satellite Office
Roger Durham, ABB-Tallahassee
Caron Falconer, EPA-Atlanta

APPENDIX C

DESIGN CALCULATIONS

VOLUME CONTAMINATED SOIL ESTIMATE -- MASS OF CONTAMINANT
NAS Key West, Flying Club, Building A127 Checked by: [signature]

The volume of contaminated soil to be excavated was estimated as shown below.

Using the area associated with the approximate extent of soil contamination shown in Figure 4-1, the volume of excavation is estimated.

Area of excavation	=	5728 ft^2
Depth of excavation	=	6 feet
Maximum observed water table depth	=	4.5 feet
Depth to water plus 1.5 ft	=	6 feet
Thickness of contamination	=	5 feet

The volume of soil to be excavated =

$$5{,}728\ ft^2 \times 6\ feet = 34{,}368\ ft^3 = 1{,}273\ yd^3$$

or with the 1.67 swell factor for limestone:

$$1{,}273\ yd^3 \times 1.67 = 2{,}126\ yd^3$$

The volume of contaminated soil =

$$5{,}728\ ft^2 \times 5\ feet = 28{,}640\ ft^3 = 1{,}060\ yd^3$$

Using a swell factor of 1.67, for limestone, from the table attached, the corrected volume of contaminated soil once excavated would be

$$1{,}060\ yd^3 \times 1.67 = 1{,}770\ yd^3$$

Using the conversion factor, 1 cubic yard of compacted soil weighs approximately 1.5 tons, the mass of contaminated soil is calculated:

$$1{,}060\ yd^3 \times 1.5\ \frac{tons}{yd^3} = 1{,}590\ tons$$

Percentage Swell and Load Factors of Materials

MATERIAL	SWELL, %	LOAD FACTOR
Cinders	45	0.69
Clay, dry	40	0.72
Clay, wet	40	0.72
Clay and Gravel, dry	40	0.72
Clay and Gravel, wet	40	0.72
Coal, anthracite	35	0.74
Coal, bituminous	35	0.74
Earth, dry loam	25	0.80
Earth, wet loam	25	0.80
Gravel, wet	12	0.89
Gravel, dry	12	0.89
Gypsum	74	0.57
Hardpan	50	0.67
Limestone	67	0.60
Rock, well blasted	65	0.60
Sand, dry	12	0.89
Sand, wet	12	0.89
Sandstone	54	0.65
Shale and soft rock	65	0.60
Slag, bank	23	0.81
Slate	65	0.60
Traprock	65	0.61

Reference:

Florida Department of Environmental Protection, Guidelines for Assessment and Remediation of Petroleum Contaminated Soil, May, 1992.

Merritt, Frederick S., Ed., 1983, Standard Handbook for Civil Engineers, Third Edition: McGraw-Hill Book Co., New York, ch. 13 p. 17.

WEATHERED GASOLINE PARAMETER ESTIMATION
NAS Key West, Flying Club, Building A-127 Checked By: F.J.W. Jr.

The mass fraction distribution and other attributes for weathered gasoline have been taken from a paper developed by Johnson et al. Using these compound attributes and their given mass fractions for weathered gasoline, it is possible to calculate a mass weighted average Henry's law constant (Hc) for weathered gasoline.

Henry's law constants for each constituent have been calculated using the following equation:

$$Hc = \frac{PFW}{S}$$

Where:

Hc = Henry's law constant (atm*m^3/mole)
P = vapor pressure (atm)
S = solubility (mg/l)
FW = gram formula weight

A mass weighted average Henry's law constant for weathered gasoline has been determined by summing the product of each constituents Henry's law constant and mass fraction.

This Henry's law constant is then converted to a unitless Henry's law constant through the following equation.

$$H = \frac{Hc}{RT}$$

Where:

H = Unitless Henry's Law Constant
Hc = Henry's Law Constant (atm*m^3/mole)
R = Universal gas law constant (0.000082057 atm*m^3/mole * K)
T = Temperature in degrees K

Weathered Gasoline Contaminant Attributes

Compound	Molecular Weight	Vapor Pressure atm	Weighted Vapor Pressure	Mass Fraction	Boiling Point C	Water Solubility mg/l	Kow	Calculated Henry's Law Const atm*m^3/mole	Weighted Hc
propane	44.1	8.5	0	0	-42	62	73	6.045967742	0
isobutane	58.1	2.93	0	0	-12	49	537	3.474142857	0
n-butane	58.1	2.11	0	0	-1	61	946	2.009688525	0
trans-2-butene	56.1	1.97	0	0	1	430	204	0.257016279	0
cis-2-butene	56.1	1.79	0	0	4	430	204	0.233532558	0
3-methyl-1-butaene	70.1	0.96	0	0	21	130	708	0.517661538	0
isopentane	72.2	0.78	0.005382	0.0069	28	48	1862	1.17325	0.008095425
1-pentene	70.1	0.7	0.00035	0.0005	30	148	710	0.331554054	0.000165777
2-methyl-1-butene	70.1	0.67	0.000536	0.0008	31	155	525	0.303012903	0.00024241
2-methyl-1,3,butadiene	68.1	0.65	0	0	34	642	323	0.068948598	0
n-pentane	72.2	0.57	0.005415	0.0095	36	40	2511	1.02885	0.009774075
trans-2-pentene	70.1	0.53	0.000901	0.0017	36	203	708	0.183019704	0.000311133
2-methyl-2-butene	70.1	0.51	0.001071	0.0021	38	155	525	0.230651613	0.000484368
2-methyl-1,2-butadiene	68.1	0.46	0.00046	0.001	41	1230	148	0.025468293	2.54683E-05
3,3-dimethyl-1-butene	84.2	0.47	0	0	41	23	1350	1.720608696	0
cyclopentane	70.1	0.35	0.00161	0.0046	50	158	871	0.15528481	0.00071431
3-methyl-1-pentane	84.2	0.29	0	0	54	56	1820	0.436035714	0
2.3-dimethylbutane	86.2	0.26	0.001144	0.0044	57	20	4786	1.1206	0.00493064
2-methylpentane	86.2	0.21	0.004347	0.0207	60	14	6457	1.293	0.0267651
3-methylpentane	86.2	0.2	0.00372	0.0186	64	13	6457	1.326153846	0.024666462
n-hexane	86.2	0.16	0.003312	0.0207	69	13	8710	1.060923077	0.021961108
methylcyclopentane	84.2	0.15	0.00351	0.0234	72	42	2239	0.300714286	0.007036714
2,2-dimethylpentane	100.2	0.11	0.000704	0.0064	79	4.4	16600	2.505	0.016032
benzene	78.1	0.1	0.00021	0.0021	80	1780	135	0.00438764	9.21404E-06
cyclohexane	84.2	0.1	0.00137	0.0137	81	55	3236	0.153090909	0.002097345
2,3-dimethylpentane	100.2	0.072	0	0.00	90	5.3	16600	1.361207547	0
3-methylhexane	100.2	0.064	0.002272	0.0355	92	4	22400	1.6032	0.0569136
3-ethylpentane	100.2	0.06	0	0	94	3.2	22400	1.87875	0
2,2,4-trimethylpentane	114.2	0.051	0.0025653	0.0503	99	2.2	42660	2.647363636	0.133162391
n-heptane	100.2	0.046	0.0020562	0.0447	98	3	30000	1.5364	0.06867708
methylcyclohexane	98.2	0.048	0.0019056	0.0397	101	14	11220	0.336685714	0.013366423
2.2-dimethylhexane	114.2	0.035	0.0007245	0.0207	107	1.5	57544	2.664666667	0.0551586
toluene	92.1	0.029	0.0010411	0.0359	111	515	490	0.005186214	0.000186185
2,3,4-trimethylpentane	114.2	0.028	0	0	114	1.8	42658	1.776444444	0
2-methylheptane	114.2	0.021	0.0006804	0.0324	116	0.9	77625	2.664666667	0.0863352
3-methylheptane	114.2	0.02	0.000686	0.0343	115	0.8	77625	2.855	0.0979265
n-octane	114.2	0.014	0.00042	0.03	126	0.7	104700	2.284	0.06852
2,4,4-trimethylhexane	128.3	0.013	0.0000442	0.0034	131	1.4	147911	1.191357143	0.004050614
2,2-dimethylheptane	128.3	0.011	0.0002486	0.0226	133	0.3	199526	4.704333333	0.106317933
ethylbenzene	106.2	0.0112	0.0001456	0.013	136.2	152	1400	0.007825263	0.000101728
p-xylene	106.2	0.0086	0.0001299	0.0151	138	198	1413	0.004612727	6.96522E-05
m-xylene	106.2	0.008	0.0003008	0.0376	139	162	1585	0.005244444	0.000197191
3,3,4-trimethylhexane	128.3	0.0073	4.088E-05	0.0056	140	1.4	147911	0.668992857	0.00374636
o-xylene	106.2	0.0066	0.0001808	0.0274	144	175	589	0.004005257	0.000109744
2,2,4-trimethylheptane	142.3	0.0053	6.36E-06	0.0012	149	0.8	389000	0.9427375	0.001131285
n-noname	128.3	0.0042	0.0001604	0.0382	150.7	0.07	46774	7.698	0.2940636
3,3,5-trimethylheptane	142.3	0.0037	0	0	156	0.8	389000	0.6581375	0
n-propylbenzene	120.2	0.0033	3.861E-05	0.0117	159	60	4786	0.006611	7.73487E-05
2,3,4-trimethylheptane	142.3	0.0031	0	0	160	0.8	389000	0.5514125	0
1,3,5-trimethylbenzene	120.2	0.0024	0.0001183	0.0493	165	73	12883	0.003951781	0.000194823
1,2,4-trimethylbenzene	120.2	0.0019	0.0001343	0.0707	169	57	12883	0.004006667	0.000283271
n-decane	142.3	0.0036	0.0000504	0.014	174.1	0.009	4897788	56.92	0.79688
methylpropylbenzene	134.2	0.001	0.000017	0.017	182	6.8	33884	0.019735294	0.0003355
dimethylethylbenzene	134.2	0.0007	2.023E-05	0.0289	190	21	44668	0.004473333	0.000129279
n-undecane	156.3	0.0004	0.000003	0.0075	196	0.004	4897788	15.63	0.117225
1,2,4,5-tetramethylbenzene	134.2	0.00046	2.576E-06	0.0056	196	3.5	12883	0.017637714	9.87712E-05
1,2,3,4-tetramethylbenzene	134.2	0.00033	2.323E-05	0.0704	205	21	12883	0.002108857	0.000148464
1,2,4-trimethyl-5-ethylbenzen	148.2	0.00029	1.888E-05	0.0651	210	7	204000	0.006139714	0.000399695
n-dodecane	170.3	0.0004	0	0	216	0.004	1537	17.03	0
napthalene	128.2	0.00014	1.064E-06	0.0076	218	33	1738	0.000543879	4.13348E-06
n-hexylbenzene	162.3	0.0001	1.47E-06	0.0147	226	1.3	309000	0.012484615	0.000183524
methylnapthalene	142.2	0.000054	7.236E-07	0.0134	241	27	7943	0.0002844	3.81096E-06
		sum	0.048081	1.00				Hc =	2.02930926
								Unitless H =	84.4630508

Johnson, P.C., C.C. Stanley, M.W. Kemblowski, D.L. Byers and J.D. Colthart, "A practical approach to the design, operation and monitoring of in situ soil venting systems", Ground Water Monitoring Review, Spring Issue, 159-177, 1990.

SOIL VOLUME WEIGHTED AVERAGE OVA CONCENTRATION
NAS Key West, Flying Club, Building A-127 Checked By:

Given the total volume of contaminated material within each isoconcentration line, a weighted average OVA concentration can be determined using an average end area calculation method. An example of an equation to determine the volume weighted average OVA concentration on the 50 ppm isoconcentration line would be as follows:

$$\textit{Volume Weighted Concentration} = \frac{50ppm + 500ppm}{2} \times \frac{(23{,}232ft^3 - 15{,}744ft^3)}{34{,}368ft^3} = 59.9ppm$$

To get the total volume weighted OVA concentration (Ca), the volume weighted concentrations are summed.

SOIL VOLUME WEIGHTED AVERAGE CONCENTRATION CALCULATION

OVA Concentration (ppm)	Total Volume (ft^3)	Volume Weighted Concentration (ppm)
10	34368	
		9.7
50	23232	
		59.9
500	15744	
		108.9
1000	10752	
		229.7
2500	6240	
		523.7
5000	1440	

Total Soil Volume (ft^3)	Total Volume Weighted Conc. OVA (ppm)
34368	932

ESTIMATE OF THE SOIL MOISTURE CONCENTRATION
NAS Key West, Flying Club, Building A127 Checked By:

Assuming the undisturbed soil creates a system in equilibrium, the concentration in the soil moisture can be determined.

Taking the total volume weighted average OVA concentration (Ca) and the estimated weathered gasoline unitless Henry's law constant (Hc), the contaminant concentration for the soil moisture can be determined using the following equation.

$$Cw = \frac{Ca}{Hc}$$

Where:

Cw = Contaminant Concentration in the soil moisture

SOIL MOISTURE CONCENTRATION CALCULATION

H= Cg/Cw

Cg=	932	ppm	SOIL VOLUME WEIGHTED AVG. CONC.
H=	84.46	unitless	WEATHERED GASOLINE ESTIMATE
Cw=	11.04	ppm	CALCULATED

Where:

H = unitless Henry's constant calculated from the weathered gasoline mass weighted average,

Cg = volume weighted average concentration for soil OVA readings from site soil borings, and

Cw = saturation concentration of the VOCs in the soil moisture.

Assumption:

The insitu conditions where OVA readings were measured are a system in equilibrium.

TSCREEN ESTIMATE OF THE MASS EMISSIONS RATE FROM THE SOIL STOCKPILES
NAS Key West, Flying Club, Building A127 Checked By:

The value for the soil moisture concentration, Cw, taken from the "Estimate of the Soil Moisture Concentration" worksheet, may then be used in the TSCREEN model to determine the mass vapor emissions from the treated soil stockpiles. Cw is used as the concentration of organics in waste oil for the land treatment facility scenario. The TSCREEN model then gives the mass emissions rate per m^2 surface area in the land treatment facility.

This emissions rate in grams per second per m^2 can be used to determine the mass emissions for the total volume of treated soil.

Assuming that one 400 ton stockpile has a surface area of 60 m^2, and that 1,590 tons of soil will be treated at the facility. Then a maximum of 4 stockpiles would be present at the site, providing a total soil surface area of 240 m^2.

The inputs for the TSCREEN model are as follows:

1) Modeling for gaseous release types,
2) Scenario is for land treatment facilities,
3) The emissions rate is not known,
4) The weighted average vapor pressure for weathered gasoline is 0.048 atm or 4,863.6 Pa,
5) Cs = the concentration of organics in waste oil,
6) The total release area for four 400 ton stockpiles is 240 m^2,
7) A rural classification is used, and
8) Fenceline distance and receptor height are both 1 meter.

TSCREEN returns the emissions rate as 7.0×10^{-7} grams per second per m^2, and for a total surface are of 240 m^2, the emissions in pounds per day are 0.32 for the entire facility.

07/31/97
14:26:02

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 95250 ***

ying Club 400 ton Stockpile Emissions

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	AREA
EMISSION RATE (G/(S-M**2))	=	.700000E-06
SOURCE HEIGHT (M)	=	.0000
LENGTH OF LARGER SIDE (M)	=	7.7460
LENGTH OF SMALLER SIDE (M)	=	7.7460
RECEPTOR HEIGHT (M)	=	1.0000
URBAN/RURAL OPTION	=	RURAL

MODEL ESTIMATES DIRECTION TO MAX CONCENTRATION

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	2.912	31.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

JY. FLUX = .000 M**4/S**3; MOM. FLUX = .000 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	MAX DIR (DEG)
1.	.1654E-01	5	1.0	1.0	10000.0	.00	45.
100.	1.124	6	1.0	1.0	10000.0	.00	44.
200.	.3939	6	1.0	1.0	10000.0	.00	36.
300.	.2042	6	1.0	1.0	10000.0	.00	44.
400.	.1267	6	1.0	1.0	10000.0	.00	31.
500.	.8727E-01	6	1.0	1.0	10000.0	.00	40.
600.	.6425E-01	6	1.0	1.0	10000.0	.00	31.
700.	.4957E-01	6	1.0	1.0	10000.0	.00	39.
800.	.4009E-01	6	1.0	1.0	10000.0	.00	31.
900.	.3324E-01	6	1.0	1.0	10000.0	.00	34.
1000.	.2811E-01	6	1.0	1.0	10000.0	.00	45.
1100.	.2427E-01	6	1.0	1.0	10000.0	.00	35.
1200.	.2123E-01	6	1.0	1.0	10000.0	.00	32.
1300.	.1877E-01	6	1.0	1.0	10000.0	.00	32.
400.	.1675E-01	6	1.0	1.0	10000.0	.00	35.
500.	.1506E-01	6	1.0	1.0	10000.0	.00	32.
1600.	.1364E-01	6	1.0	1.0	10000.0	.00	39.
1700.	.1242E-01	6	1.0	1.0	10000.0	.00	36.
1800.	.1138E-01	6	1.0	1.0	10000.0	.00	34.

1900.	.1047E-01	6	1.0	1.0	10000.0	.00	39.
2000.	.9675E-02	6	1.0	1.0	10000.0	.00	36.
2100.	.9014E-02	6	1.0	1.0	10000.0	.00	42.
2200.	.8425E-02	6	1.0	1.0	10000.0	.00	40.
2300.	.7899E-02	6	1.0	1.0	10000.0	.00	40.
2400.	.7427E-02	6	1.0	1.0	10000.0	.00	42.
2500.	.7000E-02	6	1.0	1.0	10000.0	.00	42.
2600.	.6613E-02	6	1.0	1.0	10000.0	.00	42.
2700.	.6261E-02	6	1.0	1.0	10000.0	.00	40.
2800.	.5940E-02	6	1.0	1.0	10000.0	.00	40.
2900.	.5645E-02	6	1.0	1.0	10000.0	.00	42.
3000.	.5375E-02	6	1.0	1.0	10000.0	.00	42.
3500.	.4354E-02	6	1.0	1.0	10000.0	.00	31.
4000.	.3628E-02	6	1.0	1.0	10000.0	.00	43.
4500.	.3089E-02	6	1.0	1.0	10000.0	.00	43.
5000.	.2676E-02	6	1.0	1.0	10000.0	.00	43.
5500.	.2350E-02	6	1.0	1.0	10000.0	.00	39.
6000.	.2087E-02	6	1.0	1.0	10000.0	.00	43.
6500.	.1872E-02	6	1.0	1.0	10000.0	.00	43.
7000.	.1692E-02	6	1.0	1.0	10000.0	.00	34.
7500.	.1546E-02	6	1.0	1.0	10000.0	.00	43.
8000.	.1421E-02	6	1.0	1.0	10000.0	.00	34.
8500.	.1312E-02	6	1.0	1.0	10000.0	.00	36.
9000.	.1218E-02	6	1.0	1.0	10000.0	.00	36.
9500.	.1135E-02	6	1.0	1.0	10000.0	.00	36.
10000.	.1061E-02	6	1.0	1.0	10000.0	.00	36.
15000.	.6256E-03	6	1.0	1.0	10000.0	.00	39.
20000.	.4417E-03	6	1.0	1.0	10000.0	.00	42.
25000.	.3374E-03	6	1.0	1.0	10000.0	.00	42.
30000.	.2709E-03	6	1.0	1.0	10000.0	.00	39.
40000.	.1947E-03	6	1.0	1.0	10000.0	.00	39.
50000.	.1508E-03	6	1.0	1.0	10000.0	.00	39.

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 1. M:

31.	2.912	6	1.0	1.0	10000.0	.00	45.

DIST = DISTANCE FROM CENTER OF THE AREA SOURCE
CONC = MAXIMUM GROUND LEVEL CONCENTRATION
STAB = ATMOSPHERIC STABILITY CLASS (1=A, 2=B, 3=C, 4=D, 5=E, 6=F)
U10M = WIND SPEED AT THE 10-M LEVEL
USTK = WIND SPEED AT STACK HEIGHT
MIX HT = MIXING HEIGHT
PLUME HT= PLUME CENTERLINE HEIGHT
MAX DIR = WIND DIRECTION RELATIVE TO LONG AXIS FOR MAXIMUM CONCENTRATION

****
*** END OF SCREEN MODEL OUTPUT ***
****

TITLE: NAS Key West, Flying Club		LOG of WELL: KYW-A127-1	BORING NO. SB10
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.		DATE STARTED: 10/15/93	COMPLTD: 10/15/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 10.45 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 3.57 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/15/93		SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0	SAND: silty, clayey, calcareous, medium brown to light brown, fine- coarse-grained. *Slight odor.*		SC		
				0	SAND: clayey, calcareous, light brown to gray, fine- to coarse-grained with gravel. *Slight odor.*		GC		
5				250	As above. *Strong odor.*				
10									
15									

ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Key West, Flying Club		LOG of WELL: KYW-A127-2	BORING NO. SB49
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.		DATE STARTED: 10/15/93	COMPLTD: 10/15/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 10.56 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 3.85 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/15/93		SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0	SAND: clayey, calcareous, light brown to white, fine- to coarse- grained with gravel. *No odor.*		GC		
				0					
5				950	SAND: clayey, calcareous, light brown to gray, fine- to coarse- grained with gravel. *Strong petroleum odor.*				
					SAND: clayey, calcareous, medium gray, fine- to coarse-grained with gravel. *Slight petroleum odor.*				
10									
15									

ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Key West, Flying Club	LOG of WELL: KYW-A127-4	BORING NO. SB1
CLIENT: SOUTHNAVFACENGCOM		PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.	DATE STARTED: 10/15/93	COMPLTD: 10/15/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 10.70 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 3.78 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/15/93	SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				1	SAND: clayey, silty, calcareous, medium brown, fine- to coarse- grained. *No odor.*		SC		
				60	SAND: clayey, silty, calcareous, medium brown, fine- to coarse- grained with gravel.		GC		
				2500	As above, with coarse gravel. *Slight odor.*				
10					SAND: clayey, calcareous, light brown to white, fine- to coarse- grained with gravel. *No odor.*				
15									

 ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Key West, Flying Club	LOG of WELL: KYW-A127-6	BORING NO.
CLIENT: SOUTHNAVFACENGCOM		PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.	DATE STARTED: 10/15/93	COMPLTD: 10/15/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 10.69 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 3.86 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/15/93	SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
5					SAND: clayey, calcareous, light brown, fine- to coarse-grained. *Strong petroleum odor.*		SC		
10					SAND: clayey calcareous, light brown to gray, fine- to coarse-grained with gravel. *Strong petroleum odor.*		GC		
15									

ABB ENVIRONMENTAL SERVICES, INC.

TITLE: NAS Key West, Flying Club	LOG of WELL: KYW-A127-14D	BORING NO. SB10
CLIENT: SOUTHNAVFACENGCOM		PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.	DATE STARTED: 10/16/93	COMPLTD: 10/16/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 25 - 30 FT.	PROTECTION LEVEL: D
TOC ELEV.: FT.	MONITOR INST.: OVA	TOT DPTH: 30FT.	DPTH TO ▽ 4.13 FT.
LOGGED BY: J. Williams	WELL DEVELOPMENT DATE: 10/17/93	SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0	SAND: calcareous, some silt, some clay, medium brown to light brown, fine- to coarse-grained. *Slight odor.*		GC		
				0	SAND: calcareous, some clay, light brown, white, gray, fine- to coarse-grained with gravel, wet at 4' bls. *Slight odor.*				
5				250	SAND: calcareous, some clay, light brown, white, gray, fine- to coarse-grained with gravel, saturated. *Strong odor.*				
10									
15			12/24	45	ORGANICS: 15-15.3 bls, dark brown to black. SAND: 15.3-15.5 bls, calcareous, gray, fine- to medium-grained, 25-30% silt and clay. LIMESTONE: 15.5-17 bls, white, highly weathered.		OL LS	31/30/77/80	
20			22/24	210	LIMESTONE: highly weathered, white. *Slight odor.*			30/37/45/50	
25			24/24	32	LIMESTONE: highly weathered, white.			5/8/13/12	
30			20/24	11	LIMESTONE: white, unconsolidated, well graded gravel to fine sand fragments, little silt/clay, trace phosphorous, trace quartz sand, coarse- to medium-grained, angular to sub-angular.			2/2/7/8	
35									

TITLE: NAS Key West, Flying Club		LOG of WELL: KYW-A127-17	BORING NO. N/A
LIENT: SOUTHNAVFACENGCOM			PROJECT NO: 8508-30
CONTRACTOR: Groundwater Protection, Inc.		DATE STARTED: 10/16/93	COMPLTD: 10/16/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 11.00 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 4.09 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/16/93		SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				<1	SAND: clayey, calcareous, light brown to dark brown, fine- to coarse- grained. *Petroleum odor.*		SC		
				<1	SAND: clayey calcareous, some gravel, light brown to white, fine- to coarse-grained. *Strong petroleum odor.*		GC		
5				3300					
10									
15									

TITLE: NAS Key West, Flying Club		LOG of WELL: KYW-A127-20	BORING NO. N/A
CLIENT: SOUTHNAVFACENGCOM			PROJECT NO: 8508-30
NTRACTOR: Groundwater Protection, Inc.		DATE STARTED: 10/16/93	COMPLTD: 10/16/93
METHOD: 4.25" HSA	CASE SIZE: 2 inch	SCREEN INT.: 2 - 12 FT.	PROTECTION LEVEL: D
TOC ELEV.: 10.35 FT.	MONITOR INST.: OVA	TOT DPTH: 12FT.	DPTH TO ▽ 3.52 FT.
LOGGED BY: J. Koch	WELL DEVELOPMENT DATE: 10/16/93		SITE: NAS Key West, Flying Club

DEPTH FT.	LABORATORY SAMPLE ID.	SAMPLE	RECOVERY	HEADSPACE (ppm)	SOIL/ROCK DESCRIPTION AND COMMENTS	LITHOLOGIC SYMBOL	SOIL CLASS	BLOWS/6-IN	WELL DATA
				0	SAND: clayey, calcareous sand, light brown to white, fine- to coarse- grained. *No odor.*		SC		
				9	SAND: clayey, calcareous, light brown to white, fine- to coarse grained with gravel. *Slight petroleum odor.*		GC		
5				2900	As above. *Strong petroleum odor.*				
10									
15									

APPENDIX D

ION COLLIDER SOIL REMEDIATION SYSTEM TECHNOLOGY DESCRIPTION

FLORIDA

Department of Environmental Protection

Lawton Chiles
Governor

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

Virginia B. Wetherell
Secretary

April 30, 1997

Mr. Nick Knezevich
Nacor of Naples, Incorporated
790 Harbour Drive, Suite 2C
Naples, Florida 34103

Re: Ion Collider Soil Remediation System

Dear Mr. Knezevich:

The Bureau of Petroleum Storage Systems thanks you and your associates for visiting on March 24, 1997 and April 24, 1997 to discuss the ex situ remediation of petroleum contaminated soil by an innovative, chemical oxidation method. The Ion Collider technology, developed by Universal Environmental Technologies, destroys petroleum hydrocarbon contaminants by converting them to carbon dioxide and water. We have reviewed laboratory results for treated soil from a full-scale operation at Opa Locka Airport, handling soil from the Miami International Airport expansion, and note that the method is effective.

As indicated to the department, the process is essentially a five-step, mechanized train of continuously operating equipment items, to which contaminated soil is fed on a continuous basis. The steps are: (1) screening of the feed soil on a trommel for the purpose of removing debris, rocks, and oversize material; (2) spraying the screened soil with a mixture of ionized water and potassium permanganate as it rides a conveyor belt; (3) passing it through a blade mill, where mixing occurs and more ionized water may be added; (4) moving it with an auger and passing it through a series of paddles, in both of which further mixing occurs; and (5) curing in a 400-ton stockpile for approximately 12 hours. To a small degree, any treated soil that is exposed to sunlight during and after stockpiling will benefit from ultraviolet radiation, which is capable of increasing the rate of reaction for oxidation by potassium permanganate.

A device called an Ion Collider converts water to ionized water before it is used in the process. The ionized water has an elevated concentration of hydroxyl radicals, which are effective oxidizing agents. The ionized water has a pH of approximately 8 and contains a small amount of hydrogen peroxide, which is also an oxidizer.

The bureau has no objection to expanding the application of Ion Collider technology to other sites in Florida, for the remediation of petroleum contaminated soil. The degree of treatment required will vary, depending upon the final disposition of the treated soil. There are two chapters of the Florida Administrative Code (F.A.C.), as well as some guidance documents that are worth mentioning with respect to soil remediation and soil cleanup goals. The current issue of Chapter 62-770, F.A.C., dated September 3, 1996, sets forth cleanup criteria for petroleum contaminated sites. It is presently being revised to include soil cleanup criteria for different situations and should be available this year. Chapter 62-775, F.A.C., dated November 30, 1992, sets forth clean soil criteria for soil thermal treatment facilities but may be helpful as a reference. Additionally, the Department of Environmental Protection has issued a July 5, 1994 memorandum titled "Cleanup Goals for Military Sites in Florida", and a May 1994 document titled "Guidelines for Assessment and Remediation of Petroleum Contaminated Soil". Please note that treated soil which will be used as clean fill may be subject to local requirements that may be more stringent than those set forth by the department.

If you intend to construct a large, high-volume stationary soil treatment plant, to commercially treat soil which has been excavated and hauled from petroleum contaminated sites, then you must obtain a permit for such a facility. If you intend to use smaller-scale equipment for the onsite cleanup of individual petroleum contaminated sites, such as gasoline service stations, then it is only necessary for the remedial action plan for each such site to prescribe the Ion Collider technology. In that case, either a small-scale system will be constructed at the site, or a trailer-mounted or skid-mounted system may be deployed.

While the Department of Environmental Protection does not provide endorsement of specific or brand name remediation products or processes, it does recognize the need to determine their acceptability from an environmental standpoint, with respect to applicable rules and regulations, and the interests of public health, safety, and welfare. Vendor's must then market the products and processes on their own merits regarding performance, cost, and safety in comparison to competing alternatives in the marketplace.

Department acceptance of any particular remediation product or process does not imply it has been deemed applicable for

all cleanup situations, or that it is preferred over others in any particular case. A site specific evaluation of applicability and cost-effectiveness must be considered for any product or process each time a remedial action plan is prepared for a site, regardless of whether conventional or innovative methods will be used. The plan should also include adequate site specific design details.

Preparers of remedial action plan documents for state-funded cleanups may wish to include a copy of this letter in the appendix of plans they submit, and call attention to it in the text of their document. In this way, technical reviewers throughout the state and its contracted local reviewing programs will be informed that you have contacted the Department of Environmental Protection to inquire about the environmental acceptability of this process. To aid those reviewers, the Bureau of Petroleum Storage Systems lists some items below.

a. Concentration of applied potassium permanganate ($KMnO_4$): It has been indicated that 10 pounds of pure $KMnO_4$ is applied to every 800 tons of soil processed. This equates to .000625 percent by weight. This is a very small concentration in comparison to even the most stringent soil criterion available at this time for manganese, which is .57 percent by weight.

b. Oxidation products and fate of the potassium and manganese species: For ionized water alone, which contains an elevated concentration of hydroxyl radicals, the products of petroleum hydrocarbon destruction are carbon dioxide (CO_2) and water (H_2O). For $KMnO_4$, oxidation of petroleum or other organic compounds, the products are likely to include manganese dioxide (MnO_2) and potassium carbonate (K_2CO_3) in addition to CO_2 and H_2O. For the treatment of petroleum contaminated soils where the ambient naturally occurring concentration of total organic carbon (TOC) is already elevated, the amount of ionized water and $KMnO_4$ used during the treatment process may have to be increased, if there is not sufficient oxidant in the application ratio described in item (a) above.

c. Fate of potassium and manganese with respect to final disposition of treated soil: In the interest of protecting the groundwaters of the state, the concentration of $KMnO_4$ added to soil during the

treatment process shall not be so high as to cause a leachability risk with respect to manganese upon final disposition of the treated soil. At this time, there is no leachability concentration established for manganese. Furthermore, and more importantly, the bureau believes that the amount of $KMnO_4$ typically added during the treatment process is so small that leachability is not likely to be a problem. In the unlikely event that groundwater were to be affected by soil treated by this process, the current secondary maximum contaminant level for manganese per Chapter 62-550, F.A.C., drinking water standards is 50 micrograms per liter (or equivalently 50 parts per billion). In regard to potassium, there is neither a primary nor a secondary standard.

d. Moisture content: It has been indicated that the moisture content of the soil immediately after the treatment process ranges from 30 to 40 percent. This may vary, depending upon the nature of the soil at the site. Sandy soils will have a lower moisture content.

e. Runoff: As a matter of good practice, the necessary and appropriate steps shall be taken to ensure that stockpiles of contaminated soil awaiting treatment will not cause a runoff problem. If a site does not already have a paved and bermed area for stockpiling feed soil, then liners and berms, or other means or methods of containment should be installed or employed.

f. Air emissions: Since the degree of contamination will vary from site to site, the need for air emissions control may need to be assessed on a site to site basis. However, the bureau believes that air emissions from this process are not likely to be a problem at most sites. Reasons: (1) petroleum is converted to carbon dioxide and water by the oxidation process, unlike thermal treatment processes which drive off the hydrocarbons as vapors; (2) the surface area of a contaminated stockpile awaiting treatment is small in comparison to its volume, thereby limiting the rate at which vapors may escape; and (3) transfer of soil using earth moving equipment will occur one scoop at a time, which limits the amount of vapors that may be able to escape as periodic surges.

The environmental acceptability of this soil treatment process, as determined by the bureau, is based on the use of potassium permanganate as the oxidant used in combination with ionized water. In the event that an alternate to potassium permanganate will be used in some situations, we request that the subsitution be made clear in a remedial action plan and submitted for approval. Prior to prescribing a substitute, the preparer of the plan should consider the substitute's toxicological aspects, allowable soil concentrations, allowable groundwater concentrations, and the fate of the compound and its constituent chemical species upon addition to the process and release to the environment.

The department reserves the right to revoke its acceptance of this process if the nature or composition of either or any of its principal or proprietary ingredients, or the performance of the process, has been falsely represented. You may contact me at 904/487-3299.

Sincerely,

Rick Ruscito

Rick Ruscito, P.E.
Bureau of Petroleum Storage Systems

cc: Ronald Wilson
R.H. Wilson and Associates Engineers
P.O. Box 915260
Longwood, Florida 32791-5260

Tom Conrardy, FDEP/Tallahassee

other108.doc

Technology Description

The Ion Collider provides the catalyst for a range of applications that include cleaning hydrocarbon contaminated soils and treating industrial aqueous effluents. The Ion Collider is a patented device that permanently effects the molecular structure of liquids and gases, particularly water and hydrocarbons. The Ion collider combines scientific principles into a remarkably effective method of separating imiscible particles from a liquid mixture or emulsion. The following are the four critical design criteria incorporated into the Ion Collider:

A. Mechanical pressure is utilized in place of exothermic heat.

B. Magnetohydrodynamics (MHD) are maximized in the design of the device to direct the induced magnetic field back into the liquid or gas, thus imparting a charge directly into the liquid or gas.

C. The material composition of the device is of specific alloys or combinations thereof, which are known to have catalytic properties and characteristics. This, in conjunction with the MHD, results in a negative charge being imparted into the fluid or gas.

D. The internal configuration of the device is designed to create specific flow regimes which facilitate the capability of the fluids and gases to accept the negative charge.

The Soil Oxidation System utilizes a chemical reduction and oxidation (REDOX) technology that causes the formation of hydroxyl radicals (OH). Hydroxyl radicals are powerful oxidizers that destroy organic compounds by breaking them down into non-regulated, environmentally safe compounds. As ionized water passed through the Ion Collider is applied to contaminated soil, the process achieves rapid inexpensive separation of particles and results in high degrees of purity in residual liquids while producing no waste stream. Employing inexpensive and readily available reagents, the system is easily controlled and is applicable to a wide variety of contaminants. The process will not inhibit biological activity but will actually enhance most ongoing biological processes: In contrast to other oxidizing systems it is equally effective in destroying oil & grease and hydrocarbons.

Advantages

- Highest production available - from 60 tons per hour.
- Low treatment price independent of soil type.
- Needs no custom heavy equipment.
- Patented technology.
- Technology applicable to both small mobile and large semi-mobile installations.
- Results are quick and final.
- Preserves soil matrix and will not kill indigenous microorganisms.

Soil Oxidation System Description

The process will handle all types of hydrocarbon contaminated soils at any level of contamination. The basic equipment consists of the following components: two front end loaders, a model 616 Trommel to aerate and screen the soil, a blade mill for mixing the screened soil with the oxidant and treated water, and a radial stacking conveyor. The system requires a water source, four 1500 gallon plastic tanks, a 55 gallon mixing tank with a lightening mixer, two 1 horsepower pumps and the plumbing and valves needed to distribute the ionized water to the spray head arrays (See Figures 1-3).

The soil to be cleaned is first processed by the Trommel 616 rotary screening apparatus consisting of a hopper that feeds a conveyor which, in turn, moves the soil to an inclined rotating cylindrical screen.

Oversize rocks, trash and debris exit from the end of the drum and are deposited in a stockpile by the tail conveyor.

The screened material exits from under the drum by a side conveyor. As the screened soil appears in the conveyor, it is sprayed by the proprietary oxidizer diluted with water that has been passed through the Ion Collider. This side conveyor deposits the soil into the hopper of a 40 foot conveyor which empties the soil into a blade mill. The soil is then picked up by an auger followed by a series of paddles which thoroughly mix the soil together with the oxidizer and treated water, all the while drawing it up through an inclined sluice to finally deposit the mixed soil in the hopper of a radial stacking conveyor. The soil is finally deposited in one of four 400 ton stockpiles to cure for 12 hours. Normal turn-around time for required testing procedures is 24 to 48 hours.

The illustrations show the semi-permanent installation for the Miami project at Opa Locka Airport. Figure 1 is a flow chart which illustrates the process. Figure 2 shows a plan view of the facility at Opa Locka but modified to accommodate six, four hundred ton piles. Figure 3 shows the side and front elevation of the facility. The foot print that is required for all of the equipment and piles is about 100 feet square, not including traffic areas required to feed the Trommel and to access and remove the treated soil. To minimize material handling, the treated soil is not moved until test results come back and soil can be removed to a clean fill stockpile. The soil that has been treated to date has been contaminated with Jet A and diesel fuel as well as some solvents. All soil has been cleaned to levels below the local clean fill standards.*

*For EPA 8020<100 parts per billion, for EPA 8110 diesel<500 parts per billion, for EPA 8100 solvents<250 parts per million, for EPA 9071 O&G<250 parts per million.

Soil Treatment Process Flow Diagram

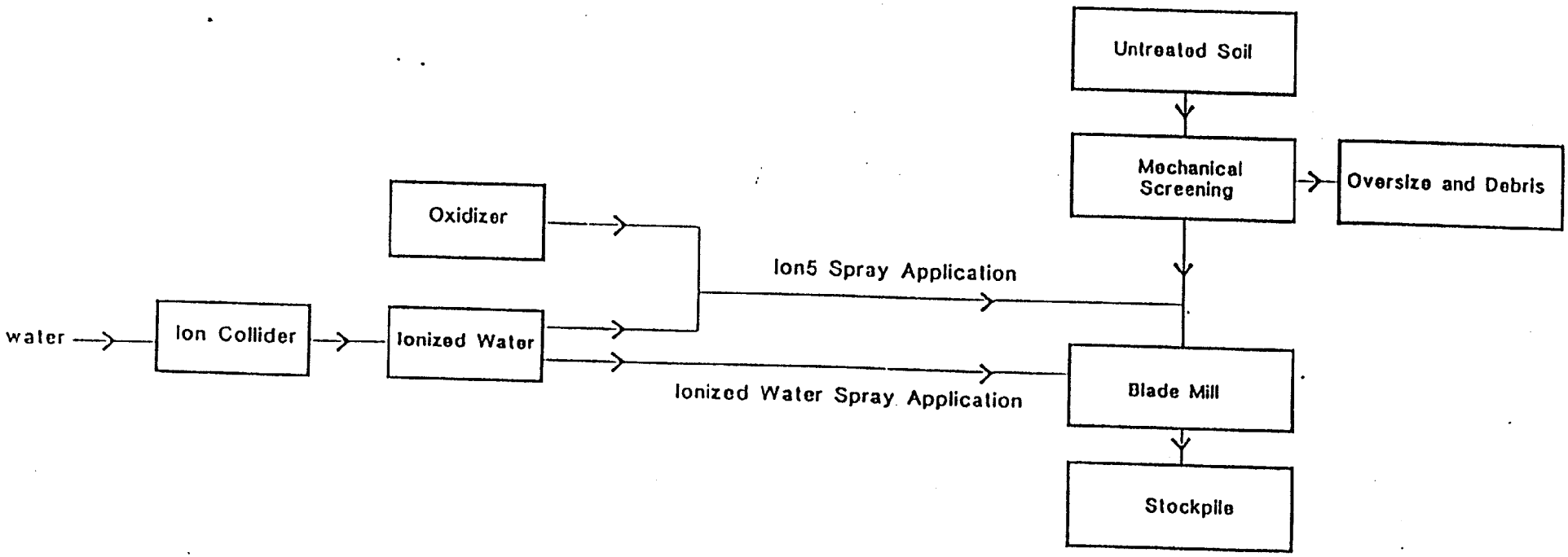


Fig. 1

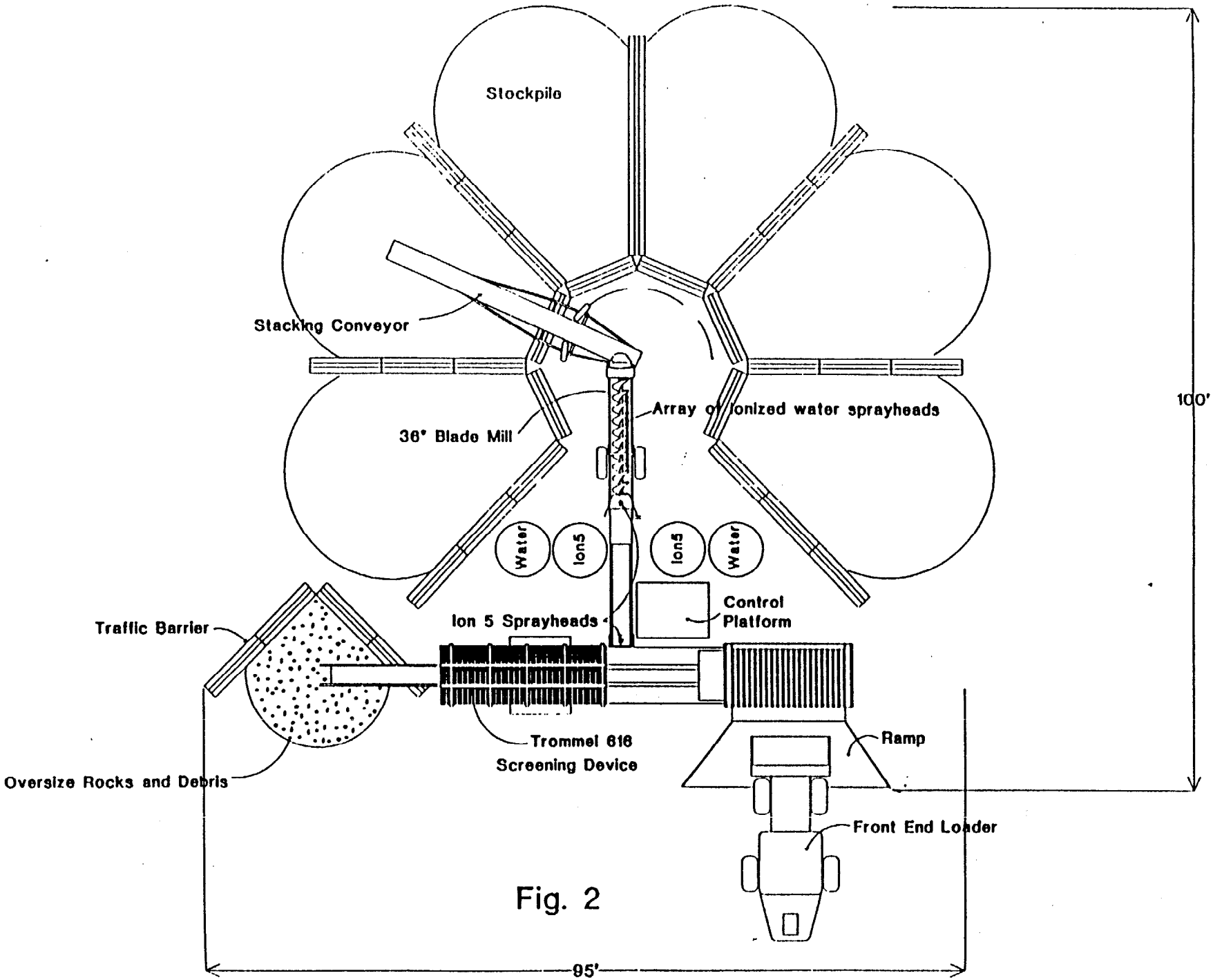
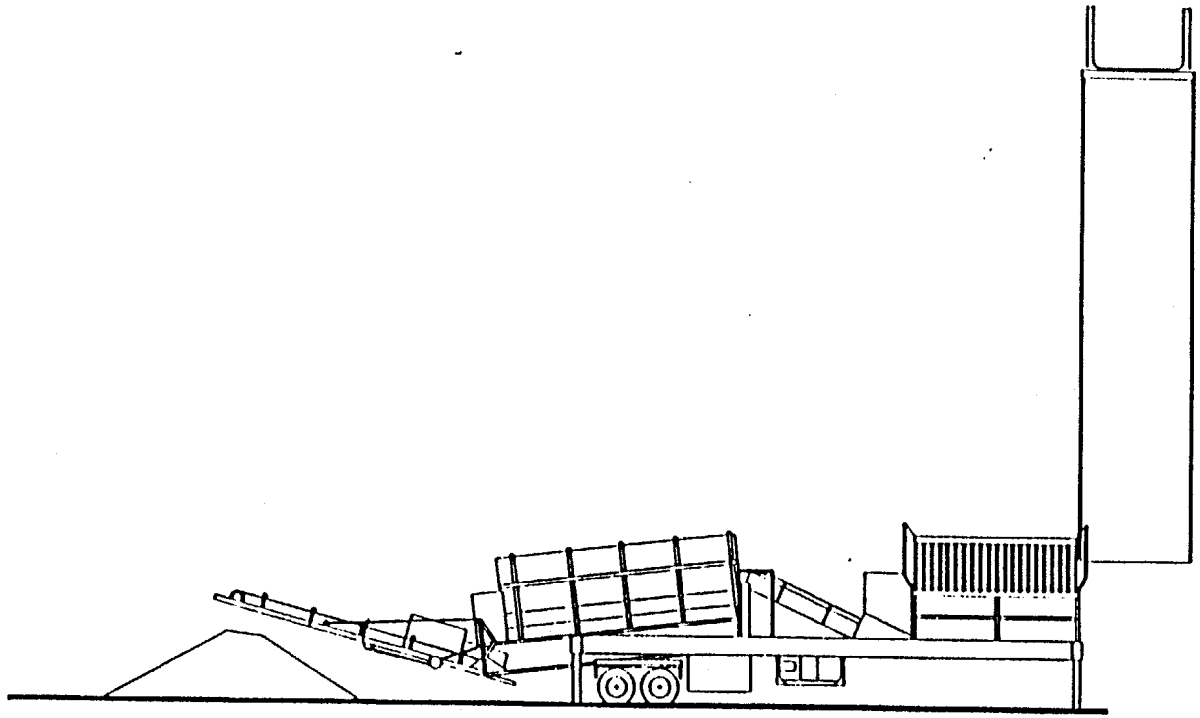
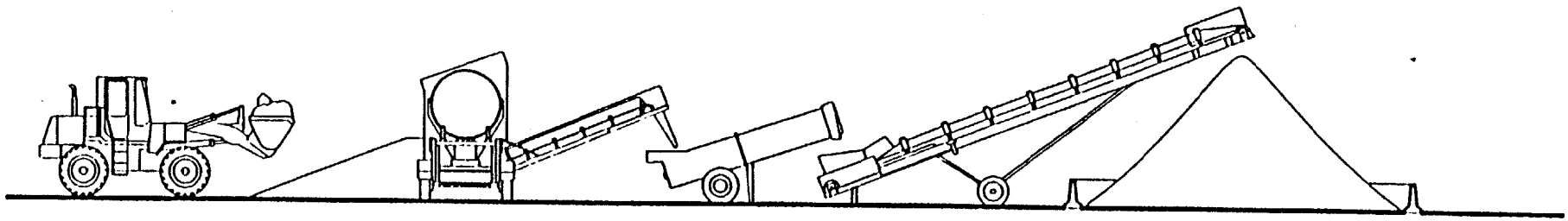

Stockpile
Stacking Conveyor
36" Blade Mill
Array of Ionized water sprayheads
Water
Ion5
Ion5
Water
Control Platform
Ion 5 Sprayheads
Traffic Barrier
Trommel 616 Screening Device
Ramp
Oversize Rocks and Debris
Front End Loader
100'
95'

Fig. 2



Side View



End View

Fig. 3

APPENDIX E

BASIS OF DESIGN

BASIS OF DESIGN

Naval Air Station (NAS) Key West, Flying Club

The purpose of this Remedial Action Plan (RAP) is to present a plan for remediation of excessively contaminated soil and associated groundwater issues at the Flying Club site at NAS Key West in accordance with the requirements of Chapter 62-770, FAC. Implementation of the RAP will include the following tasks:

- excavation and treatment of excessively contaminated soil;
- installation of one well in the center of the excavation area and replacement of monitoring wells that may become damaged or destroyed during excavation activities;
- development of a groundwater monitoring program to establish that the RAP cleanup goals have been met; and
- monitoring of the site for up to 1 year.

Based on field data, site assessment, and laboratory analytical results, site conditions are as follows.

Excessively contaminated soil at the site extends from 1 foot below land surface (bls) to the water table at 4 feet bls. The seasonal water table fluctuates and may move between 2 and 6 feet below land surface. Groundwater at the site has been identified in the approved CAR as G-III. There is little groundwater contamination associated with the petroleum release or the excessively contaminated soil. One monitoring well (KYW-A-127-MW6) exceeds the No Further Action G-III State target levels, however, this well is located on the edge of the excessively contaminated soil area.

One soil sample and a duplicate sample taken in 1996, from soil boring RB-1, indicate TPH concentrations of 3,530 mg/l and 3,890 mg/l respectively. These soil samples collected at depths between 3 and 5 feet bls indicate that contaminated soil identified during the CA is still present and may be a continuing source of contamination at the site. Natural attenuation analytical results indicated that biodegradation of site contamination would not affect the concentrations in a reasonable amount of time to justify natural attenuation as a remedial alternative.

While the Flying Club site is inactive, the adjacent taxiway is active and access to the site is limited due to aircraft traffic along this taxiway. Any activity in this area, that may disturb the soil, needs to maintain dust control and limit construction traffic along the taxiway.

Groundwater contamination at the site in excess of the NFA G-III State target levels is generally limited to the area of excessively contaminated soils and will be addressed through soil remediation efforts. Once residual soil contamination in the water table fluctuation zone is

removed, groundwater concentrations should return below the NFA G-III State target levels. A mobile chemical reduction facility will be operated locally to avoid the need for transportation of excessively contaminated soils to the Miami area, however, the mobile facility will be 6 miles from the site to eliminate the potential problem for the Navy aircraft engines. Chemical reduction of the contaminated soil with the ion collider technology will not destroy the organics in the soil and will allow the native soil to be used as backfill following proper sampling and analysis of the treated soils.

This treatment effort has a scope that addresses the degree of contamination present and will complete the remedial action efficiently. Remedial construction and monitoring activities will be discreet at the site and along the taxiway due to aircraft traffic along taxiway H.

APPENDIX F

MOST RECENT ANALYTICAL RESULTS

ANALYTICAL REFERENCE SHEET

Monitoring well identifiers indicated in the text (KYW-A-127-MW#) correspond with actual monitoring well identifiers. Sample Identifiers from the 1996 sampling event are not consistent with the monitoring well identifiers. The following is a list of monitoring well identifiers and the corresponding sample identifiers used during the 1996 sampling event.

Monitoring Well Identifier	1996 Sample Identifier
KYW-A-127-MW1	KYW-FLY-01
KYW-A-127-MW2	KYW-FLY-02
KYW-A-127-MW3	KYW-FLY-03
KYW-A-127-MW4	KYW-FLY-04
KYW-A-127-MW5	KEYWEST-Y05
KYW-A-127-MW6	KYW-FLY-06
KYW-A-127-MW7	KYW-FLY-07
KYW-A-127-MW8	KYW-FLY-08
KYW-A-127-MW9	KYW-FLY-09
KYW-A-127-MW10	KYW-FLY-10
KYW-A-127-MW11	KYW-FLY-11
KYW-A-127-MW12	KYW-FLY-12
KYW-A-127-MW13	KYW-FLY-13
KYW-A-127-MW14D	KYW-FLY-MW-14D
KYW-A-127-MW15D	KYW-FLY-15D
KYW-A-127-MW16	KYW-FLY-16
KYW-A-127-MW17	KYW-FLY-17
KYW-A-127-MW18	KYW-FLY-18
KYW-A-127-MW19	KYW-FLY-19
KYW-A-127-MW20	KEYWEST-Y20

Chain of Custody Record

Quanterra Environmental Services

OUA-4124-1

Client	Project Manager	Date	Chain Of Custody Number
ABB Environmental Services, Inc.	Mark Diblin	8/20/96	67917
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page** 1 of 2
2590 Executive Ctr. Cir. E	(904) 656-1293		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
Tallahassee / FL / 32301	Blake Svendsen	Steve Tafuni	
Project Name	**Carrier/Waybill Number**		
NAS Key West, Flying Club			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis: 601/602 w/HCl	EDB	PAH	TRPH w/HCl	Lead w/H_2SO_4	Special Instructions/ Conditions of Receipt
Key West - Y05	8/20/96	1215	X			5	1		4			3	3	2	1	1	
KYW - FLY - 01	8/20/96	1230	X			5	1		4			3	3	2	1	1	
KYW - FLY - MW - 14D	8/20/96	1345	X			5	1		4			3	3	2	1	1	
Key West Y20	8/20/96	1315	X			5	1		4			3	3	2	1	1	
KYW - FLY - 02	8/20/96	1615	X			5	1		4			3	3	2	1	1	
KYW - FLY - 06	8/20/96	1620	X			5	1		4			3	3	2	1	1	
KWY - FLY - 11	8/20/96	1651	X			5	1		4			3	3	2	1	1	
KYW - FLY - 12	8/20/96	1740	X			5	1		4			3	3	2	1	1	
KYW - FLY - 10	8/20/96	1740	X			5	1		4			3	3	2	1	1	
KYW - FLY - 15D	8/20/96	1820	X			5	1		4			3	3	2	1	1	
KYW - FLY - EB1	8/21/96	0700	X			5	1		4			3	3	2	1	1	
KYW - FLY - DP1	8/20/96		X			5	1		4			3	3	2	1	1	

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required STANDARD

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time
1. Relinquished By	8/21/96	0700
2. Relinquished By		
3. Relinquished By		

	Date	Time
1. Received By		
2. Received By		
3. Received By		

Comments

Chain of Custody Record

Quanterra Environmental Services

QUA-4124-1

Client: ABB Environmental Services, Inc.	Project Manager: Mark Diblin	Date: 8/21/96	Chain Of Custody Number: 67918
Address: 2590 Executive Ctr. Cir. E.	Telephone Number (Area Code)/Fax Number: (904) 656-1293	Lab Number:	Page 2 of 2
City: Tallahassee / State: FL / Zip Code: 32301	Site Contact: Blake Svendsen	Lab Contact: Steve Tafuni	
Project Name: NAS Key West, Flying Club	Carrier/Waybill Number:		
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H_2SO_4	HNO_3	HCl	NaOH	ZnAc/NaOH	Analysis: 601/602 w/HCl	EDB	PAH	TRPH w/HCl	Lead w/H_2SO_4	Total N/PO_4	TOC	COD	BOD	Special Instructions/ Conditions of Receipt
KYW-FLY-13	8/21/96	1030	X			5	1		4			3	3	2	1		1				
KYW-FLY-04	8/21/96	1100	X			5	4		4			3	3	2	1		1	2	1	1	
KYW-FLY-DP2	8/21/96		X			5			4			3	3	2	1						
KYW-FLY-03	8/21/96	1200	X			5	1		4			3	3	2	1		1				
KYW-FLY-19	8/21/96	1345	X			5			4			3	3	2	1						
KYW-FLY-17	8/21/96	1400	X			5	1		4			3	3	2	1		1				
TRIP BLANK			X						2			2									

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required: STANDARD

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By	8/21	1800	1. Received By		
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

Chain of Custody Record

QUA-4124-1 8508.33

Quanterra Environmental Services

Client	Project Manager	Date	Chain Of Custody Number
ABB Environmental Services	Mark Diblin	8/22/96	67919
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page 1 of 1**
2590 Executive Ctr. Cir. E	(904) 656-1293		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
Tallahassee / FL / 32301	Blake Sverdsen	Steve Tafuni	
Project Name	**Carrier/Waybill Number**		
NAS Key West, Flying Club			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/NaOH	Analysis: 601/602 w/HCl	EDB	610 PAH	TRPH w/HCl	Lead w/HNO3	Total N/PO4	Special Instructions/ Conditions of Receipt
KYW-FLY-18	8/22/96	0915	X			5			4			3	3	2	1			
KYW-Fly-16	8/22/96	0920	X			6			4			3	3	2	1			
KYW-Fly-09	8/22/96	1020	X			5			4			3	3	2	1			
KYW-FLY-07	8/22/96	1030	X			5	1		4			3	3	2	1		1	
KYW-FLY-08	8/22/96	1100	X			5	1		4			3	3	2	1		1	
KYW-FLY-13	8/21/96	1030	X					1								1		
KYW-FLY-04	8/21/96	1100	X					1								1		
KYW-FLY-03	8/21/96	1200	X					1								1		
KYW-FLY-19	8/21/96	1345	X					1								1		
KYW-FLY-17	8/21/96	1406	X					1								1		
KYW-FLY-DP2	8/21/96	—	X					1								1		
Trip Blank	—	—	X						3			3						

Possible Hazard Identification

☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal

☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required STANDARD

☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Relinquished By	Date	Time	Received By	Date	Time
1.	Blake E. Sverdsen			Carol McNulty	8/23/96	1000
2.						
3.						

Comments

DISTRIBUTION WHITE - Stays with the Sample; CANARY - Returned to Client with Report; PINK - Field Copy

Chain of Custody Record

Quanterra Environmental Services

QUA-4124-1

Client	Project Manager	Date	Chain Of Custody Number
ABB Environmental Services	Mark Diblin	8/23/96	53815
Address	**Telephone Number (Area Code)/Fax Number**	**Lab Number**	**Page** 1 of 1
2590 Executive Ctr. Cir. E	(904) 656-1293		
City / **State** / **Zip Code**	**Site Contact**	**Lab Contact**	
Tallahassee / FL / 32301	Blake Svendsen	Steve Tafuni	
Project Name	**Carrier/Waybill Number**		
NAS Key West, Flying Club			
Contract/Purchase Order/Quote No.			

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Aqueous	Sed.	Soil	Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH	Analysis: Lead	Special Instructions/ Conditions of Receipt
KYW-FLY-18	8/23/96	0915	X					1				1	
KYW-FLY-16	8/23/96	0920	X					1				1	
KYW-FLY-09	8/23/96	1020	X					1				1	
KYW-FLY-07	8/23/96	1030	X					1				1	
KYW-FLY-08	8/23/96	1100	X					1				1	

Possible Hazard Identification
☒ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☒ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 3 months)

Turn Around Time Required STANDARD
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other _____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By	8/23/96	0900	1. Received By Carol McNulty	8/24/96	0930 1000 am
2. Relinquished By			2. Received By		
3. Relinquished By			3. Received By		

Comments

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2201250				B6H2201250			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-01				KYW-FLY-02				KYW-FLY-03				KYW-FLY-04			
Collect Date:	20-AUG-96				20-AUG-96				21-AUG-96				21-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
UST GC VOLATILES																
Bromodichloromethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Bromoform	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Bromomethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Carbon tetrachloride	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Chlorobenzene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
2-Chloroethyl vinyl ether	0	U	ug/l	0	0	U	ug/l	0	0	U	ug/l	0	0	U	ug/l	0
Chloroform	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Chloromethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Dibromochloromethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,3-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,4-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Dichlorodifluoromethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,1-Dichloroethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichloroethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,1-Dichloroethene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
trans-1,2-Dichloroethene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichloropropane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
cis-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
trans-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Methylene chloride	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1.2		ug/l	1
1,1,2,2-Tetrachloroethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Tetrachloroethene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,1,1-Trichloroethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
1,1,2-Trichloroethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Trichloroethene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Trichlorofluoromethane	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Vinyl chloride	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
Benzene	4.9		ug/l	1	1	U	ug/l	1	2.1		ug/l	1	1	U	ug/l	1
Ethylbenzene	8.7		ug/l	1	1	U	ug/l	1	1	U	ug/l	1	28		ug/l	1
Toluene	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	5.3		ug/l	1
Xylenes (total)	1.5		ug/l	1	8.8		ug/l	1	2.4		ug/l	1	100		ug/l	1
Methyl tert-butyl ether	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1
UST SEMIVOLATILES																
Acenaphthene	2	U	ug/l	2	20	U	ug/l	20	2	U	ug/l	2	2	U	ug/l	2
Acenaphthylene	2	U	ug/l	2	20	U	ug/l	20	2	U	ug/l	2	2	U	ug/l	2
Anthracene	2	U	ug/l	2	20	U	ug/l	20	2	U	ug/l	2	2	U	ug/l	2
Benzo (a) anthracene	.1	U	ug/l	.1	1	U	ug/l	1	.1	U	ug/l	.1	.1	U	ug/l	.1
Benzo (a) pyrene	.1	U	ug/l	.1	1	U	ug/l	1	.1	U	ug/l	.1	.1	U	ug/l	.1
Benzo (b) fluoranthene	.1	U	ug/l	.1	1	U	ug/l	1	.1	U	ug/l	.1	.1	U	ug/l	.1
Benzo (g,h,i) perylene	.2	U	ug/l	.2	2	U	ug/l	2	.2	U	ug/l	.2	.2	U	ug/l	.2
Benzo (k) fluoranthene	.15	U	ug/l	.15	1.5	U	ug/l	1.5	.15	U	ug/l	.15	.15	U	ug/l	.15
Chrysene	.1	U	ug/l	.1	1	U	ug/l	1	.1	U	ug/l	.1	.1	U	ug/l	.1
Dibenzo (a,h) anthracene	.2	U	ug/l	.2	2	U	ug/l	2	.2	U	ug/l	.2	.2	U	ug/l	.2
Fluoranthene	.2	U	ug/l	.2	2	U	ug/l	2	.2	U	ug/l	.2	.2	U	ug/l	.2
Fluorene	2	U	ug/l	2	20	U	ug/l	20	2	U	ug/l	2	2	U	ug/l	2
Indeno (1,2,3-cd) pyrene	.1	U	ug/l	.1	1	U	ug/l	1	.1	U	ug/l	.1	.1	U	ug/l	.1
1-Methylnaphthalene	3.4		ug/l	2	22		ug/l	20	2.8		ug/l	2	23		ug/l	2
2-Methylnaphthalene	6.2		ug/l	2	40		ug/l	20	2	U	ug/l	2	30		ug/l	2

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2201250				B6H2201250			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-01				KYW-FLY-02				KYW-FLY-03				KYW-FLY-04			
Collect Date:	20-AUG-96				20-AUG-96				21-AUG-96				21-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Naphthalene	24		ug/l	2	110		ug/l	20	16		ug/l	2	23		ug/l	2
Phenanthrene	2	U	ug/l	2	20	U	ug/l	20	2	U	ug/l	2	2	U	ug/l	2
Pyrene	.2	U	ug/l	.2	2	U	ug/l	2	.2	U	ug/l	.2	.2	U	ug/l	.2
Ethylene dibromide	.02	U	ug/l	.02	.02	U	ug/l	.02	.02	U	ug/l	.02	.02	U	ug/l	.02
TPH	.5	U	mg/l	.5	1.7		mg/l	.5	.5	U	mg/l	.5	1.2		mg/l	.5

U = NOT DETECTED

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2301400				B6H2301400			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KEYWEST-Y05				KYW-FLY-06				KYW-FLY-07				KYW-FLY-08			
Collect Date:	20-AUG-96				20-AUG-96				22-AUG-96				22-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
UST GC VOLATILES																
Bromodichloromethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Bromoform	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Bromomethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Carbon tetrachloride	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Chlorobenzene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
2-Chloroethyl vinyl ether	0	U	ug/L	0	0	U	ug/l	0	0	U	ug/L	0	0	U	ug/L	0
Chloroform	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Chloromethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Dibromochloromethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,2-Dichlorobenzene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,3-Dichlorobenzene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,4-Dichlorobenzene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Dichlorodifluoromethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,1-Dichloroethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,2-Dichloroethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,1-Dichloroethene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
trans-1,2-Dichloroethene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,2-Dichloropropane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
cis-1,3-Dichloropropene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
trans-1,3-Dichloropropene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Methylene chloride	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,1,2,2-Tetrachloroethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Tetrachloroethene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,1,1-Trichloroethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
1,1,2-Trichloroethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Trichloroethene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Trichlorofluoromethane	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Vinyl chloride	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Benzene	1	U	ug/L	1	210		ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Ethylbenzene	1	U	ug/L	1	890		ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Toluene	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Xylenes (total)	1	U	ug/L	1	370		ug/l	100	1	U	ug/L	1	1	U	ug/L	1
Methyl tert-butyl ether	1	U	ug/L	1	100	U	ug/l	100	1	U	ug/L	1	1	U	ug/L	1
UST SEMIVOLATILES																
Acenaphthene	2	U	ug/L	2	20	U	ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Acenaphthylene	2	U	ug/L	2	20	U	ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Anthracene	2	U	ug/L	2	20	U	ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Benzo (a) anthracene	.1	U	ug/L	.1	1	U	ug/l	1	.1	U	ug/L	.1	.1	U	ug/L	.1
Benzo (a) pyrene	.1	U	ug/L	.1	1	U	ug/l	1	.1	U	ug/L	.1	.1	U	ug/L	.1

KEY WEST FLY CLUB -- GROU. .ATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2301400				B6H2301400			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KEYWEST-Y05				KYW-FLY-06				KYW-FLY-07				KYW-FLY-08			
Collect Date:	20-AUG-96				20-AUG-96				22-AUG-96				22-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Benzo (b) fluoranthene	.1	U	ug/L	.1	1	U	ug/l	1	.1	U	ug/L	.1	.1	U	ug/L	.1
Benzo (g,h,i) perylene	.2	U	ug/L	.2	2	U	ug/l	2	.2	U	ug/L	.2	.2	U	ug/L	.2
Benzo (k) fluoranthene	.15	U	ug/L	.15	1.5	U	ug/l	1.5	.15	U	ug/L	.15	.15	U	ug/L	.15
Chrysene	.1	U	ug/L	.1	1	U	ug/l	1	.1	U	ug/L	.1	.1	U	ug/L	.1
Dibenzo (a,h) anthracene	.2	U	ug/L	.2	2	U	ug/l	2	.2	U	ug/L	.2	.2	U	ug/L	.2
Fluoranthene	.2	U	ug/L	.2	2	U	ug/l	2	.2	U	ug/L	.2	.2	U	ug/L	.2
Fluorene	2	U	ug/L	2	20	U	ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Indeno (1,2,3-cd) pyrene	.1	U	ug/L	.1	1	U	ug/l	1	.1	U	ug/L	.1	.1	U	ug/L	.1
1-Methylnaphthalene	2	U	ug/L	2	48		ug/l	20	2	U	ug/L	2	2	U	ug/L	2
2-Methylnaphthalene	2	U	ug/L	2	61		ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Naphthalene	2	U	ug/L	2	340		ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Phenanthrene	2	U	ug/L	2	20	U	ug/l	20	2	U	ug/L	2	2	U	ug/L	2
Pyrene	.2	U	ug/L	.2	2	U	ug/l	2	.2	U	ug/L	.2	.2	U	ug/L	.2
Ethylene dibromide	.02	U	ug/L	.02	.02	U	ug/l	.02	.02	U	ug/L	.02	.02	U	ug/L	.02
TPH	.5	U	mg/l	.5	5		mg/l	.5	.5	U	mg/l	.5	.5	U	mg/l	.5

U = NOT DETECTED

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2301400				B6H2201250				B6H2201250				B6H2201250					
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST					
Locator	KYW-FLY-09				KYW-FLY-10				KYW-FLY-11				KYW-FLY-12					
Collect Date:	22-AUG-96				20-AUG-96				20-AUG-96				20-AUG-96					
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL		
UST GC VOLATILES																		
Bromodichloromethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Bromoform	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Bromomethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Carbon tetrachloride	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Chlorobenzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
2-Chloroethyl vinyl ether	0	U	ug/L	0	0	U	ug/l	0	0	U	ug/l	0	0	U	ug/l	0		
Chloroform	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Chloromethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Dibromochloromethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,2-Dichlorobenzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,3-Dichlorobenzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,4-Dichlorobenzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Dichlorodifluoromethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,1-Dichloroethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,2-Dichloroethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,1-Dichloroethene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
trans-1,2-Dichloroethene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,2-Dichloropropane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
cis-1,3-Dichloropropene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
trans-1,3-Dichloropropene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Methylene chloride	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,1,2,2-Tetrachloroethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Tetrachloroethene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,1,1-Trichloroethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
1,1,2-Trichloroethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Trichloroethene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Trichlorofluoromethane	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Vinyl chloride	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Benzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Ethylbenzene	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Toluene	1	U	ug/L	1	2.3		ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Xylenes (total)	1	U	ug/L	1	1.5		ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
Methyl tert-butyl ether	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/l	1	1	U	ug/l	1		
UST SEMIVOLATILES																		
Acenaphthene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2		
Acenaphthylene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2		
Anthracene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2		
Benzo (a) anthracene	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/l	.1	.1	U	ug/l	.1		
Benzo (a) pyrene	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/l	.1	.1	U	ug/l	.1		

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2301400				B6H2201250				B6H2201250				B6H2201250			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-09				KYW-FLY-10				KYW-FLY-11				KYW-FLY-12			
Collect Date:	22-AUG-96				20-AUG-96				20-AUG-96				20-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Benzo (b) fluoranthene	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/l	.1	.1	U	ug/l	.1
Benzo (g,h,i) perylene	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/l	.2	.2	U	ug/l	.2
Benzo (k) fluoranthene	.15	U	ug/L	.15	.15	U	ug/l	.15	.15	U	ug/l	.15	.15	U	ug/l	.15
Chrysene	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/l	.1	.1	U	ug/l	.1
Dibenzo (a,h) anthracene	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/l	.2	.2	U	ug/l	.2
Fluoranthene	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/l	.2	.2	U	ug/l	.2
Fluorene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2
Indeno (1,2,3-cd) pyrene	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/l	.1	.1	U	ug/l	.1
1-Methylnaphthalene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2
2-Methylnaphthalene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2
Naphthalene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2
Phenanthrene	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/l	2	2	U	ug/l	2
Pyrene	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/l	.2	.2	U	ug/l	.2
Ethylene dibromide	.02	U	ug/L	.02	.02	U	ug/l	.02	.02	U	ug/l	.02	.02	U	ug/l	.02
TPH	.5	U	mg/l	.5	.5	U	mg/l	.5	.5	U	mg/l	.5	.5	U	mg/l	.5

U = NOT DETECTED

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2201250				B6H2301400					
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST					
Locator	KYW-FLY-13				KYWFLY-MW-14D				KYW-FLY-15D				KYW-FLY-16					
Collect Date:	21-AUG-96				20-AUG-96				20-AUG-96				22-AUG-96					
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL		
UST GC VOLATILES																		
Bromodichloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Bromoform	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Bromomethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Carbon tetrachloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Chlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
2-Chloroethyl vinyl ether	0	U	ug/l	0	0	U	ug/L	0	0	U	ug/l	0	0	U	ug/L	0		
Chloroform	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Chloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Dibromochloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,2-Dichlorobenzene	1	U	ug/l	1	2.4		ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,3-Dichlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,4-Dichlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Dichlorodifluoromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1-Dichloroethane	1	U	ug/l	1	1	U	ug/L	1	8.6		ug/l	1	1	U	ug/L	1		
1,2-Dichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1-Dichloroethene	1	U	ug/l	1	1	U	ug/L	1	5.9		ug/l	1	1	U	ug/L	1		
trans-1,2-Dichloroethene	1	U	ug/l	1	1	U	ug/L	1	3.7		ug/l	1	1	U	ug/L	1		
1,2-Dichloropropane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
cis-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
trans-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Methylene chloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,2,2-Tetrachloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Tetrachloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,1-Trichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,2-Trichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Trichloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Trichlorofluoromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Vinyl chloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Benzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Ethylbenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Toluene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Xylenes (total)	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Methyl tert-butyl ether	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
UST SEMIVOLATILES																		
Acenaphthene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2		
Acenaphthylene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2		
Anthracene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2		
Benzo (a) anthracene	.1	U	ug/l	.1	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/L	.1		
Benzo (a) pyrene	.1	U	ug/l	.1	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/L	.1		

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				B6H2201250				B6H2301400			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-13				KYWFLY-MW-14D				KYW-FLY-15D				KYW-FLY-16			
Collect Date:	21-AUG-96				20-AUG-96				20-AUG-96				22-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Benzo (b) fluoranthene	.1	U	ug/l	.1	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/L	.1
Benzo (g,h,i) perylene	.2	U	ug/l	.2	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/L	.2
Benzo (k) fluoranthene	.15	U	ug/l	.15	.15	U	ug/L	.15	.15	U	ug/l	.15	.15	U	ug/L	.15
Chrysene	.1	U	ug/l	.1	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/L	.1
Dibenzo (a,h) anthracene	.2	U	ug/l	.2	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/L	.2
Fluoranthene	.2	U	ug/l	.2	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/L	.2
Fluorene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2
Indeno (1,2,3-cd) pyrene	.1	U	ug/l	.1	.1	U	ug/L	.1	.1	U	ug/l	.1	.1	U	ug/L	.1
1-Methylnaphthalene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2
2-Methylnaphthalene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2
Naphthalene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2
Phenanthrene	2	U	ug/l	2	2	U	ug/L	2	2	U	ug/l	2	2	U	ug/L	2
Pyrene	.2	U	ug/l	.2	.2	U	ug/L	.2	.2	U	ug/l	.2	.2	U	ug/L	.2
Ethylene dibromide	.02	U	ug/l	.02	.02	U	ug/L	.02	.02	U	ug/l	.02	.02	U	ug/L	.02
TPH	.5	U	mg/l	.5	.5	U	mg/l	.5	.5	U	mg/l	.5	.5	U	mg/l	.5

U = NOT DETECTED

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2301400				B6H2201250				B6H2201250					
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST					
Locator	KYW-FLY-17				KYW-FLY-18				KYW-FLY-19				KEYWEST Y20					
Collect Date:	21-AUG-96				22-AUG-96				21-AUG-96				20-AUG-96					
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL		
UST GC VOLATILES																		
Bromodichloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Bromoform	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Bromomethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Carbon tetrachloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Chlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
2-Chloroethyl vinyl ether	0	U	ug/l	0	0	U	ug/L	0	0	U	ug/l	0	0	U	ug/L	0		
Chloroform	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Chloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Dibromochloromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,2-Dichlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,3-Dichlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,4-Dichlorobenzene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Dichlorodifluoromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1-Dichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,2-Dichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1-Dichloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
trans-1,2-Dichloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,2-Dichloropropane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
cis-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
trans-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Methylene chloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,2,2-Tetrachloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Tetrachloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,1-Trichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
1,1,2-Trichloroethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Trichloroethene	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Trichlorofluoromethane	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Vinyl chloride	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Benzene	14		ug/l	1	2.3		ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Ethylbenzene	14		ug/l	1	5.2		ug/L	1	1	U	ug/l	1	33		ug/L	1		
Toluene	3.6		ug/l	1	3		ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
Xylenes (total)	7.6		ug/l	1	4.9		ug/L	1	1	U	ug/l	1	2.4		ug/L	1		
Methyl tert-butyl ether	1	U	ug/l	1	1	U	ug/L	1	1	U	ug/l	1	1	U	ug/L	1		
UST SEMIVOLATILES																		
Acenaphthene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	20	U	ug/L	20		
Acenaphthylene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	20	U	ug/L	20		
Anthracene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	20	U	ug/L	20		
Benzo (a) anthracene	.1	U	ug/l	.1	.5	U	ug/L	.5	.1	U	ug/l	.1	1	U	ug/L	1		
Benzo (a) pyrene	.1	U	ug/l	.1	.5	U	ug/L	.5	.1	U	ug/l	.1	1	U	ug/L	1		

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:		B6H2201250				B6H2301400				B6H2201250				B6H2201250				
Site		KEY WEST				KEY WEST				KEY WEST				KEY WEST				
Locator		KYW-FLY-17				KYW-FLY-18				KYW-FLY-19				KEYWEST Y20				
Collect Date:		21-AUG-96				22-AUG-96				21-AUG-96				20-AUG-96				
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL		
Benzo (b) fluoranthene	.1	U	ug/l	.1	.5	U	ug/L	.5	.1	U	ug/l	.1	1	U	ug/L	1		
Benzo (g,h,i) perylene	.2	U	ug/l	.2	1	U	ug/L	1	.2	U	ug/l	.2	2	U	ug/L	2		
Benzo (k) fluoranthene	.15	U	ug/l	.15	.75	U	ug/L	.75	.15	U	ug/l	.15	1.5	U	ug/L	1.5		
Chrysene	.1	U	ug/l	.1	.5	U	ug/L	.5	.1	U	ug/l	.1	1	U	ug/L	1		
Dibenzo (a,h) anthracene	.2	U	ug/l	.2	1	U	ug/L	1	.2	U	ug/l	.2	2	U	ug/L	2		
Fluoranthene	.2	U	ug/l	.2	1	U	ug/L	1	.2	U	ug/l	.2	2	U	ug/L	2		
Fluorene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	20	U	ug/L	20		
Indeno (1,2,3-cd) pyrene	.1	U	ug/l	.1	.5	U	ug/L	.5	.1	U	ug/l	.1	1	U	ug/L	1		
1-Methylnaphthalene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	70		ug/L	20		
2-Methylnaphthalene	2	U	ug/l	2	15		ug/L	10	2	U	ug/l	2	150		ug/L	20		
Naphthalene	16		ug/l	2	110		ug/L	10	2	U	ug/l	2	140		ug/L	20		
Phenanthrene	2	U	ug/l	2	10	U	ug/L	10	2	U	ug/l	2	20	U	ug/L	20		
Pyrene	.2	U	ug/l	.2	1	U	ug/L	1	.2	U	ug/l	.2	2	U	ug/L	2		
Ethylene dibromide	.02	U	ug/l	.02	.02	U	ug/L	.02	.02	U	ug/l	.02	.02	U	ug/L	.02		
TPH	.5	U	mg/l	.5	1.5		mg/l	.5	.5	U	mg/l	.5	1.9		mg/l	.5		

U = NOT DETECTED

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250			
Site	KEY WEST				KEY WEST			
Locator	KYW-FLY-DP1				KYW-FLY-DP2			
Collect Date:	20-AUG-96				21-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
UST GC VOLATILES								
Bromodichloromethane	1	U	ug/l	1	1	U	ug/l	1
Bromoform	1	U	ug/l	1	1	U	ug/l	1
Bromomethane	1	U	ug/l	1	1	U	ug/l	1
Carbon tetrachloride	1	U	ug/l	1	1	U	ug/l	1
Chlorobenzene	1	U	ug/l	1	1	U	ug/l	1
2-Chloroethyl vinyl ether	0	U	ug/l	0	0	U	ug/l	0
Chloroform	1	U	ug/l	1	1	U	ug/l	1
Chloromethane	1	U	ug/l	1	1	U	ug/l	1
Dibromochloromethane	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1
1,3-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1
1,4-Dichlorobenzene	1	U	ug/l	1	1	U	ug/l	1
Dichlorodifluoromethane	1	U	ug/l	1	1	U	ug/l	1
1,1-Dichloroethane	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichloroethane	1	U	ug/l	1	1	U	ug/l	1
1,1-Dichloroethene	1	U	ug/l	1	1	U	ug/l	1
trans-1,2-Dichloroethene	1	U	ug/l	1	1	U	ug/l	1
1,2-Dichloropropane	1	U	ug/l	1	1	U	ug/l	1
cis-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/l	1
trans-1,3-Dichloropropene	1	U	ug/l	1	1	U	ug/l	1
Methylene chloride	1	U	ug/l	1	1	U	ug/l	1
1,1,2,2-Tetrachloroethane	1	U	ug/l	1	1	U	ug/l	1
Tetrachloroethene	1	U	ug/l	1	1	U	ug/l	1
1,1,1-Trichloroethane	1	U	ug/l	1	1	U	ug/l	1
1,1,2-Trichloroethane	1	U	ug/l	1	1	U	ug/l	1
Trichloroethene	1	U	ug/l	1	1	U	ug/l	1
Trichlorofluoromethane	1	U	ug/l	1	1	U	ug/l	1
Vinyl chloride	1	U	ug/l	1	1	U	ug/l	1
Benzene	5.5		ug/l	1	1	U	ug/l	1
Ethylbenzene	18		ug/l	1	25		ug/l	1
Toluene	1.4		ug/l	1	5.1		ug/l	1
Xylenes (total)	2.4		ug/l	1	96		ug/l	1
Methyl tert-butyl ether	1	U	ug/l	1	1	U	ug/l	1
UST SEMIVOLATILES								
Acenaphthene	2	U	ug/l	2	2	U	ug/l	2
Acenaphthylene	2	U	ug/l	2	2	U	ug/l	2
Anthracene	2	U	ug/l	2	2	U	ug/l	2
Benzo (a) anthracene	.1	U	ug/l	.1	.1	U	ug/l	.1
Benzo (a) pyrene	.1	U	ug/l	.1	.1	U	ug/l	.1

KEY WEST FLY CLUB -- GROUNDWATER ANALYTICAL RESULTS
REPORT REQUEST NUMBER - 9122

Lab Sample Number:	B6H2201250				B6H2201250				
Site	KEY WEST				KEY WEST				
Locator	KYW-FLY-DP1				KYW-FLY-DP2				
Collect Date:	20-AUG-96				21-AUG-96				
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	
Benzo (b) fluoranthene	.1	U	ug/l	.1	.1	U	ug/l	.1	
Benzo (g,h,i) perylene	.2	U	ug/l	.2	.2	U	ug/l	.2	
Benzo (k) fluoranthene	.15	U	ug/l	.15	.15	U	ug/l	.15	
Chrysene	.1	U	ug/l	.1	.1	U	ug/l	.1	
Dibenzo (a,h) anthracene	.2	U	ug/l	.2	.2	U	ug/l	.2	
Fluoranthene	.2	U	ug/l	.2	.2	U	ug/l	.2	
Fluorene	2	U	ug/l	2	2	U	ug/l	2	
Indeno (1,2,3-cd) pyrene	.1	U	ug/l	.1	.1	U	ug/l	.1	
1-Methylnaphthalene	2	U	ug/l	2	24		ug/l	2	
2-Methylnaphthalene	2	U	ug/l	2	32		ug/l	2	
Naphthalene	2	U	ug/l	2	24		ug/l	2	
Phenanthrene	2	U	ug/l	2	2	U	ug/l	2	
Pyrene	.2	U	ug/l	.2	.2	U	ug/l	.2	
Ethylene dibromide	.02	U	ug/l	.02	.02	U	ug/l	.02	
TPH	.5	U	mg/l	.5	.99		mg/l	.5	

U = NOT DETECTED

KEY WEST FLY CLUB -- LEAD ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:	B6H2201250				B6H2201250				B6H2301400				B6H2301400			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-01				KYW-FLY-02				KYW-FLY-03				KYW-FLY-04			
Collect Date:	20-AUG-96				20-AUG-96				21-AUG-96				21-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Lead	5	U	ug/l	5	5	U	ug/l	5	5	U	ug/L	5	12.5		ug/L	5

U = NOT DETECTED

KEY WEST FLY CLUB -- [illegible] ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:	B6H2201250				B6H2201250				B6H2401090				B6H2401090			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KEYWEST-Y05				KYW-FLY-06				KYW-FLY-07				KYW-FLY-08			
Collect Date:	20-AUG-96				20-AUG-96				23-AUG-96				23-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Lead	5	U	ug/L	5	12.9		ug/l	5	5	U	ug/l	5	5	U	ug/l	5

U = NOT DETECTED

KEY WEST FLY CLUB -- LEAD ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:		B6H2401090				B6H2201250				B6H2201250				B6H2201250			
Site		KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator		KYW-FLY-09				KYW-FLY-10				KYW-FLY-11				KYW-FLY-12			
Collect Date:		23-AUG-96				20-AUG-96				20-AUG-96				20-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Lead	5	U	ug/l	5	5	U	ug/l	5	5	U	ug/l	5	5	U	ug/l	5

U = NOT DETECTED

KEY WEST FLY CLUB -- LEAD ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:	B6H2301400				B6H2201250				B6H2201250				B6H2401090			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-13				KYWFLY-MW-14D				KYW-FLY-15D				KYW-FLY-16			
Collect Date:	21-AUG-96				20-AUG-96				20-AUG-96				23-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Lead	5	U	ug/L	5	5	U	ug/L	5	5	U	ug/l	5	5	U	ug/l	5

U = NOT DETECTED

KEY WEST FLY CLUB -- LEAD ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:	B6H2301400				B6H2401090				B6H2301400				B6H2201250			
Site	KEY WEST				KEY WEST				KEY WEST				KEY WEST			
Locator	KYW-FLY-17				KYW-FLY-18				KYW-FLY-19				KEYWEST Y20			
Collect Date:	21-AUG-96				23-AUG-96				21-AUG-96				20-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL
Lead	5	U	ug/L	5	8		ug/l	5	5	U	ug/L	5	11		ug/L	5

U = NOT DETECTED

KEY WEST FLY CLUB -- LEAD ANALYTICAL RESULTS
GROUNDWATER -- REPORT NO. 9126

Lab Sample Number:		B6H2201250				B6H2301400			
Site		KEY WEST				KEY WEST			
Locator		KYW-FLY-DP1				KYW-FLY-DP2			
Collect Date:		20-AUG-96				21-AUG-96			
	VALUE	QUAL	UNITS	DL	VALUE	QUAL	UNITS	DL	
Lead	5	U	ug/l	5	12.2		ug/L	5	

U = NOT DETECTED

ABB ENVIRONMENTAL SERVICES, INC
TREATABILITY LABORATORY
LABORATORY ANALYSIS REPORT

Prepared For:

Karen Hartnett
ABB Environmental Services, Inc.
2590 Executive Center
Circle East, Berkeley Building
Tallahassee, FL 32301-5001

09/19/96

Prepared By:

ABB Environmental Services, Inc.
107 Audubon Road
Wakefield, MA 01880

Patricia Byrnes
Treatability Laboratory Manager

CHAIN OF CUSTODY RECORD

Page 1

PROJECT NO. 8508.32

PROJECT NAME NAS KeyWest Flying Club

SAMPLERS (SIGNATURE) Blake F. Svendsen

STA. NO.	DATE	TIME	COMP.	GRAB	STATION LOCATION	NO. OF CONTAINERS	SAMPLE TYPE: Bacteria SieveEOC	Total N, POC, TRPH	TOC	Dissolved Iron	S	Cl, Hardness, alk, Soil, Total Iron, Sulfate	NH_4, NO_3, NO_2	REMARKS: INDICATE SOIL/WATER/AIR SEDIMENT/SLUDGE
RB-1	8/20	850		X	KYW-Fly-RB1	2	2							Soil Hot BTEX
RB-1	8/20	910	X		KYW-Fly-RB1	2		2						Soil Hot BTEX
RB-1	8/20	910		X	KYW-Fly-RB1	1			1					Soil Hot BTEX
MW-4	8/21	1220		X	KYW-Fly-04	14				3	3	3	5	Water

For Bacterian samples we would like a split of specific petroleum degraders

RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
Blake F. Svendsen	8/20/91 1330	Fumiko Y 8/23/91			
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)	RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED BY: (SIGNATURE)
RELINQUISHED BY: (SIGNATURE)	DATE/TIME	RECEIVED FOR DISPOSAL BY: (SIGNATURE)	DATE/TIME	REMARKS	

ABB Environmental Services, Inc.

OH-62

91-18-120

ABB ENVIRONMENTAL SERVICES, INC.
TREATABILITY LABORATORY
BACTERIA ANALYSIS
ANALYSIS REPORT

Project: **Key West**
Project Number: **8508.32**
Date of Analysis: **8/29/96**
Work Order No.: **96-08-020A**

Sample ID	Date Sampled	Total Bacteria (CFU/ml or g)	Specific Bacteria (CFU/ml or g)	% Specific Bacteria
RB-1 (soil)	8/20/96	1.3×10^5	7.3×10^4	56
MW-4 (water)	8/20/96	7.6×10^2 J	3 J	NA

J: below quantitation limit

ABB Environmental Services, Inc.
Analytical Laboratory
Fraction Organic Carbon
Analysis Report

Project: Key West Flying Club
Project Number: 8508.32
Date of Analysis: 9/6/96
Date Reported: 9/19/96

Sample ID	Date Sampled	% Volatilzed Solids	Fraction Organic Carbon %
RB-1	8/20/96	1.67	0.83
RB-1 DUP	8/20/96	1.64	0.82

ABB ENVIRONMENTAL SERVICES, INC
ANALYTICAL LABORATORY
INORGANIC CONSTITUENTS
ANALYSIS REPORT

Project: NAS Key West Flying Club
Project Number: 8508.32
Date of Analysis: 9/10/96
Date Reported: 9/17/96
Work Order No.: 96-08-020

Sample ID	Date Sampled	Date Analyzed	NH_4-N ppm	NO_3-N ppm	NO_2-N* ppm	PO_4-PO_4* ppm	SO_4 ppm	S^- ppm	Total Fe ppm	Disolved Fe ppm	Cl^- ppm	Hardness	Alkalinity	pH
RB-1	8/20/96	9/10/96	< 5	< 1.25	NA	< 5	NA	NA	NA	NA	NA	NA	NA	7
MW-4	8/20/96	9/10/96	< 1	< 0.25	< 0.2	< 1	<10	< 0.2	< 0.5	< 0.5	17	146	180	7

NA: not analyzed

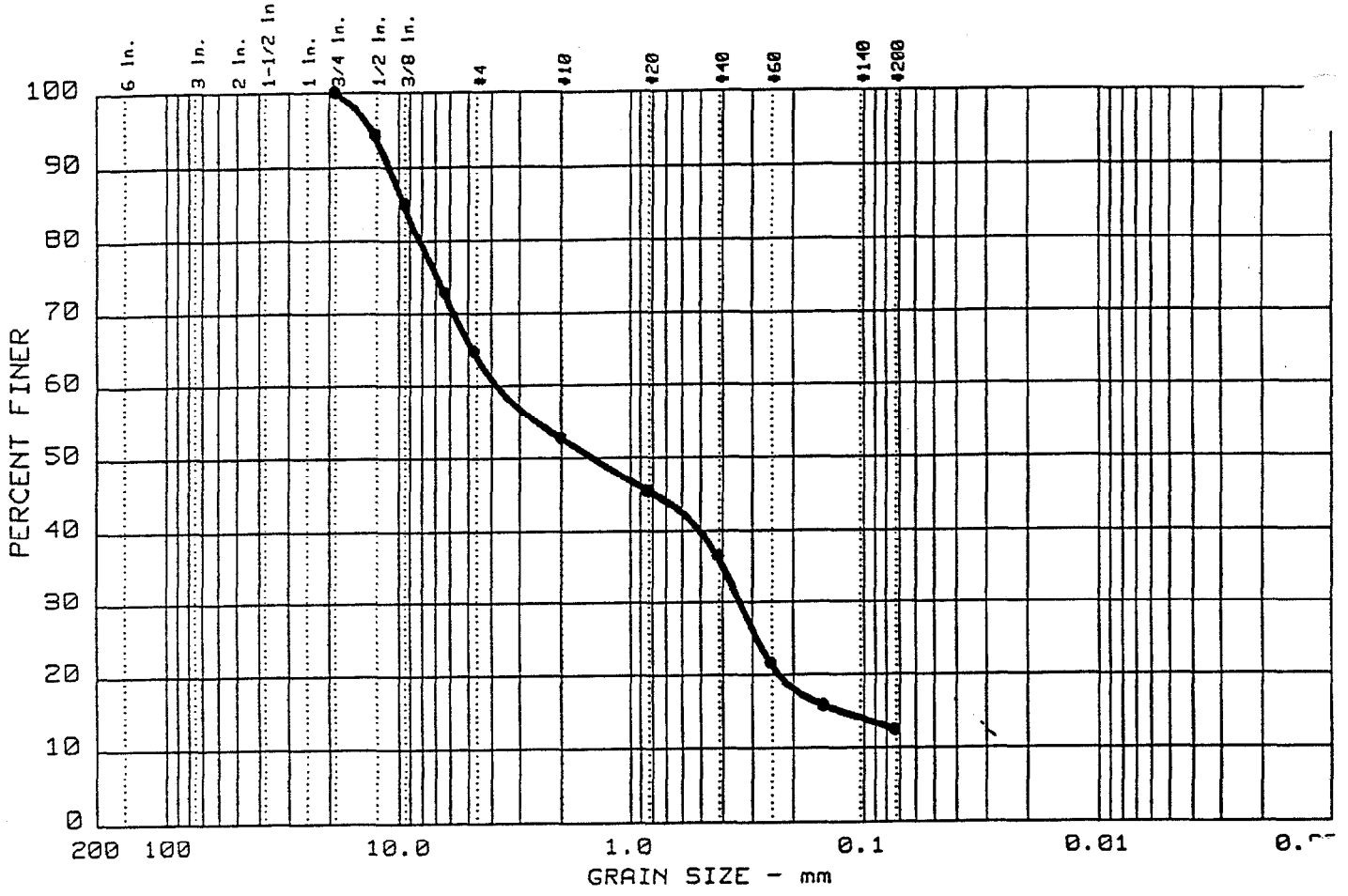
*Note: Revised data 9/19/96 11:00 am, please discard previous version.

ABB ENVIRONMENTAL SERVICES, INC.
TREATABILITY LABORATORY
TOTAL PETROLEUM HYDROCARBON ANALYSIS

Project: NAS Key West Flying Club
Project Number: 8508.32
Date Prepared: 9/17/96

Total Petroleum Hydrocarbon Method: EPA Method 418.1			
Sample ID	Date Sampled	Date Analyzed	PPM (mg/L)
RB-1	8/20/96	9/12/96	3,530
RB-1 DUP	8/20/96	9/12/96	3,890

PARTICLE SIZE DISTRIBUTION TEST REPORT



	% +3"	% GRAVEL	% SAND	% SILT	% CLAY	USCS	LL	PI
●	0.0	35.2	52.3	12.5		SM		

SIEVE inches size	PERCENT FINER ●
0.75	100.0
0.5	94.2
0.375	85.0
0.25	72.9

GRAIN SIZE	
D_{60}	3.75
D_{30}	0.33
D_{10}	

COEFFICIENTS	
C_c	
C_u	

SIEVE number size	PERCENT FINER ●
4	64.8
10	52.7
20	45.4
40	36.5
60	21.7
100	15.9
200	12.5

Sample information:

● KYW-FLY-RB1
Fine Gravely Coarse to Fine SAND; Little silt

Remarks:
Heavy fuel odor.
Cemented fragments left as recieved from the field.

ABB Environmental Services, Inc.

Project No.: 8506.33.028
Project: NAS KEY WEST FLYING CLUB

Date: 9/04/96 Data Sheet No. 5

GRAIN SIZE DISTRIBUTION TEST DATA Test No.: 3

Date: 9/04/96
Project No.: 8506.33.028
Project: NAS KEY WEST FLYING CLUB

Sample Data

Location of Sample: KYW-FLY-RB1
Sample Description 1: Fine Gravely Coarse to
Sample Description 2: Fine SAND; Little silt
USCS Class: SM Liquid limit: Plasticity index:

Notes

Remarks: Heavy fuel odor. Cemented fragments left as recieved from the field.
Data Sheet No.: 5

Mechanical Analysis Data

	Initial	After wash
Dry sample and tare=	560.99	505.81
Tare =	117.60	117.60
Dry sample weight =	443.39	388.21
Minus #200 from wash=	12.4 %	

Sieve tare method

Sieve	Weight retained	Sieve tare	Percent finer
0.75 inches	0.00	0.00	100.0
0.5 inches	25.88	0.00	94.2
0.375 inches	40.59	0.00	85.0
0.25 inches	53.68	0.00	72.9
# 4	35.75	0.00	64.8
# 10	53.97	0.00	52.7
# 20	32.10	0.00	45.4
# 40	39.79	0.00	36.5
# 60	65.41	0.00	21.7
# 100	25.66	0.00	15.9
# 200	15.17	0.00	12.5

Fractional Components

Gravel/Sand based on #4 sieve
Sand/Fines based on #200 sieve
% + 3 in. = 0.0 % GRAVEL = 35.2 % SAND = 52.3
% FINES = 12.5

D85= 9.52 D60= 3.745 D50= 1.457
D30= 0.3338 D15= 0.12402