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FINAL CHARACTERIZATION WORK PLAN MILLINGTON SUPPACT TN
10/20/1986
HARDING LAWSON ASSOCIATES

A Report Prepared for:

Department of the Navy
Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
Charleston, South Carolina 29411

FINAL CHARACTERIZATION WORK PLAN
NAVAL AIR STATION MEMPHIS
MILLINGTON, TENNESSEE

HLA Job No. 02176,081.12

by

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October 20, 1986

NAS MEMPHIS
CHARACTERIZATION WORK PLAN

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I INTRODUCTION

A. Project Description

The U.S. Navy has engaged Harding Lawson Associates (HLA) to perform a site investigation of a fuel leak at the Navy Exchange (NX) service station at Naval Air Station (NAS) Memphis, Millington, Tennessee. The HLA study will be performed under existing contract with Southern Division Naval Facilities Engineering Command (SOUTHNAVFAC). SOUTHNAVFAC will provide an Engineer-In-Charge (EIC) for technical matters.

B. General Problem Statement

A gasoline leak was discovered by NX personnel while performing routine inventory reconciliation. It was estimated that a total of approximately 5,000 gallons of gasoline were lost to the subsurface. The Tennessee Department of Health and Environment was notified of the problem by letter in March, 1986. NX personnel installed four (4) monitor wells and performed tank and line integrity testing in an attempt to establish the source and magnitude of the leak. A pipe joint on the regular unleaded line was discovered to be leaking, and it was replaced. According to Exchange personnel, current inventory data reflect no additional fuel losses.

While efforts to locate and correct the leak were on-going, an indeterminate amount of product entered the sanitary sewer lines or

trenches adjacent to the service station property. As the gasoline traveled southward along or through the sewer lines, product vapors entered Buildings S-136, S-137 and S-1, resulting in building evacuation and fire and safety investigations. The sewer lines were flushed with water, and the product was reportedly discharged to the sewer treatment facility. The quantity of product remaining in the subsurface soils is not known.

C. Project Objectives

The HLA investigation will define the extent of fuel migration, type(s) of fuel(s), geologic and hydrogeologic conditions, and degree of subsurface contamination. Chemical analyses of soil and groundwater samples, borings/monitor wells, and trenching will be employed to define the contamination, and to determine the appropriate remedial measures. The initial study area will be confined to the NX service station property, and the unimproved area adjacent to the sanitary sewer system on the south side of Navy Road (see Plates 1 and 2).

D. Project Safety

The HLA site safety plan will be submitted to SOUTHNAVFAC prior to the commencement of any field work.

II PRELIMINARY INVESTIGATION

The HLA team visited NAS Memphis on June 23, 1986, met with NAS Memphis and SOUTHNAVFAC engineers, and obtained relevant records, data, and EIC comments. NAS Memphis engineers conducted a field tour of the site to familiarize HLA personnel with the work area. Results of the preliminary investigation are presented below.

A. Location and Volume of Known Losses

As previously mentioned, approximately 5,000 gallons of gasoline were reportedly lost to the subsurface at the NX service station. The extent of lost gasoline migration is the subject of this investigation. It is well documented by NAS Memphis Fire Department log books that lost product was transported off the service station property via the sanitary sewer system.

B. Inventory Data

Inventory is performed daily at the NX service station, and the data are compiled on monthly summary sheets. Tank volumes are measured using the dip stick method, and inches of fuel are converted to gallons, using the appropriate conversion chart. Pump meter readings are also recorded daily. Exchange personnel reconcile the

sales receipts and on-hand volume at the end of each business day. It was through inventory data reconciliation that the gasoline leak was discovered.

The reconciled inventory data will be reviewed, during the characterization study, to verify the volume of fuel lost. Inventory maintenance practices will be evaluated as well.

C. Underground Utility Locations

The location of underground utilities is always an important factor when planning a subsurface investigation. NAS Memphis engineers have provided drawings of the vicinity of the Exchange service station and the area to the south-across Navy Road. Because of the variety of dates, scales and interpretation on these drawings, it is presently unclear exactly which lines/pipes are active or what their exact position is in relation to structures. The sanitary sewer lines have reportedly been the source of hydrocarbon vapor in the past. A sanitary sewer line, of undetermined size, crosses near the underground gasoline storage tanks before tying into the twelve-inch line which was reportedly the source of the vapor. In addition, a natural gas line of undetermined size crosses in the vicinity of the underground storage tanks and ties into the meter located directly south of the tanks. This meter appears to be connected to a fourteen

inch gas main that runs east/west along the south side of Navy Road. These, and other utility and pipe locations, will be investigated and confirmed before any drilling or trenching commences.

D. Geology and Hydrogeology

The general stratagraphic sequence for the area of Memphis, Tennessee, consists of an uppermost unit of undifferentiated sand, gravel, silt and clay extending to a depth of approximately 200 feet. This unit is underlain by the Jackson Formation, which consists of approximately 150 feet of clay. Beneath the Jackson Formation lies the Memphis Sand, which is the primary aquifer for the area.

Three borings were drilled by Geraghty & Miller, Inc. (1985) approximately one-half mile to the northeast of the service station. These borings reached a maximum depth of 65 feet below ground surface. A generalized stratigraphic section derived from these logs would include:

Description	Approximate Depth (feet)
Topsoil (Clayey)	0-5
Clay	5-40
Sand	40-65

Four monitor wells, which will be discussed further in the next section, were installed in February, 1986, in the vicinity of the underground storage tanks at the service station. The boring report indicates that the shallow soils consist primarily of silty clays. A perched water table within the surficial clays was also encountered. The perched zone located within the soft gray clay occurs due to the underlying firm blue clay. This clay restricts vertical ground-water flow to the underlying sands that comprise the uppermost aquifer.

The uppermost water zone is of prime importance since it is probable that any lost hydrocarbons would collect and move on its surface. Data from the monitor wells at the service station indicate that water levels range from 4.4 to 5.7 feet below ground surface. These data also indicate a local hydraulic gradient toward the south-southwest.

E. Existing Monitor Wells

Prompted by the apparent loss of motor vehicle fuel, as indicated by inventory reconciliation data, NX personnel contracted with Pittsburgh Testing Laboratories, Memphis, Tennessee, to install four (4) exploratory/monitor wells around the underground storage tank installations (see Plate 2). Drilling operations were conducted in late February 1986.

The monitor wells were installed to an approximate total depth of 14.5 feet below existing ground surface. Each well was completed with four (4) inch PVC pipe and slotted screen. The screened interval of each monitor well is approximately 5 feet to 14.5 feet below ground surface. Hydrocarbon was detected in the tank backfill in Well No. 1, and hydrocarobon odor was detected in Well No. 2. Hydrocarbons were not found in either Well No. 3 or 4. Based on the results of the monitor well sampling, NX personnel concluded that a leakage problem did in fact exist, and that integrity testing of the tanks and their associated piping was warranted.

F. Integrity Testing Results

Due to the presence of hydrocarbons in the monitor wells, NX personnel contracted with C&H Maintenance Company of Southhaven, Mississippi, to perform tank system tightness testing. Testing was performed on the tanks using the Kent-Moore Corporation's Tank Tightness Tester Model 1000. The gasoline lines connecting the tanks to the remote dispensing islands were tested with the Petrotite Line Tester. The three (3) underground gasoline storage tanks passed the tightness testing. The regular leaded and the super unleaded fuel lines also demonstrated integrity. The regular unleaded fuel line failed the tightness testing (Refer to Appendix B). According to NX personnel, the fuel lines were excavated, and a leak was located at

the piping joint under pump island No. 4. The pipe elbow joint and cut-off value were replaced. Subsequent inventory reconciliation data indicate that no additional leakage has occurred.

G. Summary

The preliminary investigation provided the HLA team with background data necessary to formulate a plan of action for the Characterization Phase of the investigation. Interviews with NAS Memphis personnel and review of available drawings, borings, and literature defined the initial area of interest, and the field and laboratory methodology to be utilized. Detailed discussion of the proposed field activities is contained in Section III.

III FIELD INVESTIGATION

The field investigation will develop the baseline data necessary to define the site-specific geology, hydrogeology, and soil characteristics of the study area. HLA will employ soil borings/ monitor wells, trenching, and ground water/soil sampling, testing, and analysis to ascertain the degree of contamination and types of fuels present. Instrumentation will be used to conduct a survey of ground surface, drainage culvert, and sewer system relative hydrocarbon vapor concentrations.

A. Borings/Monitor Wells and Trenching

Soil borings will be drilled for the purpose of collecting site-specific geologic and hydrogeologic data. In addition to serving as soil and ground-water sampling points, each boring will be cased with four (4) inch Schedule 40 PVC pipe and will be screened across the appropriate interval with four (4) inch Schedule 40 PVC slotted pipe. The subsurface interval to be screened will be determined during drilling operations, based upon observed water levels and location of visible contaminants. The monitor wells will be assigned numercial identifications and sealed to prevent surface contamination. It is currently planned to drill three (3) borings, for a total of one hundred ten (110) lineal feet. Tentative boring locations, which were selected due to their proximity to the

underground storage tanks and associated piping are shown on Plate 2. Boring No. 1 will be drilled to an approximate depth of sixty (60) feet, or equivalently, through the first significant water-bearing strata. Borings 2 and 3 will be drilled to an approximate depth of twenty-five (25) feet, or equivalently, into the top of the initial aquitard. Exact boring locations will be determined in the field, following close visual inspection and detailed site reconnaissance. Each boring location will be vertically surveyed to assure precise control. NAS Memphis Engineers will approve the location of each boring prior to commencement of drilling.

Completion of the borings as monitor wells will permit continuous access for ground-water sampling and analysis, and water level measurement. Casing the monitor wells with four (4) inch pipe, which is the minimum recommended diameter for pump installation, will permit their conversion to recovery wells for use in remedial action operations, as necessary.

Baseline hydrogeologic data will be collected from each of the borings, as they are drilled. Water level measurements, electrical conductivity readings, and HNU surveys for hydrocarbon vapors will be recorded in the field and will provide both quantitative and qualitative information immediately.

In addition to the installation of the monitor wells, it is currently planned to trench on the south side of Navy Road, parallel to and outside of the security fence (Refer to Plate 2). The trenches will be located as near to the sanitary sewer line as possible. A trench with an approximate depth of twelve (12) feet will be installed on each side of the sewer line. The trenching operation will permit immediate, close visual inspection of soil samples without altering the soil composition with water or drilling fluids. Any product vapors escaping from the trenches will also be measured with instrumentation (HNU survey).

B. Water, Soil and Fuel Sample Analyses

Water, soil, and fuel samples collected during the field effort will be screened in the field according to visual factors and through the use of the HNU Photoionization Detector. Two soil and water samples from each boring will be selected for laboratory analyses. One sample of the raw gasoline will be obtained for use in comparative analysis with water/fuel samples collected from the boreholes.

A gas chromatographic (GC) technique will be used to quantify total petroleum hydrocarbons in soil and water samples. This same GC procedure will be employed to "fingerprint" the raw product samples. These fingerprints will then be used to compare the soil and groundwater samples to the product.

Analytical chemistry support will be provided by a subcontract laboratory. Laboratory quality control and quality assurance (QA/QC) will follow an approved Quality Assurance and Laboratory Practices Manual.

C. HNU Survey

HLA has found in numerous studies of this nature that lost product in the ground frequently migrates to in-place trenches and lines. When it is possible to survey sanitary sewers in the vicinity of a product loss, valuable data may be obtained to delineate which underground systems are involved, and where the product may have migrated. HLA has conducted such surveys at other sites to determine the possible extent of product migration.

A survey of vicinity storm and sanitary sewer systems will be conducted, using a portable photoionization detector (HNU Model PI 101). The HNU will be used to survey the relative concentrations of product vapors in the drainage culvert, and through selected sanitary sewer manholes. The results of such a survey should present a profile of relative product vapor concentrations within the sewer systems. These data, coupled with knowledge of the locations of the in-place sewer systems, may help to define the extent of migration of the product. An analysis of these data will be used to determine addi-

tional target areas for any required investigations. Such data could help to delineate areas not directly affected by the fuel product problem, and therefore not requiring further investigations.

D. Fuel Plume Definition

After the fluid levels in the wells have stabilized (approximately 24 hours), water levels and free product thicknesses will be measured with a steel tape coated with water and hydrocarbon sensitive pastes. This data together with the results of the HNU survey will be used to help define the fuel plume(s) within the study area (i.e. the thickness and approximate lateral extent of fuel floating on the ground water). The water levels in the wells will be corrected for the amount of fuel floating on the ground water (if any) to allow initial determination of hydraulic gradient and the probable direction of plume migration. This information will be analyzed to provide initial estimates of the rate of plume migration.

E. Conclusion

Field activities will be coordinated with NAS Memphis and SOUTHNAVFAC EICs throughout the investigation. Following completion of the field investigation, HLA notes, information, and data will be reviewed with NAS Memphis and SOUTHNAVFAC EICs. EIC comments and suggestions will be solicited and incorporated in the Characterization Report (see Section V).

V CHARACTERIZATION REPORT

At the conclusion of field activities HLA will prepare a Draft Characterization Report. This report will be submitted to SOUTHNAVFAC and NAS MEMPHIS for review and comments. Upon return of the draft report, HLA will incorporate the EIC's comments and submit the Final Characterization Report. The schedule for submittal of Draft and Final Reports is shown on Table 1.

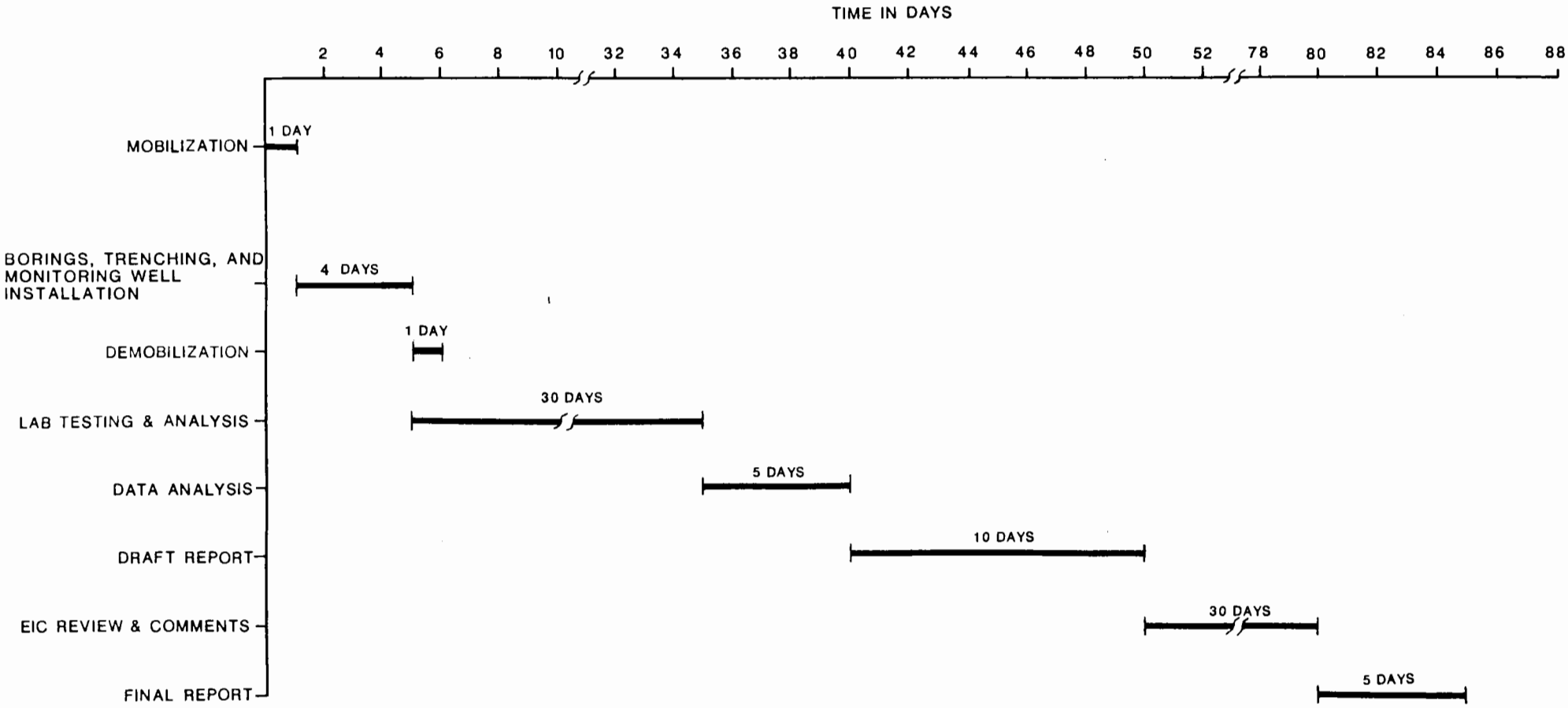
The Characterization Report developed by HLA will include data, analysis and interpretation of all activities undertaken in the field study. This information will then be used to analyze the overall effectiveness of different options for remediation including:

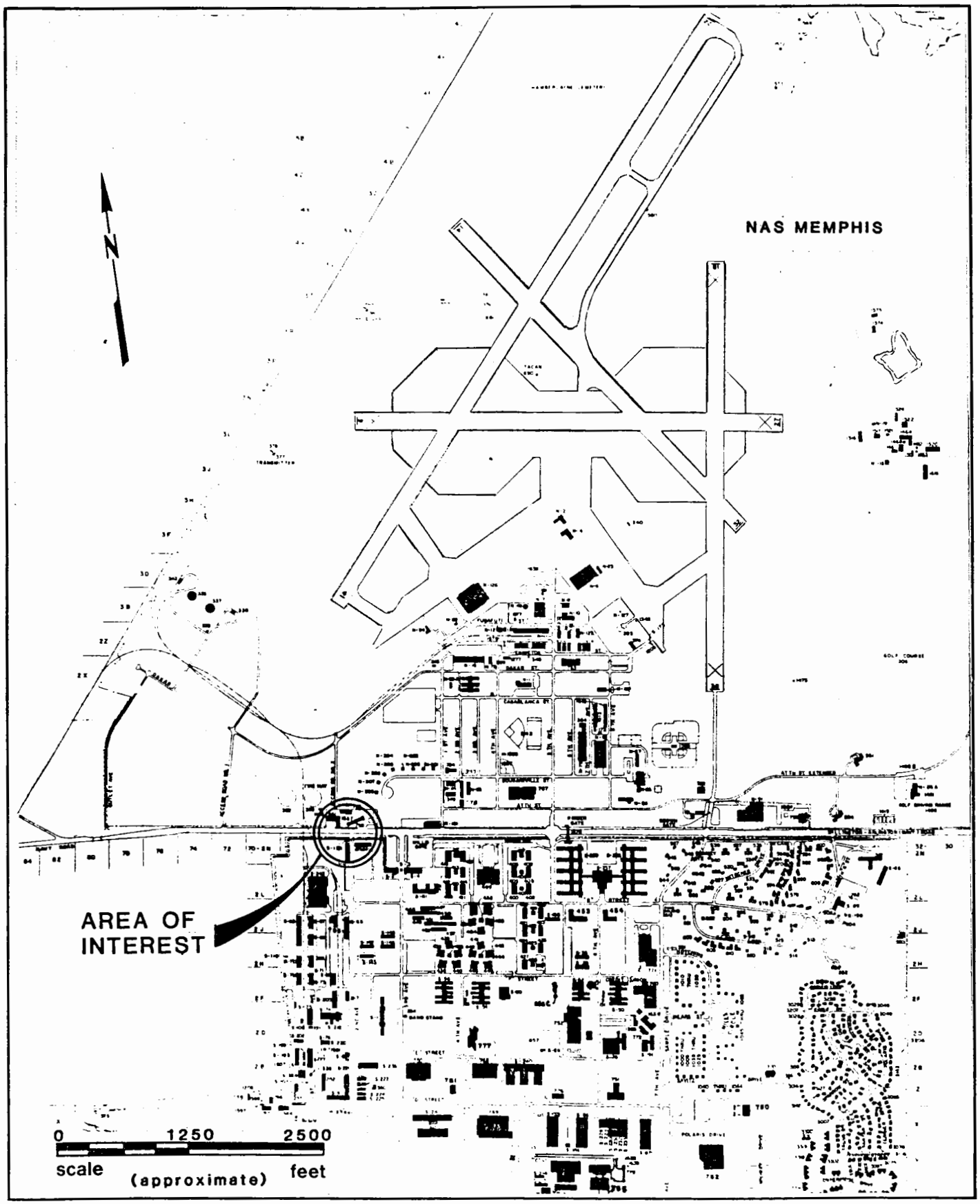
- Recovery Wells
- Interceptor Trenches
- Slurry Systems
- Flushing Systems
- Microbial Digestion
- Removal
- Treatment
- Disposal

Each option will be evaluated in terms of appropriateness, feasibility, cost and time, and formal recommendations will be presented.

TABLE 1

NAS MEMPHIS MILESTONE CHART





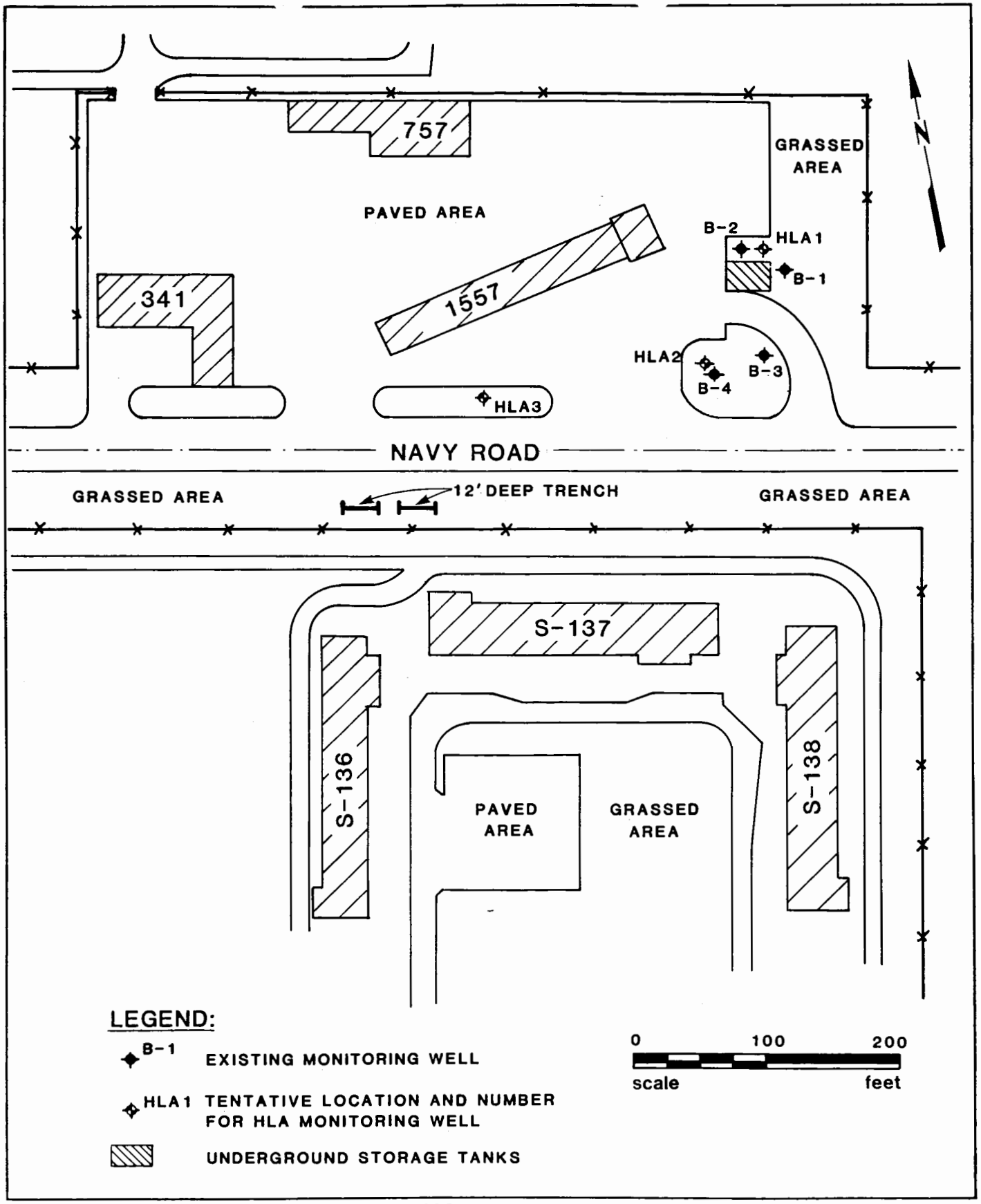
Harding Lawson Associates
Engineers, Geologists & Geophysicists

VICINITY MAP

NAS MEMPHIS
Millington, Tennessee

PLATE **1**

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
MK	02176,081.12	RC	7/28/86		



Harding Lawson Associates
Engineers, Geologists & Geophysicists

TRENCH, BORING, AND WELL LOCATIONS

NAS MEMPHIS
Millington, Tennessee

PLATE 2

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED	DATE
MK	02176,081.12	RC	7/25/86		

APPENDIX A

INSTALLATION OF MONITOR WELLS

PITTSBURGH TESTING LABORATORY

PTL – MEMPHIS
BILLY C. SMITH
Manager

Pittsburgh Testing Laboratory

MPS-5299

FEBRUARY 27, 1986

NAVY EXCHANGE
NAS MEMPHIS
MILLINGTON, TN. 38054-6024

ATTENTION: MR. DORITY

REFERENCE: NAVY EXCHANGE SERVICE STATION

SUBJECT : INSTALLATION OF MONITORING WELLS

GENTLEMEN:

On the above date four (4) monitoring wells were installed as indicated on the attached sketch. The wells consited of a four (4) inch diameter PVC schedule 40 pipe, with the bottom ten (10) feet of pipe being slotted. These wells were placed approximately 14.5 feet below the existing ground surface.

Well No. 1 was placed in the sand backfill of the unleaded tank on it's North end. The backfill was found saturated with water and hydro carbon at about four (4) feet in depth. At the end of drilling a fluid level, measured from the top of the pipe, was about five (5) feet in depth.

Well No. 2 was placed in the clayey silt soils with no hydrocarbon detected until about 14 (14) feet below. Some water was indicated with hydrocarbon odor.

Well No. 3 was placed in the clayey silt soils with no indication of hydrocarbon odor. Water was indicated at about fifteen (15) feet below the existing ground surface.

Well No. 4 was placed the clayey silt soils with no indication of hydrocarbon odor. Also, water was not indicated at the completetion of drilling.

For more accurate sampling, the fluid in the wells should be allowed to stablize. Typically this may require 24 to 48 hours.

If further analysis of the samples is required, we would be pleased to provide the service. We appreciate this opportunity and should you have any questions or have more drilling and testing needs please do not hesitate to contact us.

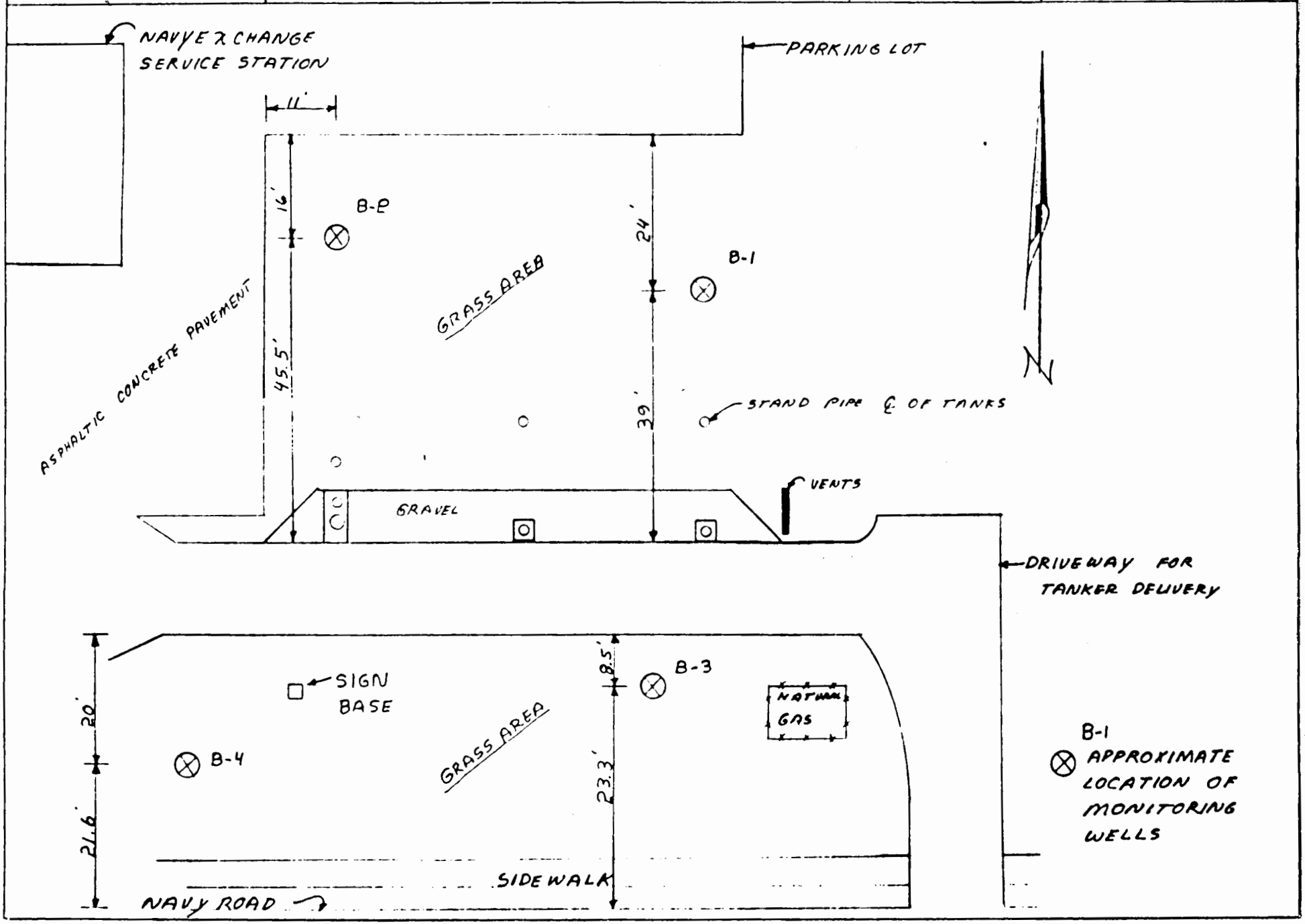
Respectfully submitted,
PITTSBURGH TESTING LABORATORY

BCS/vlc

Billy C. Smith

Billy C. Smith, Manager
Memphis District Office

Pittsburgh Testing Laboratory	Client: NAVY EXCH	Project: INSTALLATION OF WELLS	Client Order No: P.O. 275	PTL Order No.: MPS-5299	Lab No.: NA
	APPROXIMATE LOCATION OF MONITORING WELLS		Prepared By: Bob	Date Prepared: 2/28/86	Page 1 of 1



APPENDIX A

APPENDIX B

TANK SYSTEM TESTING RESULTS

Data Chart for Tank System Tightness Test

APPENDIX B

USING KENT-M[illegible]E CORPORATION TANK TIGHTNESS TEST [illegible]ODEL 1000

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PLEASE PRINT

1. OWNER Property ☒ Tank(s) ☒

Name: United States Navy — Address: — Representative: — Telephone:

Name: Navy Rd — Address: Millington Tn — Representative: — Telephone:

2. OPERATOR

Name: Navy Exchange — Address: — Telephone:

3. REASON FOR TEST (Explain Fully)

Suspected Leak

4. WHO REQUESTED TEST AND WHEN

Name: Ken Haze — Title: — Company or Affiliation: U.S Navy — Date:

Address: — Telephone:

5. WHO IS PAYING FOR THIS TEST?

Company, Agency or Individual: United States Navy — Person Authorizing: — Title: — Telephone:

Billing Address: — City: — State: — Zip:

Attention of: — Order No: — Other Instructions:

6. TANK(S) INVOLVED

Identify by Direction	Capacity	Brand, Supplier	Grade	Approx. Age	Steel/Fiberglass
East	20000		Reg UL	18 yr	Steel
Center	20,000		Reg	"	"
West	10,000		Premium UL	"	"

7. INSTALLATION DATA

Location	Cover	Fills	Vents	Siphones	Pumps
West Front or Exchange Property	Earth	4"	2"	0	Remote Wayne
North inside driveway, Rear of station, etc	Concrete, Black Top, Earth, etc	Size, Titefill make, Drop tubes, Remote Fills	Size, Manifolded	Which tanks?	Suction, Remote, Make if known

8. UNDERGROUND WATER

Depth to the Water table _____"

Is the water over the tank? ☐ Yes ☐ No

9. FILL-UP ARRANGEMENTS

Tanks to be filled _____ hr _____ Date Arranged by _____ Name _____ Telephone

Extra product to "top off" and run TSTT. How and who to provide? Consider NO Lead

Terminal or other contact for notice or inquiry _____ Company _____ Telephone

CRITERIA OF ±.050 GALLON/HOUR

10. CONTRACTOR, MECHANICS, any other contractor involved

The criteria established of ±.050 gallon/hour is a mathematical calculation based on actual liquid volume change and temperature change, and is not intended as a permission of a leak.

11. OTHER INFORMATION OR REMARKS

Line's off of STP's were tested by Petro Tite Line Tested. Both West + Center Lines were tight But East Regular UL failed

Additional information on any items above. Officials or others to be advised when testing is in progress or completed. Visitors or observers present during test etc.

12. TEST RESULTS

Tests were made on the above tank systems in accordance with test procedures prescribed for Kent-Moore Tank Systems Tightness Tester Model 1000 as detailed on attached test charts with results as follows:

Tank Identification	Tight	Leakage Indicated	Date Tested
East	yes	+.0089	3-12-86
Center	yes	+.023	3-11-86
West	yes	+.03	3-11-86

13. CERTIFICATION

This is to certify that these tank systems were tested on the date(s) shown. Those indicated as "Tight" meet the criteria established by the National Fire Protection Association Pamphlet 329.

3-12-86 — Date

Bob Cannon — Technicians

C & H Maintenance Co. — Testing Contractor or Company — By: Robert Cannon — Signature

11910239, 211910240 — Serial No. of Thermal

Dwain Hudspeth — Technicians

P.O. Box 349 Southaven Ms. 38680 — Address