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WORK PLAN

CONTAMINATION ASSESSMENT OF SUBSURFACE HYDROCARBONS SURROUNDING THE JP-5 TANK-2 AT THE TRUMBO POINT FUEL FARM, NAS KEY WEST, FLORIDA

Prepared for

DEPARTMENT OF THE NAVY
Southern Division
Naval Facilities Engineering Command
Charleston, South Carolina

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INTRODUCTION

In June 1988, Geraghty & Miller, Inc., (G&M) was retained by the Southern Division, Naval Facilities Engineering Command (Navy) to provide architectural/ engineering services which include hydrogeologic consulting services at the Naval Air Station, Key West, Florida (Figure 1). The area of investigation is located at the Trumbo Point Fuel Farm in the vicinity of the JP-5 tank (Tank No. 2) (Figure 2). The investigation was requested because personnel working in this area reportedly observed fuel seeping through openings in the sea-wall. Subsequently, the openings in the sea-wall were sealed, and a pit was excavated landward of the sea-wall to facilitate liquid-phase hydrocarbon recovery. Several weeks later, fuel was again observed seeping from the sea-wall east of the first area. The sea-wall was again sealed, and another pit was excavated to recover the fuel. As a result of the presence of liquid-phase hydrocarbons, the Navy has requested that G&M perform the first of a four-phase investigation according to the statement of work submitted to G&M by the Navy. Phase I consisted of the preparation of a Contamination Assessment Work Plan. That document, which is contained herein, outlines the work proposed for the Contamination Assessment investigation (Phase II) which includes a field investigation and report preparation.

The proposed work plan is designed to achieve the objectives of a Contamination Assessment (CA) as specified by Florida Department of Environmental Regulation (FDER), Chapter 17-70.008(2) of the Florida Administrative Code (FAC), as outlined below:

- o Determine whether the soil, sediment, surface or ground water are contaminated at the site (17-70.008[2][a]);

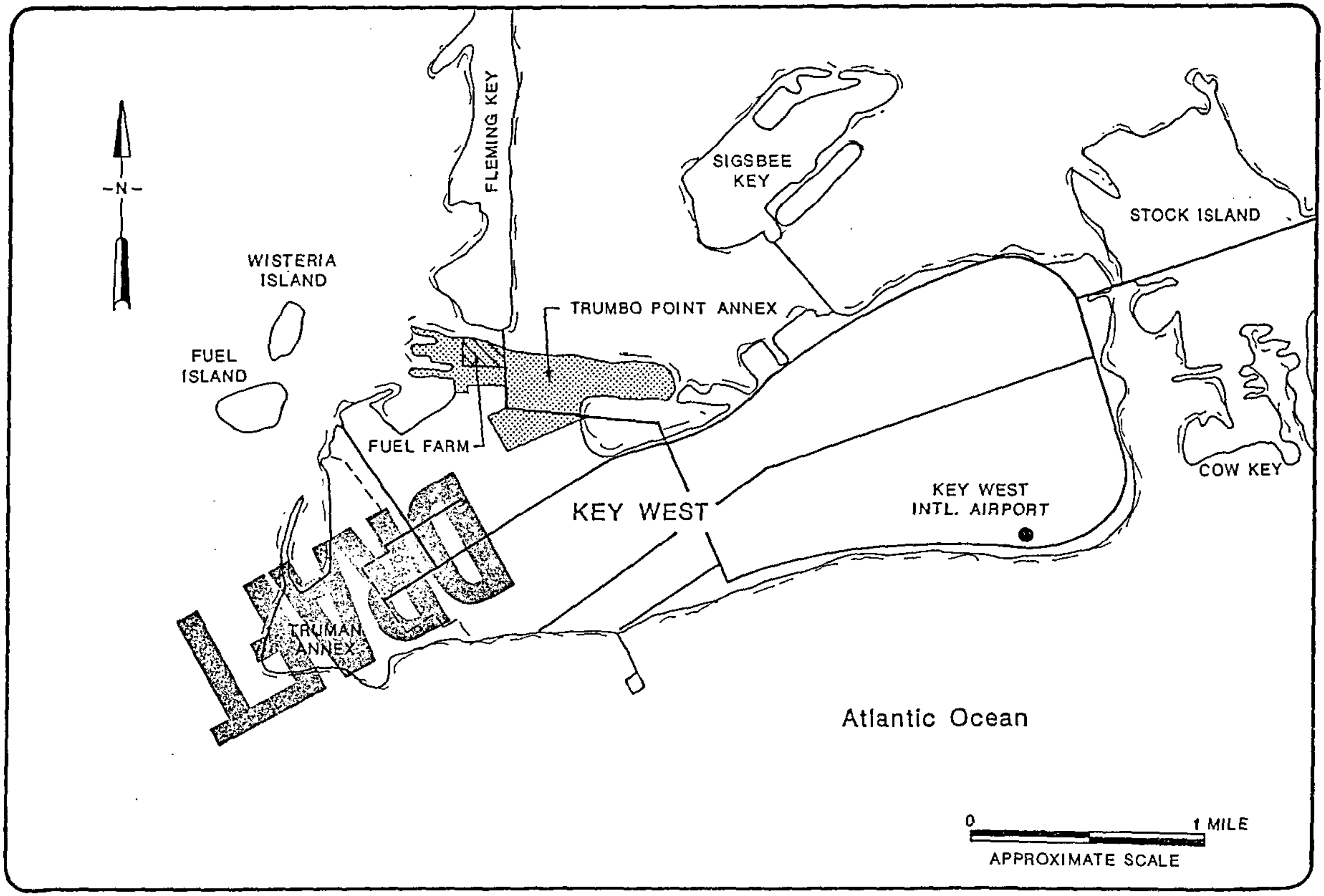

Figure 1.

Location of the Fuel Farm at the Trumbo Point Annex of the NAS-Key West, Florida.

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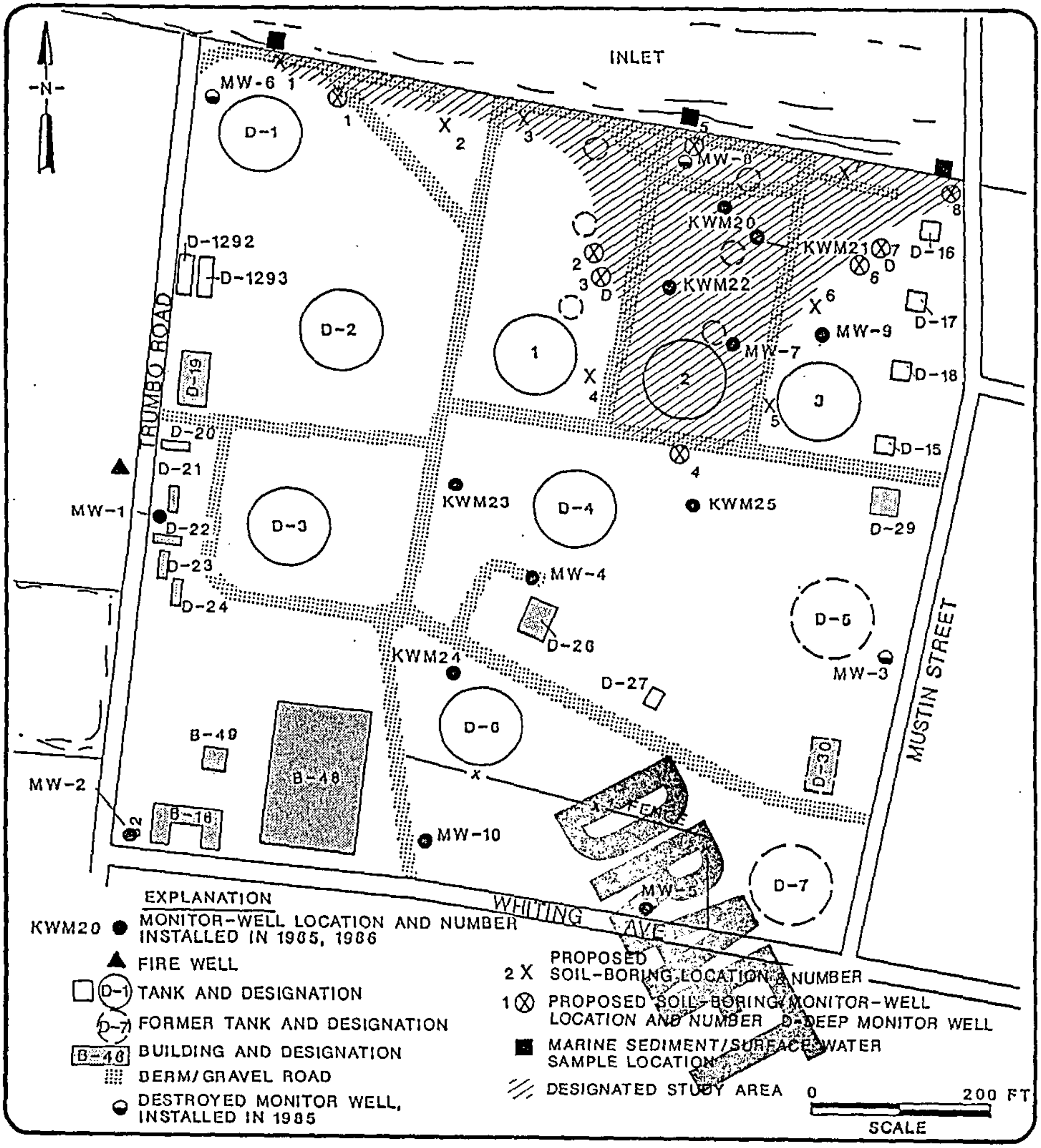

Figure 2.

Location of the JP-5 Site at the Fuel Farm.

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- o Determine or confirm the contaminant source(s) (17-70.008[2][c]);

- o Establish the horizontal extent and thickness of liquid-phase hydrocarbons (17-70.008-[2][d]);

- o Describe relevant geologic and hydrogeologic characteristics of affected and potentially affected hydrogeologic zones (17-70.008-[2][e]);

- o Describe geologic and hydrogeologic characteristics of the site which influence migration and transport of contaminants, including the rate and direction of ground-water flow (17-70.008[2][f]);

- o Determine other mechanisms of contaminant transport, including rate and direction of contaminant movement in soils and surface waters (17-70.008[2][g]); and

- o Determine the horizontal and vertical extent of the contamination (17-70.008[2][h]).

To achieve the objectives of the CA, the following tasks, which have been summarized below and detailed in the CA plan, will be performed.

- o Installation of soil borings to determine geologic and hydrogeologic characteristics of the site, such as aquifer thickness, depth to the confining bed, thickness of the unsaturated zone, and to determine the extent of liquid-phase hydrocarbons in the soil (17-70.008[3][d]).

- Installation of monitor wells to determine the horizontal and vertical direction of ground-water flow, to sample ground water, and to determine the thickness and horizontal and vertical extent of liquid-phase hydrocarbons (17-70.008[3][e][j]);

- Ground-water sampling to determine the horizontal and vertical extent of dissolved hydrocarbons in the subsurface and to determine the natural background water quality (17-70.008[3][b][j]);

- Sampling of surface water and sediments to determine if dissolved hydrocarbons have entered the marine environment (17-70.008-[3][h]);

- Survey of applicable literature sources (17-70.008[3][k]);

- Inventory of potable wells within a one-quarter-mile radius of the site;

- Aquifer testing to determine the hydraulic characteristics of the site;

- Liquid-phase hydrocarbon sampling to verify the type of liquid-phase hydrocarbons at the site; and

- Review of tank testing field reports and fuel inventory records.

All tasks will be implemented pursuant to the CA plan. Two G&M representatives will meet with Navy and FDER representatives to discuss the draft work plan prior to finalization. The data acquired during the CA will be used to prepare a CA report according to 17-70.009(2).

SITE DESCRIPTION AND PROJECT BACKGROUND

The Trumbo Point Annex (Annex) is located on the north side of the island of Key West, Florida. Since 1942, a fuel farm located at the Annex (Figure 1) has been used for storage of various types of petroleum products. Until about 1985, the fuel farm consisted of 28 tanks; currently, however, only 15 tanks are still intact, of which 11 are actively used. The fuel farm is supplied by tanks through unloading facilities located at the piers to the west as shown in Figure 2. Fuel is conveyed from the fuel farm to various facilities through underground pipelines.

Previously, G&M performed two investigations at the fuel farm and prepared two reports entitled "Subsurface Hydrocarbon Investigation at Trumbo Point Annex, NAS-Key West, June 1985;" and "Verification Study, Assessment of Potential Ground-Water Pollution at the Naval Air Station, Key West, Florida, March 1987." As part of these investigations, a soil boring/monitor-well installation program was performed. Figure 2 shows the locations of the monitor wells installed in the vicinity of the JP-5 tank site during these investigations. Liquid-phase hydrocarbon was determined to be present floating on the ground-water table in the vicinity of tanks 2 (JP-5 tank), D-3, and D-4 (Figure 2).

FIELD INVESTIGATION

The field investigation portion of the CA will include a soil boring/monitor-well installation program; collection of ground-water, surface-water, marine-sediment, soil, and liquid-phase hydrocarbon samples; collection of water-level and liquid-phase hydrocarbon thickness measurements; and aquifer testing. In addition, an inventory of potable wells within a one-quarter-mile radius of the site will be performed.

Soil-Boring Installation

To determine the horizontal and vertical extent of dissolved and liquid-phase hydrocarbons, 14 soil borings will be installed at locations shown in Figure 2. Each boring will be drilled with a hand auger to at least 1 foot below the water table (about 5 to 7 feet [ft] below land surface [bls]). Soil samples will be collected from the borings, and the presence or absence of hydrocarbons (dissolved and liquid-phase) will be evaluated visually and with an organic vapor analyzer (OVA).

Using the information obtained from the soil borings, monitor-well locations will be chosen. One monitor well will be installed in an area found to have liquid-phase hydrocarbons so that the liquid-phase hydrocarbon thickness can be measured. The location of this well is proposed next to monitor well MW-8, which has been destroyed (see Figure 2). Five monitor wells will be installed to depths of about 18 ft bls in areas without liquid-phase hydrocarbons (see Figure 2) so that the horizontal extent of dissolved hydrocarbons can be evaluated. Two deep monitor wells will be installed to depths of about 35 ft bls to determine the vertical extent of dissolved hydrocarbons; these deep monitor wells will be installed at two shallow monitor-well sites. Table 1 summarizes the soil boring/monitor-well placement rationale.

Prior to monitor-well installation, soil samples will be collected from each borehole with a split-spoon sampler using the hollow-stem auger method of drilling. In addition, split-spoon soil samples will be collected from one deep boring (about 50 ft bls) installed in an area assumed to be free of liquid-phase hydrocarbons and dissolved hydrocarbons. A tentative location for the deep boring is in the area of well KWM-25. A sample of the confining unit beneath the surficial aquifer, if encountered, will be collected with a Shelby tube and analyzed for a determination of permeability. These data will provide information as to the nature of the deeper sediments and potential for downward migration of dissolved hydrocarbons.

Soil samples will be described, and lithologic logs will be prepared by an on-site geologist to conform with Navy specifications. The presence or absence of hydrocarbons also will be evaluated using an OVA. The actual locations of the borings and monitor wells will depend on conditions encountered in the field. Borings not converted to monitor wells will be abandoned by backfilling with a neat cement grout from the bottom of the hole to land surface. The FDER will be notified at least ten days prior to initiation of drilling, and any required permits will be obtained from state or local agencies.

Monitor-Well Installation

Prior to monitor-well construction, the required permits will be obtained from the appropriate state or local agencies. Six shallow monitor wells will be constructed

Table 1. Soil-Boring and Monitor-Well Placement Rationale

Soil Boring No.	Monitor Well No.	Placement Rationale
1-4	1,2	Evaluate the western extent of hydrocarbon plume
	4	Evaluate the southern extent of hydrocarbon plume
5-7	6,8	Evaluate the eastern extent of hydrocarbon plume
	5	Replace MW-8, evaluate extent of dissolved and liquid-phase hydrocarbons adjacent to the sea-wall
	3D,7D	Evaluate the vertical extent of hydrocarbon plume

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using the hollow-stem auger method of drilling. A 0.01-inch slot, 2-inch-diameter, Schedule 40 PVC (15-ft-long) screen attached to a blank section of 2-inch-diameter, Schedule 40 PVC (2.5-ft-long) will be installed into a borehole approximately 18 ft in depth. A graded (20/30 sieve size) silica sand will be emplaced into the annular space between the well casing and borehole to about 1 ft above the top of the well screen. A fine sand cap (0.3-ft thick) will be installed on top of the sand pack. The remaining annular space will be filled with a neat cement grout to about 0.3 ft bls. A locking manhole cover will be cemented around the top of the well, flush with land surface, to protect the well from vehicular traffic and vandalism. Construction details for these wells are shown in Figure 3.

Two deeper monitor wells will be installed by the hollow-stem auger method of drilling adjacent to two shallow wells so that the vertical extent of contamination in the aquifer can be determined. The deeper monitor wells will be constructed to a depth of about 35 ft, with a surface casing depth from land surface to 18 ft. The surface casing will minimize the potential downward migration of liquid-phase or dissolved hydrocarbons during drilling. The surface casing will be installed by drilling a 10-inch-diameter borehole to a depth of 18 ft using the mud-rotary method and installing a 17.5-ft-long, 8-inch-diameter, Schedule 40 PVC casing into the borehole. The annular space between the borehole and the casing will be filled with a neat cement grout and allowed to set overnight.

The well then will be constructed by drilling a nominal 8-inch-diameter borehole by the hollow-stem auger method through the center of surface casing to a depth of 35 ft. The monitor well will be constructed by installing 5 ft of 2-inch-diameter well screen (0.01 inch slot) attached to 30 ft of 2-inch-diameter, Schedule 40 PVC casing. The annular

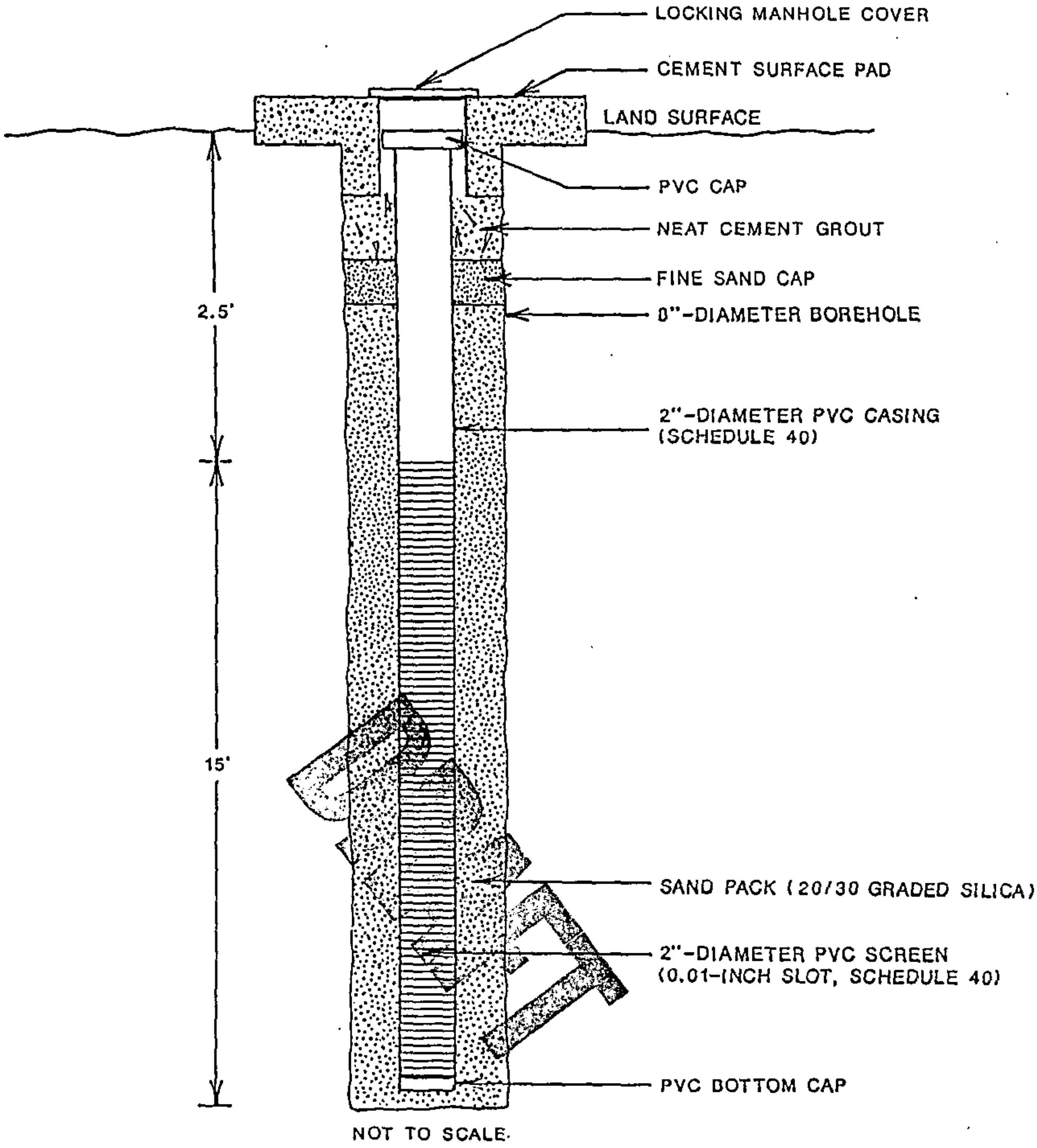

Figure 3.

Construction Diagram of a Typical Shallow Monitor Well.

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space will be filled with a uniformly-graded silica sand (20/30 sieve size) to about 3 ft above the screen. A fine sand cap (0.3-ft thick) will be installed on top of the sand pack, and the remaining annular space will be filled with a neat cement grout to about 0.5 ft bls. A locking manhole cover will be cemented in place over the top of the well, flush with land surface, to protect the well from vehicular traffic and vandalism. Construction details for these wells are shown in Figure 4.

Prior to sampling, each monitor well will be properly developed by either pumping or air-lifting until the discharge is clear and sediment-free. The deeper monitor wells will be pumped at a low rate to minimize potential downward movement of contamination. Any soils obtained from drilling and fluids produced by development will be containerized. Samples of this material will be analyzed for total recoverable petroleum hydrocarbons, ignitability, and by the Environmental Protection Agency (EPA) Toxicity Characteristic Leaching Procedure (TCLP) method for purgeable organic compounds, semi-volatiles, and metals. The results of these analyses will be used to determine the proper method of disposal to be used by NAS-Key West personnel.

Water-Level Measurements and Surveying

A measuring point elevation (top of well casing) will be established on each monitor well and referenced to a common datum (U.S. Coast and Geodetic Survey) by a Florida registered land surveyor. Ground-water level measurements in each well will be measured from the measuring point on at least two occasions and converted to water-table elevations in order to determine the direction of shallow ground-water flow. An interface probe, capable of detecting both liquid-phase hydrocarbons and water levels, will be used to determine the thickness of any liquid-phase hydrocarbons.

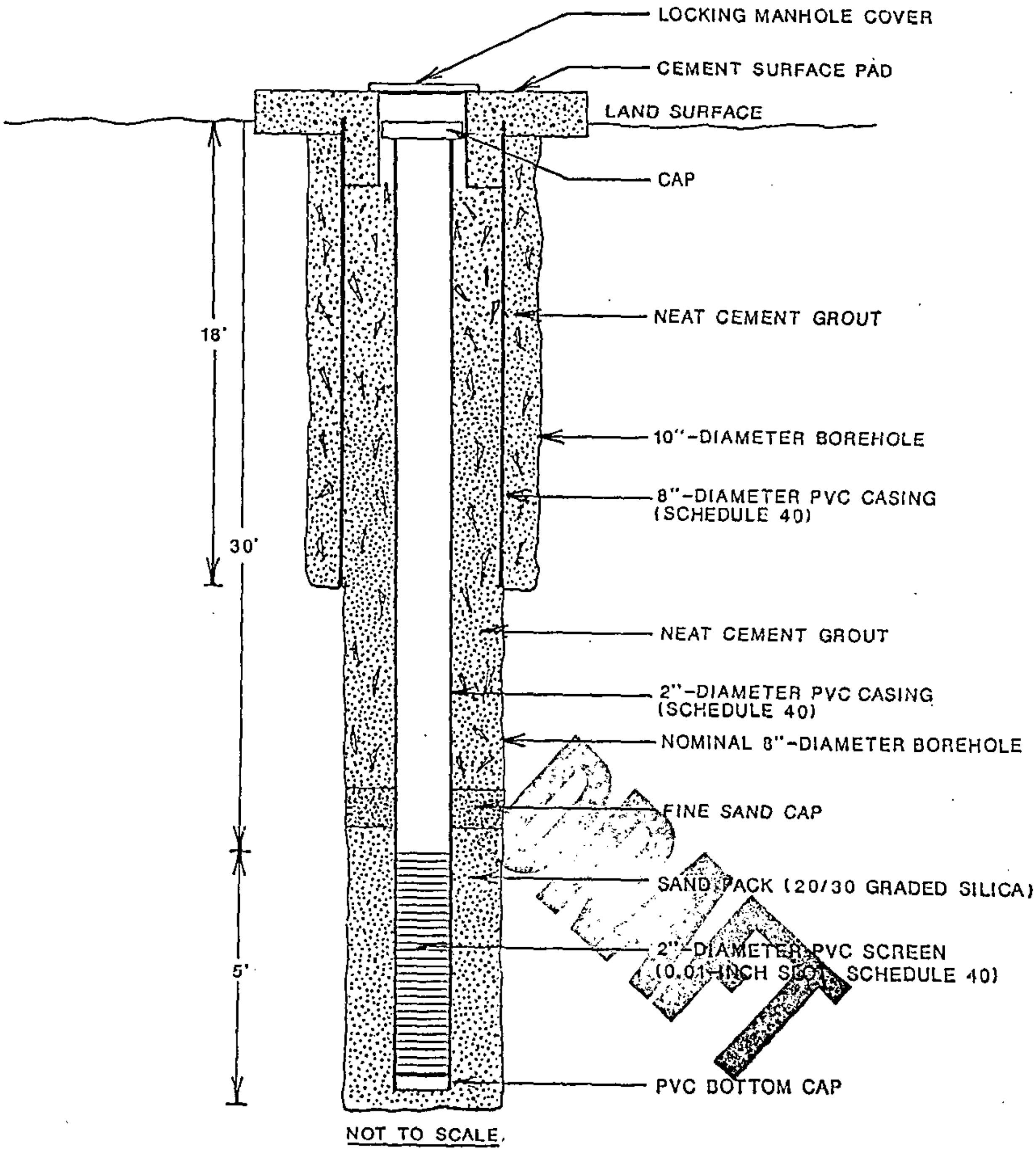

Figure 4.

Construction Diagram of a Typical Deep Monitor Well.

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Water-level measurements also will be collected from monitor wells installed during previous studies (Figure 2). All of the monitor wells (new and existing) also will be surveyed to establish the relative horizontal location of each well (using U.S. Coast Geodetic Survey datum). This information then will be used to construct a base map.

Because past investigations indicated that tidal fluctuations seem to affect ground-water levels at the fuel farm (G&M, June 1985), it is proposed that ground-water levels be continuously monitored in three wells without liquid-phase hydrocarbons present, over at least a 24-hour period or a complete tidal cycle. This will be accomplished by placing a recording transducer in at least three monitor wells near Tank 2. The wells used will be selected to represent tidal effects at various distances from the sea-wall.

As requested by the Navy, G&M will contract a Florida registered surveyor to conduct a topographic survey to establish topographic control at the fuel farm. These data will be used to construct a map (using U.S. Coast and Geodetic Survey datum) which will be used to determine drainage patterns at the fuel farm. If required, this information also may be used in the design of recovery systems.

Ground-Water Sampling and Analysis

Ground-water samples will be collected from existing monitor wells (KWMW-20, KWMW-21, KWMW-22, and MW-9) and from newly installed monitor wells. Samples will not be collected from any monitor well having liquid-phase hydrocarbons. All appropriate sampling procedures and protocol will be followed in accordance with the Quality Assurance Plan. After purging a well of three to five volumes of water, samples will be collected with a Teflon[R] bailer and poured into the appropriate containers. After the sample containers are filled, they will be placed on ice and shipped to Pioneer Laboratory, Inc., for analysis of volatile (benzene, toluene, ethylbenzene, total xylene, and methyl tert-butyl ether), and semi-volatile organic compounds including 1-methyl naphthalene and 2-methyl naphthalene (U.S. Environmental Protection Agency [EPA] Methods 601, 602, and 625), for total lead (EPA Method 239.2), and total dissolved solids (EPA Method 160.1). EPA Method 625 will be used to measure priority-pollutants and non-priority pollutants with concentration values greater than 10 parts per billion (ppb). Measurements of temperature, pH, and specific conductance will be recorded in the field.

Surface-Water and Marine-Sediment Sampling and Analysis

To evaluate surface-water and marine-sediment conditions adjacent to the site, a sampling program will be conducted at the locations shown in Figure 2. Three marine-sediment samples will be collected next to the sea wall using a bottom-sampling dredge device. The sediment samples will be put in containers, placed on ice, and sent to Pioneer Laboratory, Inc., for analysis of volatile (benzene, toluene, ethylbenzene, total xylenes, and methyl tert-butyl ether), and semi-volatile organic compounds including 1-methyl naphthalene and 2-methyl naphthalene (EPA Methods 8010, 8020, and 8250) and for total lead (EPA Method 7421). EPA Method 625 will be used to measure priority-pollutants and non-priority pollutants with concentration values greater than 10 ppb.

Surface-water samples will be collected at the sediment-sampling locations using a Teflon[R] bailer. After collection, the samples will be poured into the appropriate containers and placed on ice for shipment to the laboratory. The samples will be analyzed for volatile (benzene, toluene, ethylbenzene, total xylenes, and methyl tert-butyl ether) and semi-volatile organic compounds including 1-methyl naphthalene and 2-methyl naphthalene (EPA Methods 601, 602, 610, and 625), lead (EPA Method 239.2), and total dissolved solids (EPA Method 160.1). EPA Method 625 will be used to measure priority pollutants and nonpriority pollutants with concentration values greater than 10 ppb. Temperature, pH, specific conductance, and salinity measurements will be recorded in the field.

Aquifer Testing

In order to better define the hydraulic characteristics of the sediments, two "slug tests" and one two-day pumping test will be performed at selected monitor wells that do not contain liquid-phase hydrocarbons. Slug tests will be used to determine in-situ hydraulic conductivity values. These tests will be conducted in individual wells and will be initiated by causing an instantaneous water-level change in the well through the sudden introduction or removal of a solid cylinder (slug) of known volume. Recovery of the water level with time then will be observed and the data will be recorded. These data then will be analyzed using the Bouwer and Rice (1976) method and will be used to evaluate the ground-water flow rate and the potential for migration of ground-water contamination.

In addition to the "slug tests," a two-day pumping test will be performed at one of the monitor wells. The well selected for testing will be pumped at a constant rate over approximately a two-day period. The change in water levels with respect to time (drawdown) in the pumped well and nearby monitor wells will be recorded; these data will be analyzed to determine transmissivity and storativity of the sediments. The test will provide information regarding the response of water levels in the aquifer under long-term pumping conditions and will aid in the design of a remedial system, if required. The well to be pumped during the test and the wells selected to monitor water-level changes will be selected after reviewing lithologic and OVA data collected during the drilling and sampling program. Monitor wells chosen will be in locations assumed to be representative of water-quality and lithologic conditions at the site. One well will be selected for background water-level monitoring so that drawdown and recovery measurements can be adjusted for tidal influences.

Liquid-Phase Hydrocarbon Sampling and Analysis

Liquid-phase hydrocarbon samples will be collected from two monitor wells in the suspected plume area. The samples will be containerized and sent to a laboratory to be analyzed by a gas chromatograph/mass spectrometer "finger-printing" technique to determine the type of petroleum hydrocarbon. This information will assist in determining the possible source(s) of the subsurface contaminants.

Tank and Pipeline Testing

In order to ascertain whether or not Tank 2 and associated pipelines might be sources of contamination, G&M recommends that a tank and pipeline integrity/leak testing program be performed by Key West Pipeline.

DATA ANALYSIS AND CONTAMINATION ASSESSMENT REPORT PREPARATION

The data obtained during the field investigation will be evaluated and compiled into a written report. Included in the report will be a discussion of the work performed in the field; results of ground-water, surface-water, soil and sediment analyses; an interpretation of aquifer-test data; survey results; contaminant plume delineation; an interpretation of lithologic data; the direction and rate of ground-water movement; and any other pertinent findings of the investigation. Figures and tables will be used to illustrate these findings. Also included will be an evaluation as to whether a Risk Assessment and/or a Remedial Action Plan should be prepared.

PROJECT SCHEDULE

The schedules for completing the proposed tasks described herein will be consistent with Item B of Section III - Submittals and Sections of the Request for Fee Proposal for Amendment No. 5.

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REFERENCE

Bouwer, Herman, and R.C. Rice, 1976. A Slug Test for Determining Hydraulic Conductivity of Unconfined Aquifers with Completely or Partially Penetrating Wells: Water Resources Research 12: 423-428.